

**POLLINATOR HABITAT ASSESSMENT  
for a  
PROPOSED POLLINATOR PATHWAY**

Prepared for:  
Greenfield Conservation Commission



Respectfully submitted by:

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## Introduction

Ecosystems worldwide depend on pollination by wildlife, predominantly insects, which transfer pollen from one flower to another. Pollination benefits not only natural systems, but human systems as well. Considering just American agricultural crops, pollinators provide an estimated \$20 billion in services each year. While most pollination is conducted by bees, other hairy-bodied insects, some mammals, and hummingbirds can contribute to the pollination of certain flowering plants. Many of these important species suffer ongoing population declines due to widespread, anthropogenic conversion of natural habitats to developed spaces, farms, and lawns. Further contributing to this decline is the use of pesticides and insecticides, where the application of such chemicals often indiscriminately kills unintended species, including charismatic butterflies and under-appreciated arthropods alike. Several news headlines over the past few years describe this loss as an “insect apocalypse.” While dire, such local-scale efforts as pollinator pathways can create important, high-quality habitat for these important insects that humans have taken for granted for too long.

Pollinator pathways, or pesticide-free corridors of native plants, provide nutrition and habitat for pollinators. Pathways may take the form of many contiguous pollinator-friendly properties or a series of closely-spaced stepping-stones that help pollinators disperse to new areas. Generally speaking, such pathways strive for more natural lawns, increased native plant density, removal of invasive species, and restricted application of pesticides. Combined, these habitat improvements on public and privately-owned land support more than just pollinators – birds, mammals, amphibians, and reptiles all benefit. Even the tiniest of green spaces, from flower boxes to streetside curbs, can contribute to a community’s pollinator pathway.

The local conservation commission in Greenfield, New Hampshire plans to establish a pollinator pathway for the benefit of pollinators and the local community alike. The project will initially focus on adding native, pollinator-friendly plants to publicly-owned properties along a 1.1-mile stretch of Forest Road. In 2022, at the request of the Greenfield Conservation Commission, Moosewood Ecological LLC conducted a pollinator habitat assessment of thirteen sites identified by the Commission for future inclusion in the pollinator pathway. While some work towards this vision had already begun, the primary goal of this assessment was to establish baseline data so that changes to pollinator habitat can be tracked over time.

## Methods

Our study followed the assessment methodology established in the Xerces Society’s (2014) *Pollinator Habitat Assessment Form and Guide for Natural Areas and Rangelands*. An overview of the scoring criteria is provided below, while Appendix C includes the full assessment form.

*Landscape features* surrounding a site, such as natural grasslands and forests, promote overall ecological health and increase the likelihood that pollinators will find newly established habitats. Sites with a greater percentage of undisturbed, native habitat within a 1/2-mile-radius score higher than sites with a more unnatural features, including lawn grass, cropland, and invasive weedy areas.



*Site features* encompass characteristics within the site boundaries that are beneficial for pollinators, including the overall proportion of natural habitat to unnatural or disturbed habitat, meadow permanence, abundance of pollinator-friendly plants, and clean water sources. Sites with more of these features present, or in greater abundance, score highly.

*Foraging habitat* specifically focuses on the abundance and diversity of flowering vegetation available to pollinators during spring, summer, and fall seasons. Sites exhibiting a high percent coverage of non-invasive flowering plants and high diversity of plants in all seasons score well.

*Native bee nesting habitat* is characterized by the availability of well-drained, sparsely vegetated soils and dead woody material or hollow-stemmed plants. Approximately 30% of North America's native bees nest in woody material or vegetation, and the remaining 70% of species nest in the ground. These features are critical to supporting a healthy bee population, and plant-rich pollinator areas lacking suitable nesting habitat may be worse off than those where ample nesting habitat is included.

*Management practices*, primarily the use of insecticides and mowing regimes, strongly influence the suitability of a site for pollinators. Sites with limited insecticide use, mowing, grazing, and burning score well compared to those with more intensive practices.

Prior to data collection, a site visit on March 23<sup>rd</sup>, 2022, was conducted with Greenfield Conservation Commission members, who prioritized thirteen sites for pollinator plantings (Figure 1). These locations spanned 1.11 miles of road frontage and nearby open areas along Route 136 and Forest Road, totaling an approximate 23 acres of improvable pollinator habitat.



Figure 1. Overview map of locations at which pollinator habitat assessments were conducted. Parcel boundaries are approximate.

Habitat assessments were conducted twice, once during a late-spring/early-summer date and once during a late-summer/early-spring date, during which times the full Xerces protocol was completed. However, the landscape features analysis and management practices assessment were only conducted once as these scores remained constant throughout the year. Scores for all other features were averaged between the two seasonal visits.

The term “pollinators” has been used to broadly describe any organism that visits flowers and may or may not transfer significant amounts of pollen between flowers. This general list often includes, bees and wasps (Hymenoptera), butterflies and moths (Lepidoptera), flies (Diptera), beetles (Coleoptera), bats (Chiroptera), and hummingbirds (Trochilidae). For simplicity’s sake, and to better encompass the flower-driven biodiversity at each site, this pollinator habitat assessment did not discern between pollinators (e.g., bees) and flower visitors (e.g., nectar-feeders). While documenting pollinators and other wildlife was not part of this protocol, all incidental observations of wildlife and flowering plants were cataloged and submitted to the community science database iNaturalist ([www.inaturalist.org](http://www.inaturalist.org)).

## Results

The late-spring/early-summer assessment was conducted on June 13<sup>th</sup>, 2022, and the late-summer/early-fall assessment was conducted on August 19<sup>th</sup>. Due to wide distribution of natural habitats surrounding the study area, all 13 sites received top-marks for landscape features component of the pollinator habitat assessment. Similarly, some management practices existed across all sites, namely a lack of insecticide use. Most sites demonstrated signs of frequent mowing, although several sites received points where less-frequent mowing allowed flowering plants to bloom. The sandy, well-drained soil underlying most of downtown Greenfield is well-suited for ground-dwelling bees, and scores in this category were only limited by the amount of undisturbed, uncompacted, exposed soil available to ground-nesting bees.

During the two rounds of habitat assessments 123 wildlife species were documented, 79 of which were loosely categorized as flower visitors, including pollinators. Common insects observed included Common Ringlet (*Coenonympha californica*), Two-spotted Bumblebee (*Bombus bimaculatus*), Common Eastern Bumblebee (*Bombus impatiens*), Variegated Lady Beetle (*Hippodamia variegata*), Polished Lady Beetle (*Cycloneda munda*), Cabbage White (*Pieris rapae*), and American Copper (*Lycaena hypophlaeas*).

Approximately 80 naturalized plant species were also cataloged, and an additional moderate diversity of garden plants were observed. Common naturalized flowering plants included white clover (*Trifolium repens*), red clover (*Trifolium pratense*), bird’s-foot trefoil (*Lotus corniculatus*), common yarrow (*Achillea millefolium*), and Queen Anne’s lace (*Daucus carota*) representing the most-observed species. The species documented at each site represent a small fraction of each location’s biodiversity, which thorough surveys spread across the growing season would better document. Nonetheless, the lists provided within this report (Appendix A, B) offer helpful baseline information and may inspire local community science projects aimed at generating a more well-rounded database.

### Site-specific assessments

The following site-specific assessments are listed in geographical order, as if following a walking tour that starts at the Town cemetery and heads west along the north side of Forest Road to Oak Park, then heading back eastward along the southern side of Forest Road.

#### **Town Cemetery**

Acres surveyed: 1.8

Overall pollinator habitat score: 86

Site rank (out of 13): 12<sup>th</sup>

#### *Overview*

Also referred to as the Meeting House Cemetery or Old Church Cemetery, this site exhibits several features beneficial to pollinators (e.g., exposed, well-drained soil, some flowering plants in all seasons) yet lacks others. Constant mowing significantly limits plant diversity and the number of plants allowed to bloom, a general absence of woody material for cavity-nesting bees, and lack of a water source contribute to this site's limited suitability for pollinators. As with most other sites evaluated in this report, many opportunities exist for enhancing pollinator habitat. Each section includes site-specific recommendations following the assessment tables.



