The Seed

Top 10 Tips for Habitat
Pollinator Plants through the Year
Pollinator Resources and much more

Nebraska Statewide Arboretum
Sustainable Landscapes for Healthy Homes & Communities
Summer 2016

Why We Love Pollinators & Insects

Justin Evertson, Green Infrastructure Coordinator

"We can no longer landscape with aesthetics as our only goal. We must also consider the function of our landscapes..." Doug Tallamy

This issue of **The Seed** is all about insects and other arthropods as we explore how important they are to gardens, landscapes, natural ecology and the human endeavor in general. Arthropods are defined as invertebrate animals having exoskeletons, a segmented body and jointed legs; the word arthropod means "jointed-feet" in Greek. It's important to note that not all arthropods are insects, but all insects are arthropods.

In addition to insects, the arthropod phylum includes several other sub-groups such as arachnids (spiders), millipedes, centipedes and crustaceans (yes, lobsters and crabs are closely related to insects). It's estimated that there are at least 1.5 million species of arthropods across the world and that the actual number may be over 5 million. The diversity in size, shape and form in these creatures is truly incredible. In this publication we focus primarily on pollinators and other beneficial insects. We hope the reader will forgive us for sometimes using the word "insect" to generally mean all arthropods.

For many, perhaps most of us, insects and other arthropods are not easy to love. Once we're old enough to realize that some of them can sting or bite us, and especially if they ever do sting or bite us, we typically become fearful or disgusted with them. Most babies and toddlers don't seem concerned about grabbing at bugs or even putting them in their mouths, but somewhere along the line, many of us develop a general dislike of insects. Unfortunately, they just seem to creep us out.

We are beginning to see that insects are essential and beneficial in ways we have failed to understand or appreciate (see "Insects Run the World" on page 3). Until recently, humans didn't need to be too concerned with the ecology or survivability of insects or other animals. Our impact on the planet's biosphere was relatively minor. That is no longer the case. Industrial development is highly disruptive of ecological processes and we can now clearly see negative impacts to a wide variety of animals across the globe. Alarmingly, the World Wildlife Fund's Living Planet Report estimates a 52 percent decline in vertebrate species population since 1970. Many insect species are also in decline, including a wide variety of important pollinators. The concern for honey bees is well-known

"Why We Love Pollinators" continued inside

NEBRASKA STATEWIDE **Arboretum**

INSIDE

"Why We Love Pollinators" continued from cover

and the monarch butterfly has seen a precipitous population decline in recent years. Less known are the dozens of pollinating bees, butterflies and beetles that are also in serious decline.

Humans and insects are intertwined, and their struggles are our struggles. It is abundantly clear that we must start doing a better job of creating and sustaining

habitat that in turn helps sustain insects and other animal diversity. Those of us at NSA feel strongly that habitat development and conservation should begin at home—on our farms and in our own yards. This issue of **The Seed** celebrates pollinators and other important insects and suggests ways to help make our planted landscapes more supportive of them.

Photos from top: giant swallowtail; painted lady on purple coneflower; Emily Berg enjoying the wonder of a monarch; monarch on gayfeather.

Tips for Attracting Butterflies

Besides the sheer pleasure and beauty of turning a still garden into a suddenly moving one, there are many good reasons to plant a butterfly garden. Dennis Murphy, Director of the Center for Conservation Biology at Stanford University, argues that "Planting local native plant species in a rich, well-planned butterfly garden reduces the isolation of native plants in reserves and parks, provides essential corridors between remaining patches of habitat, and aids in repairing the patchwork of ecosystems that survive."

For many of us, though, seeing the sheer delight of a four-year-old following butterflies around a garden

is reason enough to offer habitat. Thankfully, planting a butterfly garden is an act of stewardship toward the wider environment that is confirmed and compelled by our own personal enjoyment.

Below are some tips for attracting butterflies to your garden, including many from Lucinda Mays, curator of the Chadron State College Arboretum.

- Full sun is the best place for butterflies since most butterflies need body temperatures of 80 degrees Fahrenheit in order to fly.
- Single flowers are more open and accessible to butterflies than the more heavily-petaled double flowers.
- Hybridized flowers tend to be selected for characteristics other than nectar supply and therefore are less likely to be good nectar producers.
- Flowers with disc centers offer an easy access "landing platform" for pollinators.
- Milkweeds are some of the best plants for butterflies. An added benefit is that common milkweed is bad-tasting, so predators quickly learn to avoid eating the larvae.
- One of the best nectar sources is something we grow without trying… the common dandelion attracts gossamer wings, vanessids and skippers. Another common weed, the thistle, is particularly popular with monarchs.
- Creating low, damp "puddling" areas attracts young males; they use their probosces to withdraw minerals from the wet soil.

- Shelter from wind and rain is essential. Thick grasses like little bluestem or switchgrass, as well as vines and shrubs, are good sources of protection.
- For many flowering plants, the removal of nectar stimulates more production of it.

Insects Run the World

Jennifer Hopwood, Xerces Society for Invertebrate Conservation

Pink spotted lady beetle

Insects are small and easily overlooked. It can also be easy to underestimate their value, but insects are at the heart of healthy ecosystems everywhere. Without them, there would be few flowering plants. There would be no apples, beans or sunflower seeds for us to eat. Fish, birds, amphibians, reptiles and mammals would all have much less to eat too. Dead plant and animal matter, along with dung, would mar the earth's surface and waterways. Soil quality would diminish.

Insects live everywhere we live and some places we cannot. They can be found just about anywhere, from deserts to rainforests, even in Antarctica. While most are terrestrial, some insects make their homes in caves, hot springs and marine intertidal zones. By some estimates, insects make up at least 70 percent of the identified species of animals. For every human on the planet at this moment, there are nearly 2 billion insects.

Our own lives and the lives of insects are intricately intertwined. Biologist E.O. Wilson calls them the "little things that run the world." While some insects are harmful to us, those that spread disease or consume our crops make up just a small fraction of the known species; the other 98 percent of the more than one million known insect species cause us no harm or provide us with invaluable services. Here are some of the services insects provide.

As Pollinators

Over 85 percent of flowering plant species depend on animal pollinators, primarily insects such as bees, butterflies, moths, some beetles and even some flies. In fact many of our crops in the U.S. are pollinated by the thousands of native wild bee species as well as ubiquitous managed honey bees. It's estimated that the pollination of fruits and vegetable crops is worth at least $20 billion a year. About one in three bites of our food comes to us courtesy of an insect pollinator.

As Food Providers

Many insects are herbivorous and consume only plants, which makes them a critical link in the food chain. It works like this: using water and carbon dioxide, plants convert the energy of the sun into energy-rich sugars and other nutrients. Plant-eating insects make those nutrients available to animals that do not consume plants. Insects such as grasshoppers, caterpillars, aphids and some beetles and ants bridge the gap between plants and animals by becoming food for fish, birds, amphibians, reptiles and some mammals. We consume many animals that could not survive without insects to eat.

As Dispersers of Seed

Ants and other insects disperse the seed of 35 percent of flowering plants. Some ants drop uneaten seed accidentally, while others eat the oily part before dropping the seed unharmed where it has a chance to germinate. Why is this service important? Seed dispersal is advantageous for plants because new seedlings won't have to compete with their parents or siblings for light, nutrients or water and because it may allow plants to colonize habitats which are not yet occupied by their species.

As Recyclers

What we think of as waste is food to the insect scavengers. These insects grind or chew up dead plant material, animals and fungi, as well as excrement, aiding decomposition and recycling nutrients back into the soil. Ants and termites, through their underground digging, mix decaying matter from the surface with subterranean soil and produce fertile soil. Burying beetles find and bury small dead mammals three times faster than larger scavengers like skunks or opossums. Dung beetles live up to their name by processing the 21 cubic meters of waste produced by each of the 100 million cows in the U.S. by recycling the dung. Additionally, dung beetles fertilize the soil, increase the palatability of cattle forage and reduce dung-breeding pests, services estimated to be worth $380 million a year—all for free, of course.

As Regulators

It has been estimated that in just a single summer, one pair of common house flies, along with their progeny, can produce enough offspring to cover the state of Montana to a depth of nearly 47 feet. Not to worry: insects are their own worst enemies. Predatory and parasitic insects keep populations of other insects, as well as plants and animals, from exploding and unbalancing ecosystems.

"The greatest single factor in keeping plant-feeding insects from overwhelming the rest of the world is that they are fed on by other insects," entomologist Robert Metcalf tells us. Examples of predatory insects in your own backyard include dragonflies that grab and devour mosquitoes in flight and paper wasps, which prey mainly on caterpillars, including the agriculturally destructive tobacco hornworm.

Nearly 10 percent of known insects have a unique but slightly grisly lifestyle: they place their own eggs into or onto the body of a host. When the eggs hatch, the larvae devour the host slowly, eventually killing it. These parasitoids, as they are known, are often highly host-specific and for that reason may be used as biological control agents of a particular pest.

These are just a few of the ways insects impact our lives for the better. The work of millions of ants, bees, beetles, butterflies, dragonflies, flies, grasshoppers, lacewings, wasps and more is amazing and essential! More at www.xerces.org.

Top 10 Tips for Habitat

Justin Evertson, Nebraska Statewide
Arboretum Green Infrastructure Coordinator

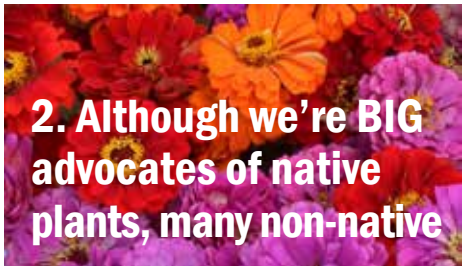
Not long ago most people, including many gardeners, would have looked at you funny if you said you were trying to create an "insect-friendly" garden or landscape. We thought many if not most insects were the enemy. We know better now. We know that inviting a rich diversity of insects leads to a better ecological balance in which fewer pest insects are available to munch on our fruits, vegetables and ornamentals. And we're now keenly aware of how important many insects are to pollination and plant reproduction. It's not just food crops that need to be pollinated, but also the vast majority of colorful flowering plants that we like to have around us. Here in prairie country it's smart to remember that the prairie itself could not have evolved without insect pollination.

