Bee Better Certified™

Production Standards

Bee Better Certified™ works to give bees a healthy place to live.

beebettercertified.org

Cover photo: Long-horned bee foraging on plains coreopsis planted in beneficial insect habitat on a farm in Montana (The Xerces Society/Jennifer Hopwood).

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Bee Better Certified™ Production Standards

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Appendices

A list of appendices is on page 13.

At its core, Bee Better Certified is about ensuring adequate habitats for bees on working farms. The habitats need to be rich in wildflowers and protected from pesticides. (The Xerces Society/Kelly Gill.)

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Getting Started

Develop a Bee Better Certified™ Plan (BBCP) that details how your operation meets the Production Standards. The plan must be submitted to the certifier upon application for Bee Better certification and made available during farm inspections. Provide annual updates to the certifier to capture any changes to farm management that are related to the Bee Better Certified standards.

The production standards are divided into four sections:

- pollinator habitat,
- pesticide mitigation,
- managed bumble bees, and
- record keeping.

The requirements must be met in all four sections to achieve certification.

Definitions of significant terms or phrases are included with each standard. For explanations of additional terms or phrases, please see the glossary in Appendix R.

1 Pollinator Habitat

1.1 Habitat Minimums

a. All certified operations are required to have at least 5% of their total acreage requested for certification in pollinator habitat.
    i. At least one-fifth of the required habitat (i.e., 1% of the parcel acreage) must be permanent habitat; the reminder may be in temporary habitat.
    ii. If mass-flowering, pollinator-attractive crops are identified as part of the temporary habitat, they may not account for more than one-fifth of the required habitat (i.e., no more than 1% of the parcel acreage).
    iii. Habitat measurements must follow the Habitat Measurement Guidelines in Appendix B.
    iv. The land where habitat is created must be owned and/or controlled by the certifying farm or operator and available for habitat management and inspection.
    v. Pollinator habitat must be on or adjacent to or within 1 mile of certified crop fields.
    vi. If certified acreage is comprised of disconnected parcels, pollinator habitat should be distributed throughout the parcels, and the sum of the habitat established on all parcels must meet the 5% minimum.
    vii. Do not plant pollinator habitat in locations where nitroguanidine neonicotinoids were applied in the previous two years. Application includes the planting of seeds treated with nitroguanidine neonicotinoids.

Definitions
Pollinator habitat is defined as areas containing flowering plants and/or nesting sites. Remnant natural habitat and newly created habitat are both considered pollinator habitat. Invasive or noxious species cannot be considered part of pollinator habitat.

Permanent habitat is present year-round, although the plants may be in a vegetative or dormant state during the winter. Examples of permanent habitat: hedgerows, perennial or re-seeding wildflower strips, riparian forests, and filter strips.

Temporary habitat typically dies back annually. It may remain in one location or move around the certified parcels (as is the case with rotating cover crops). Temporary habitat must be allowed to bloom. Examples of temporary habitat: cover crops, insectary strips, mass-flowering crops. For cover crops, at least 50% bloom must be achieved prior to termination.

Mass-flowering crops provide abundant floral resources during their bloom period, which is often short. Examples of mass-flowering crops: almond, blueberry, canola, and sunflower. When differentiating between mass-flowering crops and temporary habitat, we consider whether the crop a) was already a core part of the crops planted, and b) whether the primary purpose of the crop is revenue.

Relevant Appendices
Appendix A: On-farm Habitat Practices that can be Managed to Support Pollinators.
Appendix B: Habitat Measurement Guidelines.

1.2 Bloom

a. Permanent habitats must have a minimum of 3 flowering species present during each season (spring, summer, and fall).
b. Permanent pollinator habitat must contain a significant proportion of native, pollinator-attractive plants.
    i. For new permanent habitat, at least 70% of the vegetation established must be native to the region and acquired from local sources.
    ii. In natural or mature created permanent habitats, at least 35% of the species must be native.
c. The combined vegetative cover of the plant species in bloom should be classified "abundant" or "common" in each season
    i. Abundance Categories:

        Abundant: Numerous individuals of the flowering species are present (51–100% cover).

        Common: Several individuals of the flowering species are present (11–50% cover).

        Sparse: Only a few individuals of the flowering species are present (1–10% cover).

        Absent: No flowering species are present (0% cover).

Definitions
Flowering species can include trees, shrubs, or forbs known to provide pollen and/or nectar to pollinators.

Native plants are species that are indigenous to a region, i.e., those that occur naturally without human intervention.

New habitat is any habitat less than 3 years old or habitat created following initial certification by a farm entity.

Relevant Appendix
Appendix C: Bloom Abundance Categories

1.3 Sourcing Plants and Seed

a. Plant materials for new permanent pollinator habitat should be obtained from ecologically appropriate sources.
    i. Source plant materials from within 150 miles of your property; if no plant sources are available with this radius, document which suppliers you contacted and expand the radius to 300 miles.
        1. Contact at least 3 suppliers within 150 miles of your property, if that many are present within that radius.
    ii. If ecologically appropriate plant materials are available from sources outside the noted radii, provide documentation that they were collected from a similar climatic or ecological region to the one present on your property.
    iii. Document the native status of all plants purchased. Native plant materials are always preferred to nonnative seed and, when available, should be prioritized.

Definition
Ecologically appropriate sources are plants collected from similar climatic or ecological region to the one present on your property.

1.4 Nesting Features

a. Pollinator nesting sites must be identified and protected.
    i. Known nesting areas outside crop fields must be left undisturbed.
    ii. Identified nesting areas must be marked on a map and, if necessary, physically flagged to identify them to farm workers.
    iii. Employees must be trained in the location and protection of nest sites.
b. At least 5% of new permanent pollinator habitat plantings must be comprised of pithy-stemmed plants, plants that are used for nest cell materials, and butterfly host plants; some of each category must be included.

Relevant Appendices
Appendix D: Identifying Native Bee Nests
Appendix E: Pithy-Stemmed Plants that Above-Ground Nesting Bees Use for Nest Sites
Appendix F: Plants that Above-Ground Nesting Bees use as Nesting Materials to Create Cell Divisions
Appendix G: Butterfly Host Plant Resources

1.5 Tillage

a. Develop a standard operating procedure (SOP) for how to reduce the impact of tillage activities on ground-nesting bee nests located both within crop fields and in non-crop areas.
    i. The SOP should demonstrate that existing tillage practices are low risk or that new practices reduce the risk of disturbance to ground-nesting bees.
    ii. The SOP should encompass at least one-third of the total certified acreage each year.
    iii. The SOP must address at least two of the following:
        1. Tillage depth
        2. Timing of tillage
        3. Frequency of tillage
        4. Equipment type
        5. Location of tillage

Relevant Appendix
Appendix H: Example Tillage Standard Operating Procedures (SOPs).

2 Pesticide Mitigation

2.1 Preventive Non-Pesticide Management

a. Develop a written pest/disease scouting and monitoring protocol and demonstrate that scouting and monitoring occurs.

b. Implement and maintain at least 2 preventive non-pesticide pest management strategies.

    i. Select strategies from the Bee Better Certified non-pesticide management strategies list.

Relevant Appendices
Appendix I: Pest Scouting and Monitoring Guidance.
Appendix J: List of Approved Non-Pesticide Management Strategies.

