

WINGS

ESSAYS ON INVERTEBRATE CONSERVATION



THE XERCES SOCIETY

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Advocacy and Collaboration

On Behalf of Invertebrate Conservation

Scott Hoffman Black

The Xerces Society has always held an interesting position at the intersection of advocacy and collaboration. From its very beginning, the work Xerces did for butterfly conservation both pushed agencies to protect these beautiful animals and reached out to help them with on-the-ground activities that would improve essential habitat.

The word “advocacy” elicits a range of responses. Some people see it as ag-

gressive or overtly political or tied to a narrow mantra and consequently, are not particularly happy to support such things. But I grew up in a house where the word was very positive. In fact, according to Merriam-Webster, the definition of advocacy is “the act or process of supporting a cause or proposal.” My mom spoke out for better workshop facilities for people with learning disabilities and my dad led an effort that



A hallmark of Xerces is that staff members are always prepared to engage directly with people to effect change. Here, Mace Vaughan, co-director of our pollinator program, speaks during a field day about creating habitat on farms. Photograph by Paul Jepson.

ultimately stopped a large dam being built on the Niobrara River—the last relatively wild river in Nebraska. And now, as a parent myself, I work with my wife to ensure a quality education for our children.

In my career as a conservationist, I have advocated for many causes. Endangered species, old-growth forests, and wild rivers each need strong champions. But I've also strived to work with as many people as possible for the common cause of a better environment. If the people I oppose come to the table, I am willing to roll up my sleeves and help with the hands-on work of species conservation and to provide the technical assistance that land managers often lack when it comes to invertebrates.

One way that Xerces advocates for the most vulnerable species is by petitioning the federal government to list species under the Endangered Species Act. Although some people see this as controversial, the provision allowing “petitioning” of the U. S. Fish and Wildlife Service was written into the ESA as a way for scientists and other citizens to provide information to the USFWS so they can effectively ensure that the most vulnerable species are considered. In the early 1970s the Smithsonian petitioned the USFWS to protect sixty species of plants. If a petition does not have merit the USFWS can simply deny it. The Xerces Society is known for preparing scientifically defensible petitions that provide substantial information with which the USFWS can determine decline and threats.

By using two apparently opposing approaches, Xerces has accomplished a great deal. We have protected hundreds of thousands of acres from unneeded

insecticide spraying in Idaho, helped shape policies to protect roadless forests, and worked to get pollinators added to the Farm Bill as a primary resource concern. We have partnered with organizations across America to present workshops that have trained more than thirty thousand farmers and other land managers to better manage their landscapes for pollinators and other beneficial insects—and our work has led to more than two hundred thousand acres of flowering habitat for pollinators. We have also protected dozens of imperiled species and the habitats on which they depend, as well as worked to improve broad landscapes for a whole suite of species.

Whether it is petitioning for the mardon skipper under the Endangered Species Act and then actively participating in with a multi-agency group to put in place conservation practices so that it ultimately did not need to be listed, or advocating for federal protection for the monarch butterfly while at the same time leading an effort to cooperatively protect and restore habitat that this species will need to survive across vast landscapes, our goal is ensure that no more species will go extinct as happened to our namesake, the Xerces blue.

Melded together, advocacy and collaboration combine in powerful ways. We will continue to stand up for species at risk but at the same time we are prepared to sit down with organizations and individuals and do what's necessary for invertebrate conservation. After all, in the end it really does not matter how species and their habitats are protected or who does the protecting, as long as these species retain their rightful place in the world.

Pollinator Conservation at Sixty Miles an Hour

Jennifer Hopwood and Matthew Shepherd

With the landscape flashing by as one speeds down the freeway, thoughts of pollinators may be limited to a brief glimpse of honey bee hives in an orchard, a bright patch of flowers beside the road, or an unfortunate butterfly tossed in the slipstream. Indeed, pollinators and roadsides might seem like an incongruous pairing, given that roads are known to fragment habitat, aid in the spread of invasive plant species, and contribute to animal mortality. But, despite the risks associated with roads themselves, roadsides can often be of benefit to pollinators. An

immense amount of land is dedicated to roadsides, which form one of the most extensive networks of linear habitats on earth. Roadways that cross natural areas have negative consequences, but those that pass through urban areas and intensely farmed landscapes often provide the only natural or semi-natural habitat in the vicinity.

Considerable impetus was given to pollinator conservation along roadsides in June 2014, when President Obama issued a memorandum titled “Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators.”



Millions of acres of land are adjacent to urban and rural roads throughout the United States, offering many opportunities to create habitat in landscapes that would otherwise be barren. Photograph copyright iStock.com/dlewis33.

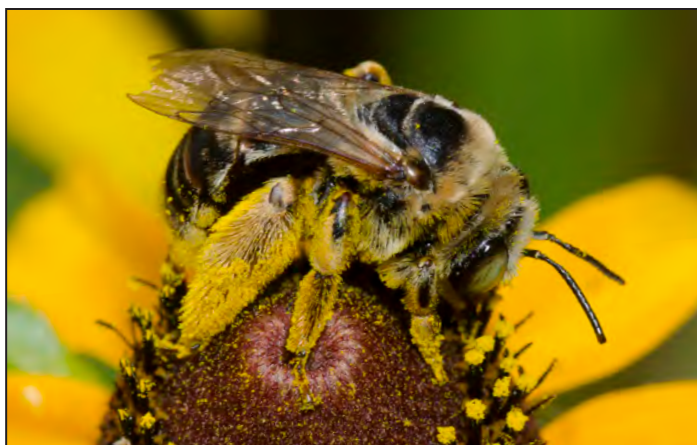
Recognizing that the decline of pollinator populations has broad and potentially long-term consequences for food security, the economy, and biodiversity across the United States, the President's memorandum outlined steps to create a national strategy to address the problem. The Federal Highway Administration was among the agencies tasked with identifying conservation strategies to stem the loss of pollinators.

In the United States, the best estimates are that federal or state highway agencies manage well over seventeen million acres of roadside lands, and, in addition, national parks and national forests manage thousands of miles of roadways. These lands can support a diversity of flowers and may have reduced exposure to insecticides; moreover, the soil in such areas is rarely disturbed to the same degree as other soils nearby—on farms, in gardens, in industrial districts—and undisturbed soil is critical for ground-nesting bees.

