

WINGS

ESSAYS ON INVERTEBRATE CONSERVATION



THE XERCES SOCIETY

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Nature Close to Home

Scott Hoffman Black

I grew up in Omaha, Nebraska. Although we lived in what would be considered an urban area, nature was very important to my family. We did not take exotic vacations, instead camping along the Missouri River or on trips to the Black Hills of South Dakota. A couple of blocks from home was a place we called “the woods”—a two-block-square area that contained forest, meadow, and an ephemeral stream, and that had not yet been turned into houses. I spent time in this area nearly every day, sometimes

playing tag or ball with friends or taking my G.I. Joes out for adventures, but often just searching around to see what wildlife I could find. I was the kind of kid who lifted rocks to look for lizards and snakes, and caught butterflies by day and fireflies by night. Sometimes I was late getting home, entranced at the many kinds of insects large and small buzzing under a single streetlamp.

Fast forward to today and I live in a neighborhood far from Nebraska. However, I can still find nature close



This “pollinator pocket garden” on the campus of the University of Vermont, a Bee Campus USA affiliate, illustrates how beautifully insect habitat can be integrated into the built environment. Photograph by Mark Starrett.

to home. We have a screech owl in the adjacent woodlot, and a skunk walked through our yard just last week. My wife and I have transformed our garden so that it supports a diversity of bees, butterflies, and other insects, as well as a large number of birds in every season.

A variety of native plants form the core of this backyard habitat, augmented by nonnatives such as blueberry bushes, raspberry canes, apple trees, and a variety of herbs and vegetables. We allow some messiness, leaving piles of branches and leaves to provide places where insects can overwinter in relative safety. We don't use insecticides or herbicides, instead adopting such practices as washing aphids from plants and picking off cabbage white caterpillars. In some instances, deciding that certain plants are just not worth the work, we replace them with others that will do better in our little patch of land.

By providing habitat for insects, we are helping the entire ecosystem. Our native bees pollinate the berries and fruit trees, and a wealth of insects provide food for birds and other animals. Eighty-eight percent of birds feed on insects at some point in their life cycle; without insects our yard would largely be devoid of birdsong.

Our garden is neither a museum piece nor a natural area. We have a small patch of grass, a trampoline, and a deck. We've kept some of the nonnative plants that were here when we moved in, including several incredibly colorful and fragrant hybrid tea roses. It is important that our yard is a home for us as well as our animal neighbors.

The more scientists look at the diversity in urban and suburban areas, the more we find that we can support

wildlife from the bottom of the food chain upward. Studies show that suburban areas in the Midwest have a higher diversity of bees than nearby farms do, and surveys reveal that the diversity of butterflies is relatively high even in some of our most urbanized environments. The rusty patched bumble bee, the first bumble bee listed under the U.S. Endangered Species Act, has some of its last strongholds in suburban gardens and parks. In short, if we want to protect and provide for insects we need to do so in all landscapes. Our parks and our yards are important pieces of the biodiversity puzzle.

Much of the recent news is not good when it comes to insect declines. The population of western monarch butterflies has seen its lowest year ever. Stories of the "insect apocalypse" have hit the popular media. The good news is that the evidence clearly shows that if we protect and restore habitat, we can increase populations of bees, butterflies, and other insects. The same holds true for your local stream or wetland: thoughtful management can bring back insect life. Restoring and protecting habitat works.

Everyone can—and should—take part. I encourage you to reimagine your garden this spring: increase the diversity of native plants, ensure that there are places for insects to nest, and avoid using pesticides. Xerces has a variety of materials to make such efforts easier, so please visit our website. You can also work with your local park or watershed group to protect and restore habitat, and urge your home town or local campus to join the Bee City USA and Bee Campus USA movements. Working together we can make a significant difference.

Bee City USA: Galvanizing Communities To Reverse Pollinator Decline

Phyllis Stiles

Mark Twain said, “The two most important days in your life are the day you are born and the day you find out why.” I found my “why” in 2011, when I formed a steering committee of beekeepers from Buncombe County, North Carolina, to design the program that would become Bee City USA. Our goal was both straightforward and audacious: to engage as many people as possible in reversing the population declines of native bees, honey bees, and other pollinators.

What we lacked in funding, we made up for in passion. Our initial efforts paid off when, on June 26, 2012, the city council of Asheville (the Buncombe County seat) voted unanimously to adopt the resolution to become the first affiliate of Bee City USA. The council chamber erupted in celebration.

Individuals, churches, nonprofits, and companies got busy enhancing pollinator habitat in Asheville. It seemed that everybody wanted to get on the bee bandwagon! As word spread about the



Bee City USA has become successful by tapping communities' enthusiasm for pollinator conservation. In Asheville, North Carolina, the New Belgium brewery transformed a brownfield site into lush pollinator habitat. Photograph by Phyllis Stiles.

new program, we received inquiring emails and phone calls from communities around the nation. We continued working to make Asheville the model of what it meant to be “PC”—pollinator conscious—and building the organizational infrastructure. We trademarked the name Bee City USA, created a website, and made presentations. Meanwhile we held our breath, waiting for that second application.

In September 2014, just when we were losing hope that the program would ever grow beyond Asheville, Dolly Warden, a beekeeper from all the way across the country in the small community of Talent, Oregon, persuaded her city to adopt the resolution and apply to become a Bee City affiliate. A third city soon followed, and a fourth, and then a fifth, and the network grew. Today eighty affiliates in twenty-four

states and the District of Columbia have been certified, from Seattle, Washington, to Webster, Florida, and from Durham, New Hampshire, to Thousand Oaks, California.

Collectively, urban and suburban areas have the potential of offering millions of acres of life-giving habitat to pollinators. The goal of Bee City is to help communities recognize that fact, and to engage them in the effort to expand urban and suburban pollinator habitat that is rich in a diversity of locally native plants and is as free of pesticides as possible.

In order to be certified as a Bee City affiliate, a city must commit to establishing a standing committee to facilitate community-wide pollinator conservation; to creating and disseminating a list of native plant species and an integrated pest-management plan; and to raising community awareness through events and habitat-enhancement activities. To maintain their certification, cities are required to report on their efforts each year, and these reports are posted on our website—beecityusa.org—to celebrate the programs’ accomplishments and to inspire the network of certified and prospective Bee City USA affiliates. The most important message is this: any community can contribute to pollinator conservation, and it can do so through a wide variety of possible actions.

