Pollinator-Friendly Plants for Restoration

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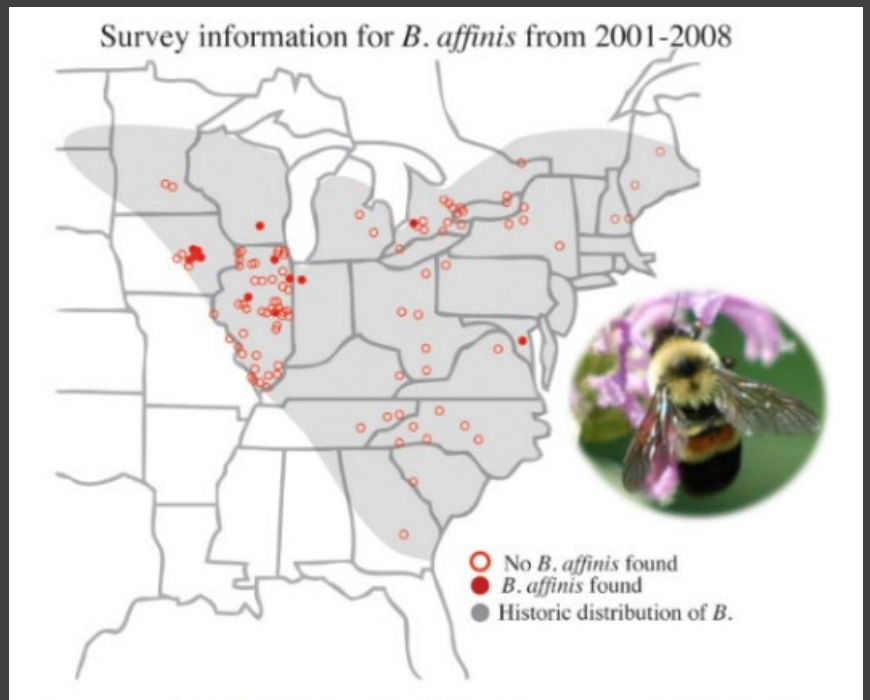
Insect pollination: an essential service

Natural ecosystems depend on Insect pollination

Bees are the most important pollinators

Some bees are in decline



The rusty-patched bumble bee has declined in approximately 87% of its former range. Map: The Xerces Society. Photo: Johanna James-Heinz.

