WINGS

ESSAYS ON INVERTEBRATE CONSERVATION

THE XERCES SOCIETY FALL 2025

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Looking Back, Moving Forward

Scott Black

Twenty-five years ago this fall, I became executive director of the Xerces Society. At the time it was a tiny organization with just a handful of staff and a very small budget. Things have changed since then. We have many more staff members (a hundred), a much larger budget thanks to our donors and supporters, and significantly greater geographic reach, with projects in every U.S. state and partnerships with groups across the globe. Now, people seek us out, and rather than asking "What's that?" when I say I am from the Xerces Society, they are excited to learn more.

But some things have not changed. We have incredible, committed staff who have a big job to do. They work every day for the betterment of invertebrates and the habitats and ecosystems they need to thrive, by engaging and partnering with people from all sectors of society—land managers, farmers, gardeners, policy makers, school children—who have one thing in common: a desire to make a better world by helping the "little things" that help us all.

Indeed, it is because of the dedication of Xerces staff that we have had great success over the last quarter of a century.

Through workshops, talks, farm walks, and more, we have reached millions of people with the importance of invertebrate conservation. We have published peer-reviewed research,

The orange sulphur declined by 40 percent or more in six of the seven regions that are assessed in the *State of the Butterflies in the United States*. Photograph by Bryan E. Reynolds.

conducted thousands of insect surveys, helped tens of thousands of people become community scientists, and managed incredibly large data sets, all to better understand how to conserve these important animals.

We have passed innovative policies for invertebrates such as getting language added to the 2008 Farm Bill that made pollinators a "priority resource concern" for the U.S. Department of Agriculture, unlocking hundreds of millions of dollars for research and conservation on farms. We have worked with federal agencies to protect some of the world's most imperiled animals under the Endangered Species Act.

We have prevented insecticide spraying on millions of acres of public lands, and helped hundreds of cities eliminate or minimize impacts from pesticides across parks and open spaces. In addition, working through partnerships, we have protected and restored more than four million acres for insects and other invertebrates and have improved management on tens of millions of additional acres.

Despite these achievements, there is a great deal more to do. The urgency of the situation was confirmed by a recent analysis conducted by the Status of Butterflies in the United States working group. We already knew that butterflies were in decline, but this new study confirmed the rate at which they are being lost in this country—1.3 percent per year, with more than one in five butterflies having disappeared from our landscapes between 2000 and 2020. Perhaps more alarming, more than 140 species declined by 50 percent or more, with two dozen of those species suffering greater than 90 percent losses.

The working group, comprising conservation biologists and butterfly experts from universities, agencies, and the Xerces Society, and led by Cheryl Schultz of Washington State University Vancouver, published its findings in the journal *Science* this spring. Building on this effort, Xerces collaborated with members of the working group to author and release the report *State of the Butterflies in the United States: A Roadmap for Butterfly Conservation in the 21st Century*. This document presents a summary of the group's findings, with species-level information on population trends for each of seven regions, and, most important, a vision for how we can reverse butterfly declines in the places we live, work, and play.

The Status of Butterflies project epitomizes what we and our partners have done over the past twenty-five years. It uses the best available data to understand the status of an important group of invertebrates—this project included 12.6 million individual butterfly records gathered from seventy-six thousand separate surveys and thirty-five monitoring programs—but, as always, it goes beyond the numbers and conclusions to ensure that this information is used to advance conservation. With this knowledge and Xerces' world-class team, our goal is to focus on conservation actions across landscapes that can help these species. Neighborhoods and farms, natural areas and college campuses, roadsides and parks—any place with space for habitat can contribute.

I hope you will join us in this difficult task by providing habitat for butterflies and other pollinators, curbing pesticide use, and helping spread the word. Together we can make a real difference.

Living Farms: Regenerative Agriculture Meets Biodiversity

Anna Murray

I am not an entomologist. In fact, I probably could not have told you what someone who studies bugs was called until my mid-twenties. I grew up in the middle of the urban sprawl of the East Bay in northern California, across the water from where the Xerces blue butterfly once flew above the sand dunes of San Francisco. But, of course, I had no idea about that. I rode buses through Oakland and Berkeley, much more interested in the circle of life that involved the graffiti on buildings and the hip-hop and punk music blasting from cars than I was in understanding the food web that teachers and camp counselors kept telling me about. I was scared of spiders, terrified that one might crawl into my mouth in the middle of the night, because I heard Oprah say that we ingest a surprising number of bugs in our sleep. That, and I was way too young when I watched the movie *Arachnophobia*.

Yet I now find myself as part of the Xerces Society's Living Farms team, working to help food companies and farms all over the country implement insect-conservation practices. Like me, most of the people I collaborate with also don't have a background in insects. They are department heads, brand managers, and commodity buyers at food companies, as well as farmers and other people who live and work on the land.

As a cover crop, lacy phacelia supports bees and flies and builds soil fertility. Photograph by Garrett Duyck / USDA-NRCS.

Xerces partners with every type and size of farm—the fact is that all farmers have a part to play if we are going to effectively conserve biodiversity—but I specialize in working with very large farms that supply some of our largest food companies. Some farmers we work with grow crops on tens of thousands of acres, spread out across growing regions that are hundreds of miles wide. These operations epitomize the image of large-scale agriculture and, like I once did, their staff can sometimes feel out of place with conservation entomologists. Indeed, our conservation model promoting native habitat for diverse pollinators and other beneficial species can seem very much out of place amid corporate food brands and the monoculture plantings of apple and lettuce varieties that cost millions of dollars to develop and sell.

The concept of pollinator and beneficial insect habitat on farms is not new, but after more than a century of researchers, chemical companies, and yes, entomologists, telling farmers that the best way to maximize yield to feed a growing population is to spray insecticides, eliminate host plants for pests, and bring in bees by the truckload, some of our farms have become inhospitable to biodiversity.

So how is someone who is not an entomologist, working with a bunch of other people who are not entomologists, helping invertebrates? Probably in the same way that many readers of this article are—one flower at a time.

In the wake of colony collapse disorder gaining national attention in the mid-aughts and the ensuing 2015 U.S. Federal Strategy on Pollinators, some key staff at the food conglomerate Gen-

The yellow flowers of tidy tips bring beauty and beneficial insects into almond orchards. The plants also increase infiltration and soil moisture retention, a valuable benefit in regions with hotter, drier summers. Photograph by the Xerces Society / Jessa Kay Cruz.