Bee City USA has energized a host of pollinator advocates across the country. Seattle has been a Bee City USA affiliate since 2015. Its Bee City committee has taken steps to create and manage habitat—including collaborating with Seattle City Light to establish habitat along a powerline corridor—and to eliminate pesticides from city parks. In



The Bee City USA committee in Ashland, Oregon, organizes an annual tour to inspire people to create pollinator gardens. Photograph by Kristina Lefever.



In Decatur, Georgia—now nicknamed Beecatur—volunteers give talks to engage and energize their local community. Photograph courtesy Bee City USA–Decatur.

2016, Decatur, Georgia, became that state's first Bee City, quickly launching an active educational program that includes elementary-school visits, native-plant talks, pollinator-photography walks, and swarming the city's Mardi Gras celebration. Decatur is working to eliminate residential pesticide treatments for mosquitoes, and has even adopted a new name, Beecatur. Similar tales could be told of enthusiastic community members from the scores of other affiliates—leading walks, giving talks, planning new habitat, enacting pesticide bans, and adopting integrated pest-management programs for their municipal lands.

It is imperative that we change our idea of a desirable landscape away from one of large green lawns treated with chemicals and bordered by predominantly exotic plants to one of a diversity of native plants free of pesticides. This effort takes place one person, one neighborhood, and one community at

a time, and the most successful affiliates recognize that becoming a Bee City is not a short-term commitment. They recognize that, if we are successful, then someday in the future the dominant landscaping practices of today will no longer be so widespread. Every interaction during the process is an educational opportunity, influencing how each of us defines an “attractive” landscape.

Remember Talent, Oregon? It wasn't long before Talent inspired the neighboring communities of Ashland, Phoenix, and Gold Hill to apply. The regional zest for pollinator conservation led Mike Oxendine, landscape director at Southern Oregon University in Ashland, to ask Bee City about starting a program for higher education. With his staff's help in designing the campus affiliates' commitments, Bee Campus USA was launched in 2015.

From the outset, we insisted that the new program had to be anchored in the grounds department, where major land-



Reducing the use of pesticides is one of the core principles of Bee City USA. Each affiliate comes up with its own ways to spread the message. Photograph by Kristina Lefever.

scaping and pest-management decisions are made. Reasoning that institutions of higher education were well-positioned to influence a great many people and to demonstrate the successful installation of pollinator habitat in landscapes, we also insisted that campuses integrate pollinator conservation into their curricular and service-learning programs.

Later that same year, an enthusiastic team from Southern Oregon University presented the Bee Campus USA program at the annual meeting of the Association for the Advancement of Sustainability in Higher Education, winning the prize for best case study. Such presentations stimulated many new applications, and today there are sixty-eight certified affiliate campuses in thirty-one states.

In 2016, we had a request to extend Bee City USA to Canada. By that time, we had expanded “city” to include counties, but stretching “USA” to another

country was too much, particularly for a volunteer-run organization. Instead, we helped Shelly Candel start Bee City Canada, which today has twenty-three certified communities.

Since its founding in 2011, Bee City USA has never needed to seek out cities or campuses to become affiliates; rather, people learn about the program through word of mouth and are galvanized to spur their local government to participate. To some degree this is how the organization was able to operate on a volunteer basis. By 2017, however, it was becoming increasingly obvious that to provide the constantly growing network of affiliates with the ongoing support and technical assistance that they needed (and deserved) in order to be effective, Bee City had to have greater capacity. Happily, the Xerces Society liked what we were doing and welcomed our request to join forces. In June 2018, Bee

City USA became an official initiative of the Xerces Society, and I joined the staff as the Bee City coordinator.

Bringing the knowledge and skills of Xerces' more than fifty talented staff members to bear on Bee City's outreach has already been transformative. From the beginning we had looked to Xerces for guidance through its publications, workshops, and technical support. Xerces staff members now directly provide information and advice on how to avoid pesticides, install habitat, and choose appropriate plants, as well as on many other important aspects of pollinator protection. Part of our job at Xerces is to facilitate communication among affiliates to pass on the best approaches to educating the public locally and to creating more pollinator habitat on public and private land. We do that through our website, a listserv for affiliate committee members, a monthly

e-newsletter, and social media. With increased capacity we are offering educational webinars for affiliates.

In turn, affiliates of Bee City USA and Bee Campus USA are both teachers and learners. We are thrilled when affiliates share their successes and we can then share them more broadly through guest blogs. When they ask for help with challenges, we try to find answers together, answers that will benefit the entire network. Affiliates of Bee City USA and Bee Campus USA now act as Xerces' grassroots advocates, eager for the latest insights on how best to give our thousands of species of pollinators what they need not just to survive, but to thrive.

Phyllis Stiles founded Bee City USA in 2011 and ran it as an independent organization until the middle of 2018, when it became an initiative of the Xerces Society.



The success of Bee City USA led to the formation of Bee Campus USA, a program for colleges and universities. Campus affiliates sponsor service projects for students, such as the renovation of this garden at Portland State University. Photograph by Heather Spalding.

Managing Invertebrate-Friendly Gardens

Jenni Denekas

To conserve biodiversity we need to work across all landscapes. Natural areas can offer sanctuary for wildlife, while habitat on farms and roadsides can support wild creatures in human-altered environments and serve as movement corridors. Yards and gardens have an important role to play in making our landscapes more hospitable. The benefits extend well beyond insects and other invertebrates, since they are frequently fundamental components of food webs that sustain many other animals.

Studies show that towns and cities can harbor a greater diversity and abundance of invertebrates than does most farmland, even providing homes for rare and declining species such as the rusty patched bumble bee. Many Xerces Society members create wildlife gardens that are particularly hospitable to invertebrates, and among them are some wonderful examples. I recently spoke with Bert and Betty Feingold, Lenora Larson, and Dennis Krusac and Jacqueline Belwood to find out more about how these dedicated gardeners care for insects in their own backyards. From the high desert of Arizona, to rural Kansas, to suburbs in Georgia, they are united by their deep-seated love for conserving the natural world, and all of them are rewarded with the pleasure of sharing their land with myriad fascinating species.