#### Landscape Features

<b>Feature</b>	<b>Value</b>	<b>Score (max)</b>
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

#### Site Features

<b>Feature</b>	<b>Value</b>	<b>Score (max)</b>
Percentage of target site that is in natural or semi-natural habitat.	<10%	0 (10)
Additional site features present.	None	0 (10)
<b>Site Features Total Score</b>		<b>0 (20)</b>

#### Foraging Habitat

<b>Feature</b>	<b>Value</b>	<b>Score (max)</b>
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	About 10%	2 (10)
Number of flowering species on site that bloom in spring and support bees.	5-9 species	5 (10)
Number of flowering species on site that bloom in summer and support bees.	4 or 5 species	4 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>16 (40)</b>



### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Moderate to abundant	4 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate to abundant	4 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse	1 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse	1 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>20 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

### Town Meetinghouse

Acres surveyed: 1.8

Overall pollinator habitat score: 94

Site rank (out of 13): 8<sup>th</sup>

#### Overview

Several planted gardens have been added around the Meetinghouse in addition to a few roadside garden beds, and these plantings provide the only reliable food source for pollinators in a setting dominated by lawn. The diversity of flowering plants is moderate to high in the garden beds, and more native species could be added to the mix. The parking lot edges may receive less compaction than the main driving and parking areas, thus providing some nesting habitat for ground-dwelling bees, yet these sites would be risky and could pose an ecological trap. Several lady beetles and wasps not documented elsewhere in Greenville were discovered in the gardens near the building.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>



### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	<10%	0 (10)
Additional site features present.	None	0 (10)
<b>Site Features Total Score</b>		<b>0 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	About 10%	2 (10)
Number of flowering species on site that bloom in spring and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in summer and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>27 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Sparse to moderate	2 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate	3 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse	1 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse	1 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>17 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

### Community Garden

Acres surveyed: 1.0

Overall pollinator habitat score: 145

Site rank (out of 13): 1<sup>st</sup>

#### Overview

One of two sites surveyed with an impressive overall pollinator habitat score, the community gardens boast an abundance of native flowering species, diverse flowering plants throughout the growing season, high-quality ground-nesting



habitat for bees, a nearby water resource, and several other positive factors. Limited mowing and minimal soil compaction from low levels of human activity also contributed to this site's high score. Despite its small size, the quality of the habitat attracts numerous insects, and many bees and butterflies were detected during both surveys.

### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	About 50%	6 (10)
Additional site features present.	Semi-permanent meadows with some native wildflowers allowed to bloom; pasture with >30% non-invasive, bee-friendly forage legumes allowed to bloom; source of clean water protected from pesticides; 10-20% of area within 25' of water features.	10 (10)
<b>Site Features Total Score</b>		<b>16 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	40-50%	7.75 (10)
Number of flowering species on site that bloom in spring and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in summer and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in fall and support bees.	8+ species	10 (10)
<b>Foraging Habitat Total Score</b>		<b>37.75 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Abundant	5 (5)
Areas with well-drained sandy to sandy/loamy soil.	Abundant	5 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Moderate to abundant	4 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Moderate to abundant	7.5 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>31.5 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is limited to 1/3 <sup>rd</sup> of area per year.	10 (30)
<b>Management Practices Total Score</b>		<b>40 (70)</b>

## Blacksmith Parking Area

Acres surveyed: 0.3

Overall pollinator habitat score: 104.5

Site rank (out of 13): 4<sup>th</sup>

### Overview

Adjacent to Greenfield’s blacksmith forge, this small parking area offers surprisingly decent pollinator habitat. The parking area itself appeared to receive little use, thus providing moderate ground-nesting opportunities for bees depending on the degree of soil compaction. A clean water resource is located nearby, and surveys detected a number of native and introduced flowering plants that support a wide range of insects. While not scored as part of the habitat assessment, the site’s roadside frontage along NH-136 positions it as a prime location for future planting as part of Greenfield’s vision for a pollinator pathway.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	About 10%	1.5 (10)
Additional site features present.	Semi-permanent meadows with some native wildflowers allowed to bloom; some non-invasive, bee-friendly forage legumes; source of clean water nearby; 20% of area within 25’ of water features	10 (10)
<b>Site Features Total Score</b>		<b>11.5 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	About 20%	4 (10)
Number of flowering species on site that bloom in spring and support bees.	5-9 species	5 (10)
Number of flowering species on site that bloom in summer and support bees.	4 or 5 species	4 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>18 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Moderate to abundant	4 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate to abundant	4 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse to moderate	2 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Moderate	5 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>25 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

### Town Fire Station

Acres surveyed: 0.4

Overall pollinator habitat score: 81

Site rank (out of 13): 13<sup>th</sup>

#### Overview

Dominated by lawn, only a single garden was documented during surveys and sparse flowering plants outside of the garden were limited to steep areas along the tree line that escaped mowing. Relative to the other sites evaluated, the best characteristics present at the fire station were a lack of insecticide use, abundant native vegetation in the surrounding landscape, and well-drained soils that support a handful of ground-nesting bees in the few un-mowed areas. Despite a documented lack of high-quality pollinator habitat, abundant potential exists for this site.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>



### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	<10%	0 (10)
Additional site features present.	None	0 (10)
<b>Site Features Total Score</b>		<b>0 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	<10%	1 (10)
Number of flowering species on site that bloom in spring and support bees.	5-9 species	5 (10)
Number of flowering species on site that bloom in summer and support bees.	4 or 5 species	4 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	3 (10)
<b>Foraging Habitat Total Score</b>		<b>13 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Moderate	3 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate	3 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse	1 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse	1 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>18 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

## Greenfield Commons

Acres surveyed: 0.2

Overall pollinator habitat score: 84.5

Site rank (out of 13): 11<sup>th</sup>

### Overview

Located between the fire station and the Greenfield Historical Society, Greenfield Commons is an affordable apartment complex for seniors. Only the roadside area adjacent to NH-136 was valued as part of this assessment,



although future work toward the pollinator pathway may consider additional plantings closer to the apartments themselves to attract more biodiversity and further enhance the quality of life for residents. Habitat-wise, a mix of native and non-native flowering plants were documented, although the area is generally dominated by lawn. Mowed land is likely too compacted for ground-nesting bees, and virtually woody material has been removed, further reducing habitat availability.

### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	About 10%	1.5 (10)
Additional site features present.	None	0 (10)
<b>Site Features Total Score</b>		<b>1.5 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	About 10%	2 (10)
Number of flowering species on site that bloom in spring and support bees.	5-9 species	5 (10)
Number of flowering species on site that bloom in summer and support bees.	4 or 5 species	4 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	3 (10)
<b>Foraging Habitat Total Score</b>		<b>14 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Sparse to moderate	2 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate	3 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse	1 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse to moderate	3 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>19 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

## Greenfield Historical Society

Acres surveyed: 0.2

Overall pollinator habitat score: 90.5

Site rank (out of 13): 9<sup>th</sup>

### Overview

Relative to the fire station and Greenfield Commons, the Historical Society building offers higher-quality pollinator habitat in terms of the diversity and seasonality of flowering plants. Several gardens were documented adjacent to the building, and a fountain, when running, would provide a clean water resource. Soils are well-suited for ground-nesting bees, although mowing on site may reduce this suitability. A highly-visible property from the main road, this site could make a significant addition to the appeal of a colorful, biodiverse pollinator pathway through downtown Greenfield.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	<10%	0 (10)
Additional site features present.	None	0 (10)
<b>Site Features Total Score</b>		<b>0 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	10-20%	3 (10)
Number of flowering species on site that bloom in spring and support bees.	5-9 species	5 (10)
Number of flowering species on site that bloom in summer and support bees.	9 or 10 species	7.5 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>20.5 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Moderate	3 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate	3 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse	1 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse to moderate	3 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>20 (35)</b>

## Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

## Greenfield Elementary School

Acres surveyed: 0.5

Overall pollinator habitat score: 99

Site rank (out of 13): 6<sup>th</sup>

### Overview

The area between the school and Forest Road offers moderate habitat for pollinators. Well-drained, partially-exposed soils and coarse woody material along the tree line provide decent nesting opportunities for bees, while a modest diversity of native flowering plants supply food throughout the growing season. Nearby wetlands, while not on the school property itself, offer a clean water resource and a variety of wetland-obligate plants that further support pollinators found on the elementary school grounds. The establishment of several pollinator gardens in such close proximity to the school could offer countless educational opportunities and may help inspire future generations of conservation-minded individuals.



## Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

## Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	10-24%	3 (10)
Additional site features present.	10% of area within 25' of water feature that is vegetated	0.5 (10)
<b>Site Features Total Score</b>		<b>3.5 (20)</b>



### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	About 10%	2 (10)
Number of flowering species on site that bloom in spring and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in summer and support bees.	9 or 10 species	7.5 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>24.5 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Moderate to abundant	4 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate to abundant	4 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse to moderate	2 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse	1 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>21 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

### Forest Road and NH-136 Intersection

Acres surveyed: 0.6

Overall pollinator habitat score: 98.5

Site rank (out of 13): 7<sup>th</sup>

#### Overview

This large, grassy area at the intersection of two main roads exhibited modest pollinator habitat that is largely limited by semi-frequent mowing.