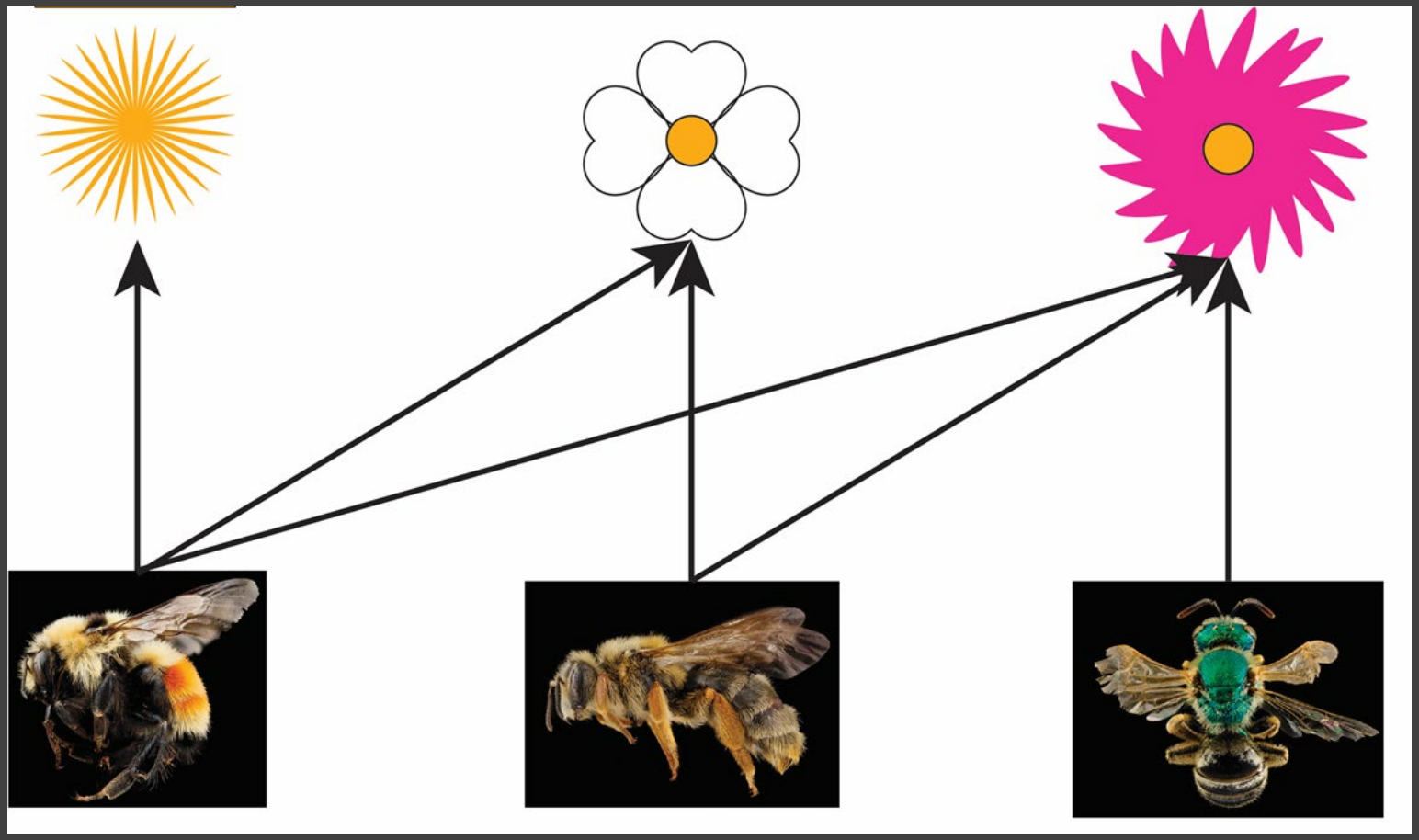
Bombus occidentalis
western bumble bee

What is the best plant species mix/mixes for bees?

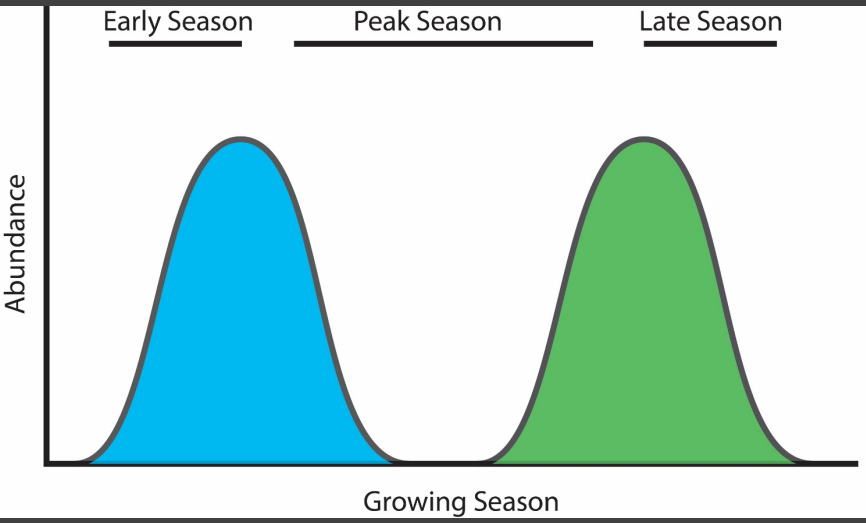
Forb and Shrub Species	Common Name	Six Letter Abbreviation	Seeds/Lb. or Plants/acre
Antennaria microphylla	Small flowered pussytoes	ANTMIC	Variable
Antennaria rosea	Rosy pussytoes	ANTROS	Variable
Achillea millefolium	Yarrow	ACHMIL	2,835,00
Penstemon procerus	Small flowered penstemon	PENPRO	Variable
Penstemon attenuatus/albertinus	Taper leaf penstemon	PENATT/PENALB	Variable
Eriogonum umbellatum	Sulphur buckwheat	ERIUMB	217,00
Lupinus sericeus	Silky lupine	LUPSER	Variable
Anaphalis margaritacea	Pearly everlasting	ANAMAR	11,000,000
Erigeron speciosus	Showy fleabane	ERISPE	Unknown
Phacelia hastata	Silverleaf scorpion weed	PHAHAS	2,182,576
Gaillardia aristata	Blanket flower	GAIARI	438,719
Hedysarum boreale	Boreal sweetvetch	HEDBOR	3,968,320
Spiraea betulifolia	White spirea	SPIBET	2200
Rosa woodsii	Wood’s rose	ROSWOO	2200
Symphoricarpos albus	Snowberry	SYMALB	1450
Artcostaphylos uva-ursi	Kinnickinik berry	ARCUVA	6329
Berberis repens	Oregon grape	BERREP	1200
Eurybia conspicua	Showy aster	EURCON	Variable
Senecio triangularis	Arrowleaf groundsel	SENTRI	2,204,622
Cornus sericea	Red osier dogwood	CORSER	3031
Salix bebbiana	Bebb’s willow	SALBEB	3250
Symphyotrichum foliaceum	Smooth aster	SYMFOL	1,014,000
Solidago canadensis	Canada goldenrod	SOLCAN	9,700,339

