Bureau of Forestry Native Pollinator Conservation Plan

2021

Prepared By:

PA Bureau of Forestry

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Bureau of Forestry Pollinator Goal

To promote diverse pollinator habitat while minimizing risks to pollinators, thereby supporting pollinator abundance and diversity.

Intent

This Conservation Plan is meant to in part, work to support many of the statewide goals set forth by the Pennsylvania Pollinator Protection Plan, which was created by a working group consisting of 28 organizations and stakeholders from across Pennsylvania. These goals include pro-active management of lawns, rights-of-way, urban areas, and natural landscapes for native pollinators; improving practices for pesticide use; supporting beekeepers; and enhanced emphasis on scientific research to improve understanding of pollinator species ecology and better inform appropriate management.

The Bureau of Forestry fully supports the efforts of other conservation agencies and stakeholders to promote, protect, and enhance native pollinator populations across the Commonwealth. The Bureau of Forestry's mission emphasizes native plants, ecosystem management, and habitat. This plan is focused for use on State Forest Land while still incorporating outreach and partnerships. With 2.2 million acres of State Forest Land, the Bureau of Forestry provides ample opportunity to promote pollinators.

Introduction

Many flowering plants rely on animals for successful pollination (Potts et al. 2010). About 78% of flowering plants in temperate areas depend on these pollinators (Ollerton 2011). This relationship is mutualistic. A diversity of native pollinators supports a variety of plant communities, upon which the pollinators and other wildlife depend (Albrecht et al. 2012). Native pollinators in Pennsylvania include butterflies, moths, bees, beetles, flies, wasps, and hummingbirds (Black et al. 2007, NRCS 2005). Pollinators are ecologically important since they pollinate plants that provide fruit and berries, and they are prey to predators such as songbirds and gamebirds (Black et al. 2007). Many songbirds depend on insects, especially caterpillars, for raising nestlings.

Many flowering forest trees and shrubs as well as herbaceous wildflowers rely on pollinators and provide pollinator habitat. Common native forest trees that are insect pollinated include: American basswood, black cherry, black willow, red maple, tulip poplar, cucumber magnolia, black gum, serviceberry, sumacs, hawthorns, and crabapples. Some of the insect pollinated trees bloom early in the season providing vital nectar and pollen for early season pollinators when not many plants are flowering. Not only are some of these trees utilized for timber, others are valuable for a diversity of wildlife. Insect pollinated native forest shrubs include eastern redbud, sassafras, dogwoods, black chokeberry, nannyberry, ninebark, elderberry, viburnums, and blueberry. These woody species are also hosts to hundreds of moth and butterfly larva.

Wetlands can also provide excellent pollinator habitat. Water is usually readily available at wetlands, especially those with surface water. A diversity of flowering plants, including shrubs and trees, can provide a diversity of floral resources over the growing season in wetlands. Trees and shrubs like pin oak, willow, and alder are host to a variety of lepidopterans. Beaver dam wetlands and the wet meadows resulting from abandoned beaver dams often provide excellent pollinator habitat.

Of the insect pollinators, native bees are especially important. Except for the bumblebees, our native bees are solitary bees. Most of these bees are ground nesters with others being wood nesting bees. Some pollinators, especially some of the lepidopterans, also act as a natural disturbance agent in the forest setting and are important links in the food web.

Pennsylvania has an estimated 8,053 species of terrestrial insects and records for 437 species of bees, 23 of which are exotic (Kilpatrick et al. 2020). In addition to the bees, Pennsylvania has records for 1,725 species of moths. The 2015 Pennsylvania State Wildlife Action Plan lists 3 species of bees, 51 species of butterflies, and 111 species of moths as Species of Greatest Conservation Need.

Pollinators have been declining globally (Potts et al. 2010). In North America, bumblebees have declined in abundance as well as distribution ranges shrinking (Cameron et al. 2011).