Anyone that owns or manages property can do their part for ecology by planting and managing a landscape that supports pollinators and generally increases insect and animal diversity and abundance. Thankfully it's not difficult to do. And when done well, there are many other benefits that come along with such an effort—reduced irrigation, better rain absorption, less mowing, less need for pesticides and fertilizers, more birds, higher property values and a more beautiful landscape with vibrant changes throughout the season.

Creating a pollinator-friendly landscape truly is within everyone's ability. If you can tie your shoes, plant a plant and don't mind getting a little dirty, you are qualified. Although there is no single recipe, most pollinator-friendly landscapes have several things in common. Here are our 10 suggestions.

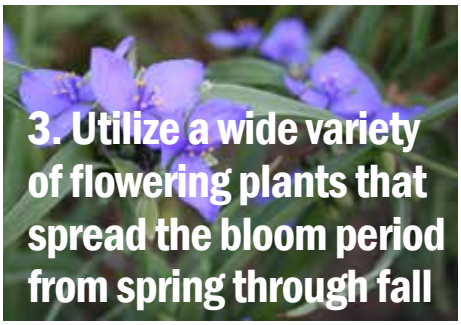
1. Use more native plants! The most

important pollinators and beneficial insects, representing dozens if not hundreds of species, come from our native prairies and woodlands. They typically prefer and often require the native plants they evolved with for both food and shelter. In fact, some specialist insects, including several types of bees and butterflies, can live only with specific native plants. For perennial borders and sunny areas, nothing beats our native prairie plants for attracting bees and butterflies. And where trees and shrubs are desired, regionally native plants are especially important. The list of native plants available for landscape use is extensive and can be found online at plantnebraska.org.



2. Although we're BIG advocates of native plants, many non-native

plants are quite good at attracting adult pollinators. Ornamentals like zinnia, petunia, salvia, Russian sage, sedum, catmint, allium, yarrow, hosta and geranium, to name just a few, can be absolutely abuzz with a wide variety of pollinators. Some of these plants are extremely reliable and easy to grow, making them almost foolproof in the garden. Our opinion is that including well-behaved, non-native plants to help fill space, enhance the bloom season and attract pollinators is a good thing (see our thoughts and cautions on non-native plants on page 6).



3. Utilize a wide variety of flowering plants that spread the bloom period from spring through fall

and which have a wide diversity of flower shapes and colors. Insect species change through the seasons so it's important that flowering is also successive. Generally speaking, the flowering of herbaceous perennials doesn't get going in earnest until well after frost is behind us and summer is looming. In our region the blooming builds to a crescendo by late summer and early fall, which is also the time of most adult insect abundance. Thus it's especially important to have a variety of late-blooming flower species such as asters and goldenrods.

4. Trees, shrubs & vines are important.

Many woody plants, like crabapple, serviceberry, hawthorn, viburnum, plum and dogwood, bloom relatively early in the season, thus providing early-season nectar to pollinators before herbaceous perennials get going. Trees and shrubs also provide important cover and leaf-feeding opportunities for a wide range of important insects. And many provide summer and late-season fruits for birds.

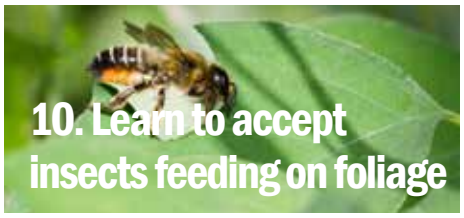
for monarchs; violets for fritillaries; nettles for red admirals and commas; parsley, dill and fennel for black swallowtails; primroses for whitelined sphinxes; elm and hops for question marks and commas; and cherries and plums for viceroys.

survival. Native grasses and other thick-stem plants such as aster, helenium, eupatorium, pitcher sage, silphium and elderberry provide cover for many insects during the growing season. Their hollow stems also offer winter nesting opportunities for various insects including certain bees. Think about a densely planted, layered landscape. Insect diversity will increase when there are layers of plants from ground-level upwards, much like native prairie. Conversely, some bees, wasps and other pollinators are ground nesters and benefit from a bit of disturbance or open ground here and there.

The biggest opportunity across any community to improve biodiversity in general, and especially insect and pollinator diversity, rests with the lawn and the way we manage it. Many people love to fuss over their lawn in an attempt to make it lush and weed free. Such lawns are practically devoid of insect life, and insecticides are regularly applied to kill anything that dares show up. If we could relax just a little bit, we'd realize that several flowering plants can coexist with lawn grasses to help sustain pollinators. Birdsfoot trefoil, dutch white clover and violets lend themselves to mowing. Where space allows or for those that are more daring, a traditional lawn can be replaced altogether with a combination of groundcovers, or with a sedge and wildflower meadow or even a prairie restoration that would only be occasionally mowed for weed management.

considered as weeds such as dandelions, henbit, purslane, clover, violets, milkweed, smartweed and nettles can be quite beneficial to pollinators and beneficial insects. We should put up with them when and where we can.

celebrate "rough" areas. Insects and other beneficial animals are generally attracted to places where plants are allowed to grow tall, a few weeds are growing, compost is being collected, wood is being piled and logs are rotting. Most yards and landscapes have back areas along fences and alleys that work well for this. Also, at least in a spot or two, cleanup should be delayed until the following spring so that more insects can survive the winter.



and put away the spray. Although some invasive insects like emerald ash borer and Japanese beetle can be quite damaging and may deserve some targeted insecticidal treatments, most insect feeding is a cosmetic problem not worthy of spraying. Larvae such as sawflies, bagworms and fall webworms are typically cyclical and eaten by a variety of birds and other insects. Many popular landscape plants are still promoted for their "clean" foliage that is not fed upon by insects. These foreign plants may be clean but they do very little to support native biodiversity. Many important public and private landscapes are managed without the regular use of insecticides. These landscapes are beautiful, functional and richly diverse with both plant and animal life. It can be done.

Most importantly—get out and enjoy it! Why plant a garden or biodiverse landscape if you don't go out and see what's blooming, crawling and buzzing? Nature's pageantry truly is wondrous for those who take time to notice it.

Native vs. Non-Native Landscape Plants

Justin comparing oak leaves with elementary students in Waverly. Bob Henrickson collecting seed from a remnant, unplowed prairie in Eastern Nebraska. We aim for locally native and regional seed sources whenever possible, but recognize the value of many non-natives as well.

Justin Evertson, Nebraska Statewide Arboretum Green Infrastructure Coordinator

We at NSA are big advocates of native plants and believe strongly that they should be put to much greater use in our planted landscapes. In fact, we believe that our community landscapes should become refuges for native prairie plants, since much of our best prairie habitat was long ago lost to the plow. There seems to be a growing trend in using native plants in the landscape, and natives are becoming more available in the nursery trade. This is a terrific trend and we will work hard to extend it even further.

Despite our love of native plants, however, we're the first to admit that they're far from perfect and aren't always the best choice for every landscape situation. Tall prairie plants can be especially difficult to use where space is limited (which is much of the community landscape), and many native plants, including some of our most attractive western beauties, can be finicky and difficult to establish for novice gardeners. Finally, it's worth noting that our only eastern Nebraska native evergreen, the redcedar, has become an invasive weed in many landscapes.

We're not ashamed to admit that we often advocate for well-behaved, non-native plants here and there to add visual interest, fill space, enhance the bloom season and to attract pollinators. Such use of non-natives is sometimes frowned upon by overzealous native plant enthusiasts who desire purity where it is neither warranted nor possible. When you stop and think about it, every community landscape is a contrived landscape that must first function for a wide variety of human-oriented purposes and activities.

Perhaps the most important thing to remember is that much of the community landscape needs to be maintained at a relatively low height to allow for play, visibility, safety and neighborliness. Thus lawns and shortly-cropped landscape areas have evolved to dominate much of the ground plane of the community. For such areas a return to native prairie just does not make sense. And because of the enormous value that trees provide, much of the community becomes shady over time. Again, sun-loving prairie plants are not the best choice where trees dominate.

The clear truth is that well-behaved, non-native, herbaceous plants are valuable to making our community landscapes both beautiful and functional and many help sustain pollinators and other important insects. One of the most important things about non-natives such as catmint, yarrow, salvia, sedum and Russian sage is that they are easy to grow and extremely reliable across a wide range of soil conditions. They allow us to cover the ground with a good variety of things that novice gardeners will have success with. Most non-native plants are not the enemy of a good environmental outcome for communities but critically important to our efforts at soil conservation, stormwater management, water conservation, pollinator health, beauty and a better quality-of-life.

On the other hand, it's very important to note that many non-native plants brought to our region have become serious problems by invading into wild areas. This includes such things as purple loosestrife, garlic mustard, honeysuckle, multiflora rose and phragmites to name just a few.

Before using non-natives, it's always smart to do an internet search to learn their potential for invasiveness. Every state maintains such lists and a good place to look for our region is the Nebraska Invasive Species Program (neinvasives.com). Finally, we would all be wise to stick with native plants when landscaping around important natural areas such as woodlands and unplowed prairies. Though these situations are somewhat rare, they really do require extra diligence in trying to prevent invasive plant problems.

If we could snap our fingers and instantly convert our community landscapes to native plantings, we would be tempted. But we would ultimately not do that since we know the limitations of native plants in our human-active communities. For us a better goal would be to strive for at least a 50/50 balance of native and non-native plants. We still have a LONG way to go to achieve that.

