



Photo: Scott Seigfreid

Pollinator Seed Mix Design and Certification

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Xerces Society for Invertebrate Conservation

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BWSR Tech Talks



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The Xerces Society for Invertebrate Conservation

Protecting wildlife through the conservation of invertebrates and their habitats



Photos: Blue butterfly by Dana Ross, Farm: Kelly Gill / Xerces Society



Xerces blue butterfly (*Glaucopsyche xerces*), the first U.S. butterfly to go extinct due to human activities

Major Focal Areas:

Pollinator Conservation

Habitat Restoration

Pesticide Reduction

Agricultural Biodiversity

Endangered Species

Education & Outreach





Xerces Society Partner Biologists

- Provide conservation staff and farmers with technical support
- Assist with habitat evaluations, conservation planning
- Conduct field days and trainings on pollinators and their habitats
- Refine technical documents, conservation practice guides, fact sheets, and seed mixes

Photos: Dana Jokela



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Overview

- Basics of pollinator conservation
- Principles of pollinator habitat seed mix design
- A framework for evaluating mixes – the key considerations
- Introduction to the new seed mix certification calculator with examples



Photo: Karin Jokela

What is a pollinator?

Circle or comment!



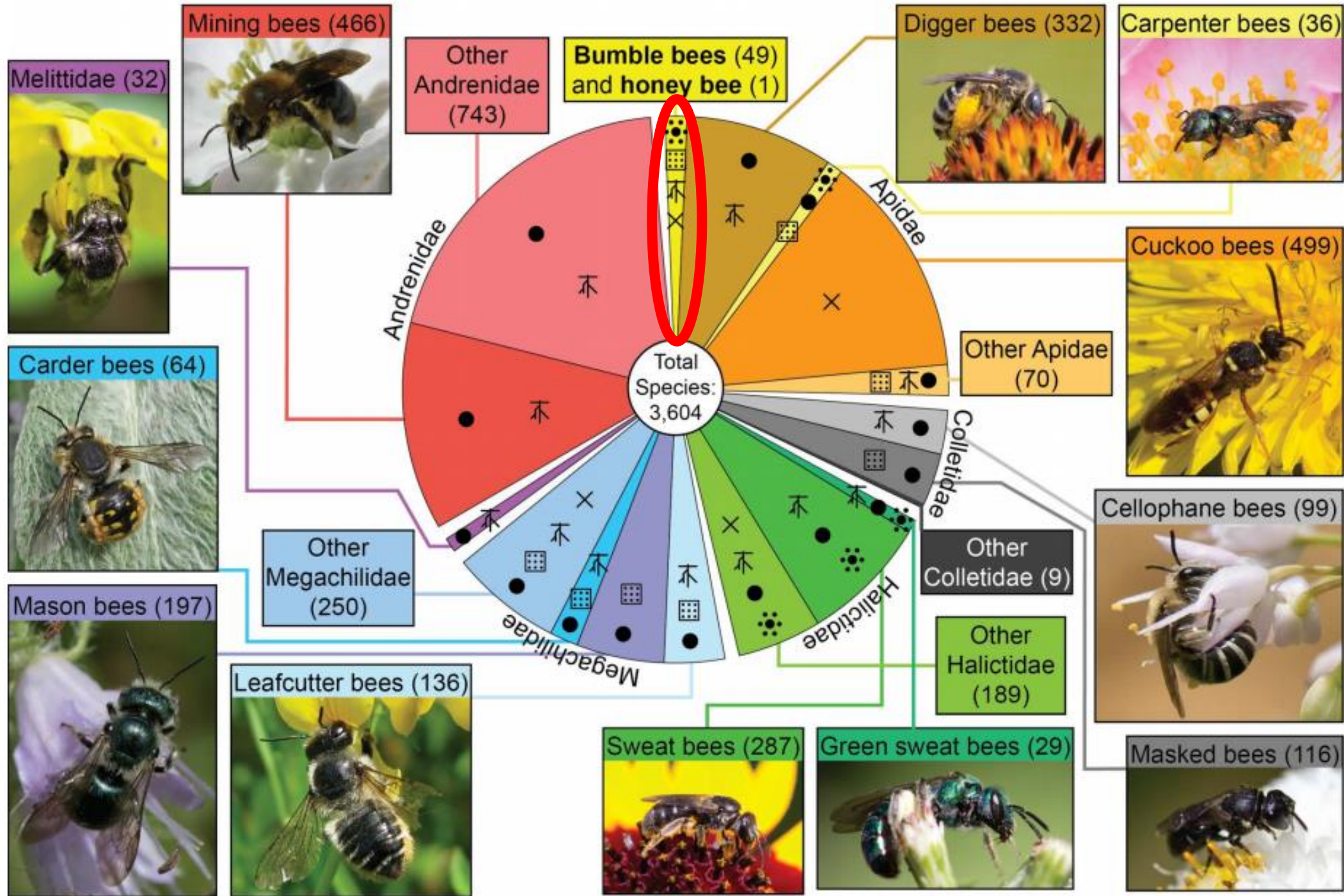
What is a pollinator?

Anything that helps move pollen from the male anther to the female stigma on a flower



Photos top left to right: Sarah Foltz Jordan; Bryan Reynolds; Sarah Foltz Jordan; Karin Jokela; John Flannery Flickr Creative Commons

Photos bottom left to right: Emily May; Whitney Cranshaw; Julie Metz; Rich Hatfield; <https://www.nosoilsolutions.com/3-methods-hand-pollination/>



- Social ● Solitary
- ⌘ Ground-nesting
- ▣ Cavity-nesting
- × Nest parasites

Life cycle of a solitary bee



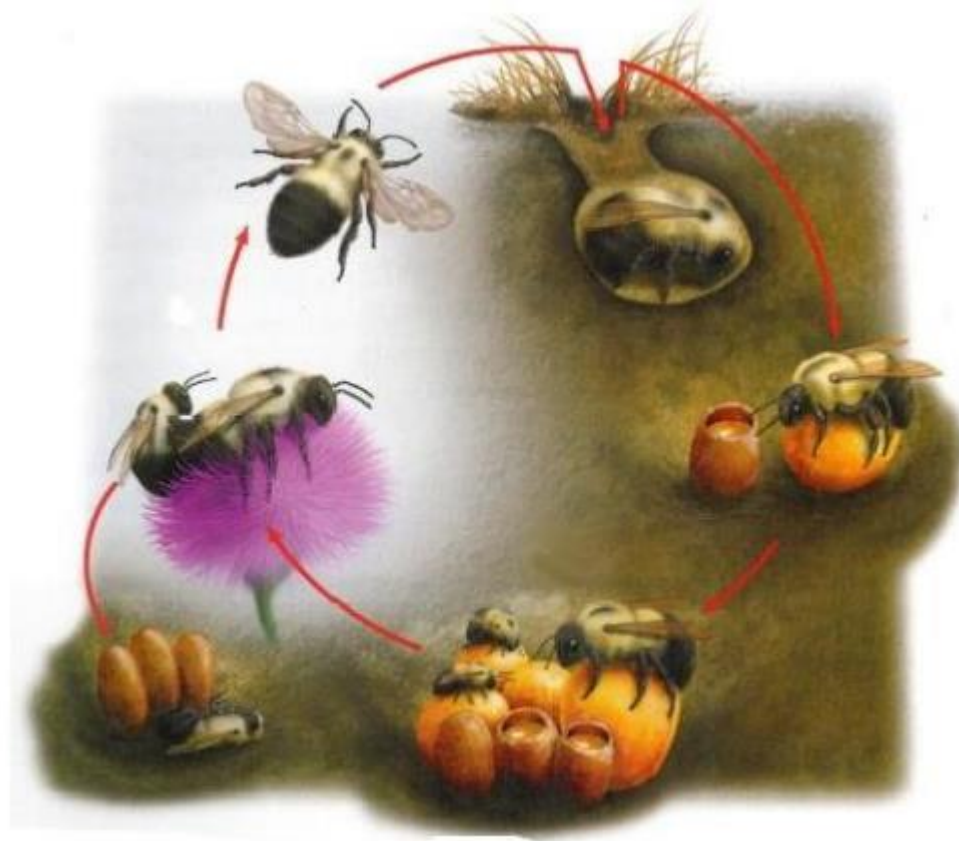
Bumble bee life cycle

Fall: Mated queens seek overwintering sites, founding queen dies

Early Fall: Males leave nest, then new queens leave to find a mate

After mating, males die

Winter: Hibernating queen



Spring: Queen establishes nest and lays eggs

Early Summer: Worker females help grow the colony

Summer: Colony peak

Pollinator conservation



Honey bees

- 1 species in the Upper Midwest
- Not at risk of extinction
- Managed by humans
- Nest provided for them
- Social, large colonies
- **Prefer nonnative flowers**



Native bees

- > 460 spp. in Upper Midwest
- Many at risk of extinction
- Mostly not managed by humans
- Nest in the wild (ground, stems, wood)
- Mostly solitary, small nests
- **Many are dependent on native flowers**



Photo: USDA-ARS/Scott Bauer (top); Sara Morris (bottom)



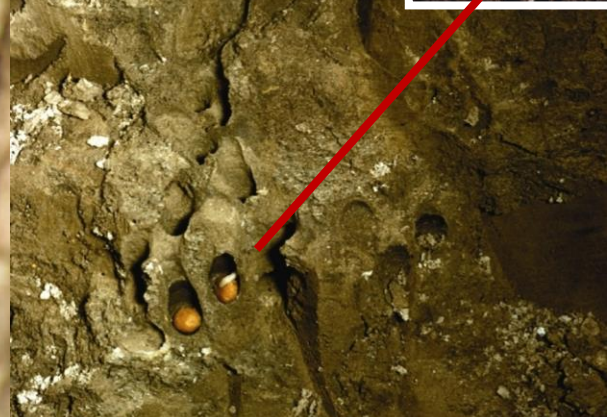
Pollinators need diverse vegetation

Bees need nesting habitat

Social Nesting (~1%)

Ground Nesting (~ 70%)

Stem/Wood Nesting (~30%)



Photos, starting clockwise upper left: Sara Morris / Xerces Society; Sarah Foltz Jordan / Xerces Society; Elaine Evans; Dennis Briggs; Sara Morris / Xerces Society; Jennifer Hopwood / Xerces Society; Colleen Satyshur

Three habitat requirements for all pollinators

1. Diverse vegetation for season-long nectar, pollen, and host plants



2. Shelter for nesting and overwintering

3. Refuge from pesticides



Photo: Karin Jokela; Jennifer Hopwood / Xerces Society; Kevin Wood / Flickr Creative Commons 2.0

Designing Seed Mixes for Pollinator Habitat



Planning a pollinator mix

Reconcile your goals with site specific realities

What's the vision?

