



HABIT

TO

HABITAT



HABIT TO HABITAT

TRANSFORMING
LAWNS TO DIVERSITY
IN WELLESLEY



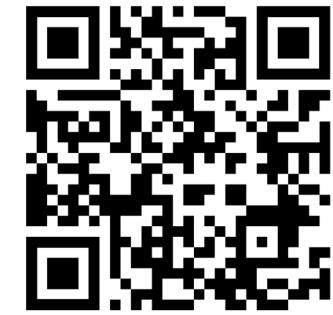
a project of

LANDSCAPE | NTERACTIONS



WELLESLEY NATURAL
RESOURCES COMMISSION

SUBMIT YOUR OBSERVATIONS
TO BEECOLOGY



PROJECT TEAM

Evan Abramson, M.Sc.

Principal, Landscape Interactions

Casey Armanetti

Associate Landscape Designer, Landscape Interactions

SCIENTIFIC CONSULTANT

Dr. Robert Gegear, Ph.D.

Associate Professor, UMass-Dartmouth

Founder and Director, New England Beecology Project

BOTANIST

Robert Eastman

IN PARTNERSHIP WITH

Wellesley Natural Resources Commission

THANK YOU

To our partners and collaborators in the Town of Wellesley, without whom this project would not be possible: Bea Bezmalinovic, Natural Resources Commission Chair; Brandon Schmitt, Director; Lisa Moore, Education and Outreach Coordinator; Cricket Vlass, Park & Tree Superintendent; Mark Patenaude, Mike Balboni, Suzy Jordan and Wally Caban, Wellesley Department of Public Works. We are also grateful to entomologist Michael Veit for his review and comments on the target bee species list.

This project has been funded through Community Preservation Act (CPA) funds provisioned by the Community Preservation Committee of Wellesley and the Wellesley Natural Resources Commission capital budget appropriated at Town Meeting.

Copyright © 2024 Evan Abramson/LandscapeInteractions LLC.
All rights reserved.

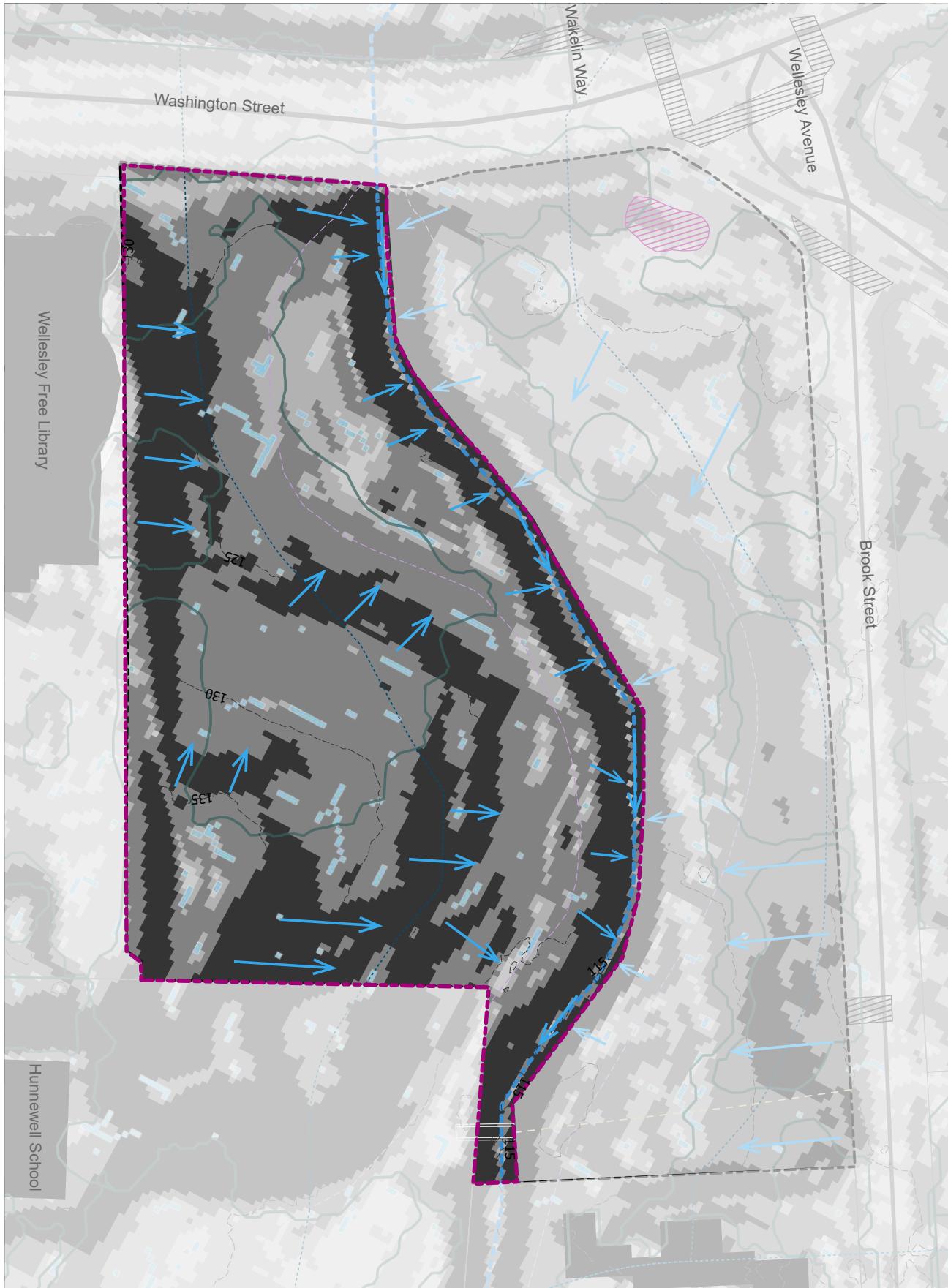


Existing conditions of Simons Park at the commencement of the project in July 2022. The site consisted primarily of non-native grasses and white clover (*Trifolium repens*) surrounded by ornamental and native trees.

In 2022

Simons Park was a large, open lawn measuring just over 2 acres, comprised almost entirely of non-native turf grasses and white clover. A highly visible public park adjacent to the Wellesley Free Library main branch on Washington Street, the site is bordered by an intermittent stream and narrow riparian forest to the east, ornamental trees and perennial plantings to the west, and a forested path leading to the Hunnewell Elementary School to the south. Students transect the park regularly on their way to and from school, and library patrons gaze out upon the site from large picture windows in the reading room. It's common to find playgroups gathered on shaded edges of the park on hot days as well as people sunning themselves, eating lunch or walking their dog.

The Wellesley Natural Resources Commission (NRC), as part of their Grow Green Wellesley Initiative, identified Simons Park as an opportunity to showcase ecological landscaping methods, improve biodiversity, reduce water consumption and resource inputs, and support pollinators. After a public procurement process, Landscape Interactions was selected by the NRC to create a landscape design and management plan for the property, with the objective of transforming the site into a functionally diverse, resource-rich habitat specifically targeting at-risk native bees and butterflies. Surveys of the site over a three year period would demonstrate the before-and-after impacts of the design on pollinator species diversity. The results would be published and shared widely, to inspire landowners across town and the wider region to view their own properties as integral components of a network of ecosystems to expand local biodiversity, ecological health and climate resilience.



Ecological site analyses that informed the design process for Simons Park included (left to right): topography and drainage, solar exposure across the growing season, soils (not pictured) and existing vegetation.



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 through the food web. Over 80% of the flowering plants on Earth depend upon insect-mediated pollination; bees alone pollinate one-third of the food grown in the United States, and nearly half the crops grown in Massachusetts. 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. 2013). In the United States, wild bee pollination services were estimated to be worth \$3.07 billion in 2006 (Losey & Vaughan 2006). 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 (Russell et al. 2013; Mathiasson & Rehan 2020).

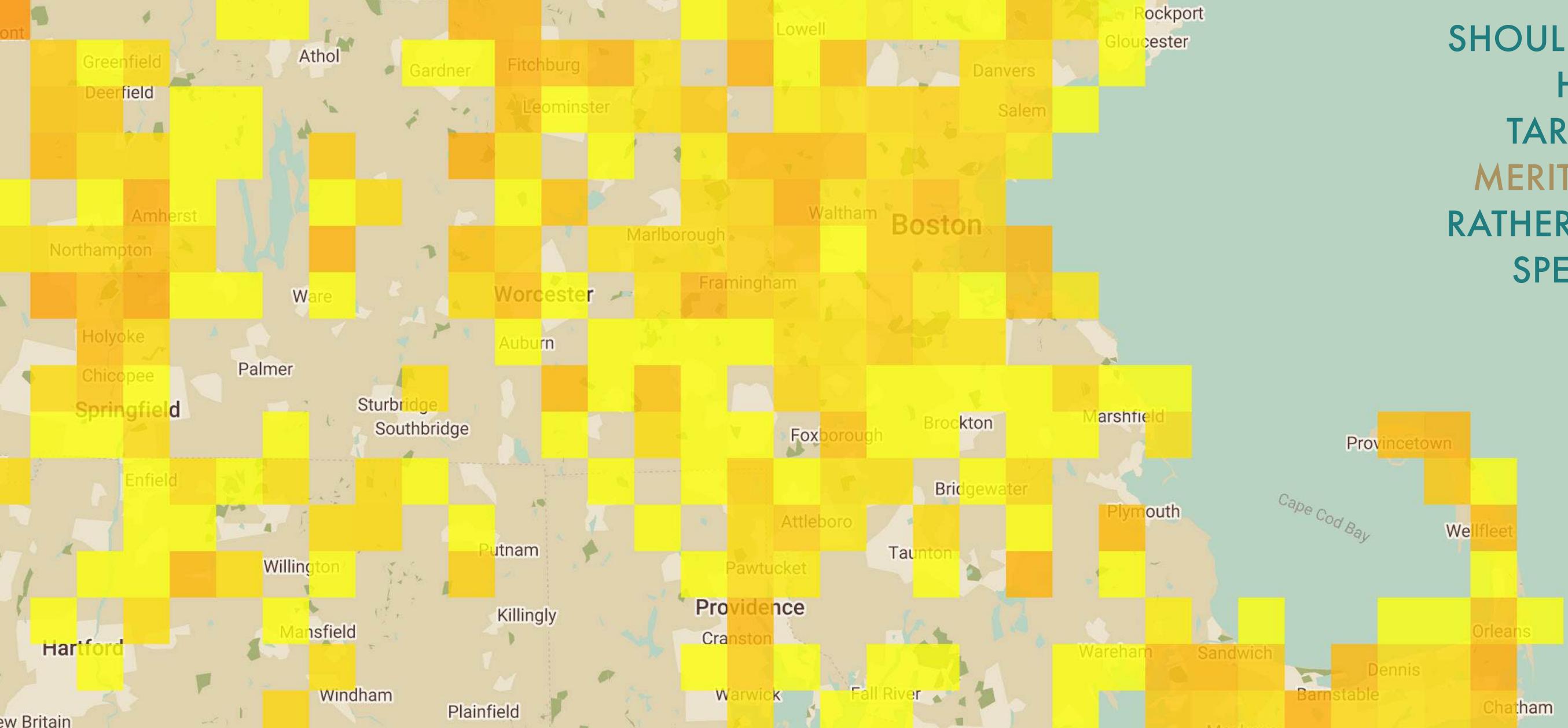
As **keystone species**, wild pollinators provide food, shelter and nest sites to wildlife at other trophic levels through their interactions with native flowering plants. Protecting a diversity of native pollination systems is therefore critical for maintaining healthy and diverse ecosystems. Pollination 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 bee species 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.