Attracting Beneficial Insects

Jennifer Hopwood, Xerces Society for Invertebrate Conservation

My toddler son often likes to sit in the patch of flowers next to our front stoop, a perfect vantage point for watching insects zoom over his head. Throughout the summer, as I watched him play in the garden, I also watched the garden. Among the many wildflowers, I noticed that several red aphids had found the brown-eyed Susans and a few bright orange aphids had discovered the butterfly milkweed in mid-July. It wasn't very long before those few aphids became many and soon the plants began to droop as the aphids fed on them. But within a few days, I began to see other insects among the aphids, namely lady beetles (aka lady bugs), lacewings and small wasps, beneficial insects that can limit outbreaks of pests like aphids.

Predatory insects like lady beetles and lacewings hunt and consume their prey, which can include pests such as aphids, whiteflies, mites and other small insects. The tiny wasps I saw around the aphids were parasitoid wasps, insects that lay their eggs on or inside insect hosts. The young wasp larvae fed off the aphids, ultimately killing the aphids when the wasps emerged as fully developed adults. These and other predator and parasitoid insects play a major role in reducing pest damage by suppressing insect pests in gardens as well as in agricultural crops. In fact, native species of predators and parasitoids contribute at least $4.5 billion annually to crop pest control in the United States.

In order for predators and parasitoids to contribute to pest control, they need habitat. Many require floral nectar or pollen to complete their life cycle or see them through times when prey is scarce. Less disturbed habitat within or close to a garden or crop can provide these resources, as well as shelter, overwintering sites, alternative prey and a refuge from pesticides. Recognizing the value of predators and parasitoids to their bottom line, some farmers have begun to incorporate habitat on their farm by including native wildflowers in their field borders or setting aside strips of native bunch grasses to serve as habitat refuges.

Conversely, landscapes without much natural or semi-natural habitat are more likely to have severe pest issues because predators and parasitoids are not present in large enough numbers.

For example, yards with large expanses of manicured lawns and only a few types of ornamental shrubs provide neither food nor shelter for predators and parasitoids (or other wildlife). Outbreaks of bagworms, lacebugs or other common pests that cause unsightly defoliation of ornamental shrubs and trees often occur in these simplified landscapes.

Flowers are already a valued component of gardens and yards. When selected and planted in yards with beneficial insects in mind, native wildflowers in particular provide habitat for beneficial insects that can limit pests like bagworms and reduce or eliminate the need for pesticide applications.

Theo Dickson watching insects; monarch butterfly on tall thistle.

Habitat allows predators and parasitoids to survive, proliferate and contribute to pest control, and habitat can also support other beneficial insects such as pollinators. Pollinators are responsible for the reproduction of nearly 85 percent of flowering plants around the world, allowing plants that are food or habitat for other wildlife to persist. Pollinators can also be a food source themselves for other wildlife, like songbirds. They are an indispensable component of a healthy environment.

Pollinators are vitally important to agriculture, too. More than two-thirds of crop species—crops that produce fruits, vegetables, spices, nuts, seeds and livestock forage—depend on them. From the coffee you drink in the morning to the apple pie you have for dessert, an estimated one-in-three mouthfuls you consume come from a pollinator-dependent crop.

There are simple steps that everyone can take to conserve beneficial insects, including creating flower-rich gardens, restoring natural areas and protecting beneficial insects and their habitat from pesticides. To learn more, visit the Xerces Society for Invertebrate Conservation's website, www.xerces.org. The Xerces Society works to protect these small animals that sustain our lives and our ecosystems.

In my own home garden, once the predators and parasitoids moved in, the numbers of aphids dwindled and the plants rebounded. My garden's flowers provide food for pollinators and other beneficial insects, as well as an endless source of interest for my family.

An Abbreviated Guide to Nebraska's Common Pollinating Insect Groups

Carter Westerhold and Doug Golick, University of Nebraska-Lincoln Department of Entomology
Photos by Jim Kalisch and Louise Lynch
Supported in part by the Nebraska Environmental Trust

Bees and Wasps

Bees come in many shapes and sizes. Here are some common bees that Nebraskans may encounter in their gardens and home landscapes.

Bumble bees: These bees belong to the genus *Bombus*. The word *Bombus* is derived from the word "bombos," which translates to "a buzzing sound." The distinct, deep buzzing sound of bumble bees is made by their wings. Another feature of bumble bees is their abundant hair and large size. These North American natives can be seen from early spring to late fall, making them especially important early and late season pollinators. Nebraska has 20 species of bumble bees with different species found in the east and west.


Bumble bee collecting nectar on a purple coneflower.

Sweat Bees: This group of bees, also known as halictid or ground-nesting bees, contains many species. These small-sized bees come in many forms. Some species are beautiful metallic greens and blues, while other species are dull in appearance and non-descriptive. Species of halictid bees can be found throughout the year. Some species will collect pollen from a


Sweat bee foraging on a coneflower.

wide range of flowers, while others are specialists that collect pollen from specific flower groups.

Leafcutter and Mason Bees: Like sweat bees, these bees belong to a large, diverse group called megachilids. Leafcutter bees construct their nests in tubes, removing sections of plant


Leafcutter bee sealing off her tunnel nest in a man-made bee block.

leaves with their large mandibles (jaws) to provision their tunnel-like nests. In their nests, they build cell walls with leaf pieces, provision the cell with pollen, and lay an egg. In each cell, the egg hatches and begins development into an adult bee. Mason bees similarly create nests in tubular holes and line these nest cells with mud. Whereas most bees carry pollen on their legs, leafcutter and mason bees collect and carry pollen on the underside of their abdomens.

Wasps: While bees and wasps are closely related, they differ greatly in what they eat. Wasps are almost exclusively carnivores, while bees feed on nectar and pollen. Wasps may also feed on flower nectar as a "pick me up." During nectar feeding, they will often pick up pollen accidentally and transfer it to other flowers.

Butterflies

Perhaps the most well-liked and recognizable of insects, butterflies come in many shapes, sizes, and colors.

Monarchs: This species of butterfly is the poster child of pollinator conservation. The amazing annual migration of monarch butterflies covers


Monarch feeding on nectar of a goldenrod.

3,000 miles from Mexico to Canada and is a true biological phenomenon. Although milkweed is the exclusive food source for monarch caterpillars, adult monarchs feed on nectar from a wide variety of flowers. For example, gayfeathers (genus *Liatris*) are extremely attractive to monarch butterflies.


Tiger swallowtail on a butterfly bush.

Swallowtails: Swallowtail butterflies are easily identified by the distinct "tail" on the lower pair of wings. Different species of swallowtail can be found throughout Nebraska. Depending on the species, larvae may feed on a wide variety of plants such as alexanders, maples, serviceberry, pawpaw, birch, poplar, elm, and others.

Flies

Often thought of as pests, many flies feed on flower nectar and incidentally get pollen stuck to them which then may be transferred to other flowers that these flies visit.

Flower Flies: This group of flies is commonly referred to as hoverflies, flower flies, or syrphid flies (syrphid coming from their family name). Many flower flies are yellow and black striped, giving


Syrphid fly resting on a leaf.

them the appearance of bees and/or wasps. This is a defensive mechanism known as mimicry that helps ward off potential predators. The best way to distinguish flower flies from bees and wasps is to look at the number of wings. Flies have one pair of wings, whereas bees and wasps have two pairs. Flies also have very short antennae compared to most bees and wasps.

Bee Flies: Bee flies, like flower flies, resemble bees. Some people find their fuzzy appearance quite comical or cute. Like flower flies, bee flies use mimicry to


Bee fly drinking nectar.

ward off predators while they feed on flower nectar for energy.

Beetles

Beetles are often overlooked as pollinators. Beetles emerge as adults in large numbers and feed on pollen as a source of protein. While feeding, they pick up pollen incidentally and deposit it on other flowers. Beetles are a very old group of insects (millions of years old), and are among the first pollinating insects.

Soldier Beetles: Adult soldier beetles are often confused with fireflies. Although both are beetles, only soldier


Soldier beetle foraging for pollen.

beetles frequent flowers to feed on pollen. Swarms are found on linden flowers in June and goldenrod (*Solidago*) is a favorite for these beetles in the late summer and fall.

Blister Beetles: Blister beetles are known for their unique defensive mechanism of secreting a chemical that blisters


Black blister beetle eating pollen.

the skin. This diverse group contains many species that vary in appearance. Adults feed on flower pollen as a source of protein and are incidental pollinators.

Be careful with fall & winter clean-up...

"Fortunately, as our appreciation for the winter forms and colors of perennials is heightened, as well as our awareness and sensitivity to the habits of birds and butterflies, we no longer mindlessly go out and cut everything back, leaving the garden naked of any signs of dormant plants. In addition to their ornamental qualities, perennials in the winter landscape are important resources for birds and butterflies. Butterflies such as the viceroy pupate in a sheltered spot for the winter; and other species of butterflies and moths lay eggs in the leaves of perennials for overwinter.

If we cut down and compost these plants, we may be composting next year's generation of butterflies."

Tracy DiSabato-Aust

Pollinator Plants through the Year

Lists compiled by Rachel Anderson, MLA,
Community Landscape Specialist for
Nebraska Forest Service &
Nebraska Statewide Arboretum

Note: Pollinaor "Bloom Boxes"
are available at plantnebraska.org

From top: Dwarf blue indigo, Baptisia minor;
golden Alexanders, Zizia aurea.

Opposite: aromatic aster, Aster oblongifolius;
showy black-eyed Susan, Rudbeckia fulgida
var. speciosa;
Gray's sedge, Carex grayii.

Insects: Lady beetle and bumble bee.

