Pollinate Northampton

REPLICABLE AND SCALABLE
LANDSCAPE DESIGN TOOLKITS
TO SUPPORT POLLINATOR SPECIES AT RISK
IN THE CONNECTICUT RIVER VALLEY
OF MASSACHUSETTS

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IN PARTNERSHIP WITH:

Western Mass Pollinator Networks

WITH THE SUPPORT OF:

New England Grassroots Environmental Fund

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grassrootsfund.org

WHAT ARE TOOLKITS?

In essence, replicable landscape designs based on common landscape scenarios and specific arrangements of plants.

The Toolkits on the following pages were designed by Evan Abramson based on years of scientific study by Dr. Robert Gegear. The designs, plant lists and habitat management guidelines have been created specifically to support bee and butterfly species that are at the greatest risk in the low elevation portion of the Connecticut River Valley of Massachusetts, and represent the most prevalent landscape typologies found in urban/periurban Northampton and Hampshire County.

WHAT MAKES THESE TOOLKITS DIFFERENT FROM OTHER PLANTING KITS OR SEED MIXES?

Most pollinator plantings have focused on overall abundance – "seeing lots of bees" — rather than on the wide range of wild pollinators found in a biodiverse and resilient ecosystem. The same problem arises from habitats planted with generic pollinator seed packets. While we see lots of flowers, those flowers are often providing resources for only a few common species of pollinators, and don't satisfy the full pollen, nectar and nesting requirements of a functionally diverse ecosystem.

HOW SHOULD THESE TOOLKITS BE USED?

The Toolkits are designed to increase biodiversity and climate resiliency by attracting and sustaining the widest possible range of pollinator species, and in particular, species of the greatest conservation priority in our region. Each Toolkit targets a particular type of landscape or ecological condition: the plant lists and designs can therefore be applied to any similar landscape. By replicating the Toolkits across Northampton and Hampshire County, the building blocks for a city-wide and regional pollinator corridor will be created.

Bombus fervidus foraging on Monarda didyma (Scarlet bee balm). 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 Norm Levey.

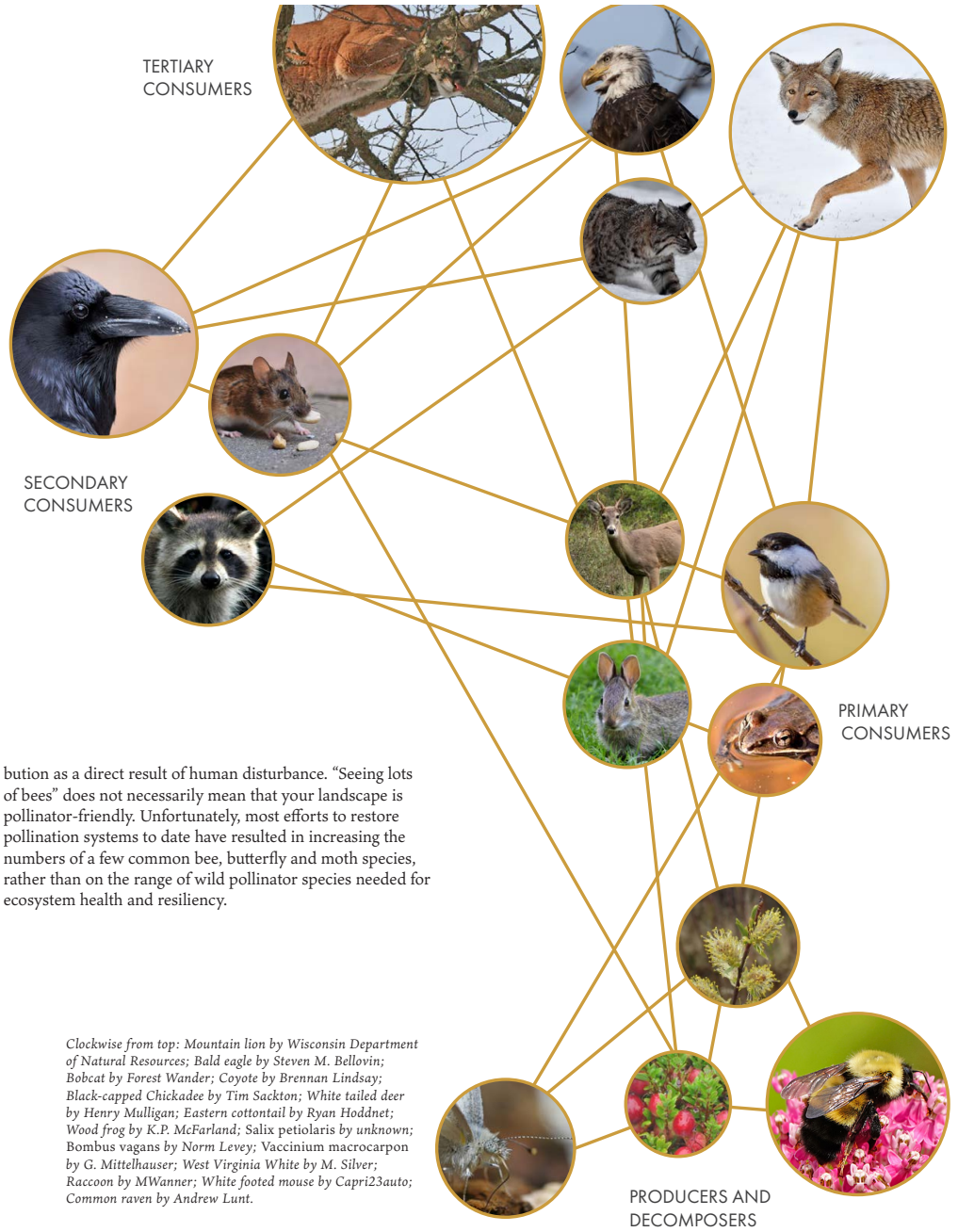
Why Pollinators?

