

Landscape Design and Management to Support Pollinator Species At Risk in Eastern Massachusetts

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Above: conceptual rendering of Birches School landscape design with Areas 2, 3 and 4 (pages 9-12) seen from the perspective of the parking lot facing south. Below: existing conditions at the Birches School in September 2019.

Plants Matter

A truly “pollinator-friendly” landscape is highly diverse in both plant and animal species composition and includes a wide range of native plant types, ensuring that pollen and nectar are available throughout the growing season; and that nesting habitat and host plants are available throughout the year. The focus of this Toolkit is to provide the necessary plants and landscape management techniques to support native pollinator species that are threatened in eastern Massachusetts. The loss of these pollinator-plant interactions, or pollination systems, can have catastrophic consequences on the biodiversity of the state, and the region as a whole. But it’s not too late to start planting.



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Why Pollinators?

Native pollinators are vital to creating and maintaining the habitats and ecosystems that most animals rely on for food and shelter — including humans. Just like humans, pollinators need nutrient-dense food, shelter, and successful reproduction to thrive. But not all species require the same thing. A delicate balance exists between native plants and their pollinators, relationships that evolved over millions of years. Some plants have a small guild of species which coevolved with them to ensure their pollination. Similarly, approximately 15% of northeastern native bees are considered pollen specialists (Fowler, 2016). For many specialists, once their “partner” is missing from the landscape, they cannot reproduce — and thus risk becoming extirpated, endangered (and eventually, extinct).

A major misconception about pollinator decline is that all species are declining at the same rate. In fact, many species are actually increasing in abundance and geographic distribution as a direct result of human disturbance. “Seeing lots of bees” does not necessarily mean that your landscape is pollinator-friendly. Unfortunately, most efforts to restore pollination systems to date have resulted in increasing the numbers of a few common bee, butterfly and moth species, rather than on *the range of wild pollinator species needed* for ecosystem health and resiliency.

Bombus fervidus foraging on red clover (Trifolium pratense). One of the most abundant bumblebee species in Massachusetts a few decades ago, it is now the second rarest bumblebee species in the state. Photograph by Dr. Robert Gegean.



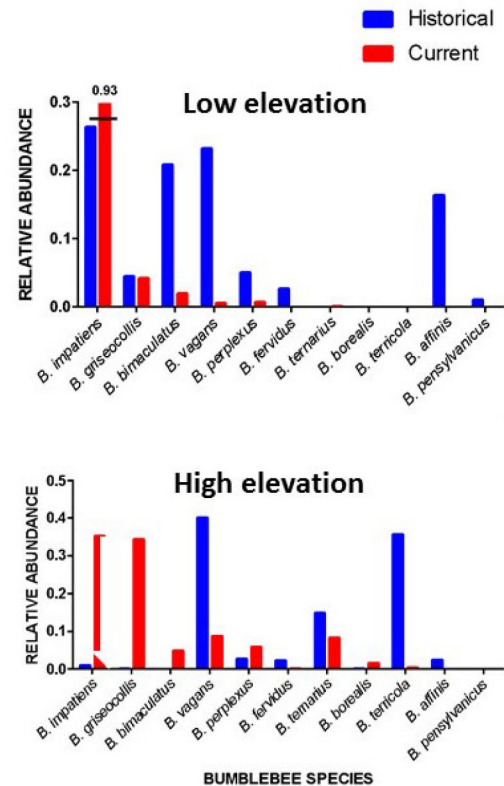
The Status of Bumblebee Species in Massachusetts (1960-2019)



Bombus impatiens



Bombus fervidus



Images and data courtesy Dr. Robert Gegear.

Pollinator Decline in Massachusetts

By tracking bee, butterfly and moth observations over the past 150+ years, we get an accurate picture of pollinator health in the state. The situation isn't so great: the number of bumblebee species has dropped from 11 to nine, with three more species (*Bombus fervidus*, *Bombus terricola* and *Bombus vagans*) in danger of being extirpated within the next decade. MassWildlife lists five more bees and 44 butterflies and moths as Species of Greatest Conservation Need (Massachusetts Division of Fisheries and Wildlife, 2015). These losses risk cascading impacts across ecosystems. If trends continue, human actions will remove too many species and natural systems will begin to collapse.

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At-Risk Pollinators Supported by this Toolkit

Bees:

- » *Bombus fervidus* Golden northern bumblebee
- » *Bombus vagans* Half-black bumblebee

Lepidoptera:

- » *Callophrys gryneus* Juniper hairstreak
- » *Callophrys irus* Frosted elfin
- » *Euphyes conspicua* Black dash
- » *Hesperia leonardus* Leonard's skipper
- » *Hesperia metea* Cobweb skipper
- » *Hesperia sassacus* Indian skipper
- » *Poanes massasoit* Mulberry wing
- » *Satyrrium acadica* Acadian hairstreak
- » *Satyrrium favonius* Oak hairstreak
- » *Speyeria aphrodite* Aphrodite fritillary



Biggest Threats Facing Pollinators

- » Habitat Loss
(human development)
- » Pesticides
- » Climate Change
- » Introduced Parasitoids
and Pathogens
(primarily from honeybees)
- » Air and Light Pollution

Photographs (clockwise from
top): *Callophrys irus* by Peter
Murray; *Bombus vagans* by Peter
Gorman; *Hesperia sassacus* by Alan
Schmierer; *Speyeria aphrodite* by
Andrea Janda.

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What You Can Do

The good news is, there's a lot that can be done on the part of individuals and communities. That's where this Toolkit comes in. By following the plant lists and habitat management guidelines outlined on the following pages, you can attract and sustain threatened pollinator species at your home or site — building local networks of biodiversity, ecosystem health and climate resiliency through pollinator-plant interactions.