2.2 Pesticide Application

a. There must be no unjustified use of pesticides.

    i. A justified use must be supported by evidence that a severe pest or disease outbreak exists or has strong potential to exist.

    ii. Farm-specific scouting and monitoring records can be used to demonstrate an outbreak. Additional documentation (e.g., extension publications, newspaper articles) that supports the severity of the issue may also be submitted.

    iii. Documentation should provide evidence that an economic threshold has been exceeded. If no threshold is available, provide an expert opinion. Experts may include a certified pest control adviser, accredited crop consultant, extension agent, or other credentialed independent pest management specialist. Advice or recommendations from pesticide or seed company representatives is not considered sufficient evidence to justify pesticide use.

    iv. Even if use is shown to be justified, growers must follow all other Bee Better Certified pesticide mitigation standards.

b. Do not apply any pesticides classified by the U.S. Environmental Protection agency (EPA) as highly toxic or moderately toxic to bees during bloom for crops that are visited by or pollinated by insects.

c. Do not make foliar applications of certain DeMethylation Inhibitor (DMI), multi-site contact activity, or carboxamide fungicides during bloom for crops that are visited by or pollinated by insects.

d. Never apply within three days of one another pesticides that jointly may increase toxicity to bees.
    i. Use the online Bee Precaution pesticide rating tool from University of California Statewide Agricultural & Natural Resources Integrated Pest Management Program to determine if there is potential for a pesticide combination to increase toxicity.
e. Do not use nitroguanidine neonicotinoids (clothianidin, dinotefuran, imidacloprid, and thiamethoxam).
    i. This ban includes the planting of treated seeds.
f. Do not use genetically modified crops that express pesticides or are resistant to herbicides.
g. Do not use soil fumigants.

Definitions
Pesticides are any substance or mixture of substances intended for preventing, destroying, repelling or mitigating a pest or disease. Pesticides can also be plant regulators, defoliants, desiccants, or nitrogen stabilizers. The term pesticide includes bactericides, fungicides, herbicides, insecticides, miticides, molluscicides, nematicides, and piscicides.

Pesticide applications include any activity that introduces a pesticide into the environment for the purposes of controlling pests, including but not limited to spraying, dusting, and chemigation. We also consider the planting of pesticide-coated seed a pesticide application.

Bloom is defined as the time period from when first blooms open until petal drop or closure of all blooms (e.g., squash blossoms are open for a single day, but spent flowers can remain attached for a long period after they cease to be viable). See Appendix K for a list of exempt crops, those that are not visited by insects and that do not bloom (e.g., leafy greens not grown for seed production).

Relevant Appendices
Appendix K: List of Pesticides Rated by the EPA as Moderately or Highly Toxic to Pollinators
Appendix L: List of Restricted Fungicides
Appendix M: Crops that are Exempt from Bloom-Time Pesticide Application Standard
Appendix N: Bee Precaution Use Instructions
Appendix O: List of Soil Fumigants

2.3 Minimizing Off-Site Movement of Pesticides

a. No aerial pesticide applications.
b. Calibrate application equipment according to manufacturer specifications at least on an annual basis.
c. Establish a pesticide-free buffer around permanent pollinator habitat.
    i. Spatial buffers should meet the following minimum widths:
        1. 40 feet for ground-based applications, except airblast.
        2. 60 feet for airblast applications.
        3. 125 feet for seed treated with nitroguanidine neonicotinoids.
    ii. Vegetative buffers (drift fences) of species that are not attractive to pollinators may be used instead of spatial buffers, or if spatial buffer distances cannot meet the above requirements.
        1. Vegetative buffers should be comprised of densely planted, small-needled evergreen species.
        2. Airflow must be maintained within vegetative buffers.
        3. Vegetative buffers should be designed to grow above spray release height. Until the buffer is above spray release height any pesticide applications on your property must be in accordance with the drift and runoff precautions on the label in order to minimize potential for movement into permanent pollinator habitat.
    iii. Buffers are required within your own property, as well as between new permanent pollinator habitat on your property and neighboring farms or land where insecticides are known or suspected to be applied.
        1. When insecticide application practices on neighboring properties change following permanent habitat creation on your parcels, spatial buffer requirements can be waived, although when feasible, we recommend incorporating a vegetative buffer.
        2. When permanent habitat is adjacent to farms containing canola, corn, cotton, soy, sunflower, and wheat, seed treatment buffer requirements must be adhered too unless there is proof that neighboring farms are not treated with nitroguanidine neonicotinoids (e.g., they are certified organic).
    iv. Herbicides (except paraquat dichloride) may be applied within buffers.

Definitions
A *spatial buffer* is an unsprayed space, such as roads or equipment turnarounds, or a section of crop that remains unsprayed.

A *vegetative buffer* is a border of plants not attractive to pollinators, such as conifers, grown between pollinator habitat and crop fields. It is designed to capture pesticide drift.

Relevant Appendix
Appendix P: Vegetative Pesticide Buffer Candidate Species.

2.4 Pesticide Use in Pollinator Habitat

a. Do not use pesticides other than herbicides in designated permanent pollinator habitat.
    i. Do not apply herbicides to plants in bloom, including weeds.
    ii. Paraquat dichloride may not be used within permanent pollinator habitat.
b. Do not apply highly or moderately toxic pesticides as classified by U.S. EPA or herbicides to temporary blooming in-field habitat (e.g., cover crops, insectary strips) or to crops with temporary in-field blooming habitat growing beneath or adjacent.
    i. If pesticide applications need to occur during the bloom period of temporary in-field habitats, mow or otherwise remove blooms at least 24 hours prior to any pesticide applications.

3 Managed Bumble Bees

3.1 Use of Commercial Bumble Bees

a. Do not use commercial bumble bees for open field pollination. Commercial bumble bees may only be used in secure indoor facilities, such as screened greenhouses, in which they are not able to interact with wild bumble bees.
   i. Carefully screen or seal vents and other greenhouse entrances to prevent individual bumble bees from entering or exiting the facility.

b. Only use native managed bumble bee species that are produced within their native ranges.
   i. Use queen excluders on all colonies.
   ii. After crop bloom, do not release any individuals from commercially acquired bumble bee colonies into the wild.
   iii. Properly dispose of all individuals through incineration, freezing, or hot soapy water (complete submersion for at least two minutes).
   iv. Dispose of materials (pollen, nectar, bedding, and cardboard) through incineration. Do not burn plastic materials, but dispose of in sealed trash bags.

Relevant Appendix
Appendix Q: Distribution Maps of Commercially Managed Bumble Bees

4 Record Keeping

3.1 Record Keeping

The following records must be submitted with your Bee Better Certified Plan and made available to inspectors during on-site inspections.

a. Habitat records
   i. Provide 8.5″ x 11″ map(s) of the parcels to be certified. The map may be an Assessor's Parcel Map, an aerial photo, or other map that clearly shows the boundaries of the parcel. The following information must also be included on the map:
      - Parcel name or code
      - Indication of north
      - Locations of temporary habitat with identifiers
      - Locations of permanent habitat with identifiers
      - Locations of spatial and vegetative buffers
      - Neighboring land uses to permanent habitat areas
      - Useful landmarks (e.g., other buildings, distinctive features, etc.)
      - Location of known nest sites, as applicable
      - Location of tillage practices described in this plan
      - Location of greenhouses where commercial bumble bees are housed, as applicable
   ii. Use the Plant Material Sourcing Record to document plant material origin and native status.
   iii. Include planting specifications and/or seed mixes, using the Plant List Record.
b. Pesticide mitigation records
   i. Pest scouting and monitoring protocol. Additional information can be found Appendix I: Pest Scouting and Monitoring Guidance.
   ii. Maintain records of pest monitoring and scouting. Examples are provided Appendix I: Pest Scouting and Monitoring Guidance. Records must contain the following information:
      - Crop
      - Pest
      - Date

- Number counted or severity category (low/moderate/high; define how categories relate to action threshold)
- Unit (e.g., per leaf, per plant, per row)
- Whether action threshold defined in protocol was reached

iii. Maintain records of preventative non-pesticide management strategies using the Non-Pesticide Strategies Record-Keeping Template.

iv. Maintain all pesticide application records, including the planting of seeds treated with pesticides.

1. If your state requires reporting, you may use those forms, otherwise, use the Pesticide Use Record form.

v. Other documentation to support a justified use, including the name, license number (if applicable) and contact information for experts. For more details on required information and expert qualifications, see Appendix I: Pest Scouting and Monitoring Guidance.

vi. Maintain all seed purchase records and make them available upon request from the certifier and at inspection.

c. Bumble bee records

i. Maintain records of all colony purchases, steps taken to secure greenhouses, and disposal dates/procedures.