Timeline

Topography

Field characteristics

- Soils
- Current and past vegetation
- Pesticide history (herbicides and insecticides)
- Disturbance history
- Edge effects
- Differences across the site

Budget

Photos: Karin Jokela



Diversity in your seed mix increases:

- overall biodiversity and functionality for wildlife
- soil health
- water interception/infiltration
- resistance to plant invasion
- resilience in the face of extreme weather events
- stand longevity

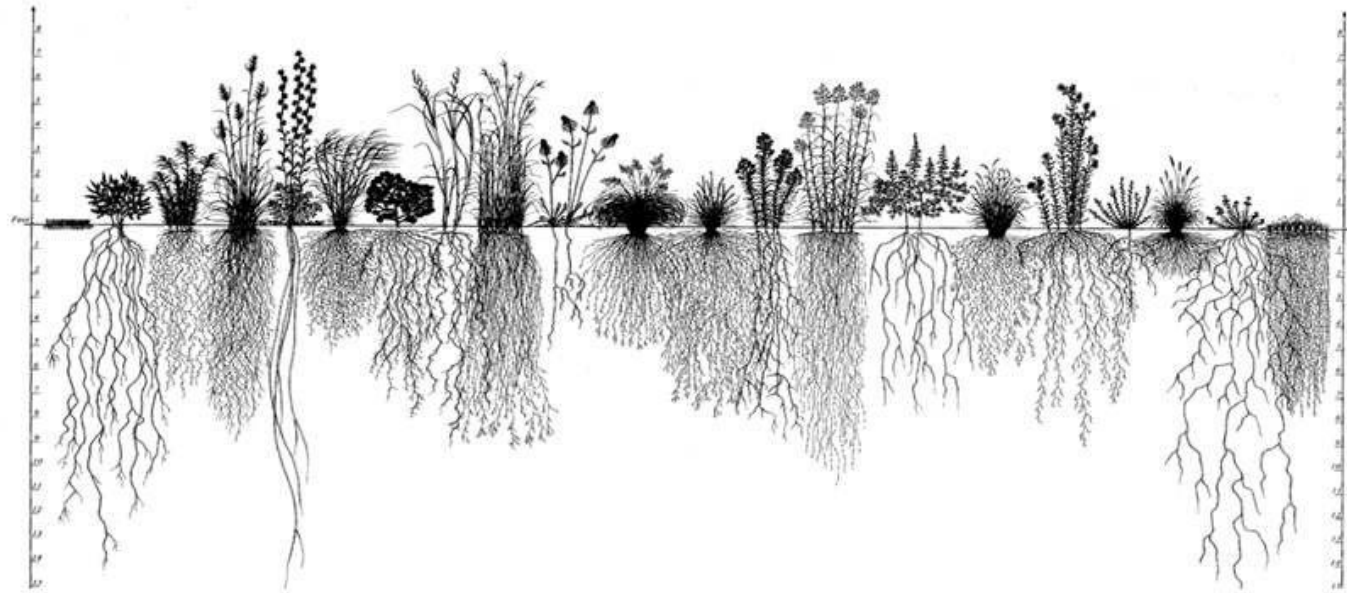
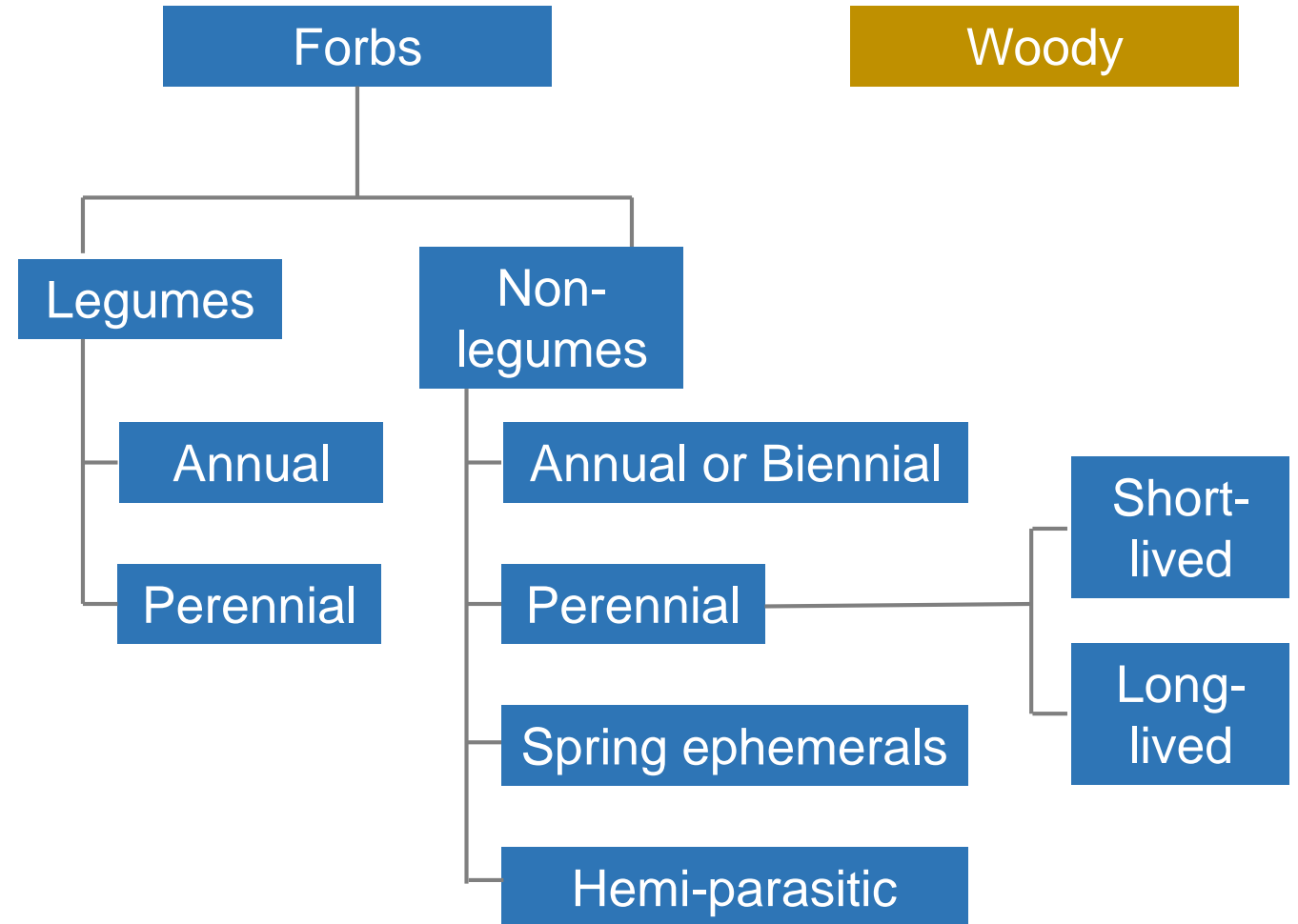
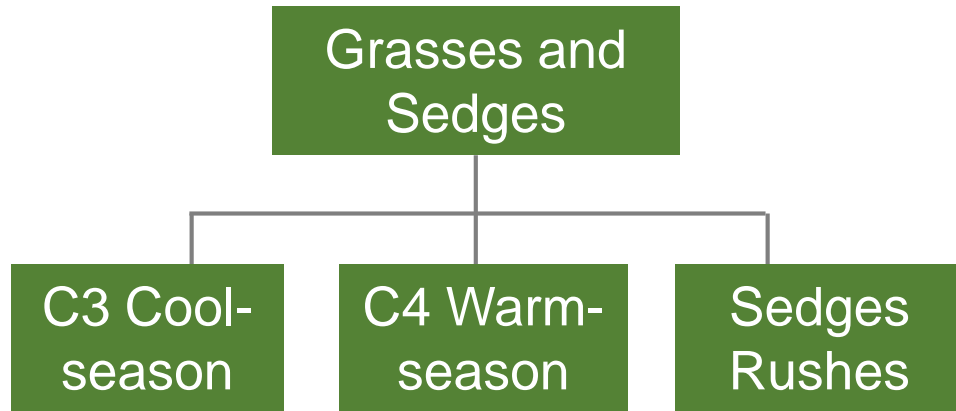


Photo: Dave Williams

Select species from different plant functional groups



Functional diversity:

- Reduces invasibility
- Accelerates establishment
- Promotes stand longevity

Provide flowers throughout the season

Consider evenness! (relative abundance of each)

**Early-season
blooms**

Prairie spiderwort



**Early-summer
blooms**

Butterfly milkweed



**Late-summer
blooms**

Rough blazing star



Fall blooms

Stiff goldenrod



Photos: Karin Jokela; Justin Wheeler; Karin Jokela; Karin Jokela

Select species from different plant families

Generalists and specialists – Invite more pollinators to the table!