Habitat plantings are designed to be protected places to support beneficial insects that help a crop grow, meeting both ecological and agricultural needs. Photograph by the Xerces Society / Jenae McCarthy.

eral Mills wanted to help. Mace Vaughan and Eric Lee-Mäder, then co-directors of Xerces' Pollinator and Agricultural Biodiversity Program, had been working with General Mills since 2012; they made the pitch that there needed to be a significant increase in the planting of pollinator habitat if food companies and farmers were going to make a meaningful difference in the fate of bees. As a result, in 2016, General Mills and the USDA's Natural Resources Conservation Service pooled $4 million in funding for the Xerces Society to support the delivery of technical assistance to farmers with planting and protecting pollinator habitat. This was a breakthrough agreement that led to the hiring of many of my exceptional Xerces colleagues, known as NRCS partner biologists.

The next year, General Mills and three of its brands—Cascadian Farms, Cheerios, and Muir Glen—made a second substantial commitment in the form of an agreement with Xerces to plant pollinator habitat directly on their supplier farms. Since that time, thousands of acres of flowering habitat and miles of hedgerows have been planted across the vast acreage of General Mills farmland. This has been a major group effort. In the early years, Stephanie

Frischie, agronomist and native plant materials specialist, and Cameron Newell, Bee Better program coordinator, along with other Xerces staff members, brought well-researched and practical models of pollinator habitat implementation to this task.

It was thanks to this partnership with General Mills that I started at Xerces in 2020, hired as a "food industry and supply chain pollinator habitat specialist." I'll be honest, I didn't really understand what the supply chain part of the title meant. At that point I had come a long way from lying in bed hoping a spider didn't crawl into my mouth. Midway through college, I unexpectedly fell deeply in love with native plants (a big shift from political science). I learned to grow them in greenhouses, plant them in the wild, manage the invasive species that threatened them, and relish the insects that visited them. I loved them so much that, at thirty, I went back to school to learn all about them. And that's when I caught the agriculture bug. I learned about the genetics of crops, the pathways for pathogens, the movement of nutrients from the soil into a plant and back again. But in my three years studying agronomy, I don't think one person mentioned the supply chain.

As in many industries, the actual mechanics of the food business are pretty opaque to outsiders. In the early years of the partnership between Xerces and General Mills, GM staff helped Eric, Stephanie, Cameron, and others navigate this complex web. Stephanie's projects were on farms supplying oats for Cheerios in the Great Plains of the Dakotas, Saskatchewan, and Manitoba. Oats are mostly processed at a cooperative grain elevator that holds harvests from multiple farms, which are shipped to a processing facility en route to your Cheerios box. This means that the supply chain is in reality a supply shed—industry-speak for the geographical area encompassing the supplier farms—where it is anyone's guess which farms' products end up at Cheerios and which ones go to another buyer.

Stephanie worked far and wide, designing sophisticated seed mixes for cover crops, pollinator meadows, and insectary strips, and had the seeds shipped to growers to plant. The work she and others did in that region led to the planting of more than thirty-seven hundred acres of flowering perennial pollinator habitat. For those who don't spend a lot of time thinking in acres, Disneyland in California is about one hundred acres. That means the farmers who Stephanie worked with planted pollinator habitat sufficient to cover thirty-seven Disneylands. Now that would be a theme park I would love to visit!

My work is in the western United States, alongside Cameron and other Xerces staff in tandem with growers of almonds, vegetables, and tomatoes in the Central Valley of California and tree fruits in the Columbia Basin of Washington and Oregon. These supply chains are a bit trickier. Cameron and I met with buyers—the staff at food companies who determine how much of a raw product to buy and where to source it—who connected us with processors, who in turn connected us with the farmers.

In the western states, seeded habitat isn't always your best bet. Planting rooted plants can work a lot better, especially during times of severe drought—which California was just recovering from in 2018—so Xerces started plant-

ing hedgerows. Lots and lots of hedgerows. As of this year, we have planted thirty-one miles of hedgerows in the GM supply shed in California, Oregon, and Washington. At maturity, these hedgerows form dense walls, ten to fifteen feet tall, of flowers and nesting materials for bees. Imagine walking along them. If they were all lined up, it would take you more than ten hours at a brisk pace. You'd pass by elderberry, toyon, and ceanothus; milkweed, sage, and wild buckwheat. Pause a moment and you'd see syrphid flies, parasitoid wasps, long-horned bees, metallic green sweat bees, or my favorite, bee graffiti in the form of a perfect half-moon shape cut out of a redbud leaf, which says to me, "I, a boss leafcutter bee, was here."

Although the Living Farms project owes its origin to the Xerces–GM partnership (and continues to work with growers of almonds, apples, pears, and tomatoes in the GM supply sheds), we have expanded our pollinator conservation efforts further into the food system. We've also started diversifying, working with large companies and small farms that grow a range of crops, including lettuces, strawberries, blackberries, olives, beans, row crops, and more. This has led to planting another nine and a half miles of hedgerows and an additional sixteen hundred acres of other habitats. That's sixteen more Disneylands!

Through all of this, our relationship with growers is a critical element. Conservation implementation is entirely dependent on relationships, and we are deeply grateful for the hard work of the farmers and their employees, and for the staff at food companies and brands who

A year and a half after planting, this hedgerow is becoming a significant feature in the orchard landscape of eastern Washington. A mix of shrubs and perennials provides diverse forage and shelter. Photograph by the Xerces Society / Angie Orpet.

Lady beetles are one of many predators and parasitoids aided by on-farm habitat. Photograph by Jon Cox, Flickr / CC BY-NC 2.0.

continue to invest their time and efforts to help make our food system better for wildlife.

Bee Better Certified, Xerces' third-party-verified, on-farm pollinator certification program, plays a crucial role in our work as well. Our model for conservation implementation on farms is voluntary. Farms and food companies are planting habitat and reducing pesticide inputs not because of regulation, but because they see the benefit of doing so. There is great value for farmers in creating a healthier agroecosystem that will reduce risk to their production, but there has to be commercial value as well. Bee Better Certified can help differentiate products and give them preferential placement in the marketplace.