This page, clockwise from top: Andropogon gerardii, Desmodium canadense, Carex pensylvanica, Eutrochium maculatum, Mulberry wing on Asclepias syriaca, Doellingeria (Aster) umbellata var. umbellata, Prunus maritima var. maritima, Viola sororia, Black dash, Salix humilis, Vaccinium pallidum, unknown bumblebee on Solidago flexicaulis, Prunella vulgaris ssp. lanceolata, Pedicularis canadensis ssp. canadensis. Opposite page, top to bottom: Cirsium pumilum var pumilum, Diervilla lonicera, Hypericum punctatum, Penstemon hirsutus, Rosa carolina, Salix petiolaris, Spirea alba var. alba



Recommended Plants for Northeastern Massachusetts*



Latin Name	Common Name
<i>Andropogon gerardii</i>	Big bluestem
<i>Asclepias syriaca</i>	Common milkweed
<i>Baptisia tinctoria</i>	Yellow wild indigo
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Cirsium pumilum</i> var. <i>pumilum</i> (sub: <i>C. discolor</i>)	Pasture thistle (sub: Field thistle)
<i>Desmodium canadense</i>	Showy tick-trefoil
<i>Diervilla lonicera</i>	Northern bush-honeysuckle
<i>Doellingeria</i> (Aster) <i>umbellata</i> var. <i>umbellata</i>	Tall white-aster
<i>Euthrochium dubium</i>	Coastal plain Joe-Pye weed
<i>Euthrochium maculatum</i>	Spotted Joe-Pye weed
<i>Hypericum ascyron</i> (<i>H. pyramidatum</i>)	Great St. John's-wort
<i>Hypericum punctatum</i>	Spotted St. John's-wort
<i>Juniperus virginiana</i> var. <i>virginiana</i>	Eastern red cedar
<i>Pedicularis canadensis</i> ssp. <i>canadensis</i>	Canadian lousewort
<i>Panicum virgatum</i>	Switchgrass
<i>Penstemon hirsutus</i>	Northeastern beardtongue
<i>Prunella vulgaris</i> ssp. <i>lanceolata</i>	Common selfheal
<i>Prunus maritima</i> var. <i>gravesii</i> (sub: <i>P. maritima</i> var. <i>maritima</i>)	Beach plum
<i>Quercus ilicifolia</i>	Scrub oak
<i>Rosa carolina</i>	Carolina rose
<i>Rubus flagellaris</i>	Northern blackberry
<i>Rubus odoratus</i>	Purple-flowering raspberry
<i>Salix humilis</i>	Prairie willow
<i>Salix lucida</i> ssp. <i>lucida</i>	Shining willow
<i>Salix petiolaris</i>	Meadow willow
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	Little bluestem
<i>Solidago caesia</i> var. <i>caesia</i>	Axillary goldenrod, Blue-stem goldenrod
<i>Solidago flexicaulis</i>	Zig-zag goldenrod
<i>Solidago juncea</i>	Early goldenrod
<i>Solidago puberula</i> var. <i>puberula</i>	Downy goldenrod
<i>Solidago sempervirens</i> var. <i>sempervirens</i>	Seaside goldenrod
<i>Spiraea alba</i> var. <i>alba</i> (sub: <i>S. alba</i> var. <i>latifolia</i>)	White meadowsweet
<i>Vaccinium pallidum</i> (sub: <i>V. angustifolium</i>)	Hillside blueberry (sub: Lowbush blueberry)
<i>Viola</i> ssp.	Violet

*plant recommendations are site-specific and based on landscape conditions at the Birches School.



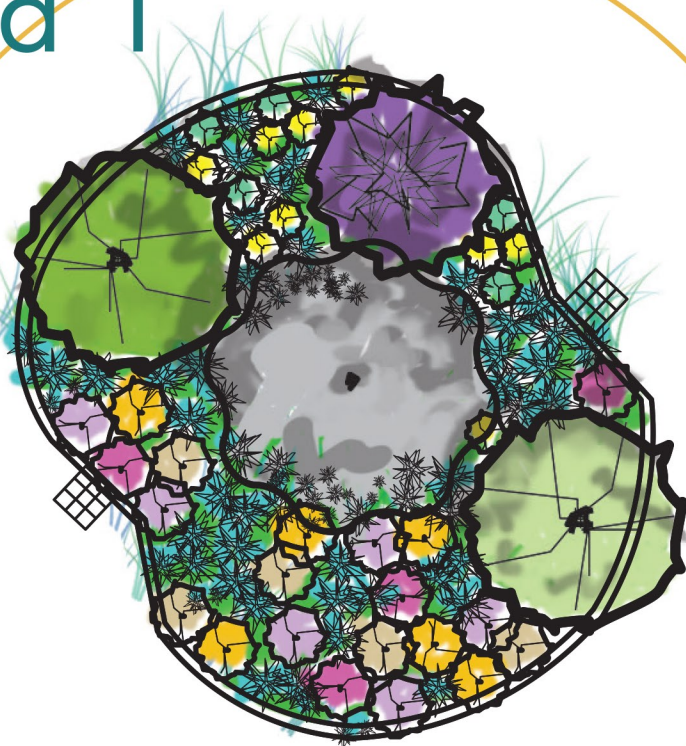
Area 1

Habitat Conditions

- » full sun to part shade
- » medium to wet soils
- » tolerant of snow plowing and harsh environment

PLANT LIST

- TALL WHITE-ASTER
- COASTAL PLAIN JOE-PYE WEED
- SPOTTED JOE-PYE WEED
- GREAT ST. JOHN'S-WORT
- PURPLE-FLOWERING RASPBERRY
- LITTLE BLUESTEM
- SHINING WILLOW
- MEADOW WILLOW
- AXILLARY GOLDENROD
- ZIG-ZAG GOLDENROD
- (EXISTING RED MAPLE)