**Asteraceae
(Asters)**

Flodman's thistle



Learn more about pollen specialist bees

Photos: Karin Jokela

**Fabaceae
(Legumes)**

Leadplant



**Salicaceae
(Willows)**

Willow



**Primulaceae
(native loosestrife –
Lysimachia)**

Fringed loosestrife



Macropis ciliata



USGS Bee Inventory and Monitoring Lab

Central United States: https://jarrodowler.com/bees_pollen.html

Restored tallgrass prairies have reduced phylogenetic diversity compared with remnants

(Barak et al. 2017 Journal of Applied Ecology)

Over-represented families

- Poaceae (grasses)
- Asteraceae (asters, goldenrods, coneflowers)
- Fabaceae (legumes)
- Lamiaceae (mints)



Missing families

- Liliaceae (wood lily, false Solomon's seal)
- Orchidaceae (ladies' tresses, lady's slipper)
- Convolvulaceae (native bindweeds)
- Caprifoliaceae (native honeysuckles)
- Caryophyllaceae (native chickweeds andampions)
- Polygonaceae (milkworts, snakeroot)
- Rosaceae (roses, strawberries, cinquefoil, Spiraea)
- Violaceae (violets)



Seeds per square foot vs. pounds per acre

Great blue lobelia (*Lobelia siphilitca*)

- 500,000 seeds/oz.
- 8,000,000 seeds/lb.
- **1 lb. of seed/acre = 184 seeds/ft²**



Cup plant (*Silphium perfoliatum*)

- 1,400 seeds/oz.
- 22,400 seeds/lb.
- **1 lb. of seed/acre = 0.5 seeds/ft²**



Photos: Prairie Moon Nursery

How to decide on seeding rates?



TABLE 1

Recommended minimum number of species and seeding rates by soil moisture for a diverse prairie seed mix planted in Iowa.

Plant Guild	Number of Species					Seeding Rates (seeds/square foot)				
	Wet	Wet-Mesic	Mesic	Dry-Mesic	Dry	Wet	Wet-Mesic	Mesic	Dry-Mesic	Dry
Cool-season Grasses	4	1	2	1	3	10.00	3.00	1.25	1.25	4.00
Warm-season Grasses	1	3	7	8	9	0.15	5.00	18.50	21.50	22.50
Sedges/Rushes	6	9	4	2	2	23.00	24.00	2.00	0.28	0.27
Legumes	1	2	6	7	10	0.10	1.10	3.78	4.65	3.50
Non-Legume Forbs	30	29	27	35	31	35.00	29.00	18.30	17.60	19.20
Total	42	44	46	53	55	68.25	62.10	43.83	45.28	49.47

Source: Tallgrass Prairie Center



Wild bergamot (*Monarda fistulosa*) at ~6.5 seeds/sq.ft.

Photos: Anne Stine / Xerces Society (top); Tom Ryan (bottom)

Seeding rates – additional considerations

- Limit annuals + biennials
 - TPC recommends: ≤ 1 seed/square foot
 - Aim for $\leq 10\%$ of mix
- Consider easy vs. difficult to germinate
 - Get to know Prairie Moon Nursery's germination codes
- Reduce rates for aggressive species
 - big bluestem, Indian grass
 - sunflowers
 - cup plant – no more than 0.01 seeds/sq. ft.
 - wild bergamot – no more than 4 seeds/sq. ft.
- Seed cost
- Consider multiple seeding events over time
- Consider bare rootstock or transplants for restoration conservative species
 - Aim for min. 30-50 individuals to sustain a population

Evaluating Seed Mixes – the Key Questions

Common Name	Scientific Name	% of Mix	Seeds/ft ²	Total lb
Grasses				
Big Bluestem	<i>Andropogon gerardii</i>	13.75%	2.2	11.000 PLS lb
Sideoats Grama	<i>Bouteloua curtipendula</i>	12.50%	2.1	10.000 PLS lb
Canada Wild Rye	<i>Elymus canadensis</i>	10.00%	0.9	8.000 PLS lb
Little Bluestem	<i>Schizachyrium scoparium</i>	13.75%	3.6	11.000 PLS lb
Forbs				
Canada Milk Vetch	<i>Astragalus canadensis</i>	2.50%	0.6	2.000 PLS lb
Partridge Pea	<i>Chamaecrista fasciculata</i>	6.25%	0.2	5.000 PLS lb
Sand Coreopsis	<i>Coreopsis lanceolata</i>	8.75%	2.6	7.000 PLS lb
Purple Prairie Clover	<i>Dalea purpurea</i>	10.00%	2.6	8.000 PLS lb
Sawtooth Sunflower	<i>Helianthus grosseserratus</i>	0.13%	0.0	0.100 PLS lb
Maximillian's Sunflower	<i>Helianthus maximiliani</i>	3.75%	0.7	3.000 PLS lb
Great Blue Lobelia	<i>Lobelia siphilitica</i>	0.25%	1.8	0.200 PLS lb
Wild Bergamot	<i>Monarda fistulosa</i>	1.50%	1.5	1.200 PLS lb
Common Evening Primrose	<i>Oenothera biennis</i>	4.00%	5.3	3.200 PLS lb
Foxglove Beardtongue	<i>Penstemon digitalis</i>	0.13%	0.2	0.100 PLS lb
Long-headed Coneflower	<i>Ratibida columnifera</i>	8.50%	5.2	6.800 PLS lb
Black-eyed Susan	<i>Rudbeckia hirta</i>	3.88%	5.2	3.100 PLS lb
Stiff Goldenrod	<i>Solidago rigida</i>	0.25%	0.2	0.200 PLS lb
Golden Alexanders	<i>Zizia aurea</i>	0.13%	0.0	0.100 PLS lb

- How many species?
- Forb : grass ratio?
- Number of seeds/ft²?
- 3 species blooming in each season?
- Butterfly host plants?
- Plant family diversity?
- Number of annuals and biennials?
- Regionally appropriate species?
- Any species dominating the mix?
- Soil moisture types?
- Cost?

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Golden Alexanders	Zizia aurea	0.13%	0.0	0.100 PLS lb
		50%	8.8	
		50%	26.1	

~ 35 seeds/ft²

- How many species? **18**
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Purple Prairie Clover	Dalea purpurea	10.00%	2.6	8.000 PLS lb
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- Butterfly host plants? **None for monarchs**
- Plant family diversity? **7 families**
- Number of annuals and biennials?
- Regionally appropriate species?
- Any species dominating the mix?
- Soil moisture types?
- Cost?

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		50%	8.8	
Forbs				
Canada Milk Vetch	Astragalus canadensis	2.50%	0.6	2.000 PLS lb
Partridge Pea	Chamaecrista fasciculata	6.25%	Annual 0.2	5.000 PLS lb
Spring Sand Coreopsis	Coreopsis lanceolata	8.75%	2.6	7.000 PLS lb
Purple Prairie Clover	Dalea purpurea	10.00%	2.6	8.000 PLS lb
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- 3 species blooming in each season? **Yes**
- Butterfly host plants? **None for monarchs**
- Plant family diversity? **7 families**
- Number of annuals and biennials? **3 species = 31% of total mix**
- Regionally appropriate species?
- Any species dominating the mix?
- Soil moisture types?
- Cost?

BWSR Tech Talk: Conservation Seeding Calculator with new Certification and Checkout Functionalities

June 14, 2021

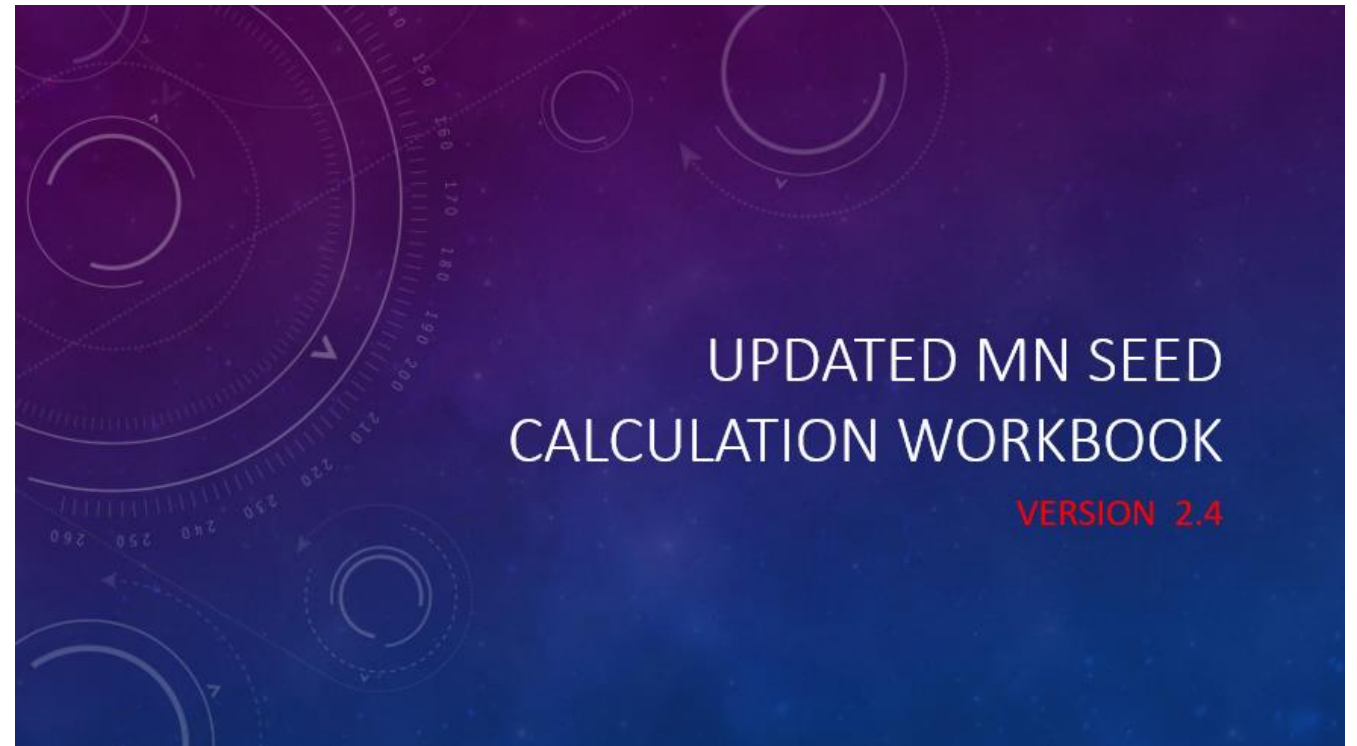
Eric Anderson, NW Area Resource Conservationist

eric.anderson@usda.gov

Find the new calculator here:

Field Office Technical Guide

- Section IV
- Ecological Sciences Tools
- MN EST Seedcalc ver2.5
seedtag and checkout May
2021



Real example:

Can I use this mix for my CP25 planting?

