

Report No. UT-23.12

PILOT POLLINATOR HABITAT AT UDOT REST AREA IN PERRY, UTAH

Prepared For:

Utah Department of Transportation
Research & Innovation Division

**Final Report
June 2023**

DISCLAIMER

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16. Abstract This report outlines the process by which a portion of the I-15 Perry Rest Area in northern Utah was modified to include a functional pollinator habitat suitable for public education, outreach and enjoyment, as well as to provide much needed habitat for local pollinators, many of whom have experienced serious declines in their populations. Converting any landscape or portion of a landscape often presents abundant learning opportunities depending upon the existing landscape and the desired landscape. The learning opportunities offered by converting a portion of the Perry Rest Area to a functional pollinator habitat and the methods by which to address potential issues are discussed in this report. The time period of this report dates from August 2021, when the work began at the rest area, to the time of this report (June 2023). The site continues to change and mature, and the research team is planning to use a community group or two with limited oversight from Utah State University (USU) personnel or contractors for ongoing maintenance. A manual was also produced for UDOT that outlines detailed instructions on how to plan and construct pollinator habitats on UDOT properties.					
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LIST OF ACRONYMS

FHWA	Federal Highway Administration
NCHRP	National Cooperative Highway Research Program
UDOT	Utah Department of Transportation
USU	Utah State University
UDAF	Utah Department of Agriculture and Food
UDWR	Utah Division of Wildlife Resources

EXECUTIVE SUMMARY

The UDOT champion for this UTRAC project – Rhonda Thiele – inspired the idea of enhancing roadside properties into usable habitat to support declining populations of pollinators. This initiated a collaboration between conservation specialists and groups interested in improving pollinator habitat and increasing availability of native plant resources for future habitat enhancement across the state.

Funding contributions for the UDOT Pollinator Habitat Improvement Program were derived from a variety of sources, including (but not limited to): UDOT, Utah State University (USU), Utah Department of Agriculture and Food (UDAF), Paisley L.L.C, and RAE Environmental, Inc. The tireless contributions and support of students, staff, environmental stewards, and members of the general public have made these habitat improvement efforts possible. We extend gratitude to the many USU students who contributed and continue to take ownership of this project.

In-kind and financial support from USU faculty and staff have been vital to our efforts. The student involvement has also been valuable in providing unparalleled experience with hands-on field lessons in restoration ecology, pollinator ecology, and public outreach. Data collected from citizen scientists for the site through [iNaturalist](#) will continue to provide critical data to help guide future decisions related to the long-term maintenance and benefits of roadside habitats.

The pilot study area is about 0.5 acre on the south end of the I-15 Perry Rest Area in northern Utah and consists of a conversion of grass sod to a habitat for pollinators complete with a walking path and a diverse selection of native flowering species. Five educational signs were erected at the site describing the different habitats of the site, the role of pollinators and links to the website hosted at Utah State University for more resources. A manual was also produced for UDOT that outlines detailed instructions on how to plan and construct pollinator habitats on UDOT properties.

Conversations with and observations of visitors through the site both during construction and maintenance work have resulted in many positive interactions about the site and comments about learning about pollinators and the native plants that support them.

1.0 INTRODUCTION

1.1 Problem Statement

It is estimated that pollination is needed for 75 percent of the crop plants grown worldwide for food, fiber, beverages, condiments, spices, and medicines. Moreover, one out of every three to four mouthfuls of food we consume is delivered to us by insect pollinators. This includes many of the more nutritious food plants such as apples, cherries, pears, blueberries, tomatoes, and strawberries. According to a study published in 2012 (peer-reviewed journal PLoS ONE), crops pollinated by honeybees and other insects contributed \$29 billion to farm income in 2010 in the United States.

Recent research and data have shown a deep decline in pollinator populations. This has direct implications for the quality, health, and production of our agricultural landscapes and ecological food webs. Some of the most common reasons for the decline include agricultural monocrop expansion, loss of habitat due to urbanization, habitat fragmentation and pesticide misuse.

Nationwide, state Departments of Transportation (DOTs) recognize the benefit of enhancing roadside pollinator habitats to help sustain native pollinator populations and to act as “waystations” for migrating pollinators such as monarch butterflies. Currently, about 33 United States DOT organizations participate in pollinator programs at varying stages of implementation (see [Federal Highway Administration website](#)). The National Cooperative Highway Research Program (NCHRP) has recently shared new regional guides on roadside pollinator habitats in the US that can be found [on their website](#).

Many native and drought-tolerant plants used in these programs are long-lived and deep-rooted, so they do not need to be replanted each year. Pollinator habitats are not only aesthetically pleasing, but they benefit wildlife and potentially reduce roadside maintenance costs.

1.2 Objectives

UDOT has a unique opportunity to provide environmental and educational resources on lands they manage by incorporating pollinator habitat into the landscape. The establishment and

maintenance of pollinator habitat on UDOT-managed lands could provide much needed food and nesting habitat for pollinators in addition to providing recreational and educational value to visitors (with the use of viewing areas and interpretive signs). These habitats would also increase public awareness and involvement in pollinator health throughout Utah and support local, state, and federal pollinator conservation goals, such as those outlined in the Western Monarch Conservation Strategy. Finally, the generation of a manual outlined methods, site selection, design, establishment, maintenance, and monitoring to serve as a template for other UDOT properties (i.e., rest areas, welcome centers, park and rides, medians, rights-of-way) for other successful pollinator habitat installations.