Habitat loss or degradation is a main cause of pollinator declines. The presence of invasive plant species that outcompete native wildflowers can degrade existing habitat since they offer lower quality pollen and are often not suitable host species for developing larva. Overabundant deer and the impacts of browsing can also reduce floral resources available to pollinators. Excessive use of artificial outdoor lighting can disrupt the reproductive cycle of insects. The overuse or inappropriate use of pesticides are also a threat to native pollinators.

Improving the Status of Native Pollinators

Conserving native pollinators on state forest land can be achieved by reducing threats and improving or creating habitat such as a diversity of forage plants, host plants, and nesting sites while promoting the wise use of pesticides. The use of outreach promotes pollinator conservation beyond state forest land.

Threats to Pollinators

Invasive Plants

Invasive plants not only provide low-nutrient pollen sources for native pollinators, they also outcompete and displace the high-quality flowering plants and spring ephemeral flowers valuable to native pollinators. While many pollinators will use a variety of plants, some specialized species form close relationships with specific native plants at different times of the year, increasing the importance of maintaining native plant populations in an area (Burkle et al, 2013). Native plants are also better hosts to herbivorous larval pollinators.

Overabundant Deer

White-tailed deer have the ability to drastically impact the vegetation in a given habitat (Alverson et al. 1998, Russell et al. 2001, Horsley et al. 2003). Since pollinators rely on vegetation for food and nesting sites, overabundant deer can negatively impact pollinator populations leading to reduced abundance and diversity of pollinators (Allombert et al. 2005, Baines et al, 1994). Cooperation with the Pennsylvania Game Commission and the use of the DMAP program can help with the management of deer impacts on State Forest Land.

Outdoor Lighting

Artificial outdoor lighting can disrupt insect reproductive activity. Minimizing the amount of outdoor lighting as much as practical can reduce the impact on insects. Using yellow lights also has less impact than white lights that are attractive to many insects.

Pesticide Use

Pesticides are used for multiple resource management objectives. One use that can be beneficial to pollinators is to control invasive plants using herbicides. The use of spot treatment for invasive plants is preferred over broadcast applications if possible. Insecticides are also used to manage populations of non-native insect pests such as the gypsy moth. As gypsy moths are lepidopterans, some treatments targeted toward gypsy moths can impact non-target organisms such as native lepidopteran pollinators. Treatments for gypsy moth include *Bacillus thuringiensis* subspecies *kurstaki* Berliner (Btk), tebufenozide, and the gypsy moth nucleopolyhedrosis virus (NPV) Gypcheck.

Bacillus thuringiensis subspecies *kurstaki* is a naturally occurring rod-shaped bacterium that can affect the larvae of many moths and butterflies. All formulations of Btk registered for gypsy moth control contain dormant bacterial spores along with crystals of a toxic protein, called delta-endotoxin, that the bacteria produce. Susceptible caterpillars must eat these spores and crystals for the Btk to work. Once eaten, the crystals dissolve in the alkaline gut of the caterpillar and cause paralysis of the digestive system. Feeding usually ceases at this point. Cells in the gut wall then break down allowing dormant spores to invade the body cavity. If the caterpillar has not died by this time, the spores germinate and multiply in the body cavity causing a lethal infection. In small larvae, the action of the crystal alone is usually fatal, but in larger larvae it is the later infection by the spores that causes death. Strains of the subspecies *kurstaki* are grown under controlled conditions by several manufacturers and are then formulated into biological insecticides for control of many forest and agricultural pests, including the gypsy moth (*Lymantria dispar*).

Tebufenozide is an insect growth regulator that acts upon the larvae of lepidopteran pests and is used throughout North America to combat several forest defoliator pests such as the gypsy moth, tent caterpillars, budworms, tussock moths, and others. Tebufenozide is a 'biorational' insecticide that controls specific insects by affecting their growth cycle. Tebufenozide acts in a unique way whereby the active ingredient, tebufenozide, triggers the molting hormone of the target insect. When ingested by susceptible larvae, the active ingredient 'mimics' the insect hormone that triggers molting as the caterpillar goes through its growth stages. The insecticide causes a premature molt in larvae, causing a stop in feeding and death.

