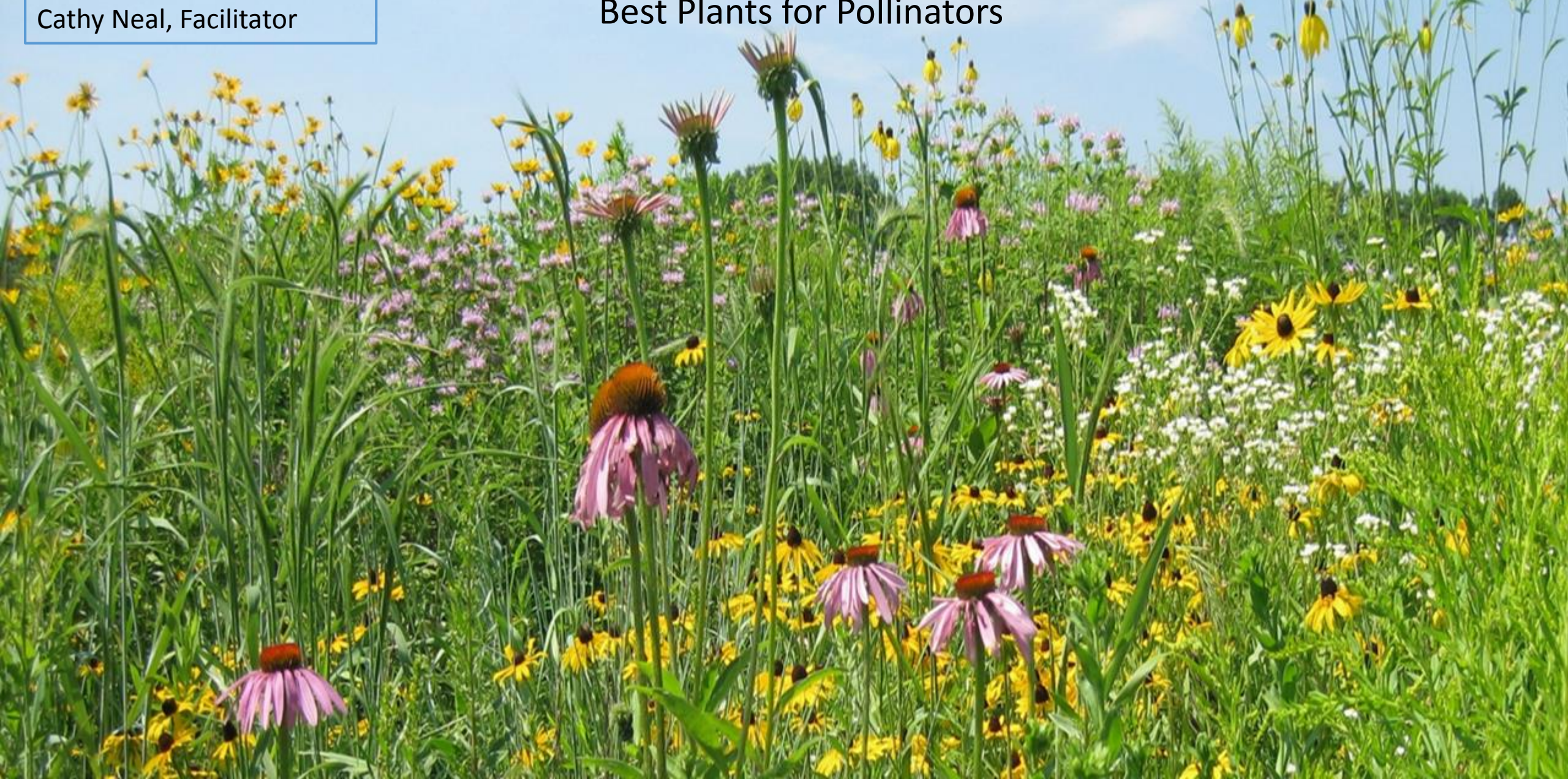


2018 Joint Winter Meeting
Discussion Group
Cathy Neal, Facilitator

Think Like A Bee!