The Feingolds are keenly observant and unceasingly curious. Both of them enjoy watching and learning from the

legion of “critters” that call their two-and-a-half-acre Arizona property home. “This is a biological laboratory, which is great for anyone who wants to learn about nature,” Betty notes. She and Bert, who have been Xerces Society donors for more than two decades, strive to keep their landscape as natural as possible, managing it in ways that support healthy ecosystems typical of their desert region.

They have a wash—a dry streambed—that runs through their property and functions as a highway for mammals such as javelinas, bobcats, and coyotes. The wash helps to channel water during infrequent rainstorms, and Bert and Betty endeavor to keep it clear of debris. When a tree falls, they will move it out of the wash, depositing it elsewhere on their land. Similarly, when pruning their trees, they will leave limbs in strategic locations so that animals large and small can utilize them for shelter and sources of food. They also provide houses for bees and butterflies, and keep a woodpile as shelter for insects and other creatures. That woodpile has attracted a throng of invertebrate visitors; these include a number of tarantulas, among them one that the couple has named Tommy.

The Feingolds also maintain a series of interconnected ponds—an unusual feature in the desert—which are filtered naturally with sand and gravel rather than a manufactured filtration system. A profusion of elegant dragon-

fly and damselfly species and hundreds of bees are attracted to the water and the various aquatic plants, including lilies, watercress, and iris. Bert and Betty enjoy viewing the various visitors to their ponds through their kitchen's bay window.

In rural Kansas, Lenora Larson's property also has a prominent water

feature—a reservoir built by the Works Progress Administration in the 1930s—which is surrounded by verdant wetlands, prairie, savanna, and woodlots. A master gardener, speaker, writer, and invertebrate enthusiast who has been a Xerces Society donor for twenty years, Lenora carefully manages her land to maintain the wide variety of habitats



The Feingolds' garden includes a series of ponds connected by flowing water—a rarity in Arizona's high desert and one that attracts much wildlife. Photograph by the Xerces Society / Scott Hoffman Black.



Lenora Larson carefully manages her rural Kansas garden to provide a variety of flowers throughout the growing season, adding to the resources available to wildlife in nearby habitats. Photograph by Lenora Larson.

it supports. “People assume that if it’s natural, it will just do what it does, but it requires constant intervention to maintain natural habitat,” Lenora explains.

One way in which Lenora intervenes is by conducting seasonal burns of the prairie, a practice rooted in the cycles that once characterized North America’s Great Plains. Left alone, Lenora’s prairie can become inundated with invasive species. Controlled burning, on the other hand, allows a diversity of wildflowers to grow in balanced abundance. That diversity, in turn, supports an array of wildlife, and Lenora is visited by a multitude of butterflies, birds, mammals, and reptiles.

Lenora’s approach would not be allowed in the suburb outside of Atlanta,

Georgia, where Dennis Krusac and Jacqueline Belwood, Xerces Society members for nine years, live. Indeed, the two face obstacles to maintaining a diverse garden that are not altogether natural. They are often at odds with the stringent standards of the local homeowners’ association, which they have nicknamed “the yard police.” “They don’t like anything that doesn’t look manicured,” Dennis says of the association, his tone suggesting a defiant shrug.

As an example, about two years ago Dennis was experimenting with alternatives to a lawn in his front yard. He would have preferred to be able to tear out the grass and add flowerbeds, but that is not an acceptable option. So instead he elected to plant a variety of

small flowering plants among the grass. Although the homeowners' association perceived these plants as "weeds," ultimately Dennis was able to work out a compromise: keeping the diverse plants cut short.

The pushback hasn't deterred Dennis and Jacqueline from creating a half-acre suburban oasis. They plant "anything native that blooms," as well as some select nonnative flower varieties. They purposefully conduct minimal maintenance so as not to disturb the diverse collection of insects that feed, nest, and breed on their plants. As Dennis explains, Georgia's climate allows them to have a garden that blooms year-round and provides nectar resources to support pollinators. The results speak for themselves: Dennis and Jacqueline are visited throughout the year by a host

of creatures, from bumble bees to birds.

They have also pursued a number of certifications, including the Xerces Society's designation as pollinator habitat. They see such certification—and the accompanying signage—as a subtle teaching tool, raising awareness among neighbors and visitors that such an achievement is both possible and desirable. Lenora, whose two-acre butterfly garden is certified by a handful of other organizations as well as Xerces, shares this sentiment. "I'm a believer in certification for a number of reasons," she says. "It supports the organization, and when you have that sign, people ask about it, and it becomes a teachable moment." Lenora has found that certification attests to her expertise while inspiring others to achieve more pollinator-friendly standards. Indeed, she became



Gardens do not have to be large to support wildlife. In suburban Georgia, Dennis Krusac's and Jacqueline Belwood's yard has an abundance of flowers that nurture a diversity of insects. Photograph by Dennis Krusac.

a master gardener not just because of her passion for plants, but also because it offers added legitimacy for the many articles and talks she gives on creating habitats that support invertebrates.

Lenora adds that a significant component of her decision making is observing what does and does not attract pollinators; in some cases, for example, she has found that nonnative flowers can provide nectar for butterflies. And she is similarly pragmatic about her species choices for human reasons. Since Lenora uses her butterfly garden as a teaching tool, hosting a variety of workshops for fellow master gardeners and other community members, she recognizes that the more showy species help motivate people. After all, as she observes, “If people don’t love their gar-

den or think it’s beautiful, they won’t do the work,” which could mean that they miss out on the opportunity to see and connect with plants and their pollinators. Indeed, Lenora considers it vitally important for people to have hands-on experiences with insects, so that they develop not just an understanding of these important creatures, but also a fondness for them.

Dennis and Jacqueline, with their knowledge of botany and pollinators, also cultivate a mix of native and non-native species. They grow several types of milkweed for monarch butterflies, and have prioritized plants that bloom throughout the year as a way of providing nectar resources, which in some cases leads them to plant such non-native species as zinnias. As Dennis



Native plants support a greater variety of insects, but it doesn’t hurt to mix in some non-native blooms, particularly those that provide nectar. Photograph by Lenora Larson.



Wildlife gardeners should expect some of their plants to be eaten, particularly if they want to support butterflies. Black swallowtail caterpillars, photographed by Dennis Krusac.

observes, “They’re easy and colorful, and they draw lots of pollinators.”