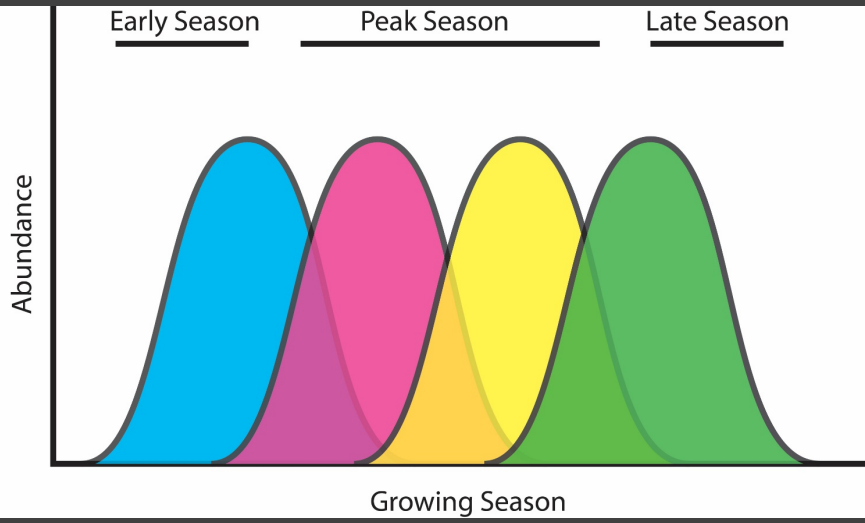
Assessing “pollinator-friendliness” of plants

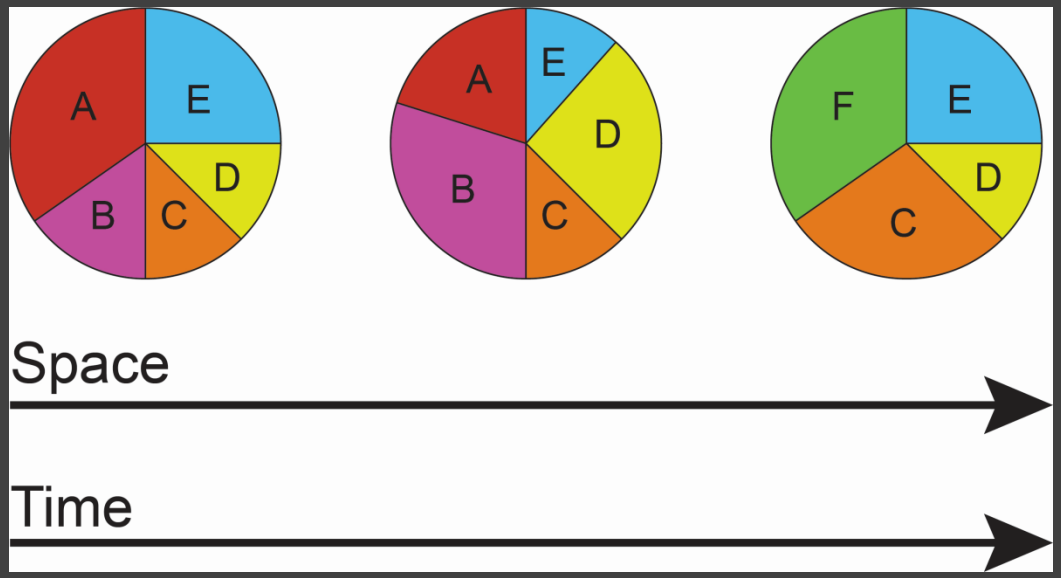
- How many bee species visit flowers?
- How frequently are flowers visited?