Relevant Appendix
Appendix I: Pest Scouting and Monitoring Guidance

Appendices

Appendix A

On-farm Habitat Practices that can be Managed to Support Pollinators

Native flowering plants must be a major component of habitat plantings for it to be considered pollinator habitat. It is critical to manage pollinator plantings over time in order for them to maintain their value. The Farm Bill provides access to technical advice and cost-share funding for on-farm conservation practices, many of which can be used to benefit pollinators. Some practices listed below, such as Pasture and Hay Planting, need to be managed specifically to benefit pollinators; if they are hayed during bloom, pollinators could be harmed or killed by equipment. If a planting is being added to control pesticide drift, do not include flowering species. Instead include non-attractive vegetation such as pine trees whose needles are capable of catching drift droplets (see Appendix G: Vegetative Pesticide Buffer Candidate Species). Specific guidance on pollinator habitat management will be provided in Bee Better Certified™ Conservation Plans.

The following list is adapted from Table 3 in "Using Farm Bill Programs for Pollinator Conservation" USDA Technical Note No. 78. All practices are as defined by the Natural Resource Conservation Service (NRCS).

[N] = Practice likely to also bolster nest sites.

Permanent Pollinator Habitat

Channel Bank Vegetation [N]
Conservation Cover (aka wildflower meadow) [N]
Constructed Wetland [N]
Contour Buffer Strips [N]
Critical Area Planting [N]
Field Border [N]
Grassed Waterway
Hedgerow Planting [N]
Pasture and Hay Planting
Range Planting [N]
Restoration and Management of Declining Habitats [N]
Riparian Forest Buffer [N]
Riparian Herbaceous Cover [N]
Silvopasture Establishment
Stream Habitat Improvement and Management

Streambank and Shoreline Protection
Tree/Shrub Establishment [N]
Upland Wildlife Habitat Management [N]
Vegetative Barriers
Wetland Enhancement [N]
Wetland Restoration [N]
Wetland Wildlife Habitat Management [N]
Windbreak/Shelterbelt Establishment or Renovation [N]

Temporary Pollinator Habitat

Alley Cropping (if crop blooms)
Cover Crop (including insectary strips)
Herbaceous Wind Barrier
Mass-flowering crops [N]
Multi-Story Cropping

Additional Practices that Augment or Protect Nesting Habitat

Residue and Tillage Management, No-Till/Strip Till/Direct Seed

Appendix B

Habitat Measurement Guidelines

Convert all measurements from feet to acres following initial calculation.

Linear habitat features (e.g., hedgerows, beetle banks)

Single row: Length (in linear feet) x 10 ft

Double row: Length (in linear feet) x 20 ft

Other habitat areas (e.g., wildflower meadows, insectary strips)

Length x width

Note: if the habitat has non-linear edges, you can approximate measurements

Individual plants

Expected mature plant size, squared

For example, a shrub expected to reach 4 ft width at maturity would take up 16 sq. ft. of space.

Understory habitat (e.g., alley crops)

Length x width

Note: This covers where the habitat is actually located; do not include cropped areas between habitat rows.

Appendix C

Bloom Abundance Categories

Abundance categories:

Abundant: Numerous individuals of the flowering species are present (51–100%).
Common: Several individuals of the flowering species are present (11–50%).
Sparse: Only a few individuals of the flowering species are present (1–10%).
Absent: No flowering species are present (0%).

Examples of application of this standard

a. A wildflower meadow in spring has six native species in bloom, with a combined cover of 70% (classification = abundant);
b. A hedgerow in fall has three species in bloom with a combined cover of 15% (classification = common).

The Xerces Society/Jessa Kay Cruz (all photos)

Appendix D

Identifying Native Bee Nests

Ground-nesting bees

Ground nesting bees can be found along field margins as well as within fields themselves, particularly if the field contained bee-attractive crops. They even nest on compacted dirt roads. Bees nest in both flat areas and on slopes. They prefer well-drained soils that don't contain too much sand or clay. Sandy soils tend to cause nest collapse while clay soils can get too wet.

To find nests in the ground, look for circular holes in bare or lightly vegetated areas. Hole sizes range from the diameter of a pencil eraser to the width of a pencil tip. Another indicator of a bee nest is a tower of excavated mud—called a tumulus— around the entrance. Some nests that are being actively excavated may contain loose soil around the entrance similar to an ant nest, but the circle of soil is comprised of soil of varying grain size. This loose soil often blows away over time.

While most ground-nesting bees are solitary, some bee species will nest in close proximity to one another. These nest aggregations can be easy to locate because they are abuzz with activity of hundreds of bees excavating and provisioning their nests. Sometimes aggregations appear in the same location year after year, but in some cases, the bees may move locations periodically to avoid building up too many parasites. If you notice bees have disappeared from a known nesting site, look around to see whether they have moved to a different area of your farm.


The Xerces Society/Eric Lee-Mäder


The Xerces Society/Hillary Sardiñas


The Xerces Society/Mace Vaughan

Above-ground nesting bees

Above-ground nesting bees nest in wood or pithy-stemmed plants. Examine dead wood, such as rafters, fence posts, or snags for open circular cavities, holes capped with mud, leaves, or a resin-like material. This indicates finishes nests. Be aware that some native wasps will also cap their nests with mud. You can also look for holes in the tops or sides of hollow stemmed plants such as elderberry or blackberry. If you are pruning a pithy-stemmed plant (for a list of plants bees nest in see Appendix E), leave long branches as most bees need at least 6 inches in order to complete their nest.


The Xerces Society/Jennifer Hopwood

Bumble bees

Bumble bee nest can be challenging to find, in fact, in England they have trained dogs to sniff out nest locations. Abandoned rodent burrows, especially at the base of woody plants or trees tend to be preferred locations. Native bunch grasses can also create cavities beneath them when they mature, which can also host bumble bee colonies. Less frequently, bumble bees nest in cavities in trees or houses. Bumble bee colonies tend to move locations every year, so if you found a nest location in one year, it might not get occupied again for a few years.

What to do if you find nests

You are most likely to find nests during the growing season, when bees actively enter and exit their nests to provision their young with pollen. If nests are discovered they should be marked, identified to farm workers, and protected from disturbance.

What if you don't find any nests

If you don't find nests, it does not indicate bees are not nesting on your property; bee nests can be extremely challenging to locate. Ground nests can be obscured by pebbles or light vegetation. Sometimes ground-nesting bees use cracks in the soil to initiate a nest entrance to facilitate digging. Nests of above-ground nesting bees may not be visible because they are inside plant stems. Make sure tillage Standard Operating Procedure leaves potential nesting areas undisturbed (Standard 1.5). Avoid heavy mulching, which can cover prime ground-nest sites (though mulch can also be a great weed management tool when establishing hedgerow habitat).

Appendix E

Pithy-Stemmed Plants that Above-Ground Nesting Bees Use for Nest Sites

This list includes plant species in which bees have been observed to nest. It is a living document and is continually added to, based on additional documentation.

Common name(s)	Scientific name	Region	Status
Agave/Century plant	*Agave* spp.	West, South	native
Allegheny blackberry	*Rubus allegheniensis*	West, East, Midwest, South	native
American black elderberry	*Sambucus nigra* ssp. *canadensis*	Pacific Northwest, West	native
Beardtongue	*Penstemon* spp.	Transcontinental	native
Bee balm	*Monarda* spp.	Transcontinental	native
Black raspberry	*Rubus occidentalis*	East, Midwest, South	native
Blackberry	*Rubus* spp.	West	native
Blue elderberry	*Sambucus nigra* ssp. *cerulea*	West (TX)	native
Boneset	*Eupatorium* spp.	East, Midwest, South	both
Boxelder	*Acer negundo*	Transcontinental	native
Common reed	*Phragmites australis*	Transcontinental	both
Coneflower	*Echinacea* spp.	East, Midwest, South	native
Corn	*Zea mays*	Transcontinental	nonnative
Cow parsnip	*Heracleum* spp.	Transcontinental	both
Culver's root	*Veronicastrum* spp.	East, Midwest, South	native
Cup plant/Rosinweed	*Silphium* spp.	South	native
Elderberry	*Sambucus* spp.	West	native
Eryngo	*Eryngium* spp.	Transcontinental	both
Evening primrose	*Oenothera* spp.	Transcontinental	both