Eastern willow miner bee (Andrena bisalicis) gathering pollen from a native willow flower. This specialist bee gathers pollen from plant species in the Salix (willow) genus, and is in decline across much of the Northeast United States compared to historical observations (Bartomeus et al. 2013). Photograph by Tom Wood.

SHOULDN'T POLLINATOR HABITAT PROJECTS TARGET SPECIES THAT MERIT CONSERVATION, RATHER THAN COMMON SPECIES WITH STABLE POPULATIONS?



Portion of map depicting 10,115 observations of bumblebees in New England based on range of species diversity, 1864-2022. Courtesy the Beecology Project.

Science Informs Design

Pollinators have experienced dramatic declines in recent decades, particularly since the year 2000. In comparing historical to contemporary records for the Northeast, over 100 native bee species are found to be declining across the region (Bartomeus et al. 2013; Mathiasson & Rehan 2019) including three bumblebee species in Massachusetts, with two more bumblebee species already extirpated from the state (Gegear 2018). The consensus among scientists is that these declines are being driven primarily by a combination of land development, pesticide use and climate change.

While the subject of pollinator decline is understood by many to be highly significant, few pollinator habitat projects target the range of species at risk in a given geographic area. This is ironic since it is due to the decline of so many species that we are aware of the pollinator crisis in the first place. **Shouldn't pollinator habitat projects target species that merit conservation, rather than common species with stable populations?**

The plants featured in this design were selected specifically to support native bees and butterflies at the greatest risk of local extinction in the Wellesley, Massachusetts area. This list of target pollinator species and the plants they utilize was developed by Dr. Robert Gegear as part of his ongoing research into bee/butterfly-flower interactions, through

his lab at UMass-Dartmouth as well as the Beecology Project that he directs. Dr. Gegear compiled the list based on peer-reviewed papers, government websites and public databases, as well as over 25,000 observations of bee/butterfly-flower interactions across Massachusetts, collected through various research-related activities.

For non-*Bombus* bees, Bartomeus et al. 2013 and Mathiasson & Rehan 2019 were compared by Dr. Gegear with museum records and public databases in order to determine which declining species have historical or contemporary presence in the Wellesley area. That list was also reviewed by entomologist Michael Veit. The list of at-risk butterfly species was compiled by Dr. Gegear based on Sharon Stichter's invaluable Butterflies of Massachusetts website, Massachusetts Butterfly Club and NABA (North American Butterfly Association) counts, as well as Michielini et al. 2020.

Using the **Beecology app** that Dr. Gegear has created, anyone can contribute observations of bumblebee and butterfly interactions with flowering plants at Simons Park to help us track the impact of the project on our target species. Get started at <https://beecology.wpi.edu/website/participate#apps>. On **iNaturalist**, join the Habit to Habitat project automatically by uploading your observations at Simons Park.



NOT A SINGLE BEE OR BUTTERFLY WAS OBSERVED DURING THREE SURVEY PERIODS

Baseline Survey Results

The design site was surveyed three times before any landscape modifications took place. Surveys were conducted by Robert Gegear, Ph.D., Professor of Biology at UMass-Dartmouth and Founder of the Beecology Project.

Surveys of all bee and butterfly interactions with flowering plants took place on August 5 and 25, 2022 as well as May 15, 2023. The entire lawn area was surveyed as well as the forest edge, and areas adjacent to the library and parking lot. Weather conditions were favorable (sunny, temperature above 70° F) during all surveys.

On August 5, 2022 all grass was dry due to severe drought conditions, and no flowers were in bloom. On August 25 after a few periods of rain, the site was surveyed again, but again no flowers were in bloom. On May 15, 2023 the site appeared to have been recently mowed. The only thing in bloom was lilac (*Syringa vulgaris*), which had no flower visitors. The site therefore lacks the floral resources needed to support any bee or butterfly species throughout its life cycle.

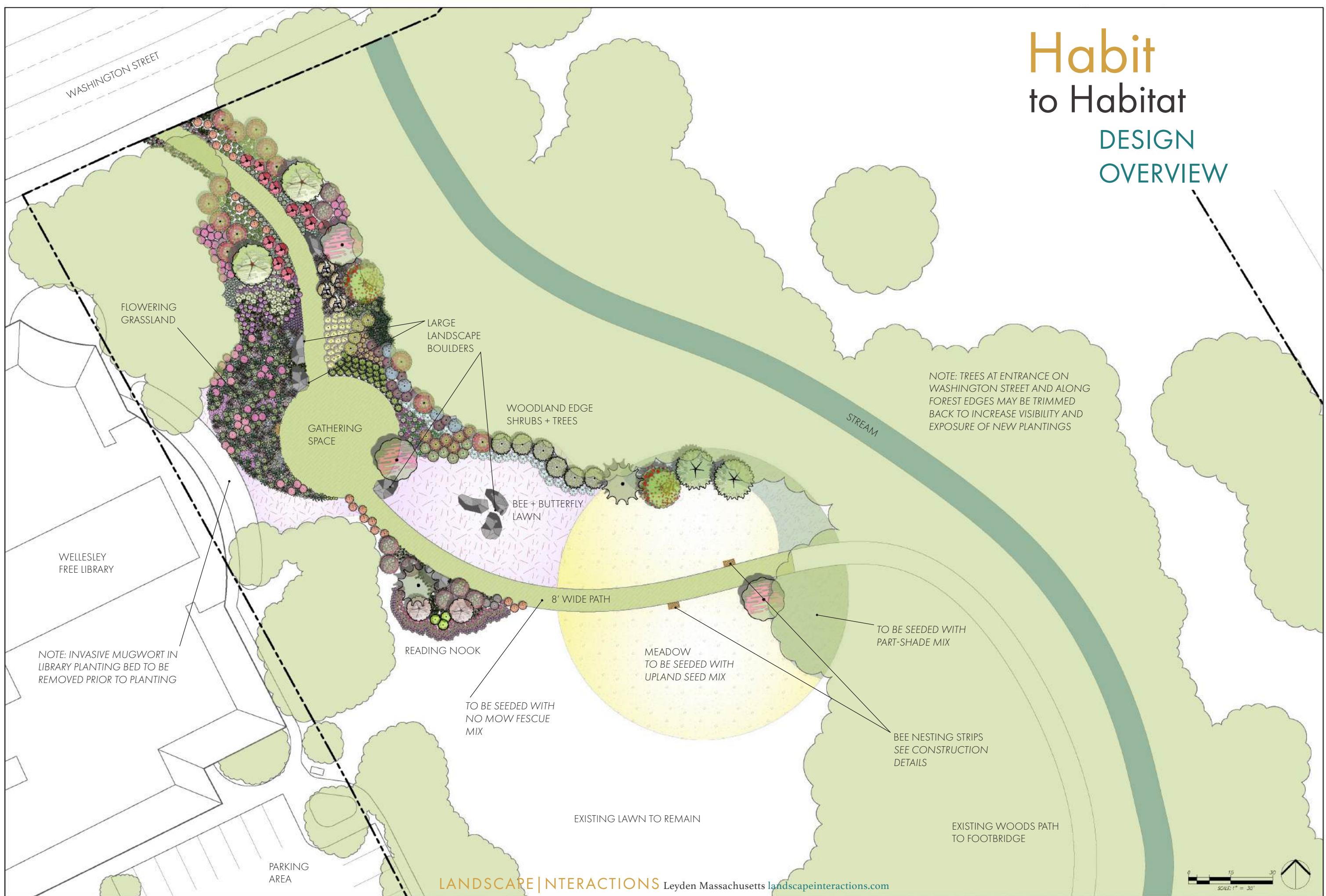
To demonstrate the impact of the design on pollinator species diversity, the site will be surveyed again by Dr. Gegear for two more seasons after plants have established. Follow up surveys are expected to commence in May 2025.

Above: The Simons Park design site in July 2022. Below: Dr. Gegear surveying bumblebee foraging behavior in the field. Photograph by Christine Peterson/Worcester Telegram.

