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Building partnerships to restore pollinator habitat

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Farms in North America have become an unfriendly place for pollinators in the past century. A mere handful of crops (namely, corn, soybeans, wheat, and cotton) have replaced the diverse native wildflower habitat that bees depend on for food and shelter. To make matters worse, these crops are typically managed with intensive chemical inputs that can cause direct harm to bees and other beneficial insects. Not surprisingly, our pollinator populations are taking a toll. One-fourth of North American bumble bees are at risk of extinction; (Hatfield et al., 2015) honey bee overwintering losses continue to be well above acceptable levels; and the monarch – one of our most abundant, well-studied, and beloved insects – has experienced greater than 80% decline in population over the last two decades. (Jepson et al., 2015) The plight of pollinators is not unique to North America. Agricultural intensification and pesticides are threatening pollinators worldwide; 40% of bees and butterfly species are facing extinction. (Potts et al., 2014–2018). While there are many strategies to address pollinator decline, *planting wildflower habitat on farms* and *protecting this habitat from pesticides* are among the most important actions we can take to rebuild pollinator communities and safeguard the ecosystem services they provide on farms.

The Xerces Society Pollinator Program brings together farmers, native seed growers, government agencies, and other organizations to create and protect pollinator habitat. Primarily focusing on farms, we work in a variety of cropping systems across the nation, with a common theme of using native habitat to support the pollination and natural-pest control needs of a given farm. This strategy, thanks in part to Xerces-sponsored research, is firmly supported by an extensive and growing body of data from university partners showing that, where sufficient habitat exists, many types of farmers can get all of their crop pollination needs met by wild native bees. In addition, because predatory insects feed on flower pollen and nectar, farmers are seeing more predatory insects and reduced pest populations in their crops when flowering habitat is planted on their farms. These, and other benefits to wildlife and soil health, are driving increased interest in planting habitat for beneficial insects among agricultural communities, worldwide. Recent Xerces projects include 54 miles of hedgerows and wildflower strips in California almonds, dozens of monarch habitat installations in the Midwest Corn Belt, and insectary strips incorporated into vegetable farms across the country.

The success and resiliency of these projects hinges on the close partnerships we form with farmers. It is striking how often plans for restoring habitat begin with conversations around kitchen tables or riding around a farm in a pickup truck. Doug and Anna Crabtree farm a few thousand acres of organic heirloom grains, legumes, and oilseed crops near Havre, Montana, and our partnership with them exemplifies this type of relationship. Having first met at a farm conference in Washington, we have now collaborated to establish nearly 100 acres of wildflower strips on their land. In the process of sharing meals and conversations and hanging out together at other farm conferences, a strong friendship has developed that makes trips out to their farm hugely enjoyable as well as more productive. The Crabtrees have generously shared their land, labor, time, and expertise in seeding equipment and seedbed preparation. Xerces conservationists, in turn, have provided information about the pollinators and beneficial insects that are best suited to support their crops, along with step-by-step strategies to increase the abundance of these insects. Together we work to develop an expanding vision for their land that fosters deep biodiversity and helps to build a new model for profitable farming, one that takes advantage of the services provided by natural ecosystems.

Our process for creating a pollinator conservation plan usually starts by walking the land with the farmer to understand the cropping systems, pollination needs, and surrounding landscape. This planning helps us prioritize the most essential habitat features for pollinators, and also minimizes the chance that pollinators are exposed to insecticides, either from drift or residual insecticides in the soils. Next, we craft a common vision for enhancing pollinator habitat, typically focusing our efforts on field edges or other areas of the farm with low productivity. Luckily, the majority of native plants do very well in soils with poor growing conditions for crops, such as dry, nutrient poor soils, or areas that experience regular flooding. Once our restoration sites are selected, we design appropriate plantings for those areas – often in the form of native shrub hedgerows, native wildflower meadows, or annual "bee pastures."