Restoration mixes should provide flowers across the entire season



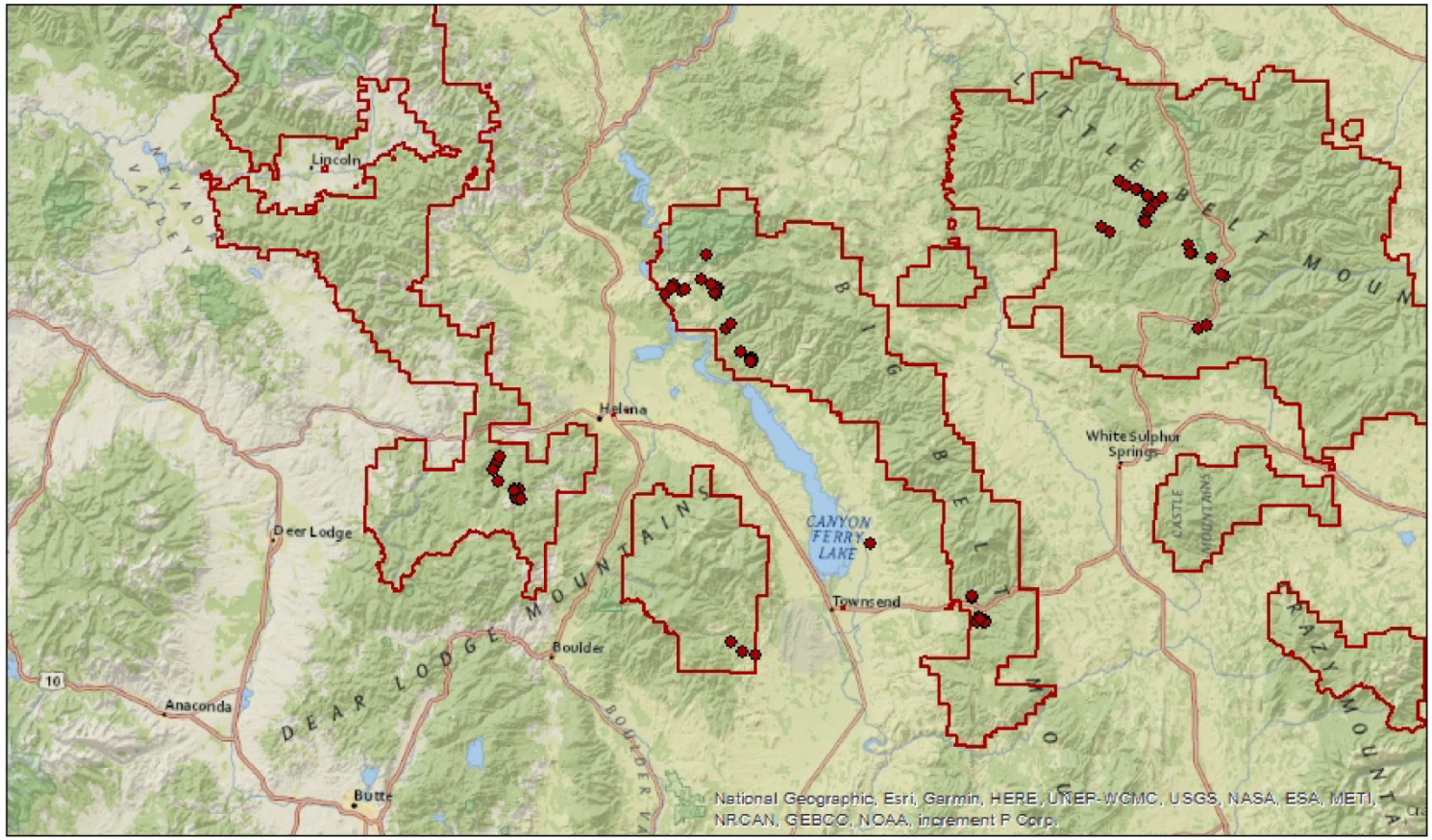




Methods

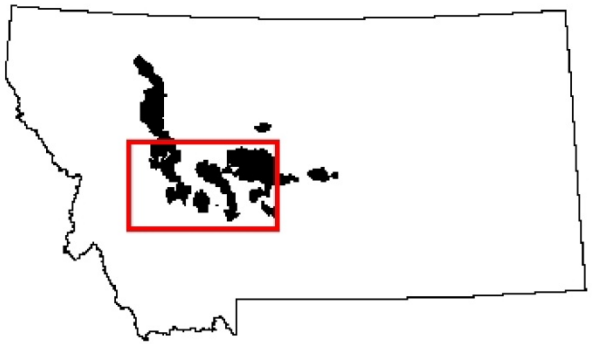
- 63 sites on Helena-Lewis & Clark NF
- Timed observations of each plant species and collected bees that visited flowers
- Sites visited throughout the growing season in 2018 and 2019
- Measured bloom duration and occurrence of plant species across sites/habitats
- “Pollinator-friendliness” score cards using number bee species, visitation rate, number of specialist species, bloom duration, and frequency of occurrence across sites