Native pollinators are vital to creating and maintaining the habitats and ecosystems that most animals rely on for food and shelter — including humans. What happens (or doesn't happen) at the pollination scale has repercussions all the way up the food chain. Over 80% of the flowering plants on Earth depend upon insect-mediated pollination; bees alone pollinate 45% of the food crops grown in Massachusetts, and one-third of the food grown in the United States. In a global study of more than 40 crops in 600 fields across every populated continent, scientists found that wild pollinators were twice as effective as honeybees in producing seeds and fruit (Garibaldi et al.). In the United States, wild bee pollination services were estimated to be worth $3.07 billion in 2006 (Losey & Vaughan). This estimate is a conservative approximation of wild bee pollination's contemporary value, considering the increase in pollinator-dependent crop plants over the past decade (Russo et al.; Mathiasson & Rehan).

As **keystone species**, wild pollinators provide food, shelter and nest sites to wildlife at other trophic levels through their interactions with native flowering plants. Protecting diversity of native pollinator-plant interactions, or "pollination systems" is therefore critical for maintaining healthy and diverse ecosystems. Pollination systems include bees, butterflies and moths, birds, beetles and flies, and represent over 80% of plant species worldwide.

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). 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.



Clockwise from top: Mountain lion by Wisconsin Department of Natural Resources; Bald eagle by Steven M. Bellovin; Bobcat by Forest Wander; Coyote by Brennan Lindsay; Black-capped Chickadee by Tim Sackton; White tailed deer by Henry Mulligan; Eastern cottontail by Ryan Hoddnet; Wood frog by K.P. McFarland; Salix petiolaris *by unknown;* Bombus vagans *by Norm Levey;* Vaccinium macrocarpon *by G. Mittelhauser; West Virginia White by M. Silver; Raccoon by MWanner; White footed mouse by Capri23auto; Common raven by Andrew Lunt.*

At-Risk Pollinators
Supported

BEES:

- *Bombus affinis* Rusty patched bumblebee
- *Bombus fervidus* Golden northern bumblebee
- *Bombus pensylvanicus* American bumblebee
- *Bombus terricola* Yellow-banded bumblebee
- *Bombus vagans* Half-black bumblebee
- *Colletes validus* Blueberry cellophane bee
- *Macropis patellata* (no common name)
- *Andrena distans* Distant miner bee
- *Epeolus scutellaris* Notch-backed cellophane-cuckoo bee

BUTTERFLIES:

- *Amblyscirtes hegon* Pepper and Salt Skipper
- *Amblyscirtes vialis* Common Roadside Skipper
- *Boloria bellona* Meadow Fritillary
- *Callophrys hesseli* Hessel's Hairstreak
- *Callophrys irus* Frosted Elfin
- *Callophrys lanoraieensis* Bog Elfin
- *Carterocephalus palaemon* Arctic Skipper
- *Chlosyne harrisii* Harris' Checkerspot
- *Euphyes bimacula* Two-spotted Skipper
- *Euphyes conspicua* Black Dash
- *Hesperia leonardus* Leonard's Skipper
- *Hesperia metea* Cobweb Skipper
- *Hesperia sassacus* Indian Skipper
- *Lycaena epixanthe* Bog Copper
- *Lycaena hyllus* Bronze Copper
- *Poanes massasoit* Mulberry Wing
- *Satyrium acadica* Acadian Hairstreak
- *Satyrium favonius* Oak Hairstreak
- *Speyeria aphrodite* Aphrodite Fritillary
- *Speyeria atlantis* Atlantis Fritillary

BIGGEST THREATS FACING POLLINATORS

- Habitat Loss *(agriculture + human development)*
- Pesticides
- Climate Change

Photographs (clockwise from top left): Andrena distans by Dejen Mengis; Aphrodite Fritillary by Andrea Janda; Bombus terricola by K.P. McFarland; Bog Coppers by Jim Brighton; Bombus affinis by Serina Jepsen.

Sun Garden Toolkit

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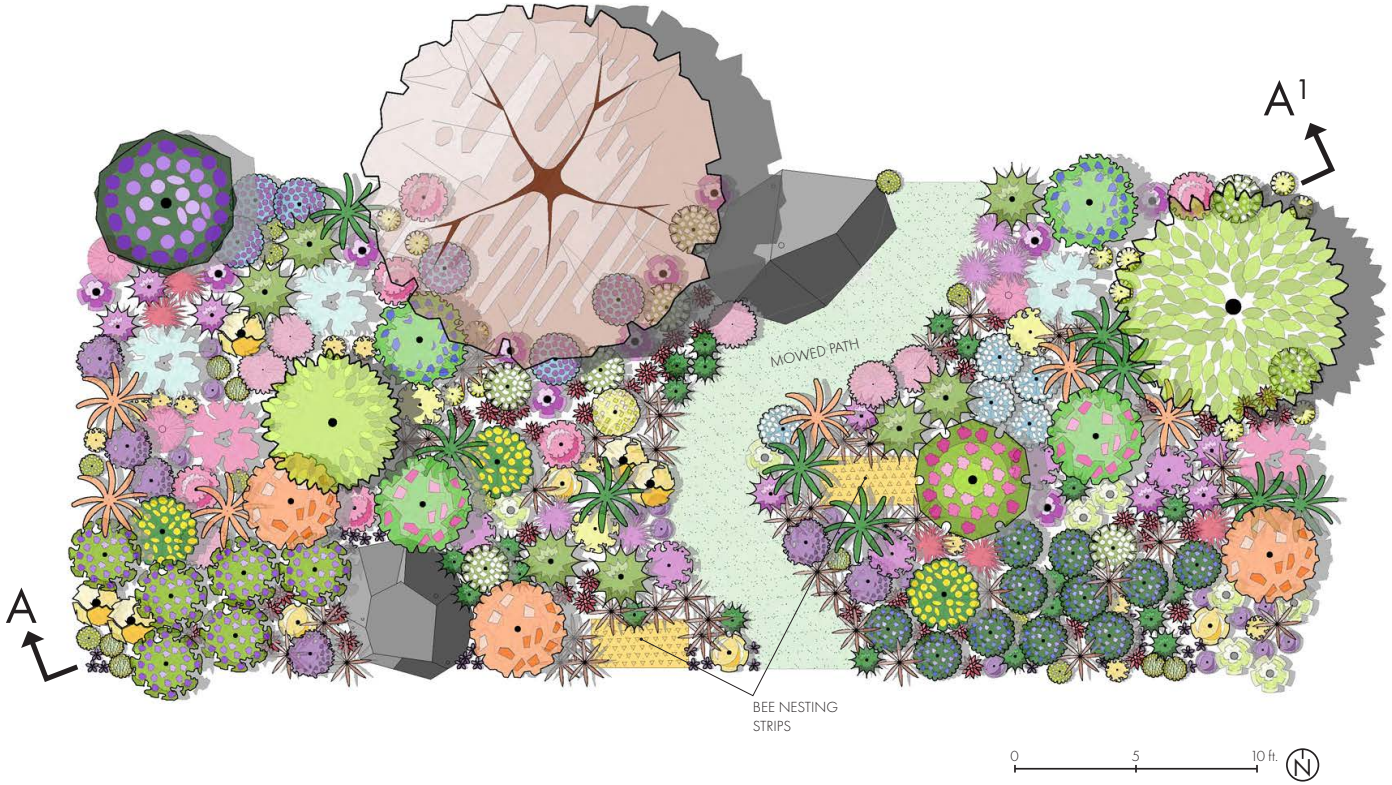
The plants in this design were selected for their propensity to thrive in full sun. Plants that are located north or beneath the canopy of taller plants are tolerant of part-shade. This design can easily be reworked to fit a range of layouts or conditions, including interspersing smaller groupings of plants within existing gardens and landscapes. Bee nesting strips can be created anywhere there is full sun and well-draining soils: remove at least 4 inches of existing vegetation and soil, and put back half the soil mixed with sand. Keep the area clear of plants at all times to allow ground nesting bees to access bare soil surface.



