**Food Chain Restoration: Reconnecting Pollinators with Their Plants in a Binational Watershed**

*Gary Paul Nabhan*

At dawn on this year’s on spring equinox, a group of people gathered in Patagonia, Arizona, to declare the Sonoita Creek–Upper Santa Cruz River watershed the Pollinator Capital of the United States. An interpretative sign, erected in a pollinator garden on the village green, noted that hundreds of native bees, dozens of butterflies and moths, fourteen species of hummingbirds, and two species of nectar-feeding bats regularly frequent the flowers of native plants in this semi-arid landscape. But the Patagonia community has not merely been interested in how much pollinator diversity has been recorded throughout their binational watershed in the past. Its citizens, nonprofits and for-profits have joined forces to catalyze the Borderland Habitat Restoration Initiative (BHRI) that hopes to ensure a safer place for pollinators, their nectar sources, and larval host plants in the future as well.

 The rallying cry for BHRI is a deceptively simple-sounding phrase: *food chain restoration,*a synonym of the phrase *food web restoration which ecologist Andy Dobson has been employiong for nearly a decade.* When local resident and world-renown ecologist Ron Pulliam began to employ this term to describe our work, he wished to imply that ecological food webs needed to be restored from the bottom-up, by reinitiating hydrological flows that would stimulate plants at the base of the food chain to flower and fruit. His working hypothesis is that certain habitats have a better chance of being fully restored by building food chains that support pollinators, frugivores, and herbivores as well as predators than by simply reintroducing “apex predators” such as jaguars or wolves that supposedly control ecosystems from the top down. But the term *food chain restoration* resonates for me at another level as well. If we bring wild pollinators back into the wild edges of working landscapes such as farms, ranches, and orchards, it is likely that they will provide yield stability to cultivated crops such as vegetables, legumes, fruits, and nuts upon which our society’s food security depends.

 Ecologist Ron Pulliam is out to test his “bottom up” restoration hypothesis in a series of carefully designed ecological restoration experiments situated along the floodplains of Sonoita Creek and its tributary, Harshaw Creek. The phenology of out plantings of pollinator-attracting shrubs is being monitored for the second year in a row, along with estimates of the intensity of floral visitation by pollinators. One goal is to determine how much influence these native shrub out plantings have on the “background pollinator fauna” of the surrounding area.

 At the same time, Caleb Weaver and I are adapting Ron’s monitoring protocols to determine the effects of hedgerows of pollinator-attracting native plants on pollinator abundance around fields, orchards, vineyards, and gardens in three Arizona counties along the U.S.-Mexican border. Through a USDA Western SARE grant, we have helped farmers and orchard-keepers plant twelve new hedgerows in Southern Arizona, and many of these on-farm habitats have now been certified as “bee-friendly” food-producing landscapes by the Partners for Sustainable Pollination.

 It should come as no surprise to Xerces Society members that much of this work has been guided by staff members Mace Vaughn and Eric Mader. Mace’s lectures and workshops in the Southwest over the last two years have attracted dozens of participants to this cause, and over 120 volunteers have helped us plant pollinator-attracting hedgerows in the region. While it is still too early to gauge the extent to which these new plantings are affecting fruit and seed set for food crops, the survival rates and flowering activities of the native plants we’ve selected has been quite high.

 Of course, these efforts are not merely about getting good numbers; they are about reinvigorating curiosity and wonder about pollinators among the Southwest region’s residents and eco-tourists, both young and old. This summer, an Earth Care Youth Corps of six teenagers is helping to collect milkweed pods, build nurseries and sow seeds of the twenty species of *Asclepias* which occur in Santa Cruz County, Arizona. The students will also be learning about milkweeds’ importance to monarch (*Danaus plexippus*), queen (*D. gilippus*), and soldier (*D. erisimus*) butterflies that frequent their homelands, and about threats to monarchs as well. We hope that they will take back to their high schools a commitment to monitor and tag monarchs on their migration through the region, and pride in the fact that they live in one of the most milkweed-diverse counties in the entire country.

 The three butterfly species in the genus *Danaus* are but a small part of the extraordinarily rich fauna of Santa Cruz County, which, over the years, has attracted exploration and documentation by the likes of Richard Bailowitz, James Brock, Kilian Roever, and Ken Davenport.At least 135 of the 240 species of butterflies known from southeastern Arizona occur along Sonoita Creek and its tributaries, and some reach into the United States only within this watershed. They include regionally rare species such as the Giant Swallowtails, the Sachem, West Coast Lady, and Mexican Fritillary, as well as accidentals such as the the Elf and the Soldier. By propagating, transplanting, and protecting the nectar and larval host plants for many of these species in our pollinator gardens and on-farm hedgerows, we have already witnessed an increase in the local abundance of butterflies such as the pipevine swallowtail, which remains active twelve months a year in this area. In fact, our attention to larval hosts plants as well as nectar and roosting sources for butterflies is making our planning of additional hedgerows and pollinator gardens more complex but much more rewarding. Already, we are develping a trail along the village green from a new “generalist” pollinator garden to an older butterfly garden, and planning a hawkmoth/sphinx moth garden, a bat garden and a hummingbird garden aklong a walkway that leads to the community’s vegetable garden. All will have interpretative signage that remind visitors of the pollinator diversity in this special place, and their ultimate importance to our food security.

 The bee fauna of Sonoita Creek has been considered by entomologists such as Stephen Buchmann, D.P. Hurd, and E.G. Lindsley to be just as exciting; more than six hundred species of bees are native to southern Arizona. The all-yellow Morrison’s bumble bee (*Bombus morrisoni*) and the large, striped Sonoran bumble bee (*B. pensylvanicus sonorus*; one of the target species for Xerces’ bumble project) frequent the watershed, as do four genera of sweat bees and two genera of squash and gourd bees. By constructing fences of dead flower stalks of century plants and desert spoons, we have increased the local abundance of carpenter bees. On the edges of the same orchards and fields, our plantings of buffalo gourds, coyote gourds, and devil’s claw have attracted smaller bees that are far more allegiant to certain crops and their wild relatives than are their naturalized competitors, the Africanized honeybee.

 The habitat restorationists and agro-ecologists involved in our projects have been rewarded to learn that sociological surveys of Southern Arizonans indicate a great deal of interest in sustaining populations of pollinators of all kinds. Many businessmen in southern Arizona recognize that the presence of so many kinds of hummingbirds and butterflies is vital to the ecotourism activities that provide significant revenues to rural communities. But they are just as aware that if native bees suffer further declines, the farming and ranching economies of the region might be adversely affected.

 These perceptions have bolstered our hope that food chain restoration can be seen as an activity that can generate a true “restoration economy” for the now-impoverished borderlands region, one where new jobs on farms, in native plant nurseries and at nature tourism destinations would be most welcome. Our vision is that the return of once-forgotten pollinators will not only curb the on-going extinction of ecological relationships which plagues the continent today, but that it will also return economic health and well-being to the rural communities along the border which choose to be good stewards of such relationships.

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