1.3 Scope

The overall scope of this project was threefold:

1. Establish successful pollinator habitat at a UDOT rest area or welcome center for educational and environmental benefits,
2. Determine its success for potential implementation at other UDOT properties, and
3. Produce a UDOT manual to guide implementation of future pollinator habitats.

The research and implementation of this project was conducted through a coordinated effort between UDOT, USU, UDWR, and private consultants. The inclusion of these different entities ensured a wide spectrum of experience and knowledge from selecting appropriate plant species, awareness of pollinator life history needs, habitat design, installation capability, and science communication proficiency.

A first step of the project was to establish a ranking system for site selection based on visitor use, site conditions, and proximity to natural biological corridors. Once the site was selected, a detailed site analysis was conducted that will dictate plant species selection, habitat design, installation technique, and a maintenance plan.

A landscape design was then developed based on site characteristics, ease of maintenance, and applications for public interest. Plants used in the design were carefully selected based on soil type, bloom time, ease of growing, and climate, with an emphasis on native species. Plants and seeds were sourced from Utah-based nurseries when possible.

Site preparation included aspects of soil preparation to assure an adequate planting medium.

Temporary “safety fencing” was used to protect the area from damage (and visitors) during construction and for a period of time after planting. Low-lying, permanent fencing was installed in some areas to establish a visual boundary and prevent trampling. Simple footpaths were added to enhance the look and use of the area.

Perennial plants and some seeds were planted in the fall of 2021 when temperatures were cooler and plants were entering dormancy. Additional seeds were broadcast the following spring, and additional plants were installed in Fall 2022. Mulch was added to minimize weed competition. Weed removal is ongoing until the habitat is established and can outcompete unwanted species.

Educational signs were designed, created, and installed to add to the visitor experience. The signs are focused on the plight of the pollinators, the plants used in the habitat, as well as methods to report sightings of pollinators and contribute as a “community scientist” with the use of interactive QR codes.

A step-by-step manual was written that includes the ranking system for selection of future UDOT pollinator habitat sites, methods for site preparation, regional plant species selection and sources, garden design, and maintenance protocols. This comprehensive manual will assist UDOT in installing pollinator habitats on other UDOT-managed properties.

The completed pollinator habitat and associated written manual will serve as a successful demonstration project for UDOT that can then be applied to other UDOT properties. Not only would these areas provide much needed pollinator habitat but targeting of high interest areas would also provide recreational and educational value to numerous visitors. Plaques and QR codes provide the public with information to demonstrate how they could contribute to improve the health of pollinators, whether through plant selection for establishment of individual pollinator gardens, reporting of pollinator encounters through a community science project, or taking proactive steps to enhance their own landscapes for the betterment of pollinators and the environment.

2.0 RESEARCH METHODS

2.1 Overview

Research methods used for converting an area of grass sod to a diverse pollinator habitat at the Perry Rest Area generally employed observed outcomes of different landscaping actions on the area. This section outlines the various steps and methods used to choose the site, design the habitat, and construct and maintain the habitat.

2.2 Background/Methodology – Site Scoring Sheet

Since UDOT has many properties throughout the state, the team created a site scoring sheet to ensure the most suitable sites are chosen to construct pollinator habitats as the most likely to be successful. The first task was to delineate an area to be converted to a pollinator habitat. A scoring sheet for potential sites was put together to help determine which sites would offer the most to visitors and have the highest probability of success. Potential sites should be put through this scoring process that includes questions about physical characteristics that are better suited for a successful pollinator habitat. These questions and scoring are fully explained in the Pollinator Habitat Manual completed for this project.

2.3 Background/Methodology – Sod Conversion

There are various methods to convert grass sod to a different landscape. Soil is a precious resource, so we opted not to take the sod and associated soil off the site, but instead kill the sod with glyphosate, then cut the sod and turn it over. We rented a couple of sod cutters after two glyphosate applications. This was a very intensive effort.



Figure 2.02.0-1 Jenny Dowd with sod cutter after glyphosate application



Figure 2.0-2 Sections of overturned sod

2.4 Background/Methodology – Path Construction

For the general public, a pollinator habitat is best viewed and enjoyed from a wandering, but distinct walking path. Our team designed the path to go through the various habitats at the site. It was first outlined with marking paint to assure the location suited the site characteristics.



Figure 2.0-3 Walking path outlined with marking paint

We then placed metal landscape borders making the path 3-foot wide with a weed barrier on the bottom of the path.



Figure 2.0-4 Walking path with metal landscaping barriers

The path was then filled with aggregate from the Ogden City green waste facility. This material was leftover aggregate from UDOT chip sealing projects. We found this material was much too soft for an accessible walkway. The following spring we added CHAT material from Staker-Parsons – a 3/8”-minus material to harden the path. We also added powdered concrete to the path as we added the CHAT to firm the path.



Figure 2.0-5 Walking path with chip seal material

2.5 Background/Methodology – Plant Selection

Live Plants - The team planted a total of 361 plants and seeded 13 species in the project area in the fall of 2021. The map below shows the locations of these planted species. These species were selected as native and appropriate for the Perry area (See Table 2.0-1). In the fall of 2022, a successful application to the Utah Pollinator Habitat Program (<https://ag.utah.gov/pollinator-habitat-program/>) yielded 120 additional live plants to be planted at the site (See Table 2.0-2). The next growing season(s), the team has spent time at the site assuring the planted species have adequate space to grow with regard to some of the undesirable species that inevitably came up after the ground disturbance.