You may have noticed that these days there is more talk about "regenerative agriculture" and less about "sustainable agriculture." That's okay, especially when these concepts include permanent habitat. Regenerative agriculture sometimes focuses on cover crops and soil health in the footprint of the crops themselves, often overlooking the permanent habitats that provide homes and food for wildlife, including the pollinators and other beneficial insects that need resources and nesting sites year-round. Establishing permanent habitat can bring farms additional benefits beyond the basic regenerative agriculture goals of cover crops and reduced tillage that builds soil. Hedgerows of native pollinator plants, for example, are environmental powerhouses: they sequester carbon and store it for the long-term, and they also help reduce erosion, trap snow, and boost water infiltration. We are working with companies to help communicate this to their stakeholders, so that pollinators and other insects don't get forgotten about and food industry priorities aren't focused solely on the cropped areas of regenerative farms.

Trying to change our food system sometimes feels like throwing a flower petal at an elephant. I don't think it notices. Other times, when I meet with a farmer next to their acres of flowering habitat or towering hedgerows, or talk with a sustainability manager at a mission-driven investment company, or see the number of habitat projects we plant growing rapidly, I feel better—more like we've draped a flower necklace over an elephant. And I think it likes the scent.

Anna Murray is a senior pollinator habitat specialist and the Food Systems and Living Farms Project lead with the Xerces Society. She oversees design, implementation, and evaluation of cutting-edge conservation systems for bees and beneficial insects on farms across the western United States.

Returning the Chequered Skipper to England

Nigel Bourn and Susannah O'Riordan

It is now seven years since the chequered skipper (*Carterocephalus palaemon*) was reintroduced into England, following targeted work to restore habitat across the butterfly's former haunt of Rockingham Forest in the English Midlands. Before we go any further, it's important to appreciate that reintroduction of a species is not an easy task, nor one that is accomplished quickly. Experience tells us that it's still early in this reintroduction, and that fixing the issues that cause a species to disappear is a long, hard process. Thus, it's not every day that we have the thrill of returning a species to a former stronghold, so here's an account of how this one happened.

Historically, despite its name, Rockingham Forest was not a continuous cover of trees. The term "forest" was a legal designation for an area used as a royal hunting ground, which would have been a mix of woodlands and open spaces. In the case of Rockingham, it had been a royal forest since the late eleventh century, providing recreation for the monarchy and just the right conditions for deer and other animals—including a small, brown butterfly, with a checker pattern of golden markings on its dark wings, that had seemingly contradictory needs of open, sunny conditions, but within woodlands.

Rockingham Forest was the chequered skipper's refuge in England. It had been locally common in the East Midlands—well-known enough to have a pub named after it in the village of Ashton Wold—but disappeared in 1976 due to changes in how the woodlands were being managed. The decline of the chequered skipper occurred gradually, starting at the beginning of the twentieth century and culminating with a

The chequered skipper was reintroduced into Rockingham Forest in 2018. Seeing this freshly emerged individual the following year was a sign of success. Photograph by David James.

sudden rush to extinction in the 1960s and '70s as the impact of woodland management decisions made several decades earlier kicked in. Parts of the already fragmented centuries-old native deciduous woodlands had been cleared and replaced with conifer plantation forestry, largely in the 1930s. There also was a reduction in traditional management work that had maintained conditions that benefited the butterfly, and, as the trees grew and the dense canopy developed, the woods became dark with far too few wide rides (paths and unpaved roads) and other open areas.

There has been a resurgence of interest in conservation of the forest. This led to many of the woodlands within this area undergoing significant changes in management, and in recent years they were again a lot more open. Much of this work was carried out by a collaborative project led by the nonprofit organization Butterfly Conservation, made possible by support from the National Lottery Heritage Fund as part of the Back from the Brink program. The improvements included restoration work on fifty-seven acres (twenty-three hectares) of habitat, which involved widening more than six miles (ten kilometers) of rides, and creating new glades to enhance the area of open spaces. In addition, a rotational mowing regime was implemented, with different sections of rides cut in alternate years to ensure that habitats are maintained in suitable condition for the chequered skipper. The scale of these changes was such that Butterfly Conservation and its collaborators became confident that an experimental reintroduction of the skipper was worth attempting after a four-decade absence.

Planning for this began in earnest

Considerable work was done over several years along woodland rides to restore the sunny conditions that are needed by the chequered skipper. Photograph by Ben Andrew / Back from the Brink / CC BY-NC 2.0.

in 2010, nearly a decade before the first individuals were released in England. An important phase was assessing the best place to source butterflies. The disappearance of the Rockingham populations had not meant loss of the chequered skipper in Britain, as it hung on in woodland edge and scrub habitat on the west coast of Scotland. Conditions there, though, were quite different from those in English woodlands, so this assessment involved reviewing surveys of populations in northern France from as far back as the early 1990s, and discussions with colleagues from Belgium and the Netherlands. Species modeling was done to compare environmental variables such as land cover and climate in the regions in Scotland, Belgium, and the Netherlands with those in the proposed reintroduction sites in England. This research suggested that three regions in Belgium were a close fit, while further local knowledge about the status of the species narrowed our eventual search zone to two areas in the southern part of that country.

The first expedition to collect chequered skippers began at nine o'clock in the morning on Sunday, May 20, 2018, when Sam Ellis and Nigel Bourn, both of Butterfly Conservation, set off from southern England with a carload of collecting equipment. They finally arrived in Rochefort, Belgium, at six o'clock that evening, having driven on a motorway at ten miles (sixteen kilometers) per hour through one of the heaviest thunderstorms imaginable. Would the weather impact the numbers of chequered skippers to be found?

The next day was bright and warm, and we met Philippe Goffart of the Wallonian (southern Belgian) government's Forest and Conservation Service. Philippe had been advising the project for several years, and had recently managed a huge woodland restoration initiative. His local knowledge of chequered skippers and their habitats would prove invaluable. We reconnoitered the sites and made the decision that we should collect the following day, as the females looked to be in great condition and in good numbers (we had found twelve). Meanwhile, the rest of the team from England traveled on the Eurostar train through the Channel Tunnel, arriving at Rochefort in the early evening.

