Annie S. White, PhD, ASLA

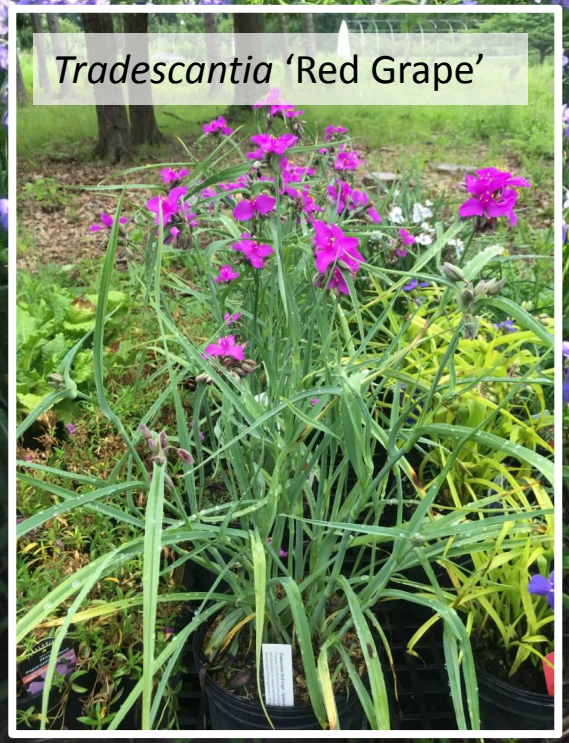
How Native Cultivars Affect Plant/Pollinator Interactions

Prairie Restoration, Prairie Haven, Wisconsin


Prairie Restoration at Earth Source, Fort Wayne, Indiana

Ohio Spiderwort

Tradescantia ohiensis



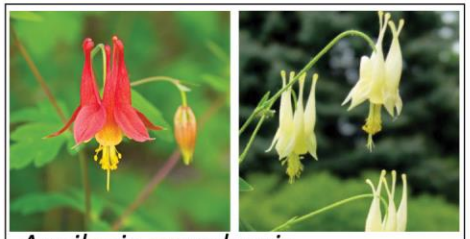
Tradescantia ‘Red Grape’

Designing with Native Species ≠ Installing Native Species

	**Bee Balm 'Grand Mum'** Monarda	Zones:3-8 SUN HT: 15-18"
	**Bee Balm 'Marshalls Delight'** Monarda	Zones:4-9 SUN HT: 36-36"
	**Bee Balm 'Raspberry Wine'** Monarda	Zones:4-9 SUN HT: 36-36"
	**Bee Balm 'Blue Stocking'** Monarda	Zones:4-9 SUN HT: 36-36"
	**Bee Balm 'Jacob Cline'** Monarda	Zones:4-8 SUN / PART SUN HT: 36-36"
	**Bee Balm 'Petite Delight'** Monarda	Zones:4-9 SUN HT: 15-18"
	**Beebalm 'On Parade'** Monarda	Zones:4- SUN / PART SHADE HT: 30-30"
	**Bee Balm 'Gardenview Scarlet'** Monarda	Zones:3- SUN / PART SUN HT: 2-'
	**Bee Balm 'Mahogany'** Monarda	Zones:4-9 SUN HT: 3-'
	**Bee Balm 'Purple Rooster'** Monarda	Zones:4- SUN / PART SHADE HT: 36-36"

Achillea millefolium
A. millefolium 'Strawberry Seduction'

Agastache foeniculum
Agastache 'Golden Jubilee'



Aquilegia canadensis
A. canadensis 'Corbett'

Asclepias tuberosa
A. tuberosa 'Hello Yellow'

Baptisia australis
B. x varicolor 'Twilite' Prairieblues

Geranium maculatum
G. maculatum 'Espresso'

Helenium autumnale
Helenium 'Moerheim Beauty'

Lobelia cardinalis
L. cardinalis 'Fried Green Tomatoes'

Monarda fistulosa
M. fistulosa 'Claire Grace'

Penstemon digitalis
P. digitalis 'Husker Red'

Rudbeckia fulgida var. fulgida
R. fulgida 'Goldsturm'

Tradescantia ohiensis
Tradescantia 'Red Grape'

Veronicastrum Virginicum
V. virginicum 'Lavendelturm'

Symphyotrichum novae-angliae
S. novae-angliae 'Alma Potschke'

Echinacea purpurea
E. purpurea 'White Swan'

Echinacea 'Sunrise' Big Sky
Echinacea 'Pink Double Delight'

NATIVE SPECIES VS. NATIVE CULTIVAR

Native Species: A plant that is a part of the balance of nature and has developed over hundreds or thousands of years in a particular region or ecosystem.

Native Cultivar: A variation of a native species, deliberately selected, cross-bred or hybridized for desirable characteristics that can be maintained by propagation.

Native Species **Native Cultivar**

Symphyotrichum novae-angliae (New England Aster) *&*
S. novae-angliae 'Alma Potschke'