Spring

6-18" high	
Plains Pussytoes	Antennaria neglecta
Prairie Larkspur	Delphinium virescens
Hoary Puccoon	Lithospermum canescens
Pasque Flower	Pulsatilla patens
Carolina Anemone	Anemone caroliniana
Prairie Phlox	Phlox pilosa
Canada Anemone	Anemone canadensis and cylindrica
Green Milkweed	Asclepias viridiflora
Beardtongue	Penstemon cobaea and digitalis
Spider Milkweed	Asclepias viridis
Prairie Smoke	Geum triflorum
Wild Geranium	Geranium maculatum
Blood Root	Sanguinaria canadensis
Birdsfoot Violet	Viola pedata
18-36" high	
Tube Beardtongue	Penstemon tubiflorus
Prairie Ragwort	Senecio plattensis
Spiderwort	Tradescantia bracteata, occidentalis and ohiensis
Wild Columbine	Aquilegia canadensis
36-48" high	
Soapweed Yucca	Yucca glauca
Indigo	Baptisia alba, australis, bracteata and minor

Early Summer

6-18" high	
Fringed Sage	Artemisia frigida
Prairie Petunia	Ruellia humilis
Yellow Sundrops	Calylophus serrulatus
Poppy mallow	Callirhoe involucrata and alcaeoides 'Logan Calhoun'
Missouri Primrose	Oenothera macrocarpa
Whorled Coreopsis	Coreopsis verticillata
Wild Onion	Allium canadense
Thimble Anemone	Anemone virginiana
18-36" high	
Coreopsis	Coreopsis lanceolata and palmata
Prairie Rose	Rosa arkansana
Milkweed	Asclepias sullivantii and syriaca
Dwarf Leadplant	Amorpha nana
Hairy Golden Aster	Heterotheca villosa
Prairie Gypsy Monarda	Monarda bradburiana 'Prairie Gypsy'
White Wild Indigo	Baptisia lactea
Palespike Lobelia	Lobelia spicata
Black-eyed Susan	Rudbeckia hirta
White Prairie Clover	Dalea candida
Pale Purple Coneflower	Echinacea pallida and purpurea
36-48" high	
Showy Milkweed	Asclepias speciosa
Wild Beebalm	Monarda fistulosa
Compass Plant	Silphium laciniatum
Michigan Lily	Lilium michiganense
Scarlet Beebalm	Monarda didyma

Late Summer

18-36" high

Western Iron Flower	Vernonia baldwinii
Round-Head Lespedeza	Lespedeza capitata
False Boneset	Kuhnia eupatoroides
Prairie Sage	Artemisia ludoviciana
Hyssop	Agastache foeniculum
Whorled Milkweed	Asclepias verticillata
Silky Prairie Clover	Dalea villosa
Blazing Star	Liatris squarrosa and punctata
Vivid Obedient Plant	Physostegia virginiana 'Vivid'
Slender Mountain Mint	Pycnanthemum tenuifolium
Joe Pye	Eupatorium purpureum
Cardinal Flower	Lobelia cardinalis
White Snakeroot	Ageratina altissima

36-48" high

White Turtlehead	Chelone glabra
Rosinweed	Silphium integrifolium and perfoliatum
Obedient Plant	Physostegia virginiana
Maximilian Sunflower	Helianthus maximilianii
Iron Flower	Vernonia fasciculata
Catnip Giant Hyssop	Agastache nepetoides
Sweet Blackeyed Susan	Rudbeckia subtomentosa
Yellow Coneflower	Ratibida pinnata
Showy Tick Trefoil	Desmodium canadense
Wild Senna	Senna hebecarpa
Meadow Blazing Star	Liatris ligulistylis
False Sunflower	Heliopsis helianthoides
Common Boneset	Eupatorium perfoliatum and purpureum

Autumn

18-36" high

Aromatic Aster	Aster oblongifolius
Downy Gentian	Gentiana puberulenta
Golden Aster	Solidaster luteus
Riddell's Goldenrod	Solidago riddellii and flexicaulis
Aster	Aster ericoides, oolentangiense and novae-angliae
Vervain	Verbena hastata
Siskiyou Pink Gaura*	Gaura lindheimeri 'Siskiyou Pink'
Rough Blazing Star	Liatris aspera
Stiff Goldenrod	Solidago rigida
Blue Lobelia	Lobelia siphilitica
Turtlehead	Chelone lyonii

36-48" high

Boltonia	Boltonia asteroides
Aster	Aster laevis and novae-angliae
Tall Boneset	Eupatorium altissimum and serotinum
Gaura	Gaura lindheimeri, coccinea and parviflora
Sunflower	Helianthus grosseserratus, hirsutus, tuberosus and flexicaulis
Brown-eyed Susan	Rudbeckia triloba
Pitcher Sage	Salvia azurea
Goldenrod	Solidago rugosa and speciosa

Sedges and Grasses

Sedges	Carex species
Bottlebrush Grass	Elymus hystrix
Little Bluestem	Schizachyrium scoparium
Prairie Dropseed	Sporobolus heterolepis

Some of Our Favorite Insects

Justin Evertson, Green Infrastructure Coordinator

Insects are just plain fascinating in the wide variety of shapes, colors, life cycles and activities they express. Some are incredibly tiny, like fairy wasps that are no bigger than an amoeba and only visible under magnification, while others such as the goliath beetles of Africa are the size of a human hand and can weigh over 3 ounces (How would you like that crawling down your back?). Or think about some periodical cicadas that can live as juveniles underground for up to 17 years only to emerge as an adult and survive just long enough to mate—usually less than three weeks. So much for enjoying the "adult" years.

A Nebraska insect that has always fascinated me is the velvet ant, sometimes called the cow-killer ant, which is actually a type of wasp. The females are wingless and look very much like a large ant cloaked in black and orange fur. Velvet ants are not aggressive and are generally harmless to humans although the females can inflict a very painful sting when handled. The velvet ant is involved in an interesting bug-eat-bug story involving cicadas and the cicada-killer wasp. In the heat of summer, female cicada-killers love nothing better than to find a cicada, paralyze it with a sting and then take it back to an underground burrow. Although the wasp is quite large (up to 2 inches long), flying with a cicada that weighs significantly more than the wasp is no small feat. Once the cicada is placed in the burrow, it will serve as a food source for the wasp's egg that will soon be hatching.

In the insect world, what goes around often comes around, and in an ironic twist of fate many cicada-killer larvae become meals themselves. After a young cicada wasp has fattened up and begins to pupate, a female velvet ant will often find the nest and lay an egg on the pupa. Eventually the velvet ant larva will emerge and start eating the developing cicada wasp. When it is ready to become an adult, the velvet ant pupates inside the nest of the wasp where it will spend the winter, eventually emerging the following summer. Fascinating!

Here are a few more favorite insects from various insect-minded folks.

Kyle Martens, Nebraska Forest Service, Lincoln

Banded woolybear caterpillar (Isabella tiger moth): They were the focal piece in all my boyhood terrariums and were widely popular during social functions; mainly, third grade Show and Tell. My siblings and I always did our best to release them back into the "wild" on our farm so we could check-in on them down the line. We laughed hysterically at the thought of a woollybear family gathering, and we wondered why they never seemed to be in a hurry. It taught me the difference between a cocoon and chrysalis. According to grandma and grandpa they preferred weeds to the vegetables in their garden. If you were cool with my grandparents, then you were A-OK in my book.

Shaun Evertson, Rancher and Writer, Kimball

Yucca moth. Symbiosis and coevolution, what's cooler than that? Carrion beetles. Colorful and efficient. And what a sense of smell! These are insects whose existence is unknown to most people and yet they're out there suiting up every day, each of them an important part of nature's earthly ecosystem. *Editor's note*: The yucca moth co-evolved with the yucca and the two depend on each other. The yucca gives up a few seeds to a developing moth larva in return for pollination by adult moths.

Alan Roesler, City of Kearney

Praying mantis in its role as a beneficial predator, despite the way they eat their mates. They seem to be increasing in my neck of the woods. I grew up aware of them but never saw them in the wild. Now we have resident individuals; one has been a front door greeter lately and there are occasional packs of "pups" around the house. I told my wife they eat spiders so they get a pass.

Todd Faller, Faller Landscape and Nursery, York

Praying mantis, hands down. We'll even take them off of plants going to a landscape job so that we can keep our population up at the nursery. I don't spray insecticides in the nursery yard so that we keep all the good guys (and ladies) around.

Mark Canney, City of Lincoln

One of my favorite insects is the great black wasp (*Sphex pensylvanicus*). It is black mono-colored as the name suggests and shimmers in the sunlight. Its armor reminds me of an alien super hero. I don't really know where it lives but I see it skillfully maneuvering like a jet fighter pilot among my rattlesnake master plants in early summer and swamp milkweed in August. I'm intimidated not out of the potential for being stung by this incredible arthropod (only the females have this skill) but rather the sheer beauty of its focus and deliberateness in gathering nectar… they're keenly aware of my presence but choose to ignore it.

Eric Berg, Nebraska Forest Service, Lincoln

Lightning bugs / fireflies. These little beetles are an indicator of landscape health and diversity to me. Drive through a typical suburban neighborhood with fescue curb-to-curb and the occasional red sunset maple and I challenge you to see a lightning bug, but go to a landscape with a diversity of native plants and structure and BOOM cheap entertainment for a July evening. The last I read, scientists still do not exactly understand how the beetle makes the glow, but we do know the insects take in oxygen and combine it with cells in their abdomen with a substance called luciferin to produce the "free" light show. Nature is pretty nifty.

I also like the "crayfish of the compost pile," the pill bug or roly-poly. These little dudes are pretty amazing at breaking down organic matter and it is

pretty amazing to me every time I stir the compost pile how many of them are in there churning things around. I have read that they are more closely related to shrimp and crayfish than to insects; I love seafood, but have not tried any sowbugs yet—too difficult to get them on a fork I guess.