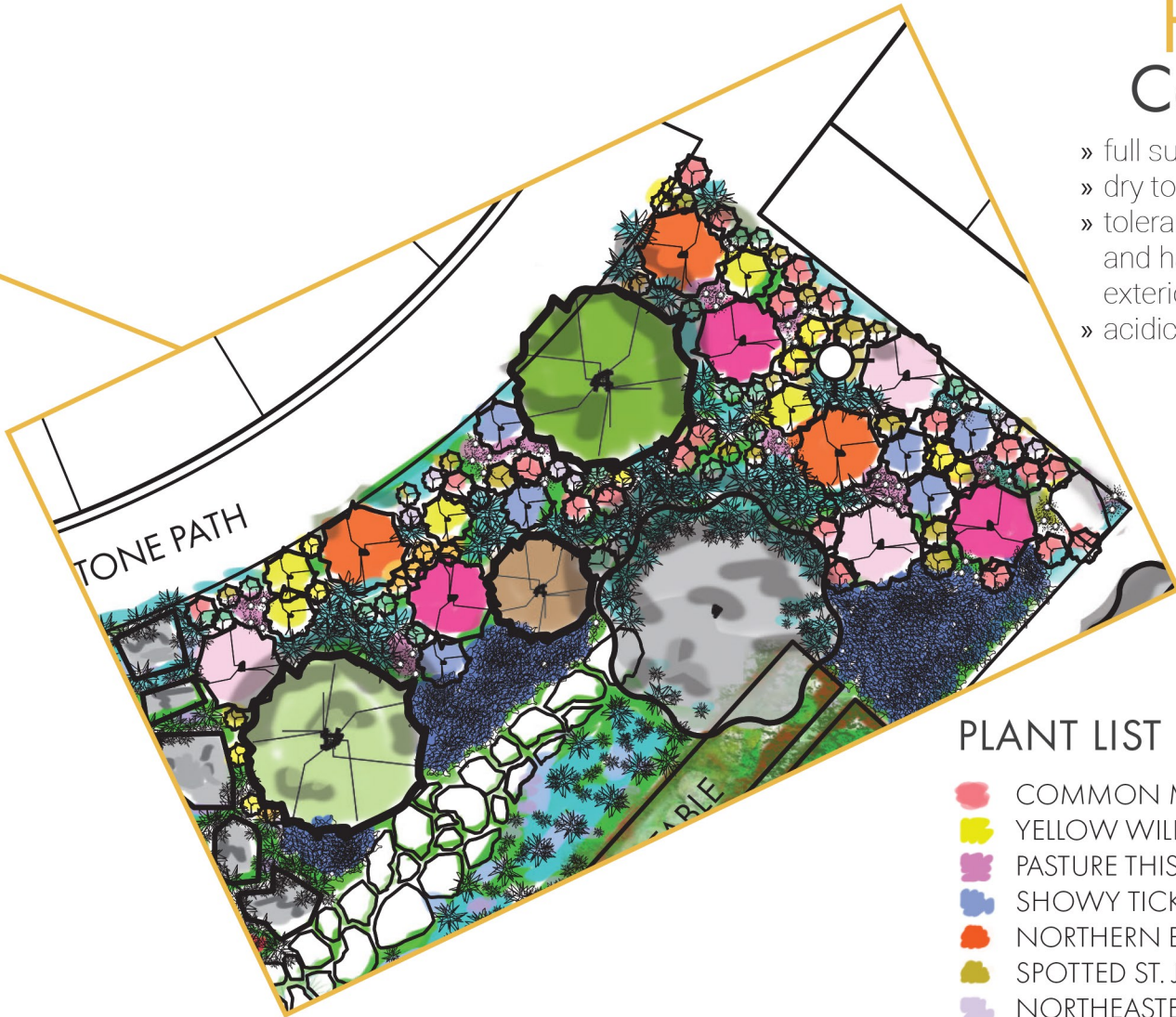
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Introduction to Design Areas

Habitat Conditions

- » full sun to part shade
- » dry to medium soils
- » tolerant of snow plowing and harsh environment on exterior edges
- » acidic soils (low pH)



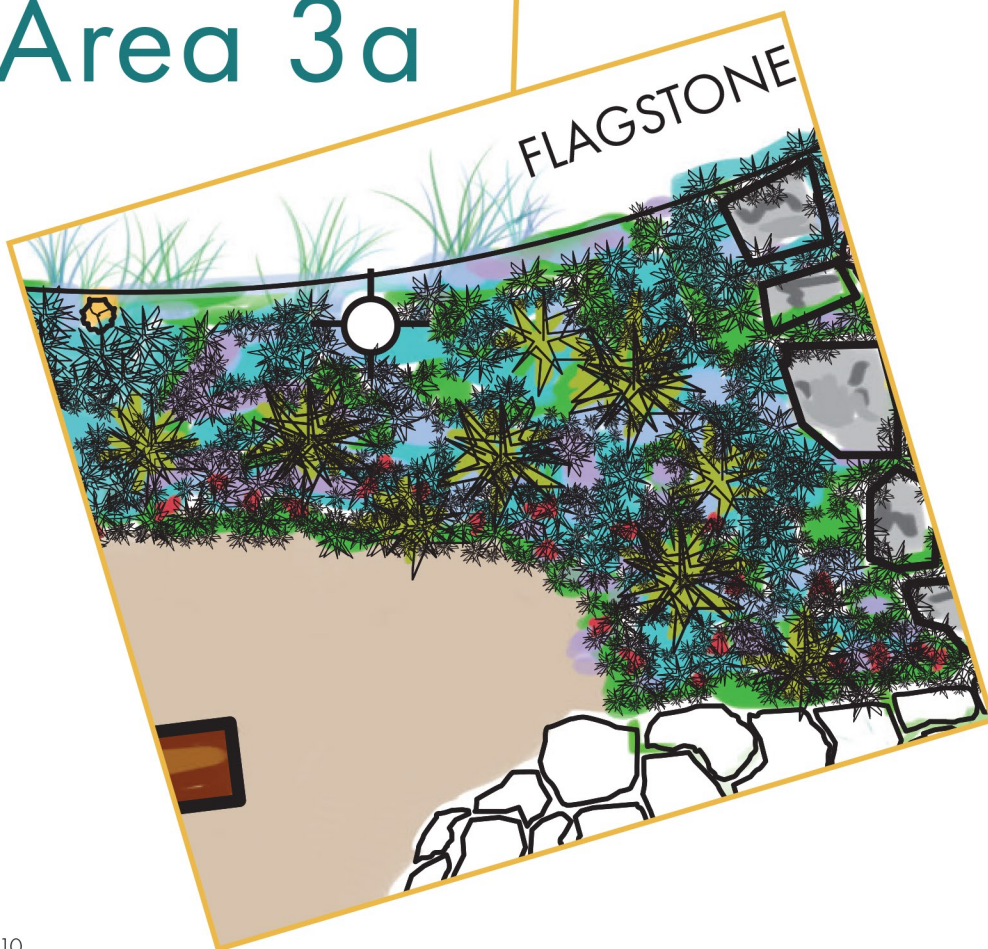
Area 2

PLANT LIST

- COMMON MILKWEED
- YELLOW WILD INDIGO
- PASTURE THISTLE
- SHOWY TICK-TREFOIL
- NORTHERN BUSH-HONEYSUCKLE
- SPOTTED ST. JOHN'S-WORT
- NORTHEASTERN BEARDTONGUE
- CAROLINA ROSE
- PRAIRIE WILLOW
- SHINING WILLOW
- MEADOW WILLOW
- LITTLE BLUESTEM
- AXILLARY GOLDENROD
- ZIG-ZAG GOLDENROD
- EARLY GOLDENROD
- WHITE MEADOWSWEET
- HILLSIDE BLUEBERRY
- (EXISTING BIRCH)