Does it support pollinators?

Common Name	Scientific Name	% of Mix	Seeds/ft ²	Total
Grasses				
Slender Wheatgrass	Agropyron trachycaulum	7.83%	1.6	0.450 PLS lb
Big Bluestem	Andropogon gerardii	17.39%	4.0	1.000 PLS lb
Sideoats Grama	Bouteloua curtipendula	13.91%	3.3	0.800 PLS lb
Blue Grama	Bouteloua gracilis	1.74%	1.7	0.100 PLS lb
Canada Wild Rye	Elymus canadensis	12.17%	1.8	0.700 PLS lb
Switchgrass	Panicum virgatum	1.74%	0.9	0.100 PLS lb
Little Bluestem	Schizachyrium scoparium	13.04%	4.9	0.750 PLS lb
Indiangrass	Sorghastrum nutans	10.43%	2.7	0.600 PLS lb
Forbs				
Anise Hyssop	Agastache foeniculum	0.26%	0.5	0.015 PLS lb
Lead Plant	Amorpha canescens	0.35%	0.1	0.020 PLS lb
Common Milkweed	Asclepias syriaca	1.39%	0.1	0.080 PLS lb
Smooth Blue Aster	Aster laevis	0.17%	0.2	0.010 PLS lb
Canada Milk Vetch	Astragalus canadensis	1.04%	0.4	0.060 PLS lb
Partridge Pea	Chamaecrista fasciculata	3.13%	0.2	0.180 PLS lb
White Prairie Clover	Dalea candidum	2.26%	0.9	0.130 PLS lb
Purple Prairie Clover	Dalea purpurea	2.61%	1.0	0.150 PLS lb
Showy Tick Trefoil	Desmodium canadense	0.87%	0.1	0.050 PLS lb
Showy Sunflower	Helianthus laetiflorus	0.26%	0.0	0.015 PLS lb
Maximilian's Sunflower	Helianthus maximiliani	0.52%	0.1	0.030 PLS lb
Ox-eye Sunflower	Heliopsis helianthoides	1.13%	0.2	0.065 PLS lb
Round-headed Bush Clover	Lespedeza capitata	0.70%	0.1	0.040 PLS lb
Prairie Blazingstar	Liatris pycnostachya	0.26%	0.1	0.015 PLS lb
Great Blue Lobelia	Lobelia siphilitica	0.09%	0.9	0.005 PLS lb
Wild Bergamot	Monarda fistulosa	0.35%	0.5	0.020 PLS lb
Common Evening Primrose	Oenothera biennis	0.52%	1.0	0.030 PLS lb
Foxglove Beardtongue	Penstemon digitalis	0.26%	0.7	0.015 PLS lb
Large-flowered Beardtongue	Penstemon grandiflorus	0.35%	0.1	0.020 PLS lb
Prairie Cinquefoil	Potentilla arguta	0.35%	1.7	0.020 PLS lb
Long-headed Coneflower	Ratibida columnifera	1.74%	1.5	0.100 PLS lb
Yellow Coneflower	Ratibida pinnata	0.43%	0.3	0.025 PLS lb
Black-eyed Susan	Rudbeckia hirta	0.96%	1.9	0.055 PLS lb
Stiff Goldenrod	Solidago rigida	0.43%	0.4	0.025 PLS lb
Blue Vervain	Verbena hastata	0.26%	0.5	0.015 PLS lb
Hoary Vervain	Verbena stricta	0.35%	0.2	0.020 PLS lb
Common Ironweed	Vernonia fasciculata	0.26%	0.1	0.015 PLS lb
Culver's Root	Veronicastrum virginicum	0.09%	1.5	0.005 PLS lb
Golden Alexanders	Zizia aurea	0.35%	0.1	0.020 PLS lb

Real example: CP25 mix

Refer to MN Agronomy Tech Note #31 Practice Standard 643: Restoration and Management of Declining Habitats

- Seed mixes will consist of a minimum of 15 native species (**37**)
 - At least 5 grasses (**8**), 5 forbs (**29**)
 - one forb = legume (**5**)
- Minimum 35-40 seeds/sq. ft. (**36.4**)
- Maximum of 60% grasses based on seeds/sq. ft. (**57% grasses**)
- No more than 20% of grasses comprised of cool season grasses (**16%**)
- Switchgrass not to exceed 5% of grass component (**4%**)
- No individual forbs comprise more than 20% of the forb mixture ✓
- Optional criteria available to benefit monarchs, pollinators, and beneficial insects
 - 3 forbs in each bloom period
 - Monarch host plants and nectar plants

Common Name	Scientific Name	% of Mix	Seeds/ft ²	Total
Grasses				
Slender Wheatgrass	Agropyron trachycaulum	7.83%	1.6	0.450 PLS lb
Big Bluestem	Andropogon gerardii	17.39%	4.0	1.000 PLS lb
Sideoats Grama	Bouteloua curtipendula	13.91%	3.3	0.800 PLS lb
Blue Grama	Bouteloua gracilis	1.74%	1.7	0.100 PLS lb
Canada Wild Rye	Elymus canadensis	12.17%	1.8	0.700 PLS lb
Switchgrass	Panicum virgatum	1.74%	0.9	0.100 PLS lb
Little Bluestem	Schizachyrium scoparium	13.04%	4.9	0.750 PLS lb
Indiangrass	Sorghastrum nutans	10.43%	2.7	0.600 PLS lb
Forbs				
Anise Hyssop	Agastache foeniculum	0.26%	0.5	0.015 PLS lb
Lead Plant	Amorpha canescens	0.35%	0.1	0.020 PLS lb
Common Milkweed	Asclepias syriaca	1.39%	0.1	0.080 PLS lb
Smooth Blue Aster	Aster laevis	0.17%	0.2	0.010 PLS lb
Canada Milk Vetch	Astragalus canadensis	1.04%	0.4	0.060 PLS lb
Partridge Pea	Chamaecrista fasciculata	3.13%	0.2	0.180 PLS lb
White Prairie Clover	Dalea candidum	2.26%	0.9	0.130 PLS lb
Purple Prairie Clover	Dalea purpurea	2.61%	1.0	0.150 PLS lb
Showy Tick Trefoil	Desmodium canadense	0.87%	0.1	0.050 PLS lb
Showy Sunflower	Helianthus laetiflorus	0.26%	0.0	0.015 PLS lb
Maximilian's Sunflower	Helianthus maximiliani	0.52%	0.1	0.030 PLS lb
Ox-eye Sunflower	Heliopsis helianthoides	1.13%	0.2	0.065 PLS lb
Round-headed Bush Clover	Lespedeza capitata	0.70%	0.1	0.040 PLS lb
Prairie Blazingstar	Liatris pycnostachya	0.26%	0.1	0.015 PLS lb
Great Blue Lobelia	Lobelia siphilitica	0.09%	0.9	0.005 PLS lb
Wild Bergamot	Monarda fistulosa	0.35%	0.5	0.020 PLS lb
Common Evening Primrose	Oenothera biennis	0.52%	1.0	0.030 PLS lb
Foxglove Beardtongue	Penstemon digitalis	0.26%	0.7	0.015 PLS lb
Large-flowered Beardtongue	Penstemon grandiflorus	0.35%	0.1	0.020 PLS lb
Prairie Cinquefoil	Potentilla arguta	0.35%	1.7	0.020 PLS lb
Long-headed Coneflower	Ratibida columnifera	1.74%	1.5	0.100 PLS lb
Yellow Coneflower	Ratibida pinnata	0.43%	0.3	0.025 PLS lb
Black-eyed Susan	Rudbeckia hirta	0.96%	1.9	0.055 PLS lb
Stiff Goldenrod	Solidago rigida	0.43%	0.4	0.025 PLS lb
Blue Vervain	Verbena hastata	0.26%	0.5	0.015 PLS lb
Hoary Vervain	Verbena stricta	0.35%	0.2	0.020 PLS lb
Common Ironweed	Vernonia fasciculata	0.26%	0.1	0.015 PLS lb
Culver's Root	Veronicastrum virginicum	0.09%	1.5	0.005 PLS lb
Golden Alexanders	Zizia aurea	0.35%	0.1	0.020 PLS lb

Enter all data into green fields

643 TALLGRASS PRAIRIE

Seed Mix Design

DATE 6/26/2021

COPY TO SEEDING PLAN

Clear Cells

Tract / Field

Acres To Seed

Background Information

LANDOWNER

PLANNER

Seed tag type

GRASS SPECIES	Input Desired PLS	N/A	N/A	PLANNED % OF GRASS COMPONENT BY SEEDS/SQ. FOOT	Planned PLS/ Acre in lbs.	TOTAL SEEDS/ SQ. FOOT	% OF GRASS MIX BY SEEDS/FT 1/		SEEDS/ SQ. FOOT At 1 lb. Rate	COC Selected	COC Reference 6/	Pounds PLS
				Planned			Can't Exceed	Planned %				
WARM SEASON 7/												
Big Bluestem				0 to 25	0.00	0.00	#DIV/0!	#DIV/0!	176000	4.0	4	0.00
Blue Grama				0 to 20	0.00	0.00	#DIV/0!	#DIV/0!	750000	17.2	8	0.00
Indiangrass				0 to 25	0.00	0.00	#DIV/0!	#DIV/0!	193000	4.4	4	0.00
Little Bluestem				0 to 30	0.00	0.00	#DIV/0!	#DIV/0!	286000	6.6	5	0.00
Prairie Cordgrass				0 to 5	0.00	0.00	#DIV/0!	#DIV/0!	183000	4.2	4	0.00
Prairie Dropseed				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!	224000	5.1	9	0.00
Prairie Sandreed				0 to 30	0.00	0.00	#DIV/0!	#DIV/0!	275000	6.3	7	0.00
Rough Dropseed				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!	480000	11.0	9	0.00
Sideoats Grama				0 to 30	0.00	0.00	#DIV/0!	#DIV/0!	180000	4.1	6	0.00
Switchgrass				0 to 5	0.00	0.00	#DIV/0!	#DIV/0!	390000	9.0	5	0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00