Bob Henrickson,
Nebraska Statewide Arboretum, Lincoln
I would highlight two: bumble bees and hover flies. According to the Xerces Society, bumble bees are some of the most important pollinators of wild flowering plants and crops. They are generalist foragers and do not depend on any one flower type. However, some plants rely on bumble bees for pollination, including red clover, alfalfa, field beans, peas, runner beans, tomatoes and in some areas cotton, raspberries, apple, plum blossom, sunflowers, strawberries, currants and brambles.

To me, hover flies are the masters of flight! I enjoy watching these tiny bee look-a-likes with their oversized eyes hovering over flowers. These are the brightly colored impersonators of bees to fool hungry birds. Despite their appearance they are not bees but flies; they don't have a sting as bees do and only have two wings as all flies do! The adults of many species feed mainly on nectar and pollen, while the larvae (maggots) eat a wide range of foods. In some species, the larvae eat decaying plant and animal matter in the soil or in ponds and streams. In other species, the larvae are insectivores and prey on aphids, thrips and other plant-sucking insects. My kind of bug!

Kendall Weyers, Nebraska Forest Service, Lincoln

One of mine is the pill bug (officially a crustacean). I like it because it's always doing work for me in my compost piles, looks cool and because of its LONG list of funky names, starting with its genus Armadillidium. Other common names from around the world include cheesy bobs, chiggy pig, monkey peas, armadillo bug, boat-builder, butcher boy, cheeselog, doodlebug, gramersow, potato bug, rolly-poly, sow bug, slater and woodlouse.

Sue Dawson,
Gardener, Lincoln
Our yard has lots of blooms throughout the growing season for pollinators to enjoy. I love going out at different times of the day, frequently camera in hand, to see what kinds of insects are out there. I especially like it when I see different kinds of insects feeding near each other. What is my favorite insect? Whatever I'm seeing at the moment.

Karen Messenger, Lincoln

I'll nominate dragonflies, since they're such good eaters of things that like to lunch on me, and also dung beetles, which are host-specific cleaner-uppers of fly nurseries and extra fertilizer-to-be.

Jennifer Hopwood, Xerces Society, Omaha

Sunflower bee, *Svastra obliqua*. Named for its penchant to frequent sunflowers, female bees of this species appear to prefer to collect pollen from sunflowers and other fall-blooming plants in the family *Asteraceae*. Although the common name, sunflower bee, can be applied to a number of fall-flying bees, I find this robust, large species particularly striking. I'm also fascinated by its nesting biology. Though females of this species each create and provision their own nest underground, they may nest communally, with multiple females sharing a single nest entrance. Aggregations of burrow openings are also common, especially in expanses of bare ground. To encourage these sunflower bees, grow sunflowers, asters, ironweed and other fall-blooming plants, and conserve existing patches of bare ground by avoiding major disturbances to the soil and barriers such as plastic mulch.

Kathleen Cue, UNL Extension, Omaha

In August and September, I especially appreciate that unsung hero, the garden spider. These black and yellow guys and gals are about the only arthropod big enough to eat grasshoppers at this time of the growing season, and I cheer their efforts when I see grasshoppers caught in their webs. Even if there are weeds I intend to pull, I leave the weeds alone if there's a garden spider attached!

Erin Ingram, Institute for Agriculture and Natural Resources, University of Nebraska-Lincoln

It's difficult to choose a favorite pollinator because part of the allure of pollinators is their diversity. However, I think a female wool carder bee takes the prize for "most striking first impression." My initial encounter with a carder bee was on a stroll through the UNL arboretum. With a stocky, robust body decorated in stark black and yellow markings, she caught my eye. I watched as she industriously scraped fuzz from the wooly leaves of lamb's ear. She occasionally would pause to roll a loose ball of this treasure under her abdomen. This behavior was unknown to me at the time, but I later learned she would return home to line her nest with her "wool ball." It was lovely to think she was using nature to craft a baby blanket.

Jody M. Green,
UNL Extension in Lancaster County
As an urban entomologist, I'm bombarded with the usual suspects: bed bugs, ants, termites and other household invaders.

Prior to moving into the Nebraska Extension office in Lancaster County, I had little experience with pollinator gardens and solitary bee hotels. Today, if I'm not at my desk working, I'm taking breaks out back, watching my new favorite insect, the leafcutter bee. It's low-tech, non-stop, outdoor entertainment, especially on warm, sunny summer days. I've really enjoyed watching them pack the hotel with discs of leaves, flower petals, eggs and pollen. If pollination and entertainment aren't good enough reasons to love them, I love megachilids because they are so darn cute!

Fun Facts about Insects

- Of the huge numbers of insects, only a tiny amount, one percent, are harmful to humans.
- The world's termites outweigh the world's humans 10 to 1.
- There are more insects in one square mile of prairie or diverse rural land than there are human beings on the entire earth.
- Aphids are born pregnant without the benefit of sex. Aphids can give birth 10 days after being born themselves.
- Katydids have ears in their front legs.
- Honey bees have to make about ten million trips to collect enough nectar for production of one pound of honey.
- Honey bees have hair on their eyes.
- Ants can lift and carry more than 50 times their own weight.
- For every human there are about 1 million ants.
- For more than 3,000 years, carpenter ants have been used to close wounds in India, Asia, and South America.
- The praying mantid is the only insect that can turn its head 360 degrees.

From top: Dragonfly; praying mantid; hummingbird moth.

- Dragonflies are one of the fastest insects, flying 50 to 60 mph.
- Leaf-cutter ants don't eat the leaves they cut... they eat the fungus which eventually grows on the leaf as it decays.
- Ants don't sleep.
- The original name for the butterfly was "flutterby."
- It takes about one hundred monarch butterflies to weigh an ounce.
- The cicada makes the loudest sound of any insect.
- The strongest creature in the world is the rhinoceros beetle. It can lift 850 times its own weight.
- Dragonflies have the largest eyes and best eyesight of any insect.
- A mayfly has a lifespan of 24 hours.
- A cockroach can live for up to 9 days without its head and dies only because of starvation.
- Mosquito repellents don't repel—they hide you. The spray blocks the mosquito's sensors so they don't know you're there.
- Mosquitoes dislike citronella because it irritates their feet.
- The mantid's strike is so fast that it cannot be processed by the human brain.
- Hairs on insects help rid them of dust, which can make them too heavy to fly. "A honeybee has the same amount of hairs as a squirrel: 3 million. That's nothing compared to butterflies and moths—each have nearly 10 billion hairs. The human head, as a comparison, has just 100,000." *Georgia Tech*
- The house fly "hums" in the key of "F."
- House flies find sugar with their feet, which are 10 million times more sensitive than human tongues.
- A slug has four noses.
- Some male spiders pluck their cobwebs like a guitar, to attract female spiders.
- "The rough dry bark of the trees is not such a barren waste as it seems. The amount of animal food in the shape of minute insects, eggs and larvae tucked away in cracks and crevices must be considerable, and, by dint of incessant peeping and prying into every seam and break in the bark, birds get fuel enough to keep their delicate machinery going." *John Burroughs*
- Baby robins eat 14 feet of earthworms every day!
- The common garden earthworm has five pairs of hearts.
- A snail can sleep for 3 years straight!
- Insects have been present for about 350 million years, and humans for only 130,000 years.
- To survive the cold winter months, many insects replace their body water with a chemical called glycerol, which acts as an "antifreeze" against lethal temperatures.
- Male mosquitoes do not bite humans, but rather live on plant juices and other natural liquids from plants and decomposing organic material.

and Pollination

Three quotes below are from Ken Druse, with plants opposite in the order they are mentioned.

"The common milkweed, *Asclepias incarnata*, is the preferred host to the monarch butterfly caterpillar. The plant is toxic, but not to the caterpillars that eat the leaves and incorporate the toxins, which makes the caterpillars bad tasting and even poisonous to potential prey."

"Like honey bees, bumble bees are important pollinators…. But bumble bees are also avian allies of some plants through a means of pollination that honey bees cannot perform: sonication, using vibration and sound to shake pollen free. Approximately 8 percent of all flowers require sonication—resonant vibration—also called buzz pollination." (wild senna, *Senna hebecarpa*)

"Plants that attract butterflies use sweet fragrance and bright color rather than an abundance of pollen. The flowers of these butterfly lures are shaped like little cups, or they may have long spurs, like the columbine's, that require the butterfly to unroll its coiled tongue."

"What about simple monotone flowers? Well, the thing about nectar guides is that we humans can't always see what the bees do! We can see all of the colors from red to violet, but bees see a shifted spectrum from yellow through ultra-violet. So to bees, even seemingly plain flowers may have bold nectar guide patterns. With UV sensors, even humans can get a glimpse of what nectar guides look like to bees. The web site Flowers in Ultra-Violet has many images comparing flowers in daylight and UV light in which the guides are visible." *The Bee Gardener, ucanr.edu/blogs/TheBeeGardener/*

Photos above of white yarrow in visible and ultraviolet light on right.
www.naturfotograf.com/
UV_flowers_list.html#top/

"We need to remember... that the generalization that pesticides should be banned (as opposed to more carefully regulated) because of misuse of a few of them might harm honeybees is foolhardy. For example, neonicotinoides applied systemically for borer control in trees such as ash and oak that are wind-pollinated can save countless trees which provide habitat for countless more organisms. Those same chemicals applied surficially (on the surface), or during the blooming season to trees that are bee-pollinated, can be a major problem. Tough questions often cannot be addressed with simple answers." *Guy Sternberg, Starhill Forest Arboretum*

"The color of the nectar guide of the horse chestnut tree (*Aesculus hippocastanum*, opposite) changes from yellow to red when nectar is no longer in production." *Wikipedia*

Large bumblebees are about the only pollinators strong enough to force open the petals of bottle gentian and crawl inside. Called a "mutualistic association," it gives bees almost exclusive access to their nectar, and the plants attract "loyal" pollinators to improve chances for cross-pollination.
* Watch a bumblebee pollinating a bottle gentian at: *plantnebraska.org*

A Call for Backyard Biodiversity

Written by Doug Tallamy,
www.bringingnaturehome.net,
and originally published in the Autumn 2009
issue of **American Forests** magazine

You have probably never thought of your property as a wildlife preserve representing the last chance we have to sustain plants and animals that were once common throughout the US. But that is exactly the role our suburban and urban landscapes are now playing—and will play even more in the near future.