[Common name(s)]	[Scientific name]	[Region]	[Status]
False-indigo bush	*Amorpha fruticosa*	Transcontinental	native
Field thistle	*Cirsium discolor*	Midwest, Southeast, Northeast	native
Golden Alexanders	*Zizia* spp.	Transcontinental	native
Goldenrod	*Solidago spp.*	Transcontinental	native
Horseweed	*Conyza canadensis*	Transcontinental	native
Hydrangea	*Hydrangea arborescens*	East	native
Hydrangea	*Hydrangea* spp.	Transcontinental	nonnative
Ironweed	*Vernonia* spp.	Midwest, South	native
Joe-pye weed	*Eutrochium*	Transcontinental	native
Lobelia	*Lobelia*	Transcontinental	both
Meadow-rue	*Thalictrum*	Transcontinental	both
Mountain mint	*Pycnanthemum*	West, East, Midwest, South	native
Poison sumac	*Toxicodendron vernix*	Midwest, Northeast, Southeast	native
Pokeweed	*Phytolacca americana*	West, East, South	native
Raspberry	*Rubus idaeus*	West	both
Rose	*Rosa* spp.	Transcontinental	both
Smooth sumac	*Rhus glabra*	Transcontinental	native
Snowberry	*Symphorcarpos* spp.	Transcontinental	native
St. John's-wort	*Hypericum*	Transcontinental	both
Sumac	*Rhus* spp.	Transcontinental	native
Thistle	*Cirsium* spp.	Transcontinental	both
Ticktrefoil	*Desmodium*	East, Midwest, South	both
Twinberry	*Lonicera involuncrata*	West	native
Wild sunflower	*Helianthus* spp.	Transcontinental	native
Yucca	Yucca spp.	Transcontinental	native

Appendix F

Plants that Above-Ground Nesting Bees use as Nesting Materials to Create Cell Divisions

This list based upon records of bees gathering nesting materials. It is a living document and is continually added to, based on additional documentation.

Common name(s)	Scientific name	Region	Native	Plant part	Documented bee use
Alfalfa	*Medicago sativa*	Transcontinental	agricultural	leaves	*Megachile rotundata*
Alsike clover	*Trifolium hybridum*	Transcontinental	nonnative	leaves	*Megachile rotundata*
American beauty-berry	*Callicarpa americana*	South	native	leaves	*Megachile* sp.
American buck-wheat vine	*Brunnichia ovata*	South	native	leaves	unknown
Bird's-foot trefoil	*Lotus corniculatus*	Transcontinental	nonnative	leaves	*Megachile rotundata*
Buckwheat	*Eriogonum* spp.	Transcontinental	native	leaves	*Megachile rotundata*
California redbud	*Cercis orbiculata*	West	native	leaves	*Megachile* sp.
Cicer milkvetch	*Astragalus cicer*	West, North	nonnative	leaves	*Megachile rotundata*
Cranberrybush	*Viburnum opulus*	East, North, Midwest	both	leaves	unknown
Crown vetch	*Securigera varia*	Transcontinental	nonnative	leaves	*Megachile rotundata*
Cusick's checker-bloom	*Sidalcea cusickii*	Pacific Northwest	native	petals & leaves	unknown
Dogwood	*Cornus florida*	East, South, Midwest	native	leaves	unknown
Eastern redbud	*Cercis canadensis*	West, Midwest, South	native	leaves	*Megachile* sp.
Giant flutter mill (evening primrose)	*Oenothera macrocarpa*	Midwest, South	native	petals	unknown
Globemallow	*Sphaeralcea* spp.	Transcontinental	both	leaves	unknown

Common name(s)	Scientific name	Region	Native	Plant part	Documented bee use
Maple	*Acer* spp.	East	both	leaves	*Megachile* sp.
Marsh gentian	*Eustoma exaltatum*	West, Midwest, South	native	petals	*Megachile* sp.
Mountain laurel	*Kalmia latifolia*	East	native	leaves	unknown
Nootka rose	*Rosa nutkana*	West	native	leaves	unknown
Rose	*Rosa* spp.	East	both	leaves	*Megachile* sp.
Rugosa rose	*Rosa rugosa*	East	nonnative	leaves	*Osmia pumila*
Sainfoin	*Onobrychis* spp.	Transcontinental (except South)	agricultural	leaves	*Megachile rotundata*
Showy ticktrefoil	*Desmodium canadense*	East, Midwest, South	native	leaves	unknown
Small bayberry	*Morella car-oliniensis*	East, South	native	leaves	*Megachile* sp.
Strawberry	*Fragaria* spp.	Transcontinental	both	leaves	*Osmia* sp.
Virginia sweetspire	*Itea virginica*	East, South	native	leaves	unknown
White clover	*Trifolium repens*	Transcontinental	nonnative	leaves	*Megachile rotundata*
Zigzag clover	*Trifolium medium*	Northeast	nonnative	leaves	*Megachile rotundata*

Appendix G

Butterfly Host Plant Resources

Black, S. H., B. Borders, C. Fallon, E. Lee-Mäder, and M. Shepherd. 2016. ***Gardening for Butterflies: How You Can Attract and Protect Beautiful, Beneficial Insects***. 288 pp. Portland, OR: Timber Press.

NWF's **Native Plant Finder** provides lists of native plants that are host plants for butterflies and moths (can be filtered by zip code).

http://www.nwf.org/NativePlantFinder/About (accessed June 7, 2017)

Butterflies and Moths of North America (BAMONA) offers host plant information in the profile of each butterfly species. You can also get regional lists of butterfly species based on your county/location.

http://www.butterfliesandmoths.org/ (accessed June 7, 2017)

BAMONA **Host Plant Database** through the Lady Bird Johnson Wildflower Center.

http://www.wildflower.org/collections/collection.php?collection=bamona (accessed June 7, 2017)

Appendix H

Example Tillage Standard Operating Procedures (SOPs)

Types of SOPs

Tillage depth: No till or reduced tillage depth—ideally no deeper than 4"— following planting of crops known to be attractive to pollinators.

Timing of tillage: In half of the fields, tillage will only occur during time periods when bees are actively building nests in the spring and summer (not during time periods when bees are developing in their nests and unable to create new nests).

Frequency of tillage: Crop fields containing crops known to be attractive to bees will only be tilled 1 - 2 times per year for the year following planting.

Location of tillage: Some fields or strips within fields left untilled each year and 50% of field edges are managed through mowing instead of tilling.

Proportion of farm tilled: At least 1% of farm (field and/or edges) left untilled every year.

Equipment type: Will use chisel plows instead of mold board ploughs.

Examples

For row crop:

1. Crop fields containing crops known to be attractive to bees will only be disked at 4" depth no more than twice during the year following planting. Fallow fields will be mowed instead of tilled.
2. Field edges will be mowed instead of cultivated.

For perennial crop:

1. Every other alley between rows will be scraped annually instead of tilled.
2. Use chemical fallow in field edges.

If already using no-till system:

1. No till will continue to be practiced throughout the farm.

Appendix I

Pest Scouting and Monitoring Guidance

Scouting and Monitoring Protocol Table

Bee Better Certified requires producers to develop a monitoring and scouting protocol for all pests that are controlled using both pesticidal and non-pesticidal options. Evidence of scouting and monitoring must also be provided to justify use of pesticides. Records of these activities must be submitted during inspection. This appendix contains guidance on how to compile suitable records.

The table below is an example of how a monitoring and scouting protocol could be recorded and presented.