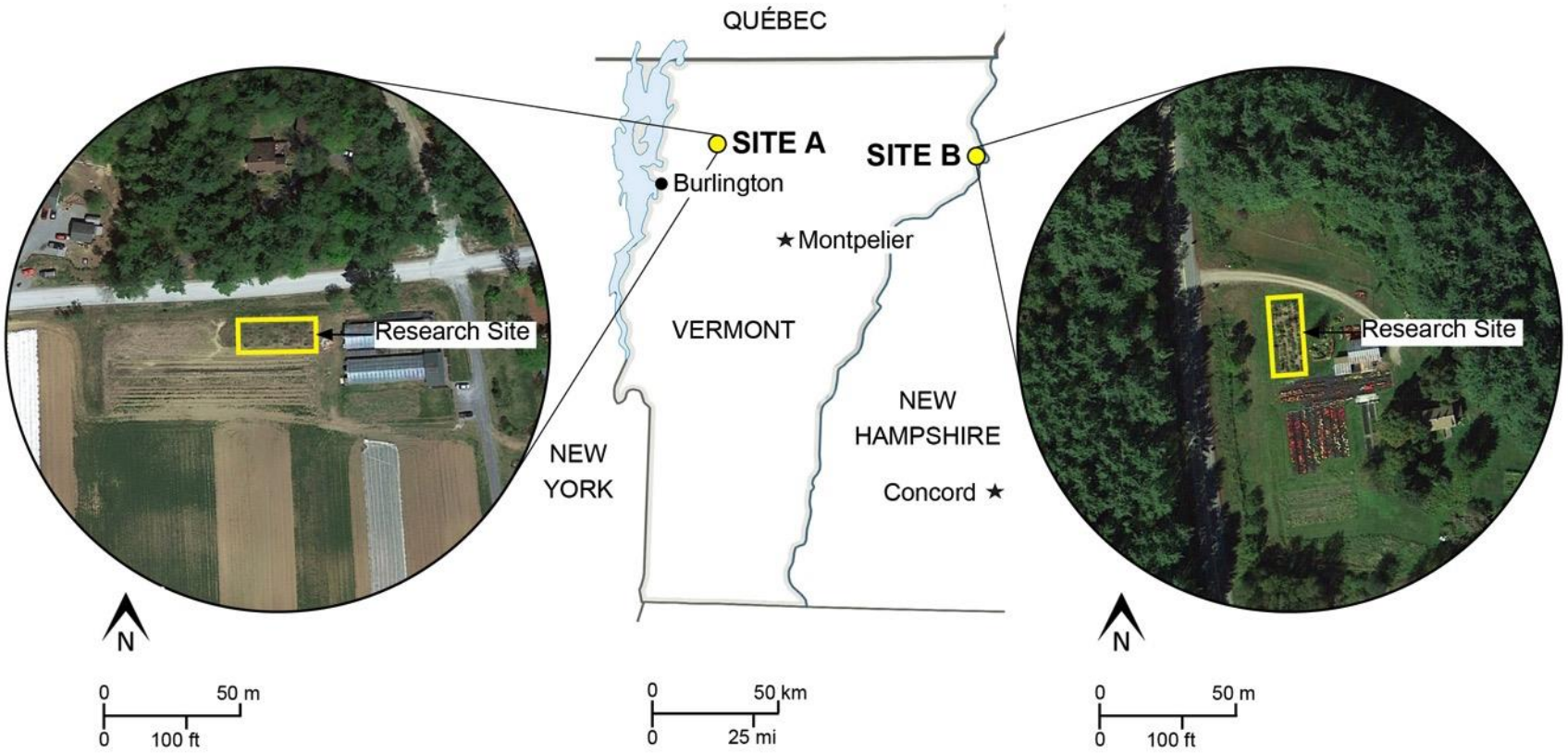
Research Goal: Evaluate whether native plant cultivars can provide the same value to pollinators as native species in pollinator habitat restorations

Site A

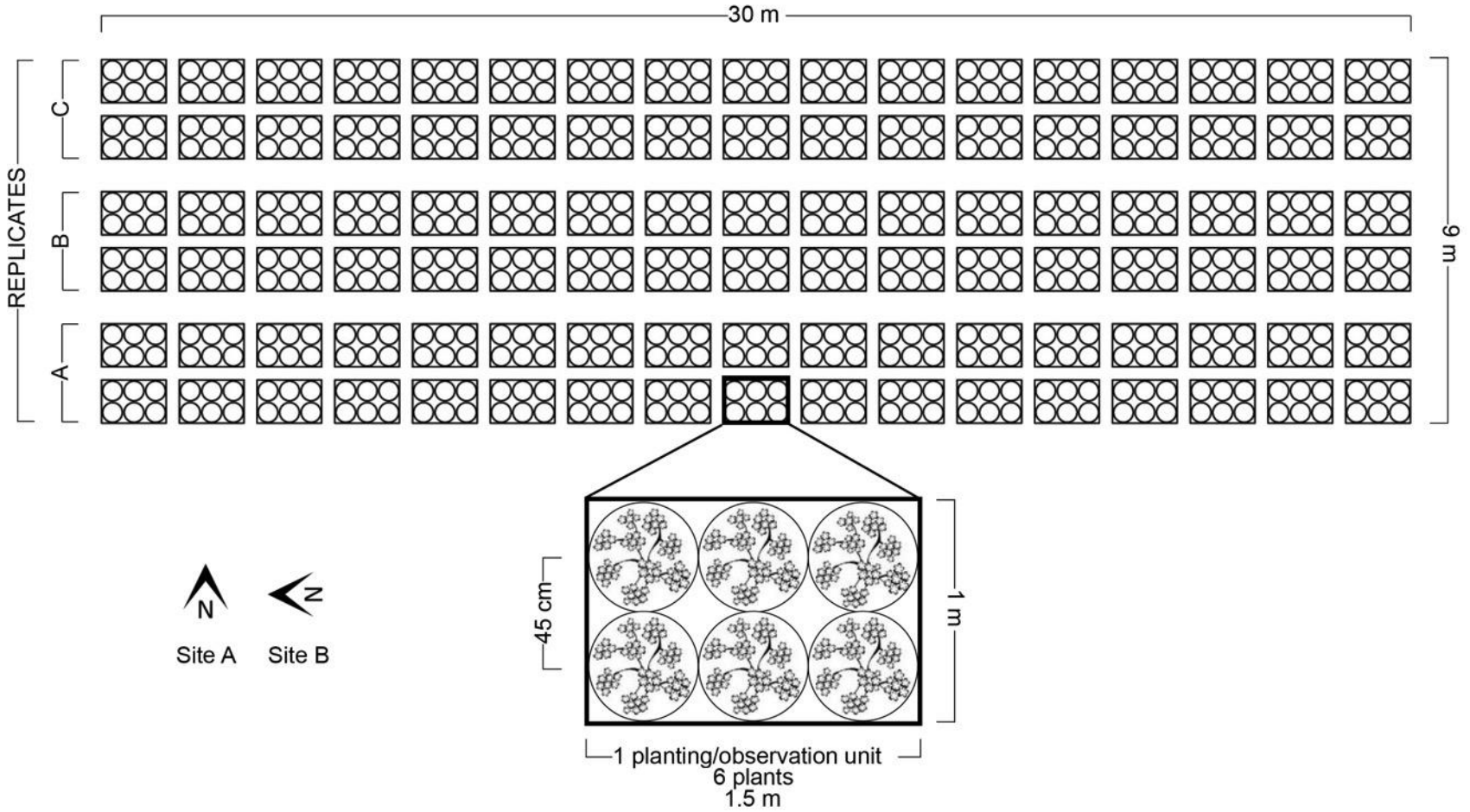
River Berry Farm
Fairfax, Franklin County, VT
USDA Hardiness Zone: 4B
Soils: Excessively drained Windsor loamy fine sand

Site B

Maidstone Plant Farm
Maidstone, Essex County, VT
USDA Hardiness Zone: 4A
Soils: Well-drained Adams loamy fine sand