Gypcheck is made from the naturally occurring gypsy moth nucleopolyhedrosis virus that is specific to gypsy moth and does not affect other butterfly or moth species. Like Btk and tebufenozide, Gypchek is applied via spray aircraft. This product is used when lepidopteran species of concern are known in the area. No gypsy moth treatment should occur around threatened or endangered Lepidopteran species unless Gypcheck is available.

Protective Measures for Pesticide Use

All treatments by the DCNR Bureau of Forestry using Btk, tebufenozide, or Gypcheck are submitted for environmental review through jurisdictional agencies in Pennsylvania. All treatments are reviewed for adverse effects to plants, wildlife, and invertebrates by the Pennsylvania Department of Conservation and Natural Resources (plants and invertebrates), the Pennsylvania Game Commission (birds and mammals), the Pennsylvania Boat Commission (fish, reptiles, aquatic invertebrates), and the U.S. Fish and Wildlife Service (all taxa). All agencies provide concerns, restrictions, and mitigation measures if necessary. Once environmental reviews are completed by the appropriate agencies, they are submitted to the USDA Forest Service for review.

No insecticides may be directly sprayed over streams, lakes, open wetlands, or other open bodies of water unprotected by a closed tree canopy. In addition, chemical insecticides such as tebufenozide may not be used within 500 feet of such open, unprotected water sources in order to prevent the introduction of spray drift into the water consistent with the insecticide label. If spraying is required within these 500-foot buffer areas to protect the forest resource, only *Bacillus* (Btk) or Gypchek may be used. Otherwise, a 500-foot, no-spray buffer must be maintained.

Btk and tebufenozide are not applied to any lepidopteran species of concern or to their habitat. Any areas identified through the PNDI process are avoided or Gypchek is used.

The Division of Forest Health can assist with specific insecticide issues and the Division of Conservation Science and Ecological Services can assist with specific herbicide issues.

Pollinator Habitat

Pollinator habitat is very diverse and dependent on the specific pollinators. Mature forests, young forests, herbaceous openings, and wetlands all provide habitat for some pollinators. Herbaceous openings and young forests typically support higher abundances and species diversity of pollinators than mature forest, though mature forests provide habitat for specialist pollinators that aren't usually found in openings (Mullally et al. 2019, Winfree et al. 2007). The Bureau of Forestry has a goal of harvesting 7,653 acres of timber as overstory removals per year on state forest land; resulting in young forest habitat available for pollinators. Additional pollinator habitat is provided via wildlife openings, meadow plantings, wetland habitat improvement projects, abandoned mine land restoration, and pipeline ROW corridors planted with native wildflowers. The Monarch Joint Venture has a goal of an addition of 1.3 to 1.8 billion stems of milkweed nationwide. The Bureau of Forestry can help with this goal by utilizing milkweed in native seed mixes designed to benefit pollinators. Details on habitat creation and improvement are described below.

Create and Maintain Habitat

All wildlife requires food, cover, and water in their habitat, and food is the limiting factor for most native pollinator populations (Surcica 2009). Cover; which is needed for egg-laying, nesting, or resting, is plentiful on state forest land and can be anything from a shrub or tussock in a field, loose bark on a tree, a snag, or a cavity in the ground. Therefore, the most efficient way to improve habitat for pollinators will be to provide more native food sources including wildflowers and flowering trees and shrubs (NRCS 2005). These flowering plants should be diverse to provide for an array of pollinators, and to ensure continuous blooming of various flowers throughout the season (Black et al. 2007, Ellis and Barbercheck 2014, Schweitzer et al. 2012, Surcica 2009). Non-native plants, though attractive, do not provide the benefits of native plants. Insect pollinators often utilize yellow, purple, and blue flowers, while hummingbirds feed from red flowers. Providing a diverse, native vegetative community to benefit adult pollinators will also benefit caterpillars that rely on host species to survive and develop. Habitat provided in one area may act as a refuge for individuals, and a source of individuals to recolonize other areas (Black et al. 2007). Providing pollinator habitat can be incorporated into many existing management practices. The following lists are not all inclusive but include some of the more valuable wildflowers for pollinators. Refer to the Bureau of Forestry's *Planting and Seeding Guidelines* for a list of additional native wildflowers and recommended seeding rates. Typically, 0.5 lbs of wildflower seed per acre is sufficient when added to a Bureau of Forestry seed mix. If the expressed goal of the site is to