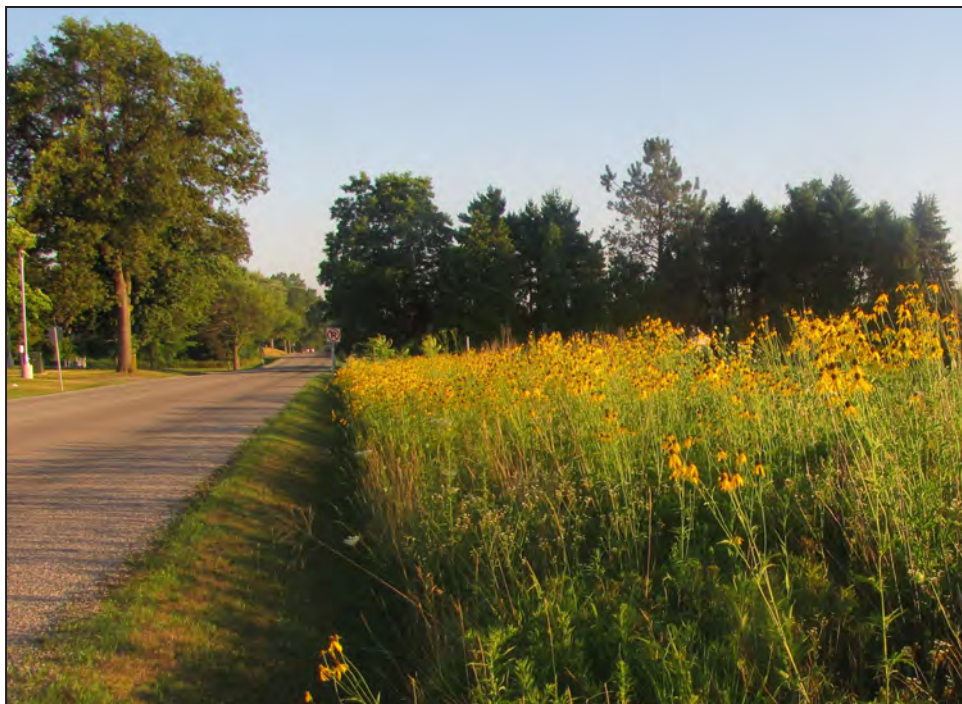
From the perspective of a pollinator, roadsides can serve as places to refuel, to

reproduce, or to overwinter. Pollinators might visit roadsides to sip nectar from wildflowers or may just pass through, using them as corridors between fragments of other habitat, but roadsides can also support entire life cycles, nurturing pollinators from egg to adult. Roadside pollinator communities can be quite diverse, and can include bees and butterflies with general habitat needs (bumble bees, for example, which will forage on a range of flowers and nest in old rodent burrows), as well as species with very specific, narrow habitat requirements—such as the Fender's blue butterfly (featured in the article on page 16), which has a limited range and relies upon a single species of lupine as its caterpillar host plant.

Not all roadsides are equally valuable habitat. Those that are mown or intensively sprayed with herbicides, maintained as turf grass, or planted with introduced grasses such as brome or fescue support far fewer numbers and species of pollinators than those with a diversity of native plants. Vegetation



Long-horned bee (genus *Svastra*) drinking nectar from black-eyed Susan (*Rudbeckia hirta*). Photograph by Bryan E. Reynolds.



In many areas, roadsides are mowed short and thus offer little support to invertebrates and other wildlife. Where they are allowed to grow, especially if they have diverse flowers, roadsides can provide important habitat. Photograph by Jennifer Hopwood.

management also influences how pollinators use roadsides and even influences the number of pollinators killed by passing vehicles. Researchers in Europe found that the frequency of mowing was linked to the proportion of butterflies killed; those that had to disperse to find new habitat after roadsides were mowed had a greater likelihood of colliding with vehicles. Moreover, roadsides with greater diversity of plants had fewer butterflies killed by traffic; high-quality roadside habitat may reduce the rate of pollinator mortality by reducing the necessity to seek new territory.

In some areas, roadsides are among the few remaining places for some species to live. Iowa, for example, was once

dominated by tallgrass prairie, with millions of acres covering more than 85 percent of the state. After European settlers discovered the fertile soil that lay beneath the prairie sod, the sea of grass and wildflowers was rapidly converted to cultivated crops. Less than one-tenth of one percent of the prairie remains, and Iowa now leads the nation as the state with the most altered landscape. One ray of hope is that, in 1988, the Iowa legislature established an Integrated Roadside Vegetation Management (IRVM) program, stating that “It is declared to be in the general public welfare of Iowa and a highway purpose for the vegetation of Iowa’s roadsides to be preserved, planted, and maintained



The regal fritillary (*Speyeria idalia*) is a butterfly of prairies, meadows, and other sunny locations. Carefully managed roadsides can provide the habitat it needs. Photographed on common milkweed (*Asclepias syriaca*) by Bryan E. Reynolds.

to be safe, visually interesting, ecologically integrated, and useful for many purposes.” The legislature’s action recognized the great opportunity for ecological restoration and cost savings offered by Iowa’s more than six hundred thousand acres of roadsides—more than the combined area of federal, state, and county parks in the state. Since then, much excellent work has been done to protect roadside habitats in Iowa and the wildlife they support. The cornerstone of the IRVM program has been the establishment and protection of native vegetation, together with a more judicious use of herbicides, mowing, and other management tools.

Though it has not yet been widely adopted across the country, the use of native plants to revegetate roadsides is not a new practice. On October 22, 1965, President Lyndon B. Johnson signed the

Highway Beautification Act. Many of the provisions of this Act limited billboards, junkyards, and other eyesores, but it was also the first federal effort to encourage the planting of flowers on roadsides. It was passed thanks to the efforts of the First Lady, Lady Bird Johnson, who argued that highway beautification was connected to many other social issues, ranging from mental health and poverty to access to parks and recreation. Her campaign on behalf of highway beautification and roadside plantings of native wildflowers continued for decades. To celebrate her seventieth birthday, Lady Bird Johnson established the Lady Bird Johnson Wildflower Center near her home in Texas, with the intent of fostering research and promoting the use of native plants in landscaping. “I want Texas to look like Texas,” she once said, “and Vermont to look like Vermont, and

every state to look like itself. I just hate to see the land homogenized.”

The use of native plants has additional benefits beyond aesthetics and connections to natural heritage and state identity. Native plants along roadsides can also serve functional roles by stabilizing soil or slowing the onslaught of invasive weeds. Plants also improve water quality by reducing runoff. Because native plants are best adapted to local growing conditions, they are more able to tolerate drought or heat, and are less likely to encroach on neighboring land. And, of course, native plant communities support more native wildlife, including pollinators, than do their nonnative counterparts.

The Xerces Society is working with environmental consulting company ICF International under a contract with the Federal Highway Administration to develop best management practices for roadsides. As part of this project we had the opportunity to hold a series of discussions with highway managers across the country. These interactions proved to be extremely valuable, providing insight into the constraints of roadside management, and also highlighting both staff enthusiasm for pollinators and the existing commitment that highway agencies have to sustainable management of roadsides. Bonnie Harper-Lore, a restoration ecologist now retired from the Federal Highway Administration, noted that when native plants are established, birds, pollinators, and biodiversity follow. These conversations also underscored the fact that, although the initial cost of native vegetation is higher than that of using nonnative plants, native plantings are more cost-effective in the long run.

