

# American Bumble Bee (*Bombus pensylvanicus*)

## Field Guide

The American bumble bee (*B. pensylvanicus*; AMBB) belongs to the subgenus *Thoracobombus*, which includes two other species in North America, *B. fervidus* and *B. californicus* (Colla et al. 2011, Koch et al. 2012). AMBB has a black head, three yellow bands on the thorax and a black posterior (Colla et al. 2011).

Historically, AMBB was among the broadest ranging bumblebees in North America (Cameron et al. 2011). This bumble bee was widespread in the eastern temperate forest and Great Plains regions throughout the eastern and central United States and southern Canada, and also in the desert west and adjacent areas of California and Oregon (NatureServe 2018). However, numerous studies indicate that this species has declined, both locally and regionally, especially in the northeastern parts of its range (Bartomeus et al. 2013, Hatfield et al. 2015). The AMBB range declined by an estimated 20 percent prior to 1980; trends suggest it is still becoming rarer. The species appears to be locally extirpated from areas of the northern margin of its historical range extent including New York, Maine and Vermont (Richardson 2013).



*American bumble bee by Kristy Baker (NYNHP)*

Habitat loss and conversion (Hatfield et al. 2012), introduction of non-native pathogens from managed bumble bees in greenhouses and honeybee colonies (Gillespie 2010, Cameron et al. 2011, Szabo et al. 2012) and widespread use of pesticides (Grixti et al. 2009) over the past 30 years have likely contributed to reduced range and abundance for this species. Bumble bee populations are uniquely susceptible to insecticides, particularly neonicotinoids, when the application overlaps with colony establishment in the spring (Leza et al. 2018, Baron et al. 2017, Arena and Sgolastra 2014, Averill 2011). AMBB is under review in Pennsylvania, listed as Critically Imperiled in New York, and Imperiled in West Virginia and Maryland (NatureServe 2018). The U.S. Fish and Wildlife Service (USFWS) is reviewing AMBB status as part of a pollinator cohort (J. Reichard (USFWS) pers. comm. July 2020). Given that habitat loss is affecting this species, this report provides habitat restoration recommendations for AMBB.

### LIFE HISTORY

Like most *Bombus* species, AMBB are highly social and form annual colonies consisting of a single queen, female workers, and males. AMBB colonies are small compared to more common *Bombus* species, producing 60-120 individuals (Robertson 1890). When there is constant and diverse food availability, the size of individual bees and colonies increases (Colla 2016, Tasei and Aupinel 2008).

AMBB has an annual cycle similar to those of other bumble bees, but shorter in duration, (Colla et al. 2011) likely due to its adaptation to warmer temperatures (Hines 2008). It begins in late spring with colony initiation by solitary queens and progresses with the production of workers throughout the summer and ending with the production of males and new queens in mid-summer to early autumn (Colla and Dumesh 2010). New queens emerge from their underground overwintering site in late May and June. The queen must immediately forage to rebuild her body reserves. Once she finds a suitable nest site, she collects nectar and pollen from flowers to support the production of her eggs, which are fertilized by sperm she has stored since mating the previous autumn. The queen lays eggs on top of a mass of pollen mixed with nectar. As the workers hatch and the colony grows, workers assume the responsibility of food collection, colony defense, and care of the young, while the queen remains within the nest and continues to lay eggs for workers, males and new queens. The period from egg laying to adult workers can be up to 30 days (COSEWIC 2018). Males and presumably new queens are produced earlier in AMBB colonies than in those of other bumble bees (Colla and Dumesh 2010). New queens and males emerge from nests to mate during which males will disperse up to ten kilometers depending on species (Kraus et al. 2009). New queens have shorter dispersal distances ranging from five to eight kilometers depending on species (Lepais et al. 2010). At the end of the season, these fertile queens feed heavily to build up reserves and find overwintering sites by late September, while the old queen, workers, and males die.

## **HABITAT**

AMBB habitat is grassland, farmland, and other open areas (Williams et al. 2014). This bumble bee species needs three things: nectar and pollen from diverse and abundant flowers from spring through autumn, undisturbed nesting sites in clumps of grass in proximity to floral resources, and overwintering sites in decaying wood for hibernating queens in proximity to spring floral resources. Liczner and Colla (2020) found that land cover, agriculture, and associated landscape-scale conditions have the most significant influence on habitat occupancy. Although AMBB is less dependent on woodland edges in spring than other bumble bees, some large, coarse, decayed woody debris for overwintering and native spring-blooming flowers associated with open/wet areas are critical for spring habitat (Liczner and Colla 2020). In summer, good habitat has high floral diversity, flower patchiness, and overall good vegetation cover. In fall, AMBB relies more on flowers associated with open and agricultural areas (Liczner and Colla 2020).