Best Plants for Pollinators



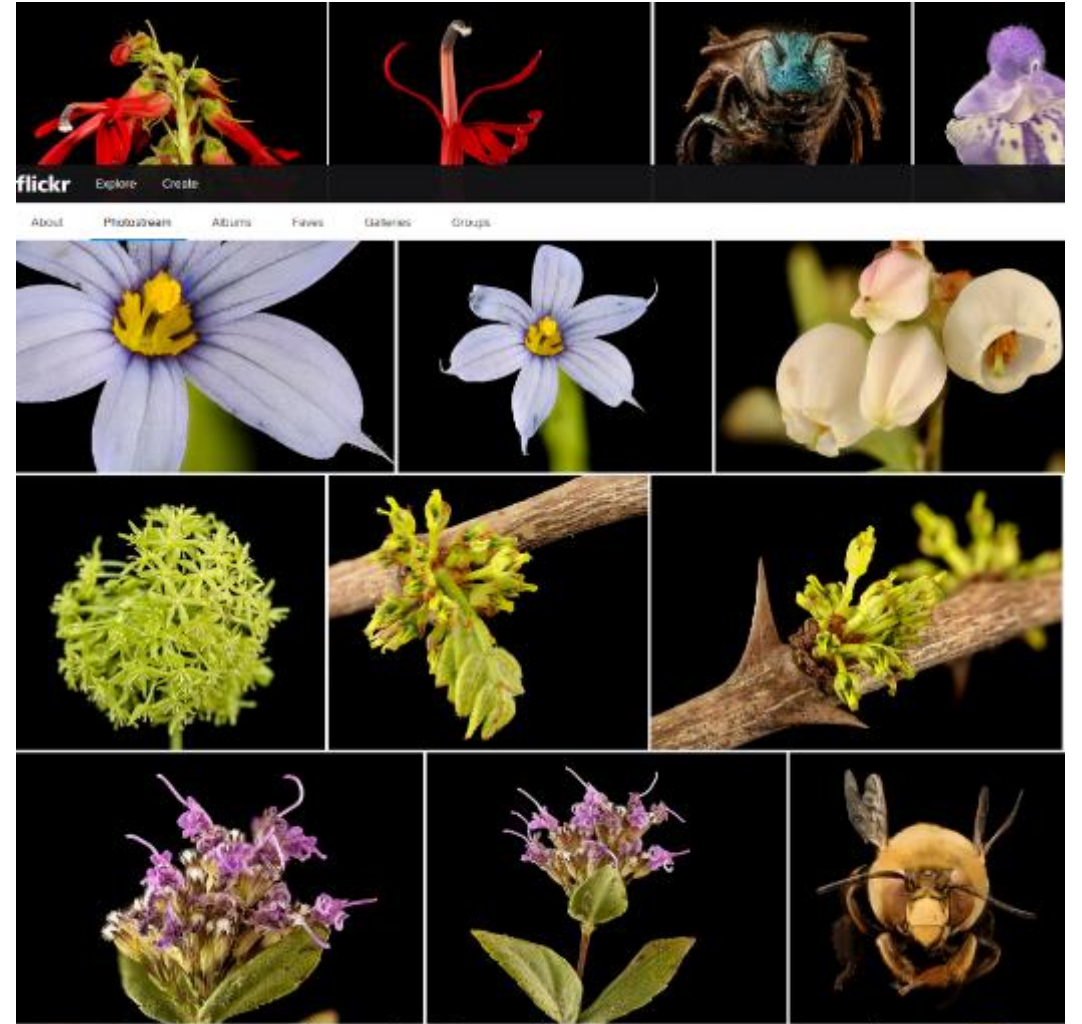
A Bee's Perspective



What do Bees Actually SEE?



Sam Droege, U.S. Geological Survey Bee Inventory and Monitoring Lab <https://www.flickr.com/photos/usgsbim/>



What do Bees Actually SEE?

- Bees can't see red but see UV light
- Color spectrum shift
- Many flowers have patterns or bands



S Droege, USGS



theatlantic.com 10.18.2017

“Flowers Have Secret Blue Halos That Bumblebees Can See”



Dr Klaus Schmitt

+ Follow

Caltha_palustris_(c)

shown in human vision, UV vision, bee vision: left to right

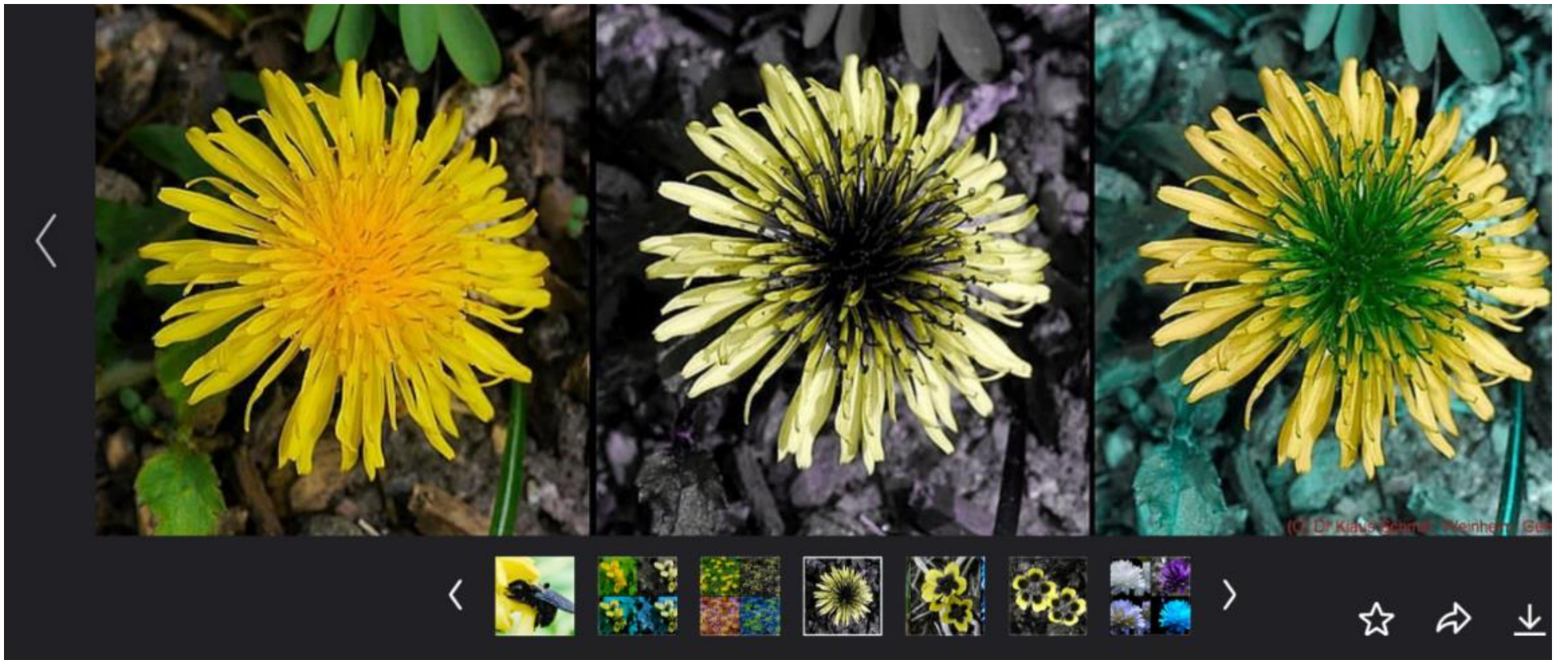
205
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Dr Klaus Schmitt