Area 3a



Habitat Conditions

- » full to part shade
- » dry to medium soils
- » tolerant of snow plowing and harsh environment

PLANT LIST

-  PENNSYLVANIA SEDGE
-  CANADIAN LOUSEWORT*
-  SWITCHGRASS
-  COMMON SELFHEAL*
-  LITTLE BLUESTEM
-  VIOLET

*to be sown directly as seed

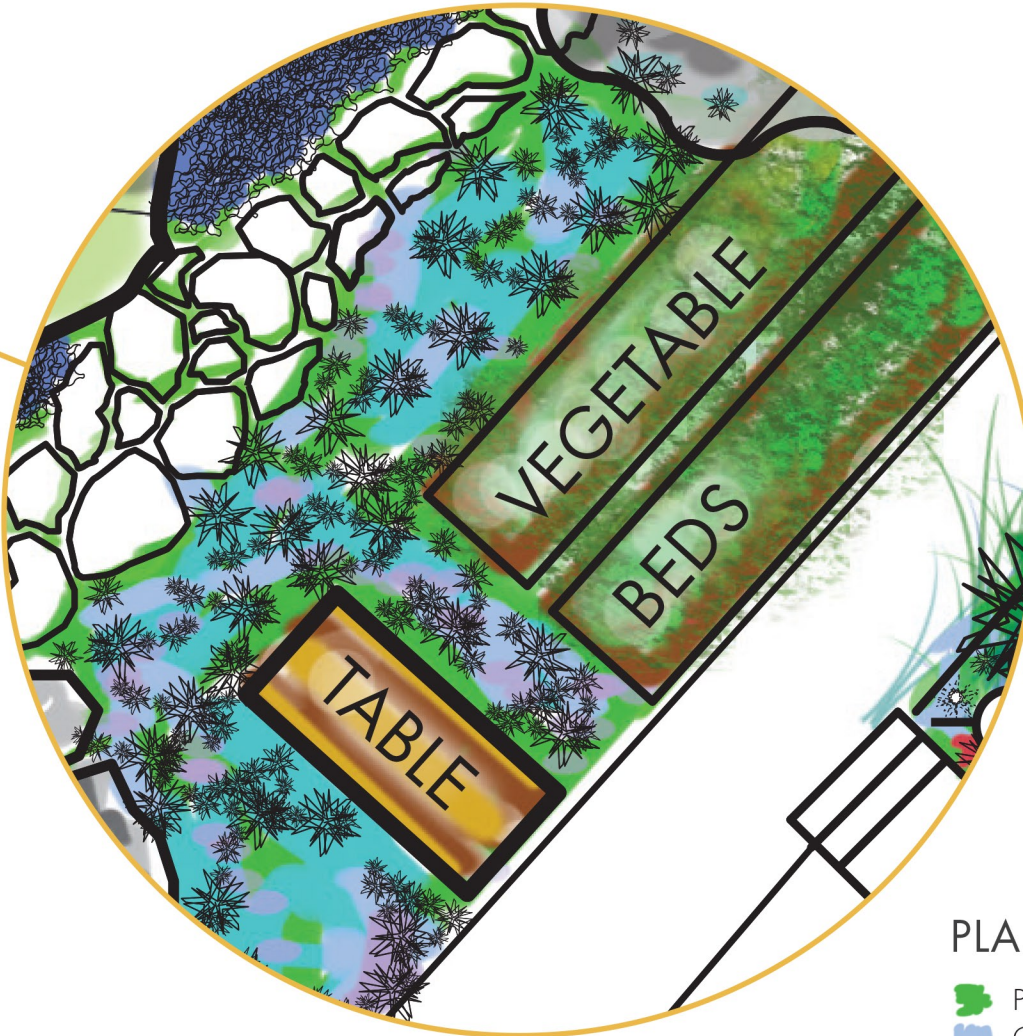
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Area 3b

Habitat Conditions

- » full sun to part shade
- » dry to medium soils
- » tolerant of heavy foot traffic and mowing



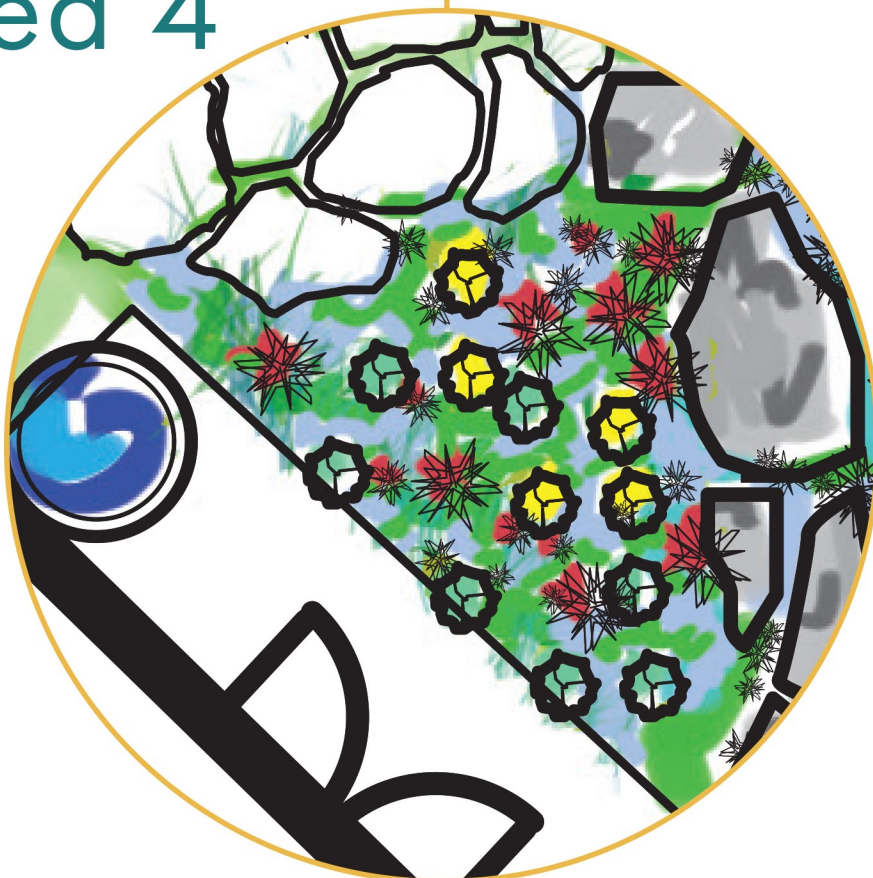
PLANT LIST

-  PENNSYLVANIA SEDGE
-  COMMON SELFHEAL*
-  LITTLE BLUESTEM*
-  VIOLET

**to be sown directly as seed*



Area 4



Habitat Conditions

- » full to part shade
- » dry to medium soils
- » tolerant of foot traffic and occasional mowing