attract pollinators, considering adding more seed and more species per acre. The wildflowers listed below typically do well within the pH range of 5.5-6.0. The rhizobium bacteria responsible for nodule formation and nitrogen fixation on legumes such as partridge pea and showy tick trefoil are sensitive to pH with few species tolerating pH values below 5.0 (Fergeson et al. 2013, Graham et al. 1994). Conducting soil tests is highly recommended for pollinator habitat projects. If the soil pH is below 5.5, liming should be considered to achieve a pH of 5.5. Submit soil test results to the Ecological Services Section for entry into the *Soil Test Results Database*. Compacted soils should be ripped or deep tilled prior to planting to provide loose soil for healthy root development. Improved soil conditions can improve vegetation health, protein content in pollen, and sugar content in nectar; leading to improved health of pollinators utilizing the plants (Cardoza et al. 2012). Refer to the Bureau of Forestry's *Pollinator Habitat at Resource Management Centers* guidance document for more information.

Practices to Provide Forage

- Plant a variety of native wildflowers to provide blooming throughout the season
- Plant a native pollinator garden at District Offices
- Add native wildflower seed to seed mixes used on timber sales, particularly log landings
- Add native wildflower seed to seed mixes used on pipeline rights-of-way
- Add short stature native flowering shrubs to pipeline rights-of way
- Plant native flowering trees and shrubs on temporary workspaces for pipeline rights-of-way
- Add native wildflower seed to post-construction storm water management structures associated with Marcellus infrastructure
- Add native wildflowers to roadside areas
- Add native wildflowers to wildlife habitat projects such as permanent herbaceous openings and wetland habitat improvement projects
- Incorporate native wildflowers in restoration projects
    - Abandoned mine lands
    - Gas infrastructure
- Consider using a native wildflower seed mix on fire lines and bare soil after controlled burns
- Leave unburned patches within controlled burns as habitat refugia
- Add native wildflower seed to mixes for Turf to Meadow (Conservation Landscaping) plantings
- Add native flowering trees and shrubs to riparian forest buffer plantings

Native Wildflowers

Wildflower	Scientific Name	Season	Pollinators
Mountainmint	*Pycnanthemum spp.*	Spring	Butterflies, Bees, Beetles
Common milkweed	*Asclepias syriaca*	Spring-Summer	Butterflies, Bees, Beetles
Tall white beardtongue	*Penstemon digitalis*	Spring-Summer	Bees
Wild bergamot	*Monarda fistulosa*	Summer	Butterflies, Bees, Hummingbirds
Butterfly milkweed	*Asclepias tuberosa*	Summer	Bees, Butterflies, Beetles
Ox-eye sunflower	*Heliopsis helianthoides*	Summer	Bees
Black-eyed Susan	*Rudbeckia hirta*	Summer	Bees, Butterflies, Beetles
Senna	*Senna hebecarpa*	Summer	Bees
Showy tick trefoil	*Desmodium canadense*	Summer	Bees, Hummingbirds
Partridge pea	*Chamaecrista fasciculata*	Summer	Bees, Butterflies
Gray goldenrod	*Solidago nemoralis*	Fall	Butterflies, Bees, Beetles
New England aster	*Symphyotrichum novae-angliae*	Fall	Bees, Butterflies

Adapted from Surcica 2009.

The Bureau of Forestry's Native Pipeline Seed Mix and AML Restoration Seed Mix both include a diversity of wildflowers important to pollinators. These seed mixes provide an excellent starting point to provide forage and cover for pollinators, as well as other wildlife.