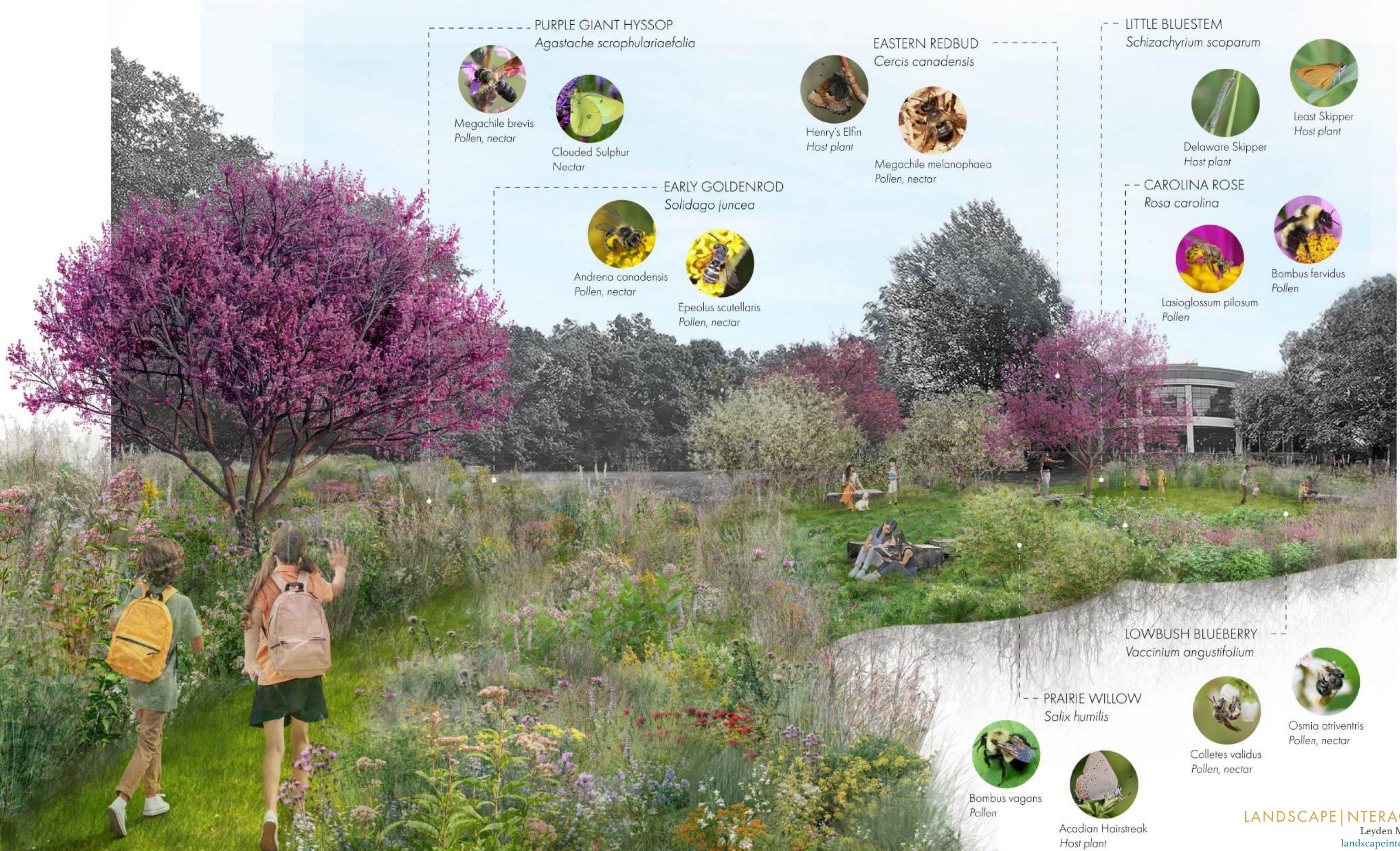


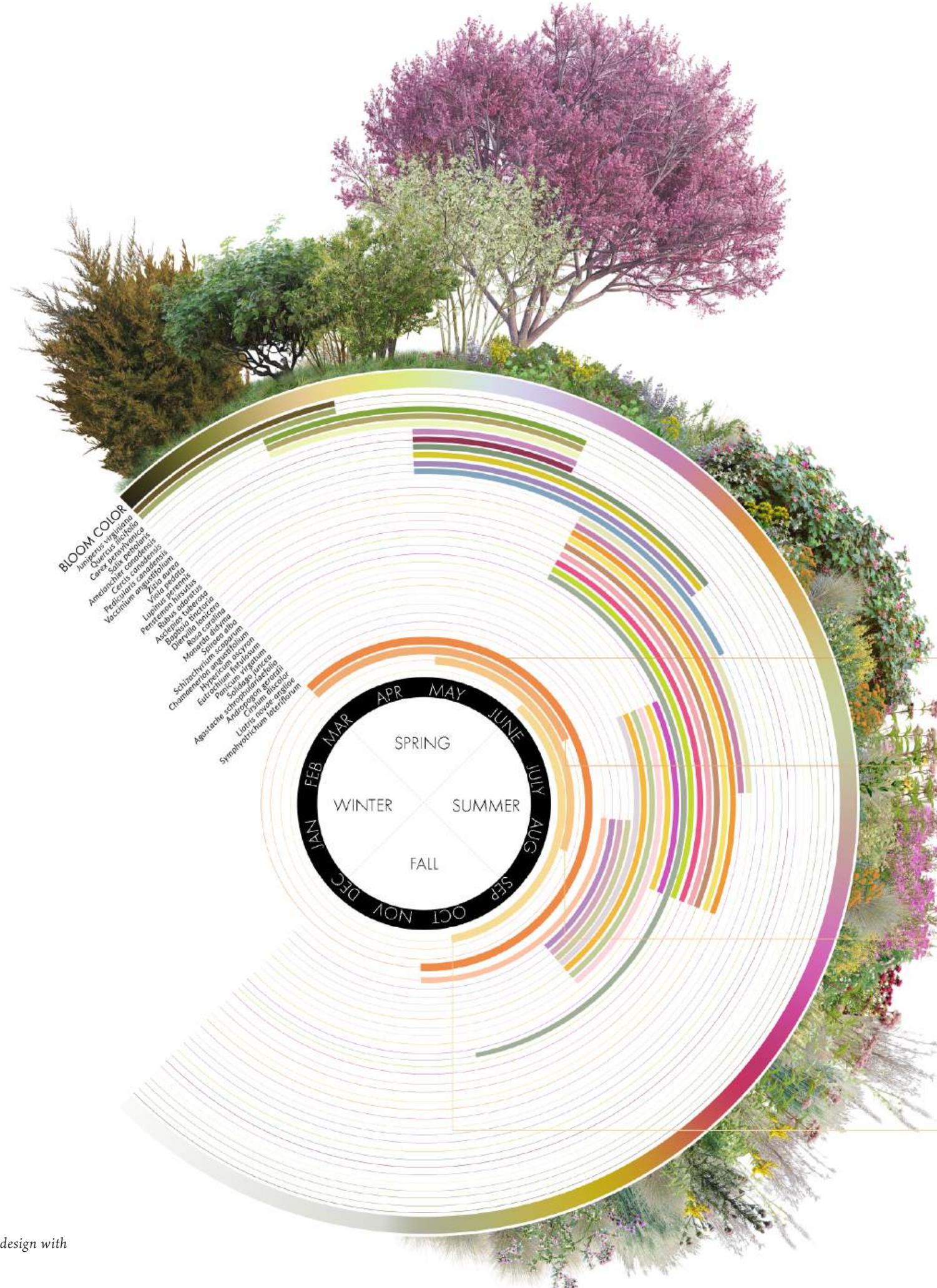
Habit to Habitat

DESIGN OVERVIEW



Perspective rendering of the Simons Park Habit to Habitat design from the meadow facing west towards the library, after plants have fully established.

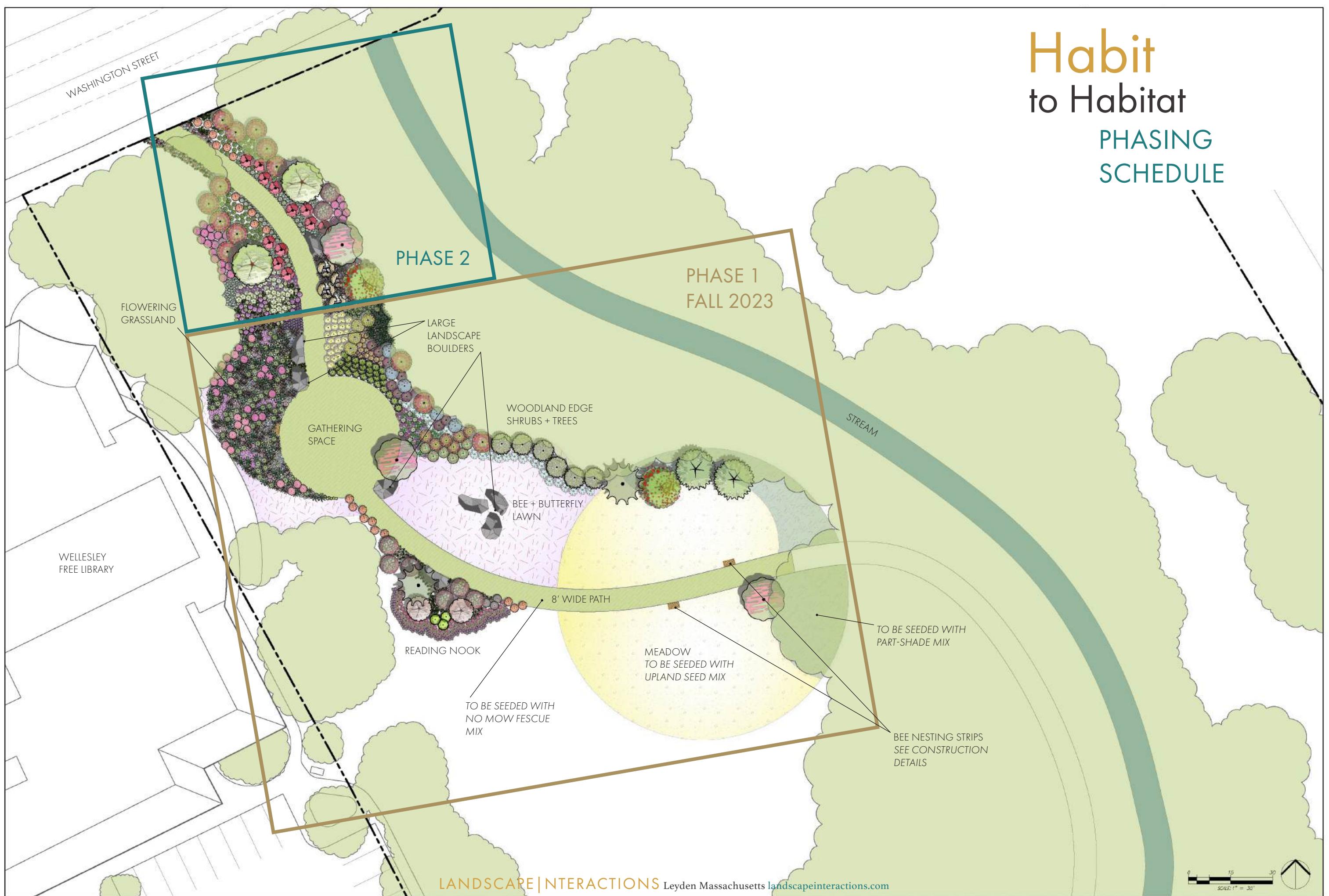




Seasonal bloom diagram of the Habit to Habitat design with pollinator species supported based on flight time.