Crop(s) affected	Pest or disease	Action threshold (e.g. # eggs/plant)	Threshold source	Monitoring Start Date	Monitoring End Date	Monitoring Frequency (e.g. daily, weekly, etc.)
Leafy vegetable	Aphids	2 per plant (seedling) or 7 per plant (established plants)	Midwest Vegetable Production Guide for Commercial Growers	When plants emerge	Harvest	2x/ week
Pistachio	Mealybug	1 adult female per 10 clusters	University of California IPM	Mid-May (if evidence of presence was found during the dormant season)	June (late season treatments are not effective)	1x/ week
Raspberry	Cane Blight (cane disease)	1-3% of canes are infected with the disease	Washinton State University Extension	Dormant period	Harvest	Check every crop stage for disease symptoms

Scouting and Monitoring Records

In addition to the outline monitoring and scouting plan, you are required to submit records indicating the implementation of the -protocol(s). Bee Better Certified does not have a standard form for this. You may use your own form or one of the following examples. At minimum the form must include the following information:

- Crop
- Pest
- Date
- # counted or severity (low/moderate/ high; define how categories relate to action threshold)
- Unit (e.g., per leaf, per tree, per row)
- Whether the action threshold was reached

When no established economic threshold exists, supply expert opinion related to the severity of the pest or disease outbreak. Experts may include a certified pest control adviser, accredited crop consultant, extension agent, or other credentialed independent pest management specialist. You may also provide additional documentation (e.g., extension publications, newspaper articles) that supports the severity of the issue.

When providing information from an expert, please include the following:

- Name of expert
- Title
- Company
- Accreditation # (if applicable)
- Phone number
- Email address

Experts must provide the following information when recommending control efforts:

- The nature of the outbreak (severity, locations of outbreaks, etc.)
- Recommendations for control
- Alternatives to control option recommended (if available)

Example Form 1

Crop	Pest	Date	# Counted	Unit	Threshold reached?

(Add rows as necessary)

Example Form 2

Plant	# leaves/ plant	# of target pest 1 per plant	# of target pest 2 per plant	Other insect	Insect damage	Disease	% leaves affected by disease
1							
2							
3							

(Add rows as necessary)

Threshold reached? ______________

Example Form 3 (with sample information)

(Circle one)

Crop stage	New leaves	Flower buds	First bloom	Full bloom	Green fruit	First harvest	Harvest	Post-harvest
Scouting method	Beat sheet	5 minute visual	X leaflets/ site	Pheromone trap	Sticky trap			

Pest or Disease	Threshold	Counts				
		1	2	3	4	5
Pest 1						
P2…						
Disease 1						
D2…						

Appendix J

List of Approved Non-Pesticide Management Strategies

Bee Better Certified requires producers to record, implement, and maintain at least 2 non-pesticide preventive pest management strategies as part of the certification process. Incorporating preventive management strategies such as biological, cultural, mechanical, and physical control can reduce reliance on pesticide control as well as minimize pesticide risks to the environment and nontarget organisms like bees (Landis and Orr 2000; Naranjo et al. 2015). Long-term pest prevention is a basic principle of IPM, and incorporating a combination of different pest management options can help achieve this IPM goal.

Conservation biological control (CBC)—the creation of habitat that supports populations of natural enemies of crop pests—is another effective preventive management strategy. CBC has been shown to augment natural enemies of crop pests while reducing pest populations that tend to thrive in weedy, unmanaged borders (Landis et al. 2000). Habitat designed to protect pollinators also benefits natural enemies of crop pests, and has been shown to contribute to crop pest control (Morandin et al. 2014). To further enhance natural enemy populations consider adding insectary plants to pollinator habitat. *Farming With Native Beneficial Insects* (Storey Publishing, 2014) is a good source of information on insectary plants and the beneficial insects they support.

In the tables that follow, please indicate which of the named practices are or will be utilized. We recognize that not all methods are applicable to all producers or cropping systems. If you are not currently practicing any non-pesticide management strategies, select at least two that are well-suited to your farm and describe how they will be implemented.

References

Landis, D. A., S. D. Wratten, and G. M. Gurr. 2000. Habitat management to conserve natural enemies of arthropod pests in agriculture. *Annual Review of Entomology* 45(1):175–201.

Morandin, L. A., R. F. Long, and C. Kremen. 2014. Hedgerows enhance beneficial insects on adjacent tomato fields in an intensive agricultural landscape. *Agriculture, Ecosystems & Environment* 189:164–170

Habitat Enhancement Practices for Conservation Biocontrol

Practice	Currently used?	Description of how practice *is applied* (where/when)	To be adopted?	Description of how the practices *will be applied* (when/where)
Conservation cover (In perennial crop sytems, maintain permanent ground covers of native grasses and forbs for weed control and natural enemy refuge.)				
Beetle banks (Establish bunch grasses to promote predatory ground beetles.)				
Companion planting (Plant species next to one another that enhance one another's growth and protect on another from pests.)				
Intercropping (Use crops that are attractive or useful to beneficial insects)				
Other (Please describe)				

Additional Preventive Practices (Physical, Cultural, Mechanical, or Biological)

Practice	Currently used?	Description of how practice *is applied* (where/when)	To be adopted?	Description of how the practices *will be applied* (when/where)
Pheromone traps				
Timing of planting or harvest				
Physical barriers (e.g., floating row covers, fruit bagging				
Sanitation				
Trap cropping				
Crop rotation				
Mulching (for weed control)				
Eliminate alternate hosts or sites for pests and disease				
Resistant varieties (insect pest and disease control)†				
Soil solarization (for nematodes and soil borne diseases)				
Mating disruption				
Maturity date selection (to avoid pest populations)				
Kaolin clay				
Other (please describe)				

(† Herbicide resistant crops are not permitted on Bee Better Certified farms, and therefore do not count as resistant varieties. We refer to crop varieties that have been breed to be insect and/or disease resistant.)

Appendix K

List of Pesticides Classified by the EPA as Moderately or Highly Toxic to Pollinators and Restricted Under Bee Better Certified

Note: This list may change as EPA reviews new pesticides and will be updated periodically. Last updated May 2017.

- Abamectin
- Acephate
- Acetamiprid
- Aldicarb
- Alpha-cypermethrin
- Arsenic acid
- Azadirachtin
- Bensulide
- Beta-cyfluthrin
- Bifenazate
- Bifenthrin
- Carbaryl
- Carbofuran
- Chlorethoxyfos
- Chlorfenapyr
- Chlorpyrifos
- Chlorpyrifos methyl
- Clothianidin
- Cyantrantriliprole
- Cyfluthrin
- Cypermethrin
- Cyphenothrin
- Deltamethrin
- Diazinon
- Dichlorvos
- Dicrotophos
- Dimethoate
- Dinotefuran
- D-trans-allethrin
- Emamectin benzoate
- Endosulfan
- Esfenvalerate
- Ethoprop
- Etofenprox
- Fenazaquin
- Fenitrothion
- Fenpropathrin
- Fipronil
- Fluvalinate
- Fosthiazate
- Gamma-cyhalothrin
- Imidacloprid
- Imiprothrin
- Indoxacarb
- Lambda-cyhalothrin
- Malathion
- Methiocarb
- Methomyl
- Momfluorothrin
- Naled
- Oxamyl
- Permethrin
- Phenothrin
- Phorate
- Phosmet
- Pirimiphos-methyl
- Prallethrin
- Profenofos
- Propoxur
- Pyrethrins
- Pyridaben
- Resmethrin
- Rotenone
- Sethoxydim
- Spinetoram
- Spinosad
- Sulfoxaflor
- Tefluthrin
- Tetrachlorvinphos
- Tetramethrin
- Thiamethoxam
- Tolfenpyrad
- Zeta-cypermethri

Appendix L

List of Fungicides Restricted Under Bee Better Certified

- Azaconazole
- Bitertanol
- Bordeaux
- Boscalid
- Bromuconazole
- Calcium polysulfide
- Captafol
- Captan
- Chlorothalonil
- Copper oxide
- Copper oxychloride
- Copper sulfate/lime
- Cyproconazole
- Difenoconazole
- Diniconazole
- Epoxiconazole
- Etaconazole
- Fenarimol
- Fenbuconazole
- Fluquinconazole
- Flusilazole
- Flutolanil
- Flutriafol
- Folpet
- Hexaconazole
- Imazalil
- Iminoctadine
- Ipconazole
- Lime sulfur
- Metconazole
- Myclobutanil
- Nuarimol
- Oxpoconazole
- Pefurazoate
- Penconazole
- Prochloraz
- Propiconazole
- Prothioconazole
- Pyridaben/Sulfur
- Pyrifenox
- Simeconazole
- Tebuconazole
- Tetraconazole
- Triadimefon
- Triadimenol
- Triflumizole
- Triforine
- Triticonazole

Appendix M

Crops that are Exempt from Bloom-Time Pesticide Application Standard

This list includes crops that are wind pollinated or self-pollinated. We excluded crops that insects visit, such as corn (many bees collect pollen from corn tassels despite the fact that it is wind pollinated) and soybean (which is mostly self-pollinated, but benefits from insect pollination; and insects do visit the flowers).