EXPERIMENTAL DESIGN



Class: Insecta

Order: Hymenoptera

Super family: Apoidea

1. *Apis mellifera*
honey bees

2. *Bombus spp.*
bumble bees

3. other native bees

4. wasps/ants

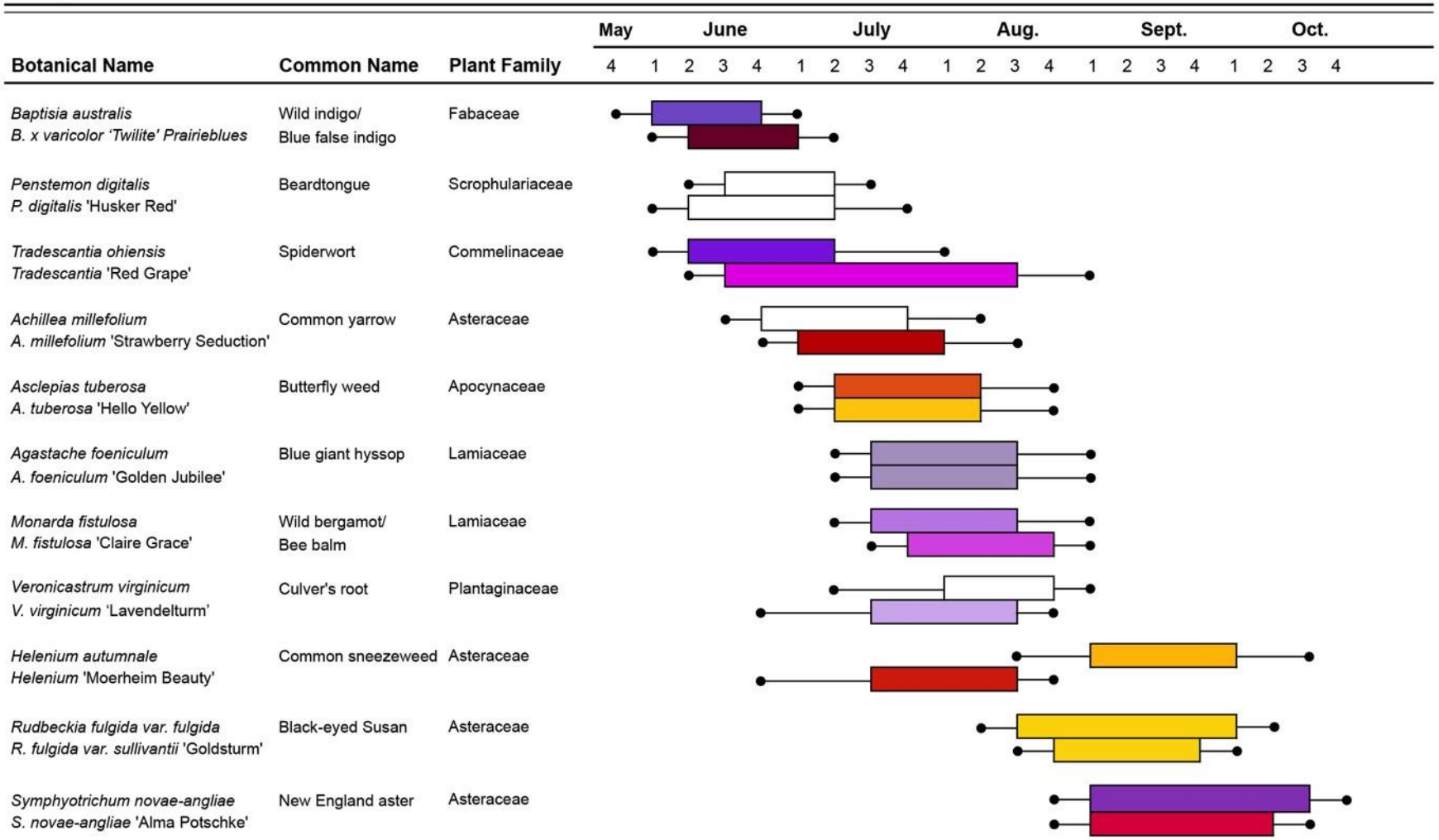
5. Diptera
flies

6. Coleoptera/Hemiptera
beetles/bugs

7. Lepidoptera
butterflies/moths

8. All pollinators
9. All bee pollinators
10. All native bee pollinators

Bloom color, time, and duration



A. White, 2016

Mean pollinator abundance foraging on species/cultivars

Mean pollinator abundance reported as least squares means. Pollinator preferences between the native species and native cultivar of each plant species was determined using a generalized linear mixed model. A preference is considered significant if $P < 0.05$. Cells with (-) had no pollinator visits or an insufficient number of visits for analysis. Plant types with (+) in Honeybee visits indicates that the species was only at Site B and no honeybees were present in the landscape during bloom.

