The Xerces Society
for Invertebrate Conservation

Native Bee Conservation

Pollinator Habitat

Assessment Form and Guide

FARMS AND AGRICULTURAL LANDSCAPES

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The Xerces Society for
Invertebrate Conservation

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Cover Photographs

Above: Mixed annual and perennial insectary strip adjacent to crop fields on Minnesota farm, photograph by Sarah Foltz Jordan, The Xerces Society; *left*: native bees foraging on raspberry (*Rubus* spp.), photograph by Sarah Foltz Jordan, The Xerces Society; *right:* monarch butterfly *(Danaus plexippus*) nectaring on rough blazing star (*Liatris aspera*), photograph courtesy of Peter Gorman, flickr.com.

Photographs

We are grateful to the photographers for allowing us to use their wonderful photographs. Nancy Lee Adamson, The Xerces Society: 2, 12a–d. Brianna Borders, The Xerces Society: 6a. Rob Cruickshank, flickr.com: 9a–c. Jessa Kay Cruz, The Xerces Society: 9d. Sarah Foltz Jordan, The Xerces Society: 9g, 9h. Jennifer Hopwood, The Xerces Society: 3a–c, 9i, 11d. Don Keirstead, New Hampshire NRCS: 11a. Eric Lee-Mäder, The Xerces Society: 7b, 7c, 9f. Tom Potterfield, flickr.com: 5. Debbie Roos, North Carolina State University Extension Service: 11f. Matthew Shepherd, The Xerces Society: 9e. Anne Stine, The Xerces Society: 6b, 11e. Mace Vaughan, The Xerces Society: 7a. South Dakota NRCS: 11c. U.S. Department of Agriculture: 6c. Lesław Zimny, Wikimedia Commons: 11b. 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.

Common eastern bumblebee (*Bombus impatiens*) foraging on peach blossoms (*Prunus persica*) in early spring.

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

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

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 or to use this tool to rank farms in any way. Rather, it is intended to help incorporate pollinator conservation into a 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 use in farm landscapes. If you are working in a natural area or rangeland setting, please use the *Pollinator Habitat Assessment Form and Guide: Natural Areas and Rangelands* (available at: www.xerces.org/pollinatorhabitatassessment_naturalareasrangelands/).
- 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 site feature should be scored with the appropriate value from the "Score" column or a 0 if not present.
- Prior to conducting an assessment, print out aerial photos/ maps to help with site and landscape questions.
- Add up the scores to calculate a subtotal for each subsection (e.g., 5b Insecticide use).
- Next, add up subsection subtotals to get a total for each section. Transfer these figures into the summary table on page 4 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 cropping system, talk to your area biologist, extension agent, or planner for guidance.

Pollinator Habitat in Agricultural Landscapes

Attracting pollinators to farms and orchards is a matter of providing pollen- and nectar-rich resources throughout the growing season. This native perennial insectary strip on Montana grain farm (*a*), provides nesting and foraging habitat for pollinators, beneficial insects, and wildlife. Dominant flowers in bloom include common sunflowers (*Helianthus annuus*), plains coreopsis (*Coreopsis tinctoria*)(*b*), and lacy phacelia (*Phacelia tanacetifolia*)(*c*).

Site Summary

Farm/ Farmer:	Planner:
Address:	County:
Date of assessment before implementation (existing habitat):	
Date of assessment after implementation:	
Describe the location you are evaluating (attach aerial maps):	

Total Score for Habitat Assessment

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

	BEFORE	AFTER
Section 1: Landscape Features *(max score 20)*		
Section 2: Farmscape Features *(max score 45)*		
Section 3: Foraging Habitat *(max score 40)*		
Section 4: Native Bee Nesting Habitat *(max score 45)*		
Section 5: Farm Management Practices *(max score 105)*		
OVERALL SCORE		

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.

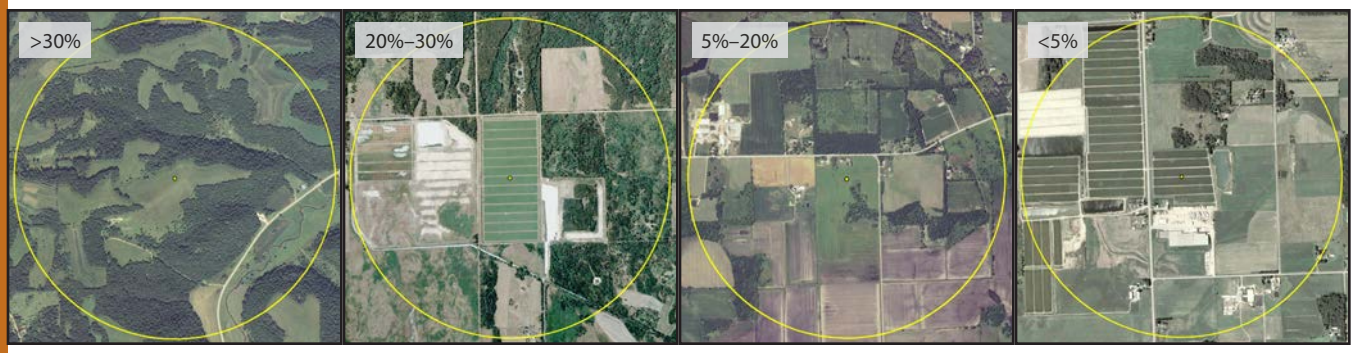
1a. Percent of natural or semi-natural vegetation within ½ mile of farm. This land use cover includes prairie, shrub lands, woodlands, grasslands, riparian habitat, and wetlands. It does NOT include lawn grass, invasive or weedy vegetation, or overgrazed pasture (areas where flowers are scarce).