SITE CONDITIONS

DRY TO MEDIUM SOILS
FULL SUN
1000 SQ.FT

PLANT SCHEDULE

TREES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Quercus ilicifolia	Scrub Oak	1	15` wide spacing
	Salix humilis	Prairie Willow	1	6` wide spacing
	Salix petiolaris	Meadow Willow	1	10` wide spacing

SHRUBS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Baptisia tinctoria	Yellow Wild Indigo	3	3` wide spacing
	Diervilla lonicera	Northern Bush-honeysuckle	3	4` wide spacing
	Rosa carolina	Carolina Rose	2	4` wide spacing
	Rosa virginiana	Virginia Rose	1	5` wide spacing
	Rubus pensilvanicus	Pennsylvania Blackberry	1	6` wide spacing
	Rubus vermontanus	Vermont Blackberry	2	4` wide spacing
	Spiraea alba	Meadowsweet	3	3` wide spacing
	Spiraea tomentosa	Steeplebush	2	3` wide spacing
	Vaccinium angustifolium	Lowbush Blueberry	6	3` wide spacing
	Vaccinium pallidum	Hillside Blueberry	11	2` wide spacing

BIENNIAL	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Cirsium pumilum	Pasture Thistle	3	2` wide spacing

GRASSES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Andropogon gerardii	Big Bluestem	9	3` wide spacing
	Bromus kalmii	Prairie Brome	21	1` wide spacing
	Eragrostis spectabilis	Purple Love Grass	8	1-2` wide spacing
	Panicum virgatum	Switchgrass	7	3` wide spacing
	Schizachyrium scoparium	Little Bluestem	41	2` wide spacing
	Sorghastrum nutans	Indian Grass	6	2` wide spacing

PERENNIALS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Agastache scrophulariifolia	Purple Giant Hyssop	6	2` wide spacing
	Asclepias syriaca	Common Milkweed	6	2` wide spacing
	Desmodium canadense	Showy Tick Trefoil	5	1-2` wide spacing
	Euthamia graminifolia	Grass-leaved Goldenrod	12	1` wide spacing
	Eutrochium dubium	Coastal Plain Joe-Pye Weed	6	2` wide spacing
	Hypericum ascyron	Giant St. John`s-wort	1	2` wide spacing
	Hypericum punctatum	Spotted St. John`s-wort	4	1` wide spacing
	Lupinus perennis	Wild Lupine	16	1` wide spacing
	Monarda didyma	Scarlet Bee Balm	5	2` wide spacing
	Monarda fistulosa	Wild Bergamot	5	2` wide spacing
	Pedicularis canadensis	Canadian Wood Betony	45	1` wide spacing
	Penstemon digitalis	Foxglove Beardtongue	8	1.5` wide spacing
	Penstemon hirsutus	Northeastern Beardtongue	11	1.5` wide spacing
	Solidago juncea	Early Goldenrod	11	1` wide spacing
	Solidago odora	Sweet Goldenrod	3	1-2` wide spacing
	Solidago speciosa	Showy Goldenrod	5	2` wide spacing
	Symphyotrichum laeve	Smooth Aster	5	1.5` wide spacing
	Symphyotrichum lateriflorum	Calico Aster	8	2` wide spacing
	Symphyotrichum novi-belgii	New York Aster	6	2` wide spacing
	Viola pedata	Bird`s-foot Violet	27	.5` wide spacing
	Zizia aptera	Heart-leaved Golden Alexanders	10	1` wide spacing
	Zizia aurea	Golden Alexanders	7	1` wide spacing

Sun Garden Toolkit

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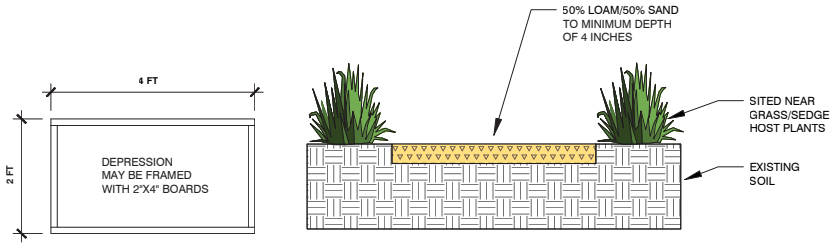
BEE NESTING STRIP DETAIL