## **NECTAR AND POLLEN PLANTS**

Bumble bees are generalist foragers, meaning they gather pollen and nectar from a wide variety of flowering plants near their nests. Unlike honeybees, *Bombus* colonies immediately consume food as there is limited storage space in the nest (Williams et al. 2014). Studies of other *Bombus* species have found foraging distances are typically less than one kilometer from nesting or overwintering sites (Knight et al. 2005, Wolf and Moritz 2008, Osborne et al. 1999).

AMBB requires a constant and diverse supply of flowers that bloom throughout the colony's life cycle, from May through September (COSEWIC 2018). Proximity of the nest to pollen and nectar is critical while the queen alone is establishing a new colony. Access to abundant and diverse floral resources in the late summer and autumn is important because it influences the number, size and fitness of fertile males and new queens needed to ensure the founding of new colonies in the following spring (Hatfield and LeBuhn 2007). For new queens to survive overwintering, the habitat needs to include large quantities of pollen and nectar in the autumn because substantial body fat reserves are needed for hibernation (Goulson 2010).

Owing to substantial variation in the nutritional value of various pollen sources (Tasei and Aupinel 2008), bees may show greater selectivity for pollen than nectar (Cane and Sipes 2006). Researchers studying several bumble bees in North America and Europe found that all of the species favored pollen from flowers in the Fabaceae family (Saifuddin and Jha 2014, Goulson and Darvill 2004). This preference persisted even when legumes were a small percentage of the plant community, suggesting that plants in this family may

be a limiting resource in otherwise suitable habitats (Saifuddin and Jha 2014). All species studied gathered nectar from a broader range of flowers than they did pollen, yet longer-tongued bees had a narrower diet breadth when collecting nectar (Goulson and Darvill 2004). Species with short colony cycles have a heightened dependence on high quality food to rear larvae quickly, which forces specialization (Goulson and Darvill (2004). Thus, AMBB, as a long-tongued species with a short colony cycle (Colla et al. 2011), likely selects for high quality pollen from Fabaceae species and obtains nectar from flowers less accessible to short-tongued species (Colla and Parker 2008).

## NESTING HABITAT

Nesting habitat may be a limiting factor for bumble bees due to long search times required to locate suitable sites, low levels of natural sites, niche overlap with other bee species, and high frequency of nest usurpation by other bees (Hines and Hendrix 2005). AMBB nests mostly on the surface of the ground, among long grass or hay stacks, but occasionally underground (Williams et al. 2014, NYNHP 2020). Grassy areas at field boundaries, meadow margins, and forest edges are valuable nesting areas for AMBB (Hines and Hendrix 2005). Successful nests of *Bombus* species are typically found within one kilometer of high plant species diversity areas (Knight et al. 2005, Wolf and Moritz 2008) in habitat that is undisturbed, until late summer when the reproductive bees leave the nest.

## OVERWINTERING HABITAT NEEDS

Overwintering sites close to spring floral resources are critical for newly emergent queens to restore body fat reserves rapidly and for adequate energy to locate a suitable nest site and establish a new colony (Goulson 2010, Williams et al. 2014). The site needs to remain undisturbed from late autumn through the spring while the queen is in hibernation. The strong positive association found with decaying wood and negative association with high densities of underground rodent burrows is thought to reflect AMBB preference for using old logs rather than burrows as overwintering habitat (Liczner and Colla 2020).

## HABITAT RESTORATION RECOMMENDATIONS

### Priority areas in Pennsylvania –

#### Primary

- Montgomery, Chester, Lancaster, York, Adams, Berks, Lebanon, Dauphin, and Cumberland Counties with expansion throughout southeastern counties
- Centre, Mifflin, Juniata, Union, and Clearfield Counties with expansion outward
- Allegheny, Westmoreland, Washington, Fayette and Beaver Counties with expansion throughout southwestern counties
- Erie and Crawford Counties with expansion throughout northwestern counties