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			
Subtotal (1a)				

(1a)

The photos below illustrate the specified percentages of cover.



1b. Dominant vegetation in non-cropped area within ½ mile of farm.

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., clover or alfalfa)	5			
Mix of native, naturalized, and weedy/ invasive species	3			
Invasive flowering weeds and/ or sod-forming grasses	0			
Subtotal (1b)				

(1b)

Landscape Features Total

(1a + 1b)

Section 1: Landscape Features

Section 2: Farmscape Features

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

2a. Percentage of farm 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
>10%	10			
6–9%	7			
3–5%	5			
1–2%	3			
0%	0			
Subtotal (2a)				

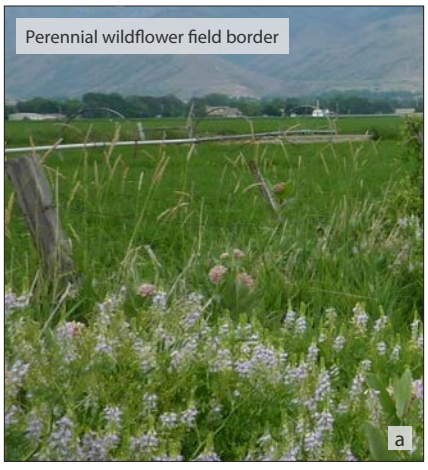
(2a)

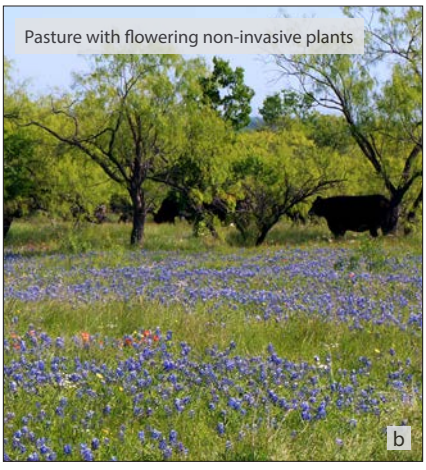
2b. Additional farm features that are present. See below for examples. *Note 'n/a' if option is not applicable to the farm.*
Max score of 35.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
Permanent meadows, field borders, or perennial insectary strips with diverse native wildflowers allowed to bloom	5			
Pasture with >30% non-invasive flowering plants (e.g., red clover, alfalfa, etc.) allowed to bloom	5			
Woodlands, hedgerows, or brushy areas adjacent to cropped areas, composed of diverse, primarily native trees/ shrubs	5			
Windbreaks composed of coniferous trees or shrubs (non-pollinator attractive) to reduce pesticide drift	5			
Source of clean surface water protected from pesticides	5			
Riparian buffers or filter strips that include flowering plants	5			
Annual flowering cover crops allowed to bloom, annual bee pasture, insectary strips or bolting crops allowed to bloom	5			
Subtotal (2b)				

(2b)

The photos below illustrate some habitats used by pollinators for shelter, egg-laying, and overwintering.





Farmscape Features Total

(2a + 2b)

Section 3: Foraging Habitat‡

Diversity and abundance of flowering plants, particularly native plants, and season-long bloom positively influence bees.

3a. Percentage of vegetative cover (non-crop area) that is wildflowers, flowering shrubs, or pollinator-friendly trees on site, including living quarters/ gardens.

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			
Subtotal (3a)				

(3a)

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

3b. Number of **spring**-blooming species of wildflowers, flowering shrubs, or pollinator-friendly trees on farm that support bees.

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
7+ species	10			
4–6 species	6			
1–3 species	3			
0 species	0			
Subtotal (3b)				

(3b)

3c. Number of **summer**-blooming species of wildflowers, flowering shrubs, or pollinator-friendly trees on farm that support bees.

Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
7+ species	10			
4–6 species	6			
1–3 species	3			
0 species	0			
Subtotal (3c)				

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‡*This does not include invasive or noxious species (e.g., knapweed, purple loosestrife, Canada thistle, yellow star thistle, etc.).*

Section 3: Foraging Habitat *continued*

3d. Number of **fall**-blooming species of wildflowers, flowering shrubs, or pollinator-friendly trees on farm that support bees.
Max score of 10.

SELECT ONLY ONE	Score	Before	After	Treatment to increase score
5+ species	10			
3–4 species	6			
1–2 species	3			
0 species	0			
Subtotal (3d)				
Foraging Habitat Total				

(3a + 3b + 3c)

(3d)

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

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, while 30% nest in cavities in wood or stems. Protecting existing nests and nesting habitat is important.

Section 4: Native Bee Nesting Habitat

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. (See page 9 for examples.)*
**Score as follows: Abundant=5, Moderate=3, Scarce=1, Lacking=0*
Max score of 25.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
1 point for every 10% of area untilled on site	0–10			
Areas of undisturbed native bunch grasses (clump-forming) in the vicinity of cropped areas	0–5*			
Areas with untilled, uncompacted, well-drained ground, either bare or with sparse vegetation	0–5*			
Rock piles, borders, or walls in the vicinity of cropped areas	0–5*			
Subtotal (4a)				

(4a)

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. Bumble bees frequently nest in abandoned rodent burrows or under clump-forming bunch grasses.* Note: *these questions pertain to ongoing site management as opposed to site preparation. (See page 9 for examples.)*
**Score as follows: Abundant=10, Moderate=5, Scarce=1, Lacking=0*
Max score of 20.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
Dead wood, snags, and/ or brush piles in the vicinity of cropped areas	0–10*			
Shrubs or woody plants with hollow or pithy stalks (e.g., elderberry, raspberry, sumac) and/ or large, sturdy prairie plants with hollow or pithy centers (e.g., *Silphium*, *Amorpha*)	0–10*			
Subtotal (4b)				
Nesting Habitat Total				

(4b)

(4a + 4b)

Native Bee Nests & Nesting Habitat

Approximately 70% of North American native bee species nest in the ground (*a*), many underneath or close to foraging habitat, whereas the remaining 30% nest in cavities in wood (*b*) or plant stems (*c*). The nesting needs for different species vary, but most commonly prefer locations that have good sun exposure and will remain well-drained or undisturbed.


a


b


c

Habitat should be placed adjacent to crops or areas of the farm where pollinators are most needed. While certain pollinators can travel a considerable distance to colonize agricultural fields—bumble bees may travel up to two miles while foraging—many smaller native bee species will only travel a few hundred feet or less. As such, habitat should be created as close to the target crop as possible, provided it remains protected from pesticide drift. For more information on installing pollinator habitat, see the *Reference Materials* (page 12). The photos below illustrate common habitat used by native bees for nesting sites.


Undisturbed native bunch grasses

d


Untilled, well-drained ground with sparse vegetation

e


Bare, untilled and well-drained ground

f


Rock pile

g


Snag with bee nests

h


Plant with hollow or pithy centers

i

Section 5: Farm Management Practices

Pest management practices, pesticide use, and land management practices in and around habitat areas have significant influence on bee populations.

Section 5: Management Practices

5a. Non-chemical crop and pest management techniques used on the farm. *Note 'n/a' if option is not applicable.*

Max score of 25.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
Farm exhibits high crop diversity and/ or whole-farm diversity, naturally limiting pest outbreaks	5			
Growing conditions optimize plant health, limit plant stress, and improve pest resistance	3			
Resistant crops and varieties are selected	3			
Crop rotation is used to break pest and disease cycles and improve plant health	3			
Planting times are altered to reduce overlap between major pests and sensitive stages of plants	3			
Sanitation is practiced (i.e., removing or destroying infested fruit or plants)	3			
Use of practices to support beneficial insects (e.g., cover-cropping, intercropping, tolerating low levels of pests)	5			
Subtotal (5a)				

(5a)

5b. Insecticide use.

Max score of 50.

SCORE ALL OPTIONS THAT APPLY	Score	Before	After	Treatment to increase score
No use of insecticides (including organic-approved products). (*Proceed to Section 5c.*)	50			
If pesticides are used:				
Most pest issues are addressed by non-chemical methods (e.g., use of row-covers, plant collars, pheromone traps, mating disrupters, hand-picking, etc.)	5			
No soil fumigation	3			
Minimum 30′ buffer between applications and habitat areas	3			
Insecticides with lowest toxicity to pollinators are prioritized	3			
Applications are made when pest pressure warrants, based on scouting and economic thresholds	3			
Application only occurs outside of crop bloom period	3			
Mowing is used to reduce bloom in any adjacent or understory habitat subject to drift	3			
Spraying occurs only in calm conditions (e.g., ≤9 mph winds)	3			
Spraying only occurs at night	3			
Specialized spray equipment is used to reduce drift (e.g., electrostatic or hooded sprayers)	3			
Spray equipment is calibrated regularly	3			
Subtotal (5b)				