Author Susannah O'Riordan gently captures a skipper in Belgium for transport to England. Photograph by Jamie Wildman.

Day three saw seven volunteers from Belgium—brought together by our other long-term Belgian collaborator, Dirk Maes of the Flemish (northern Belgian) government's Research Institute for Nature and Forest—join our team, bringing it to thirteen people. We divided into three groups to cover the large territory necessary, searching eight potential donor sites across three locations to reduce the impact on any one

The chequered skipper population in England grows stronger each year. Photograph by Ben Andrew / Back from the Brink / CC BY-NC 2.0.

donor source. One group was held up by a close encounter with a family of wild boars and beset by thunderstorms, but the main threat was exhaustion—and a lack of time—as we scoured large woodlands for this elusive butterfly.

We managed to collect thirty-seven butterflies, fewer than we had hoped, but without the expert help and knowledge of Philippe and the local volunteers we wouldn't have gotten that many. This skipper occurs in low densities across large areas, and it took on average two and a half hours of searching to locate each female. There were a few steps between capture and release (including health checks on the butterflies), but this long day of hard work led, a few days later, to the first introduction of skippers into Fineshade Wood, a large (for England) publicly managed woodland near the center of Rockingham Forest.

This initial release was bolstered by further collection trips in 2019 and 2022. (Pandemic restrictions prevented returns in 2020 and 2021.) Perhaps it was the novelty of the first trip, a growing familiarity with the methods, or the increasing number of Belgian volunteers as interest in the project grew, but these later trips seemed far more mundane, with thunderstorms and wild boars things of the past. The one constant was the low density of the butterfly and, consequently, the hard miles that needed to be walked to find sufficient numbers to make each trip a success. And, of course, there were the well-earned Belgian beers at the end of the day to thank the volunteers.

In total, 128 chequered skippers from Belgium have been released into Rockingham Forest, with the butterfly establishing itself at the initial release site and the area occupied by this population increasing each year, up through 2022. Although there was a dip in 2023, in 2024 the population remained relatively stable with some limited further expansion; work will continue to ensure

that the woodland management is targeted to maintain good quality habitat for the species. A side benefit of spending so much time searching woodlands in Belgium was seeing the habitat that the chequered skipper occupies there, as well as learning from Philippe about how the extensive network of woodland rides and glades was created and managed, all very useful in informing our future work in Rockingham Forest.

To ensure that the reintroduction is guided by evidence, it has been the focus for several PhD studies. Jamie Wildman (University of Northampton) undertook painstaking detective work in museum collections, with the result that the number of historical records of the chequered skipper in the United Kingdom's national database of distributional records increased more than thirteenfold, from 266 to 3,715. This extended our knowledge of the status of the chequered skipper in England through the nineteenth and twentieth centuries, and its decline and then rapid contraction to extinction.

A second paper by Jamie helps understand the current population of skippers by reporting on the use of a novel method utilizing volunteer-taken photographs of the butterflies to estimate population size, mobility, and behavior. It is effectively a classic mark–release–recapture study, but without the marking: each individual butterfly could be identified by its unique wing pattern.

From the founder population released from Belgium in 2018, the estimated population at Fineshade Wood had increased to 618 butterflies by 2022. The species, while colonial, is more mobile than we thought it would be, with individuals moving on average a distance of 440 yards (400 meters) while the maximum movement detected by an individual butterfly was 1.4 miles (2.2 kilometers) over a period of seventeen days. Importantly, the absolute population estimates calculated from the photographs correlate with timed counts, confirming that reduced-effort surveys such as timed counts give accurate assessments of population size.

The location of the first chequered skipper release was kept secret, despite considerable media interest. Photograph by Susannah O'Riordan.

A second PhD study is by Georgina Halford (University of Liverpool). Georgina has published one part of her PhD thesis, demonstrating the application of wide-scale species-distribution models to determine the locations of habitat most suitable for reintroductions, proving the importance of this exploratory work at the start of any reintroduction and before any individuals should be released. Her later research, focused on genetic analysis of both the source populations in Belgium and the reintroduced population in Rockingham Forest, surprised us all. Georgina found that the individual butterflies now in Rockingham Forest are descended from only one of the two areas that we collected in, suggesting that those populations in Belgium cannot interbreed.

Reassuringly, the introduced population is nonetheless genetically diverse, just from fewer individuals than we thought. How this was possible—the mechanism involved—is now the subject of a third PhD, with the frontrunner being a bacterium, *Wolbachia*, which is known to be present in many Lepidoptera and to have a range of impacts on its hosts, including on breeding success.

Clearly, the implications for efforts at reintroduction are pretty major. For example, in any subsequent reintroductions do we source only from the successful population in Belgium, or do we try again across the skipper's range? Has the same thing happened in the second reintroduced population? The answers to these questions have broader implications, demonstrating the importance of genetic monitoring of reintroductions, a conservation tool that, given the widespread declines in nature, is growing in relevance and increasingly being used.

The work by Jamie and Georgina, alongside other papers published by participants in this project detailing the success of the first five years of the reintroduction and reviewing the scientific results and the progress so far, underscore the importance of rigorous scientific research to support an effective reintroduction project.

The location of the release site in Fineshade was a closely held secret in the first few years, as we were concerned about the possible impact of trampling if too many people visited. In early 2022, though, we were pleased to share the location and encourage members of the public to view the species, confident that it had established. In addition, we released the species into a second, still secret, site, where it is also doing well.

While this project demonstrated that it is possible to establish the butterfly back into England, its future is far from secure. Further work is needed to maintain and enhance the woodland landscape—but, for now, the story of the chequered skipper in Rockingham Forest continues.

Nigel Bourn recently retired from Butterfly Conservation after nearly three decades. Recruited as a researcher following his PhD on rare moths of the Inner Hebrides (Scotland, UK) he moved on to lead the society's Species Conservation programs before leading the monitoring and research team.

Susannah O'Riordan spent eight years at Butterfly Conservation working to help protect some of the UK's rarest butterflies and moths. She managed the Chequered Skipper Project, leading key efforts that included Back from the Brink and the reintroduction of the chequered skipper.