Shade Garden Toolkit

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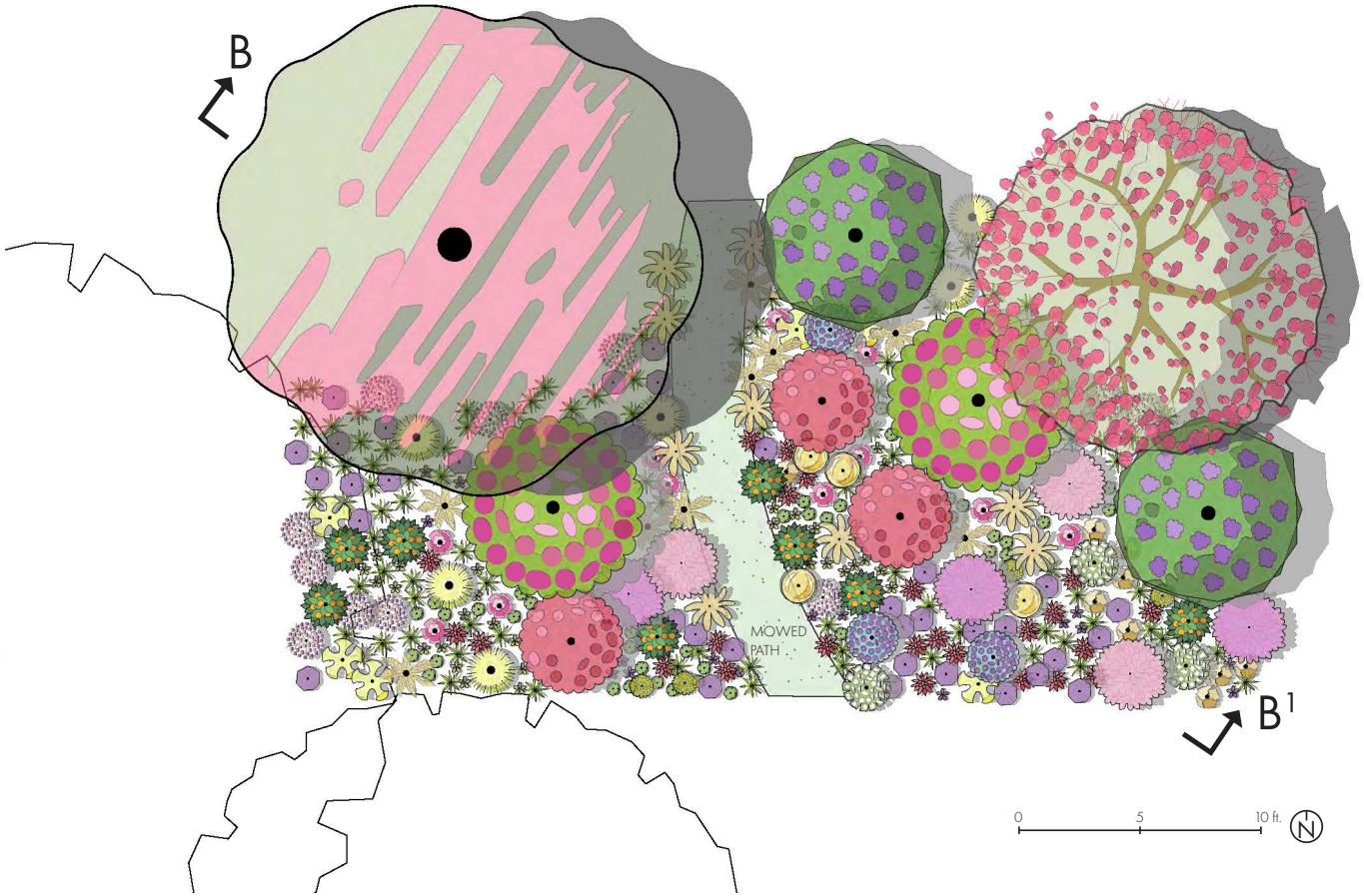

In this imagined scenario, two large mature trees are located south and southwest of the design space, casting shade and allowing for a mix of shade and light to move across the garden area throughout the day. All of the plants here are tolerant of part-shade to full shade conditions. Species located beneath the canopy of taller plants, or directly north of the adjacent mature trees, are tolerant of the deepest shade. Soils here are medium to moist, insofar as direct solar exposure to the garden is limited throughout the day.

SITE CONDITIONS

MEDIUM TO MOIST SOILS
PART-SHADE
800 SQ.FT

Shade Garden Toolkit

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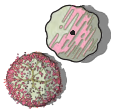
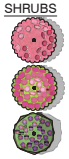
PLANT SCHEDULE

TREES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Cercis canadensis	Eastern Redbud	1	20` wide spacing
	Ilex opaca	American Holly	1	15` wide spacing

SHRUBS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Ribes cynosbati	Eastern prickly gooseberry	3	4` wide spacing
	Rubus odoratus	Purple-flowering Raspberry	2	7` wide spacing
	Vaccinium corymbosum	Highbush Blueberry	2	8` wide spacing

ANNUALS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Impatiens capensis	Spotted Jewelweed	8	2` wide spacing

GRASSES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Bromus pubescens	Hairy Wood Chess	9	1.5` wide spacing
	Carex pensylvanica	Pennsylvania Sedge	90	1` wide spacing
	Chasmanthium latifolium	River Oats	9	2` wide spacing

PERENNIALS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Cardamine concatenata	Toothwort	40	.5` wide spacing
	Doellingeria umbellata	Flat-topped Aster	6	2` wide spacing
	Eutrochium fistulosum	Hollow Joe-Pye Weed	3	3` wide spacing
	Eutrochium purpureum	Purple Joe-Pye Weed	3	3` wide spacing
	Geranium maculatum	Spotted Crane`s-bill	11	1` wide spacing
	Pedicularis canadensis	Canadian Wood Betony	24	1` wide spacing
	Prunella vulgaris	Selfheal	36	1` wide spacing
	Solidago caesia	Blue-stemmed Goldenrod	6	1.5` wide spacing
	Solidago flexicaulis	Zigzag Goldenrod	9	1` wide spacing
	Solidago puberula	Downy Goldenrod	4	1` wide spacing
	Symphyotrichum cordifolium	Heart-leaved Aster	11	1` wide spacing
	Symphyotrichum lateriflorum	Calico Aster	3	2` wide spacing
	Symphyotrichum novi-belgii	New York Aster	3	2` wide spacing
	Viola pubescens	Smooth Yellow Violet	30	.5` wide spacing
	Viola sororia	Common Violet	16	.5` wide spacing
	Zizia aptera	Heart-leaved Golden Alexanders	4	1` wide spacing