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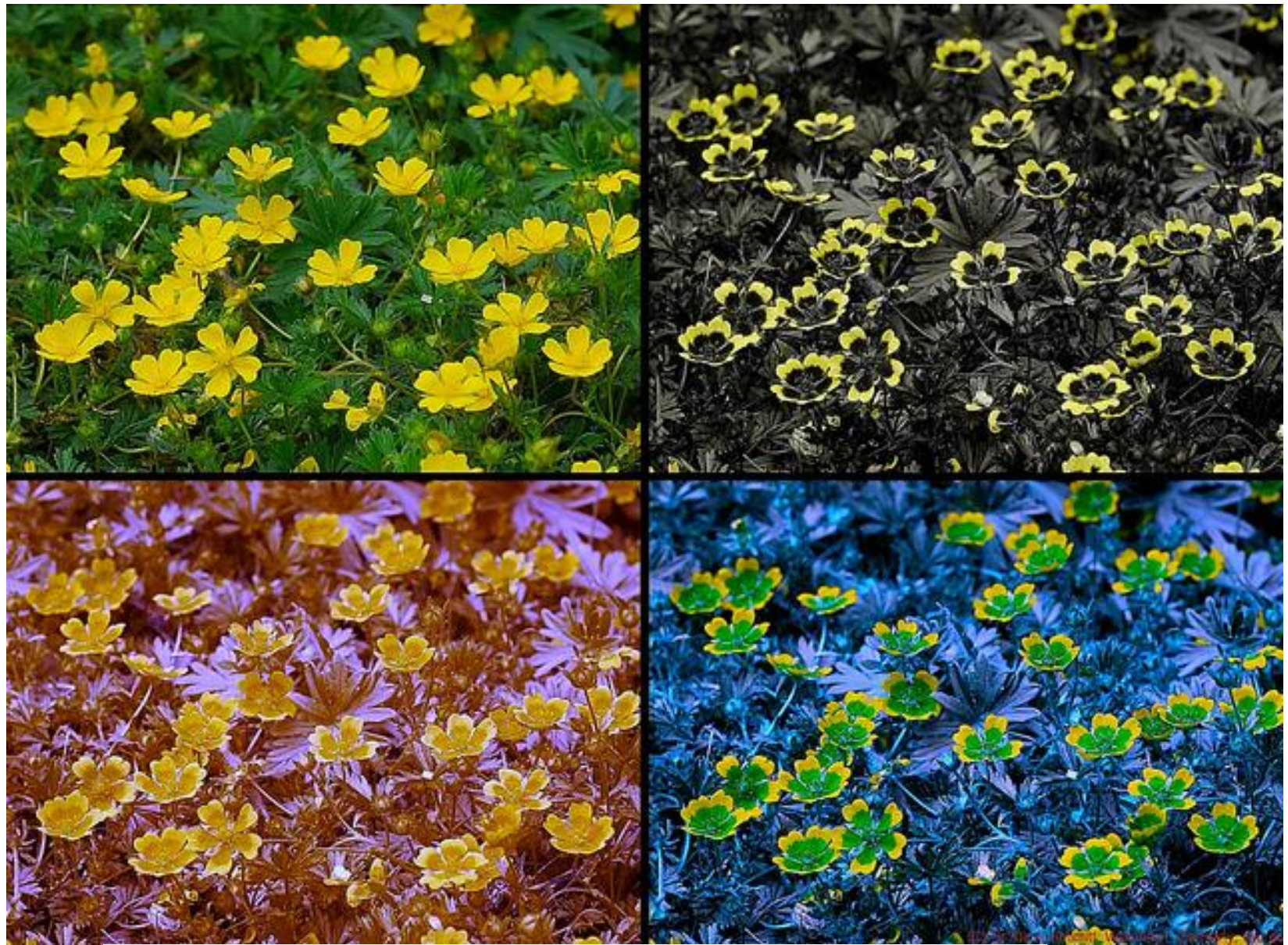
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Taraxacum_officinale_(c)

shown in human vision, UV vision, bee vision: left to right

PRO

Ultraviolet Photography group
www.flickr.com/groups/372002@N22



Dr Klaus Schmitt

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Potentilla_meadow_(c)

shown in human vision, UV vision, butterfly vision, bee vision: left to right, top to bottom

219 views

1 fave

2 comments

Taken on May 3, 2013

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Show EXIF

What Other Cues do Bees Use?

- Fragrance
- Taste – sucrose response
 - Nutritional value does not get assessed by foragers but colony may provide feedback
- Ease of access to pollen and nectar
 - Pollen packing efficiency (size and shape of pollen grains)
- Electrical field



Do Bees LEARN from Experience?

Yes. Honeybees and bumble bees develop preferences based on rewards.

- Floral consistency
- May last for 1 trip to seven days



Planting for Pollinators



Do Bees Prefer
Native Plants??

Pollinator
Preferences in NH

The Concern Over
Cultivars



Do Bees Prefer Native Plants??