- Also sampled visitation to non-focal plant species



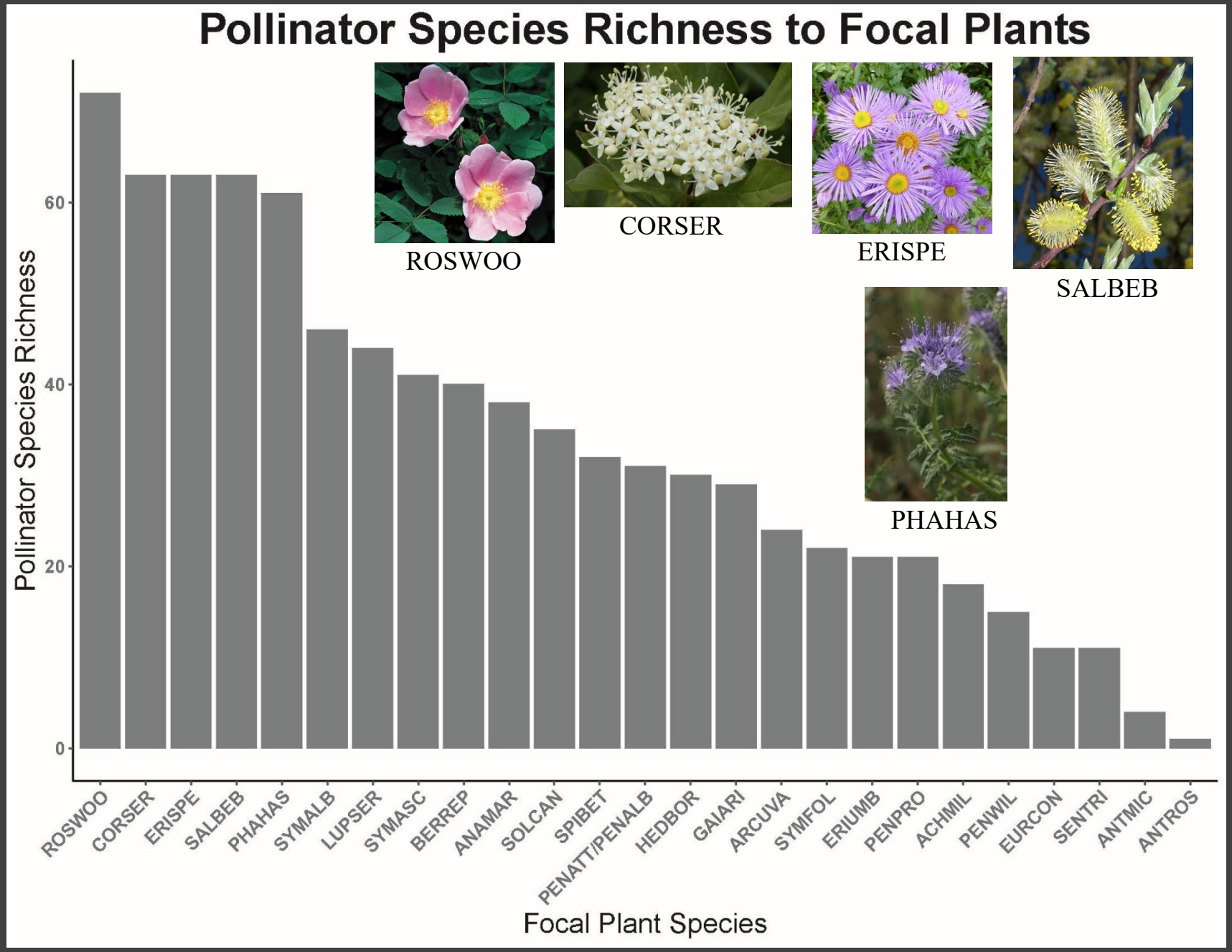
Legend

- Site Locations
- Helena Lewis & Clark National Forest



Collected nearly 3,500 bees representing 246 species

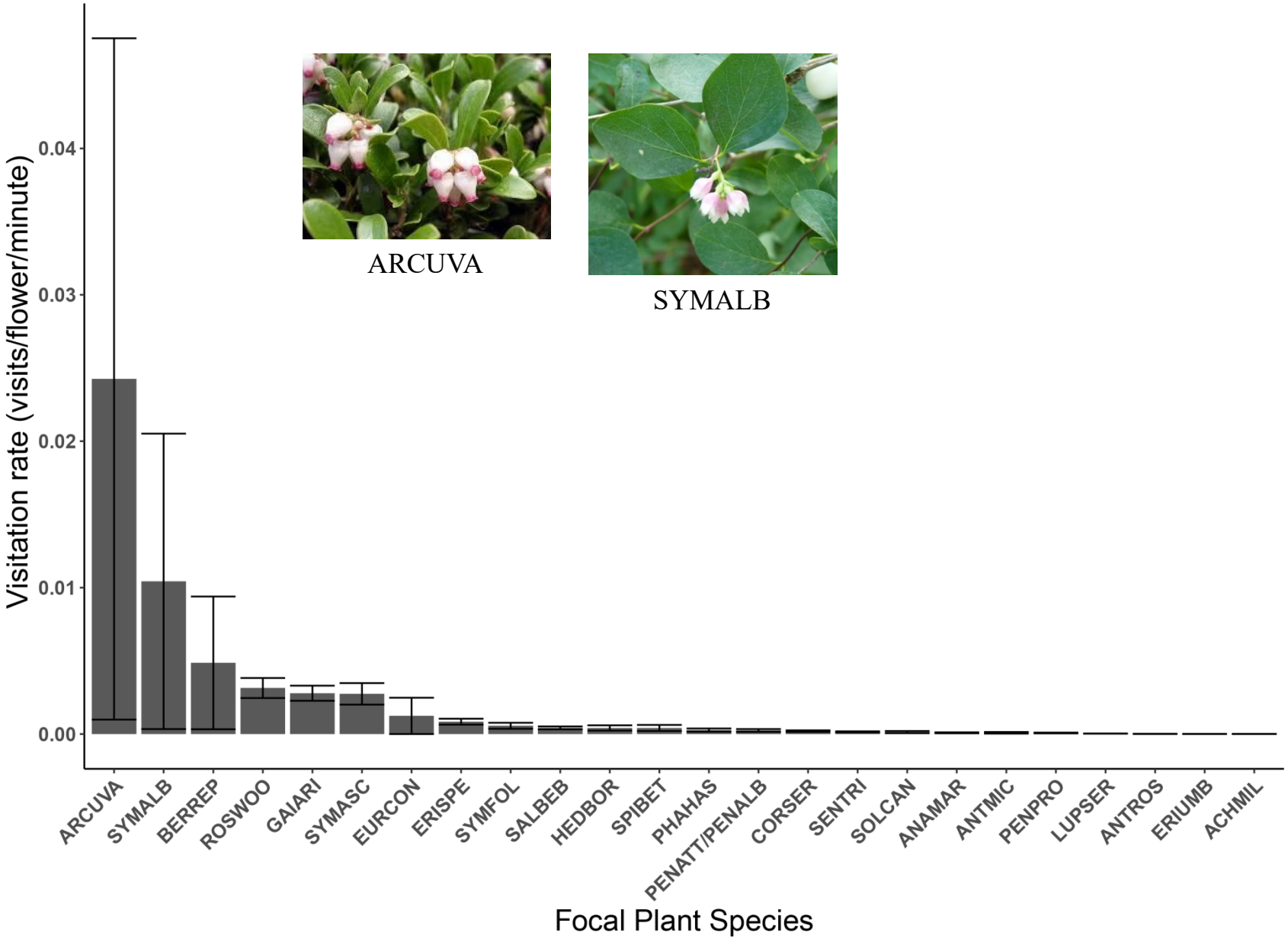
Photos: Casey Delphia (Montana State University)