COOL SEASON 2/ 7/

Canada Bluejoint				0 to 5	0.00	0.00	#DIV/0!	#DIV/0!	4480000	102.8	5	0.00
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643Tallgras CP23,25,28,37,38

Enter all data into green fields

643 TALLGRASS PRAIRIE

Seed Mix Design

DATE 6/26/2021

COPY TO SEEDING PLAN

Clear Cells

LANDOWNER Example

N/A

Tract / Field

PLANNER Jokela

N/A 0.00

Acres To Seed 14.50

Seed tag type

Background Information

GRASS SPECIES	Input desired PLS	N/A	N/A	PLANNED % OF GRASS COMPONENT BY SEEDS/SQ. FOOT	Planned PLS/ Acre in lbs.	TOTAL SEEDS/ SQ. FOOT	% OF GRASS MIX BY SEEDS/FT 1/		SEEDS/ SQ. FOOT At 1 lb. Rate	COC Selected	COC Reference 6/	Pounds PLS	
				Planned			Can't Exceed	Planned %					
WARM SEASON 7/													
Big Bluestem	1			0 to 25	1.00	4.04	19.2	OK	176000	4.0	4	4	14.50
Blue Grama	0.1			0 to 20	0.10	1.72	8.2	OK	750000	17.2	8	8	1.45
Indiangrass	0.6			0 to 25	0.60	2.66	12.7	OK	193000	4.4	4	4	8.70
Little Bluestem	0.75			0 to 30	0.75	4.92	23.5	OK	286000	6.6	5	5	10.88
Prairie Cordgrass				0 to 5	0.00	0.00	0.0	OK	183000	4.2		4	0.00
Prairie Dropseed				0 to 10	0.00	0.00	0.0	OK	224000	5.1		9	0.00
Prairie Sandreed				0 to 30	0.00	0.00	0.0	OK	275000	6.3		7	0.00
Rough Dropseed				0 to 10	0.00	0.00	0.0	OK	480000	11.0		9	0.00
Sideoats Grama	0.8			0 to 30	0.80	3.31	15.7	OK	180000	4.1	6	6	11.60
Switchgrass	0.1			0 to 5	0.10	0.90	4.3	OK	390000	9.0	5	5	1.45
				0 to 10	0.00	0.00	0.0	OK		0.0			0.00
				0 to 10	0.00	0.00	0.0	OK		0.0			0.00
				0 to 10	0.00	0.00	0.0	OK		0.0			0.00
				0 to 10	0.00	0.00	0.0	OK		0.0			0.00
				0 to 10	0.00	0.00	0.0	OK		0.0			0.00
				0 to 10	0.00	0.00	0.0	OK		0.0			0.00
COOL SEASON 2/ 7/													

FORB SPECIES	Input desired PLS	N/A	N/A	Planned PLS/ Acre in ounces.	TOTAL SEEDS/ SQ. FOOT	% OF FORB MIX BY SEEDS/FT 3/	Background Information				Pollinator Monarch Preferred (Blue)	Ounces PLS	
							SEEDS/oz	SEEDS/ SQ. FOOT At 1 oz/ac Rate	COC Selected	COC Reference			
DRY													
Bush Clover	0.55			0.55	0.10	0.6	OK	8000	0.18	3	3	Late	7.98
Culvers Root	0.082			0.08	1.51	9.2	OK	800000	18.37	5	5	Mid	1.19
Dotted Blazingstar				0.00	0.00	0.0	OK	7000	0.16		8	Mid	0.00
Purple Coneflower, Narrow Leaved				0.00	0.00	0.0	OK	7000	0.16		8	Mid	0.00
Prairie Cinquefoil	0.322			0.32	1.70	10.4	OK	230000	5.28	8	8	Late	4.67
Showy Penstemon	0.3			0.30	0.10	0.6	OK	14000	0.32	5	5	Early	4.35
Stiff Sunflower	0.1			0.10	0.01	0.1	OK	4000	0.09	5	5	Mid	1.45
Silky Aster				0.00	0.00	0.0	OK	26000	0.60		10	Late	0.00
DRY to MESIC													
Butterfly Weed				0.00	0.00	0.0	OK	4300	0.10		6	Mid	0.00
Canada Milkvetch	1.03			1.03	0.40	2.5	OK	17000	0.39	4	4	Mid	14.94
Compass Plant				0.00	0.00	0.0	OK	660	0.02		7	Mid	0.00
Evening Primrose	0.485			0.49	1.00	6.1	OK	90000	2.07	4	4	Mid	7.03
Foxglove Beardtongue	0.235			0.24	0.70	4.3	OK	130000	2.98	5	5	Early	3.41
Heart-leaved Alexander				0.00	0.00	0.0	OK	12000	0.28		8	Early	0.00
Heath Aster				0.00	0.00	0.0	OK	200000	4.59		3	Late	0.00
Hoary Vervain	0.31			0.31	0.20	1.2	OK	28000	0.64	1	1	Mid	4.50
Lance-leaved Coreopsis				0.00	0.00	0.0	OK	20000	0.46		5	Early	0.00
Leadplant	0.27			0.27	0.10	0.6	OK	16000	0.37	8	8	Mid	3.92
Long-headed Coneflower	1.56			1.56	1.50	9.2	OK	42000	0.96	5	5	Mid	22.62
Ontario Blazingstar				0.00	0.00	0.0	OK	14000	0.32		8	Late	0.00
Prairie Smoke				0.00	0.00	0.0	OK	27000	0.62		8	Early	0.00
Rough Blazingstar				0.00	0.00	0.0	OK	16000	0.37		8	Late	0.00
Showy Goldenrod				0.00	0.00	0.0	OK	95000	2.18		7	Late	0.00
Smooth Aster	0.16			0.16	0.20	1.2	OK	55000	1.26	7	7	Late	2.32
Spotted Beebalm				0.00	0.00	0.0	OK	70000	1.61		6	Mid	0.00
Stiff Tickseed				0.00	0.00	0.0	OK	10000	0.23		7	Mid	0.00
Thimbleweed				0.00	0.00	0.0	OK	26000	0.60		7	Mid	0.00
Whorled Milkweed				0.00	0.00	0.0	OK	11000	0.25		4	Mid-Late	0.00

Real example: CP25 mix / 643 Pollinator *proposed* mix

TOTAL SEEDS/FT 4/	36.4	OK	3/ Individual species not to exceed 20% of the forb component by seeds/ft
PERCENT GRASS 5/	57.67	OK	4/ Minimum 35-40 seeds/square foot
PERCENT FLOWER	42.33	OK	5/ Maximum 60% grasses
AVE. COC - MIX	4.7		6/ <i>Assignment of Coefficients</i>
SPECIES RICHNESS	37		0 to 3 : Plants with a high range of ecological tolerances/found in a variety of plant communities
			4 to 6 : Plants with an intermediate range of ecological tolerances/ associated with a specific plant community
			7 to 8 : Plants with a poor range of ecological tolerances/associated with advanced successional stage
			9 to 10 : Plants with a high degree of fidelity to a narrow range of pristine habitats
			7/ Consult with the appropriate NRCS Area Resource Conservationist or Biologist for prior approval of additional species.

- Optional criteria available to benefit monarchs, pollinators, and beneficial insects
 - 3 forbs in each bloom period ✓
 - Monarch host plants and nectar plants
 - Common milkweed makes up 0.6% of the mix (Monarch mixes should have $\geq 1\%$ milkweed) ❌
 - 60% of the forbs in the mix should be monarch nectar plants (based on seeds/sq. ft.) ✓

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- Optional criteria available to benefit monarchs, pollinators, and beneficial insects
 - 3 forbs in each bloom period
 - Monarch host plants and nectar plants ✓
 - Common milkweed makes up 0.6% of the mix (Monarch mixes should have $\geq 1\%$ milkweed) ❌
 - 60% of the forbs in the mix should be monarch nectar plants (based on seeds/sq. ft.) ✓

PSA: Save a digital copy of your planned / designed mix.
 “Save as” a NEW version for your certification process!