It is not always necessary to replant roadsides for them to have value for pollinators or other wildlife. Sometimes reducing intensive mowing or changing herbicide spraying regimes is all that is required to allow existing remnant habitat to flourish. And reducing the intensity of maintenance provides cost savings as well as ecological benefits. A study in Florida found that mowing the state’s roadsides costs \$13 million every year; altering mowing regimes can save money, reduce pollution, and benefit pollinators without compromising erosion control or motorist safety.

Stretching across agricultural and urban landscapes from seaboards to mountain passes, our roadsides offer a conservation opportunity that should not be overlooked. And it isn’t. Roadsides throughout the United States are bursting anew with color and wildlife. The situation was summed up by Jeff Caster, a landscape architect with the Florida Department of Transportation, who noted that roadsides have historically been managed as a utility rather than as a natural resource: “We maintained roadsides to keep nature from encroaching, thinking that vehicular traffic is incompatible with functioning habitat and corridors for wildlife. But we know now that roadsides can help to provide an important natural environment.” Though change is often slow, it is coming steadily to a roadside near you.

Between them Jennifer Hopwood and Matthew Shepherd have a quarter of a century of experience in pollinator conservation. Jennifer is Xerces’ senior pollinator conservation specialist for the Midwest, and Matthew is the communications director.

Blue Highways, Green Rockworms, Golden Stoneflies

Celeste Searles Mazzacano

In his book *Blue Highways*, William Least Heat-Moon describes a journey along the back roads of America, following the blue lines on a road map. Humanity's oldest highways are also blue, the twisting threads of rivers and streams that form a ready-made network for moving people and cargo over long distances. Highways of packed dirt, gravel, and asphalt have largely replaced these watery blue roads, but they retain an in-

timate connection through the runoff that flows from contemporary roadways into surrounding streams and seeps into groundwater.

Roads expand the amount of impervious surface in the landscape, through which rain and melting snow are unable to percolate. The resulting runoff—known as “nonpoint source pollution”—is a leading threat to the quality of our waters. Urbanization is accompanied by



Rainfall running off roads and other paved areas affects creeks in dramatic ways, both from pollutants that it carries and the volume and speed at which it travels. In many places, streams seem little more than open drains. Photograph by Matthew Shepherd.



As adults, dragonflies are aerial predators. As larvae, they live for two or more years in creeks and ponds and can be adversely affected by sedimentation and changed water flows. Widow skimmer (*Libellula luctuosa*) photographed by Bryan E. Reynolds.

greater density and acreage of roads—as well as of such other impervious surfaces as rooftops, sidewalks, driveways, and parking lots—with correspondingly significant impacts on water quality and aquatic life. Roads can alter stream hydrology, raise water temperatures, and deliver a toxic stew of sediment, pesticides, heavy metals, trash, petroleum products, and bacteria to streams and wetlands, and to their invertebrate inhabitants.

Thanks to paved surfaces, water runs more swiftly into streams, reaching them in a larger volume and quantity than it does from permeable surfaces. This can cause flooding to increase in both size and frequency, a characteristic known as “flashiness.” This is especially true if a stream’s riparian buffer, which helps slow, cool, and absorb water and

traps sediment and contaminants, has been reduced.

The escalated flooding and speed of peak flows have direct and indirect impacts on the invertebrates living in streams. Although many aquatic insects, such as flat-headed mayflies (Heptageniidae), larvae of water penny beetles (Psephenidae), and net-winged midges (Blephariceridae), are adapted to life in a moving current, the faster, more intense flows can be too much for them, scouring the substrate and washing out insects and their habitats. Fast-moving water can also erode stream banks, adding to the sediment load washed in from surrounding developed areas. Aquatic invertebrates such as golden stoneflies (Perlidae), green rockworm caddisflies (Rhyacophilidae), and prong-gill mayflies (Leptophlebiidae) have delicate gill

structures that are fouled or damaged by this additional sediment, making them unable to obtain enough oxygen; such sensitive groups die or leave in search of better habitat and are replaced by sediment-tolerant invertebrates. Greater sediment loads can also interfere with invertebrate feeding activities by reducing visibility, compromising the ability of predators to find food, decreasing light penetration so that plant food for grazers and scrapers is less abundant, and clogging the feeding apparatus of filter feeders. Heavier sediment load also impacts habitat, reducing the heterogeneity that is important for sustaining a diversity of aquatic invertebrates. A healthy mosaic of plants, cobble, gravel, and sand can be transformed into a thick, featureless coating of silt with few places for invertebrates to live.

A longer-term change due to increases in paved surfaces is that water doesn't percolate into the ground and recharge groundwater. This lowers the water table that sustains a stream's base flow and cools it during low-water peri-

ods; thus a perennial stream that once held water year-round may become an intermittent stream that dries up in late summer. The impacts of such changes on aquatic invertebrate communities can be dramatic. Some species, including freshwater mussels and a variety of dragonflies, stoneflies, and snails, require water all year. Changes in stream hydrology can completely remove these groups from the community. In their place, species with desiccation-resistant eggs or larvae, which allow them to survive periods of stream drying, may become dominant.

Stormwater also carries the invisible threat of chemical contaminants. Vehicles deposit tire rubber, heavy metals, motor oil, and petroleum on road surfaces, and hazardous materials can spill in traffic accidents. Because road networks extend into parking lots and driveways, water flowing off these hard surfaces carries pesticides and herbicides from gardens, parks, and landscaping. Some of these are immediately toxic, while others exert more subtle but



Stoneflies are among the many invertebrates whose lives are split between water and air. Their aquatic larvae require year-round water and may not survive when urbanization disrupts water flows. Photograph by Bryan E. Reynolds.

chronic community-level effects on invertebrate reproduction, feeding, and predator avoidance.

Many rivers and streams are listed as “impaired” under the Clean Water Act due to thermal pollution. Water running off sun-heated roads and parking lots can reach temperatures of up to 11 degrees Fahrenheit (6 degrees Celsius) warmer than that of summer rainfall. Most organisms have a fairly narrow range of temperatures within which they can function; when thermal tolerances are exceeded, respiration, feeding, movement, and reproduction can be negatively affected. At higher water temperatures the tolerance of aquatic animals to additional toxins such as chloride from road salts can also be reduced. Sensitive aquatic groups such as stoneflies and caddisflies have a maximum temperature tolerance of about 63 degrees Fahrenheit (17 degrees Celsius).