- Native bees have a long history of co-evolution with native flowering plants
 - Some bees (about 15%) are specialists and can only feed on one genus or family of plants
 - But most are generalists and feed on many types of plants including non-natives
 - Most of our agricultural crops are not native species but bees still pollinate them
 - Bees in urban and agricultural environments depend heavily on non-natives such as clover, alfalfa, buckwheat, dandelions at certain times of year
 - Research has *not* shown that native plants are generally more nutritious or more preferred than non-natives

PLANTS BEES LIKE BEST



Bee-Friendly Trees & Shrubs

All of these plants are regularly visited by bees!

Common Name	Scientific Name	Native	Type	Rating ¹	Bloom Time								
					Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
Cornelian cherry	<i>Cornus mas</i>	nonnative	tree	★★★★	*								
Dwarf fothergilla	<i>Fothergilla parviflora</i>	native	shrub	★★	*	*							
Winter honeysuckle	<i>Lonicera fragrantissima</i>	nonnative	shrub	★★	*	*							
Higan weeping cherry	<i>Prunus subhirtella 'pendula'</i>	nonnative	tree	★★	*	*							
Higan cherry	<i>Prunus subhirtella 'autumnalis'</i>	nonnative	tree	★★	*	*							
Flowering cherry	<i>Prunus</i> spp.	Varies	tree	★★	*	*							
Flowering crabapple	<i>Malus</i> spp.	varies	tree	★★	*	*							
Burkwood viburnum	<i>Viburnum burkwoodii</i>	hybrid	shrub	★★									
Cherry laurel	<i>Prunus laurococcus</i>	nonnative	shrub	★★									
Red horsechestnut	<i>Aesculus x carnea</i>	native	tree	★★									
American holly	<i>Ilex opaca</i>	native	tree	★★									
Foster's holly	<i>Ilex x attenuata</i>	hybrid	shrub	★★									
Winter king hawthorn	<i>Crataegus viridis</i>	native	tree	★★									
Servietberry	<i>Amelanchier</i> spp.	Native	both	★★									
Eastern redbud	<i>Cercis canadensis</i>	native	tree	★★									
Black gum	<i>Nyssa sylvatica</i>	native	tree	★★									
Ninebark	<i>Physocarpus opulifolius</i>	native	shrub	★★									
Fuzzy deutzia	<i>Deutzia scabra</i>	nonnative	shrub	★★									
Pyracantha	<i>Pyracantha</i> spp.	Nonnative	shrub	★★									
Japanese tree lilac	<i>Syringa reticulata</i>	nonnative	tree	★★									
American yellowwood	<i>Cladostis kentuckea</i>	native	tree	★★									
Mock orange	<i>Philadelphus</i> spp.	varies	shrub	★★									
Virginia spiraea	<i>Spiraea virginiana</i>	native	shrub	★★									
False indigo	<i>Amorpha fruticosa</i>	native	shrub	★★									
Buttonbush	<i>Cephalanthus occidentalis</i>	native	shrub	★★									
Climbing rose	<i>Rosa setigera</i>	native	shrub	★★									
Common winterberry	<i>Ilex verticillata</i>	native	shrub	★★									
Sweetspine	<i>Itea virginica</i>	native	shrub	★★									
Bottlebrush buckeye	<i>Aesculus parviflora</i>	native	shrub	★★									
Udden	<i>Tilia cordata, americana</i>	nonnative	tree	★★									
Golden raintree	<i>Koeleruteria reticulata</i>	nonnative	tree	★★									
St. John's Wort	<i>Hypericum frondosum</i>	native	shrub	★★									
Devil's walking stick	<i>Aralia spinosa</i>	native	tree	★★									
PeeGee hydrangea	<i>Hydrangea paniculata</i>	nonnative	shrub	★★									
Clethra	<i>Clethra alnifolia</i>	native	shrub	★★									
Bee bee tree	<i>Tetradium danaii</i>	nonnative	tree	★★									
Winged sumac	<i>Rhus copallinum</i>	native	tree	★★									
Crape myrtle	<i>Lagerstroemia</i> spp.	nonnative	tree	★★									
Glossy abelia	<i>Abelia x grandiflora</i>	nonnative	shrub	★★									
Seven son flower	<i>Heptacodium miconioides</i>	nonnative	tree	★★									
Chaste tree	<i>Vitex agnus-castus</i>	nonnative	tree	★★									

¹Rating based on number of bees visited during bloom

 GROW WISE. BEE SMART.™

<http://growwise.org/>

Wild bee abundance and diversity are greatest where flower resources are most diverse

- natives and non-natives
- (sub)urban habitats can support as many bees as rural environments
 - R Irwin, North Carolina State

Pollinator surveys in mid-west: natives and non-natives were equally attractive

- Different plants attracted unique assemblages of insects
 - Mach, Baker et al., Univ. of Kentucky

BEE MAGNETS



Ten Great Trees & Shrubs for Honeybees

Common Name	Scientific Name
Cornelian cherry	<i>Cornus mas</i>
Higan cherry	<i>Prunus subhirtella 'autumnalis'</i>
Foster's holly	<i>Ilex x attenuata</i>
American yellowwood	<i>Cladostis kentuckea</i>
Common winterberry	<i>Ilex verticillata</i>
Linden	<i>Tilia cordata, T. americana</i>
Golden raintree	<i>Koeleruteria reticulata</i>
St. John's Wort	<i>Hypericum frondosum</i>
Bee bee tree	<i>Tetradium danaii</i>
Winged sumac	<i>Rhus copallinum</i>