Pollinator Species Richness to Focal Plants
Pollinator Species Richness
0
20
40
60
ROSWOO
CORSER
ERISPE
SALBEB
PHAHAS
SYMALB
LUPSER
SYMASC
BERREP
ANAMAR
SOLCAN
SPIBET
PENATT/PENALB
HEDBOR
GAIARI
ARCUVA
SYMFOL
ERIUMB
PENPRO
ACHMIL
PENWIL
EURCON
SENTRI
ANTMIC
ANTROS
Focal Plant Species

Pollinator Visitation Rates to Focal Plants

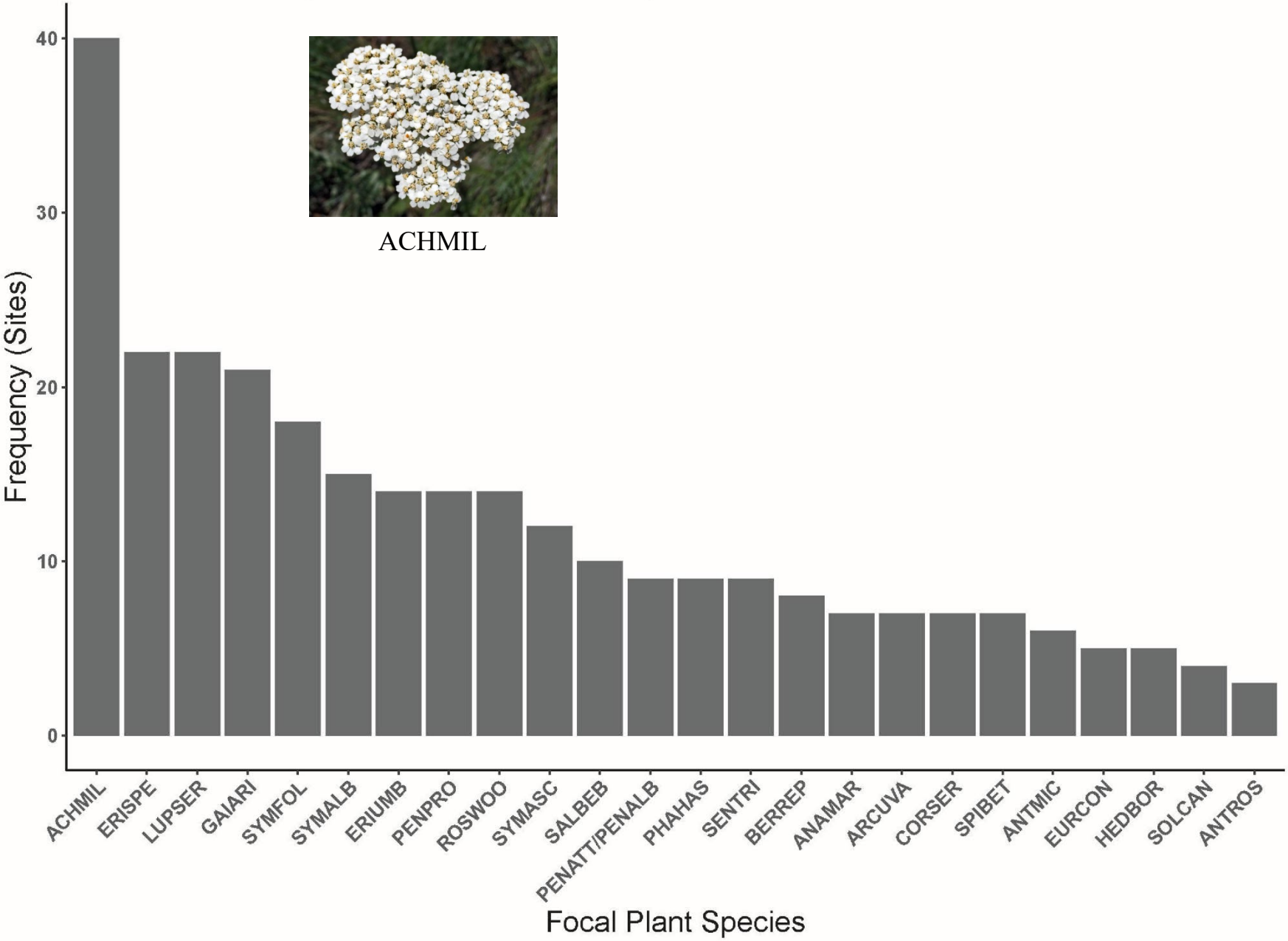
ARCUVA

SYMALB



Spatial availability of floral resources

ACHMIL



Bloom times and duration

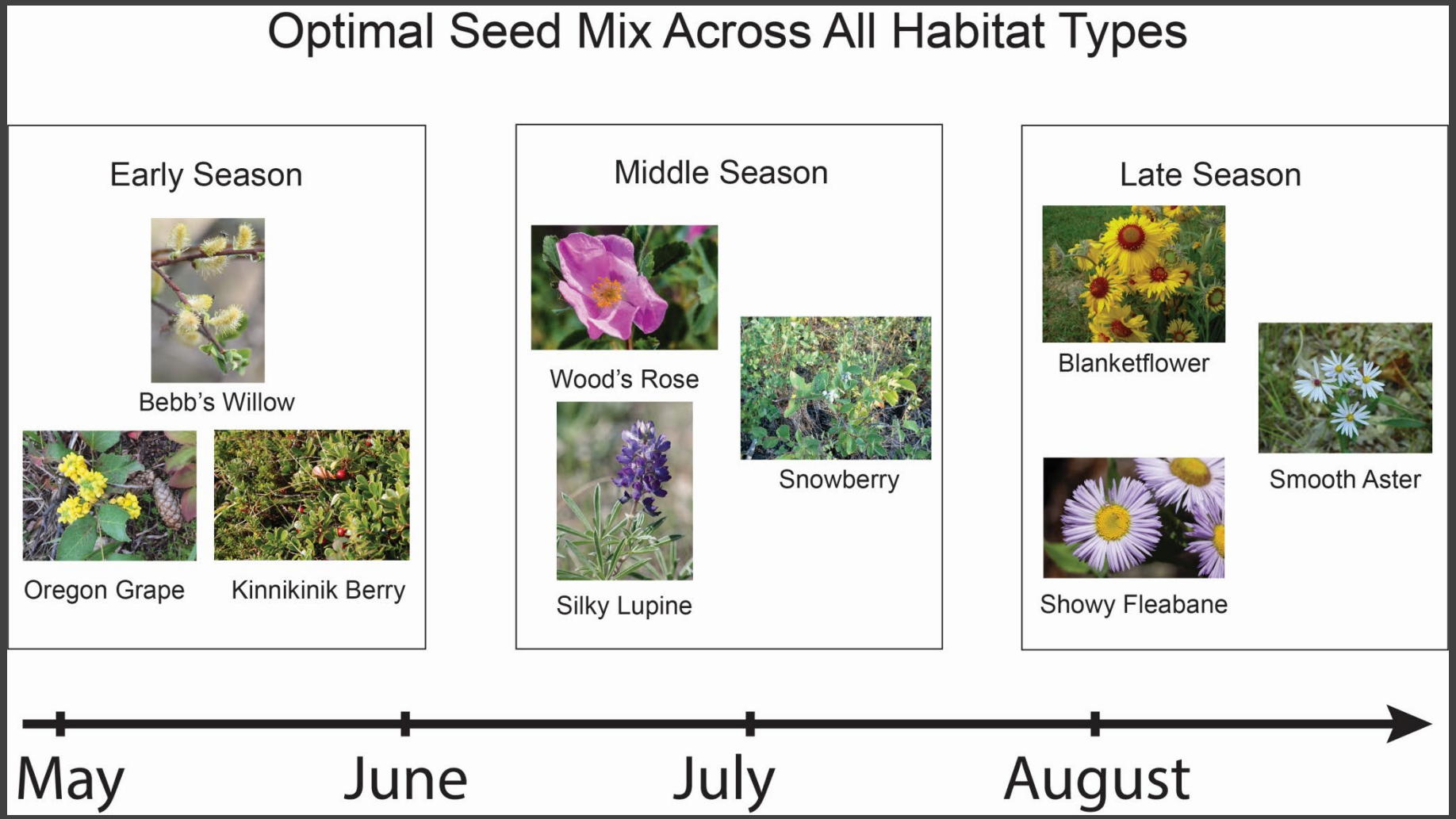
Common name	Scientific Name	Plant Type	Flower Color	April	May	June	July	August	September
Bebb's Willow	*Salix bebbiana*	shrub	white						
Oregon Grape	*Berberis repens*	shrub	yellow						
Kinnikinnick Berry	*Arctostaphylos uva-ursi*	shrub	pink/white						
Red Osier Dogwood	*Cornus sericea*	shrub	white						
Littleleaf Pussytoes	*Antennaria microphylla*	forb	white						
Rosy Pussytoes	*Antennaria rosea*	forb	pink/white						
Silky Lupine	*Lupinus sericeus*	forb	purple						