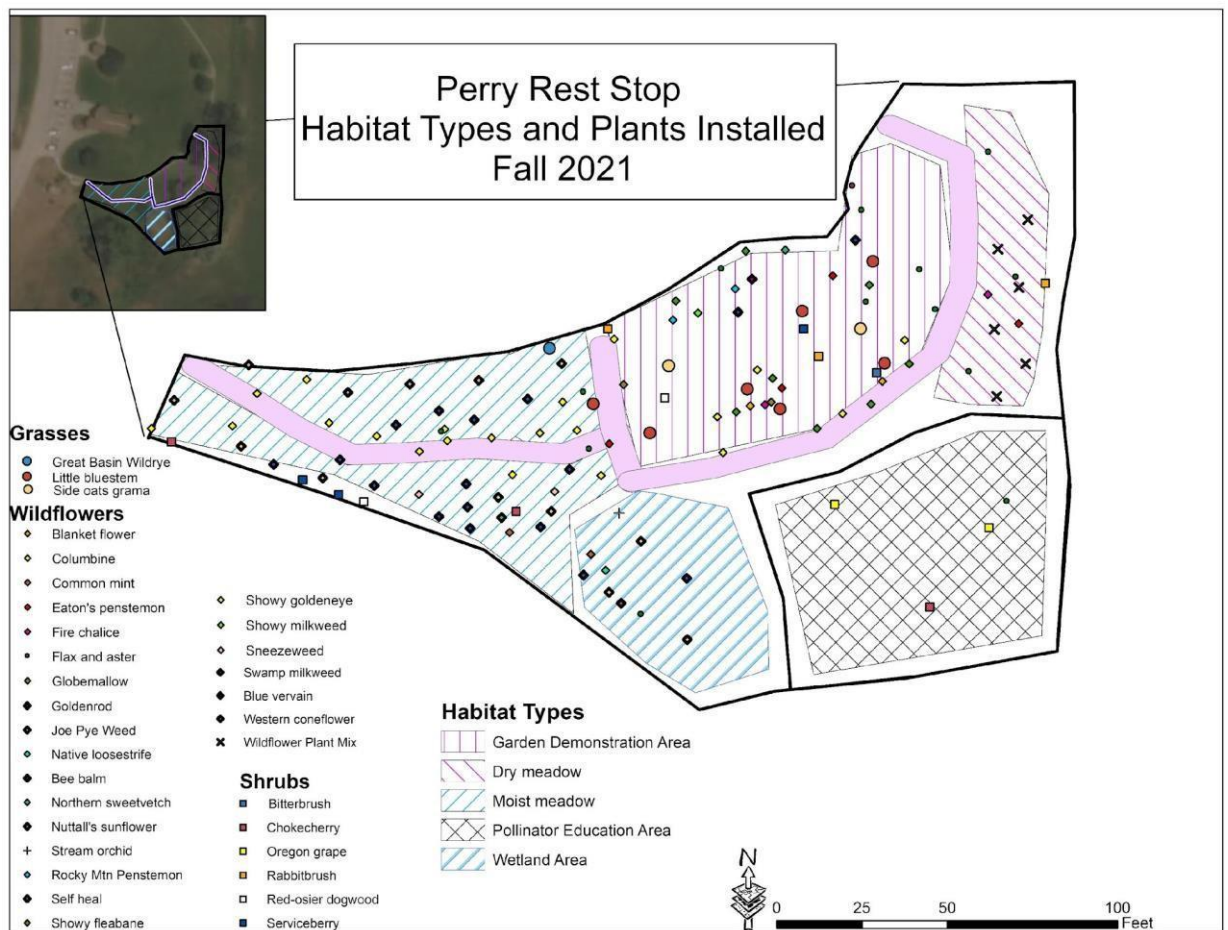


Figure 2.0-6 Planting Plan Fall 2021

Seeds

Also in the fall of 2021, seeds for some species were spread at the site. These species included Indian paintbrush (*Castilleja minor* var *exilis*), Nuttall's sunflower (*Helianthus nuttallii*), Rocky Mountain bee plant (*Cleome serrulata*), and annual sunflower (*Helianthus annuus*), Rocky Mountain penstemon (*Penstemon strictus*), Palmer penstemon (*Penstemon palmeri*), water ragwort (*Senecio hydrophilus*), sneezeweed (*Helenium autumnale*) and globemallow (*Sphaeralcea munroana*).



Figure 2.0-7 Overview of Perry Pollinator Site Summer 2022

Table 2.0-1 Species included in initial planting

Grasses	Wildflowers (cont)
Great Basin Wildrye	Sneezeweed
Little bluestem	Swamp milkweed
Side oats grama	Verbena hastata
Wildflowers	Western coneflower
Blanket flower	Shrubs
Columbine	Bitterbrush
Common mint	Chokecherry
Eaton's penstemon	Oregon grape
Fire chalice	Rabbitbrush
Globemallow	Red-osier dogwood
Goldenrod	Serviceberry
Joe Pye Weed	Seeds
Wild bergamot	Evening primrose
Northern sweetvetch	Prairie coneflower
Nuttall's sunflower	Globemallow
Rocky Mtn Penstemon	Palmer penstemon
Self heal	California poppy
Showy fleabane	Cleome serrulata
Showy goldeneye	Rocky Mtn penstemon
Showy milkweed	Palmer penstemon
	Blanket flower
	Nuttall's sunflower

Table 2.0-2 Species Planted in Fall 2022

Swamp milkweed
Joe Pye Weed
Tall evening primrose
Sneezeweed
Blue vervain
Nuttall's sunflower
Goldenrod
Water ragwort

2.6 Background/Methodology – Irrigation

Several options for irrigation at the Perry site were considered because of the irrigation schedule and pattern at the Perry Rest Area and the natural differences of moisture levels at the site. Since the seedlings were planted in the fall, the team decided to rely on the natural moisture and decreasing temperatures of the fall season to allow the plants to become established prior to the winter. Over the spring of 2022, sprinklers for the turf area just north of the sidewalk reached the planted area on a regular basis. This regular irrigation in 2022 for some of the planted area was not planned, but likely assisted some plants to become established within that sprinkler's reach. However, it likely assisted growth of some undesirable species as well (e.g., clover and turf grasses).