And Dennis has an interesting story behind some of their other plants. He’ll “rescue” flowering species from construction sites and replant them in his yard. Sometimes these are natives that he recognizes—wild geraniums, for instance—and in some cases, such as when he dug up a shade-loving sunflower variety, he will end up with a nonnative plant with which he is unfamiliar, but that is a net positive for pollinators.

The Feingolds’ property also features a combination of native and nonnative species. One half of their land is essentially untouched desert habitat, featuring mesquite, ironwood, creosote bush, and other natives. The other half, around their house and ponds, is more maintained and features more nonnative species. They used to have a vegetable garden, but, as they say, “the

critters won.” The vegetables, and sometimes the entire plants, were eaten. Bert and Betty took it in stride, even watching with fascination as a tomato hornworm demolished one of their plants. The hornworm “had a good time,” says Betty. “We knew that the plant was gone, so we just had fun watching him.” Now they simply maintain a small assortment of potted tomatoes and other plants on their southern porch, a favored spot for reading and for observing the various insect species that are drawn there.

Other nonnatives on the Feingolds’ land are the trees in their citrus grove, which buzz in the spring with a broad assortment of bees and other insects. These trees do require watering and fertilizing, but Bert and Betty try to keep it to a minimum. In contrast, the native plants on their property—including mesquite trees that are more than



Dragonflies are among the many insects that will enjoy your yard, even if the original impetus was to create a butterfly garden. Blue dasher dragonfly, photographed by Betty Feingold.

a hundred years old—do not need watering, nor much maintenance of any kind, a testament to the fact that xeriscaping is far less resource intensive and thus much more sustainable in drier climates.

Indeed, utilizing native species when possible is the most sustainable



A well-maintained garden can draw in a host of wildlife. Green lynx spider consuming its wasp prey, photographed by Dennis Krusac.

option, and brings greater benefits to native pollinators and other insects. As these three properties illustrate, a wildlife-friendly landscape doesn't come about by chance, and some planning and maintenance will be needed no matter the size of your garden. Still, because highly manicured yards are seldom the best for insects, providing for bees, butterflies, and many other animals often requires less labor, giving you more time to relax and enjoy the visitors.

As Bert Feingold puts it: "Everything has a purpose in this life cycle, on this Earth. I pay the taxes on my property, but the animals own it." May we all learn to work within our respective environments, rather than working against them. Not only will our lives be richer for it, but the wellbeing of invertebrates and our ecosystems depend upon it.

Jenni Denekas is Xerces' web and communications coordinator.

Minimizing Risk In the Prevention of Mosquito-Borne Disease

Aimée Code

Growing up in Pennsylvania in the 1970s, the most important consideration I faced when bitten by a mosquito was how to respond. A few of my favorite options were to make an X by digging a fingernail into the bite, to scratch it until it bled, or, when self-control prevailed, to ignore the bite until it went away. None of these techniques proved particularly effective, but they do highlight the casual response we had to mosquitoes. Back then, there was no fear of mosquito bites beyond the itchiness.

Now, with a changing climate expanding the range of some mosquito species and international travel bringing more people in contact with those mosquitoes that carry disease, there is growing concern about new mosquito-borne diseases establishing themselves in the United States. A few such diseases, including some types of encephalitis, have been in existence in North America for a long time. West Nile virus, which arrived in the United States in the 1990s, is now established throughout the country, and such high-profile diseases as Zika, dengue fever, and chikungunya serve to heighten fears, even though there are few to no cases that are known to have been locally acquired. Still, the potential for contracting a mosquito-borne disease is changing, underscoring the importance of instituting solid local plans for mosquito management.

Creating an integrated mosquito-management plan that focuses on prevention and early intervention goes a long way towards ensuring an effective and ecologically sound response. Having a well-designed plan also helps avoid the fear-based use of insecticides. In 2016, after sixteen people in South Carolina were diagnosed with Zika, officials in Dorchester County opted to make aerial applications of the insecticide Naled. The county came to this decision even though all of the Zika cases had been contracted outside the United States, which meant that local mosquitoes could not have been the vectors. Although the county attempted to inform its residents about the aerial application, not all beekeepers were able to protect their hives, and millions of honey bees were killed. There was no estimate of the impacts on native pollinator species, which did not have beekeepers to even try to shield them.

Beyond the effects on pollinators, spraying toxic insecticides to manage mosquitoes can be devastating to aquatic insects and other invertebrates. And the loss of these organisms can negatively impact the food chain, since birds, fish, and amphibians all rely on aquatic insects for food. Moreover, some of the insecticides used in mosquito management are directly toxic to birds and people and have been shown to cause cancer in humans.

The bee losses in South Carolina and other similar incidents, together with broader concerns about harming aquatic ecosystems, are prompting communities to take action to ensure that their mosquito-management protocols are more ecologically friendly. For example, the Bee City USA affiliate in Decatur, Georgia, is working to halt residential mosquito spraying. Decatur's Bee City committee created a position paper that both spells out the risks of such spraying and provides sound management alternatives. Other Bee City affiliates have also contacted Xerces about aligning their local mosquito-management practices with pollinator protection. We are excited to provide technical support for such forward-thinking efforts.

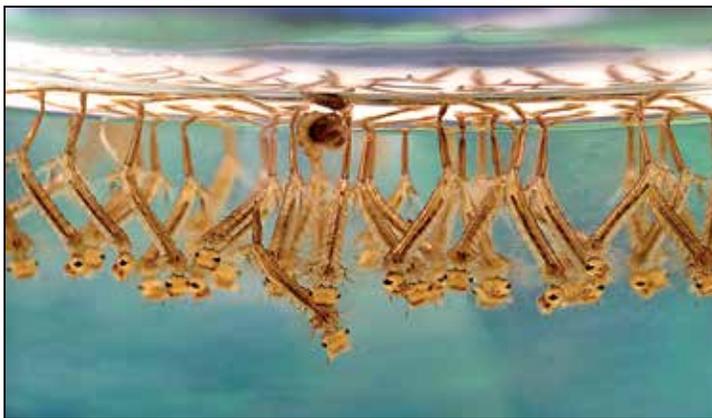
While each community must create a plan that best fits its own needs, every integrated mosquito-management plan includes the same core components. The first of these is careful monitoring to identify the species of mosquitoes

present and to assess the degree of risk that they pose. There are approximately 175 species of mosquitoes in the United States, the great majority of which do not transmit diseases. Many do not feed on humans, and even those that do, and that can transmit disease, are often not infected. It is vital that vector-control agencies have the training to identify mosquito species, so that they know when disease might be an issue. Having an accurate understanding of the risk of disease associated with local mosquitoes is hugely important when fears are running high.