Bee + Butterfly
Lawn Toolkit
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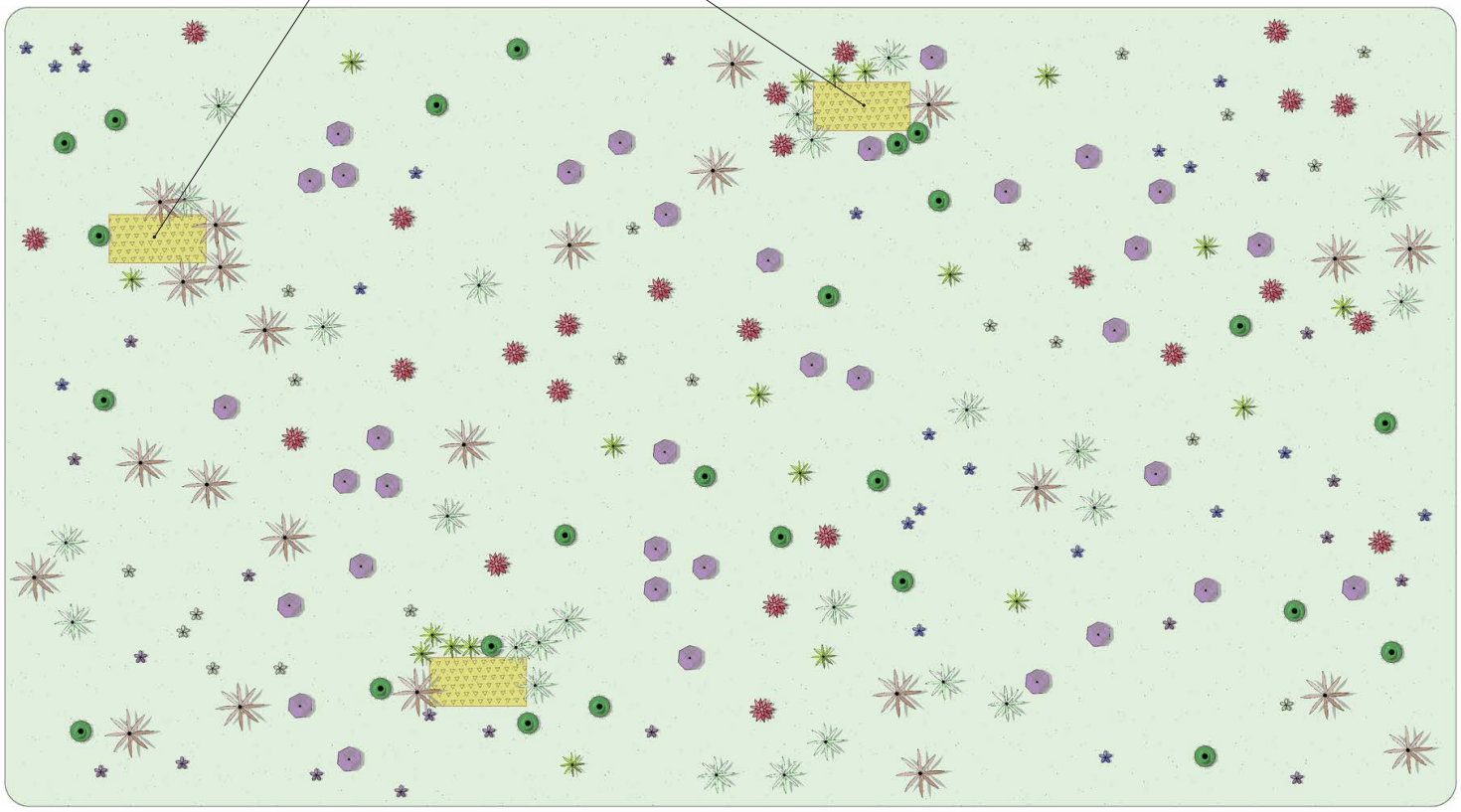
SITE CONDITIONS

MEDIUM TO DRY SOILS
FULL SUN TO PART-SHADE
2000 SQ.FT

Lawns are a personal choice and make sense in many situations; not everyone has the space or desire for a 4-8 ft. high meadow. The bee and butterfly lawn was designed to be installed in existing turf grass by scoring, scraping or otherwise removing small patches of vegetation, inserting plugs and/or seeds into the landscape and adjusting mowing regimes to allow the new plants to flower and seed. The less often you mow, and the higher you adjust your mowing blades, the more these native flowers, grasses and sedges will support bees and lepidoptera, and spread across the landscape. Mowing around flowers is a practice that we should all get used to if we are to expand the diversity and resilience of our properties, communities and regions.

All of the flowers selected for this design bloom at a height of 6-12 inches; the grasses and sedges are all tolerant of somewhat regular mowing. Try to delay mowing as much as possible the first growing season as it will stress the newly installed plants. Bee nesting strips can be created anywhere there is full sun and well-draining soils: remove at least 4 inches of existing vegetation and soil, and put back half the soil mixed with sand. Keep the area clear of plants at all times to allow ground nesting bees to access bare soil surface.

This design can also be installed to replace a traditional lawn. Clear all vegetation using a sod cutter; smothering with black tarp or plastic for one full growing season; or by sheet mulching. Rake away or dig out any remaining remnants of plants. Install 1 plug per sq.ft or mix plugs with seeds at a rate of 60-100 seeds per sq.ft, sown between November and early February. Violets and Carex pensylvanica must be installed by plug, as they are very difficult to establish by direct seeding.