The site's high visibility to passersby may warrant prioritization of pollinator pathway efforts here pending approval from departments of transportation and other relevant agencies. Typical of most other sites evaluated, the intersection area exhibited a modest mix of flowering plants, both native and introduced species, which are only allowed to bloom when mowing is delayed. Well-drained, soil underlying patchy grass with mature woodlands nearby offer suitable nesting sites for bees as well as shelter for numerous other insects.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	<10%	0 (10)
Additional site features present.	Permanent meadows with diverse native wildflowers; pasture with mixture of native and non-native bee-friendly forage legumes	10 (10)
<b>Site Features Total Score</b>		<b>10 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	About 20%	4 (10)
Number of flowering species on site that bloom in spring and support bees.	5-9 species	5 (10)
Number of flowering species on site that bloom in summer and support bees.	4-10 species	6.5 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	3 (10)
<b>Foraging Habitat Total Score</b>		<b>18.5 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Moderate to abundant	4 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate	3 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse to moderate	2 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse	1 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>20 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

## Oak Park

Acres surveyed: 13.4

Overall pollinator habitat score: 111

Site rank (out of 13): 3<sup>rd</sup>

### Overview

The site of an old race-track, this public, mixed-use property is frequently used for concerts, farmers markets, casual recreation, and other activities. Most activity at this location appeared to be located in the ballfield, around gazebo and parking area, and within the walking track, leaving the majority of the property to maintain moderate to abundant habitat features for pollinators. Ground-nesting bees benefit from an abundance of exposed, well-suited soils, and diverse flowering native plants were observed throughout the growing season. Moderate coverage of blueberries and other ericaceous plants in the un-mowed parts of the Oak Park provide critical foraging opportunities for specialist bees.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	<10%	0 (10)
Additional site features present.	Semi-permanent meadows with some native wildflowers allowed to bloom; some pasture with >30% of mixed non-native and native bee-friendly forage legumes	7.5 (10)
<b>Site Features Total Score</b>		<b>7.5 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	20-30%	5 (10)
Number of flowering species on site that bloom in spring and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in summer and support bees.	5-10 species	7.5 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>27.5 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Abundant	5 (5)
Areas with well-drained sandy to sandy/loamy soil.	Abundant	5 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Moderate	3 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse to moderate	3 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>26 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

### Railroad Embankment

Acres surveyed: 0.9

Overall pollinator habitat score: 89

Site rank (out of 13): 10<sup>th</sup>

#### Overview

An active, although infrequently used, railroad parallels a quarter-mile stretch of the Forest Road just west of downtown Greenfield. The embankment stretches approximately 1,300 feet and is interrupted by a single driveway across from the Historical Society. Along its entire length, the embankment displayed soils well-suited to ground-nesting bees, a low to moderate mixture of flowering species with a high occurrence of non-natives, and an overall composition of semi-naturalized habitat. While working conditions so close to a major road are not without risks, pollinator plantings along this lengthy stretch of roadside could present a stunning collage of color for the benefit of pollinators and passersby alike.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>



### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	25-49%	5 (10)
Additional site features present.	None	0 (10)
<b>Site Features Total Score</b>		<b>5 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	<10%	1 (10)
Number of flowering species on site that bloom in spring and support bees.	1-4 species	3 (10)
Number of flowering species on site that bloom in summer and support bees.	4-5 species	4 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	3 (10)
<b>Foraging Habitat Total Score</b>		<b>11 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Moderate to abundant	4 (5)
Areas with well-drained sandy to sandy/loamy soil.	Abundant	5 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Moderate	3 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse	1 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>23 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

### Leach Field

Acres surveyed: 1.2

Overall pollinator habitat score: 138.5

Site rank (out of 13): 2<sup>nd</sup>

#### Overview

Pollinator habitat at the leach field is on par with that of the community gardens, exceeding all other sites evaluated. The leach field's extensive grasslands that went un-mowed during the survey period provided abundant pollination



opportunities for many dozens of insects. Butterfly diversity was higher here than at any other site, and this will only improve with additional planting efforts by the Conservation Commission.

### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	>75%	10 (10)
Additional site features present.	Permanent meadows with diverse native wildflowers allowed to bloom; pasture with >30% mixed non-native and native bee-friendly forage legumes allowed to bloom; 10% of area within 25' of water features that are vegetated	10 (10)
<b>Site Features Total Score</b>		<b>20 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	About 50%	8.5 (10)
Number of flowering species on site that bloom in spring and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in summer and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>33.5 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Sparse to Moderate	2 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate	3 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Abundant	5 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Moderate	5 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>25 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	10 (30)
<b>Management Practices Total Score</b>		<b>40 (70)</b>

## Stephenson Memorial Library

Acres surveyed: 0.7

Overall pollinator habitat score: 103

Site rank (out of 13): 5<sup>th</sup>

### Overview

Well-established gardens adjacent to the public library contain a variety of non-native flowering plants, which can easily be complemented with more native species. The maintained lawn exhibited some exposed patches of well-drained soil for nesting bees, yet the mowing frequency may limit bees' use of this resource. The back lawn was un-mowed for the first survey and displayed a significantly higher biodiversity of insects compared to the second survey, which took place after the back lawn had been mowed.



### Landscape Features

Feature	Value	Score (max)
Percentage of natural or semi-natural vegetation within ½ mile of project area.	>30%	10 (10)
Dominant vegetation within ½ mile of project area.	Native plants	10 (10)
<b>Landscape Features Total Score</b>		<b>20 (20)</b>

### Site Features

Feature	Value	Score (max)
Percentage of target site that is in natural or semi-natural habitat.	10-20%	2.5 (10)
Additional site features present.	Semi-permanent meadows with some native wildflowers allowed to bloom; pasture with >30% mixed non-native and native bee-friendly forage legumes allowed to bloom	7.5 (10)
<b>Site Features Total Score</b>		<b>10 (20)</b>

### Foraging Habitat

Feature	Value	Score (max)
Percentage of non-invasive vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site.	<10%	1 (10)
Number of flowering species on site that bloom in spring and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in summer and support bees.	10+ species	10 (10)
Number of flowering species on site that bloom in fall and support bees.	1-3 species	5 (10)
<b>Foraging Habitat Total Score</b>		<b>26 (40)</b>

### Native Bee Nesting Habitat

Feature	Value	Score (max)
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation.	Sparse	1 (5)
Areas with well-drained sandy to sandy/loamy soil.	Moderate	3 (5)
1 point for every 10% of area untilled on site.	100%	10 (10)
Areas of undisturbed native bunch grasses.	Sparse to moderate	2 (5)
Site has dead wood or plants supporting wood- and cavity-nesting bees.	Sparse	1 (10)
<b>Native Bee Nesting Habitat Total Score</b>		<b>17 (35)</b>

### Management Practices

Feature	Value	Score (max)
Pesticide use, including pollinator-toxic insecticides.	No use of insecticides on site	30 (40)
Land management techniques used on site or in project area.	Mowing is not limited to 1/3 <sup>rd</sup> of area per year.	0 (30)
<b>Management Practices Total Score</b>		<b>30 (70)</b>

## Discussion

The pollinator habitat assessment, as completed, provides a quantitative baseline for comparing habitat characteristics following the implementation and growth of Greenfield’s pollinator pathway. While the community gardens and leach field exhibit high-quality pollinator habitat in their current states, pollinator habitat at most other locations can be significantly improved with easily-achievable objectives. For example, adjusting landscaping practices to annually mow a maximum of two-thirds of lawn area, retaining dead wood and herbaceous stems on-site, planting a handful of native, pollinator-friendly species, or a combination of the above. Since relatively little improvement of pollinator habitat is needed at the community garden and leach field, other, more visible sites along NH-136 could be prioritized for immediate action. When adding plants to roadside locations, such as the railroad embankment and blacksmith parking area, using native plant species tolerant of road salt is recommended.

Greenfield’s pollinator pathway will link together a variety of landowners in a collaborative effort, from private citizens and local schools to Town and State agencies. Individual landowners who wish to contribute to the pathway should be encouraged to apply the Xerces Society’s *Habitat Assessment Guide for Pollinators in Yards, Gardens, and Parks*, which walks users through an evaluation of their property and offers specific recommendations for making habitat improvements. Community buy-in will improve the long-term success of the pollinator pathway, and with time and effort, the Greenfield pollinator pathway will serve as a model for communities throughout the Monadnock Region.