PLANT LIST

-  PENNSYLVANIA SEDGE
-  CANADIAN LOUSEWORT*
-  COMMON SELFHEAL*
-  AXILLARY GOLDENROD
-  ZIG-ZAG GOLDENROD

*to be sown directly as seed

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Area 5

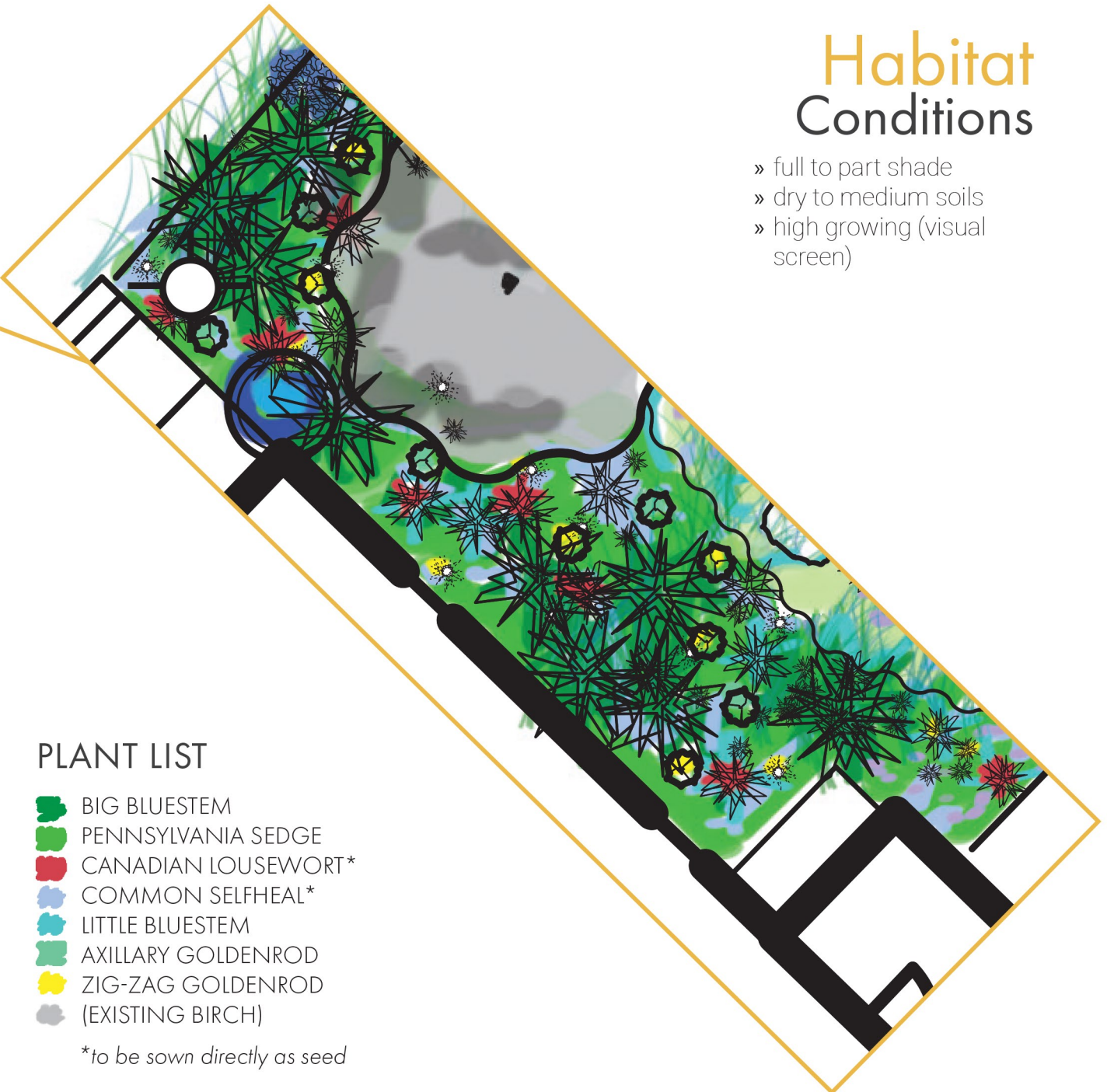
Habitat Conditions

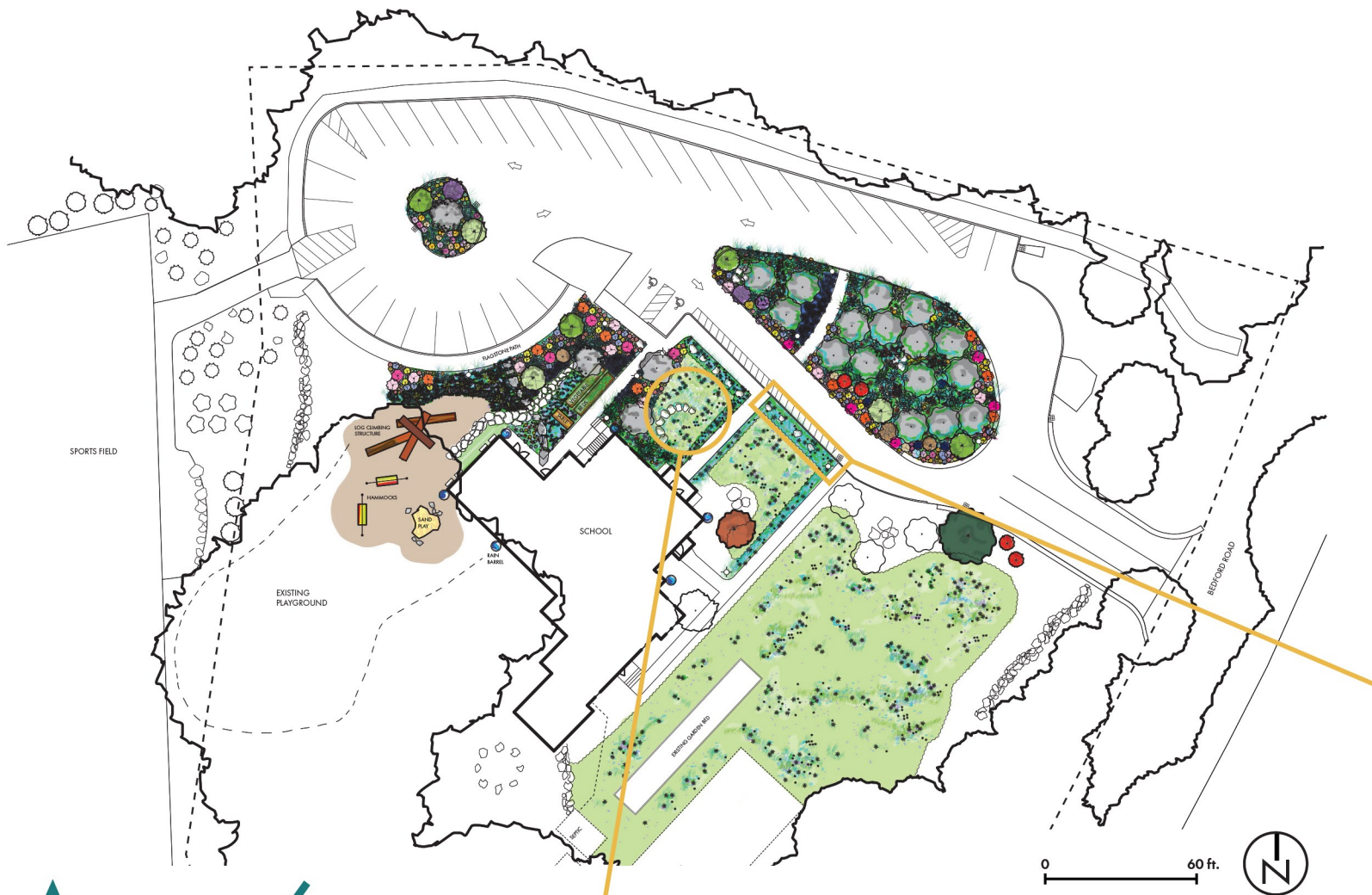
- » full to part shade
- » dry to medium soils
- » high growing (visual screen)

PLANT LIST

-  BIG BLUESTEM
-  PENNSYLVANIA SEDGE
-  CANADIAN LOUSEWORT*
-  COMMON SELFHEAL*
-  LITTLE BLUESTEM
-  AXILLARY GOLDENROD
-  ZIG-ZAG GOLDENROD