Wood's Rose	*Rosa woodsii*	shrub	pink						
Taper-Leaved Penstemon	*Penstemon attenuatus*	forb	blue/purple						
Alberta Beardtongue	*Penstemon albertinus*	forb	blue/purple						
Yarrow	*Achillea millefolium*	forb	white						
Boreal sweet-vetch	*Hedysarum boreale*	forb	purple						
Sulphur Buckwheat	*Eriogonum umbellatum*	forb	yellow						
Silverleaf Scorpion Weed	*Phacelia hastata*	forb	purple						
Blanketflower	*Gaillardia aristata*	forb	yellow/red						
Snowberry	*Symphoricarpos albus*	shrub	white						
Birchleaf Spiraea	*Spiraea betulifolia*	forb	white						
Littleflower Penstemon	*Penstemon procerus*	forb	purple						
Showy Fleabane	*Erigeron speciosus*	forb	purple						
Arrowleaf groundsel	*Senecio triangularis*	forb	yellow						
Pearly Everlasting	*Anaphalis margaritacea*	forb	white						
Showy Aster	*Eurybia conspicua*	forb	purple						
Western Aster	*Symphyotrichum ascenc*	forb	purple						
Smooth Aster	*Symphyotrichum foliace*	forb	purple						
Canada Goldenrod	*Solidago canadensis*	forb	yellow						