## Recommendations

Based on the findings of this assessment, the following recommendations offer steps to improve on-site characteristics of pollinator habitat. More general recommendations for the pollinator pathway project as a whole are also listed.

### Promoting Pollinators

- Where absent, plant native wildflower garden(s) that bloom in succession throughout the growing season and are high-value to pollinators.
- Plant native bunchgrasses, as these plants offer food for some butterflies and help provide nesting sites for bees.
- Where possible, reduce lawn area by converting frequently-mown grass to flowering meadow.
- On sites lacking a diversity of native, spring-blooming plants, add willows (*Salix*), maples (*Acer*), and native fruit trees and shrubs (e.g., blueberries (*Vaccinium*), currants and gooseberries (*Ribes*), elderberries (*Sambucus*), chokeberries (*Aronia*).
- On sites lacking a diversity of native, summer-blooming plants, add blazing star (*Liatris*), bee balm (*Monarda*), wild roses (*Rosa*), meadowsweet (*Spirea*), or other native plants.
- On sites lacking a diversity of native, fall-blooming plants, add asters (*Symphyotrichum*) native sunflowers (*Helianthus*), and goldenrods (*Solidago*).
- Where absent, plant native milkweed (*Asclepias*) and violets (*Viola*) for specialist butterflies and moths.
- Gradually replace perennial and annual plants that provide little value to wildlife (e.g., daylilies, hostas, pansies) with more diverse native wildflowers.
- If non-native plants are included in landscaping, use varieties that are known to benefit pollinators (e.g., flowers with ample pollen or nectar) and that are not invasive or aggressive.
- Where present, remove invasive species (e.g., Japanese knotweed, autumn olive, oriental bittersweet, multiflora rose) and monitor sites closely for reintroduction of invasives.
- Leave dead wood on site, including logs, snags, and brush, or move to woodland edge if necessary.
- Leave dead wildflower stems standing over winter, then prune back in early spring to 8-12" to create nesting sites for stem-nesting bees.
- Leave bare spots or areas with patchy vegetation in lawns to promote nest-site availability for ground-nesting bees.

### Community Engagement

- Promote the Greenfield iNaturalist project, *A Living Field Guide to Greenfield, NH* (<https://www.inaturalist.org/projects/a-living-field-guide-to-greenfield-nh>), to collect more information on pollinators, flowering plants, and overall biodiversity.
- Encourage pollinator monitoring to track pollinator diversity and abundance over time.
- Organize a community native plant seed exchange.
- Provide signage that explains the pollinator pathway and inspires others to participate.

## Further Reading

- New England Conservation Cover for Pollinators  
(<https://xerces.org/publications/habitat-installation-guides/new-england-conservation-cover-327-for-pollinators>)
- Establishing Pollinator Meadows from Seed  
(<https://xerces.org/publications/guidelines/establishing-pollinator-meadows-from-seed>)
- Estimated Costs to Establish Pollinator Hedgerows  
(<https://xerces.org/publications/fact-sheets/estimated-costs-to-establish-pollinator-hedgerows>)
- Monarch Nectar Plants: Northeast  
(<https://xerces.org/publications/plant-lists/monarch-nectar-plants-northeast>)
- Roadside Habitat for Monarchs: Milkweeds of the Northeast  
(<https://xerces.org/publications/fact-sheets/roadside-habitat-for-monarchs-milkweeds-of-northeast>)
- Maintaining Diverse Stands of Wildflowers Planted for Pollinators  
(<https://xerces.org/publications/guidelines/maintaining-diverse-stands-of-wildflowers-planted-pollinators>)
- Nesting and Overwintering Habitat for Pollinators and Other Beneficial Insects  
(<https://xerces.org/publications/fact-sheets/nesting-overwintering-habitat>)
- Buying Bee-Safe Plants  
(<https://xerces.org/publications/fact-sheets/buying-bee-safe-plants>)
- Pollinator-Friendly Plants for the Northeast United States  
(<https://www.nrcs.usda.gov/plantmaterials/nypmctn11164.pdf>)
- Pollinator Plants: Northeast Region  
(<https://xerces.org/publications/plant-lists/pollinator-plants-northeast-region>)
- Plants Recommended by the Pollinator Pathway: Northeast  
(<https://www.pollinator-pathway.org/plant-list>)
- NRCS Pollinator Practices in New Hampshire  
(<https://www.nrcs.usda.gov/NewHampshire/pollinatorsNH>)
- Creating a Pollinator Garden for Native Specialist Bees of New York and the Northeast  
([https://www.greatswamp.org/wp-content/uploads/2022/03/Creating-a-Pollinator-Garden-for-Specialist-Bees-in-NY\\_FINAL\\_071620\\_.pdf](https://www.greatswamp.org/wp-content/uploads/2022/03/Creating-a-Pollinator-Garden-for-Specialist-Bees-in-NY_FINAL_071620_.pdf))
- Organic Site Preparation for Wildflower Establishment  
(<https://xerces.org/publications/guidelines/organic-site-preparation-for-wildflower-establishment>)
- Changing Lawn Maintenance Practices to Benefit Pollinators  
(<https://www.pollinator-pathway.org/rethink-your-lawn>)
- Collection of Scientific Literature Related to Pollinator-Friendly Lawns  
(<https://www.pollinator-pathway.org/scientific-studies>)
- Toolkit for Starting a Pollinator Pathway in Your Community  
(<https://www.pollinator-pathway.org/steps-to-starting-a-pathway-in-your>)
- Research and Community Science Along Pollinator Pathways  
(<https://www.pollinator-pathway.org/citizen-science-ideas>)

## Appendix A: Overall Pollinator and Flower Visitor List

Insects documented on or near flowers during the habitat assessments on 13 June and 19 August 2022 by site. BP = blacksmith parking, CG = community garden, ES = elementary school, FS = fire station, FR = Forest Road and NH-136 intersection, GC = Greenfield Commons, HS = Greenfield Historical Society, LF = leach field, L = Stephenson Memorial Library, OP = Oak Park, RE = railroad embankment. TC = Town cemetery, and TM = Town meetinghouse.

Common Name	Scientific Name	BP	CG	ES	FR	FS	GC	HS	LF	L	OP	RE	TC	TM
American Copper	<i>Lycaena phlaeas</i>	X	X					X	X	X				
American Lady	<i>Vanessa virginiensis</i>			X					X					
Aphrodite Fritillary	<i>Argynnis aphrodite</i>								X					
Asian Lady Beetle	<i>Harmonia axyridis</i>										X			
Augochlorella sp.	<i>Augochlorella</i>												X	
Bald-Faced Hornet	<i>Dolichovespula maculata</i>			X										
Bicolored Striped Sweat Bee	<i>Agapostemon virescens</i>										X			
Black-shouldered Drone Fly	<i>Eristalis dimidiata</i>								X					
Blow fly sp.	<i>Calliphoridae</i>							X						
Broad-handed Leafcutter	<i>Megachile latimanus</i>										X			
Brown-belted Bumblebee	<i>Bombus griseocollis</i>								X	X				
Cabbage White	<i>Pieris rapae</i>		X	X					X		X			X
Clouded Sulphur	<i>Colias philodice</i>								X					
Common Eastern Bumblebee	<i>Bombus impatiens</i>		X	X						X				X
Common European Greenbottle fly	<i>Lucilia sericata</i>						X							X
Common Ringlet	<i>Coenonympha californica</i>		X	X	X				X	X	X			
Common Wood-Nymph	<i>Cercyonis pegala</i>	X									X			
Convergent Lady Beetle	<i>Hippodamia convergens</i>													X
Crescent sp.	<i>Phyciodes</i>								X	X				
Dark Paper Wasp	<i>Polistes fuscatus</i>	X		X					X					X
Dogbane Saucrobotys Moth	<i>Saucrobotys futilalis</i>	X		X										
Double-banded Scoliid Wasp	<i>Scolia bicincta</i>			X										
Eastern Tailed-Blue	<i>Cupido comyntas</i>		X						X					
European Paper Wasp	<i>Polistes dominula</i>		X											