Real example: CP 25 mix (seed tags) that was *actually* planted

Large Seed: 81.12 Bulk lb
Small Seed: 13.61 Bulk lb

Bulk lb/Acre
6.53

94.73 Bulk lb

80.48 PLS lb

14.5 Acres

Mix %	PLS lb	Bulk lb	Lot Number	Common Name	Scientific Name	Variety	Origin	Mix Purity	Species Purity	Germ	Hard or Dormant	TZ	Total Viable	PLS
9.91%	7.98	8.24	AGRTRA150B	Slender Wheatgrass	Agropyron trachycaulum	Revenue	Canada	8.50%	97.81%	99.00%	0.00%		99.00%	96.83%
14.41%	11.60	15.00	ANDGER010J	Big Bluestem	Andropogon gerardii	Not Stated	MN	13.31%	84.05%	17.00%	75.00%		92.00%	77.33%
22.52%	18.13	21.01	BOUCUR010B	Sideoats Grama	Bouteloua curtipendula	Not Stated	MN	21.74%	98.03%	61.00%	27.00%		88.00%	86.27%
0.90%	0.73	0.87	BOUGRA121A	Blue Grama	Bouteloua gracilis	Not Stated	MN	0.81%	87.55%	52.00%	43.00%		95.00%	83.17%
3.60%	2.90	3.56	ELYCAN010A	Canada Wild Rye	Elymus canadensis	Not Stated	WI	3.36%	89.57%	81.00%	10.00%		91.00%	81.51%
1.80%	1.45	1.58	PANVIR010B	Switchgrass	Panicum virgatum	Not Stated	MN	1.65%	98.93%	21.00%	72.00%		93.00%	92.00%
11.71%	9.43	12.47	SCHSCO010A	Little Bluestem	Schizachyrium scoparium	Not Stated	MN	10.81%	82.15%	69.00%	23.00%		92.00%	75.58%
9.91%	7.98	9.80	SORNUT310A	Indiangrass	Sorghastrum nutans	Not Stated	MN	8.86%	85.66%	5.00%	90.00%		95.00%	81.38%
2.70%	2.18	2.22	SPOASP021A	Rough Dropseed	Sporobolus aspera	Not Stated	MN	2.34%	99.96%	34.00%	64.00%		98.00%	97.96%
0.27%	0.22	0.24	ACHMIL021A	Western Yarrow	Achillea millefolium	Not Stated	MN	0.25%	96.28%	91.00%	2.00%		93.00%	89.54%
0.36%	0.29	0.33	AMOCAN121B	Lead Plant	Amorpha canescens	Not Stated	MN	0.35%	99.72%	42.00%	46.00%		88.00%	87.75%
1.44%	1.16	1.20	ASCSYR010G	Common Milkweed	Asclepias syriaca	Not Stated	MN	1.25%	98.25%	52.00%	46.00%		98.00%	96.29%
0.18%	0.15	0.16	ASTLAE021A	Smooth Blue Aster	Aster laevis	Not Stated	MN	0.15%	93.78%			99.00%	99.00%	92.84%
1.08%	0.87	0.90	ASTCAN018C	Canada Milk Vetch	Astragalus canadensis	Not Stated	IA	0.95%	99.42%	24.00%	73.00%		97.00%	96.44%
3.24%	2.61	3.35	CHAFAS019A	Partridge Pea	Chamaecrista fasciculata	Not Stated	MN	3.53%	99.88%	26.00%	52.00%		78.00%	77.91%
2.34%	1.89	1.97	DALCAN120A	White Prairie Clover	Dalea candidum	Not Stated	MN	2.05%	98.74%	26.00%	71.00%		97.00%	95.78%
2.70%	2.18	2.32	DALPUR129D	Purple Prairie Clover	Dalea purpurea	Not Stated	MN	2.44%	99.69%	53.00%	41.00%		94.00%	93.71%
0.90%	0.73	0.77	DESCAN020A	Showy Tick Trefoil	Desmodium canadense	Not Stated	IA	0.80%	98.55%	94.00%	2.00%		96.00%	94.61%
0.27%	0.22	0.23	HELLAE570A	Showy Sunflower	Helianthus laetiflorus	Not Stated	ND	0.23%	95.46%	12.00%	87.00%		99.00%	94.51%
0.54%	0.44	0.62	HELMAX129B	Maximilian's Sunflower	Helianthus maximiliani	Not Stated	Canada	0.63%	96.75%	35.00%	38.00%		73.00%	70.63%
1.17%	0.94	0.97	HELHEL078A	Ox-eye Sunflower	Heliopsis helianthoides	Not Stated	IA	1.01%	97.87%	98.00%	1.00%		99.00%	96.89%
0.72%	0.58	0.59	LESCAP460A	Round-headed Bush Clover	Lespedeza capitata	Not Stated	IA	0.62%	99.98%	91.00%	7.00%		98.00%	97.98%

New species



Certifying the mix: Was enough seed planted?

Values carried over from Input desired PLS column



643 TALLGRASS PRAIRIE
Seeding Checkout



DATE 6/26/2021

COPY TO SEEDING PLAN

LANDOWNER Example

Total Bulk Seed

Tract / Field

PLANNER Jokela

Bulk Seed /Ac. 0.00

Acres Seeded 14.50

Clear Cells

Seed tag type

Background Information

GRASS SPECIES	Purity%	N/A	Germ% (Total Viable)	PLANNED % OF GRASS COMPONENT BY SEEDS/SQ. FOOT	Applied PLS/Acre in lbs.	TOTAL SEEDS/ SQ. FOOT	% OF GRASS MIX BY SEEDS/FT 1/		SEEDS/ SQ. FOOT At 1 lb. Rate	COC Selected	COC Reference 6/	Pounds PLS
				Planned			Can't Exceed	Planned %				
WARM SEASON 7/												
Big Bluestem	1			0 to 25	0.00	0.00	#DIV/0!	#DIV/0!	176000	4.0	4	0.00
Blue Grama	0.1			0 to 20	0.00	0.00	#DIV/0!	#DIV/0!	750000	17.2	8	0.00
Indiangrass	0.6			0 to 25	0.00	0.00	#DIV/0!	#DIV/0!	193000	4.4	4	0.00
Little Bluestem	0.75			0 to 30	0.00	0.00	#DIV/0!	#DIV/0!	286000	6.6	5	0.00
Prairie Cordgrass				0 to 5	0.00	0.00	#DIV/0!	#DIV/0!	183000	4.2	4	0.00
Prairie Dropseed				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!	224000	5.1	9	0.00
Prairie Sandreed				0 to 30	0.00	0.00	#DIV/0!	#DIV/0!	275000	6.3	7	0.00
Rough Dropseed				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!	480000	11.0	9	0.00
Sideoats Grama	0.8			0 to 30	0.00	0.00	#DIV/0!	#DIV/0!	180000	4.1	6	0.00
Switchgrass	0.1			0 to 5	0.00	0.00	#DIV/0!	#DIV/0!	390000	9.0	5	0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
				0 to 10	0.00	0.00	#DIV/0!	#DIV/0!		0.0		0.00
COOL SEASON 2/ 7/												

Large Seed: 81.12 Bulk lb
Small Seed: 13.61 Bulk lb

Bulk lb/Acre
6.53

94.73 Bulk lb
80.48 PLS lb

14.5 Acres

Mix %	PLS lb	Bulk lb	Lot Number	Common Name	Scientific Name	Variety	Origin	Mix Purity	Species Purity	Germ	Hard or Dormant	TZ	Total Viable	PLS
9.91%	7.98	8.24	AGRTRA150B	Slender Wheatgrass	Agropyron trachycaulum	Revenue	Canada	8.50%	97.81%	99.00%	0.00%		99.00%	96.83%
14.41%	11.60	15.00	ANDGER010J	Big Bluestem	Andropogon gerardii	Not Stated	MN	13.31%	84.05%	17.00%	75.00%		92.00%	77.33%
22.52%	18.13	21.01	BOUCUR010B	Sideoats Grama	Bouteloua curtipendula	Not Stated	MN	21.74%	98.03%	81.00%	27.00%		88.00%	86.27%

643 TALLGRASS PRAIRIE

Seeding Checkout

LANDOWNER	Example	Total Bulk Seed	94.73	DATE	6/27/2021	COPY TO SEEDING PLAN
PLANNER	Jokela	Bulk Seed /Ac.	6.53	Tract / Field		
Seed tag type	Tag has both purity and % of mix (purity, %of mix, germ)			Acres Seeded	14.50	

Background Information

GRASS SPECIES	Purity%	% of Mix	Germ% (Total Viable)	PLANNED % OF GRASS COMPONENT BY SEEDS/SQ. FOOT	Applied PL S/Acre in lbs.	TOTAL SEEDS/ SQ. FOOT	% OF GRASS MIX BY SEEDS/FT 1/		SEEDS/ SQ. FOOT At 1 lb. Rate	COC Selected	COC Reference 6/	Pounds PLS	
				Planned			Can't Exceed	Planned %					
WARM SEASON 7/													
Big Bluestem	84.05	13.31	92	0 to 25	0.67	2.72	14.3	OK	176000	4.0	4	4	9.75
Blue Grama	87.55	0.81	95	0 to 20	0.04	0.76	4.0	OK	750000	17.2	8	8	0.64
Indiangrass	85.66	8.86	95	0 to 25	0.47	2.09	11.0	OK	193000	4.4	4	4	6.83
Little Bluestem	82.15	10.81	92	0 to 30	0.53	3.50	18.4	OK	286000	6.6	5	5	7.74
Prairie Cordgrass				0 to 5	0.00	0.00	0.0	OK	183000	4.2		4	0.00
Prairie Dropseed				0 to 10	0.00	0.00	0.0	OK	224000	5.1		9	0.00
Prairie Sandreed				0 to 30	0.00	0.00	0.0	OK	275000	6.3		7	0.00
Rough Dropseed	99.96	2.34	98	0 to 10	0.15	1.65	8.7	OK	480000	11.0	9	9	2.17
Sideoats Grama	98.03	21.74	88	0 to 30	1.23	5.06	26.6	OK	180000	4.1	6	6	17.77
Switchgrass	98.93	1.65	93	0 to 5	0.10	0.89	4.7	OK	390000	9.0	5	5	1.44

Large Seed: 81.12 Bulk lb
Small Seed: 13.61 Bulk lb

Bulk lb/Acre
6.53

14.5 Acres

94.73 Bulk lb
80.48 PLS lb

Mix %	PLS lb	Bulk lb	Lot Number	Common Name	Scientific Name	Variety	Origin	Mix Purity	Species Purity	Germ	Hard or Dormant	TZ	Total Viable	PLS
9.91%	7.98	8.24	AGRTRA150B	Slender Wheatgrass	Agropyron trachycaulum	Revenue	Canada	8.50%	97.81%	99.00%	0.00%		99.00%	96.83%
14.41%	11.60	15.00	ANDGER010J	Big Bluestem	Andropogon gerardii	Not Stated	MN	13.21%	84.05%	17.00%	75.00%		92.00%	77.33%
22.52%	18.13	21.01	BOUCUR010B	Sideoats Grama	Bouteloua curtipendula	Not Stated	MN	21.74%	98.03%	61.00%	27.00%		88.00%	86.27%

