# Nevada Bugs and Butterflies: Celebrating the invertebrate diversity of the Great Basin and Sierra Nevada

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## ABSTRACT

Nevada Bugs and Butterflies is a science education non-profit that was created in 2012 by Cynthia Scholl and Kevin Burls in Reno, Nevada. The mission of Nevada Bugs is to provide hands-on experiences with science and living things to cultivate love of the natural world and local environmental responsibility. In this paper I discuss the creation of the organization and the programming done by Nevada Bugs, emphasizing aspects unique to our organization. Since 2012 the organization has been offering educational outreach events to schools and youth groups, and in 2013 reached over 760 children in the northern Nevada area, and collaborations have been expanded in 2014. In addition, in 2013 the organization fundraised, constructed, and opened a mesh-enclosed butterfly house north of Reno that exclusively houses butterfly and moth species native to Nevada. In 2013 we welcomed over 200 visitors to the butterfly house during the open summer season. In addition to the house itself, the organization also offers workshops with topics relating to Nevada plants and animals, such as a local herpetology session or constructing native bee houses. Finally, the butterfly house is located on a one-acre organic garden with over 200 plant species and an extremely diverse desert insect community. This creates opportunities for visitors to interact with their local flora and fauna in a welcoming environment. Future plans for an expanded butterfly house and increased involvement in citizen science projects are discussed.

## INTRODUCTION

Reno is a quickly growing city with many natural and recreational resources nearby. In addition, there are several local organizations that utilize animals or plants as educational tools for children and the general public, such as a local animal sanctuary and a garden-based education program. However, in 2012, no organization existed that was dedicated to highlighting the diversity and natural history of the flora and fauna found specifically in the Great Basin or the state of Nevada as a whole. Nevada Bugs and Butterflies, created in 2012 by Cynthia Scholl and Kevin Burls in Reno, Nevada, is a science education non-profit that provides hands-on experiences with science and living things to cultivate love of the natural world and local environmental responsibility. Specifically, we use native invertebrates as examples of the amazing biodiversity found in Nevada, and as teaching tools for local natural history, biology, ecology, and evolutionary biology.

Cynthia Scholl received her Bachelor's degree in Biology from the University of Nevada, Reno (UNR) in 2008, and earned her Master's degree in Biology from UNR in 2012. She

was advised by Dr. Matt Forister, and her research studied the interactions between the caterpillar of the Melissa blue butterfly *Lycaeides Melissa*, its various host plants, mutualistic ants that tend the caterpillars, and the parasitoid flies and wasps that attack the caterpillars. Kevin Burls earned his Bachelor's degree from Mount Union College in 2007, and earned his Ph.D. from the University of Nevada, Reno in 2014. His dissertation research, advised by Matt Forister and Guy Hoelzer, used the seed beetle *Callosobruchus maculatus* (Chrysomelidae) as a model system to study animal movement, particularly the trade-offs between long distance dispersal and life history traits. This foundation in entomology, ecology, and evolutionary biology serves as motivation to teach the northern Nevada public about the amazing invertebrate diversity in their own back yard and around the state.

Nevada Bugs and Butterflies uses two complementary approaches to educate the public- first, a butterfly house and garden that focuses on native Nevada butterfly and insect species; and second, educational outreach events for schools, youth groups, and public events. Below I outline the structure and programming and the butterfly house, highlighting aspects unique to our site, as well as our outreach events. I also discuss future plans for the organization.

**Butterfly house**

Funding for the butterfly house was raised in spring 2013 entirely from private individual donations. We created an online fundraiser using the Indiegogo platform, where we raised $9,655; and a physical fundraiser, where we raised $2722. These funds were used to purchase materials for the butterfly house as well as an associated shade structure and sandbox, a metal sculpture sign, insect collecting and rearing supplies, children's toys, educational materials, and administrative costs. The butterfly house was constructed in the spring of 2013 entirely by volunteers, except for the construction of the metal sign, shade structure and sandbox. The butterfly house is free to the public; operational costs are covered entirely through individual donations and income from outreach events. The butterfly house opened to the public 25 July 2013, and closed for 2013 at the end of September, receiving 204 visitors during this time. For 2014 we opened on 19 June, and as of 19 July have received 295 visitors, with our open season lasting until the end of September.

The butterfly house is located in Lemmon Valley, approximately 20 minutes north of downtown Reno, on the property of Neil Bertrando. Neil is a hydrologist and owner of RT Permaculture, a landscape design and consulting business. Permaculture is a landscape design methodology that applies ecological principles to create sustainable agricultural ecosystems. Because the property is designed in a permaculture style, the

butterfly house serves as one element of an integrated system, and combined functions are a theme throughout our site.