Road maintenance brings its own gallery of impacts. Pavement sealants can be a source of polycyclic aromatic hydrocarbons, and chemical dust suppressants sprayed on unpaved roads can deliver salts, synthetic polymers, and petroleum-based hydrocarbons to streams and wetlands. Depending on their concentration, these materials can be directly toxic to aquatic invertebrates, impair reproduction or development, and alter the diversity and composition of the aquatic invertebrate community.

De-icing agents are an issue of particular concern in the northern United States and Canada. About half of the U.S. states use road salts during the winter, collectively applying more than twenty-two million tons of salt annually, primarily sodium chloride and



Filter-feeding invertebrates, such as the western pearlshell mussel (*Margaritifera falcata*), can be choked by sediment or poisoned by pollutants. Photograph by Roger Tabor, USFWS Pacific Region.

calcium chloride. Much of this salt enters streams and groundwater. Natural background concentrations of chloride are generally around a few parts per million (ppm), but in areas where road salts are used, chloride concentrations can be vastly greater, especially in pulses during thaws.

Long-term datasets from rural streams in the northeastern United States show that by the late 1990s background chloride concentrations increased up to 140 ppm, more than an order of magnitude greater than in the 1960s. In winter, some streams had salt concentrations as great as 25 percent of that in seawater. (The salt concentration of seawater is roughly 35,000 ppm.) A 2010 study by the U.S. Geological Survey found, in the northern metro-



Water striders, also called pond skaters, water skeeters, or skimmers, are commonly seen on the surface of ponds and slow-moving streams. Photograph by Celeste Searles Mazzacano.

politan areas examined, that from November through April more than half of the streams had chloride concentrations in excess of levels recommended by the U.S. Environmental Protection Agency to protect aquatic life (230 ppm).

Excess salt in streams can harm the metabolism of aquatic organisms by upsetting the balance of water and ions in their cells. Impacts have been seen in water fleas (Cladocera), aquatic sowbugs (Isopoda), caddisflies (Trichoptera), and non-biting midges (Chironomidae) at chloride levels ranging from a few hundred ppm to a few thousand. High salt concentrations change the density of water and can interfere with the seasonal mixing of waters in lakes, leading to decreased oxygen levels in the bottom layers.

Although the use of road salt as a de-icing agent can be necessary for human safety, its deleterious impacts are well recognized. Many municipalities are investigating ways to reduce the quantity

and impacts of road salts, such as salting prior to a storm or mixing the salt with other de-icing materials such as sand or beet juice, and using best management practices at storage depots to prevent groundwater contamination.

These various threats collectively impact the base of the food chain in streams and rivers. The resulting decreases in aquatic invertebrate diversity and altered community composition can have a ripple effect, since aquatic insects and other invertebrates are an important source of food not only for fish but for amphibians, birds, and many other terrestrial animals.

Until the flying cars of the future are developed, roads are here to stay. Even so, there are ways in which creeks and their surrounding roads and other impervious surfaces can be made more compatible with healthy communities of aquatic invertebrates. The response to flooding has often been to straighten

a stream channel or armor its banks, which further reduces habitat, disconnects a stream from its floodplain, exacerbates erosion, and increases the frequency and volume of peak flows. But maintaining or restoring vegetated stream buffers and reconnecting channelized streams with their surrounding floodplains and wetlands helps slow and cool road runoff, traps sediment and contaminants, increases infiltration of overland flow into groundwater, and provides wildlife habitat and corridors.

Portland, Oregon, the city in which the Xerces Society is based, has a program that actively manages stormwater with ecoroofs and by means of bioswales installed in streets and parking lots; these combine to trap contaminants, slow and cool water, and reduce the stormwater burden on urban streams. Seattle, Washington, another city in the rain-drenched maritime Pacific Northwest, promotes “green stormwater infrastructure” to capture storm runoff and increase percolation. Efficient de-

sign of housing structures to reduce the acreage and width of roads, discourage overbuilding of parking lots, maintain green spaces, and use pervious paving options in low-traffic areas can achieve substantial reductions in regional impervious coverage. Rain gardens are a well-established method for individual homeowners to manage rooftop discharges, and have been widely adopted across the eastern United States.

The seventeenth-century French mathematician and philosopher Blaise Pascal wrote, “Rivers are roads which move, and which carry us whither we desire to go.” With improved planning and mitigation practices, we can also help rivers—and the aquatic invertebrates that inhabit them—move toward a better direction in the future.

Celeste Searles Mazzacano directs the Xerces Society’s aquatic conservation program and works extensively with invertebrates in streams, wetlands, and springs.



Just over an inch long, the citrine forktail (*Ischnura hastata*) is the smallest damselfly in North America. It is found around marshy ponds and in wetlands with dense vegetation. Photograph by Bryan E. Reynolds.

The Butterfly and the Road Grader

Scott Hoffman Black

Recently, I attended an all-day meeting in which a group of us traveled around Yamhill County to review roadside management for the endangered Fender's blue butterfly and its host plant, Kincaid's lupine. In attendance were butterfly expert Paul Hammond, as well as staff from the U.S. Fish and Wildlife Service who are responsible for the protection of these species under the Endangered Species Act, and staff from the Yamhill County Public Works Department who are responsible for road management. We had very good discussions about how to maximize the growth of Kincaid's lupine on the back slope—the vegetated area that slopes up and away from the roadside ditch—while at the same time working to deter the plant from taking root in the roadbed itself, which periodically gets graded. This cooperative effort has been several years in the making. It did not, though, start off so congenially.

The Fender's blue (*Plebejus [Icaricia] icarioides fenderi*) is a diminutive butterfly in the family Lycaenidae (gossamer-winged butterflies), with a wingspan of about an inch. The upper sides of the wings of the males are an iridescent sky-blue, and that of the females a rusty brown. The under sides of the wings of both sexes are creamy tan and marked by black spots surrounded by a fine white border or halo. The Fender's blue lays its eggs on Kincaid's lupine (*Lupinus oreganus* var. *kincaidii*), the primary plant its caterpillars will eat.

For much of the twentieth century, the Fender's blue butterfly was believed to be extinct. It was found by lepidopterists Ken Fender, Ralph Macy, and others in the early decades—specimens in museums were collected between 1929 and 1937—but by the 1940s it had apparently disappeared (just about the same time the Xerces blue vanished in California). The Fender's blue was rediscovered in 1989, twice: there were two independent records that year from Paul Hammond and Paul Severns.

It is thought that the butterfly once thrived in the prairies of Oregon's Willamette Valley, but during the past 140 years an estimated 99 percent of this native prairie has been turned into farmland or developed for cities and towns. The Fender's blue was listed as endangered under the Endangered Species Act in 2000. The butterfly is presently relegated to small pockets in the upland prairies where Kincaid's lupine—itself listed as threatened—survives.