Amaranth	Rye
Barley	Sorghum
Kamut	Spelt
Millet	Teff
Oats	Triticale
Rice	Wheat

The following crops either do not need to bloom or not allowed to bloom before harvest, and are therefore not pollinated by insects. When these crops are grown for seed production, then they do bloom and the bloom-time pesticide application standard does apply to them.

All brassicas (e.g., broccoli, cabbage, cauliflower, collards, kale, kohlrabi)

Asparagus	Fennel
Basil	Garlic
Beets	Lettuce
Brussels sprouts	Onions
Carrots	Parsnip
Chard	Radish
Chicory	Spinach
Choi	Turnip
Endive	

Appendix N

Bee Precaution Use Instructions

Website

http://www2.ipm.ucanr.edu/beeprecaution/

Toxicity Ratings

The Bee Precaution tool was developed by the University of California Statewide Agricultural & Natural Resources Integrated Pest Management Program (UC IPM) to help identify pesticides that can harm pollinators. Bee Precaution developed three categories for pesticides, which follow both the US EPA designations as well as the Oregon State University publication, *How to Reduce Bee Poisoning from Pesticides* (Johansen et al. 2013).

Category	Recommendation
I- Highly toxic	Do not apply or allow to drift to plants that are flowering.
II- Moderately toxic	Do not apply or allow to drift to plants that are flowering, except when the application is made between sunset and midnight if allowed by the pesticide label and regulations.
III- Practically non-toxic	No bee precaution, except when required by the pesticide label or regulations.

The Bee Precaution rankings include EPA pesticides listed as highly or moderately toxic to pollinators, but also include additional pesticides that have honey bee LD_{50} rates between 0 and 11 micrograms. The authors of the Bee Precaution index also evaluated whether pesticides were toxic to honey bee brood. When available, they included information about whether a pesticide has also been found to be toxic to other non-*Apis* bees.

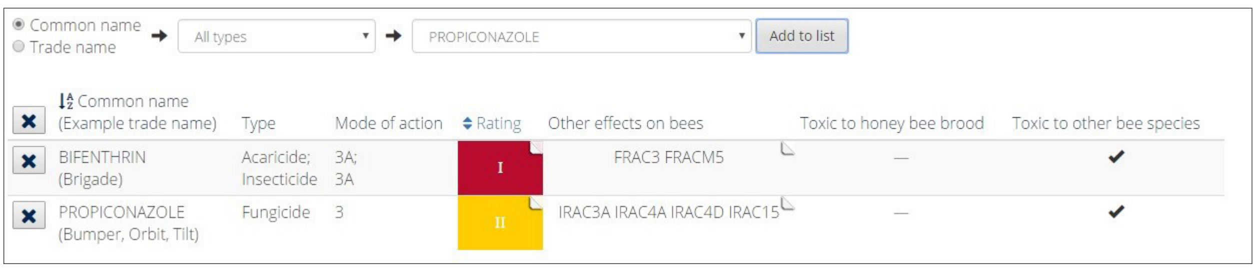
Bee Better Certified only requires that pesticides listed by the EPA as highly or moderately toxic to pollinators (see Appendix K) not be applied during crop bloom. We recommend that the other pesticides listed as I or II by the Bee Precaution index be applied in the manner instructed by the index.

Synergistic Effects

The Bee Precaution database also includes information that indicates whether two pesticides used in combination are more toxic to bees than they are when applied separately. This risk of increased toxicity is indicated in both the “Mode of action” column (which lists the pesticide’s chemical group designated by a “FRAC” or “IRAC” number) and the “Other effects on bees” column (which lists the pesticide group codes that can increase toxicity when combined; see the image of a sample list in figure H1, below). The FRAC and IRAC codes refer to Mode of Action codes developed by the Fungicide Resistance Action Committee and the Insect Resistance Action Committee.

Bee Better Certified requires that if a code appears in the “Other effects on bees” column and cross-referneces to the “Mode of action” column of the other pesticide listed—indicating that two pesticide groups can cause increased toxicity—then the pesticides in question cannot be applied within three days of one another. Example of pesticide groups that cannot be applied jointly are pyrethroid insecticides (IRAC3A) and DeMethylation Inhibitor (DMI) fungicides (FRAC3).

Figure L1. Sample of Bee Precaution search results



	Common name (Example trade name)	Type	Mode of action	Rating	Other effects on bees	Toxic to honey bee brood	Toxic to other bee species
✖	BIFENTHRIN (Brigade)	Acaricide; Insecticide	3A; 3A	I	FRAC3 FRACM5	—	✔
✖	PROPICONAZOLE (Bumper, Orbit, Tilt)	Fungicide	3	II	IRAC3A IRAC4A IRAC4D IRAC15	—	✔

How to use the Tool

To determine whether any pesticide combinations synergize, add the chemicals in question to the list of chemicals on the Bee Precaution webpage.

1. Select “Common name” or “Trade name”.
2. Leave the selection in first drop-down list as “All types” or, to narrow down the options, select a pesticide class from that list.
3. Select the pesticides from the second drop down list.
4. The pesticide name, trade name, type, mode of action, rating, other effects, and toxicity information will populate the table below.
5. You may add more than one pesticide to the list at a time, but may need to change the pesticide class in step 2. To remove a pesticide, click the blue “x” nest to its name. To clear the entire table, click the blue “x” on the top line of the table.

6. To determine potential synergies, compare the number in the "Mode of action" column for one pesticide with the "FRAC" or "IRAC" number in the "Other effects on bees" column of another. The sample table in Figure L1 includes two pesticides, the insecticide Bifenthrin and the fungicide Priopiconazole. Bifenthrin has a "Mode of action" number of 3A. The IRAC number in the "Other effects of Bees" column for Priopiconazole is "IRAC3A" (along with three other IRAC codes). This indicates that these two chemicals should not be applied within 3 days of one another. This synergy is also indicated because Bifenthrin has a FRAC3 designation and Priopiconazole has a listed "Mode of action" of 3.
7. To save the result of your Bee Precaution query, you can access the print menu by typing Control+P and then either print it or, by changing the "destination" to "Save as PDF", save the page as a PDF file..

Resources

Insect Resistance Action Committee: http://www.irac-online.org/

- 2017 IRAC code list: http://www.irac-online.org/documents/moa-classification/ (accessed June 7, 2017)

Fungicide Resistance Action Committee: http://www.frac.info/

- 2017 FRAC code list: http://www.frac.info/docs/default-source/publications/frac-code-list/frac-code-list-2017-final.pdf (accessed June 7, 2017)

References

Johansen, E., L. A. Hooven, and R. R. Sagili. 2013. *How to Reduce Bee Poisoning from Pesticides*. Corvallis, OR: Oregon State University Extension Service. Available at https://catalog.extension.oregonstate.edu/pnw591 (accessed June 7, 2017)

Appendix O

List of Soil Fumigants Restricted Under Bee Better Certified

Aluminum phosphide
Magnesium phosphide
Phosphine
Chloropicrin
Dazomet
1,3 Dichloropropene
Dimethyl disulfuide (DMDS)
Methyl isothiocyanate (MITC)
Metam sodium/potassium
Methyl bromide

Appendix P

Vegetative Pesticide Buffer Candidate Species

When planting a vegetative buffer to intercept chemical drift, use evergreen species that are not attractive to pollinators (do not bloom) to prevent pollinator exposure to any chemicals the buffer may intercept. The best pesticide drift protection comes from multiple rows of vegetation that include small-needled evergreens. Small-needled evergreens are two to four times as effective as broadleaf plants in capturing spray droplets and provide year-round protection. Two rows of evergreens can provide 60 percent density (40 percent porosity) which is recommended for capturing drift. A porous buffer is preferable to a solid buffer, which can push drift up and over it instead of capturing most of it. The buffer should be designed to grow as tall as the spray release height of the pesticide application equipment. To assist with rapid establishment of buffer plants, we recommend selecting bare root or container plants (e.g., in 5 gallon containers) that are at least 4' tall with an extensive root system.