The second core component is the removal of artificial or inadvertently created mosquito habitat, such as standing water in buckets, pots, birdbaths, gutters, and old tires, as well as in ditches and storm drains. Because the larvae of most mosquitoes require stagnant water to develop, emptying water from such places (known as source reduction) is the first step in reducing mosquito



The United States is home to roughly 175 species of mosquitoes, most of which do not interact with people. Mosquito drinking nectar from prairie fleabane, photographed by Bryan E. Reynolds.



Mosquito larvae live in water. Unblocking gutters, emptying rain-water from buckets, and otherwise removing standing water are effective ways to control mosquito populations. Photographed in a laboratory by James Gathany / Centers for Disease Control.

numbers. Individuals can remove containers around the home, and vector-control districts can work to eliminate stagnant water on public property.

In situations where disease-causing mosquitos are identified, interventions may be needed. In these circumstances, early action is preferable because mosquito larvae are contained in water and cannot fly, and thus are easier to kill than the adults. In some settings, small freshwater crustaceans, cyclopoid copepods, can drastically reduce the number of larval mosquitoes; copepods are voracious predators of mosquito larvae and occur naturally in many wetlands. The targeted use of insecticides for larvae—larvicides—is preferable to the broader spraying that would be necessary to kill adult mosquitoes. Still, careful selection and use of larvicides is extremely important, as any pesticide can cause unintended consequences. The Xerces Society has supported targeted use of the biological larvicide *Bacillus thuringiensis israelensis* (Bti).

In addition to community-level action, individuals should take responsibility for protecting themselves from mosquito bites. Simple choices, such as wearing long sleeves when mosquitoes are active and keeping screens on windows and doors in good repair, go a long way to protect people from mosquito-borne diseases. Educational campaigns urging such personal protection can be very helpful.

Insecticide treatments to kill adult mosquitoes—adulticides—are often part of an integrated mosquito-management plan, but should be a last resort. Attempts to kill flying adult mosquitoes are less effective than source reduction and early intervention, and broadcast applications of insecticides over homes and natural areas can cause harmful effects. The World Health Organization guidelines include the targeted use of adulticides as an option only during a disease outbreak.

Around the country, there are numerous examples of comprehensive in-



Although application methods have changed in the decades since this picture was taken, fogging and spraying are still used to control mosquitoes—and often with harmful or even lethal consequences for other creatures. Photograph courtesy National Archives and Records Administration.

tegrated mosquito-management plans that respond effectively to mosquito-borne disease while simultaneously protecting human health and the environment from pesticides.

The city of Boulder, Colorado, has long been a leader when it comes to environmental issues, and the way it deals with mosquito management is no exception. In 2003, in response to an epidemic of West Nile virus, the city established an innovative mosquito-management program, including a vector index to estimate the virus risk to the public. While other jurisdictions routinely sprayed insecticides to control adult mosquitoes during the epidemic, Boulder used the index to appraise public risk and succeeded in completely avoiding the use of adulticides.

Mosquitoes in the genus *Culex* are the main vector for West Nile virus in Boulder. Since the city's policy is to

identify mosquitoes by species, it was able to target larvicide treatments only to locations that support *Culex* larvae and to abstain from treating sites that did not. Boulder also monitors for the presence of West Nile virus itself, and when mosquitoes test positive the city kicks into high gear, increasing efforts to eliminate the standing water that allows *Culex* to develop while simultaneously expanding its already extensive public outreach to involve the whole community in preventive measures.

Boulder is currently updating its mosquito-management plan to make it even more effective and to better protect ecosystems from the unintended consequences of interventions. A key component of the proposed improvements is to categorize mosquito-production sites on natural lands on the basis of their ecological quality. A suite of management techniques using adaptive site-specific

approaches tailored to each location will help to protect biodiversity as well as to reduce the use of the larvicide Bti.

The county of Cape May, New Jersey, which has experienced cases of both West Nile virus and Eastern equine encephalitis virus, also has developed a noteworthy integrated mosquito-management plan. Approximately 60 percent of the county consists of marshlands and woodlands. With so much natural mosquito-production ground, an integral component of the county's program is an open-marsh water-management strategy that connects mosquito-supporting standing waters with tidal creeks and other larger water bodies. This helps maintain natural areas, reduces the suitability of marshland for mosquito breeding, and allows in fish and other natural predators that consume mosquito larvae, thus limiting mosquito populations while improv-

ing water quality in the marshes. The county also urges community members to take part in efforts to mitigate mosquito-production sites. Staff members respond every time there is a mosquito complaint and are generally able to identify and control problems simply by removing nearby stagnant water.

Unlike Boulder, Cape May has made the choice to use targeted insecticide applications to control adult mosquitoes. Recognizing the potential damage that these insecticides can cause, however, the county collaborates with conservation organizations such as the New Jersey Audubon Society to reduce the risks posed to wildlife. This collaboration was effective last summer when an organic farm that serves as a stopover for migrating warblers experienced a significant mosquito outbreak. To protect the warblers and the crops from insecticide exposure while still responding



Boulder, Colorado, is known for its outdoor lifestyle and responsible approach to the environment. The city minimizes insecticide use by monitoring its mosquito population and treating only where *Culex* species larvae are found. Photograph by Kent Kanouse / Flickr.



In Cape May, New Jersey, where people live in close proximity to salt marshes, county staff work to ensure that the marshes retain their tidal flows to minimize still water where mosquitoes might breed. Photograph by the Xerces Society / Celeste Mazzacano.

to the public-health threat posed by the mosquitoes, the county used dry ice to draw them to a small area where it could then target the insecticide spray. Since then, the farm has taken steps to limit mosquito production.

An effective plan for managing mosquitoes takes an all-hands-on-deck approach. Community members and local agencies have to work together to keep mosquito-borne diseases in check. Although all management approaches need to protect natural resources (including aquatic systems and pollinators), there is latitude to decide which efforts are right for each community. Boulder and Cape May have each created methods that specifically address the unique concerns of their regions, yet at their core the two programs are very similar. Both are informed by monitoring, focused on stopping mosquito production through nonchemical means,

and reliant on the entire community to make the programs work. These are two excellent models for other locales who are working to ensure that they have in place effective and sustainable mosquito-management programs. With new diseases making headlines we need to rein in our fears, stay grounded in reality, and plan ahead. Our communities, both human and invertebrate, deserve no less.