Ten Great Trees & Shrubs for Bumblebees

Common Name	Scientific Name
American yellowwood	<i>Cladostis kentuckea</i>
False Indigo	<i>Amorpha fruticosa</i>
Buttonbush	<i>Cephalanthus occidentalis</i>
Sweetspire	<i>Itea virginica</i>
Golden raintree	<i>Koeleruteria reticulata</i>
St. John's Wort	<i>Hypericum frondosum</i>
Clethra	<i>Clethra alnifolia</i>
Glossy abelia	<i>Abelia x grandiflora</i>
Seven-son flower	<i>Heptacodium miconioides</i>
Chaste tree	<i>Vitex agnus-castus</i>

Trees & Shrubs That Attract Relatively Few Bees

Common Name	Scientific Name
Forsythia	<i>Forsythia</i> spp.
Star magnolia	<i>Magnolia stellata</i>
European boxwood	<i>Buxus sempervirens</i>
Sassafras	<i>Sassafras albidum</i>
Japanese Kwanzan cherry	<i>Prunus 'Kwanzan'</i>
Mulan magnolia	<i>Magnolia liliflora</i>
White azalea	<i>Azalea</i> spp.
Koreanspice viburnum	<i>Viburnum carlesii</i>
Carolina alspice	<i>Calycanthus floridus</i>
White fringetree	<i>Chionanthus virginicus</i>
Hybrid tea rose	<i>Rosa</i> spp.
Smooth hydrangea	<i>Hydrangea arborescens</i>
Bigleaf hydrangea	<i>Hydrangea macrophylla</i>

Wild bee pollination networks in northern New England

Erika M. Tucker¹ · Sandra M. Rehan¹

Season-long sampling of bees visiting flowers at UNH Horticulture Farm (2014)

63 bee species

34 plant species

About 50% of plant-pollinator interactions were on native plants.

Best bee plants

- Red clover and white clover (non-natives)
- Monarda, solidago, vernonia, agastache, coreopsis, Echinacea (natives)

Eastern bumble bee and sweat bees were predominant bee species and had the broadest floral host range

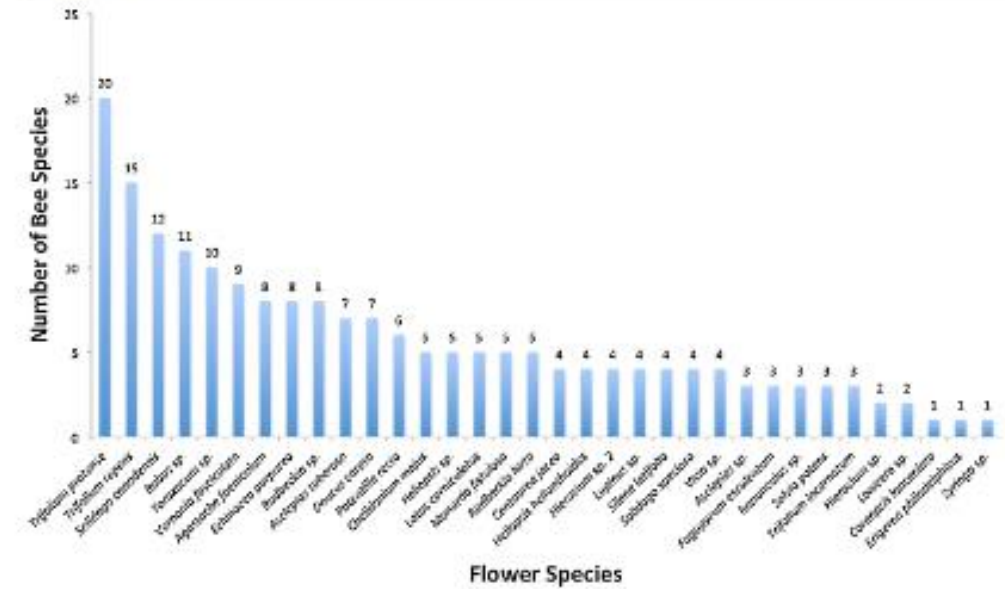


Fig. 2 Bee species diversity for each flower species sampled using sweep netting. Flower species are in order of greatest bee diversity supported