Recommended Species

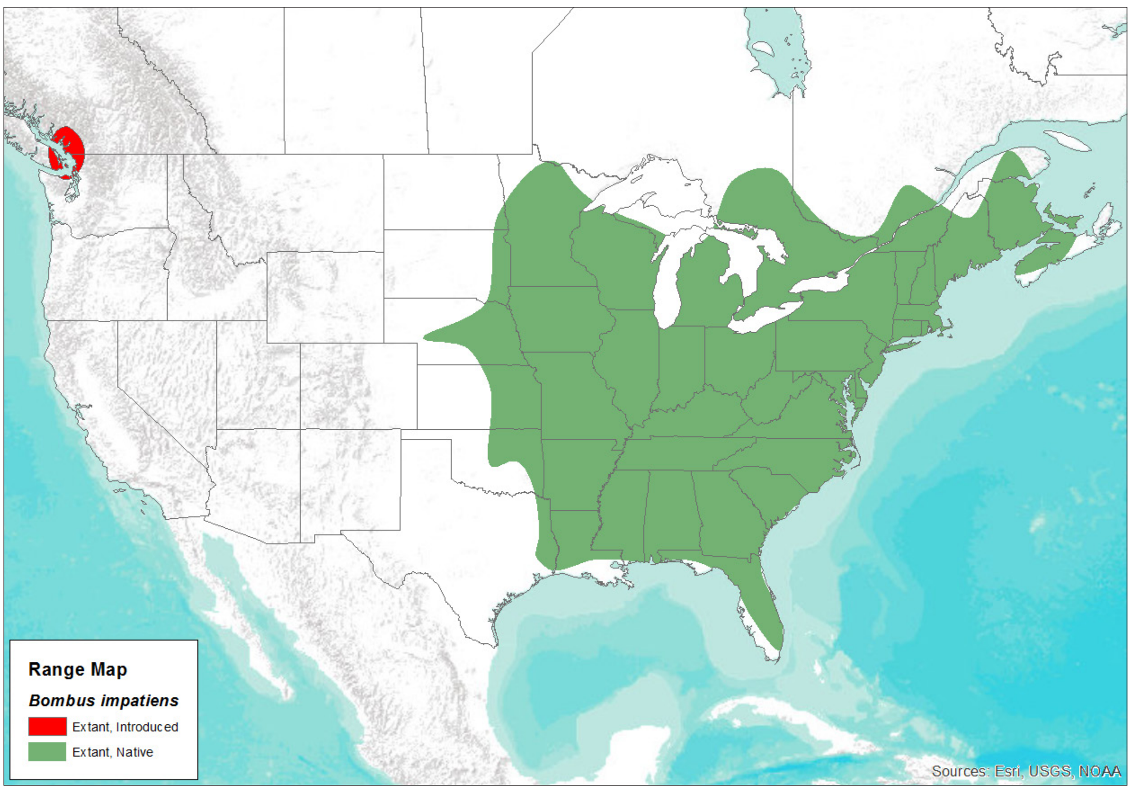
- Cypress
- Fir
- Juniper
- Pine (less preferred)
- Spruce
- Thuja (Arborvitae)

Appendix Q

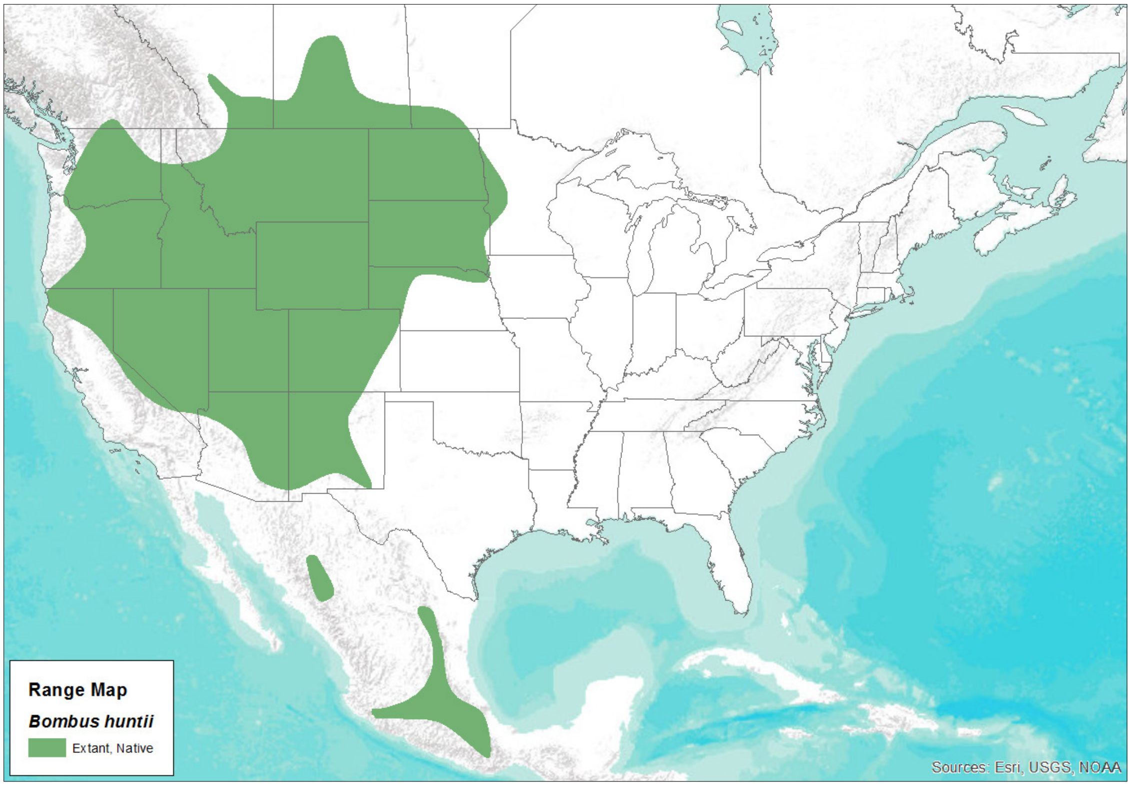
Distribution Maps of Commercially Managed Bumble Bees

The common eastern bumble bee (*Bombus impatiens*) is the principle species native to North America that is commercially managed for crop pollination (see Map Q1). Two other species, Hunt's bumble bee (*Bombus huntii*; Map Q2) and the yellow-faced bumble bee (*Bombus vosnesenskii*; Map Q3) are being developed for commercial use in the United States. Maps for other native species can be found at Bumble Bee Watch, https://www.bumblebeewatch.org/app/#/species/profile