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Bee + Butterfly
Lawn Toolkit
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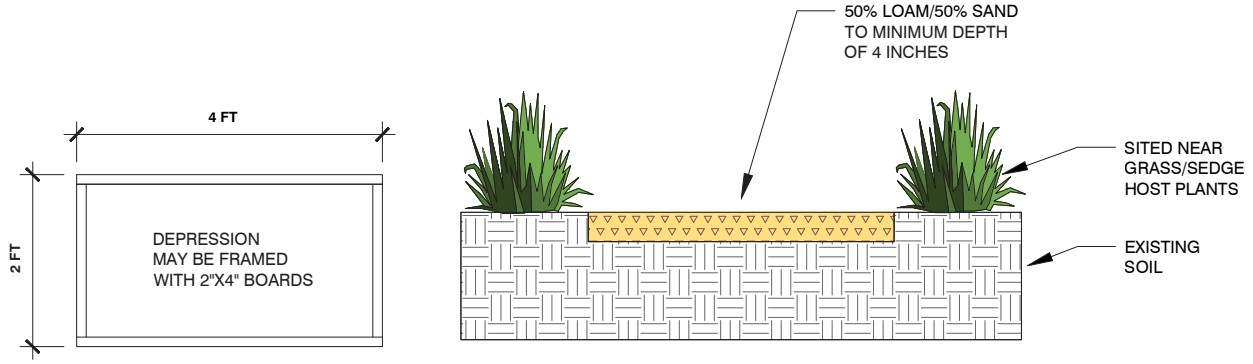
PLANT SCHEDULE

GRASSES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Agrostis perennans*	Autumn Bentgrass	25	1` wide spacing
	Carex pensylvanica	Pennsylvania Sedge	20	1` wide spacing
	Danthonia spicata*	Poverty Oat-Grass	25	1` wide spacing
	Schizachyrium scoparium*	Little Bluestem	25	2` wide spacing
PERENNIALS	**BOTANICAL NAME**	**COMMON NAME**	**QTY**	**REMARKS**
	Pedicularis canadensis	Canadian Wood Betony	25	1` wide spacing
	Prunella vulgaris*	Selfheal	35	1` wide spacing
	Viola pedata	Bird`s-foot Violet	20	.5` wide spacing
	Viola pedatifida	Prairie Violet	20	.5` wide spacing
	Viola striata	Cream Violet	20	.5` wide spacing

Can also be direct seeded.

BEE NESTING STRIP DETAIL



Sidewalk Strip Toolkit

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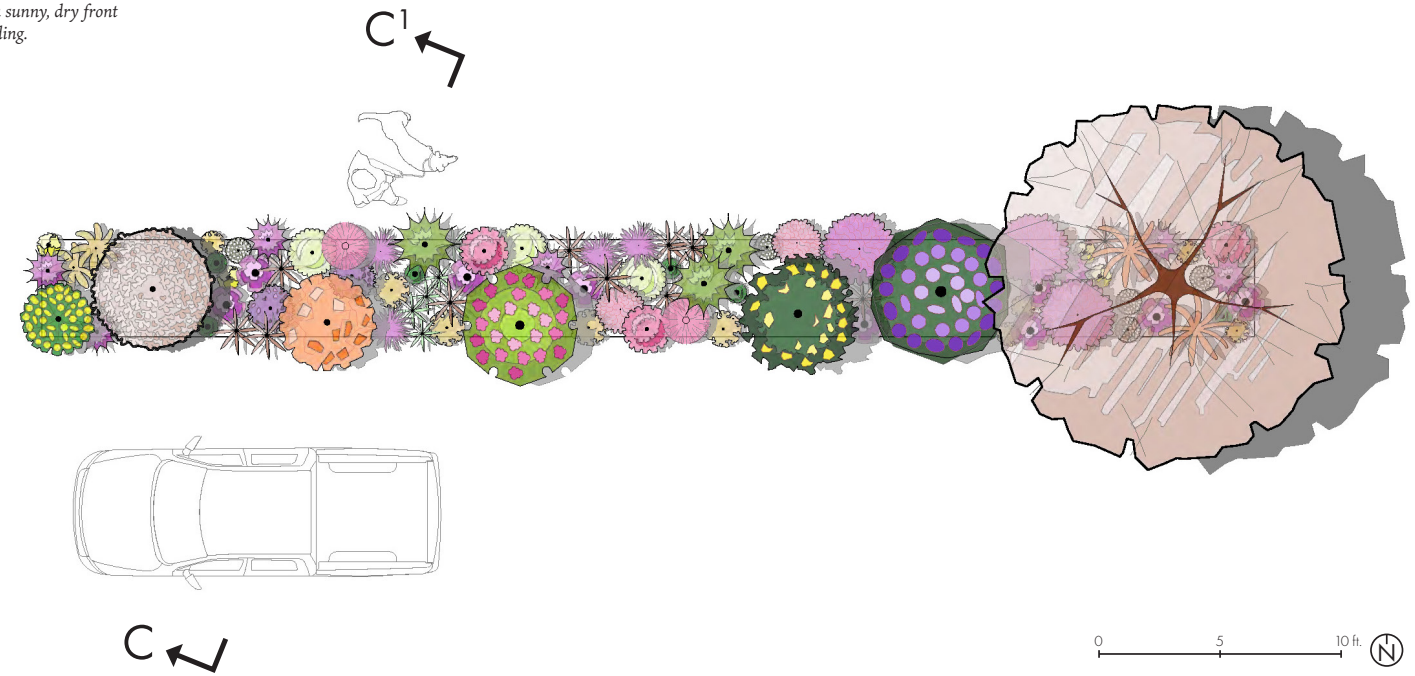
This assembly of hardy, salt and drought-tolerant plants survive the roughest of conditions. Many are less than 4' height or tolerate repeated cutting. The scrub oak and dwarf prairie willow are much shorter than most urban street trees and would fare well beneath power lines.

This design is also well suited for a sunny, dry front yard or south-facing side of a building.