Once a species is listed as threatened or endangered under the ESA, it is protected by an impressive set of provisions. First, the ESA gives the Secretary of the Interior authority to acquire land on behalf of any listed species. Second, the act calls for the cooperation of all federal agencies in the conservation of any listed species whose habitats occur on land under their jurisdiction or that might be affected by their actions or by any actions funded or authorized by the federal government. Third—and most

pertinent for this story—it is illegal to “take” an endangered species of animal. The term “to take” is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.” Limited “taking” may occur under federal permits for research purposes or when a safe harbor agreement is in place.

The issue of Fender’s blue conservation came to the forefront in Yamhill County when a local resident noticed that Kincaid’s lupine and caterpillars of the Fender’s blue were being destroyed during routine maintenance work on the county’s gravel roads. Those roads are periodically smoothed and leveled

with a road grader, a large vehicle with a sturdy blade that scrapes gravel from the middle of the road and distributes it toward the edges. Sometimes gravel several inches deep is displaced. In some places, Kincaid’s lupine was growing in the middle of the road, where the grader removed the plant and destroyed any caterpillars feeding on it; in other places the lupine was growing in or directly adjacent to the roadbed, and caterpillars and plants were buried in the grading process.

Having determined that the county was killing butterflies with its routine road grading, as well as potentially impacting habitat through its mowing



Maintaining a good surface on a gravel road involves grading, which scrapes gravel from the middle to the edges. In the process, plants growing on the road side of the ditch can be buried, along with any butterfly eggs or caterpillars. Photograph by Bruce Newhouse.

and herbicide applications, the U.S. Fish and Wildlife Service over several years pressed Yamhill County to protect the lupine and the butterfly. The USFWS sent letters to the county government requesting that it solve the problem and even offered a \$391,000 grant to help develop a Habitat Conservation Plan that would have addressed these issues. Unfortunately, the county commissioners chafed at the idea of the federal government telling them what to do. The USFWS would have required 10 percent in matching funds; the county, saying that it could not afford the \$39,000 match, rejected the federal grant.

Frustrated with Yamhill County's unwillingness to protect the species, the Xerces Society stepped in. With assistance from Oregon's Crag Law Center and working with the Center for Biological Diversity, the Yamhill Watershed Stewardship Fund, and three individuals—Laura McMasters, Bill Fender, and

Dorothy McKey-Fender, family members of the late Kenneth Fender, after whom the Fender's blue butterfly was named—Xerces sent a letter stating that unless action was taken we would sue Yamhill County in federal court for failure to comply with the federal Endangered Species Act.

Protecting species via lawsuits is not a normal course of action for the Xerces Society, but in cases where actions may drive an endangered species further toward extinction we sometimes have little choice. Our initial goal was to get the county to cease maintenance work that affects habitat in roads and ditches unless and until it committed to developing a protection plan. The ultimate goal was to have the county create a Habitat Conservation Plan that established strategies to avoid harming or killing the Fender's blue butterfly.

The threat of going to court broke the impasse and led to the parties sitting



The male Fender's blue (*Plebejus [Icaricia] icarioides fenderi*) has been likened to a piece of the sky fallen to the ground. Photograph by Dana Ross.



Away from the immediate road edge, Kincaid's lupine can be overwhelmed by competition from bracken fern, rose, and other plants. Photograph by Bruce Newhouse.

down to seek a possible solution and ultimately to discuss ways to work together to protect the species. The county commissioners approved a \$98,000 contract with environmental consultant Cardno Entrix to prepare the requisite Habitat Conservation Plan, and the Xerces Society was invited to join a working group that included members of the county's public works department, USFWS staff, and Paul Hammond.

When this working group was initially convened there was not a lot of trust on either side. This was the county that had been recalcitrant about protecting this animal and had even turned down a grant to develop a plan for these butterflies, and I was there representing the groups that had threatened to sue

them unless they complied with the law. As you might imagine, the early conversations were somewhat cautious.

As we talked it through, though, things changed. Xerces' goal was always to protect the butterfly and its habitat. The county's representatives came to understand that this was necessary and, as important, that we were willing to sit down and work with them to find practical solutions.

The summer after we entered into this process, two consultants were hired to survey Yamhill County roadsides. Lepidopterist Dana Ross would search for the butterfly, while Salix Associates' Bruce Newhouse, a fellow of the Oregon Native Plant Society, would search for the lupine. These surveys were necessary



Female Fender's blue perched atop Kincaid's lupine. Their lives are intertwined. Photograph courtesy U.S. Army Corps of Engineers.

because in order to be successful any plan that would be developed needed to identify all of the potential sites that the county would be required to manage. Moreover, securing an assessment by independent consultants was an important step in building trust and ensuring that the working group members would be able to move forward together.

Once the areas that needed man-

agement had been identified, the group set about creating site-specific plans. Although there are general guidelines for the management of Fender's blue and its host plant, Xerces felt that, to avoid future uncertainty, the working group needed to provide explicit guidance for county staff on what to manage and how and when to manage it. Some areas, for instance, have host plants but no

butterflies; the goal in these areas is to manage them to provide the best habitat potential for colonization from other sites. Managing weeds in such cases is relatively easier because there is no worry about harming the butterfly. At sites where the Fender's blue is already established, management actions are more challenging because of the need to ensure that the butterfly is given adequate protection while still allowing for mowing and other necessary actions. Developing site-specific plans was vital to improve the chances of recovery for the butterfly.

Another focus was to encourage habitat on the back slope while discouraging it in the roadbed. Gravel roads like those managed by the county require grading to maintain a smooth surface for cars, and anyone who has driven on washboard roads that make your teeth chatter as you drive along can appreciate why this would be the case. The plan calls for identifying areas where the lupine is growing in the roadbed and either removing any lupine while butterflies are not present, or, if they are present, moving the caterpillars to nearby host plants that are out of the roadway. Once this has been accomplished, these areas will be graded more frequently to prevent the lupine from recolonizing in places where it would, in effect, lure the butterflies to their death.

The Habitat Conservation Plan does in fact allow for some butterflies to be killed. Although this may seem counterproductive, there are situations in which some management is necessary to prevent existing habitat from being lost to overgrown weeds and encroaching trees. In such instances, mowing and other methods of weed control can

lead to the unfortunate loss of some butterflies; with care, though, relatively few are harmed, and in the longer run the vast majority of the population is helped.

Now, Yamhill County has demonstrated an even broader commitment to protecting Fender's blue and Kincaid's lupine, by agreeing to manage habitat in Deer Creek County Park on behalf of the butterfly and its host plant. The park already has a small number of butterflies in residence and, with restoration, has the potential to harbor many more.