643 TALLGRASS PRAIRIE

Seeding Checkout

DATE	6/27/2021	COPY TO SEEDING PLAN
Total Bulk Seed	94.73	
LANDOWNER	Example	
Bulk Seed /Ac.	6.53	
Tract / Field		Clear Cells
PLANNER	Jokela	
Acres Seeded	14.50	
Seed tag type	Tag has both purity and % of mix (purity, %of mix, germ)	

Background Information

GRASS SPECIES	Purity%	% of Mix	Germ% (Total Viable)	PLANNED % OF GRASS COMPONENT BY SEEDS/SQ. FOOT	Applied PLS/Acre in lbs.	TOTAL SEEDS/ SQ. FOOT	% OF GRASS MIX BY SEEDS/FT 1/		SEEDS/ SQ. FOOT At 1 lb. Rate	COC Selected	COC Reference 6/	Pounds PLS
				Planned			Can't Exceed	Planned %				
WARM SEASON 7/												
Big Bluestem	84.05	13.31	92	0 to 25	0.67	2.72	14.3	OK	176000	4	4	9.75
Blue Grama	87.55	0.81	95	0 to 20	0.04	0.76	4.0	OK	750000	17.2	8	0.64
Indiangrass	85.66	8.86	95	0 to 25	0.47	2.09	11.0	OK	193000	4.4	4	6.83
Little Bluestem	82.15	10.81	92	0 to 30	0.53	3.50	18.4	OK	286000	6.6	5	7.74
Prairie Cordgrass				0 to 5	0.00	0.00	0.0	OK	183000	4.2	4	0.00
Prairie Dropseed				0 to 10	0.00	0.00	0.0	OK	224000	5.1	9	0.00
Prairie Sandreed				0 to 30	0.00	0.00	0.0	OK	275000	6.3	7	0.00
Rough Dropseed	99.96	2.34	98	0 to 10	0.15	1.65	8.7	OK	480000	11.0	9	2.17
Sideoats Grama	98.03	21.74	88	0 to 30	1.23	5.06	26.6	OK	180000	4.1	6	17.77
Switchgrass	98.93	1.65	93	0 to 5	0.10	0.89	4.7	OK	390000	9.0	5	1.44

TOTAL SEEDS/FT 4/	34.5	LOW	3/ Individual species not to exceed 20% of the forb component by seeds/ft
PERCENT GRASS 5/	55.16	OK	4/ Minimum 35-40 seeds/square foot
PERCENT FLOWER	44.84	OK	5/ Maximum 60% grasses
AVE. COC - MIX	4.7		6/ Assignment of Coefficients
SPECIES RICHNESS	38		0 to 3 : Plants with a high range of ecological tolerances/found in a variety of plant communities
			4 to 6 : Plants with an intermediate range of ecological tolerances/ associated with a specific plant community
			7 to 8 : Plants with a poor range of ecological tolerances/associated with advanced successional stage
			9 to 10 : Plants with a high degree of fidelity to a narrow range of pristine habitats
			7/ Consult with the appropriate NRCS Area Resource Conservationist or Biologist for prior approval of additional species.

You've entered all the seed tag data ...
 now Copy to Checkout_Certification

643 TALLGRASS PRAIRIE														
Seeding Checkout														
LANDOWNER		Example		Total Bulk Seed		94.73		DATE		6/27/2021		<input type="button" value="COPY TO SEEDING PLAN"/> <input type="button" value="Clear Cells"/>		
PLANNER		Jokela		Bulk Seed /Ac.		6.53		Tract / Field						
Seed tag type		Tag has both purity and % of mix (purity, %of mix, germ)		Acres Seeded		14.50								
Background Information														
GRASS SPECIES	Purity%	% of Mix	Germ% (Total Viable)	PLANNED % OF GRASS COMPONENT BY SEEDS/SQ. FOOT	Applied PLS/Acre in lbs.	TOTAL SEEDS/ SQ. FOOT	% OF GRASS MIX BY SEEDS/FT 1/		SEEDS/ SQ. FOOT At 1 lb. Rate	COC Selected	COC Reference 6/	Pounds PLS		
				Planned			Can't Exceed	Planned %						
WARM SEASON 7/														
Big Bluestem	84.05	13.31	92	0 to 25	0.67	2.72	14.3	OK	176000	4.0	4	4	9.75	Andropogon gerardii
Blue Grama	87.55	0.81	95	0 to 20	0.04	0.76	4.0	OK	750000	17.2	8	8	0.64	Bouteloua gracilis
Indiangrass	85.66	8.86	95	0 to 25	0.47	2.09	11.0	OK	193000	4.4	4	4	6.83	Sorghastrum nutans
Little Bluestem	82.15	10.81	92	0 to 30	0.53	3.50	18.4	OK	286000	6.6	5	5	7.74	Schizachyrium scoparium

Copy to Checkout_Certification

Checkout and Certification

Name **Example**

Date **6/27/2021**

Prepared by **Jokela**

Tract No./ Field No.

Type of Seeding: **643 - Restoration of Rare or Declining Natural**

Field Area (acres): **14.50**

Planting Date **6/28/20**

CLEAR CONTENTS

HIDE / UNHIDE EXTRA ROWS

PRINT

Seeding Mix Summary

643 TALLGRASS PRAIRIE

Grasses/ Sedges	Common Name	Scientific Name	PLS Lbs/Acre	PLS Lbs
1	Big Bluestem	Andropogon gerardii	0.672392926	9.75
2	Blue Grama	Bouteloua gracilis	0.044013338	0.64
3	Indiangrass	Sorghastrum nutans	0.471036902	6.83
4	Little Bluestem	Schizachyrium scoparium	0.533753363	7.74
5	Rough Dropseed	Sporobolus compositus	0.149757201	2.17
6	Sideoats Grama	Bouteloua curtipendula	1.225238823	17.77
7	Switchgrass	Panicum virgatum	0.099177792	1.44
8	Canada Wildrye	Elymus canadensis	0.178921602	2.59
9	Slender Wheatgrass	Agropyron caninum	0.537720897	7.80

Seeding Evaluation and Checkout

TOTAL SEEDS/FT	34.5	LOW
Percent Grass	55.16	OK
percent forb	44.84	OK
Ave COC Mix	4.71	
species richness	38.00	

Real example: *Will this mix support a honey bee operation?*

Number of seeds/ft²? Forb : grass ratio? 3 species blooming in each season?

Number and percentage of annuals and biennials? Soil moisture types?

CUSTOMER NAME: [REDACTED] ACRES: 34.04
 MIX LOT NUMBER: PROJECT NAME: **MN CP 2/CP 27/CP 28** SEEDING RATE/ACRE: **8.49**

	LATIN NAME	LOT NUMBER	% MIX	ACTUAL PURITY	GERM	HARD/DORMANT	TOTAL VIABLE	ORIGIN	BULK/BAG	PLS/BAG
Native Black Eyed Susan	Rudbeckia hirta	16A6160	0.69	99.88	85	6	91	IA	0.13	0.12
MN Native Canada Milkvetch	Astragalus canadensis	F95152	0.30	99.06	16	81	97	MN	0.06	0.06
MN Native Evening Primrose	Oenothera biennis	OENBIE446B	0.13	99.60	40	46	86	MN	0.02	0.02
IA Native Illinois Bundleflower	Desmanthus illinoensis	170402	0.37	99.94	0	0	99	IA	0.07	0.07
ND Native Maximilian Sunflower	Helianthus maximiliani	RMAX17	0.09	89.28	1	84	85	ND	0.02	0.01
MS Native Maximilian Sunflower	Helianthus maximiliani	171H3N	0.08	97.09	11	84	95	CAN	0.01	0.01
MN Native Partridge Pea	Chamaecrista fasciculata	15661	0.41	99.83	10	79	89	MN	0.08	0.07
MN Native Prairie Coneflower	Ratibida columnifera	17822	1.30	90.89	0	0	85	MN	0.27	0.21
MN Native Purple Prairie Clover	Dalea purpurea	F9516	0.59	99.95	58	36	94	MN	0.11	0.11
Bison Big Bluestem	Andropogon gerardii	E5518	20.56	91.65	81	13	94	MN	4.32	3.72
Bad River Blue Grama	Bouteloua gracilis	E5559	1.17	86.34	95	2	97	MN	0.26	0.22
Bad River Blue Grama	Bouteloua gracilis	E5560	1.86	84.34	88	9	97	MN	0.42	0.35
Certified Mandan Canada Wildrye	Elymus canadensis	BT9924	6.68	97.70	91	6	97	WY	1.31	1.24
Tomahawk Indiangrass	Sorghastrum nutans	E5526	21.56	88.09	80	10	90	MN	4.69	3.72
Badlands Little Bluestem	Schizachyrium scoparium	E5553	4.34	63.92	63	32	95	MN	1.30	0.79
MN Native Sideoats Grama	Bouteloua curtipendula	E5536	8.05	91.00	86	9	95	MN	1.69	1.46
Certified Revenue Slender Wheatgrass	Elymus trachycaulis	17918AVS0949	10.81	99.02	96	2	98	CAN	2.09	2.03
Dacotah Switchgrass	Panicum virgatum	E6028	4.85	99.91	49	36	85	MN	0.93	0.79
Certified Rosana Western Wheatgrass	Pascopyrum smithii	6HW59350	6.74	95.74	93	3	96	WA	1.35	1.24

Multiple lots of the same species: consult with your ARC

In this case, since lots are roughly equal: ADD % of mix values and AVERAGE Purity and Total Viable