The butterfly house design is a semicircular 'hoophouse' greenhouse style, measuring 12' wide x 28' long and covered in black 50% shade cloth to mitigate the intense summer sun. Inside, the house is planted with a combination of climate-appropriate annual and perennial nectar plants including hardy ice plant (*Delosperma cooperi*), stonecrop (*Sedum spp.*), red hot poker (*Kniphofia sp.*), catmint (*Nepeta sp.*), buckwheat (*Erioganum spp.*), and scorpionweed (*Phacelia spp.*); as well as several types of crop plants including chard, tomatoes, perennial ground cherries (*Physalis sp.*), peppers, basil, carrots, and hyssop (*Agastache spp.*), the latter three of which are also nectar plants. Most species of the plants inside the house are labeled. We use this combination of plants to talk about plant growth, insect herbivores and pollinators, and the connection between insects and food production. Nectar plants are placed close to path edges to attract butterflies towards the visitors. Perhaps the most unique feature of the house is that it is mobile; the house uses wheels and a track to move over two alternate, adjacent 'footprints.' This design, created by Eliott Coleman and Johnny's Selected Seeds, is a season extension technique; the house covers crops in winter on one side, the spring and summer crops on the other side. Because of this, the butterfly house has two mirror images, and is on alternate sides in alternate seasons. This means that during the off-years, the alternate footprint serves as an outdoor pollinator garden, attracting a diverse array of insects as visitors enter the house.

We stock the butterfly house with butterfly species that are native to Nevada (Table 1). We have found that papillonid butterflies do not exhibit normal behavior in the house, failing to nectar likely because of the limited length and height of the house. Butterflies are acquired through a combination of wild collection and collection of eggs from females, both from females inside the house as well as from wild-caught females.

Table 1. Species of butterflies used successfully in the butterfly house. Askerisks indicate species that have been reared from eggs; others are wild-collected.

| Pieridae | Lycaenidae | Nymphalidae | |
|---|---|---|---|
| *Colias philodice* | *Brephidium exile* | *Aglais milberti* | *Phyciodes mylitta* |
| *Colias eurytheme** | *Glaucopsyche lygdamus* | *Chlosyne palla* | *Polygonia gracilis* |
| *Pontia beckerii** | *Lycaeides melissa** | *Cercyonis pegala* | *Polygonia satyrus* |
| *Pontia protodice* | *Lycaena editha* | *Cercyonis sthenele* | *Speyeria cybele* |
| Hesperiidae | *Lyceana arota* | *Coenonympha tullia* | *Speyeria zerene* |
| *Erynnis sp.* | *Mitoura gryneus* | *Danaus plexippus** | *Vanessa annabella** |
| *Hesperia juba* | *Strymon californica* | *Euphydryas chalcedona* | *Vanessa atalanta** |
| *Pyrgus communis** | *Strymon melinus* | *Junonia coenia** | *Vanessa cardui* |
| | *Plebjus icarioides* | *Limenitis lorquini* | |

Because of this, the presence of some species in the house varies according to their seasonality. Typically there are between 6 and 12 species present in the house at any given time, creating opportunities to talk about local butterfly diversity, seasonal cycles and life cycles, and insect overwintering.

In addition to the butterfly house itself, we offer several other activities for visitors of all ages. We bring in a selection of our native insects that are appropriate to hold and observe, such as millipedes, death-feigning beetles, and caterpillars. Our shade structure also contains a bench that doubles as a vermiculture bin, which is an excellent opportunity to explain the role of invertebrates (both native and non-native) in the decomposition process and what that means for the food we eat and throw away. We also offer occasional free workshops about local natural history, such as one about local reptiles featuring live lizards, snakes, and frogs. For younger visitors, we have a collection of insect-related costumes and toys such as insect wings and masks, oversized rubber insects, and wooden puzzles. There are also kid-size butterfly nets to collect flying insects on the site (outside the house), as well as plastic collecting jars and magnifying lenses. We have also designed a scavenger hunt for plant and animal related features on the property. These materials encourage children to imagine themselves from an insect's perspective and also to wander the property (described below) to observe investigate the diverse plant and animal life around the property. In the spring of 2014 we also installed 10 permanent wooden interpretive signs that contain information regarding the site design and native insects found on site; the material can be changed over the season. These signs are placed around the north end of our property and facilitate a self-guided tour for visitors. Finally, in the spring of 2014 we converted our sandbox to habitat for two Mojave desert tortoises (*Gopherus agassizii*) that were adopted from the Dick Tracy lab at UNR, which now stay on the site during the open season. These animals offer a chance for visitors to observe and touch the Nevada state reptile, and for discussion about conservation concerns and scientific studies regarding this species.