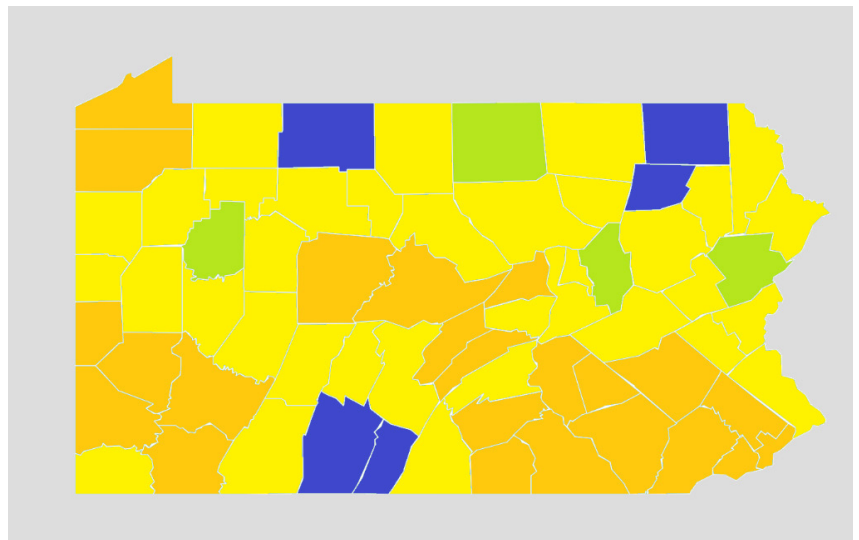


Figure 1. Historical areas (blue), priority occupied areas (1st-orange; 2nd-green) with expansion areas (yellow) based on Kilpatrick et al. (2020).

#### Secondary

- Tioga, Clarion, Columbia and Monroe Counties

## Habitat Sub-Types and Target Species to meet Annual Landscape Target

- 1) Upland or wet meadow areas in open habitats (e.g., pastures, old fields, farmland buffers)
  - a. Meadows with adult nectar and pollen sources (at least 50 percent of site)
    - Blooming from early May to late September
    - At least ten species of flowers blooming in all three seasons
    - At least three nectar superfoods (as denoted in table below) blooming in all three seasons
    - At least three pollen superfoods (as denoted in table below) blooming in all three seasons
    - No or low density (1 hive/2 acres) of domestic honeybees

COMMON NAME	SPECIES	PERIOD	RANGE IN PA
<b>Forbs</b>			
Yellow Giant Hyssop <sup>1, 2</sup>	<i>Agastache nepetoides</i>	SuAu	Southern and NJ border counties
<b>Swamp Milkweed <sup>1, 2</sup></b>	<b><i>Asclepias incarnate</i></b>	<b>SuAu</b>	<b>Throughout PA</b>
Common Milkweed <sup>1, 2</sup>	<i>Asclepias syrica</i>	Su	Throughout PA
Butterfly Milkweed <sup>1, 2</sup>	<i>Asclepias tuberosa</i>	SpSuAu	All northern counties, except Erie
Canada Milkvetch <sup>1, 2, 3</sup>	<i>Astragalus canadensis</i>	SpSu	SW and Erie counties
Blue False Indigo <sup>1, 2, 3</sup>	<i>Baptisia australis</i>	SpSu	Western counties
Yellow False Indigo <sup>1, 2, 3</sup>	<i>Baptisia tinctoria</i>	SpSu	All but NC and NE counties
Downy Pagoda Plant <sup>1</sup>	<i>Blephilia cilitata</i>	SpSu	Western counties
Bluebell Bellflower <sup>1</sup>	<i>Campanula rotundifolia</i>	Su	All but Allegheny and Ohio basins
Partridge Pea <sup>2, 3</sup>	<i>Chamaecrista fasciculata</i>	SuAu	SC and SE counties
Field Thistle <sup>1, 2</sup>	<i>Cirsium discolor</i>	SuAu	All but Lake Erie basin and Upper Allegheny basin
<b>Swamp Thistle <sup>1, 2</sup></b>	<b><i>Cirsium muticum</i></b>	<b>SuAu</b>	<b>All but Susquehanna basin</b>
Pasture Thistle <sup>1, 2</sup>	<i>Cirsium pumilum</i>	SuAu	All but Lower Susquehanna basin
<b>Virginia Springbeauty <sup>1</sup></b>	<b><i>Claytonia virginica</i></b>	<b>Sp</b>	<b>Throughout PA</b>
<b>Spring Blue-Eyed Mary <sup>1</sup></b>	<b><i>Collinsia verna</i></b>	<b>Sp</b>	<b>SW counties</b>
<b>Tall Tickseed <sup>1</sup></b>	<b><i>Coreopsis tripteris</i></b>	<b>Su</b>	<b>All except extreme NC and NE counties</b>
Arrowhead Rattlebox <sup>1, 3</sup>	<i>Crotalaria sagittalis</i>	SuAu	SC and SE counties
<b>Dwarf Larkspur <sup>1</sup></b>	<b><i>Delphinium tricornne</i></b>	<b>Sp</b>	<b>SW counties</b>
Illinois Bundleflower <sup>3</sup>	<i>Desmanthus illinoensis</i>	SpSuAu	Lake Erie basin
Showy Ticktrefoil <sup>2, 3</sup>	<i>Desmodium canadense</i>	Su	Throughout PA
Panicledleaf Ticktrefoil <sup>3</sup>	<i>Desmodium paniculatum</i>	Su	All but NC counties
Perplexed Ticktrefoil <sup>3</sup>	<i>Desmodium perplexum</i>	Su	All but NC and NE counties
<b>Duchman's Breeches <sup>1, 2</sup></b>	<b><i>Dicentra cucullaria</i></b>	<b>Sp</b>	<b>Throughout PA</b>
Philadelphia Fleabane <sup>1</sup>	<i>Erigeron philadelphicus</i>	SpSu	Throughout PA
<b>Boneset <sup>1</sup></b>	<b><i>Eupatorium perfoliatum</i></b>	<b>SuAu</b>	<b>Throughout PA</b>
Flattop Goldenrod <sup>1</sup>	<i>Euthamia graminifolia</i>	Su	Throughout PA
<b>Trumpetweed <sup>1</sup></b>	<b><i>Eutrochium fistulosum</i></b>	<b>SuAu</b>	<b>Throughout PA</b>
<b>Sweet Scented Joe Pye Weed <sup>1</sup></b>	<b><i>Eutrochium purpureum</i></b>	<b>SuAu</b>	<b>Throughout PA</b>
<b>Bottle Gentian <sup>1, 2</sup></b>	<b><i>Gentiana clausa</i></b>	<b>SuAu</b>	<b>Throughout PA</b>