		All Insect Pollinators	All Bee Pollinators	All Native Bees	Honey Bees	Bumble Bees	Other Native Bees	Flies	Butterflies/ Moths	Beetles/ Bugs	Wasps/ Ants
Selections	*Asclepias tuberosa*	14.87 ± 1.73	14.53 ± 1.80	14.53 ± 1.80	+	14.40 ± 1.71	-	0.13 ± 0.08	-	-	-
	A. tuberosa 'Hello Yellow'	10.89 ± 1.40	10.46 ± 1.39	10.46 ± 1.39	+	10.30 ± 1.32	-	0.27 ± 0.15	-	-	-
	Significance	P = 0.066	P = 0.057	P = 0.057	+	P = 0.0540	-	P = 0.2914	-	-	-
	Monarda fistulosa	10.28 ± 0.78	9.21 ± 0.78	9.14 ± 0.70	-	12.73 ± 0.712	-	-	-	-	-
	M. fistulosa 'Claire Grace'	8.88 ± 0.67	7.90 ± 0.67	7.81 ± 0.92	-	9.68 ± 0.58	-	-	-	-	-
	Significance	P = 0.097	P = 0.139	P = 0.152	-	P = 0.0544	-	-	-	-	-
	Penstemon digitalis	4.85 ± 0.69	4.31 ± 0.62	3.71 ± 0.50	1.35 ± 0.31	0.93 ± 0.23	2.22 ± 0.43	-	-	-	-
	P. digitalis 'Husker Red'	3.40 ± 0.51	3.10 ± 0.46	2.98 ± 0.41	0.23 ± 0.12	0.79 ± 0.20	1.56 ± 0.33	-	-	-	-
	Significance	P = 0.054	P = 0.068	P = 0.197	P = 0.0129	P = 0.4976	P = 0.1989	-	-	-	-
	Rudbeckia fulgida var. fulgida	4.80 ± 0.59	2.28 ± 0.25	2.28 ± 0.25	+	0.26 ± 0.11	2.15 ± 0.22	2.34 ± 0.44	-	-	-
	R. fulgida var. sullivantii 'Goldsturm'	5.12 ± 0.62	2.34 ± 0.25	2.32 ± 0.25	+	0.32 ± 0.12	1.81 ± 0.23	2.54 ± 0.47	-	-	-
	Significance	P = 0.657	P = 0.910	P = 0.910	+	P = 0.6814	P = 0.3029	P = 0.6882	-	-	-
	Veronicastrum virginicum	14.36 ± 1.10	12.24 ± 0.93	6.95 ± 0.79	3.80 ± 0.76	5.94 ± 1.55	-	-	-	-	-
	V. virginicum 'Lavendelturm'	27.35 ± 1.76	26.30 ± 1.45	19.04 ± 1.48	5.60 ± 1.37	16.22 ± 4.45	-	-	-	-	-
	Significance	P = 0.018	P = 0.011	P = 0.011	P = 0.071	P = 0.640	-	-	-	-	-
Hybrids	*Achillea millefolium*	22.33 ± 2.74	8.81 ± 1.54	8.70 ± 1.48	-	-	8.59 ±1.09	8.39 ± 3.33	-	0.45 ± 3.93	-
	Achillea 'Strawberry Seduction'	3.17 ± 0.62	0.37 ± 0.21	0.38 ± 0.21	-	-	0.39 ± 0.11	4.57 ± 2.75	-	0.04 ± 0.37	-
	Significance	P < 0.001	P < 0.001	P < 0.001	-	-	P < 0.0001	P = 0.3616	-	P = 0.0019	-
	Agastache foeniculum	31.07 ± 6.06	23.11 ± 4.76	13.35 ± 2.67	9.03 ± 2.32	12.31 ± 2.29	-	-	-	4.63± 1.55	-
	Agastache 'Golden Jubilee'	20.03 ± 4.14	18.63 ± 3.88	13.30 ± 2.66	4.96 ± 1.30	11.39 ± 2.15	-	-	-	0.33 ± 0.19	-
	Significance	P = 0.041	P = 0.308	P = 0.980	P = 0.0112	P = 0.4531	-	-	-	P = 0.0128	-
	Baptisia australis	7.01 ± 0.49	6.88 ± 0.52	6.88 ± 0.52	-	5.51 ± 0.52	1.30 ± 0.23	-	-	-	-
	B. x varicolor 'Twilite Prairieblues'	3.12 ± 0.32	3.07 ± 0.34	3.07 ± 0.34	-	2.89 ± 0.29	0.15 ± 0.08	-	-	-	-
	Significance	P < 0.001	P < 0.001	P < 0.001	-	P < 0.0001	P = 0.0006	-	-	-	-
	Helenium autumnale	35.99 ± 5.07	31.17 ± 5.43	15.89 ± 4.49	12.85 ± 3.69	14.30 ± 3.21	0.20 ± 14.47	0.57 ± 0.33	-	-	-
	Helenium 'Moerheim Beauty'	3.53 ± 0.40	2.52 ± 0.37	2.31 ± 0.30	0.46 ± 0.12	1.21 ± 0.22	0.17 ± 12.66	0.76 ± 0.29	-	-	-
	Significance	P < 0.001	P < 0.001	P < 0.001	P < 0.0001	P < 0.0001	P = 0.6788	P = 0.6835	-	-	-
	Symphyotrichum novae-angliae	46.04 ± 1.42	43.89 ± 1.27	30.59 ± 1.04	9.02 ± 0.56	29.89 ± 1.08	0.40 ± 0.14	-	1.23 ± 0.27	-	-
	S. novae-angliae 'Alma Potschke'	4.98 ± 0.41	4.93 ± 0.40	2.92 ± 0.31	1.83 ± 0.22	2.84 ± 0.32	0.09 ± 0.05	-	0.09 ± 0.06	-	-
	Significance	P < 0.001	P < 0.001	P < 0.001	P < 0.0001	P < 0.0001	P = 0.0267	-	P = 0.0021	-	-
	Tradescantia ohiensis	5.35 ± 0.70	3.44 ± 0.61	1.71 ± 0.38	3.65 ± 0.80	-	-	0.83 ± 0.14	-	-	-
	Tradescantia 'Red Grape'	3.17 ± 0.40	1.43 ± 0.29	0.82 ± 0.19	1.39 ± 0.29	-	-	0.42 ± 0.60	-	-	-
	Significance	P < 0.001	P = 0.001	P = 0.006	P = 0.0002	-	-	P = 0.8856	-	-	-

KEY: Preference for species | No significant preference | Preference for cultivar