In 2023, the team continued with no regular supplemental irrigation. The differences in plant growth between 2022 and 2023 are noticeable, but it is likely most plants are established well enough to survive on natural moisture. Nonetheless, it may be beneficial for the Perry Rest Area as a whole to continue irrigating the entirety of the turf areas. Likely as a result of the pollinator habitat project, one sprinkler has been turned off completely, and a large portion of the turf is either dormant or dead. It is likely possible to both continue irrigating the turf, but not the pollinator habitat area, with a small adjustment on the range of the sprinkler.

2.7 Background/Methodology – Website

The website format (now hosted at USU) includes room for expansion for other potential sites. The website can be found at <https://qcnr.usu.edu/pollinator-habitat/>. Content and layout were designed, written and edited by the team, then passed to USU's PR team to build and host the website to be consistent with USU's web page organizational design.



About UDOT Pollinator Habitats

UDOT has recently funded a pollinator habitat enhancement program to establish pollinator habitat on existing properties owned and managed by UDOT. This program was launched in response to mounting evidence of declining pollinator populations nation-wide, as a conservation partnership to increase public awareness and provide safe-haven to pollinators in established sanctuary habitats throughout the state. An initial phase of habitat restoration was established as a pilot in northern Utah at the Perry Rest Stop (located in Perry, Utah along the I-15 corridor). Pending approval, UDOT will expand habitat restoration efforts to additional UDOT sites throughout Utah. A 'Site Selection and Maintenance Manual' is being developed to help guide restoration goals and best practices for habitat establishment on future properties.

Projects & Partners

 <p>UDOT - Perry Rest Stop</p> <p>The Perry Rest Stop was launched as a pilot site for UDOT to restore a portion of property as pollinator habitat in 2021. The site is still under construction with expected completion in 2023.</p> <p>More about UDOT and the Perry Pilot</p>	 <p>Pollinator Conservation in Utah</p> <p>Several agencies and organizations have partnered to contribute to address national pollinator declines.</p> <p>More on Pollinator Conservation in Utah</p>	 <p>Perry Citizen Science-iNaturalist</p> <p>Regional biologists have developed a site project through iNaturalist to record pollinator presence at the Perry Rest Stop before and after restoration efforts.</p> <p>More about iNaturalist</p>
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Figure 2.0-8 Screenshot of Home Page of UDOT Pollinator Habitat Website

2.8 Background/Methodology – Educational Signs

The design of the educational signs for the site are 2' x 3' and these are shown below. The signs were fabricated at Fusion Imaging in Kaysville, Utah. The QR codes on the signs will take visitors to the website (on the introductory sign) as well as to audio recordings at each of the other signs that discuss pollinator and ecological aspects of those areas.

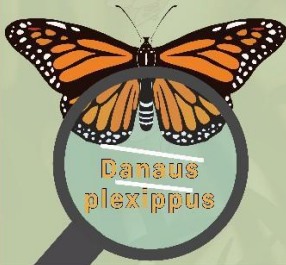

Introductory Sign:

Perry Pollinator Habitat

Utah is home to 900+ types of native bees, 250+ butterflies, and 1,300+ species of moths, and even more beetles, birds, flies, and wasps. That's a lot of pollinators! In this area, **UDOT** is growing pollinator-friendly native plants to provide habitat for native pollinators that benefit our Utah landscapes.

Many pollinators, including the **Monarch Butterfly** (*Danaus plexippus*) and **Western Bumble Bee** (*Bombus occidentalis*) are disappearing from the landscape. Scientists have shown that this is caused by the loss of suitable flowers, extreme weather and drought, pesticides, and fragmented and low quality habitat.

As you walk along the path spot how many different pollinators are active around the various flowers!

You Can Boost Pollinators In Your Yard!


- ✓ Grow native plants that provide reliable nectar.
- ✓ Choose a wide range of flowering plants.
- ✓ Limit your use of pesticides and herbicides.
- ✓ Provide areas with bare soil and good sun for ground-nesting bees.

Why Are Pollinators Important?

- Most crops grown worldwide for food, fiber, and medicine require pollination.
- Out of every 3 bites of food we eat, one is grown thanks to insect pollinators.
- In 2010, crops pollinated by insects added \$29 billion to farm incomes in the United States.

For More Information

Visit usu.edu/pollinator-habitat to learn more about efforts Utah and other states are taking to enhance habitat for pollinators at rest stops and in roadside areas.



Sign for Meadows:

Meadows

Grow Your Space for Native Pollinators!

Meadows are natural homes for wildlife and pollinators. Did you know your yard could become an urban meadow? Dedicate a space that creates a home for pollinators.

Natural meadows are composed of a variety of grasses and flowers that provide pollen, nectar, and nesting habitat throughout the year.

Low Maintenance Landscaping Makes EXCELLENT Pollinator Habitat!

Most lawns use one species of grass that requires frequent watering and mowing and offers little food for pollinators. Consider removing some of your lawn and planting a variety of water-wise flowers and tall grasses.


Strategic Mowing for Success!