Native Flowering Shrubs and Trees

Dogwoods (*Cornus spp*.)
Elderberry (*Sambucus spp*.)
Serviceberry (*Amalanchier spp*.)
Hawthorn (*Crataegus spp*.)
Maples (*Acer spp.*)
Willows (*Salix spp.*)
Tulip Poplar (*Liriodendron tulipifera*)
Blueberry (*Vaccinium spp.*)
Viburnums (*Viburnum spp*.)
American mountain ash (*Sorbus americana*)
American sweet crabapple (*Malus coronaria*)
Redbud (*Cercis canadensis*)
Black Cherry (*Prunus serotina*)
American Basswood (*Tilia americana*)
Cucumber Tree (*Magnolia acuminata*)
Staghorn Sumac (*Rhus typhina*)

Establishing Pollinator Meadows

One of the best ways to provide pollinator habitat is to create pollinator meadows. These meadows can be multi-functional and act as wildlife openings or replace large areas of lawn and non-native food plots. Native meadows with abundant and diverse wildflowers benefit a variety of pollinators and other beneficial insects. More information about how to establish these meadows can be found in the *Bureau of Forestry Guidance for Pollinator Meadows*. The watershed staff in the Rural and Community Forestry section and the staff in the Ecological Services Section can provide additional assistance.

Pollinator-Wildlife Orchards

Orchards planted to provide food for wildlife can also benefit pollinators with some thought about tree and shrub selection. Trees and shrubs that are great for both attracting game animals and pollinators include serviceberry, hawthorn, American mountain ash, and sweet crabapple. Using a pollinator friendly seed mix such as those mentioned above for ground cover will further enhance a wildlife-

pollinator orchard; increasing the number of pollinators generally leads to increased fruit-set on orchard trees.

Nesting Habitat

In addition to providing floral resources, including pithy stemmed plants can benefit solitary bees that nest within the stems. Some examples include *Rubus spp*., beardtongue, wild bergamot, elderberry, goldenrod, mountain mint, pokeweed, staghorn sumac, and showy ticktrefoil (Xerces Society 2019). There are also plants that are favored as leaf material for nest building such as blackberry, eastern redbud, maple, showy ticktrefoil, and senna (Xerces Society 2019).

While nesting sites are not often limited in natural areas, there are options for providing nesting structures around developed areas such as District Offices. Bee blocks designed for wood nesting bees can provide nesting sites around pollinator gardens, thereby providing both nesting sites and forage. These blocks can be easily constructed, consisting of untreated lumber with holes of various sizes drilled to accommodate different species of bees. Bee nesting blocks must be cleaned on a regular basis to prevent pathogens. Pithy stemmed vegetation provides natural nest sites for some bees. Stems of perennial vegetation cut about 15 inches high can provide nest sites, as well as pithy elderberry. Most of our native bees are ground nesting and require bare patches of soil that are left undisturbed. Bumblebees will overwinter in leaf litter if left on site and undisturbed.

Pollinator habitat creation or improvement projects should be entered into the Wildlife Habitat Improvement Layer in FIMS.

Roadside Vegetation Management

There are over 2,000 miles of Z1 roads and an additional 4,200 miles of Z2 and Z3 roads on State Forest Land. Roadside rights-of-way (ROW) can provide opportunities to benefit pollinators depending on the vegetation present and maintenance regime. If the ROW is in a maintained herbaceous state, some simple practices can drastically improve pollinator habitat by providing floral food sources, host plants, nesting opportunities, and habitat connectivity. These practices consist of utilizing a mowing and maintenance regime that reduces risks to pollinators while providing habitat and incorporating native vegetation, especially wildflowers, within the ROW. One of the easiest and most effective practices is simply to reduce mowing. The Bureau of Forestry has guidance on maintaining roadside rights-of-way for pollinator habitat based on frequency, season, and height of mowing along with width of maintained area and seed mixes. Refer to *Bureau of Forestry Roadside Pollinator BMPs* for more information.