Habit to Habitat

PHASING SCHEDULE



Habit to Habitat

PLANTING SCHEDULE

PLANT SCHEDULE PHASE 1

TREES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS	PERENNIALS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	AME CAN	Amelanchier canadensis	Canadian Serviceberry	6	7' wide spacing		AGA SCR	Agastache scrophulariifolia	Purple Giant Hyssop	29	2' wide spacing
	CER CAN	Cercis canadensis	Eastern Redbud	2	15' wide spacing		AST CAN	Astragalus canadensis	Canadian Milkvetch	69	1.5' wide spacing
	JUN VIR	Juniperus virginiana	Eastern Red Cedar	2	15' wide spacing		BLE CIL	Blephilia ciliata	Downy Wood Mint	18	1' wide spacing
	POP TRE	Populus tremuloides	Quaking Aspen	2	15' wide spacing		BLE HIR	Blephilia hirsuta	Hairy Wood Mint	9	1' wide spacing
	QUE ILI	Quercus ilicifolia	Scrub Oak	2	9' wide spacing		CHA ANG	Chamaenerion angustifolium	Fireweed	8	1.5' wide spacing
	RHU HIR	Rhus hirta	Staghorn Sumac	1	15' wide spacing		CLA CAR	Claytonia caroliniana	Carolina Spring Beauty	59	0.75' wide spacing
	SAL HUM	Salix humilis	Prairie Willow	3	4' wide spacing		EUT FIS	Eutrochium fistulosum	Hollow Joe-Pye Weed	15	3' wide spacing
	SAL ODT	Salix occidentalis	Dwarf Prairie Willow	3	3' wide spacing		EUT PUR	Eutrochium purpureum	Purple Joe-Pye Weed	15	3' wide spacing
	SAL PET	Salix petiolaris	Meadow Willow	6	8' wide spacing		GER MAC	Geranium maculatum	Spotted Crane's-bill	26	1' wide spacing
SHRUBS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS		HYP ASC	Hypericum ascyron	Giant St. John's-wort	17	2' wide spacing
	BAP TIN	Baptisia tinctoria	Yellow Wild Indigo	26	3' wide spacing		LAP CAN	Laporta canadensis	Canada Wood-nettle	17	2' wide spacing
	DIE LON	Diervilla lonicera	Northern Bush-honeysuckle	10	3' wide spacing		LIA NOV	Liatris novae-angliae	Northern Blazing Star	73	1' wide spacing
	HYP PRO	Hypericum prolificum	Shrubby St. John's-wort	4	5' wide spacing		LUP PER	Lupinus perennis	Wild Lupine	62	1' wide spacing
	ROS PAS	Rosa carolina	Carolina Rose	6	4' wide spacing		MON DID	Monarda didyma	Scarlet Bee Balm	29	2' wide spacing
	ROS VIR	Rosa virginiana	Virginia Rose	6	5' wide spacing		PEN HIR	Penstemon hirsutus	Northeastern Beardtongue	13	1.5' wide spacing
	RUB ALL	Rubus allegheniensis	Allegheny Blackberry	5	5' wide spacing		SOL ARG	Solidago arguta	Atlantic Goldenrod	41	2' wide spacing
	RUB ODO	Rubus odoratus	Purple-flowering Raspberry	3	7' wide spacing		STA PIL	Stachys pilosa	Hairy Hedge-nettle	76	1' wide spacing
	RUB PEN	Rubus pensylvanicus	Pennsylvania Blackberry	10	4' wide spacing		SYM LAT	Sympphytum lateriflorum	Calico Aster	7	2' wide spacing
	SPI ALB	Spiraea alba	Meadowsweet	24	3' wide spacing		ZIZ AUR	Zizia aurea	Golden Alexanders	44	1' wide spacing
	VAC ANG	Vaccinium angustifolium	Lowbush Blueberry	32	3' wide spacing	GROUND COVERS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
BIENNIAL	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS		BEE LWN	Bee + Butterfly Lawn	Mow-Tolerant Sedges + Flowers	3,108 sf	
	CIR DIS	Cirsium discolor	Field Thistle	22	2' wide spacing		NO MOW	No Mow Lawn	No Mow Fescue Mix	3,708 sf	
GRASSES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS		SHD MDW	Shaded Meadow	Part-Shade Meadow Seed Mix	1,920 sf	
	AND GER	Andropogon gerardii	Big Bluestem	117	3' wide spacing		UPL MDW	Upland Meadow	Upland Meadow Seed Mix	7,653 sf	
	CAR PEN	Carex pensylvanica	Pennsylvania Sedge	141	1' wide spacing						
	PAN VIR	Panicum virgatum	Switchgrass	84	3' wide spacing						
	SCH SCO	Schizachyrium scoparium	Little Bluestem	253	2' wide spacing						

PLANT SCHEDULE PHASE 2

TREES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	AME CAN	Amelanchier canadensis	Canadian Serviceberry	2	7' wide spacing
	CER CAN	Cercis canadensis	Eastern Redbud	1	15' wide spacing
	PRU MAR	Prunus maritima	Beach Plum	4	6' wide spacing
	QUE PRI	Quercus prinoides	Dwarf Chestnut Oak	2	15' wide spacing
	RHU HIR	Rhus hirta	Staghorn Sumac	1	15' wide spacing
SHRUBS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	DIE LON	Diervilla lonicera	Northern Bush-honeysuckle	11	3' wide spacing
	RUB ODO	Rubus odoratus	Purple-flowering Raspberry	10	7' wide spacing
	SWI SER	Swida sericea	Red-osier Dogwood	12	5' wide spacing
ANNUALS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	IMP CAP	Impatiens capensis	Spotted Jewelweed	76	2' wide spacing
GRASSES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	CAR PEN	Carex pensylvanica	Pennsylvania Sedge	259	1' wide spacing
	SCH SCO	Schizachyrium scoparium	Little Bluestem	62	2' wide spacing
PERENNIALS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	APO AND	Apocynum androsaemifolium	Spreading Dogbane	23	2' wide spacing
	APO CAN	Apocynum cannabinum	Hemp Dogbane	18	2' wide spacing
	ASC PUR	Asclepias purpurascens	Purple Milkweed	24	2' wide spacing
	BLE CIL	Blephilia ciliata	Downy Wood Mint	51	1' wide spacing
	BLE HIR	Blephilia hirsuta	Hairy Wood Mint	248	1' wide spacing
	CHE GLA	Chelone glabra	White Turtlehead	23	2' wide spacing
	CLA CAR	Claytonia caroliniana	Carolina Spring Beauty	39	0.75' wide spacing
	EUT PUR	Eutrochium purpureum	Purple Joe-Pye Weed	25	3' wide spacing
	GER MAC	Geranium maculatum	Spotted Crane's-bill	49	1' wide spacing
	LYS CIL	Lysimachia ciliata	Fringed Yellow-loosestrife	32	2' wide spacing
	PEN HIR	Penstemon hirsutus	Northeastern Beardtongue	27	1.5' wide spacing
	PRU VUL	Prunella vulgaris	Selfheal	16	1' wide spacing

Habit to Habitat

PHASE 1 DESIGN AREAS

PLANT SCHEDULE WOODLAND EDGE

TREES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	SAL PET	Salix petiolaris	Meadow Willow	6	8' wide spacing
SHRUBS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	BAP TIN	Baptisia tinctoria	Yellow Wild Indigo	26	3' wide spacing
	HYP PRO	Hypericum prolificum	Shrubby St. John's-wort	4	5' wide spacing
	ROS PAS	Rosa carolina	Carolina Rose	6	4' wide spacing
	ROS VIR	Rosa virginiana	Virginia Rose	6	5' wide spacing
	RUB ALL	Rubus allegheniensis	Allegheny Blackberry	5	5' wide spacing
	RUB ODO	Rubus odoratus	Purple-flowering Raspberry	3	7' wide spacing
	RUB PEN	Rubus pensylvanicus	Pennsylvania Blackberry	10	4' wide spacing
	SPI ALB	Spiraea alba	Meadowsweet	24	3' wide spacing
	VAC ANG	Vaccinium angustifolium	Lowbush Blueberry	32	3' wide spacing
GRASSES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	AND GER	Andropogon gerardii	Big Bluestem	45	3' wide spacing
	PAN VIR	Panicum virgatum	Switchgrass	18	3' wide spacing
	SCH SCO	Schizachyrium scoparium	Little Bluestem	1	2' wide spacing
PERENNIALS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	BLE CIL	Blephilia ciliata	Downy Wood Mint	18	1' wide spacing
	BLE HIR	Blephilia hirsuta	Hairy Wood Mint	9	1' wide spacing
	CHA ANG	Chamaenerion angustifolium	Fireweed	8	1.5' wide spacing
	GER MAC	Geranium maculatum	Spotted Crane's-bill	26	1' wide spacing
	HYP ASC	Hypericum ascyron	Giant St. John's-wort	17	2' wide spacing
	LAP CAN	Laportea canadensis	Canada Wood-nettle	17	2' wide spacing
	PEN HIR	Penstemon hirsutus	Northeastern Beardtongue	13	1.5' wide spacing
	SYM LAT	Sympyotrichum lateriflorum	Calico Aster	7	2' wide spacing