If this is news to you, it's not your fault. We were taught from childhood that the plantings in our yards are made mostly for beauty; they allow and encourage us to express our artistic talents, to have fun, and to relax. And whether we like it or not, the way we landscape our properties is seen by our neighbors as a statement of our wealth and social status.

But no one has taught us that we have forced the plants and animals that evolved in North America (our nation's biodiversity) to depend more and more on human-dominated landscapes for their continued existence. We have always thought that biodiversity was "happy somewhere out there in nature": in our local woodlot, or perhaps our state and national parks. We have heard nothing about the rate at which species are disappearing from our neighborhoods, towns, counties, and states. Even worse, we have never been taught how vital biodiversity is for our own well-being.

We Have Taken It All

The U.S. contains 4 million miles of paved roads, turning nature into long, barren stretches of land.

The population of the U.S., now over 304 million people, has doubled since most of us were kids, and continues to grow by roughly 8,640 people per day. All of those additional souls—coupled with cheap gas, our love affair with the car, and our quest to own ever larger homes—have fueled unprecedented development that continues to sprawl over 2 million additional acres per year (the size of Yellowstone National Park). We have connected all of our developments with four million miles of roads; their paved surface is five times the size of New Jersey.

Somewhere along the way we decided to convert the forests that used to cover our living and working spaces into huge expanses of lawn dotted with a few small, mostly nonnative trees. So far we have planted over 62,500 square miles—some 40 million acres—in lawn. Each weekend we mow an area eight times the size of New Jersey to within an inch of the soil and then congratulate ourselves on a job well done.

And it's not as if those little woodlots and "open spaces" that we have not paved over are pristine. Nearly all are second-growth forests that have been thoroughly invaded by alien plants like autumn olive, multiflora rose, bush honeysuckle, privet, Oriental bittersweet, buckthorn, and Japanese honeysuckle. More than 3,400 species of alien plants have invaded over 200 million acres of the U.S.

To nature lovers, these are horrifying statistics. I stress them so that we can clearly understand the challenge before us. We have turned 54 percent of the lower 48 states into a suburban/urban matrix, and 41 percent more into various forms of agriculture.

That's right: We humans have taken 95 percent of nature and made it unnatural.

But does this matter? Are there consequences to turning so much land into the park-like settings humans enjoy? Absolutely, both for biodiversity and for us. Our fellow creatures need food and shelter to survive and reproduce, and in too many places we have eliminated both. State Natural Heritage Centers have estimated that as many as 33,000 species of plants and animals in the U.S. are now imperiled—too rare to perform their role in their ecosystem. These species can be considered functionally extinct. The songbirds that brighten spring mornings have been in decline since the 1960s, having lost 40 percent of their numbers so far. One hundred twenty-seven species of neotropical migrants are in steep decline. In fact, a survey of our nation's bird populations, commissioned by former President Bush, has found that one-third of our nation's birds are endangered.

Why We Need Biodiversity

Nonnative ornamentals like the Asian azalea in this yard cannot support the nutritional and lifecycle needs of our native insect species.

For most of us, hearing such numbers triggers only a passing sadness; few people feel personally threatened by the loss of biodiversity. Here's why you should. Biodiversity losses are a clear sign that our own life-support systems are failing. The ecosystems that support us—that determine the carrying capacity of the earth and our local spaces—are run by biodiversity. It is biodiversity that generates oxygen and cleans water, creates topsoil out of rock, buffers extreme weather events like droughts and floods, pollinates our crops, and recycles the mountains of garbage we create every day.

And now, with human-induced climate change threatening the planet, it is biodiversity that, if given half a chance, will suck that carbon out of the air and sequester it in living plants. Humans cannot live as if they are the only species on this planet. Why? Because it is other species that create the ecosystem services that are so essential to us. Every time we force a species to extinction, we are encouraging our own demise. Despite the disdain with which we have treated it in the past, biodiversity is not optional.

Parks Are Not Enough

Neotropical migrants like the wood thrush are especially hard-hit by habitat loss.

I am often asked why the habitats we have preserved within our park system are not enough to save most species from extinction. Years of research by evolutionary biologists have shown that the area required to sustain biodiversity is pretty much the same as the area required to generate it in the first place. The consequence of this simple relationship is profound. Since we have taken 95 percent of the U.S. from nature, we can expect to lose 95 percent of the species that once lived here unless we learn how to share our living, working, and agricultural spaces with biodiversity. Ninety-five percent of all plants and animals! Now there is a statistic that puts climate-change predictions of extinction to shame.

And studies of habitat islands with known histories, such as Barro Colorado Island in the Panama Canal and Ashdown Forest in England, suggest that these predictions are accurate. Species are lost in the same proportion in which a habitat is reduced in size. The good news is that extinction takes a while, so if we start sharing our landscapes with other living things soon, we should be able to save much of the biodiversity that still exists.

Redesigning Suburbia

What will it take to give our local animals what they need to survive and reproduce on our properties? Native plants, and lots of them. This is a scientific fact deduced from thousands of studies about how energy moves through food webs.

Here is the general reasoning: All animals get their energy directly from plants, or by eating something that has already eaten a plant. Insects are the group of animals most responsible for passing energy from plants to the animals that can't eat plants. This fact is what makes insects such vital components of healthy ecosystems. So many animals depend on insects for food (e.g., spiders, reptiles, amphibians, rodents, and 96 percent of all terrestrial birds) that removing insects from an ecosystem spells its doom.

Diverse native gardens like this one provide support for many native species that cannot survive on nonnative plants.

But that is exactly what we have tried to do in our suburban landscapes. For over a century we have favored ornamental landscape plants from China and Europe over those that evolved right here. If all plants supported wildlife equally, that would be fine. But every plant species protects its leaves with a mixture of nasty chemicals that makes them distasteful at best, and downright toxic at worst. With few exceptions, only insect species that have shared a long evolutionary history with a particular plant lineage have developed the physiological adaptations required to disarm the chemical defenses in their host's leaves. They have developed over time to eat only the plants with those particular chemicals.

When we present insects from Pennsylvania, for example, with plants that evolved on another continent, chances are those insects will be unable to eat them. We used to think this was good. Kill all insects before they eat our plants! But a plant that cannot pass on the energy it has harnessed cannot fulfill its role in the food web.

We have planted Kousa dogwood, a species from China that supports only a few insect herbivores, instead of our native flowering dogwood (*Cornus florida*), which supports 117 species of moths and butterflies alone. In hundreds of thousands of acres, we have planted goldenraintrees, ginkgos, and dawn redwoods from China instead of one of our beautiful native oaks, and in doing so we have lost the chance to grow and support 534 species of caterpillars, all of them nutritious bird food. My research has shown that alien ornamentals support 29 times fewer animals than do native ornamentals.

The main message of Tallamy's research: what we do in our backyards can make a difference.

Plants Matter

Even the clear dagger moth caterpillar, which can feed off of many species, cannot digest nonnative plants.

In the past we have ignored the vital role plants play in our landscapes. Plants, of course, are the only organisms that capture energy from the sun and turn it into the simple sugars and carbohydrates: the food that supports nearly all the food webs on earth. Every time we bulldoze a native plant community, we are reducing the amount of food available for our fellow creatures. In fact, the amount of life that can exist in an area is directly proportional to the amount of vegetation in that area. Because plants have physical structure, they also provide housing for animals.

We can no longer landscape with aesthetics as our only goal. We must also consider the function of our landscapes if we hope to avoid a mass extinction that we ourselves are not likely to survive. As quickly as possible, we need to triple the number of native trees in our lawns and underplant them with the understory and shrub layers absent from most managed landscapes. Homeowners can do this by planting the borders of their properties with native trees such as white oaks *(Quercus alba)*, black willows *(Salix nigra)*, red maples (*Acer rubrum*), green ashes *(Fraxinus pennsylvanica),* black walnuts *(Juglans nigra)*, river birches (*Betula nigra*), and shagbark hickories (*Carya ovata*).

Those trees should be underplanted with woodies like serviceberry (*Amelanchier canadensis*), bottlebrush buckeye (*Aesculus parviflora*), arrowwood (*Viburnum dentatum*), hazelnut (*Corylus americanus*), and blueberries (*Vaccinium spp*).

Studies have shown that even modest increases in the native plant cover on suburban properties raise the number and species of breeding birds, including birds of conservation concern. As gardeners and stewards of our land, we have never been so empowered to help save biodiversity from extinction, and the need to do so has never been so great. All we need to do is plant native plants!

What to Plant in the Midwest

Certain native staples are essential to any forest restoration within the suburban/urban matrix. In the Midwest, native bur oak, honeylocust, and crabapple and understory plantings of bottlebrush buckeye, rough dogwood, pawpaw and wafer ash. Wafer ash, incidentally, is the primary host for the giant swallowtail butterfly, while pawpaw is the sole host for zebra swallowtails. And disease-resistant American elms are now available for urban restorations east of the Mississippi.