-  (EXISTING BIRCH)

*to be sown directly as seed

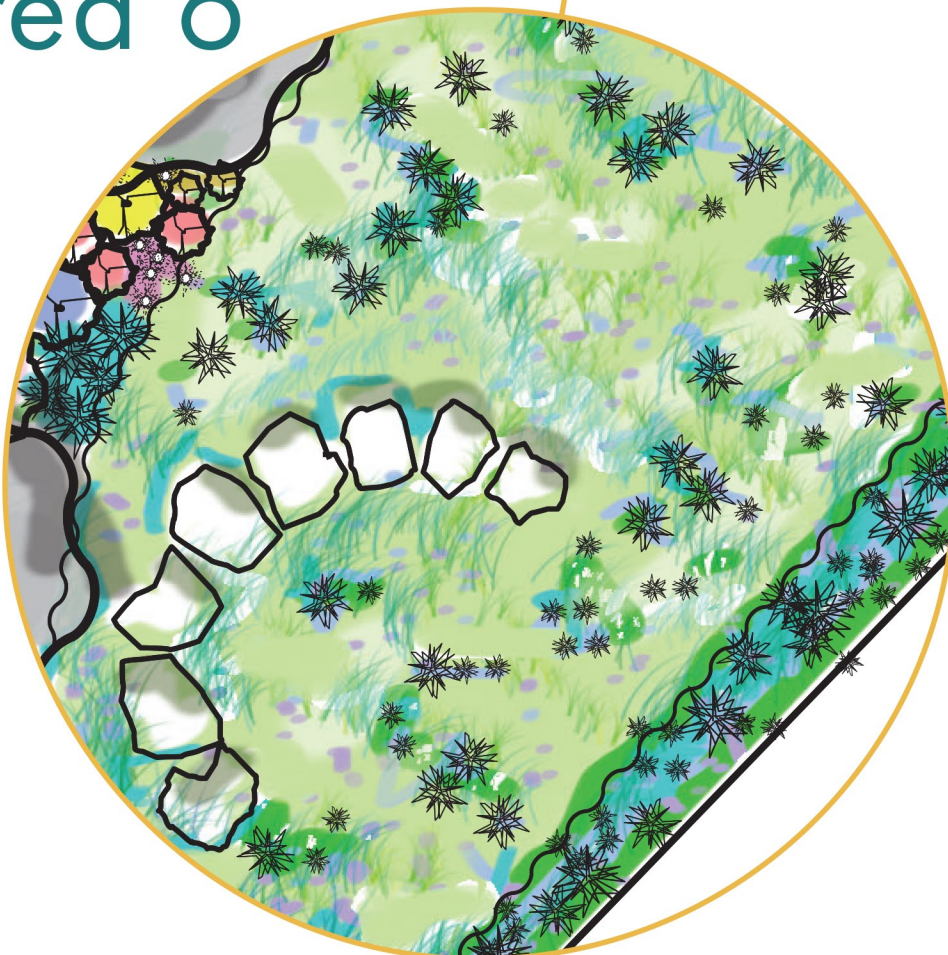




Area 6

Habitat Conditions

- » full sun to part shade
- » dry to medium soils
- » tolerant of heavy foot traffic and mowing



PLANT LIST

- PENNSYLVANIA SEDGE
- COMMON SELFHEAL*
- LITTLE BLUESTEM*
- VIOLET
- (EXISTING TURF)

*to be sown directly as seed

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Area 7

Habitat Conditions

- » full sun
- » dry to medium soils
- » tolerant of heavy foot traffic, mowing and proximity to snow plowing