PLANT SCHEDULE READING NOOK

TREES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	AME CAN	Amelanchier canadensis	Canadian Serviceberry	6	7' wide spacing
	JUN VIR	Juniperus virginiana	Eastern Red Cedar	1	15' wide spacing
	QUE ILI	Quercus ilicifolia	Scrub Oak	2	9' wide spacing
	SAL HUM	Salix humilis	Prairie Willow	3	4' wide spacing
	SAL ODT	Salix occidentalis	Dwarf Prairie Willow	3	3' wide spacing
SHRUBS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	DIE LON	Diervilla lonicera	Northern Bush-honeysuckle	10	3' wide spacing
GRASSES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	CAR PEN	Carex pensylvanica	Pennsylvania Sedge	107	1' wide spacing
PERENNIALS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	CLA CAR	Claytonia caroliniana	Carolina Spring Beauty	59	0.75' wide spacing
	LIA NOV	Liatris novae-angliae	Northern Blazing Star	73	1' wide spacing
	MON DID	Monarda didyma	Scarlet Bee Balm	29	2' wide spacing
	SOL ARG	Solidago arguta	Atlantic Goldenrod	41	2' wide spacing
	STA PIL	Stachys pilosa	Hairy Hedge-nettle	76	1' wide spacing
PLANT SCHEDULE FLOWERING GRASSLAND					
BIENNIAL	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	CIR DIS	Cirsium discolor	Field Thistle	22	2' wide spacing
GRASSES	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	AND GER	Andropogon gerardii	Big Bluestem	73	3' wide spacing
	CAR PEN	Carex pensylvanica	Pennsylvania Sedge	34	1' wide spacing
	PAN VIR	Panicum virgatum	Switchgrass	63	3' wide spacing
	SCH SCO	Schizachyrium scoparium	Little Bluestem	256	2' wide spacing
PERENNIALS	CODE	BOTANICAL NAME	COMMON NAME	QTY	REMARKS
	AGA SCR	Agastache scrophulariifolia	Purple Giant Hyssop	29	2' wide spacing
	AST CAN	Astragalus canadensis	Canadian Milkvetch	69	1.5' wide spacing
	EUT FIS	Eutrochium fistulosum	Hollow Joe-Pye Weed	16	3' wide spacing
	EUT PUR	Eutrochium purpureum	Purple Joe-Pye Weed	16	3' wide spacing
	LUP PER	Lupinus perennis	Wild Lupine	62	1' wide spacing
	ZIZ AUR	Zizia aurea	Golden Alexanders	44	1' wide spacing

Habit to Habitat

PHASE 1 DESIGN AREAS

UPLAND MEADOW SEED MIX

LATIN NAME	COMMON NAME
<i>Agastache scrophulariaefolia</i>	Purple giant hyssop
<i>Andropogon gerardii</i>	Big bluestem
<i>Asclepias incarnata</i>	Swamp milkweed
<i>Asclepias syriaca</i>	Common milkweed
<i>Asclepias tuberosa</i>	Butterfly milkweed
<i>Astragalus canadensis</i>	Canada milkvetch
<i>Baptisia tinctoria</i>	Yellow wild indigo
<i>Blephilia ciliata</i>	Downy wood mint
<i>Blephilia hirsuta</i>	Hairy woodmint
<i>Chamaenerion angustifolium</i>	Fireweed
<i>Cirsium discolor</i>	Field thistle
<i>Desmodium canadense</i>	Showy tick trefoil
<i>Eutrochium fistulosum</i>	Hollow Joe-Pye weed
<i>Eutrochium purpureum</i>	Purple Joe-Pye weed
<i>Hypericum punctatum</i>	Spotted St. John's-wort
<i>Lupinus perennis</i>	Wild lupine
<i>Monarda didyma</i>	Scarlet bee balm
<i>Monarda fistulosa</i>	Wild bergamot
<i>Panicum virgatum</i>	Switchgrass
<i>Pedicularis canadensis</i>	Wood betony
<i>Penstemon digitalis</i>	Foxglove beardtongue
<i>Penstemon hirsutus</i>	Northeastern beardtongue
<i>Prunella vulgaris ssp. lanceolata</i>	Common selfheal
<i>Schizachyrium scoparum</i>	Little bluestem
<i>Solidago juncea</i>	Early goldenrod
<i>Solidago odora</i>	Sweet goldenrod
<i>Solidago speciosa</i>	Showy goldenrod
<i>Spiraea alba</i>	White meadowsweet
<i>Spiraea tomentosa</i>	Steeplebush
<i>Symphytum lateriflorum</i>	Calico aster
<i>Tridens flavus</i>	Purpletop
<i>Zizia aptera</i>	Meadow zizia
<i>Zizia aurea</i>	Golden Alexanders

PART-SHADE MEADOW SEED MIX

LATIN NAME	COMMON NAME
<i>Andropogon gerardii</i>	Big bluestem
<i>Apocynum androsaemifolium</i>	Spreading dogbane
<i>Apocynum cannabinum</i>	Hemp dogbane
<i>Asclepias incarnata</i>	Swamp milkweed
<i>Astragalus canadensis</i>	Canada milkvetch
<i>Blephilia hirsuta</i>	Hairy woodmint
<i>Carex blanda</i>	Common wood sedge
<i>Carex brevior</i>	Plains oval sedge
<i>Carex sprengelii</i>	Long-beaked sedge
<i>Eutrochium fistulosum</i>	Hollow Joe-Pye weed
<i>Eutrochium purpureum</i>	Purple Joe-Pye weed
<i>Hypericum punctatum</i>	Spotted St. John's-wort
<i>Impatiens capensis</i>	Jewelweed
<i>Lysimachia ciliata</i>	Fringed yellow loosestrife
<i>Pedicularis canadensis</i>	Wood betony
<i>Penstemon digitalis</i>	Foxglove beardtongue
<i>Penstemon hirsutus</i>	Northeastern beardtongue
<i>Prunella vulgaris ssp. lanceolata</i>	Common selfheal
<i>Solidago juncea</i>	Early goldenrod
<i>Symphytum lateriflorum</i>	Calico aster
<i>Zizia aptera</i>	Meadow zizia
<i>Zizia aurea</i>	Golden Alexanders

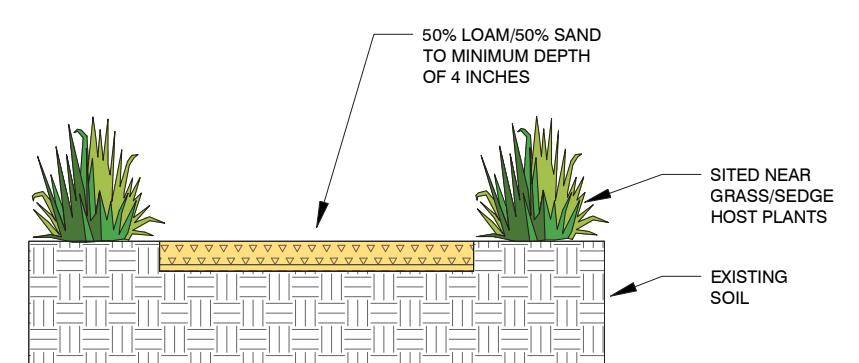
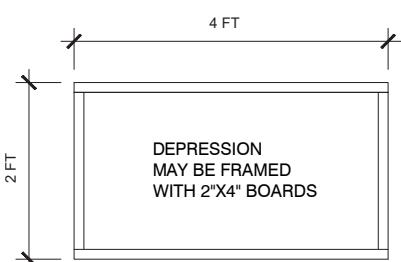
BEE + BUTTERFLY LAWN PLANTINGS

LATIN NAME	COMMON NAME
<i>Blephilia ciliata</i>	Downy wood mint
<i>Carex brevior</i> *	Plains oval sedge
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Danthonia spicata</i> *	Poverty oat grass
<i>Juncus tenuis</i> *	Path rush
<i>Pedicularis canadensis</i>	Wood betony
<i>Prunella vulgaris ssp. lanceolata</i> *	Common selfheal
<i>Viola pallens</i>	Smooth white violet
<i>Viola pedata</i>	Bird's foot violet
<i>Viola striata</i> *	Striped cream violet

*To be direct seeded

BEE NESTING STRIP*

(2 FT. X 4 FT.)



*Bee nesting strips can be installed alongside paths, in meadows, or anywhere with sunny, well draining soil.

At-Risk Pollinators Supported by this Project

BEES:

Andrena barbilabris
Andrena bisalicis
Andrena brevipalpis
Andrena canadensis
Andrena distans
Andrena erigeniae
Andrena erythrogaster
Andrena forbesii
Andrena geranii
Andrena imitatrix
Andrena integra
Andrena miserabilis
Andrena nubecula
Andrena placata
Andrena sigmundi
Andrena w-scripta
Bombus fervidus
Bombus vagans
Coelioxys modestus
Coelioxys octodentatus
Coelioxys rufitarsis
Colletes compactus
Colletes validus
Epeorus scutellaris
Lasioglossum cinctipes
Lasioglossum heterognathum
Lasioglossum imitatum
Lasioglossum leucocomum
Lasioglossum perpunctatum
Lasioglossum pilosum
Lasioglossum quebecense
Lasioglossum truncatum
Macropis ciliata
Macropis nuda
Megachile brevis
Megachile frigida
Megachile latimanus
Megachile melanophaea
Megachile montivaga

Bearded Miner Bee
 Eastern Willow Miner Bee
 Short-tongued Miner Bee
 Canada Miner Bee
 Distant Miner Bee
 Spring Beauty Miner Bee
 Red-bellied Miner Bee
 Forbes's Miner Bee
 Geranium Miner Bee
 Imitator Miner Bee
 Intact Miner Bee
 Smooth-faced Miner Bee
 Cloudy-winged Miner Bee
 Peaceful Miner Bee
 Sigmund's Miner Bee
 W-marked Miner Bee
 Golden northern bumble bee
 Half-black bumble bee
 Northeastern Cuckoo Leafcutter Bee
 Eight-toothed Cuckoo Leafcutter Bee
 Red-legged Cuckoo Leafcutter Bee
 Aster Cellophane Bee
 Blueberry Cellophane Bee
 Red-chested Cuckoo Nomad Bee
 Band-footed Sweat Bee
 Wide-mouthed Sweat Bee
 Bristle Sweat Bee
 White-haired Golden Sweat Bee
 Densely Punctured Sweat Bee
 Hairy Sweat Bee
 Quebec Sweat Bee
 Truncate Sweat Bee
 Fringed Loosestrife Oil-collecting Bee
 Common Loosestrife Oil Bee
 Little Leaf-cutter Bee
 Frigid Leaf-cutter Bee
 Broad-handed Leaf-cutter Bee
 Black-and-gray Leaf-cutter Bee
 Silver-tailed Petal-cutter Bee