The property surrounding the butterfly house consists of a 1-acre permaculture site containing over 200 plant species. The plant community is composed of groundcover, herbaceous plants, vines, woody shrubs, and small and large trees. These plants serve a variety of functions beyond food production, including biomass accumulation and nutrient cycling, nitrogen fixation, pollinator attraction, animal habitat, and poultry food. Many of the plants surrounding the butterfly house are labeled, and native species are highlighted. This design and diverse plant assemblage has resulted in a diverse animal community, including not only insects but also numerous reptile, bird, and mammal species. Particularly of interest to our organization are the many butterflies that visit or use host plants on the property (Table 2); and our native bumblebee and solitary bee

species, which are in decline in the western U.S. but are particularly numerous on the site due to the availability of undisturbed bare ground in the area. This diversity facilitates the kids' activities on the site mentioned above, particularly catching butterflies or other live insects and searching for scavenger hunt items like a predator-prey interaction. Most broadly, the site represents the connection between the urban and the natural in northern Nevada and the amazing biodiversity that exists in that area.

Table 2. Species of butterflies that are visitors (bold) or residents on the butterfly house property.

| | |
|---|---|
| *Brephidium exile* | *Pieris rapae* |
| *Cercyonis sthenele* | *Pontia beckerii* |
| ***Danaus plexippus*** | *Pontia protodice* |
| *Lycaeides melissa* | *Pyrgus communis* |
| ***Papillio multicaudata*** | *Strymon melinus* |
| ***Papillio rutulus*** | *Vanessa annabella* |
| *Hesperia juba* | *Vanessa cardui* |

**Outreach events**

In addition to having visitors at the butterfly house, we also reach the public through numerous outreach events each year. Our outreach events are typically free of charge and donation-based, to encourage events with low-income and early childhood educations teachers that may have little or no budget for visitors. Most of these events rely heavily on the use of live arthropods that we bring with us in small cages to the event. Events are approximately an hour and focus mainly on understanding the characteristics and life cycles of arthropods. We reserve a large proportion of time to describe each live specimen that we bring, and plenty of time for children to observe and hold insects that are non-aggressively defended. We typically have at least three or more volunteers, and we divide the 'kid-friendly' bugs into different stations to ensure individual attention. Live insects that are brought include a vinegaroon, scorpion, millipede, velvet ants, tenebrionid beetles, grasshoppers or crickets, caterpillars and butterflies, and the desert tortoises. In addition to the insects, we often add other components to these various stations, including various art activities; microscopes with butterfly eggs, caterpillars, and wing scales; pinned collections of insects owned by Nevada Bugs or UNR; and pollinator seedling plantings in the spring. In 2013 Nevada Bugs had over 1,000 contacts at outreach events, and as of July 20$^{th}$, 2014 has 1,792 contacts. Examples of locations include Washoe County elementary schools, Montessori and charter schools, low-income area recreation centers, 4-H entomology clubs, and the Reno Earth Day.

In addition to these core outreach events, we have paid contracts with some public Reno institutions. The Terry Lee Wells Discovery Museum is located in downtown Reno and is a hands-on museum that is visited by more than 155,000 people in 2013. Nevada Bugs regularly performs paid programming for the museum and was a collaborator for this year's National Pollinator Week (see below). We also have paid programming for the Washoe County Library System, bringing our materials to libraries around the county. Funds from this programming go directly towards future programs and operational costs.

**Collaborations**

We are also collaborating with local organizations for national events that are insect-related and also have broader impacts across the community. This year, we led a collaborative effort to celebrate National Pollinator Week (June 16-23, 2014). Events included: a program at the Discovery Museum featuring native pollinators, a live bumblebee colony, and pollinator plant seedlings, in combination with their Farm Week programming; a program at the Great Basin Community Food Co-Op featuring a honey tasting with local beekeepers, films about pollination, and a group discussion with beekeepers and bee researchers (led by Dr. Anne Leonard) at UNR; and a workshop at the butterfly house planting pollinator seedlings and making native bee houses. These events reached over 200 residents and were the first official events for National Pollinator Week in the state of Nevada.

## FUTURE PLANS

In the coming year, one goal of our organization is to integrate our site into national citizen science projects using the help of visitors at the butterfly house. There is currently narrow-leaf milkweed (*Ascplepias fascicularis*) on the property, which can be monitored for the Monarch Larva Montioring Project, organized by the University of Minnesota; as well as adult monarchs that can be tagged for the Southwest Monarch Study. There are also species of ladybugs (Coccinelidae), which can be identified for the Lost Ladybug Project, organized by Cornell University and researchers at the South Dakota USDA. Species of bumblebees can be photographed and identified for use in the Bumblebee Watch Project, organized by the Xerces Society. Other programs of interest for our property include National Moth Week and the Journey North project. These projects connect citizens to their natural resources in a personal, interactive manner that is also beneficial to scientists and gives the visitor a sense of ownership of the butterfly house and their surrounding natural areas.

A second major goal of our organization is to create an intern position for the butterfly house that is focused on a creating an insect inventory on our site. We hope to partner with Dr. Matt Forister at UNR and create a position for a mid-level undergraduate student that is interested in entomology and science education, who would also earn college credit for completing an independent study project. A species list of our site is a necessary prerequisite for any biodiversity-related research and will serve as a valuable natural history record of the current insect diversity in the Reno area. This position will also strengthen our connection with UNR and maintain the presence of young scientists as the main volunteers of our organization.