Mowing isn't all bad for pollinators. Natural spaces evolved with grazing wildlife like deer and elk. Strategic mowing can mimic natural grazing by increasing blade height (6-12 inches), mowing only twice a year, and leaving islands of uncut vegetation.


These activities allow native plants and pollinators to thrive!



Leymus cinereus
(Basin Wild Rye)



Festuca idahoensis
(Blue Bunchgrass)



For More Information

Follow the QR code, or visit usu.edu/pollinator-habitat to contribute to future habitat restoration projects.

Sign for Wetland Area:


Wetlands

Wetlands are the lifeblood to Utah – the second driest state in the nation. Although wetlands make up less than 1% of our landscape, more than 80% of animals need wetlands for food and shelter. Millions of birds depend on the Great Salt Lake during seasonal migrations.

Wetlands are a natural sponge to store water during dry periods and reduce problems with flooding during wet periods. Wetlands also help maintain a delicate balance of nutrients in the ecosystem (like nitrogen and phosphorus) to support a wide variety of living creatures. Wetlands help to clean water for human consumption and for the survival of other species.


Migratory Flyways

Different Flyways of the USA



- Pacific Flyway
- Central Flyway
- Mississippi Flyway
- Atlantic Flyway

Great Salt Lake Migratory Birds



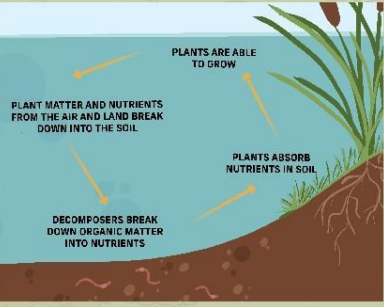
Migratory Shorebirds
Migratory Raptors


Conservation

Utah has lost more than **50%** of its wetlands since 1930. This makes the remaining **1%** of Utah lands that are wetlands even more important for the life that depends on it, including us!

CHALLENGE: Can you find 5 plants growing in the wetland that you don't see elsewhere in the pollinator area?

Cycle Of Growth






For More Information


Follow the QR code, or visit usu.edu/pollinator-habitat to contribute to future habitat restoration projects.


Sign for Pollinator Habitat:


Pollinator Habitat

Ways to Help Native Bees in Your Yard!

- 


Provide natural nesting habitat like access to bare ground.
- 

Offer a thin layer of leaves or compost for ground nesting bees.
- 


Grow plants with hollow stems like raspberries, milkweed, and Joe Pye weed for stem-nesting bees.
- 

Keep a pile of twigs, branches, and dead logs for cavity-nesting bees.


Gardening Tip: An out-of-sight brush pile is an easy way to manage clippings and yard waste while offering natural materials and cover for native bees.




Wasps/Bees




Butterflies




Moths



Beetles




Flies



Ants

Share Your BEE-utiful Pictures!

Utah biologists are studying the diversity of pollinators at this habitat. You can help us! We want to learn about the different diversity (kinds) and abundance (number) of insect pollinators visiting this site. Your contributions to this project will help us continue similar habitat restoration efforts by showing how pollinators use these plants.



For More Information

Follow the QR code, or visit usu.edu/pollinator-habitat to contribute to future habitat restoration projects.

Sign for Demonstration Garden:

Demonstration Garden

Native Plants for Native Pollinators

Native pollinators play an important role in maintaining healthy ecosystems. Not only do pollinators help food grow throughout our state, but they also contribute to the ultimate success and beauty of our wild spaces, diverse landscapes, and thriving gardens. Native plants help fuel these pollinators by providing important food resources throughout all growing seasons.

Why Native?

Biological Communities Have Evolved Together! Native plants and pollinators have evolved unique relationships over time, shaped by regional soil, climate, and water conditions. Special adaptations and behaviors exist between native species to help them survive and thrive in our unique landscapes.

Did You Know?

Home Gardens can provide EXCELLENT pollinator habitat! Adding native plants to your yard adds visual interest, attracts more pollinators and contributes to the success of your garden. The more habitat and resources we provide for native pollinators, the more our garden spaces and surrounding landscapes will thrive. **No space is too small!**

Other Ways Your Garden Can Help



BEE Strategic with Weed Barrier!
Many native bees are ground-nesting species that need soil access to complete their life cycle. Consider leaving your fallen leaves or a thin layer of mulch in your garden beds to help support native bees.



Ditch the Spray!
Use of chemical pesticides is a leading cause of pollinator declines throughout the West. When planting specifically for pollinators **AVOID** using sprays in your yard, especially during active blooming seasons, which could disrupt pollinator lifecycles.



Diversify!
Native is best, but diversity is key! Plant 2-3 floral resources varying in color and structure per season (*spring, summer, fall*) to help support a wide variety of native pollinators all year long. Native plants use less water and are better suited for our dry state.



Follow the QR code, or visit usu.edu/pollinator-habitat to contribute to future habitat restoration projects.

The installation of the signs took a bit of time and effort from the staff and students from Utah State University as deep post holes needed to be dug and signs settled in with gravel and powdered cement.



Figure 2.0-9 USU staff and students after sign installation

2.9 Background/Methodology – Maintenance

To date, site maintenance has chiefly been addressing undesirable species on site and/or thinning out some species that have been very successful, particularly from seed. These species are outlined below.

Designated state noxious weeds:

1. Poison Hemlock (*Conium maculatum*) – Found throughout the site and best controlled as early in the spring as possible with both pulling and herbicide when nothing else is up and few to no pollinators are present.
2. Canada thistle (*Cirsium arvense*) – Found chiefly in the wetland area. This is a very rhizomatous plant that needs to be controlled. It is best to treat this plant with herbicide late in the fall.