Focal plants supporting specialist bee species

Forb and Shrub Species	Common Name	Number of specialists
Salix bebbiana	Bebb's williow	12
Phacelia hastata	Silverleaf scorpionweed	9
Symphyotrichum ascendens	Showy aster	7
Cornus sericea	Red osier dogwood	7
Erigeron speciosus	Showy fleabane	6
Lupinus sericeus	Silky lupine	5
Symphoricarpos albus	Snowberry	4
Rosa woodsii	Wood's rose	4
Spiraea betulifolia	White spiraea	3
Gaillardia aristata	Blanketflower	3
Solidago canadensis	Canada goldenrod	2
Arctostaphylos uva-ursi	Kinnikinnick	2
Achillea millefolium	Yarrow	2
Symphyotrichum foliaceum	Smooth aster	1
Penstemon attenuatus/albertinus	Penstemon species	1
Hedysarum boreale	Boreale sweetvetch	1

“Pollinator-friendliness” score cards

Forb and Shrub Species	Season	Visitation rate	Bee richness	Specialists	Temporal availability	Spatial availability	Total Score
Salix bebbiana	Early	4	4	6	6	6	26
Arctostaphylos uva-ursi	Early	6	6	4	5	4	25
Berberis repens	Early	5	3	3	3	5	19
Cornus sericea	Early	3	5	5	2	3	18
Antennaria rosea	Early	1	1	2	4	1	9
Antennaria microphylla	Early	2	2	2	1	2	9
Rosa woodsii	Middle	8	9	7	3	5	32
Lupinus sericeus	Middle	3	3	8	9	8	31
Symphoricarpos albus	Middle	9	1	7	6	7	30
Achillea millefolium	Middle	1	8	4	7	9	29
Phacelia hastata	Middle	5	6	9	5	3	28
Penstemon spp.	Middle	4	5	3	8	4	22
Hedysarum boreale	Middle	7	7	3	2	1	20
Eriogonum umbellatum	Middle	2	4	3	4	6	19
Spiraea betulifolia	Middle	6	2	5	1	2	16
Gaillardia aristata	Late	9	5	7	6	8	35
Erigeron speciosus	Late	6	8	8	1	9	32
Symphyotrichum ascendens	Late	8	6	9	3	5	31
Eurybia conspicua	Late	7	9	4	9	2	31
Solidago canadensis	Late	3	7	6	7	1	24
Symphyotrichum foliaceum	Late	5	3	5	2	7	22
Senecio triangularis	Late	4	1	4	8	4	21
Anaphalis margaritacea	Late	2	4	4	5	3	18
Penstemon procerus	Late	1	2	4	4	6	17



This mix visited by 198 of the 246 (80 percent) of bee species

Plants Visited by the Western Bumble bee

Western bumble bee

Monument Plant

Purple Harebell

Purple monkeyflower

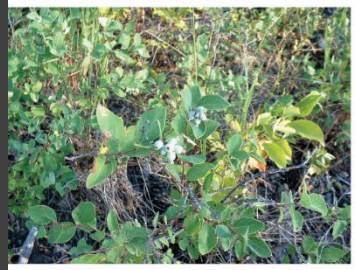
Richardson's geranium

White Spirea
Photo: Matt Lavin

Silky Lupine

Elephant head

Canada goldenrod



Snowberry

Musk Thistle

Stonecrop

Rocky mountain goldenrod
Photo: Matt Lavin

Other native plants that are pollinator-friendly

Forb and Shrub Species	Common Name	Six Letter Abbreviation
Geranium viscosissimum	Sticky geranium	GERVIS
Eurybia integrifolia	Thickstem aster	EURINT
Geranium richardsonii	Richard's geranium	GERRIC
Fragaria virginiana	Wild strawberry	FRAVIR
Agoseris glauca	Pale agoseris	AGOGLA
Heterotheca villosa	Hairy false goldenaster	HETVIL
Campanula rotundifolia	Purple harebell	CAMROT
Thlaspi arvense	Pennycress	THLARV
Geum triflorum	Prairie smoke	GEUTRI
Potentilla gracilis	Slender cinquefoil	POTGRA

Conclusions

- “Pollinator-friendliness” varied greatly across plant species
- Score cards allow land managers to create and tailor revegetation mixes for pollinators
- Some native plant species that aren’t available for revegetation warrant attention (e.g., for the western bumble bee)
- These methods can be used to design seed mixes for pollinator restoration on other public lands
- A publication (GTR) should be out this year

Acknowledgments

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Matt Lavin (Montana State University)

Bee identification:
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Field work:
Jake Anton, Alissa Freeman, Jared Trilling, Jessica Eggers

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