<b>Wild Geranium</b> <sup>1, 2</sup>	<i>Geranium maculatum</i>	<b>Sp</b>	<b>Throughout PA</b>
<b>Common Sneezeweed</b> <sup>1</sup>	<i>Helenium autumnale</i>	<b>SuAu</b>	<b>Throughout PA</b>
<b>Thin-Leafed Sunflower</b> <sup>1</sup>	<i>Helianthus decapetalus</i>	<b>SuAu</b>	<b>Throughout PA</b>
Woodland Sunflower <sup>1</sup>	<i>Helianthus divaricatus</i>	SuAu	Throughout PA
<b>Giant Sunflower</b> <sup>1</sup>	<i>Helianthus giganteus</i>	<b>SuAu</b>	<b>All but northern counties</b>
Smooth Oxeye <sup>1</sup>	<i>Heliopsis helianthoides</i>	Su	Throughout PA
American Alumroot <sup>1</sup>	<i>Heuchera americana</i>	SpSu	All except northern counties
<b>Crimsoneyed Rosemallow</b> <sup>1</sup>	<i>Hibiscus moscheutos</i>	<b>Su</b>	<b>SE and NW counties</b>
<b>Eastern Waterleaf</b> <sup>1, 2</sup>	<i>Hydrophyllum virginianum</i>	<b>SpSu</b>	<b>Throughout PA</b>
Jewelweed <sup>1, 2</sup>	<i>Impatiens capensis</i>	SuAu	Throughout PA
Pale Touch-Me-Not <sup>1, 2</sup>	<i>Impatiens pallida</i>	SuAu	Throughout PA
Beach Pea <sup>1, 3</sup>	<i>Lathyrus japonicus</i>	Su	Lake Erie Basin
Cream Pea <sup>1, 3</sup>	<i>Lathyrus ochroleucus</i>	Su	Northern counties
<b>Marsh Pea</b> <sup>1, 3</sup>	<i>Lathyrus palustris</i>	<b>Su</b>	<b>Lake Erie basin, Susquehanna and Delaware basin</b>
Roundhead Lespedeza <sup>1, 3</sup>	<i>Lespedeza capitata</i>	Su	Eastern, upper Allegheny basin and Lake Erie basin
Shrubby Lespedeza <sup>1, 3</sup>	<i>Lespedeza frutescens</i>	Su	All but Upper Susquehanna basin
Slender Lespedeza <sup>1, 3</sup>	<i>Lespedeza virginica</i>	Su	All but northern counties
Dense Blazing-Star <sup>2</sup>	<i>Liatris spicata</i>	Su	Southeast counties
<b>Great Blue Lobelia</b> <sup>1, 2</sup>	<i>Lobelia siphilitica</i>	<b>SuAu</b>	<b>Throughout PA</b>
Wild Blue Lupine <sup>1, 2, 3</sup>	<i>Lupinus perennis</i>	SpSu	Lake Erie basin, Susquehanna and Delaware basins
<b>Virginia Bluebells</b> <sup>1</sup>	<i>Mertensia virginica</i>	<b>Sp</b>	<b>All but Allegheny and Upper Delaware basins</b>
<b>Scarlet Beebalm</b> <sup>1, 2</sup>	<i>Monarda didyma</i>	<b>SpSuAu</b>	<b>Throughout PA</b>
Wild Bergamont <sup>1, 2</sup>	<i>Monarda fistulosa</i>	Su	Throughout PA
Evening Primrose <sup>1</sup>	<i>Oenothera biennis</i>	Su	Throughout PA
Common Yellow Oxalis <sup>1</sup>	<i>Oxalis stricta</i>	SpSuAu	Throughout PA
Eastern Gray Beardtongue <sup>1</sup>	<i>Penstemon canescens</i>	Su	SC counties
Foxglove Beardtongue <sup>1, 2</sup>	<i>Penstemon digitalis</i>	SpSu	Throughout PA
Hairy Beardtongue <sup>1, 2</sup>	<i>Penstemon hirsutus</i>	Su	All but Lake Erie basin
Eastern Smooth Beardtongue <sup>1</sup>	<i>Penstemon laevigatus</i>	SpSu	Western counties
Pale Beardtongue <sup>1, 2</sup>	<i>Penstemon pallidus</i>	SpSu	Southeastern counties
Wild Blue Phlox <sup>1</sup>	<i>Phlox divaricata</i>	Sp	All but NE counties
Wild Sweet William <sup>1</sup>	<i>Phlox maculata</i>	Sp	Throughout PA
Fall Phlox <sup>1</sup>	<i>Phlox paniculata</i>	Su	Throughout PA
Creeping Phlox <sup>1</sup>	<i>Phlox stolonifera</i>	Sp	Appalachian ridge counties
Moss Phlox <sup>1</sup>	<i>Phlox subulata</i>	SpSu	All but Allegheny basin
<b>Obedient Plant</b> <sup>1</sup>	<i>Physostegia virginiana</i>	<b>SuAu</b>	<b>Throughout PA</b>