3. Bindweed (*Convolvulus arvensis*) – Currently found chiefly on the east end of the site. Control will almost always be an issue as this plant is incredibly rhizomatous and has a very robust root system.
4. Jointed goatgrass (*Aegilops cylindrica*) – A few plants found, easily pulled and controlled early in the season.
5. Dyer’s Woad (*Isatis tinctoria*) – A couple of plants present in the spring of 2023. Easily pulled early in the season.

Other weeds:

1. Teasel (*Dipsacus fallonum*) – Although this is not on the state noxious weed list, it is a tenacious competitor particularly in the moist areas of the site and should be controlled.
2. White Bryony (*Bryonia alba*) – this is a relative newcomer to the area and not yet on the state noxious weed list, but should be controlled aggressively.

A community group is being formed to assist with maintenance of the site. A Facebook group (Perry Pollinator Habitat) has been initiated for volunteers to access for photos and information on the undesirable species to control at the site as well as to serve as a platform to communicate with one another to plan trips out to the site together when possible.

2.10 Background/Methodology – Pollinator Surveys

In order to have a baseline for pollinator diversity and abundance prior to any work being done in the pollinator habitat area, a survey for pollinators was completed by Amanda Barth (USU Rare Insect Conservation Project Leader) and an intern in mid-September of 2021. This survey was completed again in the fall of 2022 and in June 2023. Observations can be viewed at the iNaturalist project established for this site at:

<https://www.inaturalist.org/projects/udot-perry-rest-area-pilot-pollinator-habitat>



Figure 2.0-10 Monarch caterpillar at the Perry Rest Area - July 2022

3.0 DATA COLLECTION AND EVALUATION

3.1 Overview

Data collection and evaluation consisted of taking notes and having discussions amongst team members about observations regarding sod conversion success, weed removal success, plant survivorship, site maturation, pollinator abundance and diversity, and visitor experience.

Additionally, citizen scientist observations of pollinators can be found at

<https://www.inaturalist.org/projects/udot-perry-rest-area-pilot-pollinator-habitat> for the duration of the project.

3.2 Data Collection and Evaluation – Sod Conversion

Killing the sod with glyphosate, cutting it with a sod cutter, then turning over was likely **not** the most effective way to rid the site of sod for the new pollinator habitat. First, even though there were several applications of glyphosate, it was not completely effective in killing the sod. Different species of grass in the sod mix have different characteristics (peak growing season, growth habit) that can make glyphosate more or less effective. Second, the cutting and turning over of the sod likely created excessive disturbance of the soil to allow additional weed seeds to get established. One alternative approach may be to solarize the sod to kill it prior to installing a pollinator habitat site. This involves covering the sod to be killed with a sheet of clear 4-mil plastic, tightly secured in the earth, and left for the hottest 6 weeks of the summer. This should bake the sod and everything else under the plastic to kill the plants underneath. It is best to water the area to be solarized right before the area is covered with plastic for maximum effect.

Another alternative method to consider takes 15-30 days and includes: (1) mow/scalp turf sod; (2) 1st glyphosate application with water-soluble nitrogen included to increase efficiency; (3) water with intent to germinate any remaining seed in the soil and wait 10 days after 1st glyphosate application; (4) mow/scalp again and water to moisten the soil; (5) 1-2 days after watering, till top 3-6 inches and incorporate dead organics; (6) irrigate again to encourage germination and wait 7-10 days; (7) follow up with 2nd glyphosate treatment; and (8) begin planting with seed or container plants.

3.3 Data Collection and Evaluation – Path Construction

The final work on the path of adding CHAT and powdered cement to the chip seal material made the path the correct texture for the abundant foot traffic on the path. Each visit by the team has observed at least 6 people walking through the habitat, sometimes up to 20 people over a time period of about 4 hours. The team has yet to receive a negative review from the public. Even though weed fabric was placed under the path, weeding of chiefly bindweed within the path is still needed on a regular basis.

3.4 Data Collection and Evaluation – Plant Selection and Survivorship

Through the growing seasons, the team has collected identification tags that were put in the ground with each plant, but had no plant visible – meaning those plants have likely perished. So far, species that have done very well (established and re-seeded or survived through the winter(s)) include blanket flower, annual sunflower, Rocky Mountain Bee Plant, blue flax, Nuttall’s sunflower, showy milkweed, goldenrod, tall evening primrose, and rabbitbrush. Species that have not done well, but are continuing to be evaluated include sulfur flower buckwheat, swamp milkweed, Oregon grape, and blue vervain. However, it should be noted that it takes up to 5 years for a site to stabilize as the disturbance produced from the site conversion creates a vacuum that nature proceeds to fill, often in an undesirable manner with excessive weeds. With time, the site stabilizes as the plants find their niche within the site in terms of abundance and relative diversity. As such, it is likely too early to make final conclusions about the performance of the individual species planted at the site.

Further, as part of the Utah Pollinator Habitat Program, from which the site received an additional 120 wetland plants, a report is required that requests information on the levels of success for the various species that were received from that program. A copy of that report will be shared with UDOT when it is finished.

3.5 Data Collection and Evaluation – Website

The team and Utah State University collaborated on putting together a website found at <https://qcnr.usu.edu/pollinator-habitat/> to have a presence on the internet where interested visitors can go for more information on UDOT's efforts. Text and layout were created by the team, then passed on to USU personnel to assure the website was consistent with that institution's website layout and guidelines.

The QR codes from the informational signs at the habitat link to both the landing page of the website as well as the audio files hosted on the site. The audio files are YouTube files whose URLs can be copied and pasted into a web browser to find details on the number of views. To date (June 2023), each audio has been played from 5 to 16 times.