The Power of Many Hearts

Rachel Dunham

In 2018, the Xerces Ambassador Program was nothing more than an idea—to recruit, train, and support volunteers around the United States to represent Xerces at events, with the goal of inspiring and motivating people to take action for invertebrates. It was a big dream, and an untested concept. To our knowledge, at that time there was no other conservation organization that had a similar nationwide program. Would volunteers give talks and table at events in their communities, often alone? Could we provide enough support from hundreds or even thousands of miles away? How could volunteers be connected to create an engaging community? We decided that all we could do was try. And, as I write this article more than seven years later, I am sure glad we did.

We launched a pilot program in Portland, Oregon, with fourteen ambassadors. The success of that initial effort demonstrated that the idea could actually work, and we developed a plan to expand to cities in other states. And then the pandemic intervened, changing everything. Expansion of the Ambassador Program was put on hold, but we also learned new ways of working that showed that we could successfully function remotely. The larger version of the program relaunched three years ago, and we now have more than a hundred and seventy ambassadors across the United States and Canada, in forty-one

Xerces' dedicated ambassadors bring enthusiasm and passion to connecting with communities and individuals. Photograph courtesy Gio Leos.

states, one province, and a hundred and sixty-one cities.

Collectively, ambassadors have done more than a thousand events and have reached more than seventy-one thousand people. They have given talks to garden clubs and have been keynote speakers at conferences, set up information tables in local libraries and hosted booths at Earth Day festivals and garden shows, engaged with homeschool groups and summer camps throughout an entire season, motivated organizations to put on conservation events, and inspired decisions to become Bee Cities. The number of requests we receive continues to grow as more organizations and even businesses want presentations or a presence at their events. Ambassadors are becoming household names in their local communities.

The impact of the ambassadors' hard work is not the only benefit of the program. We believe that any good volunteer program should be beneficial to both the organization and its volunteers. It is not only about what we as an organization receive, but, equally, what our volunteers get out of participating.

When asked why he serves as an ambassador, Brad O'Brien, who lives in South Carolina and has been in the program since 2022, said, "It's empowering. Being an ambassador has provided me with the training, resources, and opportunities to make a local impact on a global issue that's very important to me." Brad also noted that, although the scale of the environmental challenges we face sometimes feel overwhelming, he knows he's not helpless. Being a Xerces ambassador has been a way for him to actively engage in helping with invertebrate conservation.

Jacqui Ver Loren van Themaat, formerly an ambassador in Las Vegas and

Engaging activities and friendly conversations combine to create highly effective outreach that helps draw more people into conservation. Photograph courtesy Jessica Hildreth.

now in California—one advantage of the remote nature of the program is that people don't have to stop being an ambassador if they move—shares a similar perspective. Even after being an ambassador for three years, she still finds opportunities to learn more about the world of invertebrates and to connect with other like-minded people to share information about the value of insects and their importance in our environment. "When I was officially accepted as part of this amazing team of people dedicated to the conservation of these important little creatures and telling their fascinating life stories, I just felt like the luckiest person in the world," she said.

Truth be told, we are the lucky ones. What makes the Ambassador Program successful goes beyond the structures we created, the activities and materials we supply, and the ongoing training and support we provide. I have always felt that a volunteer program is only as great as its volunteers, and that could not be truer here. Our ambassadors are not only experienced in outreach and education, but have a thirst for learning and a fervent desire to share their knowledge with the public.

"With a friendly smile and enthusiastic messaging, ambassadors model a humane and caring attitude toward bugs and the more natural habitat they need," said Rosalind Reilly in Virginia. "I like to think that our passion for invertebrates is contagious, and that each conversation we engage in can have a multiplier effect when our contacts take the next step by rewilding part of their yard, adding a sign, or telling friends and neighbors what they have learned."

One interaction at an event called "Bee-My-Valentine" particularly resonated with Rosalind. She was showing a woman a cutaway model of the nest of a ground-nesting bee, and explaining how the "single mom" works to dig the tunnels and visit hundreds of flowers to provide her future offspring with pollen, when, in Rosalind's words, "One of those lights clicked on." The woman was visibly astonished and declared: "We humans need to learn from these bees. Their priority in life is not grabbing everything for their own comfort but ensuring that the next generation will have all they need."

Craft projects create happy memories. Photograph by Leslie Campbell.

It is clear that the ambassadors themselves are the conduit for inspiring the public and that shines through in their personalities and the heart they pour into their outreach. Beyond the number of individuals they reach or events they attend, though, ambassadors are seeing the impact through change in their communities. Bob Shaw, one of the volunteers who went through the very first ambassador training in Portland in 2018, noted that, since he

Ambassadors reach people and places that our staff cannot, greatly expanding the range and impact of Xerces' work. Photograph courtesy Jacqui Ver Loren van Themaat.

became a Xerces volunteer, "more and more gardeners are getting rid of their lawns, planting native plants, creating nesting and overwintering sites for native bees, and greatly reducing or eliminating pesticide usage."

Brad O'Brien also noticed change in South Carolina: "People in Columbia are now aware of Xerces, interested in the message, and eager to learn more!" He has delivered two firefly presentations, tabled at multiple firefly events, and published an article in a local newspaper on firefly conservation. Brad notes that it's now not uncommon for someone who attended an event or read his article to ask him for help identifying fireflies they've seen, or for guidance on what else they can do to help fireflies.

Doing outreach on behalf of invertebrates is fun, but it is not always easy. There are challenges ambassadors face in interacting with the public. When asked about those challenges, Jacqui Ver Loren van Themaat observed how, in our modern Western worldview, we have really vilified most insects: "Disgust can be a powerful driver, as insects are often associated with unsanitary environments and potential disease. I see ads for pest control on television, on social media, on vehicles passing on the freeway, and on billboards, and even hear them on the radio."

Jacqui shared an anecdote underscoring the pervasive nature of such messages. She hadn't even unpacked her moving boxes before a pest control company knocked on her new front door offering a "great deal" on a preventive pesticide treatment that promised to protect the whole home and garden. "The poor young student doing this summer job did not expect the long lecture that followed, proclaiming that this is now a pollinator-friendly home, and explaining why our insect friends are so important to our ecosystems!"

Some insects, of course, can bite or sting, triggering a fear response. Jacqui has often encountered this—mentioning that even with specimens that are very clearly no longer alive, people can still sometimes be fearful. This is why she thinks it is so important that we also focus on our younger naturalists through programs like X Kids and the other resources that ambassadors provide for children, their families, and teachers: "Not only are they our future stewards and conservationists, their curiosity and wonder at the natural world is often a bridge for adults to let go of their fears and share in their excitement to learn."