Megachile relativa
Melissodes druriellus
Nomada bella
Nomada depressa
Osmia atriventris
Osmia lignaria

Relative Leaf-cutter Bee
 Drury's Long-horned Bee
 Beautiful Cuckoo Nomad Bee
 Depressed Cuckoo Nomad Bee
 Maine Blueberry Bee
 Blue Orchard Bee

BUTTERFLIES:

Acadian Hairstreak
 American Lady
 Banded Hairstreak
 Clouded Sulphur
 Cobweb Skipper
 Common Ringlet
 Common Sootywing
 Common Wood-nymph
 Compton Tortoiseshell
 Crossline Skipper
 Delaware Skipper
 Dreamy Duskywing
 Dusted Skipper
 Eastern Pine Elfin
 Edwards' Hairstreak
 Eyed Brown
 Frosted Elfin
 Henry's Elfin
 Hobomok Skipper
 Juniper Hairstreak
 Juvenal's Duskywing
 Least Skipper
 Little Wood Satyr
 Long Dash
 Meadow Fritillary
 Mourning Cloak
 Oak Hairstreak
 Peck's Skipper
 Pepper and Salt Skipper
 Question Mark
 Sleepy Duskywing

SUBMIT YOUR OBSERVATIONS
AT SIMONS PARK
TO BEECOLOGY



Photographs (clockwise from top left):
Bombus fervidus by Norm Levey;
Epeorus scutellaris by Vermont Center for Ecosystem Studies;
Crossline Skipper by Vitaly Charny; *Osmia lignaria* by Chelsey Ritner; *Question Mark* by Cattails.

BIGGEST THREATS FACING POLLINATORS

- » HABITAT LOSS
- » PESTICIDES
- » CLIMATE CHANGE



SITE WAS SOLARIZED WITH
BLACK SILAGE TARP FOR FIVE
MONTHS TO KILL EXISTING
TURF



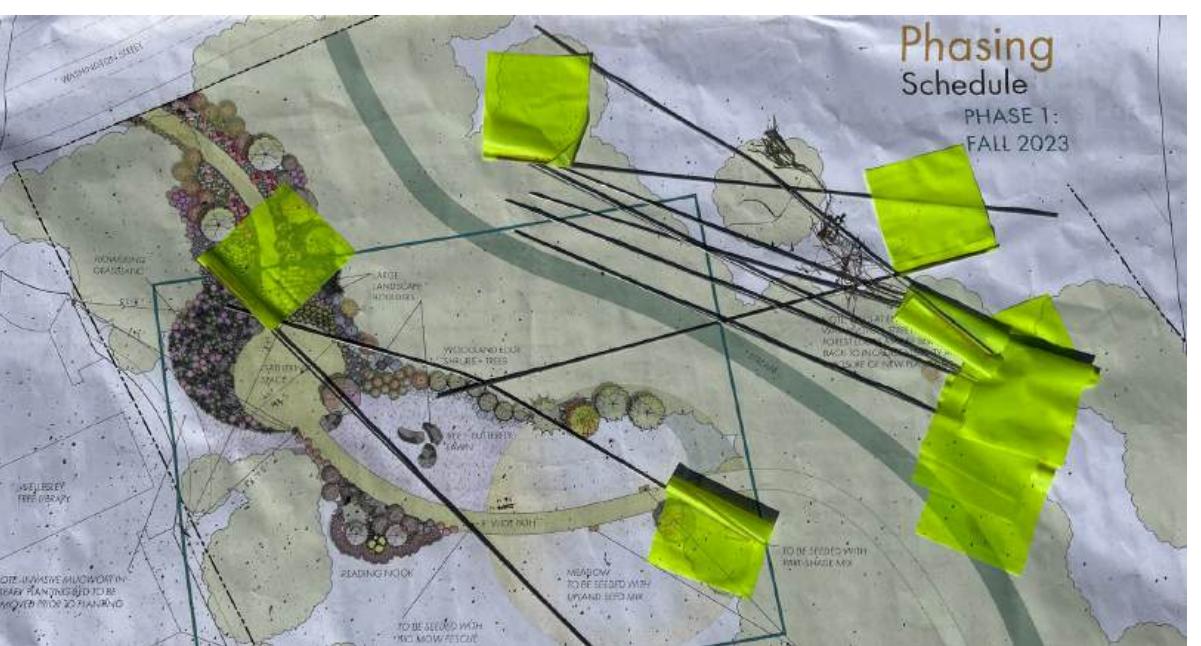
WE SPRAYPAINTED INSECTS
AND FLOWERS TO PROMOTE
PUBLIC ACCEPTANCE



Site
Preparation
MAY 2023

Design Installation

SEPT 2023

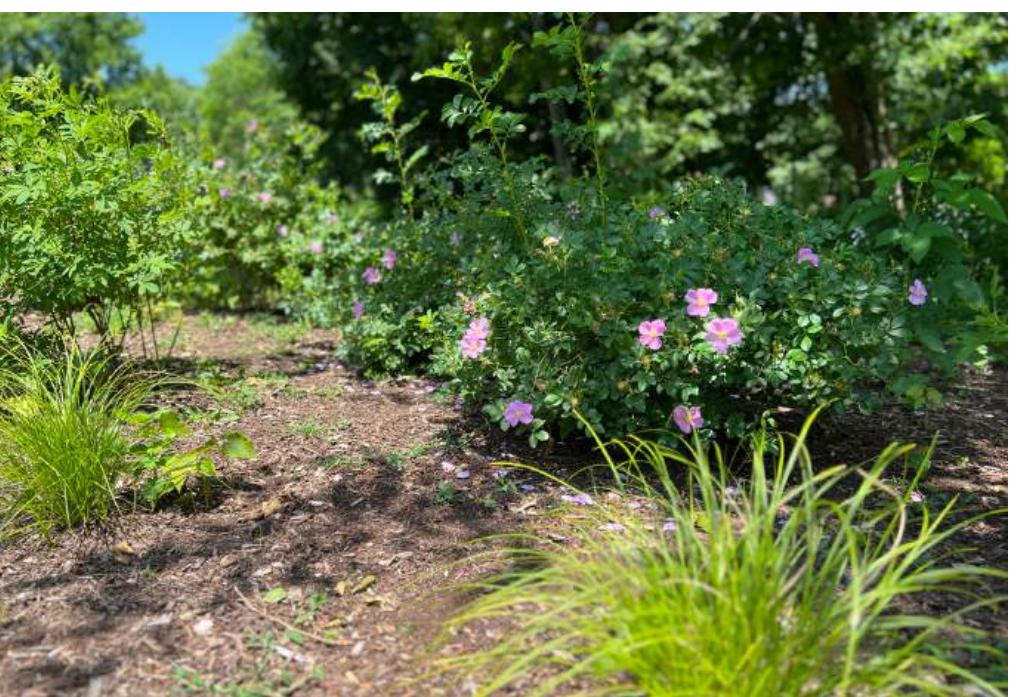


THANKS TO THE WELLESLEY
PUBLIC WORKS STAFF AND
OVER 50 VOLUNTEERS WHO
SHOWED UP!

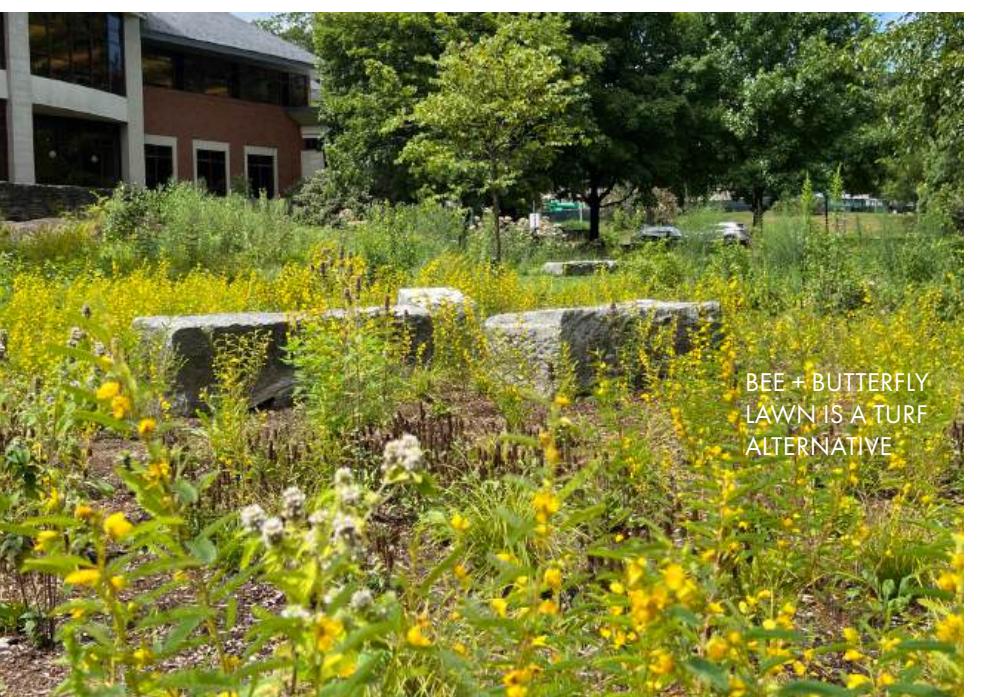
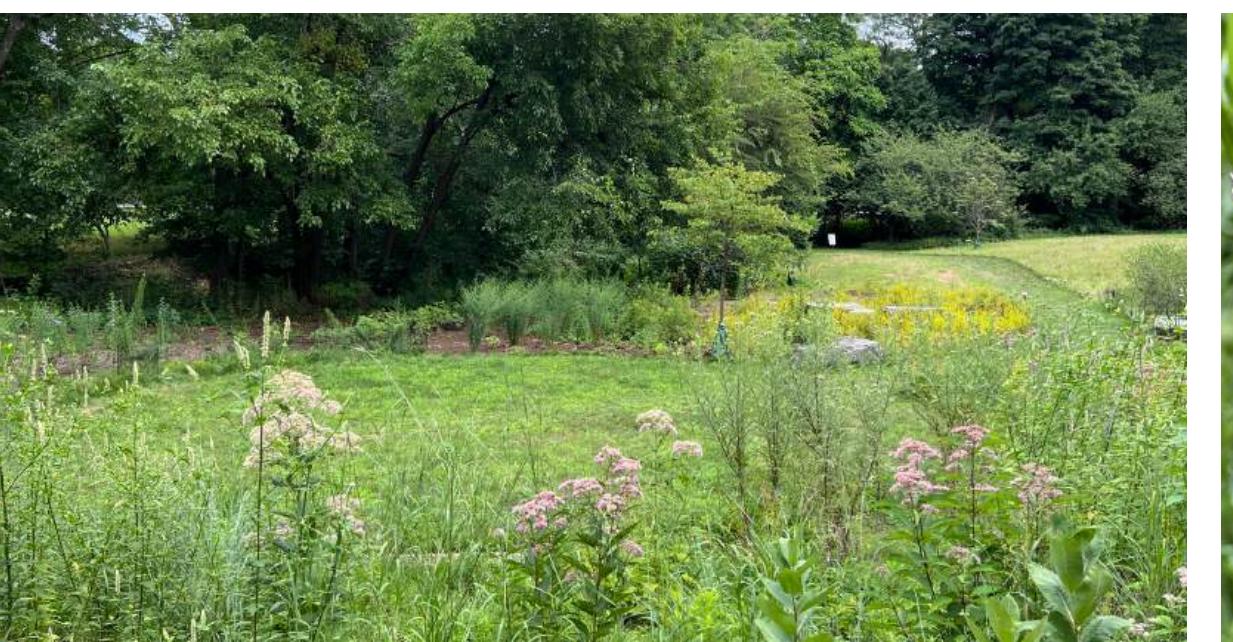