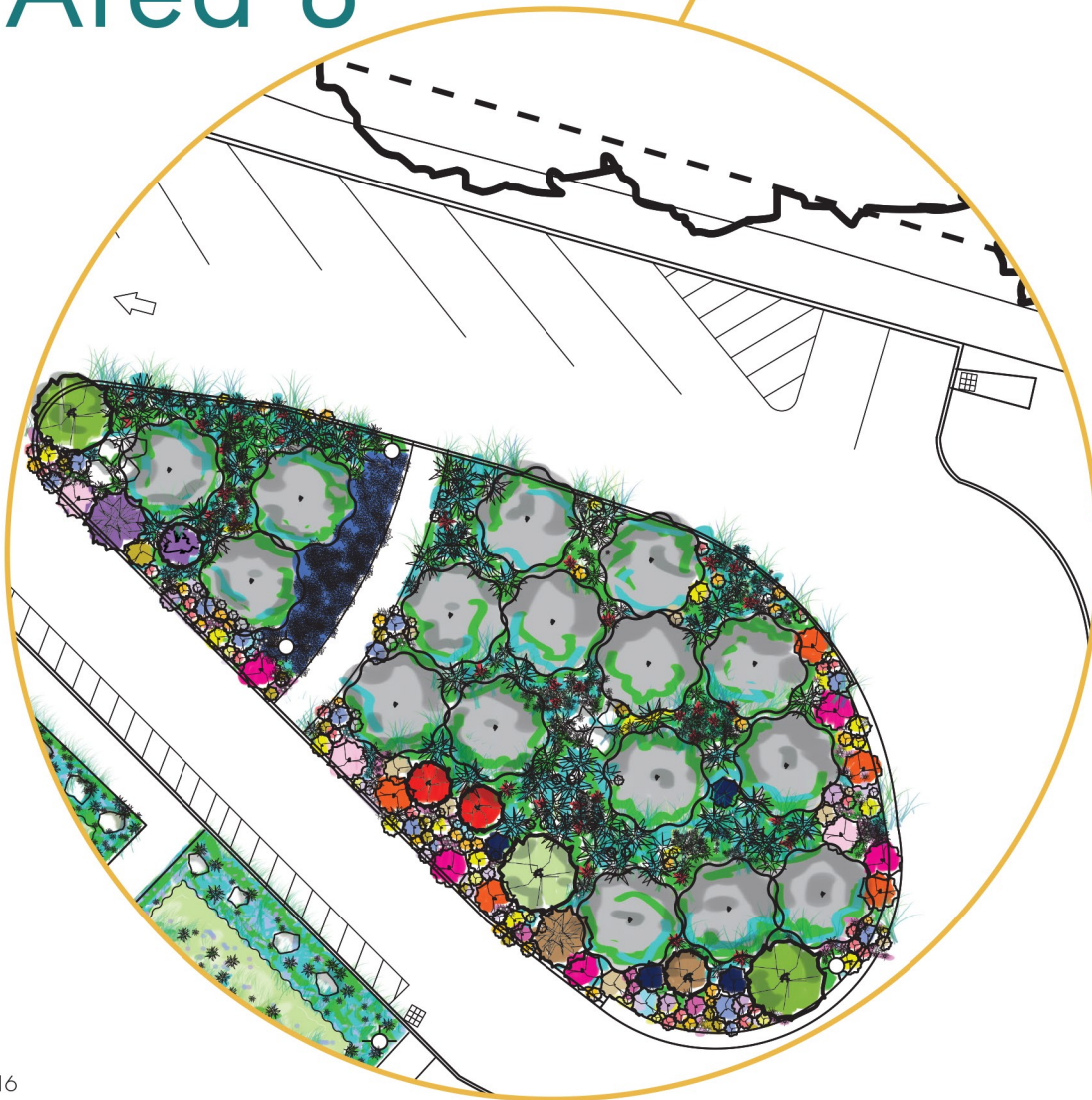
PLANT LIST

-  PENNSYLVANIA SEDGE
-  COMMON SELFHEAL*
-  LITTLE BLUESTEM
-  VIOLET

**to be sown directly as seed*



Area 8



Habitat Conditions

- » full sun to part shade
- » medium to wet soils
- » tolerant of snow plowing and harsh environment on exterior edges
- » acidic soils (low pH)

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PLANT LIST

-  BIG BLUESTEM
-  COMMON MILKWEED
-  YELLOW WILD INDIGO
-  PENNSYLVANIA SEDGE
-  PASTURE THISTLE
-  SHOWY TICK-TREFOIL
-  NORTHERN BUSH HONEYSUCKLE
-  TALL WHITE-ASTER
-  COASTAL PLAIN JOE-PYE WEED
-  SPOTTED JOE-PYE WEED
-  GREAT ST. JOHN'S-WORT
-  SPOTTED ST. JOHN'S-WORT
-  CANADIAN LOUSEWORT*
-  SWITCHGRASS
-  NORTHEASTERN BEARDTONGUE
-  BEACH PLUM
-  CAROLINA ROSE
-  NORTHERN BLACKBERRY
-  PURPLE-FLOWERING RASPBERRY
-  LITTLE BLUESTEM
-  PRAIRIE WILLOW
-  SHINING WILLOW
-  MEADOW WILLOW
-  EARLY GOLDENROD
-  DOWNY GOLDENROD
-  SEASIDE GOLDENROD
-  WHITE MEADOWSWEET
-  HILLSIDE BLUEBERRY
-  (EXISTING BIRCH)

**to be sown directly as seed*

Best Management Practices



1. No Chemicals

Eliminate pesticide use, particularly those containing neonicotinoids. Herbicides and chemical lawn treatments can also be highly damaging to pollinators.

Avoid planting in areas previously contaminated by pesticides or without a spatial buffer from areas where pesticides are applied (at least 100' wide forested buffer is recommended).

Ensure plants and seeds come from a clean, pesticide-free source. Many commercial nurseries treat their plants and seeds, oftentimes before retailers receive them. Some pesticides and most neonicotinoids persist in plants and soil for months to years.



2. Diverse Native Plants

Plant straight native plant species. Cultivars and exotic plants largely do not support the pollen and nectar preferences of threatened pollinators and tend to be visited by common pollinator species whose populations are stable.

Include a range of plant types (trees, shrubs, forbs, grasses, sedges) with varying bloom times, to ensure pollen, nectar and host plants are available across the entire growing season.