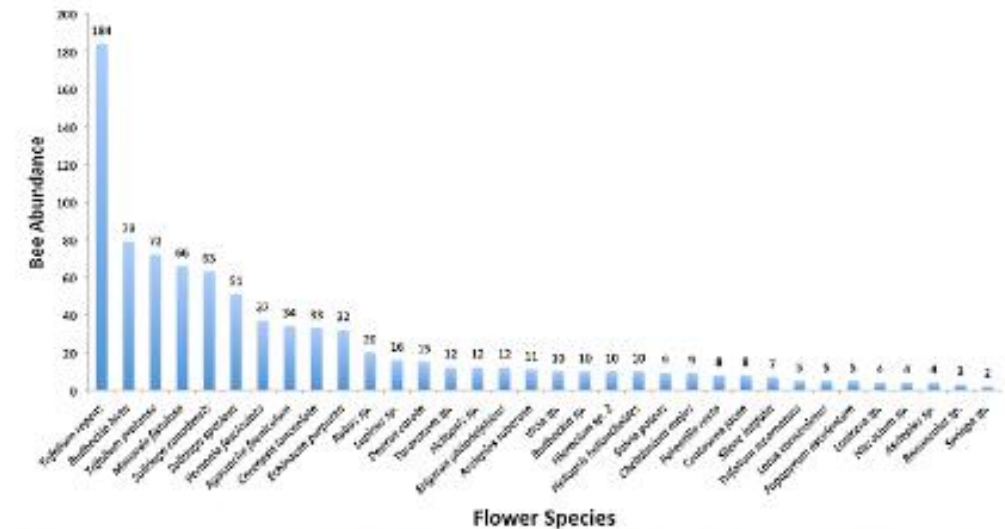
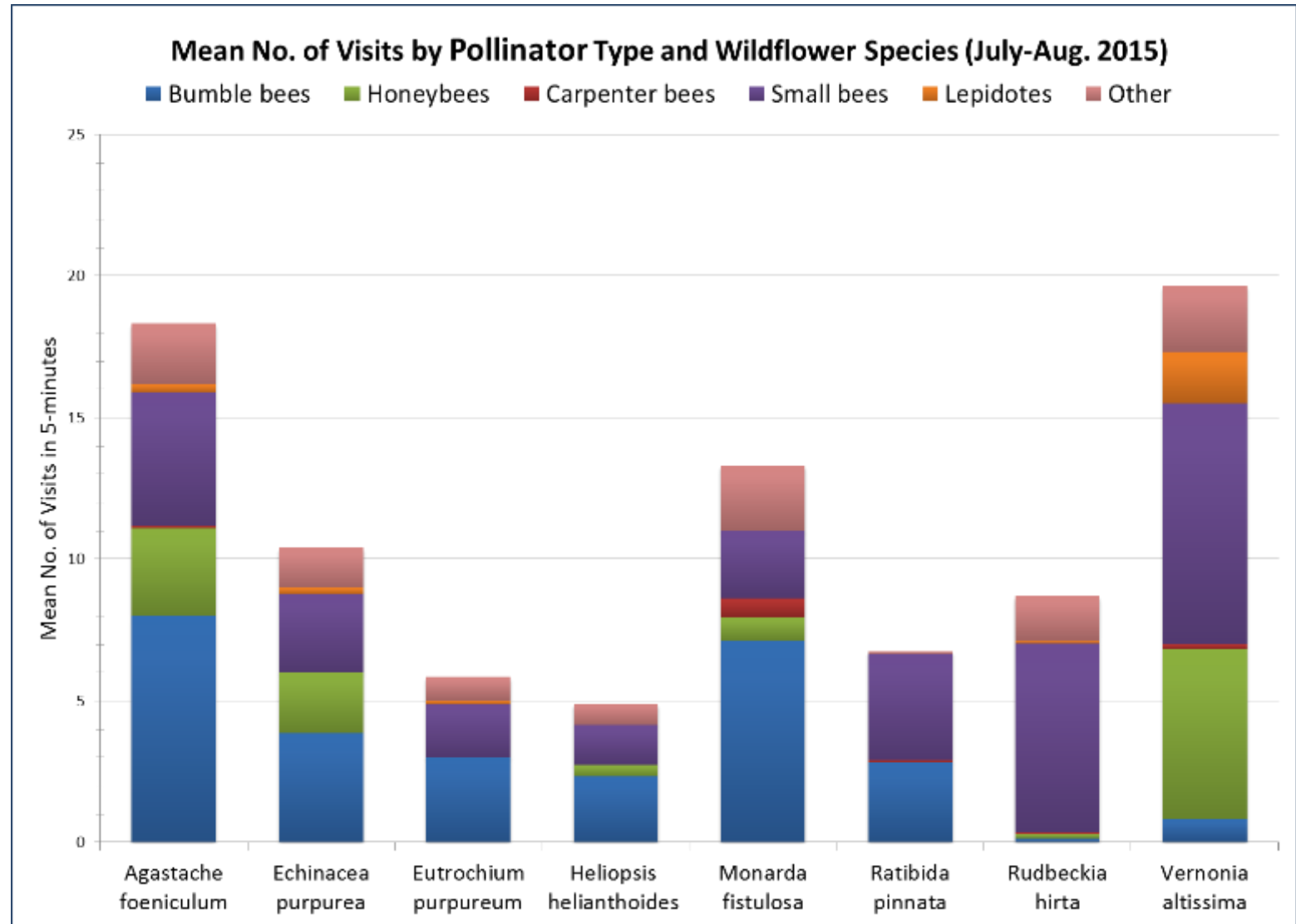


Fig. 3 Abundance of bee specimens collected from each flower species during sweep netting. Flower species are in order of greatest abundance of bees

Monitoring Pollinator Preferences



Planting for Pollinators

- Provide high quality pollen and nectar sources
- From diverse flowering species
- Available spring through fall
- In areas that are safe and accessible





Pollinator Plants for Northern New England Gardens

Catherine Neal, Extension Professor and Landscape Horticulture
Specialist, UNH Cooperative Extension.

Many people want to create pollinator-friendly gardens to support numerous kinds of native bees, as well as honey bees, butterflies, hummingbirds, and other pollinators. Planting a diverse mix of flowering plants that provides a sequence of blooms from early spring to late fall will have the most impact. Even a small patch of the right flowers can help, as it adds to the larger landscape mosaic in which the pollinators live and search for food.

Pollinators visit flowers to collect food in the form of nectar and/or pollen. Below are some plants you can add to your garden and landscape to provide these food resources for bees and other pollinators. The plants listed here grow well in our region and have been observed to attract large numbers of bees, butterflies or hummingbirds when in bloom. There are many other plants you can use as well, and many plant lists are available on the web. The best resources will be those with local research or observation behind them.

In general, bees like white, blue, purple and yellow flowers and hummingbirds love red tubular shaped flowers. What insect pollinators you'll find on which flowers depends on both the anatomy of the flower (is it open and accessible?) and the insect (how strong is it, how long is its tongue?). Select flowers with abundant supplies of nectar and pollen. By observing the plants in your garden, you will soon learn which are the most visited by bees and other pollinators. Here are some guidelines to get you started.