First
Spring
MAY 2024

First Spring JUNE 2024



First Summer AUG 2024



PROJECT TIMELINE

	2023												2024											
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
SITE PREPARATION																								
Tarp (mow low first)																								
Invasive species removal																								
Rake dead vegetation after tarp removal																								
INSTALLATION																								
Planting (plugs, shrubs, trees)																								
Mulching after planting																								
Caging for deer protection																								
Broadcast meadow seed mixes																								
MAINTENANCE																								
Brush hog/weed whack seeded areas*																								
Weed planted areas																								
Water (if rainfall lacks)																								
Keep bee nesting strips free of vegetation																								
Check deer protection for damage																								
																						continue		
																							continue	

*See following page

MOWING + MAINTENANCE SCHEDULE

FOR MEADOW

Year One (2024): Meadow should be mowed or weed whacked down to 5 inches height every time vegetation reaches an average of 12 inches height. This will likely occur once per month, depending on rainfall.

Year Two (2025): Mow down to 5 inches in the spring, after vegetation reaches 12 inches height. Allow meadow to establish without mowing for the rest of the season, hand pulling or cutting weeds and non-native species as they appear.

Years Three and Onward (2026+): Mow down to 5 inches on average once per year during the shoulder season (November 1 - April 1), alternating half of the meadow each time.

Ongoing Maintenance: Hand pull or cut non-native and invasive species as they appear, as well as young trees.

Periodic burning of the meadow using a flame weeder or drip torch is highly recommended to encourage the growth of native grassland vegetation, and suppress cool season grasses and weeds. Adjacent vegetation should be mowed down as low as possible beforehand, clearing at least 4 feet in any given direction, and keeping a water source on hand for safety. The best time for burning is in the early spring (April-May) during a dry spell.

FOR BEE + BUTTERFLY LAWN

Year One (2024): Bee + Butterfly Lawn should be mowed or weed whacked down to 6 inches height once, after the growing season ends (November 1).

Years Two and Onward (2025+): Bee + Butterfly Lawn should be mowed or weed whacked down to 6 inches height every time vegetation reaches an average of 16 inches height. This will likely occur twice per year, depending on rainfall.

Ongoing Maintenance: Hand pull or cut non-native and invasive species as they appear, as well as young trees.

FOR BEE NESTING STRIPS

Every Year: Keep bee nesting strips weeded and clear of any vegetation that attempts to grow inside of them.



MEADOW SEEDING

It is highly recommended to install native seed mixes in the dormant season, mid-October through January. This is because most native flowering species require between one and three months of cold stratification in order to germinate. Fall and winter naturally provide this opportunity in the Northeast, and are usually followed by rainfall in the spring. It is also possible to sow seeds in the early spring, but many species may not germinate until the following year, and watering may be necessary.

SEEDING

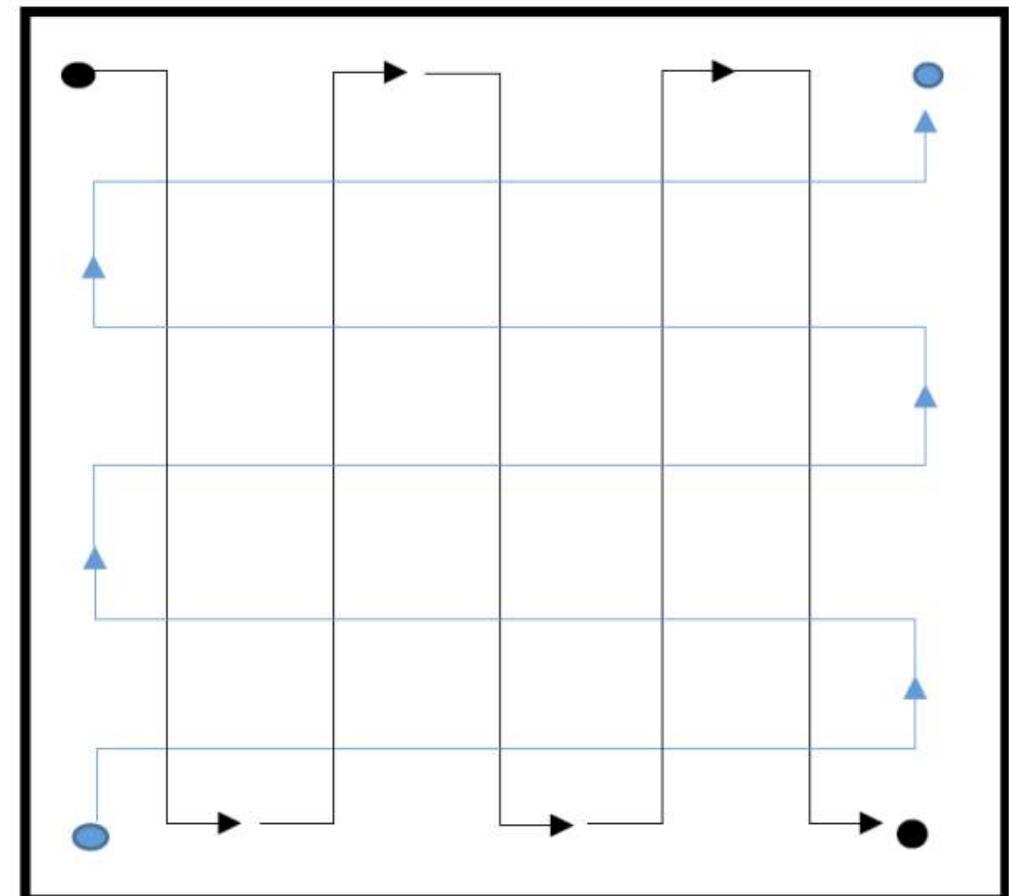
Due to the small scale of the meadow at Simons Park (less than 10,000 sq.ft), it was possible to install all seeds manually by broadcasting the mixes. The process is fairly straightforward: after seed mixes are created and purchased for each area (in this case, the meadow is divided into two mixes: full-sun and part-shade), the mixes are weighed with a food scale and divided in half. Each half is then mixed with a 5 gallon bucket of moistened sand or parboiled rice hulls (PBH) as a carrying agent. The physical areas to be seeded are divided into two sections per mix (a string may be used), and each section is distributed evenly with a bucket containing the seed mix and the carrying agent.

A cover crop should always be included when direct seeding: winter wheat (*Triticum aestivum*) for fall or winter installations, and wild oats (*Avena sativa*) for spring installations, at 100 lbs/acre. When broadcasting, cover crops can be installed separately following the seed mixes.

It is best to walk back-and-forth across each area in two directions (West to East and North to South for example) in order to guarantee even coverage. Refer to the diagram to the right for an example of how to evenly broadcast seeds across a site.

For the first growing season following seeding, at least 1 inch of rain per week is ideal. If there is not adequate precipitation, areas recently seeded should be watered 1-2 times per week the first growing season.

For the “no mow” fescue mix which was seeded across the walking path and gathering area at Simons Park, no carrying agent or cover crop is necessary. Fescues are cool season grasses, and should therefore be seeded in early fall, when temperatures are still above 50° at night. Seeds can be hand broadcast or distributed with a grass-seed spreader and should be lightly raked in and then watered for the first month or two, if needed. Depending upon conditions, germination can be expected in one to two weeks.



This diagram from the University of New Hampshire illustrates the two directions that should be walked when broadcasting seeds, in order to ensure even coverage.

BEST MANAGEMENT PRACTICES



1. NO CHEMICALS

Eliminate pesticide use, particularly those containing neonicotinoids. **Backyard mosquito and tick spraying by private companies using “natural” or synthetic pyrethrins is lethal to not only pollinators, but all insects for up to 90 days.** 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, nectar and host plant 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.

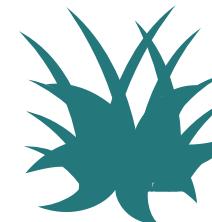


3. CREATE NESTING OPPORTUNITIES

Seventy percent of native bee species in the Northeast are ground nesting. Mulch using natural materials (chopped leaves, seed-free hay, composted wood chips) and leave bare areas of well-drained soil in sunny locations. Thirty percent of native bee species are cavity nesting. Allow dead trees, snags and pithy stemmed plants such as raspberries and Joe-Pye weed to remain standing all winter.

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 or straw are also ideal.

Limiting or eliminating tillage practices will also limit the potential of harming ground-nesting bees, including 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 *Solanum ptycanthum* (Eastern black nightshade) for the Five-spotted Hawkmoth, and *Lepidium virginicum* (Virginia peppergrass) for the Checkered White butterfly.