<b>Mayapple</b> <sup>1</sup>	<b><i>Podophyllum peltatum</i></b>	<b>Sp</b>	<b>Throughout PA</b>
<b>Jacob's Ladder</b> <sup>1, 2</sup>	<b><i>Polemonium reptans</i></b>	<b>Sp</b>	<b>Throughout PA</b>
Smooth Solomon's Seal <sup>1</sup>	<i>Polygonatum biflorum</i>	Sp	Throughout PA
Dwarf Cinquefoil <sup>1</sup>	<i>Potentilla canadensis</i>	Sp	Throughout PA
Common Cinquefoil <sup>1</sup>	<i>Potentilla simplex</i>	Sp	Throughout PA
Common Selfheal <sup>1, 2</sup>	<i>Prunella vulgaris</i>	SpSu	Throughout PA
Narrowleaf Mountainmint <sup>1, 2</sup>	<i>Pycnanthemum tenuifolium</i>	Su	Throughout PA
<b>Virginia Mountain Mint</b> <sup>1, 2</sup>	<b><i>Pycnanthemum virginianum</i></b>	<b>Su</b>	<b>All but northern tier, except Erie County</b>
Blackeyed Susan <sup>1</sup>	<i>Rudbeckia hirta</i>	SuAu	Throughout PA
Cutleaf Coneflower <sup>1</sup>	<i>Rudbeckia laciniata</i>	SuAu	Throughout PA
Browneyed Susan <sup>1</sup>	<i>Rudbeckia triloba</i>	SuAu	Throughout PA
Hairy Skullcap <sup>1</sup>	<i>Scutellaria elliptica</i> <sup>1</sup>	SpSu	SE counties
Hoary Skullcap <sup>1</sup>	<i>Scutellaria incana</i>	Su	All but SE and northern counties
Blue Skullcap <sup>1</sup>	<i>Scutellaria lateriflora</i>	SuAu	Throughout PA
American Senna <sup>2, 3</sup>	<i>Senna hebecarpa</i>	Su	All but NE and NC counties
Maryland Senna <sup>2, 3</sup>	<i>Senna marilandica</i>	Su	Southern counties
Fire Pink <sup>1</sup>	<i>Silene virginica</i>	SpSu	Western counties, except Lake Erie basin
Whorled Rosinweed <sup>1, 2</sup>	<i>Silphium trifolatum</i>	Su	Western and extreme Southern counties
Atlantic Goldenrod <sup>1</sup>	<i>Solidago arguta</i>	Au	Throughout PA
White Goldenrod <sup>1</sup>	<i>Solidago bicolor</i>	Au	Throughout PA
Wreath Goldenrod <sup>1</sup>	<i>Solidago caesia</i>	Au	Throughout PA
Canada Goldenrod <sup>1</sup>	<i>Solidago canadensis</i>	Au	Throughout PA
Zigzag Goldenrod <sup>1</sup>	<i>Solidago flexicaulis</i>	Au	All but central counties
Giant Goldenrod <sup>1</sup>	<i>Solidago gigantean</i>	Au	Throughout PA
Early Goldenrod <sup>1</sup>	<i>Solidago juncea</i>	SuAu	Throughout PA
Gray Goldenrod <sup>1</sup>	<i>Solidago nemoralis</i>	Au	Throughout PA
Roundleaf Goldenrod <sup>1</sup>	<i>Solidago patula</i>	Au	All but Susquehanna basin
Downy Goldenrod <sup>1</sup>	<i>Solidago puberula</i>	Au	Central and Eastern counties
Wrinkle Leaf Goldenrod <sup>1</sup>	<i>Solidago rugosa</i>	Au	Throughout PA
Blue Wood Aster	<i>Symphyotrichum cordifolium</i>		Throughout PA
Smooth Blue Aster <sup>1</sup>	<i>Symphyotrichum laeve</i>	Au	All but Allegheny basin
White Panicle Aster <sup>1</sup>	<i>Symphyotrichum lanceolatum</i>	Au	Throughout PA
Calico Aster <sup>1</sup>	<i>Symphyotrichum lateriflorum</i>	Au	Throughout PA
New England Aster <sup>1</sup>	<i>Symphyotrichum novae-anglia</i>	Au	Throughout PA