Despite widespread disparaging attitudes toward insects, ambassadors find ways to reach past misinformation and connect with the public—and, consequently, to make a meaningful difference. "On multiple occasions, I've observed guests being shocked to learn that honey bees are not native to the United States, are not endangered, and should not be the focus of conservation efforts," said Brad O'Brien. "This is often accompanied by relief that bee conservation involves planting native plants to create habitat rather than managing a hive."

Bob Shaw draws on his experience as a gardener to reassure people unsure about creating garden habitat. "Some gardeners hesitate to plant native plants, leave the leaves, create brush piles, and wait until spring to cut back perennials; they consider many native plants unattractive and want their gardens to be tidy," he notes. He encourages them to adopt an ecological perspective—instead of favoring a hybrid plant's showy flowers, think of a plant's beauty as based on the number of native bee species that it supports.

One reason I think the ambassadors are so effective is that they are out and about in their communities, meeting people where they are, and having conversations one on one. The impact of talking to someone in real time and having a face-to-face interaction is very different from reading a post on social media or watching a webinar. While all outreach efforts are important, the relationships the ambassadors build are truly irreplaceable.

The program is so much more than we ever could have imagined. I am constantly impressed with the creativity and dedication of the ambassadors. Their willingness to go above and beyond is inspiring. As the program continues to expand—this fall we recruited more than fifty new ambassadors, and we have many volunteers who have been in the program for several years—I am delighted to see people responding directly to them in their communities, and the ripple effect of their efforts.

Xerces' Ambassador Program has become an important part of our ongoing work to make real change where people live. We are incredibly fortunate and grateful to have each ambassador in the program. I consider myself lucky to work with every one of them, and we look forward to seeing the program grow even further.

Rachel Dunham is Xerces' community engagement and volunteer coordinator. She built the Ambassador Program from the ground up and is finding new ways to connect to communities through X Kids and as a co-host of Xerces' Bug Banter *podcast.*

PARTNER SPOTLIGHT

The California Association of Resource Conservation Districts

The California Association of Resource Conservation Districts (CARCD) has been a partner in our work for almost two decades. Over this period there have been many projects on which our organizations have collaborated, including outreach efforts as varied as on-farm hedgerow field days, conference presentations, school visits, and community events. Individual resource conservation districts have participated in Xerces' pollinator-monitoring trainings and subsequently used these protocols to monitor their own project sites.

The partnership has had particular impact through a large number of habitat projects, especially those supported by Xerces' Habitat Kits. Over the past seven years, this program has provided plants to nearly 850 projects across California—with RCD involvement in more than 230 of them. The RCDs provided local connections with schools, colleges, parks, farms, ranches, and other places that have space for the plants. They also managed these projects, often offering additional supplies such as irrigation and mulch—and, in some cases, labor—to make the plantings successful.

In the past few years this relationship has been strengthened further thanks to CARCD and Xerces being partners on a grant from the California Wildlife Conservation Board that funds work to build climate resilience in the state through habitat restoration. A particular focus is creating a connected corridor of habitat across the southern part of the Central Valley. This effort draws together the RCDs, land stewards, and Xerces to expand breeding areas for the monarch butterfly as well as for native bees and other pollinators.

There are many individuals who we could recognize at CARCD, but we want to give a special thank you to Heather Bernikoff. As its tribal liaison and pollinator program manager, she has been pivotal in connecting Xerces with regional RCDs, engaging people in the Habitat Kit program, and advocating for the work that we do throughout the state. She is herself a rancher and a participant in the Habitat Kit program.

A hedgerow in the Central Valley. Photograph by the Xerces Society / Anna Murray.

STAFF PROFILE

Rachel Dunham, Community Engagement and Volunteer Coordinator

What got you interested in invertebrates? When I was an undergrad, I worked at the Seattle Aquarium as an educator. Most of our programs focused on marine invertebrates, so that was when I was really introduced to invertebrates. After that my career revolved around vertebrate conservation. As a biologist, I always knew invertebrates were important, but I didn't really connect with them until I started working at Xerces. During a short course, my boss, Matthew Shepherd, found a variety of bees and taught me how to catch them—and suddenly, I was seeing a whole world I'd never truly noticed before.

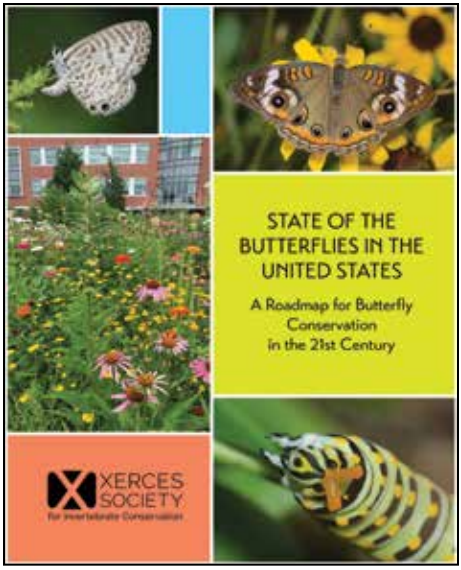
What made you want to work at the Xerces Society? What initially drew me to Xerces was its great reputation, but what pulled me in was the opportunity. I was ready for a new challenge. I had spent ten years working with "charismatic" species such as bears, whales, and eagles. It isn't hard to convince people that these animals are important. Insects are a harder sell, but arguably more important because of the lack of attention they receive and their critical role in our world. That made the mission here so compelling, and the chance to build a nationwide volunteer program from the ground up was exactly the kind of opportunity I'd been dreaming of.

What is most satisfying about your work here? Hands down, it's the people I work with. The volunteers and the staff inspire me every day. I've never worked with such a passionate, intelligent, and kind group of people, and I am grateful every day for my job because of them.

Who is (or was) your environmental hero? David Attenborough. He's inspired countless people to care deeply about nature, and I still aspire to have a similar impact. When I worked as a naturalist on cruise ships, someone once told me I reminded them of David Attenborough and that was a huge moment for me!