This process started out as a confrontation, a face-off over the protection of a species that had already lost too much of its habitat. Each side had its negative impression of the other, and each had misgivings about working together. But, over time, we became a group of individuals who were able to build mutual trust and respect. Hearing from those at the county with expertise on roadbed and roadside management has taught me a lot about the challenges faced by county staff who have limited time and budgets. On the other hand, Xerces staff and others brought to the table knowledge that made it possible to provide clear guidelines for management at each site. Working together will ultimately lead to better habitat quality and a brighter future for these little blue jewels of the Willamette prairie.

Xerces Society executive director Scott Hoffman Black has been involved with protecting endangered butterflies for two decades. He was part of the team that won the Wings Across the Americas 2012 Butterfly Conservation Award for conservation of the mardon skipper.

CONSERVATION SPOTLIGHT

The Greater Atlanta Pollinator Partnership

Between 1990 and 2010, the population of the metropolitan area of Atlanta, Georgia, increased by nearly 2.4 million people, resulting in the loss of close to 400,000 acres (162,000 hectares) of tree canopy and green space—an average of 54 acres (22 hectares) per day. Alarmed by this habitat loss and concomitant declines in pollinators, local organizations joined together in 2009 to launch the Greater Atlanta Pollinator Partnership—GAPP—with the goal of creating and restoring viable pollinator habitats throughout Atlanta.

Focusing on a 25-mile (40-kilometer) radius around the urban core, the GAPP is working to create habitat at an ecologically significant scale by connecting privately and publically owned lands through habitat corridors. In addition to education, outreach, and research, key components of this effort include using native species when available, rescuing native plants from construction sites, controlling invasive species, establishing community gardens, and facilitating citizen science projects.

Community participation has been tremendous, with more than 30 partner organizations and some 230 individual gardens registered. Integral to the GAPP's success has been its website (<http://gapp.org>), which has been an important tool for increasing awareness, building capacity, and encouraging community participation. Created and hosted by the USDA Forest Service under an agreement with the Atlanta

Botanical Garden, the website offers online garden registration, allows mapping to track garden establishment and assess habitat development trends, and provides a newsletter and other online educational materials.

A central part of the GAPP's mission is to foster gardening with a purpose, the purpose being pollinator conservation. All of the urban gardens of partner organization Truly Living Well Center for Urban Agriculture, for example, contain pollinator plantings. Through the Center's efforts, the American bumble bee (*Bombus pensylvanicus*), a declining species, has been documented in the heart of downtown Atlanta.

So how do you build a successful partnership structure without dedicated funding and with no staff? The key is having a true collaboration in which each participant brings its strengths forward and contributes resources, while keeping the focus local. Individual partners (including the Xerces Society) bring their own networks, and the synergy thus developed is powerful. Utilizing the strengths of individual partners is critical; the Department of Geosciences at Georgia State University developed the GAPP map (<http://map.gapp.org/#>), for example, and members of the Georgia Native Plant Society are champions of plant rescue.

It is also important, though, not to lose focus on the partners' individual missions. Developing schoolyard habitats is a priority, since pollinator gardens

can function as ideal outdoor classrooms providing both habitat and education, and the National Wildlife Federation and Captain Planet Foundation both work on this effort; between them, they have established more than 130 school gardens as part of the GAPP. Similarly, the Greening Youth Foundation and the Atlanta Botanical Garden both advocate for conservation education and outreach; they joined with Spelman College and the U.S. Forest Service to offer internships at the Garden that expose students to career opportunities in plant and pollinator conservation.

The GAPP is becoming a model for community engagement and urban

pollinator conservation and recently received a national award for urban conservation. The Cincinnati Nature Center in Ohio wants to pursue a similar effort, and groups in Austin, Texas, and Savannah, Georgia, are also interested in the GAPP model. Now, building upon the tremendous interest in pollinator conservation in Georgia, the GAPP is working on the statewide plan to create the Georgia Pollinator Partnership.

Contributed by Dennis L. Krusac (USDA Forest Service), Jacqueline J. Belwood (Georgia Highlands College), and Jennifer Cruse-Sanders (Atlanta Botanical Garden).



Developing pollinator-friendly gardens is central to the mission of the Greater Atlanta Pollinator Partnership, and is supported by the efforts of project partners and the content of the organization's website. Photograph by Penny Stowe.

INVERTEBRATE NOTES

Imperiled Butterfly a Bellwether for Climate Change?

The federally endangered Karner blue butterfly has disappeared from its southernmost habitat, an event researchers believe may be an early example of what climate change could have in store for the Earth's more fragile species. The butterfly, which is nonmigratory and flies only for short distances, struggled to survive at Indiana Dunes National

Lakeshore for some time. Following a drought in 2012, park rangers found only four butterflies—all male. Surveys fifteen years earlier counted more than thirteen hundred. Climate change models predict that weather patterns will shift northward during the next century. That could spell disaster for the Karner blue. (<http://indy.st/1NOewDU>.)

Study of Europe's Wild Bee Species Shows a Risk of Extinctions

A new study has recorded information for all 1,965 of Europe's wild bee species. The assessment, part of the IUCN European Red List of Bees and the Status and Trends of European Pollinators Project, shows that 7.7 percent of Europe's bees have declining populations (25.8 percent of wild bumble bees were found threatened with extinction), while the populations of 12.6 percent remain stable and those of 0.7 percent are increas-

ing. The status of 79 percent remains unknown, a figure the study's authors say points to a lack of expertise and resources that urgently necessitates heavier investment in pollinator research.

The report identifies two main drivers of the pollinator declines: climate change, and shifting farming practices coupled with agricultural intensification that leads to major habitat loss and degradation. (<http://bit.ly/1C3pUWb>.)

New Books

As spring flowers bloom and dragonflies, bumble bees, and other creatures emerge, readers may find themselves excited about getting outside and observing a diverse array of invertebrates.

A new book by Sharman Apt Russell, *Diary of a Citizen Scientist: Chasing Tiger Beetles and Other New Ways of Engaging the World* (Oregon State University Press), provides inspiration for amateur naturalists. Russell, a writer, spent a year studying the little-documented West-

ern red-bellied tiger beetle on her home turf in New Mexico. Her account is an engaging and sometimes humorous snapshot of one woman's connection to the natural world—and a meditation on the factors that draw non-scientists to scientific inquiry.

Two new field guides could also prove to be excellent warm-weather companions. *Bumble Bees of North America: An Identification Guide* (Princeton Field Guides) overflows with pho-

tographs of North America's forty-six recognized bumble bee species. It includes diagrams, range maps, and extensive illustrated keys to distinguish color morphs and social castes. *The ROM Field Guide to Butterflies of Ontario* details

all 167 butterfly species ever recorded in that province—and the best places to find them. We hope both will be helpful to readers as they delight in the world's rich diversity of invertebrate life this spring and summer!