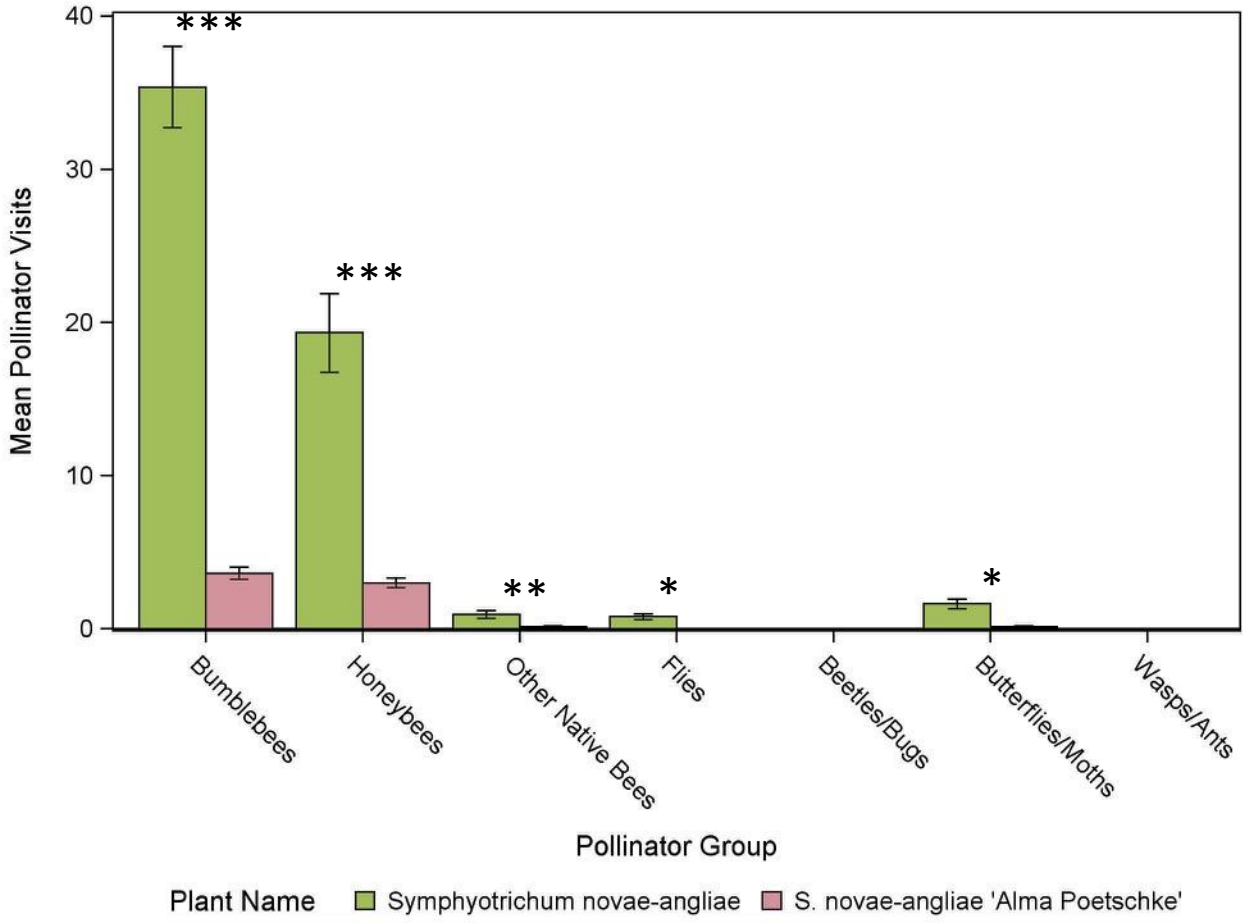
A. White & L. Perry, In review, 2017

New England Aster
Symphyotrichum novae-angliae

New England Aster
S. novae-angliae ‘Alma Potschke’


Symphyotrichum novae-angliae
S. novae-angliae 'Alma Poetschke'

Mean abundance of pollinators foraging on native species *Symphyotrichum novae-angliae* and native cultivar *S. novae-angliae* 'Alma Potschke' per planting unit per 5 minutes by seven pollinator groups at Site A and Site B in 2013 and 2014 combined

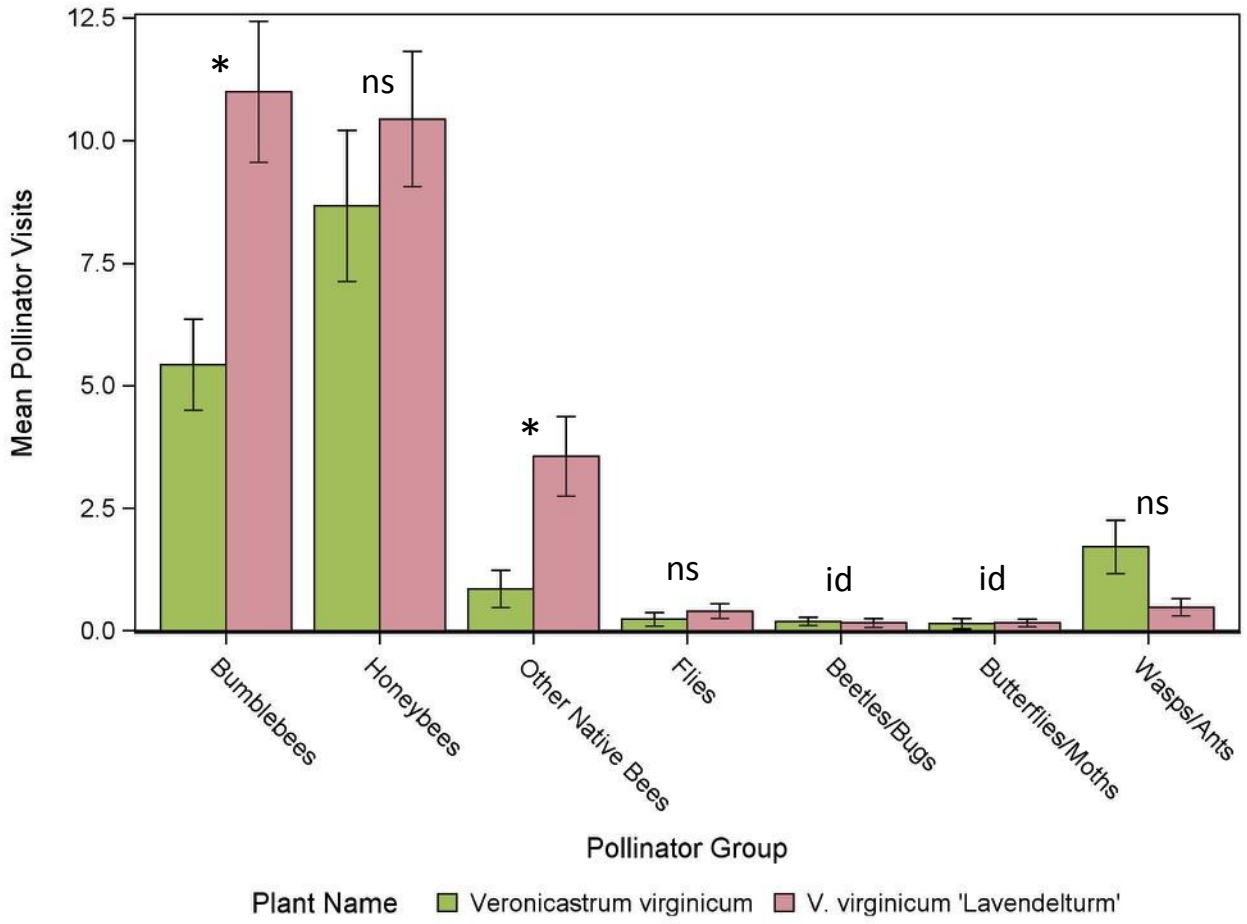


A. White & L. Perry, In Review 2017

Veronicastrum Virginicum
V. virginicum ‘Lavendelturm’

Veronicastrum Virginicum
V. virginicum 'Lavendelturm'

Mean visits to *Veronicastrum virginicum* and cultivar *V. virginicum* 'Lavendelturm' by seven pollinator groups for Site A and Site B in 2013 and 2014 combined