In the near future and going forward, we will be working with USU to find methods by which to ensure the website will be found on an internet search as well as ways in which to keep track of visitation to the site.

3.6 Data Collection and Evaluation – Educational Signs

The educational signs designed and fabricated for this project were created and modified by every member of the team to ensure the signs would read well and be understandable to the general public. The public relations expert at Utah State University was also instrumental in this process.

The signs were designed by Maegan Castleton and fabricated at Fusion Imaging in Kaysville, Utah, using aluminum as the medium to cut down on glare and withstand UV rays for as long as possible, then welded on to powder coated bases. The signs also included tamper-proof bolts to ensure the signs are relatively secure from public vandalism.

General observations of the public at the site indicate people take the time to read the signs, but a smaller percentage take the time to link to the QR codes for more information or to the audio files. It may be desirable to install a trail counter to get a firm count of the number of visitors to the pollinator habitat, as well as to help determine how many people are being reached through this effort.

3.7 Data Collection and Evaluation – Site Maintenance

Ongoing maintenance at the Perry site has been necessary in order to continue to control noxious and undesirable weeds. In order to effectively control some weeds, the employment of select herbicides has been useful. Careful application in terms of rate and weather conditions in accordance with the herbicide labels are critical to ensure the fewest pollinator species may be injured. As a rule, the team did not spray any species that may be flowering where pollinators may be foraging. After application, the team made observations on effectiveness and possible off-target injury. As an example, the herbicide Milestone was used on Canada thistle in the fall of 2021, and it was apparent that some adjacent milkweed was injured.

3.8 Data Collection and Evaluation – Pollinator Surveys

A key aspect of this project is to determine differences in pollinator abundance and diversity before, during, and after the conversion of this area from a grass-/sod-dominated area to a diverse wildflower and grass pollinator habitat. The hope is to show a clear increase in pollinator abundance and diversity to reflect the associated increased abundance and diversity of pollinator resources at the site. At the outset of this project, a project in iNaturalist was established to help collect and store these data: <https://www.inaturalist.org/projects/udot-perry-rest-area-pilot-pollinator-habitat>. These data are easily accessible to anyone at any time with a free iNaturalist account.

Amanda Barth and an assistant visited the site in August of 2021, August of 2022, and in June of 2023. August of 2021 (prior to the installation of the new habitat) yielded 30 observations of approximately 19 pollinator species, August of 2022 yielded 61 observations of approximately 28 species, and June of 2023 yielded 89 observations of about 53 different species (See Table 3.0-1). Another survey will take place in August of 2023 to make all data consistent and comparable.

Table 3.0-1 Results of Pollinator Surveys

<u>Aug 12, 2021: 19 species observed -</u>	<u>Aug 16, 2022: 28 species observed -</u>	<u>June 22, 2023: 53 species observed -</u>
western honey bee	oblique longhorn bee	ligated furrow bee
Mylitta crescent	monarch butterfly	small white
banded bee fly	ligated furrow bee	western honey bee
gray hairstreak	western honey bee	short-horned grasshopper
small white	European paper wasp	yellow bumble bee
sandhill skipper	Carolina grasshopper	common ringlet
checkered skipper	Asian lady beetle	Odontomyia cincta (soldier fly)
Seladonia (solitary bee)	Phidippus (jumping spider)	transverse lady beetle
yellow bumble bee	European earwig	Omalus (parasitoid wasp)
vivid dancer	jagged ambush bug	dark firefly
Lasioglossom (solitary bee)	red-femured milkweed borer	face fly
thick-legged hover fly	black-chinned hummingbird	European drone fly
European paper wasp	Noctuidae (cutworm moth)	yellow-shouldered drone fly
jagged ambush bug	Crabonidae (square-headed)	black blow fly
brown-belted bumble bee	yellow bumble bee	Lestidae (spreadwing)
two-striped grasshopper	European mantis	painted lady
Eumenes (potter wasp)	small milkweed bug	meadowhawk
stiletto fly	differential grasshopper	bee fly
Agnathidinae (braconid)	twelve-spotted skimmer	common drone fly
	two-striped grasshopper	Bibio (marsh fly)
	Prionyx (grasshopper-preying)	vivid dancer
	Zonitis sayi (blister beetle)	mourning cloak
	Megachile parallela (leaf-cutter)	Tephritini (picture-wing fly)
	dark firefly	zebra jumping spider
	calyptrate fly	blue dock beetle
	yellow-shouldered drone fly	European paper wasp
	Eumelissodes (longhorn bee)	European harvestman
	Callandrena (digger bee)	Tule bluet
		Eumeninae (potter wasp)
		Anthrenus (carpet beetle)
		Hylaeus (masked bee)
		Neomyia cornicina (fly)
		Orthocladinae (non-biting midge)
		Sepsis (fly)
		Condylostylus occidentalis (long-legged fly)
		Thaumatomyia glabra (grass fly)
		Myzinum maculatum (wasp)
		Ophraella (beetle)
		Megachile inermis (leafcutter bee)
		broad-headed marsh fly
		Smicronyx (weevil)
		dusky raisin moth
		western leafcutter bee
		Chrysotus (fly)
		Torymus (chalcid wasp)
		flat-collared beewolf
		Leucopsis affinis (parasitic wasp of leafcutter bees)
		Thecophora (thick-headed fly)
		Pagasa (true bug)
		Orsillinae (true bug)
		Melanosmia (mason bee)
		Aritranis (parasitic wasp)
		Myxosargus knowltoni (soldier fly)

Further analysis and interpretation of these data is forthcoming from Amanda Barth, Rare Insect Conservation Project Leader.