Common Name	Scientific Name	BP	CG	ES	FR	FS	GC	HS	LF	L	OP	RE	TC	TM
Exenterus sp.	<i>Exenterus</i>							X						
Furrow bee sp.	<i>Halictus</i>						X							
Golden Sweat Bee	<i>Augochlorella aurata</i>	X												
Goldenrod Soldier Beetle	<i>Chauliognathus pensylvanicus</i>								X					
Gonia sp.	<i>Gonia</i>			X										
Grass-carrying wasp sp.	<i>Isodontia</i>	X												
Great Black Digger Wasp	<i>Sphex pensylvanicus</i>													X
Great Golden Digger Wasp	<i>Sphex ichneumoneus</i>													X
Great Spangled Fritillary	<i>Argynnis cybele</i>			X							X			
Hairy-eyed Mimic Fly	<i>Mallota posticata</i>								X	X				
Hedychrum sp.	<i>Hedychrum</i>			X										
Hesperina sp.	<i>Hesperina</i>										X			
Ligated Furrow Bee	<i>Halictus ligatus</i>	X		X					X					
Little Wood Satyr	<i>Megisto cymela</i>										X			
Long Dash	<i>Polites mystic</i>					X			X					
Margined Calligrapher	<i>Toxomerus marginatus</i>									X				
Masked bee sp.	<i>Hylaeus</i>								X					
Mason bee sp.	<i>Osmia</i>												X	
Megachilidae sp.	<i>Megachilidae</i>					X								
Metopius sp.	<i>Metopius</i>										X			
Mexican Grass-carrying Wasp	<i>Isodontia Mexicana</i>			X										
Mining bee sp.	<i>Andrena</i>								X	X			X	X
Monarch	<i>Danaus plexippus</i>		X							X				
Nomad bee sp.	<i>Nomada</i>				X									
Oblong Woolcarder Bee	<i>Anthidium oblongatum</i>	X	X											
Pasture Grass-Veneer	<i>Crambus saltuellus</i>				X						X		X	
Pearl Crescent	<i>Phyciodes tharos</i>		X											
Peck's Skipper	<i>Polites peckius</i>								X	X				
Pink-edged Sulphur	<i>Colias interior</i>								X					
Polished Lady Beetle	<i>Cycloneda munda</i>	X	X											X

Common Name	Scientific Name	BP	CG	ES	FR	FS	GC	HS	LF	L	OP	RE	TC	TM
Pug moth sp.	<i>Eupithecia</i>													X
Red Admiral	<i>Vanessa atalanta</i>		X											
Red Milkweed Beetle	<i>Tetraopes tetrophthalmus</i>		X	X										
Small carpenter bee sp.	<i>Ceratina</i>		X											
Small Milkweed Bug	<i>Lygaeus kalmia</i>	X												
Sod Webworm Moth	<i>Pediasia trisecta</i>								X					
Striped sweat bee sp.	<i>Agapostemon</i>													X
Subgothic Dart	<i>Feltia subgothica</i>										X			
Tawny-edged Skipper	<i>Polites Themistocles</i>		X						X					
Thread-waisted sand wasp sp.	<i>Ammophila</i>		X	X				X			X			
Tiger swallowtail sp.	<i>Pterourus</i>										X			
Transverse-banded Flower Fly	<i>Eristalis transversa</i>						X							
Tufted Globetail	<i>Sphaerophoria contigua</i>											X		
Two-lined Swamp Fly	<i>Anasimyia bilinearis</i>						X							
Two-spotted Bumblebee	<i>Bombus bimaculatus</i>	X	X						X		X			X
Typical weevil wasp sp.	<i>Cerceris</i>		X											
Variegated Lady Beetle	<i>Hippodamia variegata</i>													X
Viceroy	<i>Limenitis Archippus</i>								X					
Western Honey Bee	<i>Apis mellifera</i>	X							X	X				X
Widow Yellowjacket	<i>Vespa vidua</i>			X										
Wild Indigo Duskywing	<i>Erynnis baltisiae</i>							X	X					
Wilke's Mining Bee	<i>Andrena wilkella</i>	X												
Wool Sower Gall Wasp	<i>Callirhytis frigidus</i>				X									



## Appendix B: Overall Plant List

Plants documented during the habitat assessments on 13 June and 19 August 2022 by site. BP = blacksmith parking, CG = community garden, ES = elementary school, FS = fire station, FR = Forest Road and NH-136 intersection, GC = Greenfield Commons, HS = Greenfield Historical Society, LF = leach field, L = Stephenson Memorial Library, OP = Oak Park, RE = railroad embankment. TC = Town cemetery, and TM = Town meetinghouse.

Common Name	Scientific Name	BP	CG	ES	FS	FR	GC	HS	LF	L	OP	RE	TC	TC
alfalfa	<i>Medicago sativa</i>								X					
allegheny blackberry	<i>Rubus allegheniensis</i>		X											
american pokeweed	<i>Phytolacca americana</i>								X					
autumn olive	<i>Elaeagnus umbellata</i>		X										X	
azure bluet	<i>Houstonia caerulea</i>			X										
bird's-foot trefoil	<i>Lotus corniculatus</i>	X	X	X					X			X		
black-eyed susan	<i>Rudbeckia hirta</i>		X						X	X				
blue curls	<i>Trichostema dichotomum</i>		X											
blue toadflax	<i>Nuttallanthus canadensis</i>	X		X					X					
blue-eyed grass sp.	<i>Sisyrinchium</i>		X						X					
bull thistle	<i>Cirsium vulgare</i>	X												
Canada mayflower	<i>Maianthemum canadense</i>										X			
Cichorieae	<i>Chichorieae</i>												X	
common cinquefoil	<i>Potentilla simplex</i>		X	X		X								
common jewelweed	<i>Impatiens capensis</i>		X											
common milkweed	<i>Asclepias syriaca</i>	X	X	X			X		X					
common self-heal	<i>Prunella vulgaris</i>												X	
common soapwort	<i>Saponaria officinalis</i>							X						
common St. John's-wort	<i>Hypericum perforatum</i>								X					
common yarrow	<i>Achillea millefolium</i>	X	X				X			X		X		
cut-leaf goldenrod	<i>Solidago arguta</i>								X					
dandelion sp.	<i>Taraxacum</i>												X	
early goldenrod	<i>Solidago juncea</i>		X											
flat-top white aster	<i>Doellingeria umbellata</i>	X												

Common Name	Scientific Name	BP	CG	ES	FS	FR	GC	HS	LF	L	OP	RE	TC	TC
flat-topped goldenrod	<i>Euthamia graminifolia</i>	X		X							X		X	
fleabane sp.	<i>Erigeron</i>	X						X		X				
fringed bindweed	<i>Fallopia cilinodis</i>		X											
goldenrod sp.	<i>Solidago</i>	X		X										
goutweed	<i>Aegopodium podagraria</i>								X					
great mullein	<i>Verbascum Thapsus</i>								X	X			X	
greater celandine	<i>Chelidonium majus</i>									X				
ground-ivy	<i>Glechoma hederacea</i>									X				
hawkweed sp.	<i>Hieracium</i>										X	X		
hemp dogbane	<i>Apocynum cannabinum</i>	X												
hoary alyssum	<i>Berteroa incana</i>							X						
Japanese knotweed	<i>Reynoutria japonica</i>											X		
lance-leaved coreopsis	<i>Coreopsis lanceolata</i>			X					X					
large hop clover	<i>Trifolium aureum</i>		X								X			
lowbush blueberry	<i>Vaccinium angustifolium</i>										X			
lupine sp.	<i>Lupinus</i>								X					
maiden pink	<i>Dianthus deltoides</i>								X		X			
meadow buttercup	<i>Ranunculus acris</i>								X	X			X	
mouse-eared hawkweed	<i>Pilosella officinarum</i>		X	X						X	X		X	
multiflora rose	<i>Rosa multiflora</i>		X							X				
oriental bittersweet	<i>Celastrus orbiculatus</i>												X	
oxeye daisy	<i>Leucanthemum vulgare</i>	X		X						X				
phloxes	<i>Phlox</i>												X	
pineapple-weed	<i>Matricaria discoidea</i>	X												
primrose sp.	<i>Oenothera</i>		X					X						
purple crownvetch	<i>Securigea varia</i>							X				X		
purple loosestrife	<i>Lythrum salicaria</i>			X										
Queene Anne's lace	<i>Daucus carota</i>	X	X	X					X	X				X
rabbitfoot clover	<i>Trifolium arvense</i>	X								X				X
rabbit-tobacco sp.	<i>Pseudognaphalium</i>			X										