British Studies Examine Pollinators in Agricultural Settings

Two new British studies explore different aspects of the interaction between pollinators and agricultural landscapes.

In the first, researchers at the University of Sussex sought to determine the extent to which wildflower strips increased bee populations in farm fields. They compared pollinator populations on farms that employ bee-friendly practices with those on control farms; the former had a greater number of bumble bees and contained bumble bee nests at significantly greater densities. They concluded that increasing forage plant availability does greatly increase the size of wild bumble bee populations—but only for common species. Protecting

rarer species will necessitate more specific and geographically focused management. (<http://bit.ly/1GZoQOk>.)

A second study, from the University of Plymouth, investigated the way herbicides and fertilizers affected bee food sources. The researchers compared bumble bee abundance at thirty sites in southwestern England where hedgerows were adjacent to crop boundaries, finding that bumble bees were more than twice as likely to visit the road-facing sides of hedgerows as they were to visit the crop-adjacent sides. The researchers concluded that this demonstrated the chemicals' effect on the crop-facing sides. (<http://bit.ly/1GKYBVt>.)



Research in Britain has underscored the importance of hedgerows and flower strips for supporting bees in farmlands. Photograph by Michael Button/Flickr.

STAFF PROFILE

Jennifer Hopwood, Senior Pollinator Conservation Specialist

What got you interested in insects? Like many kids, I loved being outdoors when I was young, chasing fireflies, watching butterflies on flowers, and turning over rocks to watch beetles scatter. It didn't occur to me that I could turn my curiosity and appreciation into a vocation until much later, after I took a college course on biodiversity from a professor who studied beetles.

How did you hear of the Xerces Society? A mentor in graduate school loaned me a copy of *Xerces' Pollinator Conservation Handbook*. I don't think I read more than a few pages before I visited the Xerces website and figured out how to become a member. I was so excited to learn that there was an organization out there that was protecting invertebrates.

What made you want to work here? I really admired the work that Xerces was doing and I wanted to be a part of a group that translates science into conservation actions so effectively.

Who is (or was) your environmental hero? I admire Rachel Carson for her passion for science and concern about health and the environment. I also have great regard for Aldo Leopold, a beautiful writer who turned his experiences and observations into a land ethic.

Where did you study? I attended the University of Kansas in Lawrence, where I received a bachelor's degree in ecology and evolutionary biology and a master's degree in entomology.



Which books are you currently reading? I'm rereading two old favorites, Gerald Durrell's *My Family and Other Animals*, and Terry Pratchett's *Going Postal*.

Who's in your family? My husband, Tim, and our young son, Theo.

What do you do for relaxation? I like to read, hike, cross-country ski, garden, take canoe trips, play pick-up soccer, and start—but rarely finish—knitting projects. My latest hobby is making up silly songs to entertain my son.

What's your favorite place to visit? In the United States it's Sleeping Bear Dunes and the Manitou Islands in Michigan. Outside of the United States, my favorite so far is Stewart Island, New Zealand.

What music do you have on your iPod? Some Gipsy Kings for dancing, Bach's cello suites for quiet moments, Sonny Rollins to brighten gray days, and Emmylou Harris for singing along.

Collaboration is the Backbone of Xerces' Monarch Effort

Monarch butterflies are a North American phenomenon, and conserving this iconic pollinator requires collaboration at all levels. To that end, Xerces staff are working strategically on monarch conservation in multiple ways—through science, policy, outreach and education, and management and restoration.

Science: Xerces is collaborating with scientists at universities and such federal agencies as the U.S. Geological Survey to develop ways to target protection and restoration efforts where they will have the greatest impact. We are also conducting applied research to better understand how to manage and restore monarch habitat.

Policy: Protecting monarchs is an international effort, and our work is engaging both the U.S. and Mexican governments in monarch conservation. Last fall, at the invitation of the Mexican government and the World Wildlife Fund Mexico, Xerces gave a presentation on monarchs in Valle de Bravo, Mexico, at the Second International Symposium for Research and Conservation of the Monarch Butterfly. As an ex officio member of the U.S. Monarch Butterfly

High Level Working Group, Scott Hoffman Black, Xerces' executive director, attended the XX Annual Meeting of the Trilateral—Canada, Mexico, U.S.—Committee for Wildlife and Ecosystem Conservation and Management.

Outreach and education: A central component of Xerces' work continues to be outreach and education efforts around some of the least known but most important animals on the planet. Although monarch butterflies are well known and loved by millions, much work remains to engage people in proactive conservation efforts. We are always reaching out to gardeners, schools, farmers, and land managers with information on ways that they can make a difference for monarchs.

Management and restoration: In partnership with the Natural Resources Conservation Service, the U.S. Forest Service, and the U.S. Fish and Wildlife Service, as well as multiple state agencies and nonprofits, Xerces is working to develop management strategies and sources of milkweed seed (monarchs' essential host plant) in order to directly protect and restore monarch habitat.

Migratory Dragonfly Partnership Highlighted

As the weather warms up, dragonflies are emerging and attracting the attention of observers across North America—and people are paying attention to the Migratory Dragonfly Partnership,

too! The MDP's Migration Monitoring Project was selected as one of SciStarter's top five migration projects for citizen scientists, and in March, Celeste Searles Mazzacano, director of Xerces' aquatic



One of the species studied by the Migratory Dragonfly Partnership is the variegated meadowhawk (*Sympetrum corruptum*). Photograph by Celeste Searles Mazzacano.

program, participated in the SciStarter Twitter panel. The project also appeared on the websites of *Discover Magazine*, the National Science Teachers Association, and the Public Library of Science.

The Migration Monitoring Project engages citizen scientists to monitor the timing, duration, and direction of travel of migrating dragonflies, and to

record anything of note observed in a migratory flight. The data thus collected allow scientists to answer questions about different species' migration patterns, routes, and behaviors. Hopefully, the project's increased exposure will engage even more people in this important work. For more information, visit www.migratorydragonflypartnership.org.

Xerces Advocacy Leads to Improved Pesticide Regulation

Two years of advocacy culminated in a success for our pesticide program this spring. In February, the Oregon Department of Agriculture finalized a rule prohibiting all uses of clothianidin, dinotefuran, imidacloprid, and thiamethoxam on *Tilia* (linden or basswood) trees. This was prompted in part by seven recent incidents of acute bumble bee poisonings in Oregon following the use of neonicotinoids on *Tilia*. As a member of the Oregon Task Force on Pollinator Health, Xerces recommended the rule change in June 2014. We then advocated for the change with the ODA and raised

awareness in the stakeholder community, and finally, when the ODA proposed the suggested rule change, we submitted substantive comments in support.