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Section 5: Farm Management Practices *continued*

5c. Land management techniques used in habitat on the farm. *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 farm includes natural areas or pollinator habitat, burning, mowing or haying is limited to ⅓ of habitat per year when feasible. Haying or mowing is done with high mower height (1–6"), and in late summer (after peak bloom). A 3–10 year burn rotation period is used, and the time of year when burning occurs is varied	10			
If farm includes rangeland or pasture, prescribed grazing practices that encourage wildflower diversity/ abundance, such as low-intensity grazing, or short-duration grazing with long recovery periods are used	10			
If farm has orchards, vineyards, or row crops, disturbance in field borders is performed infrequently and only to enhance habitat quality	10			
Subtotal (5c)				
Farm Management Practices Total				

(5a + 5b)

(5c)

(5a + 5b + 5c)

Farm Management Practices for Pollinator Conservation

Some common farm management practices can cause harm to pollinators— such as insecticide use or mowing. Ideally, farm and land management should be adapted to consider the nesting and foraging needs of native bee populations. For more information on pollinator-friendly farm and land management practices, see the *Reference Materials* (page 12).

Habitat Assessment Reference Materials

General Pollinator Conservation

Pollinator Conservation Resource Center
The Resource Center includes regional information on plants for pollinator habitat enhancement, habitat conservation guides, nest management instructions, bee identification and monitoring resources, and more.
www.xerces.org/pollinator-resource-center/

Attracting Native Pollinators
A complete guide to pollinators, including profiles of 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/

Pollinator Plant Lists
Recommended native plants that are highly attractive to pollinators such as native bees, honey bees, butterflies, moths, and hummingbirds, and are well-suited for small-scale plantings.
www.xerces.org/pollinator-conservation/plant-lists/

Streamlined Bee Monitoring Protocol
Designed for conservationists, farmers, land managers, and restorationists, this guide provides instructions for assessing pollinator habitat quality and diversity by monitoring native bees.
www.xerces.org/streamlined-bee-monitoring-protocol/

Conserving Bumble Bees
A publication to help landowners and managers create, protect, and restore habitat for bumble bee populations.
www.xerces.org/bumblebees/guidelines/

Habitat Installation & Assessment

Pollinator Habitat Installation Guides
Regional guidelines provide in-depth practical guidance on how to install and maintain habitat for pollinators, along with region-specific plant recommendations.
www.xerces.org/pollinator-conservation/agriculture/pollinator-habitat-installation-guides

Xerces Society Habitat Assessment Guides
These habitat assessment guides are designed to help conservation planners and landowners prioritize conservation actions and quantify habitat or land management improvements for pollinators or beneficial insects.
www.xerces.org/habitat-assessment-guides

Farm Management Guidelines

Farming for Bees
A guide that outlines ways to protect and enhance habitat for native crop pollinators in the farm landscape.
www.xerces.org/guidelines-farming-for-bees/

How to Reduce Bee Poisoning from Pesticides
From Pacific Northwest Extension, this publication includes common agricultural pesticides and their known effects on bees.
https://catalog.extension.oregonstate.edu/pnw591

"Windbreaks designed with pollinators in mind," Inside Agroforestry Vol. 20, Issue 1
This article from the National Agroforestry Center explains how to install windbreaks to benefit pollinators.
http://nac.unl.edu/documents/insideagroforestry/vol20issue1.pdf

Agronomy Technical Note No. 9: Preventing Negative Impacts of Pesticides on Pollinators
This USDA Natural Resources Conservation Service manual provides NRCS staff and IPM professionals with guidance on conservation strategies that can reduce the risk of pesticides to bees.
http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=34828.wba

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

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

Enhancing Nest Sites for Native Bee Crop Pollinators
This article describes how to provide nesting habitat for native bees.
http://plants.usda.gov/pollinators/Enhancing_Nest_Sites_For_Native_Bee_Crop_Pollinators.pdf

Pollinator-Friendly Crops

Many crops and cover crops provide pollen and/ or nectar for bees: alfalfa, almonds, alsike clover, apples, avocados, apricots, blueberries, buckwheat (*a*), canola, cherries, citrus, crimson clover, corn, cotton, cranberries, cucumber, dutch white clover, eggplant, fava beans, macadamia nuts, milkvetch, melons, mustard, peaches (*page 2*), pears, peas, peppers, phacelia (*3c*), plums, pumpkins, raspberries (*b*), red clover (*c*), sainfoin, soybean, squash, strawberries, sunflower, tomatoes (*d*), vegetable seed, purple vetch, and watermelon.
Please note: this list is not exhaustive.