Common Name	Scientific Name	BP	CG	ES	FS	FR	GC	HS	LF	L	OP	RE	TC	TC
red clover	<i>Trifolium pratense</i>	X	X	X					X	X	X		X	
red sand-spurrey	<i>Spergularia rubra</i>	X	X											
ribwort plantain	<i>Plantago lanceolata</i>								X				X	
Robin's-plantain	<i>Erigeron pulchellus</i>												X	
rubus sp.	<i>Rubus</i>											X		
silverrod	<i>Solidago bicolor</i>										X			
silvery cinquefoil	<i>Potentilla argentea</i>	X		X					X					
smooth sumac	<i>Rhus glabra</i>							X						
spotted knapweed	<i>Centaurea stoebe</i>	X												
spreading dogbane	<i>Apocynum androsaemifolium</i>		X										X	
staghorn sumac	<i>Rhus typhina</i>				X									
strawberry sp.	<i>Fragaria</i>		X								X			
sulphur cinquefoil	<i>Potentilla recta</i>	X	X						X	X				
sweet everlasting	<i>Pseudognaphalium obtusifolium</i>		X											
thyme-leaved sandwort	<i>Arenaria serpyllifolia</i>												X	
tower mustard	<i>Turritis glabra</i>		X											
tufted vetch	<i>Vicia cracca</i>							X			X	X		
upright yellow woodsorrel	<i>Oxalis stricta</i>												X	X
white campion	<i>Silene latifolia</i>	X					X			X				
white clover	<i>Trifolium repens</i>	X	X	X				X	X	X	X		X	X
white meadowsweet	<i>Spiraea alba</i>	X		X								X		
whorled loosestrife	<i>Lysimachia quadrifolia</i>											X		
woodsorrel sp.	<i>Oxalis</i>										X			

## **Appendix C: Pollinator Habitat Assessment Form and Guide**



THE XERCES SOCIETY  
FOR INVERTEBRATE CONSERVATION

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Native Bee Conservation

# Pollinator Habitat

## Assessment Form and Guide

### NATURAL AREAS AND RANGELANDS



December 2014

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The Xerces Society for  
Invertebrate Conservation

[www.xerces.org](http://www.xerces.org)



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## Authors

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## Editing and layout

Sara Morris and Emily Krafft. Template by Jessa Kay Cruz, Matthew Shepherd, Ashley Minnerath, and Hailey Walls.

## Cover Photographs

Cover main: California rangeland planted with wildflowers to promote pollinators (photograph by Claudia Street, Glenn County RCD); left: *Megachile* leafcutter bee on native swamp thistle, *Cirsium muticum* (photograph by Sarah Foltz Jordan, The Xerces Society); right: eastern woodland with pollinator-friendly understory (photograph by Jennifer Hopwood, The Xerces Society).

## Photographs

We are grateful to the photographers for allowing us to use their wonderful photographs. Jessa Kay Cruz, The Xerces Society: 2, 9d, 11. Sarah Foltz Jordan, The Xerces Society: 10b, 10c. Jennifer Hopwood, The Xerces Society: 10d. Eric Lee-Mäder, The Xerces Society: 7c, 7d, 9b. Scott Seigfreid: 12. Matthew Shepherd, The Xerces Society: 9a, 9c, 10a. Claudia Street, Glenn County RCD: 3. Mace Vaughan, The Xerces Society: 7a. Katharina Ullmann, The Xerces Society: 7b. The copyright for all photographs is retained by the photographers. None of the photographs may be reproduced without permission from the photographer. If you wish to contact a photographer, please contact the Xerces Society at the address below.



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Regional offices in California, Minnesota, Nebraska, New Jersey, North Carolina, and Texas.

The Xerces Society for Invertebrate Conservation is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. Established in 1971, the Society is at the forefront of invertebrate protection, harnessing the knowledge of scientists and enthusiasm of citizens to implement conservation programs worldwide. The Society uses advocacy, education, and applied research to promote invertebrate conservation.

The Xerces Society is an equal opportunity employer and provider.

# Native Bee Conservation

## Habitat Assessment Form and Guide

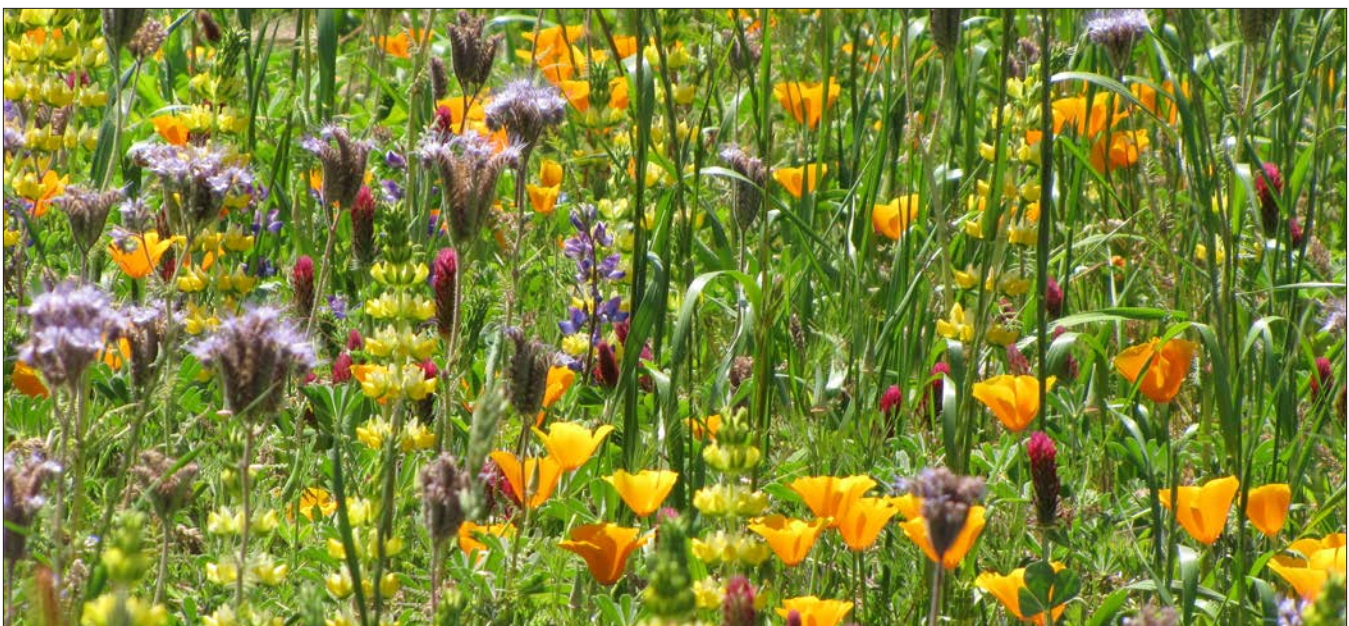
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### Purpose

This tool is meant to help educate conservation planners and landowners, prioritize conservation actions, and quantify habitat or land management improvements on a single site. The goal of this tool is not to compare one site with another. Rather, it is intended to help incorporate pollinator conservation into a landscape management plan and then document improvements in pollinator habitat resulting from specific actions and management practices. As with any tool of this nature, the evaluation and scoring practice is a subjective process, and the usefulness of the tool is dependent upon the consistency of the evaluator. While the goal is to implement changes that will result in an increased final score, there may not always be a viable treatment for individual variables. The scoring goals outlined in the instructions are general guidelines, but the capacity to reach or exceed these goals varies widely in different landscapes and may be refined by state NRCS offices and other conservation agencies for a more regionally specific pollinator habitat assessment guide.

### Instructions

- This pollinator habitat assessment guide is designed for natural areas and rangelands, on public and private lands. If you are working in a farm landscape, please use our *Pollinator Habitat Assessment Form and Guide: Farms and Agricultural Landscapes* (available at: <http://www.xerces.org/wp-content/uploads/2009/11/PollinatorHabitatAssessment.pdf>).
- The accompanying photos and notes will help you identify and assess some specific habitat features.
- An assessment should be done twice, once during the conservation planning process (before project implementation) and once after the plan has been implemented.
- Each item in the assessment should be given a score of 0 if not present or the appropriate value from the “Score” column.
- Prior to conducting an assessment, print out aerial photos to help with site and landscape questions.
- Add up the scores to calculate a subtotal for each subsection (e.g., 4a. Sites for ground-nesting bees).
- Next, add up subsection subtotals to get a total for each section. Transfer these figures into the summary table on page 3 to generate the overall score for each assessment.
- The post-implementation goal is hard to define for the country as a whole. Ideally, landowners/ managers should strive to achieve an overall score of at least 100, and an improvement of at least 40 points. If this is not possible for your region or land management plan, talk to your area biologist, regional ecologist, or planner for guidance.