Weed control prior to planting is one of the most important factors governing the success of the planting over the long term. While herbicides are a common tool for controlling weeds, there are a number of alternatives that we have found to be highly successful and enables us to avoid the environmental and human health risk of chemical inputs. These methods include solarization (killing weeds and weed seed by covering the area with greenhouse plastic for a season), smother cropping (using successive cover crop plantings to outcompete weeds), and repeated cultivation to flush weeds out of the system. Although attentive weed management is required in the early years of site preparation and plant establishment, plantings become resistant to weed invasion with time, and only occasional management is needed over the long term. For example, overseeding additional wildflower species may be useful if the planting has become grass dominated, or selective grazing by livestock may be used to enhance wildflower abundance.

Design of the flowering seed mixture is critical to the success of any pollinator habitat. We strive for a diversity of native flowering plants that bloom in succession throughout the season, with a minimum

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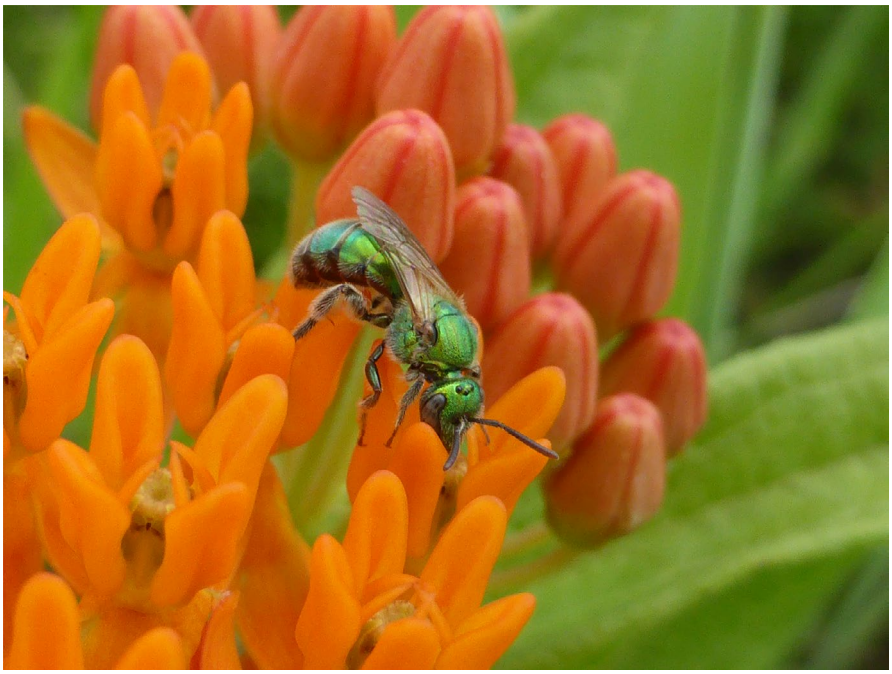
Doug and Anna Crabtree have integrated native wildflower strips like this for pollinators and other beneficial insects throughout the 1200 acres of their Montana Farm. Photo credit: Jennifer Hopwood.

Restoring flower-rich habitat to farmlands is vital for building resilient pollinator populations and increasing pollination of crops. Photo credit: Eric Lee-Mäder.