Aimée Code, director of the Xerces Society's pesticide program, has been engaged in pesticide-reduction advocacy for more than twenty years.

You can learn more about managing mosquitoes from our reports, How to Help Your Community Create an Effective Mosquito Management Plan and Ecologically Sound Mosquito Management in Wetlands. Both are available at xerces.org.

CONSERVATION SPOTLIGHT

Good Neighbor Iowa

Talk of being a good neighbor evokes images of running errands, clearing snow, or unclogging gutters. Good Neighbor Iowa advocates for a less direct approach to helping, albeit via a fairly typical neighborly activity, lawn maintenance.

Founded by Kamyar Enshayan and run from the University of Northern Iowa's Center for Energy and Environmental Education, Good Neighbor Iowa aims to “reduce unnecessary urban pesticide use and to transform lawn-culture to encourage appreciation of diverse lawns.” It promotes pesticide-free lawn care to benefit wildlife—particularly pollinators—and to protect water quality, as well as to shield children and pets from pesticides.

The group endeavors to change behaviors through two programs. Its healthy lawns initiative works to replace chemical-based lawn management with alternative approaches that improve soil and plant health and challenge perceptions of what a lawn should look like. In the second strategy, turf to prairie, lawns are converted to low-maintenance wildflower meadows. This reduces pesticide exposure and transforms neighborhoods by replacing monotonous lawns with vibrant, colorful prairie.

Good Neighbor Iowa has only a single staff member, Audrey Tran Lam, who works with the assistance of two UNI students, under the guidance of an advisory group that includes Xerces' Aimée Code. Tran Lam has built partnerships with many Iowa organizations

and coordinates a cohort of enthusiastic volunteers who attend community events to spread the word and engage more neighbors—and has achieved significant progress across the state in just two years. For example, the elementary schools in the Waverly-Shell Rock Community School District are all pesticide-free and the Iowa City Community School District has committed to manage 190 acres of its holdings, including twenty schoolyards, without turf pesticides. In city parks in Cedar Falls and Dubuque, the use of chemicals is being reduced, and state parks use no pesticides to manage mown grass areas. In all, nearly five thousand acres of lawns in more than 250 locations are being cared for in a sustainable way.

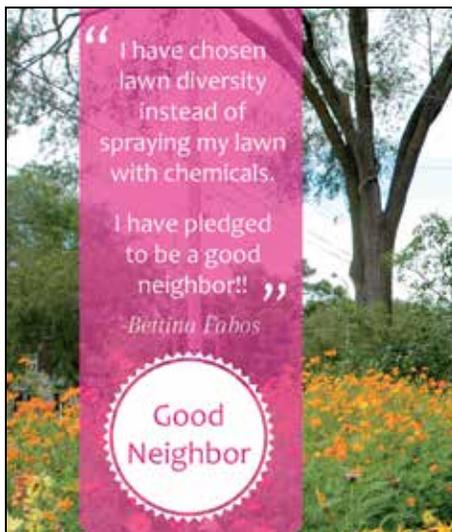


Image courtesy Good Neighbor Iowa.

INVERTEBRATE NOTES

Bees, Insects, Arachnids: Books for a Variety of Interests

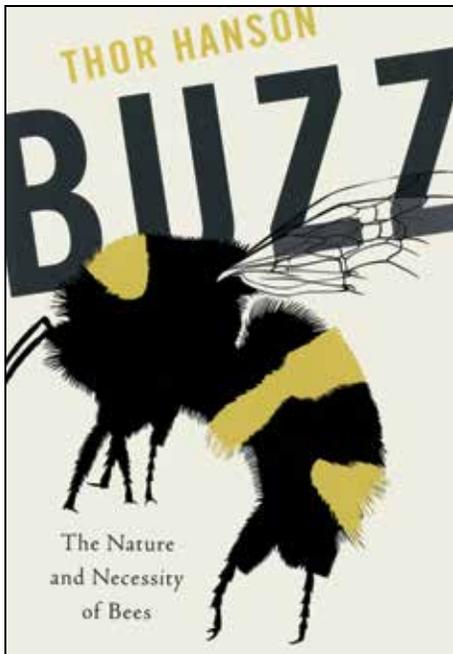
There is a good chance that as a reader of *Wings* you are aware of the importance of bees to our environment and our very existence. It's also likely that you recognize that the diversity of bees goes far beyond honey bees, bumble bees, and mason bees. In his latest book, *Buzz: The Nature and Necessity of Bees* (Basic Books, 2018), Thor Hanson takes readers on an extended journey to learn more about the diversity of bees, their habits and behaviors, and the ways they intersect with our lives. Along the way, we meet scientists, enthusiasts, and conservationists who are dedicated to bees.

Hanson's writing style is reminis-

cent of that of Robert Michael Pyle, weaving personal anecdote and scientific facts into an engaging tale. It feels as though we are alongside the author as he follows bumble bees across his garden with his son, investigates bees in the rainforest canopy, tours habitat restoration projects on agricultural land, or peeks inside collection drawers in the Smithsonian—and we share his excitement at encountering a massive cliff-face aggregation of bee nests.

Throughout, Hanson never shies away from the fact that he is writing about science, which in some books can be dry and heavy. But under his guidance, complex subjects become clear and dense topics are an easy read. This is a book of discovery and investigation, with its origins in an experience early in the author's career when he knew pollinators were visiting the flowers he was studying but couldn't see them. That launched a lifelong pursuit to fill in the gaps in his knowledge.

For many, it may seem impossible to separate a discussion of bees from the threats they face and the actions needed to counter those. But it is also important just to take time to understand and appreciate these tiny yet hugely consequential animals. As the description on the jacket flap says, *Buzz* is “a book of curiosity, joy, and wonder, and the irresistible urge to get outside, find a bee on a flower, and settle down to watch.” With spring here and summer approaching, we recommend that you do just that.



A very different book from *Buzz*, though no less engrossing, *Pacific Northwest Insects* (Seattle Audubon, 2018) is the kind of field guide that we dream about in the depths of gray, soggy winters. A professor at Western Washington University, Merrill Peterson has spent decades studying and exploring the region's insect life, amassing encyclopedic knowledge that is distilled into an accessible form in this marvelous book.