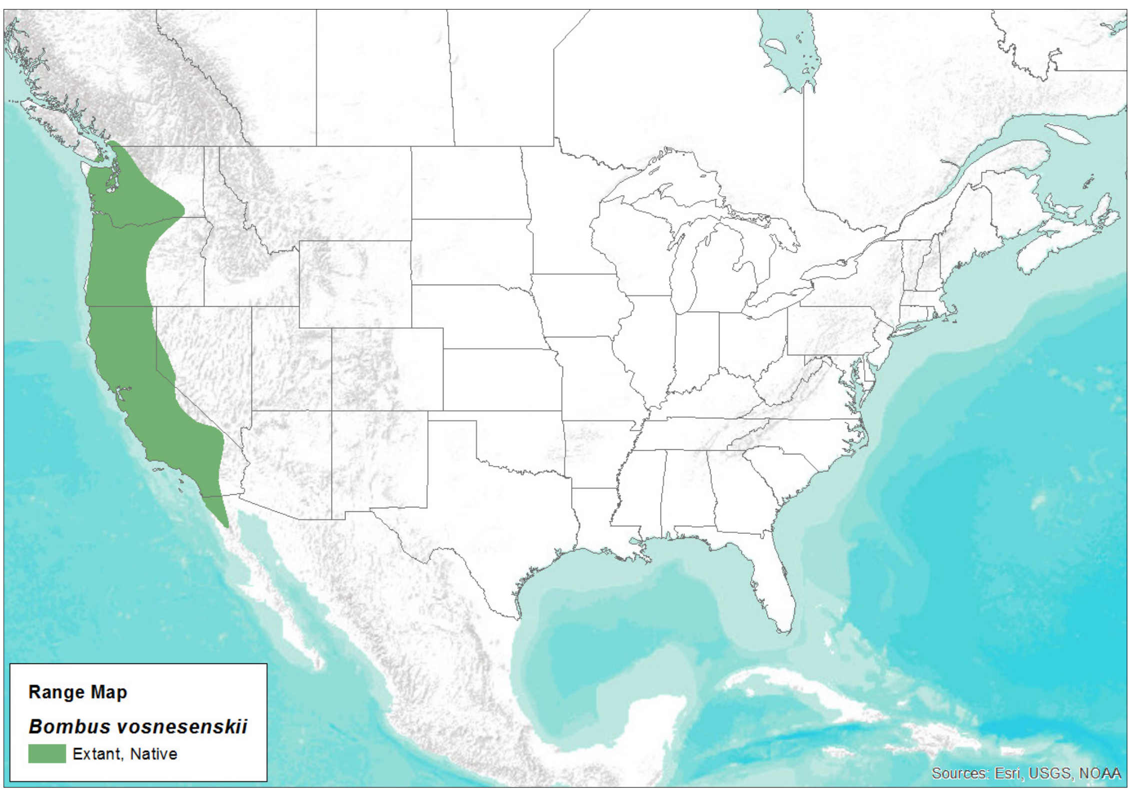
Map Q1. Distribution of the common eastern bumble bee (*Bombus impatiens*).



Map Q2. Distribution of Hunt's bumble bee (*Bombus huntii*).



Map Q3. Distribution of the yellow-faced bumble bee (*Bombus vosnesenskii*).



Appendix R

Glossary

Beneficial insects Insects that contribute to farm or ecosystem functioning, including crop pollination and pest control. Pollinators and natural enemies (see definition below) are collectively referred to as "beneficial insects." Other arthropods, including spiders, are also beneficial.

Biological control The use of natural enemies (predators, parasites, pathogens) to suppress pest insect populations.

Bloom The time period from when first blooms open until petal drop or closure of all blooms (e.g., squash blossoms are open for a single day, but spent flowers can remain attached for a long period after they cease to be viable). See Appendix F for a list of exempt crops—crops that are not visited by insects and crops that do not bloom (e.g., leafy greens not grown for seed production).

Classical biological control Permanent suppression of a pest over a large area through the introduction of a predator, parasite, or disease from the pest's native homeland. The idea is to re-establish the pest's natural enemy complex to provide continual pest control. Natural enemies are only released following a thorough vetting process by USDA APHIS to ensure the biological control agent will not itself become a pest or attack native non-target organisms.

Companion planting Planting species next to crops that attract pest insects away from the crop.

Conservation biological control The protection and enhancement of insects and other organisms that provide natural pest control on a farm. This is accomplished by incorporating farm practices that create a favorable environment that conserve natural enemies in and around crop fields and enhance pest control. One of the leading practices for enhancing populations of natural enemies on farms is the conservation of natural habitat and creation of diverse, native habitat. (Bianchi et al. 2006; Tscharntke et al. 2007; Landis et al 2000; Chaplin-Kramer et al 2011)

Cover cropping Seasonal vegetative cover. In this case, we are referring to flowering cover crops, or mixes that contain flowering species.

Crop rotation Alternating different crops in fields or areas of a farm over time. Benefits include disrupting diseases and pest spread and maintaining soil fertility.

Ecologically appropriate sources Plant materials are considered "ecologically appropriate" when they are collected from similar climatic or ecological region to the one present on property where pollinator habitat is being established.

Economic threshold The pest density at which management action should be taken in order to prevent pest populations from reaching levels where they could cause economic injury. Note that thresholds do not exist for all pests in all crops, and expert opinion coulped with thorough scouting and monitoring records can assist with pest management decisions.

Economic injury level The number of pests that will cause yield losses equal to the potential costs of management actions.

Flowering species Plants (including trees, shrubs or forbs) known to provide pollen and/or nectar to pollinators.

Intercropping Growing two or more crops in proximity to one another, often in adjacent rows.

Integrated pest management (IPM) An ecological approach to pest management that focuses on pest prevention and relies on treatment measures only when there is a demonstrated need. IPM incorporates a combination of biological, cultural, mechanical/physical, and chemical management tools.

Habitat restoration Defined in the Society for Ecological Restoration Primer as, "The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." (http://www.ser.org/resources/resources-detail-view/ser-international-primer-on-ecological-restoration)

Mass-flowering crops Crops that provide abundant floral resources during their bloom period, which is often short. Examples of mass-flowering crops: almond, blueberry, canola, and sunflower. When differentiating between mass-flowering crops and temporary habitat, we consider whether the crop a) was already a core part of the crops planted, and b) whether the primary purpose of the crop is revenue.

Native plants Plant species that are indigenous—occur naturally without human intervention—to a region. The time period within an area for a species to be considered native is typically before European settlement of the Americas.

Natural enemies Predators, parasites and pathogens of crop pests. Many natural enemies are insects.

New habitat Any habitat created following initial certification by a farm entity or any habitat created after June 19th, 2023.

Noxious weed Noxious weeds are classified by USDA NRCS as, "A weedy or invasive plant that has the potential to become invasive in all or part of its range within the US." State lists can be found at http://plants.usda.gov/java/noxiousDriver.

Permanent habitat Habitat that is present year-round, although the plants may be in a vegetative or dormant state during the winter. Examples of permanent habitat: hedgerows, perennial or re-seeding wildflower strips, riparian forests, and filter strips.

Pest control advisor (PCA) Licensed professionals certified in pest management. When selecting an advisor, make sure they are familiar with IPM practices and the nonchemical pest management standards and pesticide mitigation standards required by Bee Better Certified.

Pesticide Any substance or mixture of substances intended for preventing, destroying, repelling or mitigating a pest or disease. Pesticides can also be plant regulators, defoliants, desiccants or nitrogen stabilizers. The term pesticide includes bactericides, fungicides, herbicides, insecticides, miticides, molluscicides, nematicides, and piscicides.

Pesticide applications Any activity that introduces a pesticide into the environment for the purposes of controlling pests, including but not limited to spraying, dusting, and chemigation. We also consider the planting of pesticide-coated seed a pesticide application.

Polyculture A farming practice that incorporates multiple crops into the same farm, avoiding monocultures (single stands of a specific crop).

Prophylactic use Preventative use of pesticides that is not in response to a demonstrated pest problem. For example, spraying on a schedule without monitoring to confirm a pest is present. Many seed treatments are prophylactic.

Spatial buffer An unsprayed space, such as roads or equipment turnarounds, or a section of crop that remains unsprayed.

Structural diversity The presence of multiple strata of crops (for example, row crops and orchards) in proximity to one another.

Systemic pesticide When an active ingredient is water soluble and therefore can be transported throughout plant tissues. These pesticides can also be expressed in pollen and nectar. Systemic pesticides are often used as a seed coating.

Temporary habitat Habitat that typically dies back annually. It may remain in one location or move around the certified parcels (as is the case with rotating cover crops). Temporary habitat must be allowed to bloom. Examples of temporary habitat: cover crops, insectary strips, mass-flowering crops. For cover crops, at least 50% bloom must be achieved prior to termination.

Trap crop A plant that attracts a pest insect away from another nearby crop. Note that flowering trap crops cannot be sprayed during their bloom period.

Vegetative buffer A border of plants not attractive to pollinators, such as conifers, grown between pollinator habitat and crop fields. It is designed to capture pesticide drift.

References

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