What music do you enjoy listening to? I'm a big Taylor Swift fan. My go-to favorites also include Imagine Dragons, Jack Johnson, and Brandi Carlile. Lately, though, my playlist has been leaning into Noah Kahan and Quinn XCII, along with a mix of string quartet covers—and anything with 180 beats per minute to keep me motivated on my runs.

New Xerces Report: *State of the Butterflies*



In June, Xerces released *State of the Butterflies in the United States: A Roadmap for Butterfly Conservation in the 21st Century*. The report is the first attempt ever to identify the core conservation actions needed for butterfly recovery across hundreds of species and diverse U.S. landscapes. It builds on studies that show the disturbing rate of loss across the country—22 percent in twenty years—by providing a full overview of the research, details of what butterflies need, regional profiles that specify the species seeing the most severe declines or doing well, and actions to help butterflies.

The report provides clear solutions organized by landscape type, including natural areas, working lands, and towns and cities, and emphasizes the need to support butterflies' entire life cycle with habitat that includes caterpillar host plants. Additionally, there are recovery success stories and an appendix that lists steps people can take. Anyone can work to help butterflies—wildlife agency staff, farmers, gardeners, city park managers, golf course superintendents. *State of the Butterflies* identifies the most impactful things you can do.

Creation of the report was a collaboration with members of the Status of Butterflies in the United States working group, led by Cheryl Schultz, professor of conservation biology at Washington State University Vancouver and a longtime scientific advisor to Xerces. Cheryl notes that "this report provides us an accessible roadmap for conservation success. But we must act quickly across all parts of our landscape if we hope to preserve the existence and the wonder of butterflies in decades to come."

While some butterflies are suffering 80 or 90 percent declines, it is not all doom and gloom. Some species are increasing dramatically. One is the gulf fritillary, which seems to be benefiting from gardeners' enthusiasm for passionvine, its caterpillar host plant. This underscores the importance of host plants to the health of butterfly populations, and demonstrates that seemingly minor actions can help butterflies when they are undertaken across large areas.

State of the Butterflies can be downloaded from the Publications Library on our website, xerces.org.

Pesticides Linked to Monarch Deaths in Pacific Grove

Hundreds of dead monarch butterflies were found in a garden adjacent to the world-famous Monarch Sanctuary in Pacific Grove, California, in January of last year. Xerces partnered with the Pacific Grove Museum of Natural History and the U.S. Geological Survey to investigate. Dead butterflies were collected and sent to the USGS laboratory in Sacramento. Testing revealed multiple pesticides—an average of seven per butterfly, including several at levels known to be lethal to insects. In all, fifteen chemicals were identified in the butterflies, including eight insecticides, two herbicides, and two fungicides. These results were published in the journal *Environmental Toxicology and Chemistry* in June.

Staci Cibotti, pesticide program specialist for the Xerces Society and the study's lead author, said that the monarch population is especially vulnerable to mass deaths from pesticides when they congregate for the winter. In California, monarchs overwinter along the coast in hundreds of small forest groves that are often surrounded by residential neighborhoods or agricultural fields, exposing them to pesticide residues or accidental drift from nearby applications.

While habitat loss, climate change, and disease all contribute to the decline of monarchs and other butterflies, pesticide exposure is increasingly recognized as a significant and preventable threat.

Everyone can help to avert similar tragedies in the future:

- Learn more about the risks of pesticides in residential landscapes and adopt safer, non-chemical alternatives;
- Establish pesticide-free buffer zones around overwintering sites and other places where monarchs cluster;
- Ensure that protections against pesticide exposure are included in monarch conservation and recovery plans; and
- Improve coordination among agencies to track and address pesticide risks.

When clustered during the winter, monarchs are vulnerable to threats, including pesticides. Photograph by Joanna Gilkeson / USFWS / CC BY 2.0.

Your Legacy for Invertebrates

As a member of Xerces for fifteen years, I recently designated the organization as a beneficiary in my will. I am a Master Naturalist in Maryland, and invertebrates capture my interest most—given the enormous variety, their relatively small size but tremendous contribution to our ecosystem, and the tenacity with which they go about their lives. In the above image, I stand with sculptor James O'Neil of ATD Metal under a stunning, newly installed dragonfly that soars over Quiet Waters Park, where I chaired the Environmental Committee. The sculpture evokes awe and serves as a wonderful educational opportunity for park visitors.

The science-based attention that the Xerces Society brings to invertebrates is incomparable and its efforts across the country make a difference.

—Catherine Stirling, Annapolis, Maryland; loyal Xerces member since 2010, whose favorite invertebrate is the wandering glider dragonfly (*Pantala flavescens*).

Connect with Shannon at engagement@xerces.org or visit xerces.org/donate/planned-giving.

Protecting Public Lands from Insecticides

Xerces has had another success in our years-long effort to protect public lands from unnecessary insecticide applications. In August, a federal judge in Oregon confirmed that the Animal and Plant Health Inspection Service has a legal duty to consider preventive measures—rather than a "spray first, ask questions later" approach—in its program allowing insecticide spraying to kill native grasshoppers and crickets on millions of acres in seventeen western states. The court's rulings also require APHIS to be more open with the public about where, when, and why it is spraying pesticides on public lands.

The court case began in May 2022, when, represented by Advocates for the West, the Xerces Society and the Center for Biological Diversity sued APHIS over the agency's failure to properly assess harm from the spraying, as required by the National Environmental Policy Act. Last year, the court ruled that APHIS violated the law by focusing solely on spraying pesticides for suppressing grasshoppers and Mormon crickets.

This second judgment finalizes the court's ruling and requires APHIS to complete a new environmental impact statement covering the seventeen-state program. Importantly, the court also confirmed that APHIS has a legal duty to use integrated pest management—an approach to managing pests that combines multiple strategies to minimize economic, health, and environmental risks—in controlling grasshopper populations. This should mean a reduction in harm to sensitive rangeland pollinators, particularly native bees, butterflies and moths, and all the species that rely upon them for food, including imperiled greater sage-grouse.

A recent court ruling will help protect bees, butterflies, and other wildlife from insecticide use across millions of acres of public lands. Photograph by Ann Boucher, BLM / PDM 1.0.