Perennials: American native perennials, or wildflowers, with long bloom periods, prolific flowers and colors attractive to pollinators can be combined to provide a pollinator paradise from late spring through fall. For the most impact, plant in full sun and design in masses (groups of 3-5 or more plants placed together). Choose to use the straight species^x or choose cultivars or varieties that have flowers similar in color and form to the original species. Be aware, however, that many of the straight species are very tall and not as neat and tidy as your typical perennial garden.

UNH Cooperative Extension Programs

- Community and Economic Development
- Food and Agriculture ✓
- Natural Resources
- Youth and Family



Bee on yellow coneflower

Planting a diverse mix of flowering plants that provides a sequence of blooms from early spring to late fall will have the most impact.



Monarch butterfly on goldenrod

Species	Common Name	Average Bloom Period (2013-15) in Durham, NH											
		May	June	July	August	Sept.	October						
<i>Zizia aurea</i>	Golden Alexanders		■										
<i>Aquilegia canadensis</i>	Wild Columbine		■	■									
<i>Lupinus perennis</i>	Wild Lupine		■	■									
<i>Tradescantia ohioensis</i>	Ohio Spiderwort		■	■	■								
<i>Baptisia australis</i>	Blue Wild Indigo		■	■									
<i>Penstemon digitalis</i>	Foxglove Beardtongue			■	■								
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis				■	■							
<i>Echinacea pallida</i>	Pale Purple Coneflower				■	■							
<i>Rudbeckia hirta</i>	Black Eyed Susan				■	■							
<i>Agastache foeniculum</i>	Lavender Hyssop				■	■	■						
<i>Asclepias syriaca</i>	Common Milkweed				■	■							
<i>Heliopsis helianthoides</i>	Ox Eye Sunflower				■	■							
<i>Asclepias tuberosa</i>	Butterfly Milkweed				■	■							
<i>Baptisia tinctoria</i>	Yellow Wild Indigo				■	■							
<i>Dalea purpurea</i>	Purple Prairie Clover				■	■							
<i>Echinacea purpurea</i>	Purple Coneflower				■	■	■						
<i>Parthenium integrifolium</i>	Wild Quinine				■	■	■						
<i>Senna hebecarpa</i>	American Senna				■	■							
<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint				■	■							
<i>Ratibida pinnata</i>	Yellow Coneflower				■	■							
<i>Rudbeckia fulgida</i>	Orange Coneflower				■	■	■						
<i>Allium cernuum</i>	Nodding Wild Onion				■	■							
<i>Liatris spicata</i>	Dense Blazing Star				■	■							
<i>Verbena hastata</i>	Blue Vervain				■	■							
<i>Lobelia cardinalis</i>	Cardinal Flower				■	■	■						
<i>Monarda fistulosa</i>	Wild Bergamot				■	■	■						
<i>Eryngium yuccifolium</i>	Rattlesnake Master				■	■							
<i>Liatris pycnostachya</i>	Prarie Blazingstar				■	■							
<i>Eutrochium purpureum</i>	Sweet Joe-Pye				■	■							
<i>Rudbeckia subtomentosa</i>	Sweet Black Eyed Susan				■	■	■						
<i>Rudbeckia triloba</i>	Brown Eyed Susan				■	■	■						
<i>Vernonia altissima</i>	Ironweed						■	■					
<i>Solidago juncea</i>	Early Goldenrod						■	■					
<i>Solidago graminifolia</i>	Flat-topped Goldenrod						■	■					
<i>Oligoneuron rigidum</i>	Stiff Goldenrod						■	■					
<i>Gentiana clausa</i>	Closed Gentian								■	■			
<i>Solidago speciosa</i>	Showy Goldenrod								■	■			
<i>Symphotrichum laeve</i>	Smooth Aster								■	■			
<i>Symphotrichum novae-angliae</i>	New England Aster										■	■	

Concern Over Cultivars

Are they as attractive to insect pollinators?

Paired comparisons of species and their cultivars yielded mixed results.

8/14 pairs – bees preferred species over cultivar.

5/14 – no difference

1/14 – bees preferred the improved cultivar (Veronicastrum)



<https://pollinategardens.org>

A. White and L. Perry, 2016. Univ. of Vermont.

Echinacea purpurea Comparisons

Which cultivars do you think attracted the most bees?



1	<i>Echinacea purpurea</i>
2	Magnus
3	PowWow [®] Wild Berry
4	White Swan
5	Cheyenne Spirit
6	Hot Papaya
7	Double Scoop Lemon Cream
8	Big Sky Sunrise