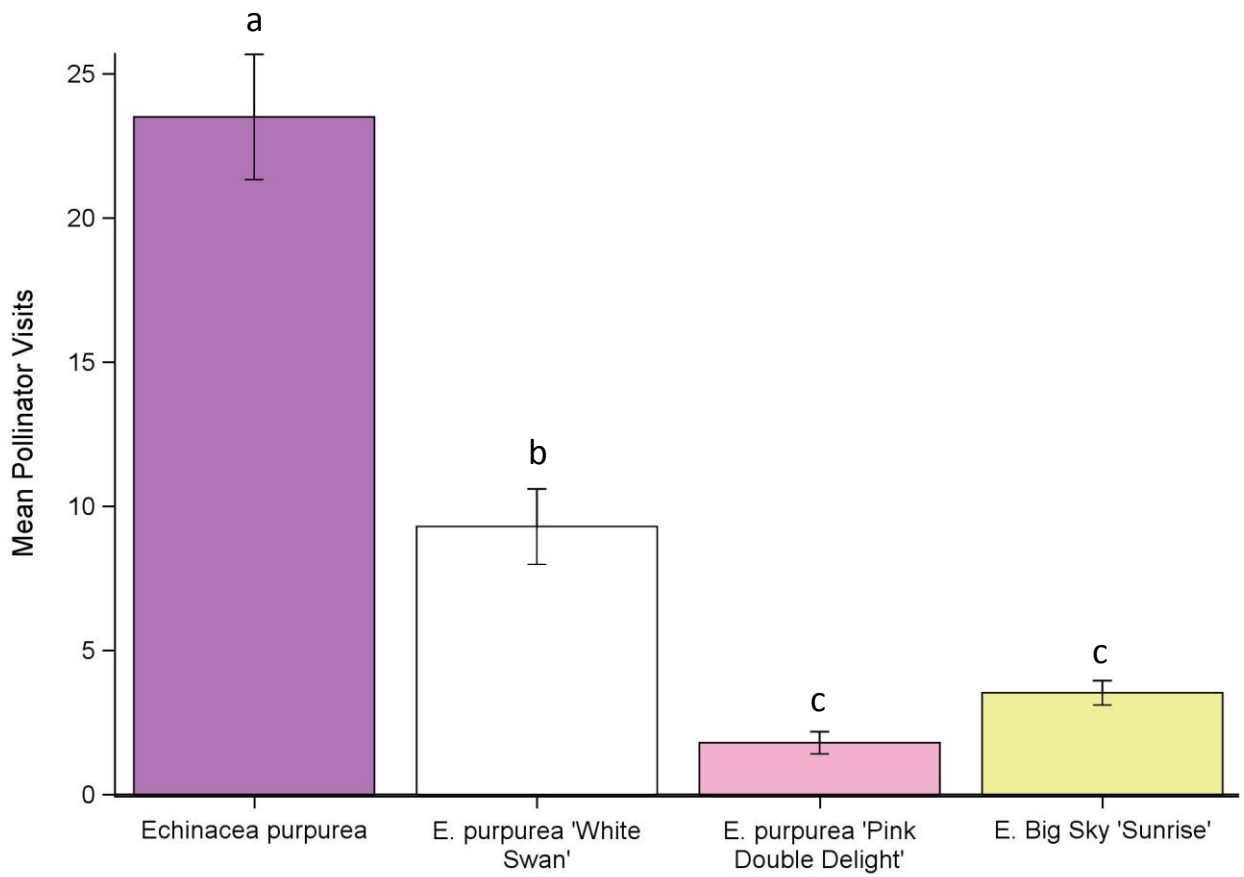
A. White & L. Perry, In Review, 2017

EVALUATING ECHINACEAS (Coneflower)

	Botanical Name	Description	Breeder	Selected traits	Fertility	Bloom duration	floral abundance	Winter Survival
	*Echinacea purpurea*	Native Species	N/A	None	high	30-45 days	20.8 ± 8.81	82%
	*E. purpurea* 'White Swan'	Open-pollinated selection	N/A	White ray flowers, compactness	high	30-45 days	12.63 ± 5.70	82%
	*E. purpurea* 'Pink Double Delight'	Double-flowered selection	AB Cultivars	Pink, double-flowers, many blooms, disease resistance	low	45-60 days	34.22 ± 10.02	75%
	*Echinacea* 'Sunrise'	Interspecific hybrid	ItSaul Plants	Yellow ray flowers, disease resistance, compactness	low	30-45 days	8.62 ± 3.65	32%

A. White & L. Perry, In Review, 2017

Bee Pollinators Foraging on *Echinacea*



Research Question: Do quantity, quality, and patterns of nectar production differ between native species and native cultivars?

Disposable microcapillary tubes in 0.5 *µL - 5 µL*

Handheld refractometer modified for low volumes

(Comba et al. 1998; Morrant et al. 2009)

Lobelia cardinalis

Cardinal Flower

Lobelia siphilitica

Great Blue Lobelia

Lobelia x speciosa

Hybrid Lobelia

Lobelia x speciosa ‘Fan Scarlet’
Lobelia x speciosa ‘Fan Blue’

Nectar production in *Lobelia cardinalis* and *Lobelia siphilitica* vs. *Lobelia* x speciosa