Working Behind the Scenes on Policy

Changing policy or legislation at the national, state, or local level is an ongoing task. Individual efforts can take months or years. The outcomes are not guaranteed and may take years to be felt, but the work is important and impactful. Here is a snapshot of some of our recent efforts.

Artificial light at night (ALAN) is a primary contributor to firefly declines worldwide. ALAN also confuses moths, disorients migrating birds, and interferes with our ability to view the night sky (both casually and scientifically). This year, endangered species conservation biologist Richard Joyce crafted testimony in support of "responsible lighting" bills in Maryland and Pennsylvania. The bill in Maryland passed and the bill in Pennsylvania remains active.

In Connecticut, Emily May and Mia Park from Xerces' pesticide reduction team helped a coalition secure another victory: the passage of a statewide ban on neonicotinoid use on turf grass.

In Massachusetts, Jacqueline Buenrostro, the urban policy lead for our pesticide reduction team, is supporting a bill that would require the state to implement an ecologically based mosquito management program with the intent of shifting from broad pesticide spraying to more sustainable methods such as source reduction and prioritizing nonchemical controls.

In Maine, Xerces supported a successful bill requiring the Pesticide Board to report on the impact and use of neonicotinoid-coated seeds within the state.

The Endangered Species Act has been one of our nation's most powerful tools for preventing extinction. There have been many attempts to weaken

The intrusion of artificial light is transforming our nighttime environment. Photograph by Matthew Shepherd.

Springwater dancer damselfly (*Argia plana*). Photograph by Bryan E. Reynolds.

Tax-Wise Giving

Every donation to the Xerces Society helps protect species and their habitat. As you plan your contributions this year-end, here are some smart, tax-wise gifts to consider:

- ♦ Donating gifts of appreciated securities or publicly traded stock may offer significant tax advantages over giving cash. Account transfer information can be found at xerces.org/donate/stock.
- ♦ If you are 70½ years or older, you can give directly from your individual retirement account (IRA). You may give up to $108,000 per person each year without incurring income tax on your withdrawal. These Qualified Charitable Distributions (QCDs) may also satisfy your required minimum distribution, depending on your age.
- ♦ Establishing a donor-advised fund (DAF) gives you flexibility and control over your philanthropy. You can recommend a gift to Xerces through a DAF now and in the future.

The Xerces Society does not provide tax or legal advice. Please consult with your professional advisor for guidance on your situation. Noncash gifts should be initiated in advance of the end of the calendar year to ensure that the gift falls into the tax year that you intend. You can notify us of your plans at membership@xerces.org. Thank you for your support!

the law, and the last nine months have been no exception. In April, Xerces was one of many organizations that submitted public comments in opposition to a proposed rule change that would undermine endangered species habitat protections by changing the definition of "harm" in the ESA. Xerces alerted our members to this issue and submitted a sign-on letter opposing the rule change with more than forty-three hundred signatures from Xerces donors and others.

Pesticide contamination of plants eaten by caterpillars threatens butterfly populations. Photograph by the Xerces Society / Emma Pelton.

Pesticides Contaminate Butterfly Host Plants

Scientists from the Xerces Society and the University of Nevada, Reno, undertook a study to assess the safety of butterfly host plants for caterpillars. Samples were collected in two cities, Albuquerque, New Mexico, and Sacramento, California. The study, published in September in *Environmental Toxicology and Chemistry*, found nearly ubiquitous pesticide contamination of butterfly host plants across the two cities.

Pesticide residues were detected in 314 of the 336 individual plants tested, with an average of three pesticides per plant and a maximum of eighteen. In Sacramento, the fungicide azoxystrobin was found in 84 percent of samples, and the insecticide methoxyfenozide was present in 78 percent of samples. In Albuquerque, the herbicide atrazine was found in 70 percent of samples.

Notably, two pesticides, the insecticide chlorantraniliprole and the fungicide azoxystrobin, were found in seventy-one samples at concentrations that exceeded levels known to kill or cause other negative impacts to butterflies.

Study co-author Aaron Anderson ot the Xerces Society said, "We know that in addition to killing butterflies or their caterpillars outright, pesticide exposure can cause subtle changes that could severely harm them. For example, one of the fungicides we detected causes decreased wing size in monarch butterflies, which could hurt their ability to migrate long distances."

The finding that so many host plants are potentially harmful to caterpillars is particularly alarming in the context of the recent news about long-term butterfly declines, and underscores the importance for wildlife and our environment of protecting habitat or natural areas from pesticides.

Anderson emphasized that the specific impacts that most of the detected pesticides have on butterflies have not been studied, so these findings likely underestimate the true, cumulative risk that contaminated plants pose to butterflies in these cities.

Short Bites

Defending Bee Research: Word reached us in May that federal funding for the Bee Lab at the U.S. Geological Survey was under threat. The Bee Lab is a vital source of data on native bees, and the work done by its scientists and collaborators informs research, conservation, and policy development in many states.

Xerces delivered a letter protesting the proposed defunding to relevant committees in the U.S. House and Senate, as well as the Secretary of the Department of the Interior. The letter was signed by hundreds of researchers, land managers, and conservationists from universities, agencies, nonprofits, and businesses, highlighting the value of the Bee Lab to diverse practitioners.

New Publication: Traditionally, grazing lands are managed for grass production, with other plants seen as weeds to be controlled. Xerces staff have been working with partners in the Great Plains to change attitudes. By measuring the nutritional quality of native flowers, including the crude protein content, minerals important for livestock health, and percentage of digestible nutrients through the growing season, this work has shown that far from being undesirable, wildflowers enhance the quality of grazing.

The report, *Rangeland Wildflowers: Their Value to Livestock and Pollinators*, can be downloaded from the Publications Library on our website, xerces.org.

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Visit us at xerces.org or contact us at 855-232-6639.

The larva of the white-bowed smoothwing (*Scaeva affinis)* is completely unlike the adult in form and diet. A larva will eat hundreds of aphids before transforming into a nectar-drinking adult flower fly. Photograph by Sara Morris.

A $45 per year Xerces Society membership includes a subscription to *Wings*.

On the cover: Known as one of the fastest runners on the planet (relative to body length), tiger beetles are highly active predators found in natural areas and farms. Splendid tiger beetle (*Cicindela splendida*), photographed by Bryan E. Reynolds.

XERCES SOCIETY
for Invertebrate Conservation