5. IT DOESN'T STOP WITH PLANTING

With new plantings, water and weed regularly for the first two years.

To deter deer and rodents until plants fully establish, it is often necessary to construct deer exclosures, fencing or individually cage woody plants until they establish.

Mow less often, mow higher, and delay mowing meadows and fields until the end of the growing season (after November 1 or before April 1). If brush hogging roadsides, fields or meadows, try to cut no more than 1/3 to 1/2 at a time, to allow pollinators to nest undisturbed.



6. LAST BUT NOT LEAST

If a water source is not close by, 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.

References

Ascher, J. S., Pickering, J. (2023). Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila). http://www.discoverlife.org/mp/20q?guide=Apoidea_species

Bartomeus, I., Ascher, J. S., Gibbs, J., Danforth, B. N., Wagner, D. L., Hettke, S. M., & Winfree, R. (2013). Historical changes in northeastern US bee pollinators related to shared ecological traits. *Proceedings of the National Academy of Sciences*, 110(12), 4656–4660. <https://doi.org/10.1073/pnas.1218503110>

Fowler, J. (2016). Specialist bees of the northeast: Host plants and habitat conservation. *Northeastern Naturalist*, 23(2), 305. <https://doi.org/10.1656/045.023.0210>

GBIF: The Global Biodiversity Information Facility. <https://www.gbif.org/>

Garibaldi, L. A., et al. (2013). Wild pollinators enhance fruit set of crops regardless of honey bee abundance. *Science*, 339(6127), 1608–1611. <https://doi.org/10.1126/science.1230200>

Gegear, R. J. (2018). Native Pollinator Decline and Conservation: The Ecological Perspective. The Beecology Project. Retrieved September 12, 2022, from <https://beecology.wpi.edu/website/learn#section1>

Gegear, R. J. (2020). Plants for pollinators at risk. Gegear Lab at UMass Dartmouth. Retrieved September 12, 2022, from <https://gegearlab.weebly.com/plant-list.html>

iNaturalist. <https://www.inaturalist.org>

LaBerge, W. E. (1967). A revision of the bees of the genus *Andrena* of the western hemisphere. Part I. *Callandrena*. (Hymenoptera: Andrenidae). *Bulletin of the University of Nebraska State Museum* 7:1–318.

LaBerge, W. E., Bouseman, J. K. (1970). A revision of the bees of the genus *Andrena* of the western hemisphere. Part III. Subgenus *Tylandrena*. *Transactions of the American Entomological Society* 96(4):543–605.

LaBerge, W. E., Ribble, D. W. (1972). A revision of the bees of the genus *Andrena* of the western hemisphere. Part V. Subgenera *Gonandrena*, *Geissandrena*, *Parandrena*, *Pelicandrena*. *Transactions of the American Entomological Society* 98(3):271–358.

LaBerge, W. E. (1973). A revision of the bees of the genus *Andrena* of the western hemisphere. Part VI. Subgenus *Trachandrena*. *Transactions of the American Entomological Society* 99(3):235–371.

LaBerge, W. E. (1977). A revision of the bees of the genus *Andrena* of the western hemisphere. Part VIII. Subgenera *Thysandrena*, *Dasyandrena*, *Psammandrena*, *Rhacandrena*, *Euandrena*, *Oxyandrena*. *Transactions of the American Entomological Society* 103(1):1–143.

LaBerge, W. E. (1980). A revision of the bees of the genus *Andrena* of the western hemisphere. Part X. Subgenus *Andrena*. *Transactions of the American Entomological Society* 106(4):395–525.

LaBerge, W. E. (1986). A revision of the bees of the genus *Andrena* of the western hemisphere. Part XII. Subgenera *Leucandrena*, *Ptilandrena*, *Scoliandrena* and *Melandrena*. *Transactions of the American Entomological Society* 112(3):191–248.

Losey, John E., & Vaughan, Mace (2006). The economic value of ecological services provided by insects. *BioScience*, 56(4), 311. [https://doi.org/10.1641/0006-3568\(2006\)56\[311:tevoes\]2.0.co;2](https://doi.org/10.1641/0006-3568(2006)56[311:tevoes]2.0.co;2)

Lotts, K., Naberhaus, T., coordinators. (2021). Butterflies and moths of North America. <http://www.butterfliesandmoths.org/>

Mathiasson, M. E., & Rehan, S. M. (2019). Status changes in the Wild Bees of northeastern North America over 125 years revealed through museum specimens. *Insect Conservation and Diversity*. <https://doi.org/10.1111/icad.12347>

Mathiasson, M. E., & Rehan, S. M. (2020). Wild bee declines linked to plant-pollinator network changes and plant species introductions. *Insect Conservation and Diversity*, 13(6), 595–605. <https://doi.org/10.1111/icad.12429>

Michielini, J. P., Dopman, E. B., & Crone, E. E. (2020). Changes in flight period predict trends in abundance of Massachusetts butterflies. *Ecology Letters*, 24(2), 249–257. <https://doi.org/10.1111/ele.13637>

Mitchell, T.B. (1962) Bees of the eastern United States. II. Technical bulletin (North Carolina Agricultural Experiment Station), 152, 1-557.

Mitchell, T.B. (1962) Bees of the eastern United States. II. Technical bulletin (North Carolina Agricultural Experiment Station), 152, 1-557.

NatureServe. (2023). NatureServe Network Biodiversity Location Data accessed through NatureServe Explorer. NatureServe, Arlington, Virginia. <https://explorer.natureserve.org/>

Robinson, G. S., Ackery, P. R., Kitching, I., Beccaloni, G. W., Hernández, L. M. (2023). HOSTS - a database of the world's lepidopteran hostplants. Natural History Museum. <https://doi.org/10.5519/havt50xw>

Russo, L., DeBarros, N., Yang, S., Shea, K., & Mortensen, D. (2013). Supporting crop pollinators with floral resources: Network-based phenological matching. *Ecology and Evolution*, 3(9), 3125–3140. <https://doi.org/10.1002/ece3.703>

Stichter S. (2015). Butterflies of Massachusetts. <http://www.butterfliesofmassachusetts.net/>

White, A. (2016). “From Nursery to Nature: Evaluating Native Herbaceous Flowering Plants Versus Native Cultivars for Pollinator Habitat Restoration.” Graduate College Dissertations and Theses. 626. <https://scholarworks.uvm.edu/graddis/626>

VanDyk, J., ed. (2023). BugGuide.net: identification, images, & information for insects, spiders & their kin for the United States & Canada. Iowa State University. <https://bugguide.net/>

Wagner, D. L. (2005). *Caterpillars of eastern North America*. Princeton, New Jersey: Princeton University Press.

Bee Specimen Databases Accessed through GBIF:

- American Museum of Natural History, Bee Specimen Record database
- Bee Biology and Systematics Laboratory database
- Cornell University Insect Collection database
- Entomology Division, Yale University Peabody Museum database
- Rutgers University Arthropod Collection database
- University of California, Riverside, Entomology Research Museum database
- University of Connecticut Insect Collection database



Plants + Seeds

SOURCES FOR NATIVE PLANTS AND SEEDS:

Archewild - Quakertown, PA - <https://archewild.com/nursery/>
 Bigelow Nurseries - Northboro, MA - <https://bigelownurseries.com/>
 Blue Stem Natives - Norwell, MA - <https://www.bluestemnatives.com/>
 Butterfly Effect Farm - Westport, MA - <https://www.butterflyeffectfarm.com/>
 Dragonfly Natives - South Dartmouth, MA - <https://dragonflynatives.com/pages/about>
 Earth Tones Native Plants - Woodbury, CT - <http://www.earthtonesnatives.com/>
 Ernst Seeds - Meadville, PA - <https://www.ernstseed.com/>
 Native Plant Trust - Framingham and Whately, MA - <http://www.nativeplanttrust.org/>
 New England Wetland Plants - South Hadley, MA - <https://newp.com/>
 New Moon Nursery - Bridgeton, NJ - <http://www.newmoonnursery.com/>
 North Creek Nurseries - Oxford, PA - <https://www.northcreeknurseries.com/>
 Northeast Pollinator Plants - Fairfax, VT - <https://www.northeastpollinator.com/>
 Pinelands Nursery & Supply - Columbus, NJ - <https://www.pinelandsnursery.com/>
 Polly Hill Arboretum - West Tisbury, MA - <https://www.pollyhillarboretum.org/plants/plant-sale/>
 Prairie Moon - Winona, MN - <https://www.prairiemoon.com/>
 Prickly Ed's Cactus Patch - Barrington, RI - <https://pricklyeds.com/>
 Toadshade Wildflower Farm - Frenchtown, NJ - <https://toadshade.com/>
 Vermont Willow Nursery - Fairfield, VT - <https://vermontwillownursery.com/>
 Wild Seed Project - Portland, ME - <https://wildseedproject.net/>
 Wing and a Prayer Nursery - Cummington, MA - <https://aliceskitchenathoneyhill.com/amys-nursery/>

NATIVE PLANT PROPAGATION GUIDELINES:

Wild Seed Project - How to Grow Natives from Seed:
<https://wildseedproject.net/how-to-grow-natives-from-seed/>

Prairie Moon - How to Germinate Native Seeds
<https://www.prairiemoon.com/blog/how-to-germinate-native-seeds>

Native Plant Network Propagation Protocol Database:
<https://nqn.rngr.net/propagation>

Indigenous Landscapes - Native Plant Propagation Guide and Nursery Model:
<https://indigescapes.com/nativepropguide>

Clockwise from top left: *Vaccinium angustifolium*; *Prunus maritima*; *Rubus odoratus*; *Penstemon hirsutus*; *Bombus ternarius* on *Salix discolor*; *Cercis canadensis*; *Spirea alba*; *Lupinus perennis* ssp. *perennis*; *Carex pensylvanica*; *Schizachyrium scoparium*; *Baptisia tinctoria*; *Zizia aurea*; *Cirsium discolor*; *Agastache scrophulariifolia*; *Amelanchier canadensis*; *Desmodium canadense*.

SUBMIT YOUR OBSERVATIONS
TO BEECOLOGY



ТИВАХ



ОТ

ТАТИВАХ