Late Purple Aster <sup>1</sup>	<i>Symphyotrichum patens</i>	Au	Eastern counties
Hairy White Oldfield Aster <sup>1</sup>	<i>Symphyotrichum pilosum</i>	Au	Throughout PA
Crooked Stem/Zigzag Aster <sup>1</sup>	<i>Symphyotrichum prenanthoides</i>	SuAu	Throughout PA
<b>Purplestem Aster <sup>1</sup></b>	<b><i>Symphyotrichum puniceum</i></b>	<b>Au</b>	<b>Throughout PA</b>
Virginia Tephrosia <sup>3</sup>	<i>Tephrosia virginiana</i>	SpSu	All but Northern counties
Canada Germander <sup>1</sup>	<i>Teucrium canadense</i>	Su	Throughout PA
Spiderwort <sup>1, 2</sup>	<i>Tradescantia ohiensis</i>	SpSu	Western and Southeastern counties
Virginia Spiderwort <sup>1, 2</sup>	<i>Tradescantia virginiana</i>	SpSu	All but NC and NE counties
Clasping Venus' Looking Glass <sup>1</sup>	<i>Triodanis perfoliata</i>	Sp	All but Allegheny basin
Large Flower Bellwort <sup>1</sup>	<i>Uvularia grandiflora</i>	Sp	Extreme W and N counties
Sissle Leaf Bellwort <sup>1</sup>	<i>Uvularia sessilifolia</i>	Sp	Throughout PA
Wingstem <sup>1, 2</sup>	<i>Verbesina alternifolia</i>	SuAu	All but NC and NE counties
<b>Blue Vervain <sup>1</sup></b>	<b><i>Verbena hastata</i></b>	<b>Su</b>	<b>Throughout PA</b>
White Vervain <sup>1</sup>	<i>Verbena urticifolia</i>	SuAu	Throughout PA
Giant Ironweed <sup>1</sup>	<i>Vernonia gigantea</i>	SuAu	Western counties
NY Ironweed <sup>1</sup>	<i>Vernonia noveboracensis</i>	SuAu	All but extreme Northern counties
<b>American Speedwell <sup>1</sup></b>	<b><i>Veronica americana</i></b>	<b>Su</b>	<b>Throughout PA</b>
American Vetch <sup>1, 3</sup>	<i>Vicia americana</i>	SpSu	Susquehanna and Delaware basins
Carolina Vetch <sup>1, 3</sup>	<i>Vicia caroliniana</i>	SpSu	Throughout PA
<b>Meadow Zizia <sup>1</sup></b>	<b><i>Zizia aptera</i></b>	<b>SpSu</b>	<b>All but Lake Erie basin and Northern counties</b>
<b>Golden Zizia <sup>1</sup></b>	<b><i>Zizia aurea</i></b>	<b>SpSu</b>	<b>Throughout PA</b>
<b>SHRUBS/VINES</b>			
<b>Buttonbush <sup>1, 2</sup></b>	<b><i>Cephalanthus occidentalis</i></b>	<b>Su</b>	<b>All but extreme NC counties</b>
<b>Virgin's Bower <sup>1</sup></b>	<b><i>Clematis virginiana</i></b>	<b>Su</b>	<b>Throughout PA</b>
Mountain Laurel <sup>1</sup>	<i>Kalmia latifolia</i>	Sp	Throughout PA
Rosebay Rhododendron <sup>2</sup>	<i>Rhododendron maximum</i>	Sp	All but extreme NC and Shenango basom
American Black Current <sup>1</sup>	<i>Ribes americanum</i>	Sp	All but SW and NC counties
Eastern Prickly Gooseberry <sup>1</sup>	<i>Ribes cynosbati</i>	Sp	All but SE and SC counties
Appalachian Gooseberry <sup>1</sup>	<i>Ribes rotundifolium</i>	Sp	All but SW and NE counties
Carolina Rose <sup>1, 2</sup>	<i>Rosa carolina</i>	Su	Throughout PA
Swamp Rose <sup>1, 2</sup>	<i>Rosa palustris</i>	Su	Throughout PA
Virginia Rose <sup>1, 2</sup>	<i>Rosa virginiana</i>	Su	SE and NE counties
Blackberries/Raspberries <sup>1, 2</sup>	<i>Rubus spp.</i>	Su	Throughout PA
<b>Silky Willow <sup>1</sup></b>	<b><i>Salix sericea</i></b>	<b>Sp</b>	<b>Throughout PA</b>
<b>White Meadowsweet <sup>1</sup></b>	<b><i>Spiraea alba</i></b>	<b>SuAu</b>	<b>Throughout PA</b>