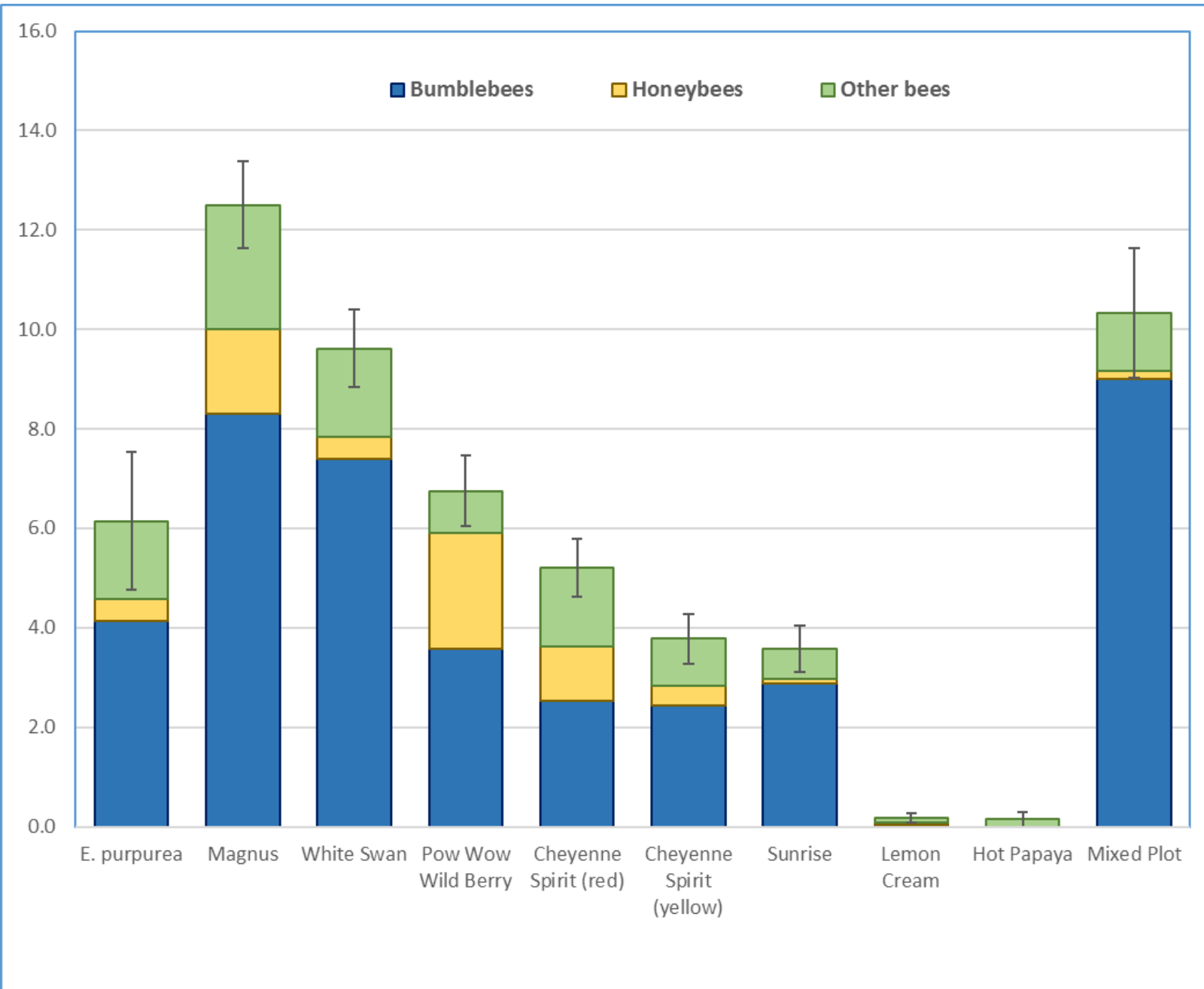
Echinacea purpurea Comparisons

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5	Cheyenne Spirit
6	Hot Papaya
7	Double Scoop Lemon Cream
8	Big Sky Sunrise

Average number of bee visits in 5 minutes



Bumble bees preferred

Magnus
White Swan
Mixed cultivars
E. purpurea



Honey bees preferred

Pow Wow Wild Berry
Magnus



Nobody liked

Lemon Cream
Hot Papaya



Nesting Sites

Cavity nesters – holes, cracks, stems

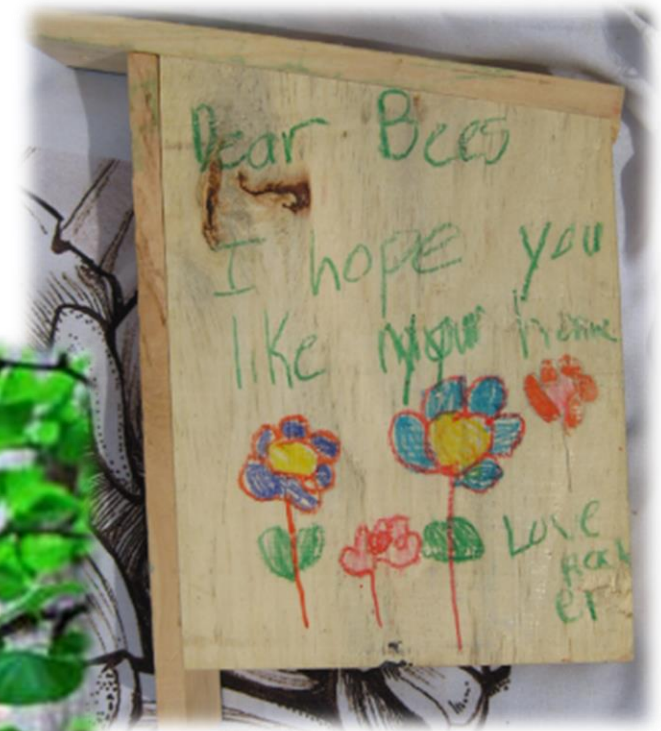
- Pithy stems – sumac, raspberries, milkweed
- Dead wood – holes created by borers, birds, etc.
- Bee houses/hotels
- Brush piles, stone walls



Nesting Sites

Cavity nesters – holes, cracks, stems

- Pithy stems – sumac, raspberries, milkweed
- Dead wood – holes created by borers, birds, etc.
- Bee boxes/houses/hotels
- Brush piles, stone walls



Mason Bee Boxes

Nesting Sites

Ground nesters – need patches of bare ground.

Rodent nests preferred!

Mulch less



Bumble Bee Nest
(top)



Illustration (bottom) Sarina Jepsen,
courtesy Xerces.org



Keys to Successful Wildflower Meadow Establishment

<https://extension.unh.edu/Sustainable-Landscapes-and-Turf/Wildflower-Meadows>



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