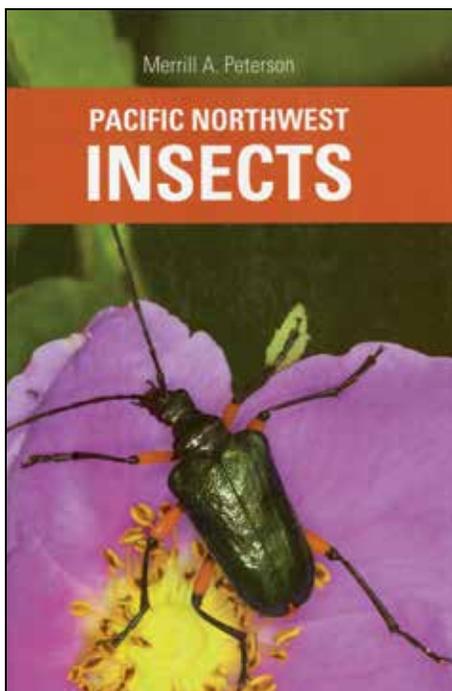
Pacific Northwest Insects begins with an overview of the diversity and importance of insects, notes on finding and identifying them, and a summary of conservation needs. The bulk of the book is organized by taxa; sections open with a detailed description of an order and a guide to different groups within it, followed by profiles of individual species. The author is also a talented photographer, and more than twelve hundred species of insects and other arthropods are illustrated, with adequate information to help identify a further eighteen hundred.

Given the incredible diversity of insects it is an impossible task to include everything in one volume, especially one intended to be carried into the field. Some groups of insects, such as butter-

Amazing Arachnids (Princeton University Press, 2018) takes its readers on a detailed and extremely well-illustrated exploration of eight-legged animals. Spiders dominate the book, but scorpions, vinegaroons, harvestmen, wind spiders, ticks, mites, and several other groups are fully covered. A cross between a coffee-table book and a textbook, this volume is packed with information.

For some people, the mere thought of a spider is enough to send shivers

flies and dragonflies, are dealt with more comprehensively in other books. But many insect groups that get short shrift in other field guides get robust coverage here, and the sections on beetles, flies, and bugs alone are well worth the price. This is a book that deserves to find a home in your backpack.



down their spine, but those who are willing to allow curiosity to get the better of that reaction will be introduced to the attentive parenting of wolf spiders and scorpions, the entertaining antics of jumping spiders, the color-changing ability of flower spiders, the spider-eating habits of the cellar spider, the fish-catching skill of the fishing spider, and many more intriguing behaviors. Hours perusing *Amazing Arachnids* will be time well spent.

STAFF PROFILE

Kelly Gill, Pollinator Conservation Specialist

What got you interested in insects? When I was a child in northeastern Pennsylvania, our backyard ended at a creek (or “crick,” as the locals say) across which was a forested area with hiking trails. The neighborhood kids and I spent endless hours on what felt to us like full-on wilderness expeditions. I was fascinated by things that others found creepy, unusual, and curious, and was infatuated with nature’s oddities. I would examine insects in awe of their different colors, patterns, shapes, protrusions, and other features. Shiny iridescent beetles, fuzzy bumble bees, butterflies, and moths were among my favorites.



What’s the best thing about your job? There are so many best things! My position is interesting in that I am also a partner biologist with the USDA Natural Resources Conservation Service, which provides me with ongoing opportunities to educate landowners, land managers, conservation practitioners, and others on the importance of insects and how to protect these animals. The end goal of the conservation plans I write as part of my daily work is to improve habitat for pollinators and beneficial insects on working lands, so what I do is contributing to conservation on the ground. Additionally, my colleagues are some of the most knowledgeable players in the game and they are always willing to share their knowledge and experience, which creates a supportive and collaborative work environment.

Who is (or was) your environmental hero? Mine include environmental and artist heroes (some are both!): Aldo Leopold, Rachael Carson, John Muir, Edith Patch, Anna Atkins, Maria Sibylla Merian, Agnes Martin, Frida Kahlo, Ida Applebroog, Joni Mitchell, to name a few.

What do you do to relax? Hiking, camping, frisbee, nature photography, drawing, painting, going to hear live music.

What music do you have on your iPod? The Band, the Allman Brothers, the Grateful Dead, Derek and the Dominos, Little Feat, Frank Zappa, Umphrey’s McGee, Paul Simon, Phish, Tedeschi Trucks, the Wood Brothers, Bela Fleck, Sam Bush, Billy Strings, David Grisman, Turkuaz, and Lettuce are frequently in rotation—but I have a huge music collection and I’ll give anything a spin.

Western Monarchs Suffer Alarming Decline

Data gathered over two decades of the Western Monarch Thanksgiving Count show a steady decline of monarch butterflies in western North America. Even knowing this long-term trend, we were shocked by the results from this winter's count: an all-time record low of 28,429 monarchs overwintering in California. This is an 86 percent drop from the previous count done in 2017—and a dizzying 99.4 percent decline from the numbers present in the 1980s. In short, for every 160 monarchs three decades ago, there is only one today.

Faced with the extent of this decline and its abrupt nature, Xerces' conservation biologists released a Western Monarch Call to Action to highlight the

most urgent steps to help recover the monarch population. A quick response is crucial because research has suggested that a population this low may result in a partial or total collapse of the western monarch migration.

The call to action focuses on four priorities. The first is to protect overwintering sites in California. Without these places to return to there is no hope of maintaining the migration. Second, it is vital to restore breeding and migratory habitat in California in order to sustain monarchs as they leave their overwintering sites and again as they traverse the final leg of their arrival in the fall. Restoration in California's Central Valley is key to monarch survival. Third,



The number of monarchs overwintering in California has plummeted. Xerces' call to action highlights the most urgent steps needed to give these butterflies a chance of recovery. Photograph by the Xerces Society / Candace Fallon.

there is a need to protect and restore habitat in the butterflies' summer breeding range across the West. The fourth priority is to protect monarchs and their habitat from pesticides. All of these actions must be supported by further research about the biology and conservation needs of western monarchs.