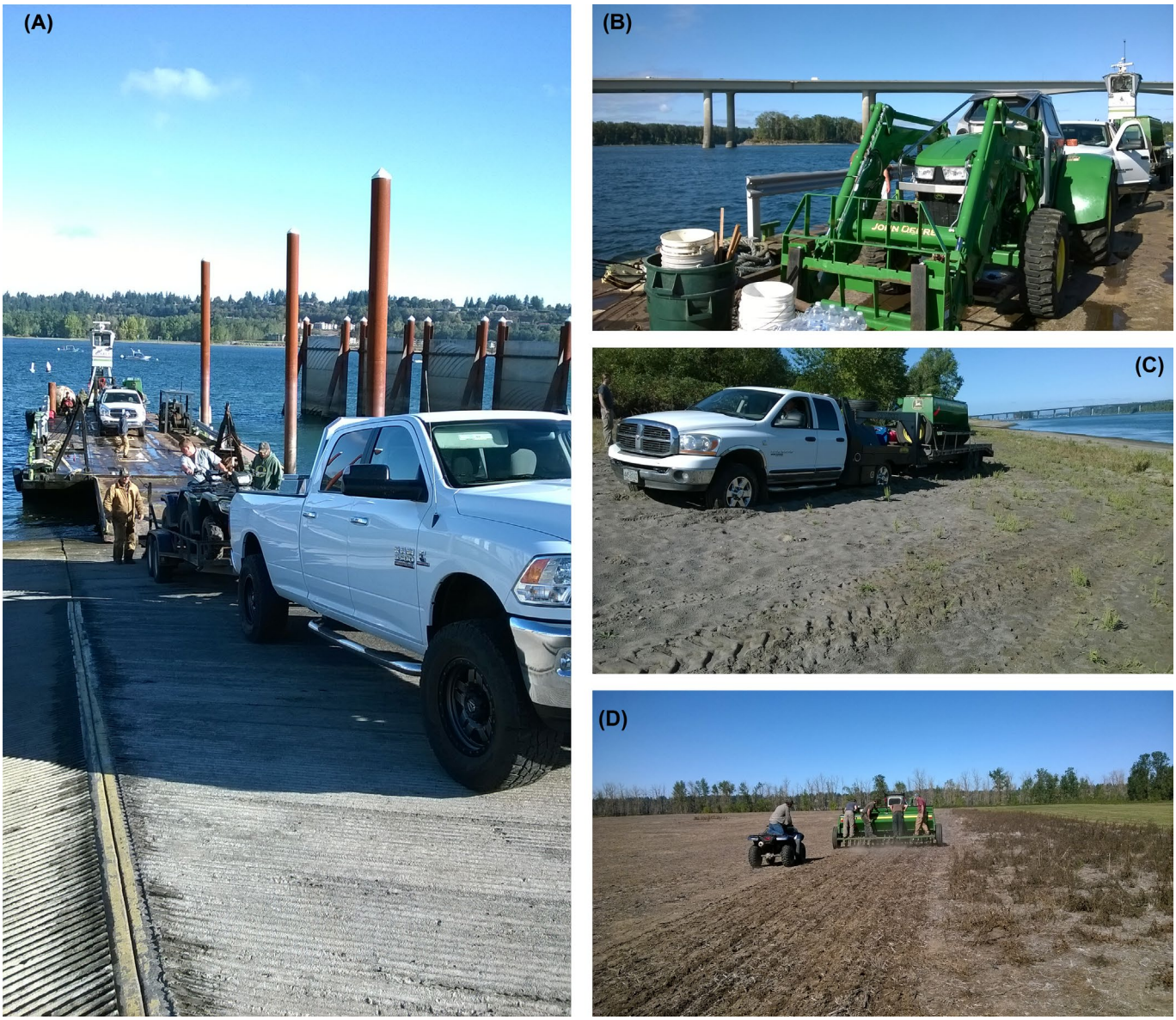
Sweat Bee (Augoclora pura) feeding on milkweed (Asclepias tuberosa) in Minnesota. Photo credit: Sarah Foltz Jordan.

Native thistles are relished by bees and other pollinators. A leaf cutter bee (*Megachile* sp.) feeding on swamp thistle (*Cirsium muticum*). Photo credit: Sarah Foltz Jordan.

of three species in bloom at any given time. Ensuring there are little to no gaps in phenology provides a steady supply of food for a myriad of pollinators, especially during the most critical, energy intensive stages in their life cycle (i.e., nesting, brooding). Because we need to pack a lot of pollinator conservation into relatively small areas on the farm, we plant concentrated wildflower-dense mixes, with an emphasis on plants that provide high quality forage for pollinators, such as milkweed, bee balm, aster, and goldenrod. In addition, we include plants that provide shelter and nesting resources for insects, such as bunch grasses for bumble bee nesting habitat and large-statured prairie plants for cavity nesting bees. We select seed from plant populations originating in the same region or ecosystem to increase the chances that the populations will be adapted to the soil and climate conditions of the site, and will not contaminate the genetic pools of local remnant plant populations. At the end of the process, we have a diverse, continuously flowering assemblage of high-value pollinator plants that are native and adapted to our site.