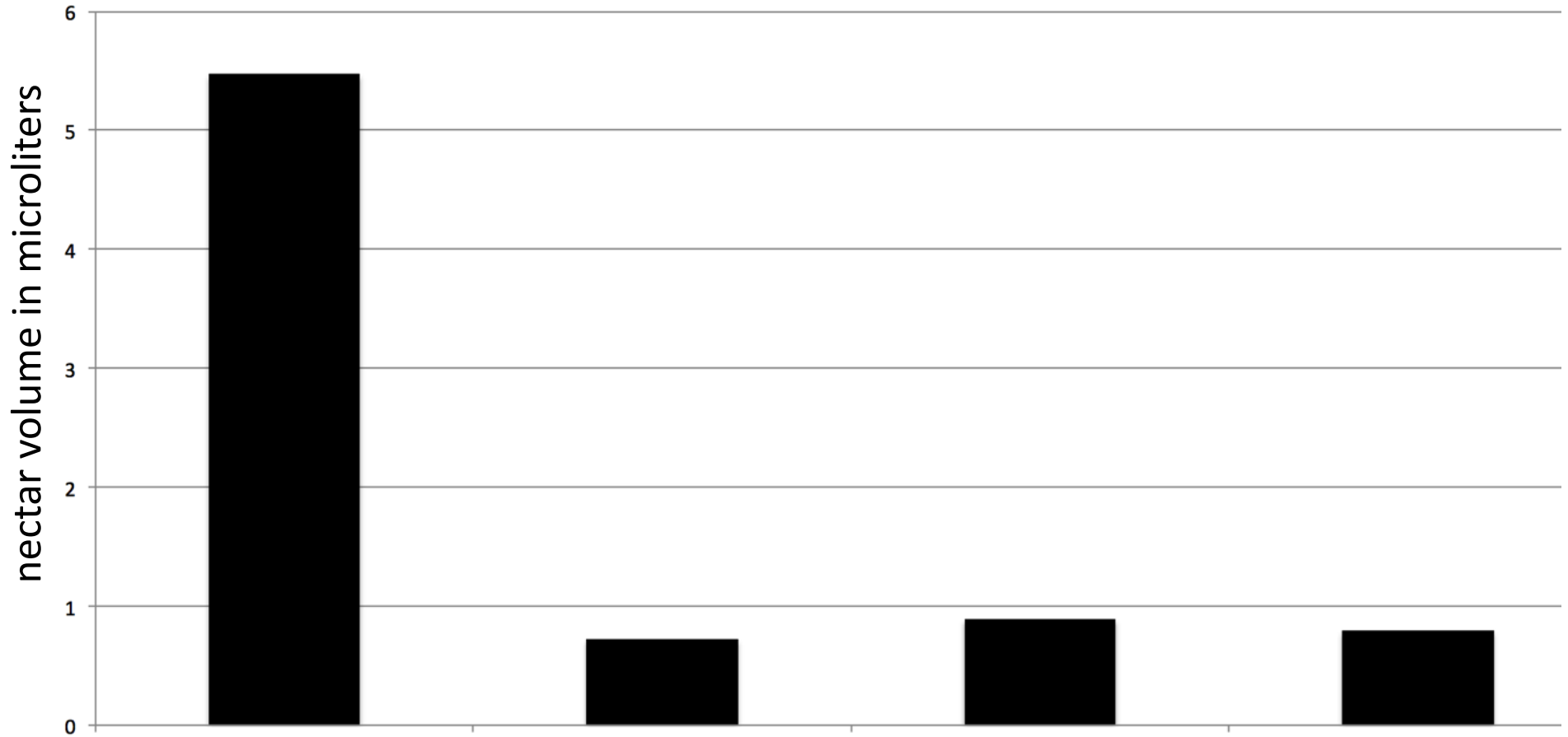
Lobelia cardinalis

Lobelia x speciosa
'Fan Scarlet'

Lobelia x speciosa
'Fan Blue'

Lobelia siphilitica

Mean nectar volume in Lobelias



Lobelia cardinalis
5.47 *µL* ±4.13

Lobelia x speciosa
'Fan Scarlet'
0.72 *µL*±0.30

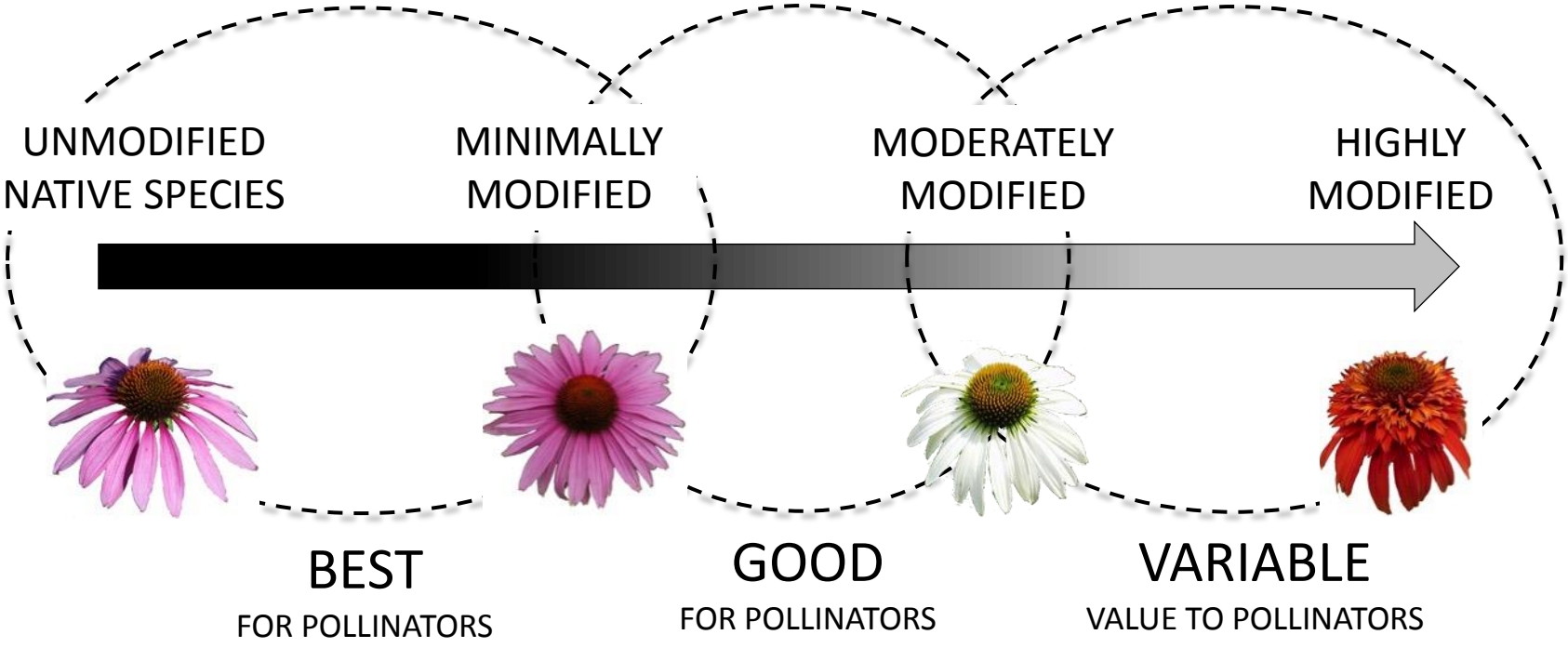
Lobelia x speciosa
'Fan Blue'
0.89 *µL*±0.48