Both within these observations and others made by additional members of the team, there have been approximately 12 observations of either monarch butterflies or monarch caterpillars over time, indicating monarch butterflies are breeding at the Perry Rest Area.

4.0 CONCLUSIONS

4.1 Summary

The world-wide decline in pollinator populations is concerning since pollinators play such an important role in our ecosystems and food production. Any increase in functional habitat for these creatures is a welcome feature for the pollinators, those that watch them, and the ecosystem as a whole. UDOT has a unique opportunity to provide environmental and educational resources on lands they manage by incorporating pollinator habitat into the landscape. The establishment and maintenance of pollinator habitat on UDOT-managed lands could provide much needed food and nesting habitat for pollinators while providing recreational and educational value to visitors. These habitats also increase public awareness and involvement in pollinator health throughout Utah and support pollinator conservation goals. Additionally, the generation of a manual that outlined methods, site selection, design, establishment, maintenance, and monitoring serves as a template for other UDOT properties (i.e., rest areas, welcome centers, park and rides, medians, rights-of-way) for other successful pollinator habitat installations.

The conversion of the south end of the Perry Rest Area to a functional pollinator habitat has been an overall success. The establishment of dozens of native species at the site has brought an associated increase of pollinator abundance and diversity, including breeding monarch butterflies, as the repeated pollinator surveys show.

It is important to remember that any conversion of a landscape, or portion of a landscape, will generate a reaction from the earth to compensate for the sudden change in vegetation cover and composition. This compensation from the earth can bring both desirable and undesirable results. At the Perry site, it will be important to continue regular maintenance to assure the site continues to develop into a desirable vegetation community. Minimal guidance may be needed from the team going forward to ensure the site continues on the correct trajectory.

4.2 Findings

Below are the most pertinent findings to date. These are mostly ‘lessons learned’ to keep in mind for any future pollinator habitat construction.

*Findings Item 1: Do not use a sod cutter to turn over killed sod to provide the medium in which to plant native pollinator species.

The loosened soil provides an overly suitable bed for undesirable species to get a foothold in the area and expand. It is suggested to try solarizing the site to kill sod and weeds on site without herbicides. This process involves covering the area to be planted in a clear sheet of plastic (at least 2 mil) for 6 to 8 weeks in the heat of the summer. The heat under the plastic will kill the sod.

*Findings Item 2: No pollinator habitat should take only a year from start to finish. This process will generally require up to 5 years of followup after instigation and planting.

A newly disturbed site – whether 0.25 acre or 10,000 acres – will react strongly by filling in the void with whatever is most abundant and amenable to the site characteristics (existing surrounding vegetation, soil type, water availability, slope). These introductions to the site need to be monitored and controlled as necessary to ensure the site follows a desirable trajectory to a diverse, relatively weed-free pollinator habitat.

4.3 Limitations and Challenges

Each pollinator habitat will be different as each site will be affected by the existing vegetation community, soil type, elevation, slope, and other physical characteristics. As such, the preparation, design, and outcome will be different. It will be important to keep this fact in mind as each site is approached to become a pollinator habitat. Further, it is very important to stress that the description of these sites should be pollinator *habitat* NOT pollinator *garden.* In order for these to be successful, the public must understand the difference between the two, and that these UDOT sites are not meant to be well manicured, garden-type settings. These sites are meant to be self-sustaining mini-ecosystems in that they will naturally change and mature in terms of the number and relative abundance of pollinator-friendly native plant species.

5.0 RECOMMENDATIONS AND IMPLEMENTATION

5.1 Recommendations

The installation and/or enhancement of pollinator habitats on additional UDOT lands is certainly recommended. A manual produced for the creation of pollinator habitats for this project should be consulted for recommendations and an implementation plan as well as for consistency across sites. Within that manual, there are also recommendations for onsite documentation and community involvement.

Each Pollinator Habitat Site created by UDOT should keep a project binder onsite that contains all necessary forms, site selection worksheets, design concepts, irrigation layouts, forms for habitat install and plant species lists, maintenance logs, correspondence (especially for irrigation and grounds crew), and habitat monitoring forms. A location should be selected at each site where it can safely be kept from the weather or other damage. These forms should also be housed in an online Google Drive folder that is shared with all pertinent parties.

Insect and pollinator documentation should be recorded using iNaturalist under the specific project name both before and after habitat modifications are made.

A practical maintenance option for these sites would be to solicit local groups or organizations in nearby communities to provide upkeep (primarily, weekly weeding) of the pollinator habitat. This could consist of individual citizen scientists or community group/organizations that would be willing to “Adopt a Pollinator Habitat.” It will be necessary for each of these volunteers to sign a UDOT waiver prior to working at the site. We suggest the use of social media to organize these groups and encourage community support among vested parties. The Perry Pollinator Habitat Facebook page (<https://www.facebook.com/groups/109412742177214>) was developed for the volunteers, and serves as a place for members to organize and communicate the needs and efforts at the habitat. It also serves as a place to catalog important site-specific unwanted plants and document the common native plants to facilitate identification by the volunteers.

A volunteer training day or two should be scheduled to go over weeding procedures (e.g., where to put pulled plants) and plant identification as well as to assist in the organization of the group. It is important that a willing “leader” is designated who can continue to work with and organize the other volunteers.

5.2 Implementation Plan

Implementation of any additional pollinator habitats on UDOT lands will need to work with UDOT directly to ensure all involved (UDOT, site attendants, contractor) are communicating as to what is expected at the site through the process.