Best Providers for Pollinators

Compiled by Dr. Douglas Tallamy,
Professor & Chair of Entomology and Wildlife Ecology,
University of Delaware
www.bringingnaturehome.net

Woody Plants

Common Name	Plant Genus	Butterfly/moth species supported
Oak	Quercus	534
Black cherry	Prunus	456
Willow	Salix	455
Birch	Betula	413
Poplar	Populus	368
Crabapple	Malus	311
Blueberry	Vaccinium	288
Maple	Acer	285
Elm	Ulmus	213
Pine	Pinus	203
Hickory	Carya	200
Hawthorn	Crataegus	159
Spruce	Picea	156
Alder	Alnus	156
Basswood	Tilia	150
Ash	Fraxinus	150
Rose	Rosa	139
Filbert	Corylus	131
Walnut	Juglans	130
Beech	Fagus	126
Chestnut	Castanea	125

Oak in early spring

Herbaceous Plants

Common Name	Plant Genus	Butterfly/moth species supported
Goldenrod	Solidago	115
Asters	Aster	112
Sunflower	Helianthus	73
Joe pye, Boneset	Eupatorium	42
Morning glory	Ipomoea	39
Sedges	Carex	36
Lupine	Lupinus	33
Violets	Viola	29
Geraniums	Geranium	23
Black-eyed susan	Rudbeckia	17
Iris	Iris	17
Evening primrose	Oenothera	16
Milkweed	Asclepias	12
Verbena	Verbena	11
Beardtongue	Penstemon	8
Phlox	Phlox	8
Bee balm	Monarda	7
Veronica	Veronica	6
Little bluestem	Schizachyrium	6
Cardinal flower	Lobelia	4

Fireworks goldenrod in fall

Bountiful Borage

Graham Herbst
Nebraska Forest Service Community Forestry Specialist

The insect on this borage is Ailanthus webworm moth, a subtropical species that has moved north with ailanthus trees.

In the gardening world, well-behaved plants get most of the glory while more capricious species are viewed with skepticism and disdain, and often rightly so. If you have never planted a little plug of mint in a corner of the garden with dreams of summer evening mojitos on the patio—only to find a sod mat of the stuff within a year or two—then you've probably been warned by a friend who did. There are plenty of plants in the nursery trade that can "get away from you" if you don't have an effective plan for managing them, but not every plant in this category is as tenacious as they seem.

One of the first plants that taught me to embrace a plants' prerogative to travel around the garden was borage or starflower *(Borago officinalis)*. As an annual herb that spreads by seed, it is easy to see why many gardeners steer clear of planting borage but for me, to grow it is to love it. This plant forms 2-3 feet tall clumps of fuzzy pollinator playground that is topped by 5-pointed flowers for nearly four months! On one hand I can count the plants I know that give you pink and blue flowers side-by side but borage offers both, along with white-flowering varieties.

As a prolific self-pollinating annual, borage is a "wandering perennial" and not well-suited for the formal display garden. I like mixing my ornamental and vegetable gardens together and borage is wonderful in this context. If it's growing in an inconvenient place, I easily pull it up and lay the foliage in pathways. Borage is a deep-rooted plant that pulls minerals and nutrients from deep in the ground into its leaves and this is great material for replenishing the soil and smothering weeds as a green mulch.

Responding to the way starflower moves around my garden allows me to collaborate with the plant community I cultivate, rather than imposing strict control over every square foot. It is a well-known companion plant that protects beans, spinach and brassica while confusing tomato hornworms with its similar-looking foliage.

The young leaves and flowers have a mild cucumber flavor that makes the flowers a classic garnish for savory dishes and desserts. Borage seed oil is used in medicine to slow blood clotting, ease arthritis and it may be effective for treating some types of skin irritation in infants. A quick online search revealed quotes about the plant from a few famous botanists. Francis Bacon noted borage having "an excellent spirit to repress the fuliginous vapour of dusky melancholie," while John Gerard wrote, "The leaves and floures of Borage put into wine make men and women glad and merry and drive away all sadnesse, dulnesse and melancholy." I couldn't have said it any better.

The Joy of Bugs

Amy Seiler, Nebraska Forest Service Western Community Forestry Specialist

I have always wanted my kids to enjoy insects. I became intrigued with them when I took an entomology class in college and then I had the opportunity, as a student worker with the Nebraska Forest Service, to work in the lab sorting and identifying insect and spider samples. Insects look very different under a microscope… they have a whole new beauty to them. Because I thought insects were so interesting I thought my kids would be equally entertained with them. When they were young I bought picture books of bugs; decorated my first child's room with a beetle theme; bought stuffed toy insects; and when they were older, an ant farm and bug net with a holder to feed and observe the bugs they captured.

Through all of this effort I assumed my kids would respect insects, but they had no interest whatsoever in the insect world. Why not? When I asked what the word "bugs" made them think of, they talked about biting mosquitos, gnats flying around their face, flies in the house, creepy-crawlies, noisy crickets, wasp stings and bedbugs. They were only focused on the negative aspects of insects, the irritations of the bug world. I was crushed. My efforts to turn my children into advocates for the most common animals on the planet had failed.

Where had I gone wrong? I discovered they were seeing and even "experiencing" insects but they didn't know the important role they played in the ecosystem. They were seeing them as a piece of art, something to be looked at or observed. When I changed the conversation and began to talk about how important insects were instead of how cool they looked, my kids became much more aware and interested in some of the hardest workers on the planet.

Recently I asked them about their favorite insects. Instead of saying "red ants look cool," my youngest son said, "I like ants, yes they can bite and it hurts but they are food for other animals, they build roadways underground and help the soil breathe and they clean up stuff." My favorite comment from him was, "I really like them because they work together to get a job done, they can move things that are way bigger than they are when they all work together." That's good thinking for a 9-year-old.

So how did that change occur? For one thing I reframed our conversations. When I saw an insect I would point it out and we would talk about its physical attributes, but I would always follow with why it was important to us. A conversation would go something like, "Isn't that a pretty butterfly, but did you know that in its caterpillar stage it's important to our song birds as a food source for their babies." When we're out weeding, I talk about the bright colors on squash beetles and tell them that if we want zucchini or pumpkins, we need them to pollinate our plants. Now our kids are checking for pollinators, hoping everything will work just right and we will have huge pumpkins this fall. They've begun to know the value of those creatures.

Our oldest child got to dive deeper into appreciating pollinators when he worked with a friend of ours who is a beekeeper. He helped pick up a new hive of bees and introduce them to new surroundings. He talked with the beekeeper about the challenges and heartbreak of losing hives and the excitement/rush of checking the hives and harvesting the honey. Honey tastes better to him knowing where it comes from and now his favorite insects, hands down, are bees. He sees the value in our native bees as pollinators and he certainly appreciates honeybees and what they produce.

My final effort to get kids enthused about insects was to make it fun. I tried a treasure hunt in the yard, challenging them to find a red bug, an insect with lace-like wings, an insect that protects plants…. When they found them, I asked why they thought that insect was important. It's an opportunity to give a little more information that allows them to not only see the beauty (or grossness) of the insect but puts in their hearts and minds the valuable things these insects do to make the world a better, more livable place.

Nate Seiler uncovering a praying mantis. Ants are one of his favorite bugs, "they work together to get a job done."

Now I challenge all of **you** to get out there and do this with your kids, grandchildren, kids at church or at the ball diamond. You don't need to be an entomologist to teach kids about insects. My son plays baseball and now when I go to the ball field two little girls frequently ask me to go on a nature hike with them to look for bugs and all the other cool stuff nature provides. They look forward to it and they know it's going to be an adventure. They've learned the joy of bugs!

Don't treat it like dirt...

Beneficials beneath Your Feet

Kendall Weyers, Nebraska Forest Service
Sustainable Communities Coordinator

When discussing beneficial critters, it's easy to forget about the ones we don't see, especially those below ground. Yet the soil is where it all starts, so they deserve recognition and admiration too. From cycling and retaining nutrients to improving structure, suppressing disease and moving and holding water, air and carbon, the soil fauna does an incredible amount of work providing essentials for plant growth.

A healthy soil is an amazingly diverse, self-regulating ecosystem with a long list of creatures interacting with one another. When given appropriate conditions, their work generates soil rich in available nutrients, with favorable and stable pH, and good structure necessary for healthy root growth and critical water- and air-holding pore space.

The list of soil creatures is long, and their diversity and populations vary dramatically, not only from one biome to the next, but also from one plot to the next. Each prairie, field, forest or back yard has a unique mix of vegetation, microclimate, soil type and management practices, and with it, a unique food web. Yet within each soil food web there are common tasks that must be done. Following are the shared job titles, a few of the beneficial workers and the jobs they do.

Decomposers and Mutualists: Bacteria and Fungi

The decomposers take essential first steps to breaking down plant residue, while mutualists enhance plant growth. Bacteria and fungi retain nutrients in their biomass, create new organic compounds, help bind soil in beneficial aggregates, convert forms of nitrogen and aid in control of disease causing organisms. Some fungi even deliver nutrients and water to the plant.

Bacterial- and Fungal-feeders: Protozoa, Nematodes and Microarthropods

These guys (springtails, mites, etc.) are the grazers. As they work they release numerous nutrients, including plant-available nitrogen, control multiple disease-causing and root-feeding pests and energize and regulate bacterial and fungal populations.

Shredders: Earthworms and Macroarthropods

Shredders (millipedes, pill bugs, etc.) do just that while they feed on bacteria and fungi. This aids in breaking down

residue and their burrowing and fecal pellets enhance soil structure. Their guts and fecal pellets also provide habitat for beneficial bacteria.

Higher-level Predators: Predatory Nematodes, Macroarthropods

Population control is the main role of the predators (centipedes, beetles, ants, spiders, etc. and mammals like voles, mice and shrews). Their burrowing also contributes to soil structure.

Photos from top: pill bug;
millipede;
ground beetle.