3. Create Nesting Opportunities

Seventy percent of native bee species are ground nesting. Mulch using compost or natural materials (e.g. chopped leaves, seed-free hay, composted wood chips) and leave bare areas of well-drained soil in sunny locations.

Thirty percent of native bees are cavity nesting. Allow dead trees, snags and pithy stemmed plants such as raspberries to remain standing.

To benefit bumblebees, maintain small brush piles. This will provide cover for rodents that will in turn create nesting habitat for bumblebees. Where possible, leave leaf litter in gardens and allow it to build up over time. This provides cover for overwintering queens. Barns with unbaled hay or a dry, protected cavity containing hay, straw, clumps of moss or grass located above or below ground are also ideal.

As with other ground nesting bees, limiting or eliminating tillage practices will limit the potential of harming bumblebees.

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4. Be Messy

Skip the fall clean up, allowing dead stems, leaves and seed heads to stand over winter, and wait until evening temperatures consistently reach 50 degrees before raking in the spring.

Don't be overzealous when it comes to tidying up. Some "weeds" act as host plants for caterpillars, such as lambsquarters (*Chenopodium album*) for common sootywing (*Pholisora catullus*) and Queen Anne's lace (*Daucus carota*) for black swallowtail (*Papilio polyxenes*).



5. It Doesn't Stop with Planting

That being said, with new plantings, water and weed regularly for the first two years.

To deter deer and rodents until plants fully establish, it may be helpful to construct temporary fencing or set up netting. Natural repellent sprays such as *Plantskydd* can be effective when applied regularly. Thorny plants such as roses can also deter deer browse and function as natural fences for more vulnerable plants.



6. Last But Not Least

Put something in place to catch rainwater, with a dirt base to simulate a puddle, providing pollinators necessary minerals. Make it last between rainy days.

Keep night skies dark for moths and other nocturnal insects: motion-detecting lights or lamps facing down instead of spotlights on all night.

Some plant species establish best by direct seeding: while late fall or early winter is the best time to sow, early spring seeding is also possible, although some species may not germinate until the following year.



*Lawn containing Prunella vulgaris (common selfheal).
Photograph by Matt Lavin.*

Turn Your Lawn into Habitat

Maintaining a manicured lawn can not only be expensive, it also oftentimes requires high water and chemical usage. Many turf lawns are habitat dead zones, as they are comprised primarily of non-native sod-forming grasses that spread by rhizome, outcompeting native vegetation and offering little opportunities for ground-nesting bees by carpeting the soil.

Lawns can be converted into habitat in a number of ways:

Method 1: Overseed a Traditional Lawn

STEP 1: Mow your lawn at one inch or less to improve seed to soil contact. Remove grass clippings to expose as much soil as possible.

STEP 2: Rake, scrape, score or use a spading fork to break up the lawn surface. This helps create good conditions for seed germination and healthy growth through seed to soil contact.

STEP 3: Spread native seed. Here are the recommended rates for overseeding lawn as depicted in Area 6 of this Toolkit (*page 14*):

- » Common selfheal at 2.4 ounces (5 tablespoons)/1000 ft²
- » Little bluestem at 3.6 ounces (7.5 tablespoons)/1000 ft²
- » Pennsylvania sedge at 3.6 ounces (7.5 tablespoons)/1000 ft²
- » Violet at 1.2 ounces (2.5 tablespoons)/1000 ft²

You can mix the seed into compost and apply. Compost can be applied up to 40 lbs./50 ft² of lawn. It improves seed to soil contact and germination rates.

WHEN TO DO IT

Late fall or late winter are the best times to direct seed most native plant species. Species such as Pennsylvania sedge will not germinate without a two-month cold period.

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Method 2: Create a Blank Slate

STEP 1: To start you must first remove existing grass. Plan accordingly: large areas of bare soil are easily eroded by runoff and provide fertile ground for weeds to establish. Chemical herbicides are not recommended because of their negative impacts to pollinators and ecosystems as a whole. Below are several alternatives to chemical removal.

- » **Sod cutting** is the quickest way to remove grass. Equipment rental companies and hardware stores rent walk behind sod cutters for \$100-\$150/day. In a few hours several thousand square feet of grass can be cut, rolled up and carted away. A lot of topsoil is lost in the process, however, so a follow up with compost or a 50/50 compost/topsoil blend is recommended before planting.
- » **Sheet mulching** uses cardboard or newspaper to smother grass. It is best started several months before you want to use the planting area. Fall is an excellent time to sheet mulch as the material breaks down slowly over the winter and is ready for planting in the spring. The basic technique involves smothering grass and building organic matter in place by placing alternate layers of carbon materials and nitrogen materials directly on top of each other. Layers should be fairly equal to allow for even decomposition, approximately 1" thick. An internet search will tell you all the rest.
- » **Solarization** is a method of site preparation that involves covering the planting area with black or clear plastic and allowing the sun and lack of water to kill unwanted vegetation. This takes time (a full growing season at a minimum), requires that the plastic is firmly secured in place all along the edges at all times, and should be performed in sections rather than on a large scale.
- » **Phydura** is an OMRI listed, non-selective herbicide made from natural, biodegradable ingredients. It is an ecologically responsible alternative to glyphosate and effectively removes herbaceous broadleaf and grass weeds.

STEP 2: Plant plugs or follow the previous directions to direct seed (seeding rates will be higher if starting with a blank slate).

MAINTENANCE

If you mow, keep your blades at least three inches off the ground, and mow every two or three weeks. Taller lawns shade the ground, preventing moisture from evaporating while also discouraging weed seeds from sprouting. Refrain from mowing while flowers are blooming to increase the amount of forage available for pollinators.

References:

1. Fowler, J. 2016. Specialist bees of the Northeast: Host plants and habitat conservation. *Northeastern Naturalist*, 23(2):305-320.
2. Massachusetts Division of Fisheries and Wildlife. 2015. Massachusetts State Wildlife Action Plan 2015. Westborough, MA.
3. "Turf Alternatives." Blue Thumb, www.bluethumb.org/turf-alternatives.

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Written and designed by Evan Abramson
Principal, Landscape Interactions

Scientific Consultant: Dr. Robert Gegear
Professor of Biology, UMass-Dartmouth
Founder and Director, New England Beecology Project

For more information contact:

Landscape Interactions
16 Center Street #426
Northampton, Massachusetts 01060
landscapeinteractions.com

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