<b>Steeplebush</b> <sup>1</sup>	<i>Spiraea tomentosa</i>	<b>SuAu</b>	<b>All but SC and SW counties</b>
American Bladdernut <sup>1</sup>	<i>Staphylea trifolia</i>	Sp	All but Allegheny basin
Common Snowberry <sup>1</sup>	<i>Symphoricarpos albus</i>	Su	Throughout PA
Lowbush Blueberry <sup>1,2</sup>	<i>Vaccinium angustifolium</i>	Su	Throughout PA
Highbush Blueberry <sup>1,2</sup>	<i>Vaccinium corymbosum</i>	Su	Throughout PA
<b>Southern Arrowhead</b> <sup>1,2</sup>	<b><i>Viburnum recognitum</i></b>	<b>SpSu</b>	<b>Throughout PA</b>
<b>Nannyberry</b> <sup>1</sup>	<b><i>Viburnum lentago</i></b>	<b>Sp</b>	<b>All but Susquehanna basin</b>
<b>American Cranberrybush</b> <sup>1</sup>	<b><i>Viburnum opulus var. americanum</i></b>	<b>SpSu</b>	<b>NW counties</b>
<b>TREES</b>			
Common Serviceberry <sup>1</sup>	<i>Amelanchier arborea</i>	Sp	Throughout PA
Allegheny Serviceberry <sup>1</sup>	<i>Amelanchier laevis</i>	Sp	All except SW counties
Redbud <sup>1,2</sup>	<i>Cercis canadensis</i>	Sp	Southern counties
Flowering Dogwood <sup>1</sup>	<i>Cornus florida</i>	Sp	Throughout PA
Cockspur Hawthorn <sup>1</sup>	<i>Crataegus crus-galli</i>	Sp	Western and Southern counties
Fanleaf Hawthorn <sup>1</sup>	<i>Crataegus flabellata</i>	Sp	Throughout PA
Sweet Crabapple <sup>2</sup>	<i>Malus coronaria</i>	Sp	All but Susquehanna and Lake Erie basins
<b>American Plum</b> <sup>1,2</sup>	<b><i>Prunus americana</i></b>	<b>Sp</b>	<b>All but NE</b>
Pin Cherry <sup>1</sup>	<i>Prunus pensylvanica</i>	Sp	All but SW
Black Cherry <sup>1,2</sup>	<i>Prunus serotina</i>	Sp	Throughout PA
Chokecherry <sup>1</sup>	<i>Prunus virginiana</i>	Sp	Throughout PA
Black Locust <sup>1</sup>	<i>Robinia pseudoacacia</i>	Sp	Throughout PA
<b>Pussy Willow</b> <sup>1,2</sup>	<b><i>Salix discolor</i></b>	<b>Sp</b>	<b>All but SC counties</b>
<b>Black Willow</b> <sup>1,2</sup>	<b><i>Salix nigra</i></b>	<b>Sp</b>	<b>Throughout PA</b>
Basswood <sup>1</sup>	<i>Tilia americana</i>	Su	Throughout PA
<sup>1</sup> ABB observed on listed plant or plant in genus (Colla and Dumesh 2010); only native species listed			
<sup>2</sup> Bumble bee superfood based on nectar presence or immune boosting benefits (Xerces 2020)			
<sup>3</sup> Bumble bee superfood based on pollen presence (Saifuddin and Jha 2014)			
<b>Bold</b> indicates moist soil required			

b. Nesting habitat (20 percent of site)

- Unmowed, low density, predominantly native grass mix
- Patches of thatch or hay between grass clumps
- Grass and leaf litter accumulation

c. Overwintering habitat (20 percent of site)

- Edges, hedgerows, old fields, buffer strips, wetlands, wet meadows and swales
- At least ten species of native spring blooming flowers, trees and/or shrubs
- Scattered decaying logs



## Restoration Approaches

Objective: Protect, create or enhance wildflower and grass upland or wet meadows in open farmland, grassland and old field areas. Preferred habitats provide high abundance and diversity of the nectar and pollen flowering plants listed above from late spring to early autumn (Colla 2016; NYNHP 2020). Habitats for foraging, nesting, and overwintering should be within close proximity to each other and without roads or railroads between them, which may be barriers to movement (NYNHP 2020). Target areas adjacent to small agricultural fields (less than 2.0 ha) as nest productivity is higher when travel distance across non-habitat is minimized (Geppert et al. 2020). Suitable areas are free of commercial honeybee operations or greenhouse industries that use captive bumble bees as AMBB has higher sensitivity to parasites than other wild bumble bee species (Cameron et al. 2011).