Lobelia siphilitica
0.79 *µL*±0.37

A. White, In Preparation, 2016

Lobelia cardinalis
Mean nectar: 5.47 *µL* ±4.13

***Lobelia x speciosa* 'Fan Scarlet'**
Mean nectar: 0.72 *µL*±0.30


UNMODIFIED
NATIVE SPECIES
MINIMALLY
MODIFIED
MODERATELY
MODIFIED
HIGHLY
MODIFIED
BEST
FOR POLLINATORS
GOOD
FOR POLLINATORS
VARIABLE
VALUE TO POLLINATORS

A. White, 2016

OTHER CONCERNS WITH NATIVE CULTIVARS

Monarda fistulosa 'Claire Grace' (left) and *Monarda fistulosa* (right)

- Decreased hardiness
- Decreased genetic diversity = decreased resiliency to environmental fluctuations

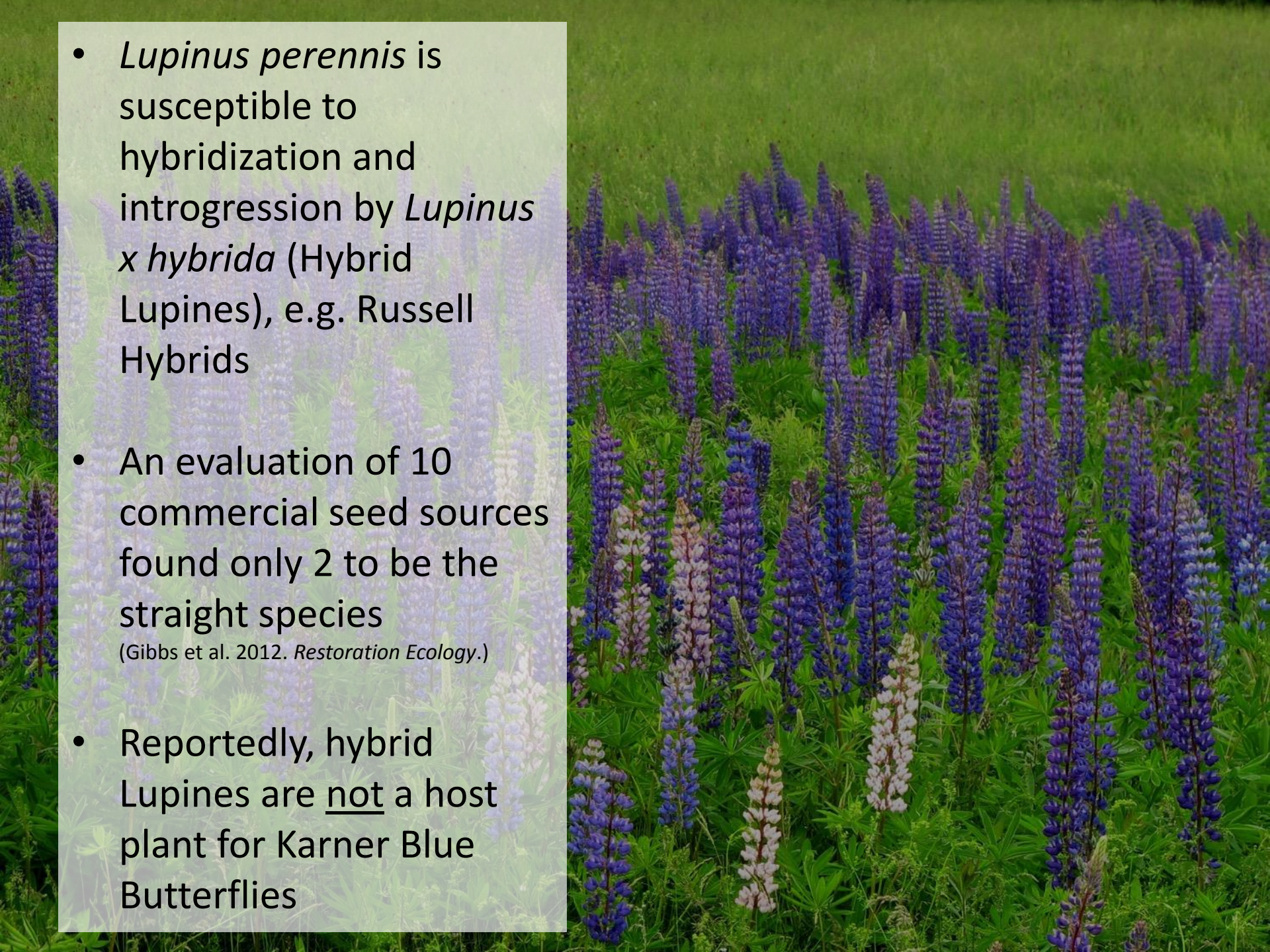
OTHER CONCERNS WITH NATIVE CULTIVARS

*Lupinus perennis (*Wild Lupine)

Plebejus melissa samuelis
(Karner Blue Butterfly)

Risk of genetically polluting native species

(Van Gaal et al. 1998; Gibbs et al. 2012; Kaljund & Leht 2013)



- *Lupinus perennis* is susceptible to hybridization and introgression by *Lupinus x hybrida* (Hybrid Lupines), e.g. Russell Hybrids

- An evaluation of 10 commercial seed sources found only 2 to be the straight species
  (Gibbs et al. 2012. *Restoration Ecology*.)

- Reportedly, hybrid Lupines are <u>not</u> a host plant for Karner Blue Butterflies

Native Species

Benefits

- Adapted to local soils & climate conditions
- Preferred host plants for native insects and food source for native birds
- Promote biodiversity
- Promote conservation and stewardship of our natural heritage

Challenges

- Less predictable in the landscape
- Less uniform and in size/shape
- Aesthetic perception that they are “too wild” and “too weedy”
- Difficulty sourcing plant material

Native Cultivars

Benefits

- Unique ornamental traits (e.g. new flower or foliage color)
- More uniform in size/shape
- Some have more flowers and longer bloom times
- Easier to propagate

Challenges

- Loss of genetic diversity
- Less adapted to local soils & climate
- May not be open-pollinated and will not self-seed
- May be less attractive and provide lower quality resources to pollinators

A. White, 2016.


“We shall never achieve harmony with the land, anymore than we shall achieve absolute justice or liberty for people. In these higher aspirations the important thing is not to achieve but to strive.”
— Aldo Leopold, Round River: From the Journals of Aldo Leopold

Annie S. White, PhD, ASLA
Lecturer, University of Vermont
Owner, Nectar Landscape Design Studio, llc

email: annie@nectarvt.com

Facebook/Instagram: @nectarlandscapes

research website:
www.pollinatorgardens.org

company website:
www.nectarvt.com