California pollinator meadow featuring a mix of native wildflowers. Dominant flowers in bloom include California phacelia, California poppies, and golden lupine.

# Site Summary

Owner/ Operator:		Planner:	
Address:		County:	
Dates	Assessment before implementation (existing habitat):		
	Assessment after implementation:		
Define and describe the project area (attach annotated maps; include Ecological Classification System information, if known):			

## Total Score for Habitat Assessment

The figures entered into this summary table will be calculated during completion of the assessment.

	BEFORE	AFTER
<b>Section 1:</b> Landscape Features <i>(max score 20)</i>		
<b>Section 2:</b> Site Features <i>(max score 35)</i>		
<b>Section 3:</b> Foraging Habitat <i>(max score 40)</i>		
<b>Section 4:</b> Native Bee Nesting Habitat <i>(max score 35)</i>		
<b>Section 5:</b> Management Practices <i>(max score 70)</i>		
<b>OVERALL SCORE</b>		



## Section 1: Landscape Features

Characteristics of the broader landscape have a significant influence on wild bee populations and pollination services on adjacent sites. Natural areas in the landscape can also increase the likelihood that new habitat will be colonized by bees. Native plants, especially, are critical for supporting overall pollinator and wildlife diversity.

1a. Percent of natural or semi-natural vegetation within ½ mile of project area (whether on- or off-site). This land use cover includes prairie, shrub lands, woodlands, grasslands, riparian habitat, wetlands, and non-invasive weedy areas. It does NOT include lawn grass, cropland, or overgrazed pasture.

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score (no treatment if off-site)
>30%	10			
20%–30%	7			
5%–20%	3			
<5%	0			
<i>Subtotal (1a)</i>				<b>(1a)</b>

The photos below illustrate the different percent covers.



## Section 1: Landscape Features *continued*

1b. Dominant vegetation in non-cropped area within ½ mile of project area (whether on- or off-site).

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score (no treatment if off-site)
Native plants	10			
Mix of native and naturalized (non-invasive) plants	7			
Naturalized flowering species (e.g., alfalfa)	5			
Mix of native, naturalized, and weedy/ invasive species	3			
Invasive flowering weeds and/ or sod-forming grasses	0			

<i>Subtotal (1b)</i>				
----------------------	--	--	--	--

**Landscape Features Total**

(1a)

(1b)

(1a + 1b)

## Section 2: Site Features

On-site natural areas and other features have a significant influence on pollinator abundance and diversity.

2a. Percentage of target site that is in natural or semi-natural habitat (see 1a for examples).

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
>75%	10			
50%–75%	7			
25%–49%	5			
10%–24%	3			
<10%	0			

<i>Subtotal (2a)</i>				
----------------------	--	--	--	--

(2a)

2b. Additional site features that are present.

Max score of 10.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
Permanent meadows with diverse native wildflowers allowed to bloom	10			
Pasture with >30% non-invasive, bee-friendly forage legumes (e.g., red clover, alfalfa, etc.) allowed to bloom	5			
Source of clean surface water protected from pesticides	5			
Buffers: 1 point for every 20% of area within 25' of water features (e.g., stream, irrigation ditch, pond) that is vegetated, ideally including bee-friendly plants	0–5			

<i>Subtotal (2b)</i>				
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**Site Features Total**

(2b)

(2a + 2b)

Section 2: Site Features



## Section 3: Foraging Habitat

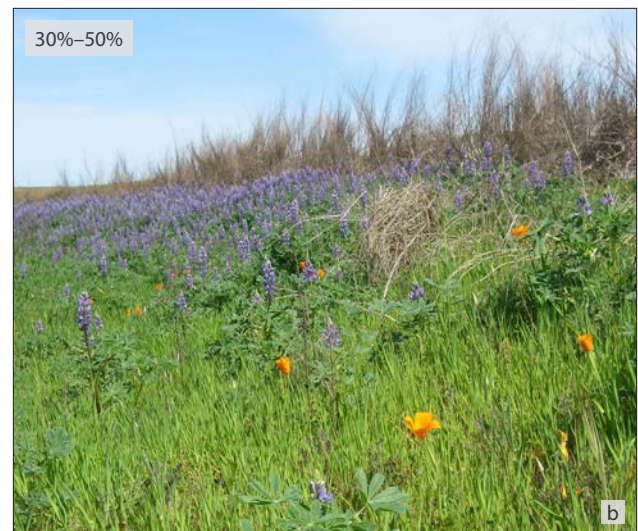
High flower abundance and season long bloom positively influence bee abundance and diversity.

3a. Percentage of vegetative cover that is forbs, flowering shrubs, or pollinator-friendly trees on site. *This does not include invasive or noxious species (e.g., knapweed, purple loosestrife, Canada thistle, yellow star thistle, etc.).*

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
>50% cover	10			
30%–50% cover	7			
20%–30% cover	5			
10%–20% cover	3			
<10% cover	1			
<i>Subtotal (3a)</i>				<b>(3a)</b>

The photos below illustrate some categories. See regional technical notes (listed on page 12) for lists of preferred pollinator plants and other information.



### Section 3: Foraging Habitat *continued*

3b. Number of species of forbs, flowering shrubs, or pollinator-friendly trees on site that bloom in **spring** and support bees. *In rangelands, this includes some forage legumes and cover crops, but does not include invasive or noxious species (see references section for examples).*

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
5+ species (for rangelands) 10+ species (for natural areas)	10			
3–4 species (for rangelands) 5–9 species (for natural areas)	5			
1–2 species (for rangelands) 1–4 species (for natural areas)	3			
0 species	0			
<i>Subtotal (3b)</i>				(3b)

3c. Number of species of forbs, flowering shrubs, or pollinator-friendly trees on site that bloom in **summer** and support bees. *In rangelands, this includes some forage legumes and cover crops, but does not include invasive or noxious species (see references section for examples).*

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
5+ species (for rangelands) 10+ species (for natural areas)	10			
3–4 species (for rangelands) 5–9 species (for natural areas)	7			
1–2 species (for rangelands) 1–4 species (for natural areas)	3			
0 species	0			
<i>Subtotal (3c)</i>				(3c)

3d. Number of species of forbs, flowering shrubs, or pollinator-friendly trees on site that bloom in **fall** and support bees. *In rangelands, this includes some forage legumes and cover crops, but does not include invasive or noxious species (see references section for examples).*

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
5+ species (for rangelands) 8+ species (for natural areas)	10			
3–4 species (for rangelands) 4–7 species (for natural areas)	7			
1–2 species (for rangelands) 1–3 species (for natural areas)	5			
0 species	0			
<i>Subtotal (3d)</i>				(3d)

**Foraging Habitat Total**

(3a + 3b + 3c + 3d)

Section 3: Foraging Habitat

(3a)



## Section 4: Native Bee Nesting Habitat

Native bees have a variety of nesting requirements. About 70% of native bee species in North America nest in the ground, 30% nest in cavities in wood or stems.

4a. Sites for ground-nesting bees. *Ground nests are often marked by a small mound of excavated soil, but may also be nothing more than a small hole in the ground. Nests may be dug in bare soil, areas of patchy vegetation, or hidden among plants. They are usually in marginal areas such as ditch banks or track sides, and frequently can be found on slopes with well-drained soil and good sun exposure. Bumble bees frequently nest in abandoned rodent burrows or under clump-forming bunch grasses.*

Max score of 25.

SCORE ALL OPTIONS THAT APPLY A = abundant, M = moderate, S = scarce	Score	Before	After	Treatment to increase score
Areas of site with undisturbed, well-drained bare ground, or with sparse vegetation (A = >20%, M = 20%–5%, S = <5%)	A = 5 M = 3 S = 1			
Areas with well-drained sandy to sandy/ loam soil (A = >20%, M = 20%–5%, S = <5%)	A = 5 M = 3 S = 1			
1 point for every 10% of area untilled on site	0–10			
Areas of undisturbed (for example, ungrazed) native bunch grasses (clump-forming) (A = >20%, M = 20%–5%, S = <5%)	A = 5 M = 3 S = 1			
<i>Subtotal (4a)</i>				<b>(4a)</b>

The photos below illustrate some ground nests and typical habitat.





## Section 4: Native Bee Nesting Habitat *continued*

4b. Sites for wood- and cavity-nesting bees. *The majority of wood- or cavity-nesting bees nest in pre-existing tunnels or cavities in snags, brush, or the centers of pithy-stemmed shrubs, and large-statured prairie plants.*

Max score of 10.