SITE CONDITIONS

DRY SOILS
FULL SUN
200 SQ.FT

Sidewalk Strip Toolkit

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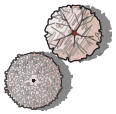
PLANT SCHEDULE

TREES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Quercus ilicifolia	Scrub Oak	1	15` wide spacing
	Salix occidentalis	Dwarf Prairie Willow	1	5` wide spacing

SHRUBS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Baptisia tinctoria	Yellow Wild Indigo	1	3` wide spacing
	Diervilla lonicera	Northern Bush-honeysuckle	1	4` wide spacing
	Hypericum prolificum	Shrubby St. John`s-wort	1	5` wide spacing
	Rosa virginiana	Virginia Rose	1	5` wide spacing
	Rubus pensilvanicus	Pennsylvania Blackberry	1	6` wide spacing

BIENNIAL	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Cirsium pumilum	Pasture Thistle	2	2` wide spacing

GRASSES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Agrostis perennans	Autumn Bentgrass	6	1` wide spacing
	Chasmanthium latifolium	River Oats	2	2` wide spacing
	Danthonia spicata	Poverty Oat-Grass	5	1` wide spacing
	Eragrostis spectabilis	Purple Love Grass	7	1-2` wide spacing
	Panicum virgatum	Switchgrass	3	3` wide spacing
	Schizachyrium scoparium	Little Bluestem	11	2` wide spacing
	Sorghastrum nutans	Indian Grass	2	2` wide spacing

PERENNIALS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Agastache scrophulariifolia	Purple Giant Hyssop	2	2` wide spacing
	Asclepias syriaca	Common Milkweed	3	2` wide spacing
	Eutrochium dubium	Coastal Plain Joe-Pye Weed	2	2` wide spacing
	Eutrochium purpureum	Purple Joe-Pye Weed	3	3` wide spacing
	Monarda fistulosa	Wild Bergamot	4	2` wide spacing
	Penstemon hirsutus	Northeastern Beardtongue	9	1.5` wide spacing
	Solidago juncea	Early Goldenrod	5	1` wide spacing
	Solidago nemoralis	Gray Goldenrod	4	1` wide spacing
	Solidago sempervirens	Seaside Goldenrod	4	1` wide spacing
	Symphyotrichum ericoides	Heath Aster	5	1` wide spacing
	Symphyotrichum pilosum	Awl Aster	3	2` wide spacing

Wet Garden Toolkit

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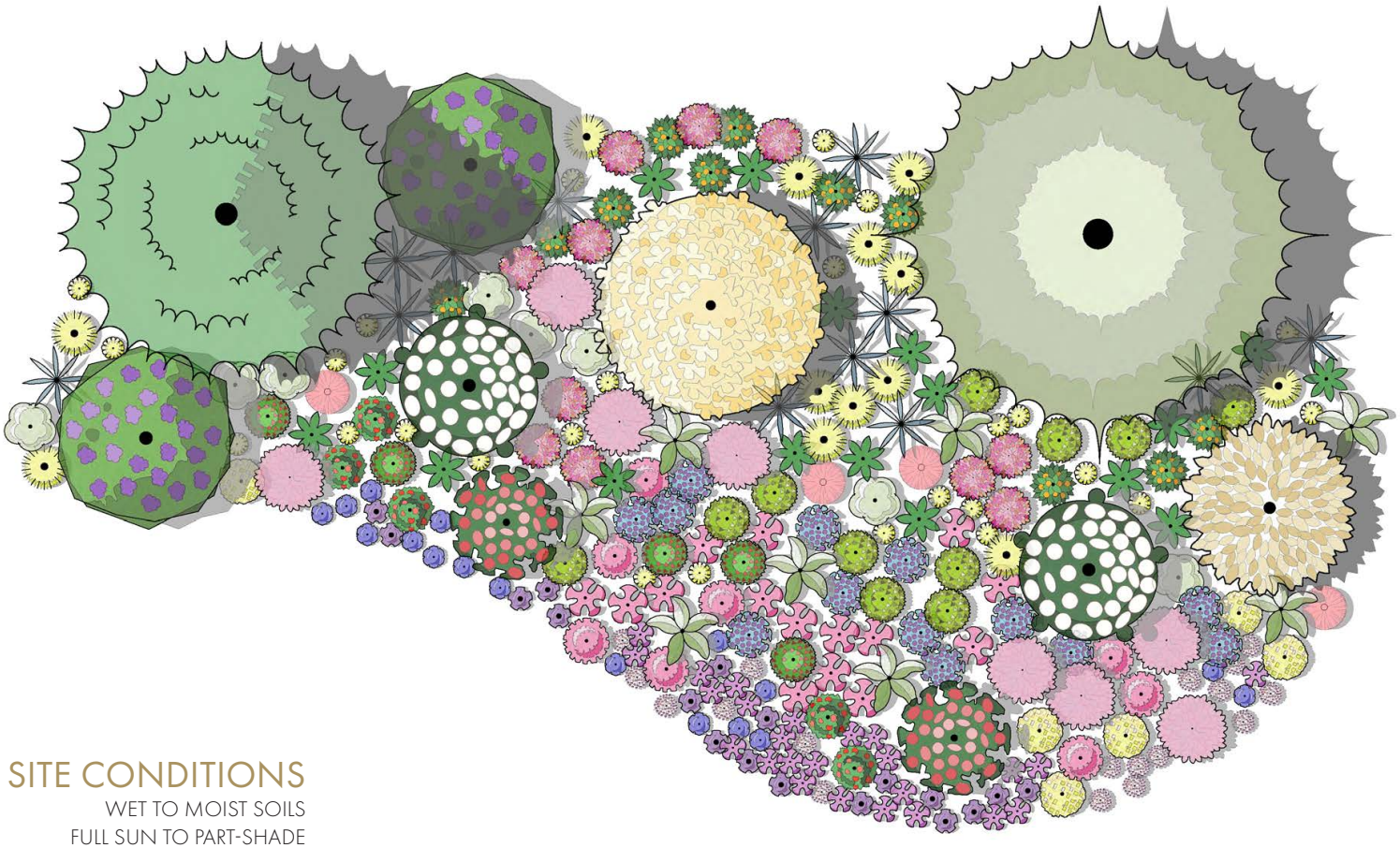

The plants here prefer soils that are wet. This design would work well for a moist spot in a lawn that doesn't dry up very often, or for a wet meadow/wetland restoration. Plants that are situated beneath the canopy of taller plants or directly north of them, are tolerant of the most shade.