Registering Pollinator Gardens

Pollinator gardens should not only be added to the Wildlife Habitat Improvement layer in FIMS, they should also be registered with Pollinator Partnership's Million Pollinator Garden Challenge. Priorities for entries include new habitat created for pollinators along with habitat improvement projects performed for pollinators. This can be done by entering basic information about the pollinator garden at: https://www.pollinator.org/mpgcmap/register

Monitoring

Pollinator habitat can be monitored to determine its value to a diversity of pollinators and understand current conditions. Monitoring protocols developed by the Xerces Society and the Monarch Joint Venture can be used on created pollinator habitat in locations such as gardens, pipeline rights-of-way,

and abandoned mine land restoration sites. The Bureau of Forestry is currently utilizing multiple habitat monitoring protocols for abandoned mine land restoration projects and is exploring opportunities for incorporating monitoring protocols for gas rights-of-way.

Tools

Pennsylvania Conservation Explorer

Projects on state forest land regardless of permit requirements, require a PNDI to be run via the Pennsylvania Conservation Explorer Tool to avoid or minimize conflict with rare, threatened, and endangered species. These species include rare insect pollinators.

Beescape

Beescape is an online interactive map tool that allows a user to click on a location on the map and retrieve an estimated number of native bees nesting in the area, along with scores assigned to floral resources for spring, summer, and fall. This information can be used to help site pollinator habitat projects and to tailor a seed mix to compensate for a season with a low-ranking score. The Beescape tool can be located at: https://beescape.org/

Outreach

Improving awareness of pollinators conservation depends on outreach to both the public and Bureau of Forestry staff. Outreach includes providing guidance on pollinator habitat, showcasing pollinator habitat at Resource Management Centers, utilizing signs that advertise pollinator habitat, providing educational presentations, and using DCNR social media to promote pollinator conservation and awareness. Service foresters that give pollinator related presentations report information about these presentations to the Rural and Community Forestry section.

Partnerships

Many opportunities exist for partnerships to promote pollinator conservation. Some examples of existing partners include the Xerces Society, Western Pennsylvania Conservancy, the Center for Pollinator Research at Pennsylvania State University, the Pollinator Partnership, the Monarch Joint Venture, and the Bureau of Forestry Lawn Conversion Advisory Committee. Project Wingspan is a program implemented by the Pollinator Partnership that focuses on habitat conservation and native seed collection. The Pennsylvania State University Center for Pollinator Research provides many opportunities for collaboration and research, some of which is conducted on State Forest Land. Being a partner of the Monarch Joint Venture provides access to educational materials, other pollinator professionals, and training opportunities.

Citizen Science

Bumble Bee Watch

A program called Bumble Bee Watch allows for monitoring of bumble bees by submitting observations online. Bumblebee watch is available at: https://www.bumblebeewatch.org/ . This program also has tools to help with identification of unknown bumble bees.

iNaturalist

iNaturalist is a citizen science program that allows users to upload occurrences of pollinators and other taxa into the iNaturalist database. iNaturalist is available at: https://www.inaturalist.org/ . The addition of this citizen science data can lead to improvement in tools designed to assist with the management of pollinators.

Monarch Larva Monitoring Project

The Monarch Larva Monitoring Project (MLMP) allows monarch reproductive data to be submitted to better understand breeding monarch population dynamics. This data is valuable to conservation efforts focused on monarchs and their reproductive needs such as milkweed. The MLMP is managed by a partnership of the Monarch Joint Venture and the University of Wisconsin-Madison Arboretum. https://monarchjointventure.org/mlmp

Goal, Strategies, and Objectives

Goal: *To promote diverse pollinator habitat while minimizing risks to pollinators, thereby supporting pollinator abundance and diversity.*

Strategy 1: Create and improve pollinator habitat on State Forest Land

Objective 1.1: Create new pollinator habitat on State Forest Land

Tactics:

- Create new pollinator habitat at RMCs making up at least 5% of available lawn
    - Convert turf to meadow at RMCs
- Plant pollinator gardens at RMCs
- Use pollinator friendly native seed mixes in conjunction with active management
    - Utility rights-of-way
    - Timber sales
    - New herbaceous openings
    - Converting non-native food plots to native herbaceous openings
    - Prescribed fires
    - PCSM structures
    - Abandoned mine land restoration sites
    - Gas infrastructure restoration sites
    - Wetland habitat improvement projects

Objective 1.2: Improve existing pollinator habitat

Tactics:

- Add missing habitat components to existing pollinator areas
    - Nesting habitat
    - Host plants
    - Gaps in seasonal floral availability
- Maintain roadside rights-of-way to improve habitat conditions

- Over-seed existing herbaceous openings or non-native food plots with native wildflowers
- Utilize pollinator friendly lawn maintenance techniques at RMCs

Strategy 2: Gain information about pollinator habitat conditions

Objective 2: Monitor pollinator habitat using existing protocols

Tactics:

- Monitor pollinator specific habitat projects
- Monitor gas pipeline rights-of-way for pollinator habitat
- Monitor pollinator habitat at abandoned mine land restoration sites

Strategy 3: Minimize threats to pollinators

Objective 3.1: Reduce risks from invasive plants

Tactics:

- Continue to implement EDRR
- Monitor and treat invasive plants in pollinator habitat areas

Objective 3.2: Reduce risks from pesticides

Tactics:

- Avoid pesticide use around designated pollinator habitat
- Minimize pesticide use
- Follow pesticide labels
- Comply with DCNR and Bureau of Forestry pesticide guidance

Objective 3.3: Reduce risks from outdoor lighting

Tactics:

- Minimize outdoor lighting to the greatest extent practical
- Utilize yellow spectrum LED lights for outdoor lighting

Strategy 4: Increase pollinator awareness

Objective 4.1: Promote pollinator awareness within the Bureau of Forestry

Tactics:

- Provide guidance on pollinators
- Plant pollinator gardens at RMCs
- Emphasize pollinators during herbaceous opening workshops
- Develop additional pollinator workshops

Objective 4.2: Promote pollinator awareness to the public

Tactics:

- Provide pollinator brochures and factsheets at RMCs
- Plant pollinator gardens at RMCs and incorporate pollinator signs
- Provide educational presentations to the public and Bureau of Forestry staff
- Utilize existing media
    - DCNR Facebook
    - DCNR Twitter

Strategy 5: Emphasize partnerships to promote pollinators

Objective 5.1: Strengthen existing partnerships

Tactics:

- Continue to coordinate pollinator information exchange
- Promote partner pollinator research
- Continue collaborating with partners

Objective 5.2: Develop new partnerships

Tactics:

- Explore opportunities to partner with organizations with similar missions and goals
- Create innovative opportunities to partner with utility companies

Strategy 6: Contribute to statewide and nationwide pollinator initiatives through Citizen Science

Objective 6: Promote existing Citizen Science programs pertaining to pollinators

Tactics:

- Submit bumble bee sightings to Bumble Bee Watch
- Submit pollinator sightings to iNaturalist
- Submit monarch reproductive data to the Monarch Larva Monitoring Project

Strategy 7: Track pollinator efforts conducted by Bureau of Forestry Staff

Objective 7: Evaluate progress and report out on pollinator efforts conducted by Bureau of Forestry staff

Tactics:

- Enter pollinator habitat projects into the Wildlife Habitat Improvement Layer in FIMS
    - New habitat created to benefit pollinators
    - Habitat that was actively managed to improve existing habitat for pollinators

- Document pollinator related educational and outreach events to be compiled by the Ecological Services section
- Develop an annual report on pollinator habitat projects and educational events conducted by Bureau of Forestry staff

Summary

By creating or improving habitat for pollinators and reducing stressors such as pesticide use, we can drastically improve conditions for pollinators on state forest land. Pollinators are critical to the entire ecosystem including timber trees due to their pollination services and food web connections. We can also further efforts of partners by collecting and submitting information about nest and bee sightings as well as monarch larva.

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