SCORE ALL OPTIONS THAT APPLY S = scarce, M = moderate, A = abundant	Score	Before	After	Treatment to increase score
Site has dead wood, snags, brush piles, shrubs with hollow or pithy stalks (e.g., elderberry, cane fruit, sumac) and/ or large, sturdy prairie plants with hollow or pithy centers (e.g., <i>Silphium</i> , <i>Solidago</i> , <i>Amorpha</i> ). Note: all of these features may not be appropriate for each habitat type.	S = 1 M = 5 A = 10			
<i>Subtotal (4b)</i>				<b>(4b)</b>

The photos below illustrate some wood- and cavity-nest sites.



Section 4: Native Bee Nesting Habitat

(4a)

Native Bee Nesting Habitat Total

(4a + 4b)

## Section 5: Management Practices

Management practices in and around habitat areas have a significant influence on bee populations.

5a. Pesticide use, including pollinator-toxic insecticides.

Max score of 40.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
Buffer of at least 30' between any insecticide application and habitat areas, either on- or off-site	5			
Invasive weed control, if any, carried out with targeted herbicide applications, rather than broadcast	5			
No use of insecticides on site	30			
If insecticides are used (e.g., for mosquito control, grasshoppers, gypsy moth control), IPM program is in place	10			
If insecticides are used (e.g., for mosquito control, grasshoppers, gypsy moth control), IPM program is in place that specifically addresses pollinator protection	5			
If insecticides are used, spray drift is carefully controlled	5			
If insecticides are used, spray equipment calibrated annually, as per state regulations	5			
<i>Sum all scores above for subtotal (5a)</i>				(5a)

5b. Land management techniques used on the site or in project area. *These questions pertain to ongoing site management as opposed to site preparation. Note 'n/a' if option is not applicable to the site.*

Max score of 30.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
If mowing or haying occurs, then entire disturbed area is limited to 1/3 of habitat per year. Haying or mowing is done patchily, at reduced speeds (<8 mph), with high mower height (12–16"), and in late summer (after peak bloom).	0–10			
If site is grazed, then conservation grazing plan is in place and includes prescribed grazing practices that encourage wildflower diversity/ abundance, such as low intensity grazing, or short duration grazing with long recovery periods.	0–10			
If burning occurs, then entire disturbed area is limited to 1/3 of habitat per year, and a patchy burn approach is used leaving numerous skips and unburned patches. A 3–10 year burn rotation period is used, and the time of year when burning occurs is varied. Rare invertebrate species and their specific needs are considered.	0–10			
<i>Subtotal (5b)</i>				(5b)
<b>Management Practices Total</b>				(5a + 5b)

Section 5: Management Practices





# Habitat Assessment Reference Materials

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## Crops and cover crops that provide pollen and/ or nectar for bees:

Alfalfa, almonds, alsike clover, apples, avocados, apricots, blueberries, buckwheat, canola, cherries, citrus, crimson clover, corn, cotton, cranberries, cucumber, dutch white clover, eggplant, fava beans, macadamia nuts, milkvetch, melons, mustard, peaches, pears, peas, peppers, phacelia, plums, pumpkins, raspberries, red clover, sainfoin, soybean, squash, strawberries, sunflower, tomatoes, vegetable seed, purple vetch, and watermelon. (Note: this list is not exhaustive.)

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## General Pollinator Conservation

### *Pollinator Conservation Resource Center*

The Pollinator Conservation Resource Center includes regional information on plants for pollinator habitat enhancement, habitat conservation guides, nest management instructions, bee identification and monitoring resources, and directories of native pollinator plant nurseries.

[www.xerces.org/pollinator-resource-center/](http://www.xerces.org/pollinator-resource-center/)

### *Attracting Native Pollinators*

A complete guide to the fascinating lives of these vital creatures. The book includes detailed profiles of over 30 commonly encountered bee genera and more than 50 pages of fully-illustrated plant lists that enable you to choose the best plants for your region.

[www.xerces.org/announcing-the-publication-of-attracting-native-pollinators/](http://www.xerces.org/announcing-the-publication-of-attracting-native-pollinators/)

### *Streamlined Bee Monitoring Protocol*

Developed by the University of California–Davis, Rutgers University, Michigan State University, and The Xerces Society, this guide provides instructions for assessing pollinator habitat quality and diversity by monitoring native bees. It was developed for conservationists, farmers, land managers, and restoration professionals to document how native bee communities change over time in pollinator habitats.

[www.xerces.org/streamlined-bee-monitoring-protocol/](http://www.xerces.org/streamlined-bee-monitoring-protocol/)

### *Pollinator Habitat Installation Guides*

These regional guidelines provide in-depth practical guidance on how to install and maintain foraging and nesting habitat for pollinators in wildflower meadow plantings or linear rows of native flowering shrubs. Region-specific seed mixes and plant recommendations are included in the appendices of each guide.

[www.xerces.org/pollinator-conservation/agriculture/pollinator-habitat-installation-guides/](http://www.xerces.org/pollinator-conservation/agriculture/pollinator-habitat-installation-guides/)

### *Pollinators in Natural Areas: A Management Primer*

A fact sheet discussing the importance of pollinators in natural areas, as well as their habitat needs. An extensive list of references is also provided.

[www.xerces.org/wp-content/uploads/2008/11/pollinators\\_in\\_natural\\_areas\\_xerces\\_society.pdf](http://www.xerces.org/wp-content/uploads/2008/11/pollinators_in_natural_areas_xerces_society.pdf)

### *Inside Agroforestry–Windbreaks*

An article about using windbreaks to provide pollinator habitat or to capture pesticide drift.

<http://nac.unl.edu/documents/insideagroforestry/vol20issue1.pdf>

### *Introduced, Invasive, and Noxious Plants*

Federal and state noxious weed lists, invasive plant lists, and introduced plant lists, with links to more information.

<https://plants.usda.gov/java/noxiousDriver>

## Bumble Bee Conservation

### *Conserving Bumble Bees: Guidelines for Creating and Managing Habitat for America's Declining Pollinators*

A publication to help landowners and managers create, protect, and restore habitat for bumble bee populations.

[www.xerces.org/wp-content/uploads/2012/06/conserving\\_bb.pdf](http://www.xerces.org/wp-content/uploads/2012/06/conserving_bb.pdf)

### *Bumble Bee Watch*

A collaborative citizen science effort to track and conserve North America's bumble bees.

[www.bumblebeewatch.org](http://www.bumblebeewatch.org)

## Native Bee Nest Sites Guidelines

### *Tunnel Nest Construction and Management*

Guidelines on the construction and maintenance of nests for tunnel-nesting native bees.

[www.xerces.org/wp-content/uploads/2009/11/tunnel-nest-management-xerces-society.pdf](http://www.xerces.org/wp-content/uploads/2009/11/tunnel-nest-management-xerces-society.pdf)

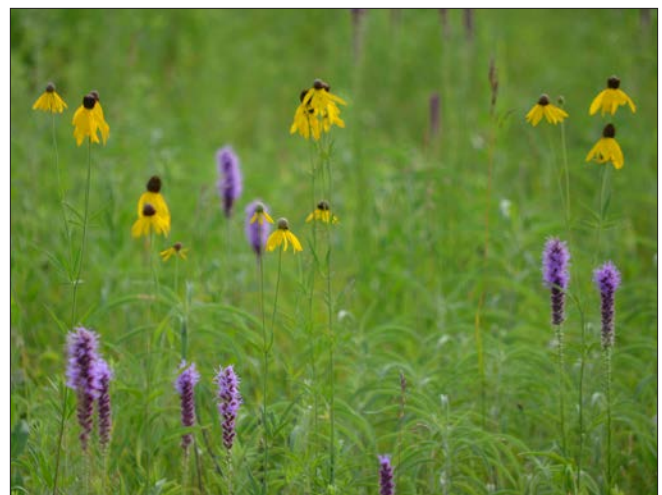
### *Enhancing Nest Sites for Native Bee Crop Pollinators*

This article describes how to provide nesting habitat for native bees.

[www.xerces.org/wp-content/uploads/2011/02/agroforestrynotes34-bee\\_nests1.pdf](http://www.xerces.org/wp-content/uploads/2011/02/agroforestrynotes34-bee_nests1.pdf)

## Coming Soon from the Xerces Society

- *Prescribed Grazing to Increase Pollinator Habitat in the Central United States*
- *Natural Nesting Materials for Native Bees*



This mesic prairie provides both forage and nesting habitat with a mix of native wildflowers and bunch grasses.

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