The circumstances are somewhat better for the monarch butterfly population that overwinters in Mexico and migrates east of the Rockies. The survey done by WWF–Mexico found that those overwintering colonies covered

a combined area of 6.05 hectares (14.95 acres), a 144 percent increase over the prior year. Although this is encouraging, a single good year does not equal recovery, and even with this increase the eastern population has declined by two-thirds since the 1990s.

Monarch butterflies require help across the United States, Mexico, and southern Canada, but the need is most urgent in the West. You can read the call to action and learn about what you can do to help monarchs in the western states at savewesternmonarchs.org.

Pollinator Conservation in the Great Plains

A recent survey showed that the majority of Iowa's farmers are concerned about declines in the monarch population and more than 40 percent wanted to learn how to improve habitat. Clearly, farmers are interested in making a difference. Since last July, the Xerces Society's Sarah Nizzi has been working to meet this de-

sire. Nizzi works jointly with the USDA Natural Resources Conservation Service as a farm conservation planner, advising farmers and landowners on how to create pollinator habitat, including guiding them toward technical and financial assistance available through federal, state, and local programs. She also advises NRCS staff on native seed mixes and the habitat needs of pollinators.

A large part of this work is building relationships between the agricultural and conservation communities, helping bridge the gap between two seemingly divergent groups. Says Nizzi, "I am excited to continue working on establishing pollinator-habitat projects in Iowa and helping others to learn all they can along the way."

In Minnesota, the majority of pollinator conservation specialist Sarah Foltz Jordan's work also addresses the creation of habitat on farms. In addition, over the past two years Foltz Jordan has served on the Governor's Committee on Pollinator Protection, established in 2016 by then-Governor Mark Dayton to ad-



Xerces staff work closely with farmers to create new pollinator habitat. Photograph by the Xerces Society / Sarah Foltz Jordan.



Leafcutter bee on blue mistflower, photographed by Bryan E. Reynolds.

Gifts Through Your IRA

If you are 70½ years of age or older, and you're looking for a “tax-wise” way to support the work that matters most to you, you can make a tax-free distribution from your IRA directly to the Xerces Society. Distributions of any size help us achieve our mission, but the maximum total amount of qualified charitable distributions is \$100,000 per person each year without incurring income tax on the withdrawal.

Please reach out to your personal tax or legal advisor for more information and advice about your situation, and how to properly execute a qualified charitable contribution. Gifts should be initiated well in advance of the end of the calendar year to ensure that they fall in the intended tax year. The Xerces Society does not render tax or legal advice. If you would like to notify us of a gift you have planned, please email us at membership@xerces.org.

Thank you for your support!

advise the governor and state agencies on statewide efforts to protect pollinators.

The fifteen-person committee represents a diverse cross-section of Minnesotans, and while the members didn't agree on everything (to put it Minnesota nicely), together they developed proposals that are likely to move forward through the state legislature. Many of the recommendations focus on the need

for habitat improvements in both urban and rural areas, and on reducing the use of neonicotinoid insecticides, including restricting sales of garden products and providing financial assistance to farmers who choose to move away from treated seed. The committee has set forth a strong, practical game plan for protecting pollinators. Now it's up to policy makers to put them into action.



Rachel Dunham, shown here with a young visitor at an outreach event, is spearheading our new initiative, the Xerces Ambassadors program. Photograph by the Xerces Society / Chad Wildermut.

Xerces Ambassadors Engage with Local Communities

The Xerces Society has embarked on a new adventure: building a volunteer program to inspire communities across America to conserve invertebrates. The volunteers, called Xerces Ambassadors, will be the face of the organization at a range of public events, multiplying our capacity to interact with communities. Under the guidance of our community engagement coordinator, Rachel Dunham, the ambassadors will connect people to nature through activities that explore the diversity of pollinators and the value of invertebrates, and encourage them to make a difference in their own yards or neighborhoods.

The ambassador program was launched in March in Portland, Oregon, with a group of fifteen outstanding volunteers. After watching a series of videos online about Xerces work and conservation issues, volunteers gathered at the Xerces office for a day-long training to learn about the techniques of interpre-

tation and our variety of outreach materials. With a wide range of backgrounds from master gardeners to graduate students, each volunteer offers a different set of experiences, skills, and passions. It was evident that this diverse community will be the start of something great.

Portland's Xerces Ambassadors have already engaged in events in several cities in Oregon and Washington. This initial cohort will help us test the program's success before we expand it to other states. We hope to establish ambassador groups in cities from coast to coast, but, as with all Xerces projects, quality is paramount, and it will take some time to be certain that our volunteers have what they need to succeed.

We are grateful to the individuals who already are on board. Their enthusiasm is infectious as they spread the word about invertebrate conservation and work to make a difference for the little things that matter most.

Helping You Take Action

Whether planting milkweed for monarchs, creating habitat for bumble bees, or protecting freshwater mussels during bridge construction, there is only so much that Xerces staff can do. Xerces presents workshops and produces a wide range of materials to give members of the public the information they need in order to take action in their own communities. Engaging as many people as possible is an essential step in achieving the changes that will benefit us all.

Some recent additions to our conservation resources offer guidance on creating and sustaining pollinator habitat. *Maintaining Diverse Stands of Wildflowers for Pollinators* provides detailed advice that is useful nationwide on how to ensure the existence of healthy habitat for bees. We have also released new lists of pollinator plants for four regions

in California, and a fact sheet about establishing milkweeds in that state.

Freshwater mussels are often overlooked in construction projects and when planning habitat-restoration work in creeks. Two new publications are helping to change that. A brochure, *Freshwater Mussel Conservation*, introduces mussel biology and conservation with artwork illustrating the unseen life beneath the water's surface. *Mussel-Friendly Restoration* presents a summary of best management practices to protect mussels during restoration and construction activities, accompanied by a series of issues and solutions to help address common challenges. Its small format fits conveniently into a coat pocket for ease of use in the field.

All of these are available for free download from our website, xerces.org.

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For information about membership and to learn about our conservation programs for native pollinators, endangered species, and aquatic invertebrates, as well as our efforts to reduce the impacts of pesticides, contact us:

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Welcoming wildlife into your yard or garden can lead to moments of wonder. This freshly emerged dragonfly is clinging to its larval skin as its wings harden. Photograph by Betty Feingold.

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On the cover: We share our neighborhoods with a wide range of wildlife. Gardens that are thoughtfully planned and cared for can provide significant support for insects such as this common eastern bumble bee (*Bombus impatiens*). Photograph by Dennis Krusac.