Xerces also worked to prevent the aquatic use of neonicotinoids in Washington state. In 2014, Washington oyster growers applied for a permit to use the highly toxic and long-lived chemical imidacloprid to control native shrimp on shellfish beds in Willapa Bay and Grays Harbor. Over the following year, Xerces brought together fifteen organizations in an effort to reconsider allowing the use of imidacloprid. Both

the National Marine Fisheries Service and the U.S. Fish and Wildlife Service expressed concerns as well. Finally, on

May 3, the Willapa–Grays Harbor Oyster Growers Association withdrew its application for imidacloprid use.

Expanding the Number of Pesticide-Free Cities and Parks

In a local success for Xerces, on April 1 the City Council in Portland, Oregon, unanimously passed an ordinance halting the purchase of neonicotinoids and similar systemic insecticides, and ending their use on city property. The Xerces Society and its partners worked with the City of Portland to develop the ordinance, and three staff members—Aimee Code, our pesticide program coordinator, and Sarina Jepsen and Rich Hatfield of our endangered species program—provided testimony at the City Council hearing on the issue. We look forward to continuing to work with the City to

ensure successful implementation. This ban will protect bees as well as many other beneficial species that are essential to healthy farms and natural areas.

Xerces recently worked with five additional local governments to pass policies to halt the use of neonicotinoids, including the cities of Seattle, Washington, and Stillwater, Minnesota. Further, we continue to support efforts to protect pollinators from pesticides on city parks and properties in nine other municipalities, including Oakland, California; Boulder, Colorado; Minneapolis, Minnesota; and Tucson, Arizona.



Xerces' Aimee Code testifies at the Portland City Council's hearing on neonicotinoids. Photograph by Margo Conner.

Tiger Beetles and Tickle Bees: Xerces on Television

Two recent videos featuring members of our conservation staff helped to introduce new audiences to invertebrate

conservation. For many years, Xerces has worked to conserve the Siuslaw hairy-necked tiger beetle, one of the

rarest beetles in the world. Public television audiences got their first peek at this important project when Sarina Jepsen, director of Xerces' endangered species program, was featured on an episode of Oregon Public Broadcasting's *Oregon Field Guide*.

The television crew traveled to the tiger beetle's coastal sand dune habitat on the banks of the New River in southwest Oregon, filming Xerces conservationists in action in the field while also getting some great close-ups of the speedy, metallic-colored beetle.

Meanwhile, pollinator program co-director Mace Vaughan's account of a local elementary school and the chil-

dren's love for their "tickle bee" population gained widespread notice. The story of people and bees living happily together in an urban setting captured people's imaginations, bringing national attention to pollinator conservation.

Those "tickle bees" are actually stingless, ground-nesting mining bees, which live in large colonies and are quite common, often taking up residence in lawns. Mace's essay and a local television station's video of him talking about the school and its bees was posted in blogs and picked up as far away as Florida. We've since heard that this story is changing people's perceptions of their own mining bee populations.

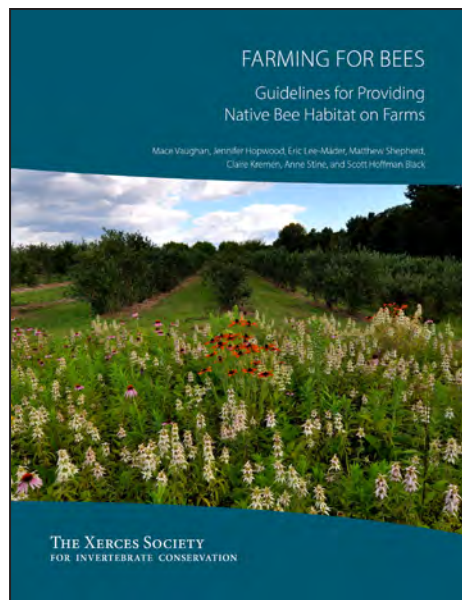
An Updated Edition of *Farming for Bees*

In February, Xerces proudly announced the release of the fourth edition of *Farming for Bees*. This guide is at the heart of

our agricultural pollinator conservation program, and contains a wealth of information about the common groups of native bees, their habitat requirements, and conservation strategies to increase their numbers on farms.

Published in 2004, the first edition of *Farming for Bees* presented the findings of our earliest work in California's Central Valley with Dr. Claire Kremen (now at UC Berkeley), and was a groundbreaking resource for farmers. The latest edition is almost double in length, with greatly expanded sections on a number of topics, including establishing pollinator habitat and using flowering cover crops to support bees. It also includes more-extensive guidance on pesticide risk reduction, checklists of farm habitat features for bees, and new case studies from around the country.

The guide is available as a free download on the Xerces Society website



(www.xerces.org). We hope it will be a valuable resource for years to come, allowing farmers to expand on the more

than two hundred thousand acres of pollinator habitat that we have helped to conserve so far.

Good News: With Your Help, We're Growing!

Thanks in large part to your support, the Xerces Society has been able to add five new positions so far this year. These include Emilie Blevins, endangered species conservation biologist; Thelma Heidel-Baker, integrated pest management specialist; Emilie May, pollinator conservation specialist for Project ICP (Integrated Crop Pollination); and Ashley Taylor, regional monarch and

pollinator conservation specialist for the Pacific Northwest. Our fifth new hire is Jillian Vento, who replaced Emily Krafft as pollinator program administrator. We haven't lost Emily, though; she moved to fill a new position as grants and corporate giving associate. We are sincerely thankful to you, our members, for helping us to expand our capacity to protect invertebrates and their habitats.

Thank You to Xerces Partners in the Business Community

We are grateful to these business partners for their significant support, as well as for their activities to help raise conservation awareness among their customers, enabling us to influence the management of vast acreages of farmland

nationwide: Aveda, Cascadian Farm, Endangered Species Chocolate, General Mills, Häagen-Dazs, J.Crew, Madhava Natural Sweeteners, Maisie Jane's California Sunshine Products, and Whole Foods Market and its vendors.

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For information about membership and our conservation programs for native pollinators, endangered species, and aquatic invertebrates, contact us:

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A well-designed and carefully tended pollinator garden can bring a host of unanticipated delights, such as this unusual view of a black swallowtail caterpillar (*Papilio polyxenes*) chowing down on dill. Photograph by Dennis Krusac.

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On the cover: Female Fender's blue (*Plebejus [Icaricia] icarioides fenderi*) on its caterpillar host plant, Kincaid's lupine (*Lupinus oreganus* var. *kincaidii*). Neither occurs outside of Oregon or Washington; both are protected by federal law. Photograph by Candace Fallon.