Our Role

The vast majority of soil organisms are beneficial, but there are some organisms that can cause damage to plants. These include certain nematodes and various larvae that feed on roots, as well as disease-causing bacteria and fungi. Yet a biodiverse soil does a great job of controlling the populations, usually limiting their impact to tolerable levels.

We greatly affect the biodiversity, and the resulting effectiveness, of our soil by how we treat it. If we treat it like dirt, instead of living soil, we pay the price. Excessive traffic and over-tilling leads to compaction and limited pore space. Over-watering can create anaerobic conditions. Reliance on chemical pesticides and fertilizers creates artificial, often uninhabitable conditions. All of these negatives greatly limit, inhibit or eliminate a large portion of these valuable creatures and the benefits they provide.

To maximize your soil's potential, be kind to it and its inhabitants. Use a diversity of plants (especially natives), add organic mulch and compost, allow at least some plant litter to remain, water properly, limit tilling, limit foot and machine traffic and limit or avoid chemical applications. Then sit back and marvel at the diverse soil ecosystem and the extensive and essential behind-the-scenes work it does.

The (unseen) Value of Trees

Ryan Armbrust
Forest Health & Conservation Forester,
Kansas Forest Service

I've been a tree lover since I was a small boy. I grew up on a farm in rural Douglas County, in the bluffs of the Elkhorn River. I can still vividly recall the massive cottonwoods, ragged and storm-worn, that towered above all else and provided shade for the cattle all summer. The wafting aromas of the black locust grove in flower made me aware that more than just lilacs can be lovely in spring. And the hulking bur oak in the lower pasture, 200 years old if it was a day old, made me wonder at the scale of time as I climbed its stout, low-slung branches.

Each of these trees, when I first encountered it as a kid, impressed upon me something significant about its character at first glance. The impressive size of the cottonwoods, the unexpected fragrance of black locust, and the longevity and strength of the bur oak. But with trees, as is also true for people, there is much more to their beauty than the first impression. The cottonwood brings a "summer snow" of seeds and a gentle rustle of leaves. The black locust produced interesting seed pods and resisted the sharpest chainsaw when it was dry. And the bur oak, more than any other tree, was a home to all kinds of life from raccoons to gall wasps, and everything in between.

It's this feature of oaks that made me realize the importance of their place in our landscape. These oaks are a friend to all, providing food, shelter and a landmark to hundreds (if not thousands) of their neighbors. In a way, it's the insects that connect our oaks to the rest of their surroundings, even more than the tree's roots. These insects are the common currency of the ecosystem around them, making withdrawals and deposits of energy from plants to animals, and back again, as they go through what must appear from the tree's perspective a blindingly fast cycle of life and death. Innumerable generations of tiny bugs provide the caloric foundation for larger animals such as birds and mammals. These birds and mammals, making their home in the oak, serve as critical laborers in the business of seed dispersal. Obviously, without these links in the chain, immobile oaks would have perished long ago, buried under their own rotting acorns.

Bur oaks in Bur Oak Canyon;
Henry Armbrust with a walnut.

So, as I became aware of the role of tiny insects in the survival of trees and their dependent ecosystems, I developed a deeper appreciation of their role in connecting trees (and us) to our surroundings. It's not the size or age of a tree that connects it to its landscape, but the tiny insects that really integrate it within that context. And it's not our first impression of a tree that makes it important to us, but the almost unseen services it renders that make it crucial in our landscapes.

Pollinators—
so small
and yet
so much
depends
on them

Pollinator Resources

- Bugs in my Backyard, www.bugsinmybackyard.com
- Butterflies and Moths of North America, www.butterfliesandmoths.org
- Community as Habitat, a joint effort between NSA and UNL Entomology, communityashabitat.unl.edu
- Identification guide for North American insects, www.bugguide.net
- Illinois Wildflowers lists insect associates of prairie plants, www.illinoiswildflowers.info
- Prairie Ecologist Blog, prairieecologist.com
- University of Nebraska-Lincoln entomology, entomology.unl.edu
- University of Nebraska-Lincoln extension publications, extensionpubs.unl.edu
- Xerces society, www.xerces.org

Recent books include...

Planting in a Post-wild World

Thomas Rainer & Claudia West

Excerpt: "The front lines of the battle for nature are not in the Amazon rain forest… the front lines are our backyards, medians, parking lots and elementary schools."

Review: "Over time, with industrialization and urban sprawl, we have driven nature out of our neighborhoods and cities. But we can invite it back by designing landscapes that look and function more like they do in the wild: robust, diverse, and visually harmonious. [This book] is an inspiring call to action dedicated to the idea of a new nature—a hybrid of both the wild and the cultivated—that can flourish in our cities and suburbs. This is both a post-wild manifesto and practical guide that describes how to incorporate and layer plants into plant communities to create an environment that is reflective of natural systems and thrives within our built world."

The Living Landscape: Designing for Beauty and Biodiversity in the Home Garden

Rick Darke and Doug Tallamy

Excerpt: "Despite frequent remnant patches of layered woodlands, grasslands, and wetlands within the broad suburban landscape, they are just that: patches. These isolated fragments are typically surrounded by highly altered expanses with minimal habitat functionality. Their separation and relatively small size is insufficient to sustain the great diversity of wildlife that requires larger, continuous habitat. Reintroducing layers to residential landscapes is the best strategy for restoring biological function on a vast scale, contributing to habitat and to a wide range of ecosystem services that are broadly beneficial, including replenishment of atmospheric oxygen, carbon sequestration, groundwater recharge and filtration, soil conservation, and moderation of weather extremes."

Review: "Interest in the native plant movement is slowly growing, but this guide will interest all gardeners as Darke and Tallamy go beyond simple gardening tips to describe how native plants can play "essential roles in gardens designed for multiple purposes, with a focus on proven functionality." Beauty ranks high as a value and function, and the authors also note such equally important garden purposes as screening and cooling. They cover the various botanical, cultural, and temporal layers in wild landscapes, the interrelationships of living organisms, what landscapes do ecologically, the cultivation of appreciation for the wonder of nature's processes, and diverse home garden applications. Abundant color photographs of herons, egrets, turtles, and other animals enhance images of biodiverse landscapes and instructions for using native plant cuttings to create interior decor. The authors also provide useful grids showing selected plants' landscape and ecological functions organized by North American regions. Essential for gardeners and nature lovers interested in sustainability."

Using What We Have—

Community as Habitat

Justin Evertson, Green Infrastructure Coordinator

If the green spaces of our communities were properly planted and managed, they could become critical refuges for important native plants and wildlife including a wide variety of important pollinators. Every town has unused park spaces, school properties, fairgrounds, cemeteries, industrial areas and transportation corridors that are managed primarily by mowing the lawn or whatever grows there, and often by spraying away anything but turfgrass. And nearly every commercial or residential property has green space that would be healthier planted to something. These green spaces may as well include more native plants. Some of the bigger spaces could be planted and managed as richly diverse prairie plots. And although true prairie is harder to do on small residential or commercial yards, many native prairie plants lend themselves well for ornamental use in landscape plantings.

To help push this vision along, the Nebraska Statewide Arboretum is partnering with the UNL Department of Entomology and the Nebraska Environmental Trust on an initiative called "Community as Habitat." The goal of the three-year initiative is to improve the biodiversity and ecological health of targeted community landscapes via greater use of native plants that in turn attract a much wider variety of important wildlife, especially pollinators and other critical insects. In short we will work to convince Nebraskans that landscape conservation and environmental stewardship should begin in our own yards and neighborhoods.

Specifically, grant funds will be used to plan and implement up to 40 publicly accessible prairie-inspired landscape projects in partner communities across the state. Projects will demonstrate environmental benefits of biodiversity, native plants, waterwise practices and soil building, with a special emphasis on pollinator-friendly and Nebraska appropriate plantings. The Community as Habitat Initiative will advance the Nebraska Environmental Trust's priority of creating habitat by working to transform sterile landscapes into richly diverse, pollinator-friendly and prairie inspired habitat. The initiative will benefit a wide variety of wildlife including beneficial insects, birds, bats and amphibians.

Community as Habitat will aim to extend the definition of landscape beauty to include not just color, texture, shape and form, but also a "sense of place" that reflects biodiversity and ecological soundness. The time has come for a new paradigm in the way we landscape our communities—one that is less about exerting our will on Mother Nature and more about our embrace of biodiversity.

The landscape surrounding the Ferguson House, home to the Nebraska Environmental Trust at 700 S 16th St. in Lincoln, has a wide variety of native plants and serves as a model of sustainable landscaping.

The Nebraska Environmental Trust
preserving NATURAL NEBRASKA™ for future generations

Nebraska Statewide Arboretum, Inc.
102 Keim Hall
P.O. Box 830964
Lincoln, NE 68583-0964

Non Profit
U.S. Postage
PAID
UNL

Landscape Ideas, The Recycled Garden, Kids Outdoors and more at pinterest.com/nearboretum




Lots of Ways to Connect!

You are part of the NSA community and there are many ways to get involved:

- JOIN US for events, including talks, tours, plant sales and free brown-bags the first Thursday of every month in UNL Keim 150
- BUY PLANTS, either online or at plant sales, from our wide selection of regional recommendations, many with local seed source
- RECOMMEND our organization and resources to friends, family and co-workers
- VOLUNTEER at our greenhouse, office or at statewide events
- GIVE—donations are essential to NSA since we are a grassroots membership-based nonprofit.
- FOLLOW us on Facebook, Twitter, Pinterest or Instagram

www.facebook.com/NeArb

twitter.com/NEarboretum

pinterest.com/nearboretum

plantnebraska.org

Nebraska Statewide Arboretum

The Nebraska Environmental Trust
preserving NATURAL NEBRASKA™ for future generations

Nebraska Forest Service

University of Nebraska Lincoln

The New Jacob North Print & Media Solutions