- 1) Habitat Creation - Crop field conversion adjacent to old fields, hedgerows or wet meadows
  - Herbicide – One application to control weeds
  - Soil-appropriate grass and forb seed mixes for nectar areas -
    - Autumn with winter rye or spring without
    - Include at least ten forbs listed above for each season (i.e., spring, summer, autumn)
    - Include at least three nectar superfoods
    - Include at least three pollen superfoods
  - Seed patches of native grasses or predominantly grass mixes as nesting areas
  - Protect spring ephemerals, shrubs, and trees in adjacent habitat to supply early nectar and pollen
  - Leave downed logs and decaying wood within unmowed areas for overwintering
- 2) Habitat Enhancement - Warm season grass plantings or native wet meadow enhancement (spring only)
  - Remove some grasses to create bare soil patches
  - Plant plugs of or seed with target forbs to improve foraging areas
    - Include at least ten forbs listed above for each season (e.g., spring, summer, autumn)
    - Include at least three nectar superfoods
    - Include at least three pollen superfoods
  - Leave downed logs and decaying wood within unmowed areas for overwintering

## **LONG-TERM MAINTENANCE**

- 1) Existing Habitat - Areas that meet foraging, nesting and overwintering needs for AMBB and include plant species identified above should be protected and maintained.
  - The species presence should be documented. Local naturalists should be queried to document their observations. Surveys should be conducted using the methods and schedule for rusty-patch bumble bee from USFWS (2019). Photo documentation is warranted for AMBB. Avoucher can be collected if multiple AMBB are present and obtaining a high resolution photograph is not possible.
  - If present, evaluate the existing disturbance regime (e.g., grazing, mowing, burning, herbicides). Disturbances should be used on small proportions (less than  $\frac{1}{3}$ ) of the occupied habitat in any one year and in scattered patches to ensure the colonies have continuous nectar and pollen, as well as nesting and overwintering habitat (Schweitzer et al. 2012). Native grass areas with decaying wood that serve as overwintering habitat should not be disturbed. Intervals of 4-6 years should be used to accommodate foraging, nesting and overwintering areas. Shrub control cycle can be longer depending on species' growth rates.
  - Mowing is more conducive to maintaining mosaics on divergent schedules than burning or grazing. Mowing can be used to improve select areas while protecting nesting habitat for queens in the native grass litter. Mowing patches to 12 inches during the summer months can be beneficial providing less than one third of habitat is cut (Schweitzer et al. 2012).

- Sites currently managed with prescribed burning should be divided into several units with less than  $\frac{1}{3}$  of the habitat burned in each year during the winter using a 4- to 6-year rotation (Schweitzer et al. 2012). Overwintering habitat along hedgerows and edges should be left unburned, if safe to do so. Fallen trees should be left on the ground.
- AMBB could be at risk from pesticides if habitat is in proximity to treated areas. Bumble bee populations are uniquely susceptible to insecticides, particularly neonicotinoids, when the application overlaps with colony establishment in the spring (Leza et al. 2018, Baron et al. 2017, Arena and Sgolastra 2014, Averill 2011). If occupied habitat is adjacent to crops, implement a 125-foot buffer to prevent effects from neonicotinoids and 40-foot buffer from other ground-applied pesticides (Xerces 2017).
- In areas where vegetation is controlled by herbicides, management should be shifted to mowing. Limit herbicide use for invasive plant control to spot, injections and stump treatments to prevent loss of target plants.
- Conduct surveys and/or use citizen scientists to monitor bumble bee occupancy and adjust management based on occupancy.

## 2) Restored Habitat

- Disturbances within each habitat sub-type should be used on small proportions (less than  $\frac{1}{3}$ ) of the occupied habitat in any one year and in scattered patches to ensure the colonies have continuous nectar and pollen, as well as nesting and overwintering habitat (Schweitzer et al. 2012).
- Summer mowing of patches is the preferred management tool providing the mower blade is set at 12 inches to avoid grass nests of AMBB.
- Maintain connectivity of colonies where they are clustered (less than five kilometers separation) as it is likely to be critical for long term persistence of populations for most *Bombus* species (Lepais et al. 2010).
- Maintain foraging areas on 4- to 6-year mowing cycle.
- Maintain trees and shrubs on edges with spring wildflowers
- If habitat is adjacent to crops, implement a 125-foot buffer to prevent effects from neonicotinoids and 40-foot buffer from other ground-applied pesticides (Xerces 2017). Limit herbicide use for invasive plant control to spot, injections and stump treatments to prevent loss of target plants.
- Conduct surveys and/or use citizen scientists to monitor bumble bee occupancy and adjust management based on occupancy

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