SITE CONDITIONS

WET TO MOIST SOILS
FULL SUN TO PART-SHADE
1200 SQ.FT

Wet Garden Toolkit

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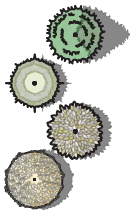
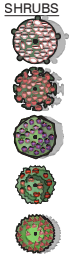
PLANT SCHEDULE

TREES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Chamaecyparis thyoides	Atlantic White Cedar	1	15` wide spacing
	Picea mariana	Black Spruce	1	20` wide spacing
	Salix discolor	Pussy Willow	1	8` wide spacing
	Salix lucida	Shining Willow	1	10` wide spacing

SHRUBS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Cephalanthus occidentalis	Buttonbush	2	6` wide spacing
	Rosa palustris	Swamp Rose	2	5` wide spacing
	Vaccinium corymbosum	Highbush Blueberry	2	8` wide spacing
	Vaccinium macrocarpon	American Cranberry	5	2` wide spacing
	Vaccinium oxycoccos	Small Cranberry	5	2` wide spacing

ANNUALS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Impatiens capensis	Spotted Jewelweed	11	2` wide spacing

BIENNIAL	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Cirsium muticum	Swamp Thistle	4	2` wide spacing

GRASSES	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Calamagrostis canadensis	Bluejoint Grass	13	2` wide spacing
	Carex stricta	Tussock Sedge	17	2` wide spacing

PERENNIALS	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	Asclepias incarnata	Swamp Milkweed	11	2` wide spacing
	Doellingeria umbellata	Flat-topped Aster	13	2` wide spacing
	Eupatorium perfoliatum	Boneset	8	1-2` wide spacing
	Euthamia graminifolia	Grass-leaved Goldenrod	26	1` wide spacing
	Eutrochium fistulosum	Hollow Joe-Pye Weed	8	3` wide spacing
	Eutrochium maculatum	Spotted Joe Pye Weed	8	2` wide spacing
	Hypericum ascyron	Giant St. John`s-wort	6	2` wide spacing
	Lobelia siphilitica	Blue Lobelia	18	1` wide spacing
	Mimulus ringens	Monkeyflower	18	1` wide spacing
	Physostegia virginiana	Obedient Plant	15	1.5` wide spacing
	Pontederia cordata	Pickerelweed	17	1` wide spacing
	Rumex altissimus	Pale Dock	8	2` wide spacing
	Scutellaria lateriflora	Mad-dog Skullcap	25	1` wide spacing
	Symphyotrichum novae-angliae	New England Aster	13	2` wide spacing
	Symphyotrichum puniceum	Purple-stemmed Aster	11	2` wide spacing

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 ft. 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.

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: CONVERT 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 plant establishment and healthy seed growth through seed to soil contact.

STEP 3: Spread native seed and plant plugs. Here are the recommended rates based on the Bee + Butterfly Lawn Toolkit:

- *Agrostis perennans* (Autumn bentgrass) at 20 seeds or 1 plug per sq.ft of exposed ground
- *Carex pensylvanica* (Pennsylvania sedge) at 1 plug per sq.ft of exposed ground
- *Danthonia spicata* (Poverty oat-grass) at 20 seeds or 1 plug per sq.ft of exposed ground
- *Schizachyrium scoparium* (Little bluestem) at 30 seeds or 1 plug per sq.ft of exposed ground
- *Pedicularis canadenis* (Canadian wood betony) at 1 plug per sq.ft of exposed ground
- *Prunella vulgaris ssp. lanceolata* (Common selfheal) at 60 seeds or 1 plug per sq.ft of exposed ground
- *Viola spp.* (Violets) at 2 plugs per sq.ft of exposed ground

Thoroughly mix the seed into a filler material such as sand or sawdust before applying. Use 4 gallons of filler per 1,000 sq.ft and hand broadcast the seed mix, leaving it on soil or snow surface.

WHEN TO DO IT

Late fall or winter are the best times to direct seed most native plant species, although early spring is also possible. If there is not adequate rainfall, areas recently seeded or planted should be watered.

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.
- 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.
- SMOTHERING/SOLARIZIATION 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 a full growing season at a minimum, requires that the plastic is firmly secured in place all along the edges at all times, and may be best performed in sections rather than on a large scale.

STEP 2: Follow the previous directions to direct seed and plant plugs (seeding rates can be increased by 50% if starting with a blank slate).

MAINTENANCE

If you mow, keep your blades at least 6 inches off the ground; allow newly seeded and planted vegetation to fully establish before cutting. Once vegetation is established, mow no more than every three to six weeks. Taller lawns are beneficial in that they 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 and to allow plants to more fully establish by setting seed.

References

WHY POLLINATORS?

Garibaldi, L. A. et al. Wild Pollinators Enhance Fruit Set of Crops Regardless of Honey Bee Abundance. Science 339, 1608 (2013).

John E. Losey, Mace Vaughan, The Economic Value of Ecological Services Provided by Insects, BioScience, Volume 56, Issue 4, April 2006, Pages 311–323.

Russo, L., DeBarros, N., Yang, S., Shea, K. & Mortensen, D. Supporting crop pollinators with floral resources: network-based phenological matching. Ecology and Evolution 3, 3125–3140 (2013).

Mathiasson, M. E. & Rehan, S. M. Wild bee declines linked to plant-pollinator network changes and plant species introductions. Insect Conservation and Diversity 13, 595–605 (2020).

Fowler, Jarrod. (2016). Specialist Bees of the Northeast: Host Plants and Habitat Conservation. Northeastern Naturalist. 23. 305-320. 10.1656/045.023.0210.

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Blue Thumb. Turf Alternatives. Retrieved January 23, 2021, from www.bluethumb.org/turf-alternatives