The resiliency of native plant communities lies in their diversity. A diverse plant community occupies the available ecological niches much more efficiently than a simple assemblage, leaving little opportunity for invaders to get a foothold. It would be ideal to have access to the full suite of native plants to design the most diverse habitats. In reality, only a small subset of native species is available commercially for use in habitat installations. To address this limitation, Xerces is working with a network of native seed farmers across the country to bring high-quality plants for pollinators into production. These efforts have been successful; our Project Milkweed, for example, has recently developed large-scale commercial sources of milkweed seed for monarch butterflies and other pollinators in California, Texas, and several other states where availability of milkweed seed was previously very limited. We are now turning our attention to native thistles, *Cirsium* species. Native thistles are another group of plants that are rarely available for conservation plantings yet very important to pollinators. Native tall thistle (*Cirsium altissimum*), for example, was the single most visited flower by monarch butterflies in an 18-year monitoring study in eastern Nebraska.

Since its inception more than a decade ago, the Xerces Society's Pollinator Program has undertaken a broad array



Planting a 50-acre wildflower meadow for pollinators on an island in the Columbia River. Photo credit: Jim Eckberg. (A) Loading all vehicles and equipment onto the barge in reverse so we would be able to drive forward onto the island beach. (B) Trucks, tractor, seed, and seed drill were all shipped across the Columbia River. (C) After landing on the island, it took several attempts and lots of head scratching to haul the heavy equipment across the beach without becoming stuck in the sand. (D) Two years of planning and preparation led up to the planting. Just enough moisture in the soil provided a firm but penetrable seed bed for the drill, ideal for planting.

of projects that have placed pollinators squarely in the realm of mainstream conservation. Working with growers across the country, our projects employ the principles of adaptive management by field-testing new methods and incorporating lessons learned into ongoing management and future projects. In addition to direct partnership with the farmers, we frequently work with state and federal agencies, including the USDA Natural Resources Conservation Service (NRCS). Through programs that provide financial incentives for conservation actions, the NRCS helps farmers to offset the costs of buying seed and preparing areas for pollinator habitat. Xerces' partnership with the NRCS and other agencies has led to the establishment of more than 120,000 acres of new pollinator habitat on hundreds of farms across the United States. And we're just getting started: growing interest from farmers, citizens, corporations, and the federal government is fueling a renaissance in modern agriculture. Farmers are embracing the importance of restoring natural ecosystem functions on their land. At the same time, consumers are more concerned than ever about the impact of their food choices on the environment. Xerces builds bridges between consumers and farmers. By partnering with some of the most progressive food companies in the country, we create pollinator habitat on the farms where they source their major ingredients. Marketing and promotion of these "pollinator-friendly" products empowers consumers to support conservation of pollinators with the choices they make in the grocery store.

Our work extends beyond farms. In one case, on an island in the Columbia River between Oregon and Washington state Xerces and our partners (Port of Portland, Pacific Northwest Natives, and Tenbusch Farms) planted 50 acres of polllinator habitat. Years of controlling invasive non-native blackberry and thistle preceded the planting to ensure the emerging seedlings would not be overtaken. We loaded up a barge with a tractor, truck, drill seeder, and hundreds of pounds of seed. After floating out to the island, we seeded the 50 acres in less than two days despite sinking our heavy equipment into the beach sand and bending the seed drill

disks on numerous rocky areas. Seedlings have been vigorously emerging with the onset of winter rains, and this island will be seeing more blooms this spring than in living memory.

Of course, the steps outlined here are somewhat simplified and idealized. In the real world, every phase of the restoration process is under constant assault from more issues than can be anticipated: the flash flood that washes away all of the seed from the restoration site; or the unprecedented week of 80 degree Fahrenheit February weather in Wisconsin that causes wildflower seed to germinate prematurely only to be killed by a late frost. Each of these events has actually happened to one of our projects, and in such moments, we are reminded that humor and resiliency are just as critical as the science of ecology.

Ultimately, you plant more seed, pull a few more weeds, and carry on. The resulting landscapes are never perfect, but the impact on bee communities is nearly always self-evident. Within a year or two of establishment, pick any warm, sunny day, walk these new meadows or hedgerows with an ear toward the ground, and you hear the gentle, constant, unmistakable hum of success.

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