LATIN NAME	LOT NUMBER	% MIX	ACTUAL PURITY	GERM	HARD/DORMANT	TOTAL VIABLE	ORIGIN	BULK/BAG	PLS/BAG
<i>Rudbeckia hirta</i>	16A6180	0.69	99.88	85	6	91	IA	0.13	0.12
<i>Astragalus canadensis</i>	F95152	0.30	99.06	16	81	97	MN	0.06	0.06
<i>Oenothera biennis</i>	OENBIE446B	0.13	99.60	40	46	86	MN	0.02	0.02
<i>Desmanthus illinoensis</i>	170402	0.37	99.94	0	0	99	IA	0.07	0.07
<i>Helianthus maximiliani</i>	RMAX17	0.09	89.28	1	84	85	ND	0.02	0.01
<i>Helianthus maximiliani</i>	171H3N	0.08	97.09	11	84	95	CAN	0.01	0.01
<i>Chamaecrista fasciculata</i>	15661	0.41	99.83	10	79	89	MN	0.08	0.07
<i>Ratibida columnifera</i>	17822	1.30	90.89	0	0	85	MN	0.27	0.21
<i>Dalea purpurea</i>	F9516	0.59	99.95	58	36	94	MN	0.11	0.11
<i>Andropogon gerardii</i>	E5518	20.56	91.65	81	13	94	MN	4.32	3.72
<i>Bouteloua gracilis</i>	E5559	1.17	86.34	95	2	97	MN	0.26	0.22
<i>Bouteloua gracilis</i>	E5560	1.86	84.34	88	9	97	MN	0.42	0.35
<i>Elymus canadensis</i>	BT9924	6.69	97.70	91	6	97	WY	1.31	1.24
<i>Sorghastrum nutans</i>	E5526	21.56	88.09	80	10	90	MN	4.69	3.72
<i>Schizachyrium scoparium</i>	E5553	4.34	63.92	63	32	95	MN	1.30	0.79
<i>Bouteloua curtipendula</i>	E5536	5.05	91.00	36	9	95	MN	1.69	1.46
<i>Elymus trachycapus</i>	17918AVS0049	10.81	99.02	96	2	98	CAN	2.09	2.03
<i>Panicum virgatum</i>	E6028	4.85	99.91	49	36	85	MN	0.93	0.79
<i>Pascopyrum smithii</i>	6HW59350	6.74	95.74	93	3	96	WA	1.35	1.24

PROJECT NAME: MN CP2/CP2 7/CP28

SEEDING RATE/ACRE:

8.49

LATIN NAME	LOT NUMBER	% MIX	ACTUAL PURITY	GERM	HARD/DORMANT	TOTAL VIABLE	ORIGIN	BULK/BAG	PLS/BAG
Rudbeckia hirta	16A6150	0.69	99.88	85	6	91	IA	0.13	0.12
Astragalus canadensis	185152	0.30	99.06	16	1	97	IA	---	---

327 CONSERVATION COVER - NATIVE GRASS/FORBS

Seeding Checkout

DATE: 6/27/2021

LANDOWNER: Example

PLANNER: Karin Jokela

Seed tag type: Tag has both purity and % of mix (purity, % of mix, germ)

Total Bulk Seed: 288,999

Bulk Seed /Ac.: 8.49

TRACT/FIELD: []

Acres Seeded: 34.04

COPY TO SEEDING PLAN

Clear Inputs

Copy to Checkout Certification

GRASS SPECIES	Purity %	% of Mix	Germ % (Total Viable)	PLANNED % OF GRASS COMPONENT SEEDS/SQ. FOOT	Applied PLS/Acre in lbs.	TOTAL SEEDS/ SQ. FOOT	% OF GRASS MIX BY SEEDS/FT 1/	Can't Exceed	Planned %	SEEDS/ SQ. FOOT At 1 lb. Rate	COC Selected	COC Reference	Pounds PLS	
WARM SEASON 7/														
Big Bluestem	91.65	20.7	94	0 to 30	1.51	6.11	20.9	OK		176000	4	4	51.49	Andropo
Blue Grama	86.34	3.03	97	0 to 20	0.22	3.71	12.7	OK		750000	8	8	7.33	Boutelou
Indiangrass	88.09	21.6	90	0 to 30	1.45	6.43	22.0	OK		193000	4	4	49.40	Sorghastr
Little Bluestem	63.92	4.34	95	0 to 30	0.22	1.47	5.0	OK		286000	5	5	7.62	Schizach
Prairie Cordgrass				0 to 5	0.00	0.00	0.0	OK		183000	4	4	0.00	Spartina
Prairie Dropseed				0 to 10	0.00	0.00	0.0	OK		224000	9	9	0.00	Sporopol
Prairie Sandreed				0 to 30	0.00	0.00	0.0	OK		275000	7	7	0.00	Calamovi
Rough Dropseed				0 to 10	0.00	0.00	0.0	OK		480000	9	9	0.00	Sporobol
Sideoats Grama	91	8.05	95	0 to 30	0.59	2.44	8.4	OK		180000	6	6	20.11	Boutelou
Switchgrass	99.91	4.85	85	0 to 10	0.35	3.13	10.7	OK		390000	5	5	11.90	Panicum
				0 to 10	0.00	0.00	0.0	OK					0.00	
				0 to 10	0.00	0.00	0.0	OK					0.00	

				<u>3/ Individual species not to exceed 50% of the forb component by seeds/ft</u>
TOTAL SEEDS/FT <u>4/</u>	33.3	LOW	<u>4/ Minimum 35-40 seeds/square foot</u>	
PERCENT GRASS <u>5/</u>	87.89	OK	<u>5/ Maximum 90% grasses</u>	
PERCENT FLOWER	12.11	OK	<u>6/ Assignment of Coefficients</u>	
AVE. COC - MIX	4.6		0 to 3 : Plants with a high range of ecological tolerances/found in a variety of plant communities	
SPECIES RICHNESS	17		4 to 6 : Plants with an intermediate range of ecological tolerances/ associated with a specific plant community	
			7 to 8 : Plants with a poor range of ecological tolerances/associated with advanced successional stage	
			9 to 10 : Plants with a high degree of fidelity to a narrow range of pristine habitats	
			<u>7/ Consult with the appropriate NRCs Area Resource Conservationist or Biologist for prior approval of additional species.</u>	

- Number of seeds/ft²? **33.3**
- Forb : grass ratio? **~ 12% forbs (4.03 seeds/ft²)**
- 3 species blooming in each season? **No – 0 Early; 7 Mid; 1 Late**
- Number and percentage of annuals and biennials? **Most are annuals, biennials, short-lived perennials (will fade out over time). Three species are longer-lived perennials, but they make up about 1% of the mix.**
- Soil moisture types? **Mismatched for this site, so forbs (and grasses) may not establish well anyway...**

Conclusion: not much honey bee forage built into this mix!



Photo: Eric Lee-Maer / Xerces Society

Final thoughts on the calculator

- The calculator doesn't have good judgement! It has a lot of checks built into it, but you still need to develop a discerning eye to make sure that the mix will perform well for your client's goals!
- Another update possible within the next year...
- Provide input to:
 - Eric.Anderson@usda.gov
 - Jeffrey.Kalin@usda.gov
 - Karin.Jokela@xerces.org



Summing it up

- Pollinators (and invertebrates) are not optional. They sustain us!
- Diversity is your panacea. It drives ecosystem function, productivity, stability, and resilience.
- YOU have the power to optimize seed mixes to achieve your restoration goals.

Photos: Chris Helzer / The Nature Conservancy



Questions?

Karin Jokela

Farm Bill Pollinator

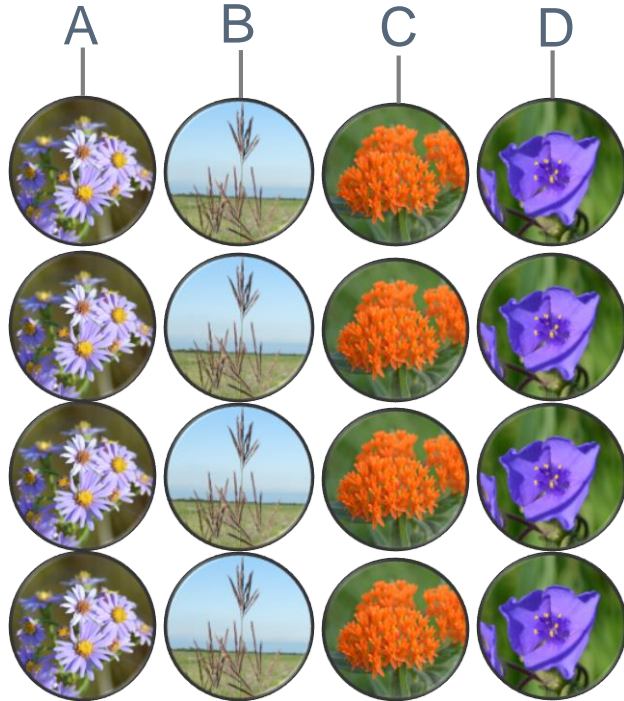
Conservation Planner and
NRCS Partner Biologist

karin.jokela@xerces.org

763-213-4341

Extra slides

What is diversity?



Richness: 4 species

Evenness:

A: 25%; B: 25%; C: 25%; D: 25%



Richness: 4 species

Evenness:

A: 12.5%; B: 69%; C: 12.5%; D: 6%

- **Abundance:** how many individuals of a species
- **Richness:** how many species are in the community
- **Evenness:** relative abundances across species

★ **Diversity:**
combination of
richness and
evenness

Restoration conservative species – consider planting bare roots or transplants



Bastard toadflax



Hoary puccoon



Wood betony



Wild strawberry



Leadplant



Downy gentian



Prairie phlox



**Blue-eyed
grass**



Prairie violet

Economics of diversity

Economic value \neq ecological value

Factors that can cause seed to be inexpensive:

- Short life cycle
- Easy to germinate
- Common species
- Mechanically harvested
- Small, hard seed
- Easy to clean
- Less shatter (seed retention)



Great St. John's wort



Pasque flower



Milkweed

Photos: Karin Jokela

Factors that can cause seed to be expensive:

- Species rarity
- Hand-harvested
- Spring-blooming
- Difficult germination requirements
- Irregular shaped seed
- Seed pests

Genus	Species	Common Name	% of MIX (seeds/ sq. ft.)	Seeding rate (seed/ft2)	Seeding rate (lbs seed/ac)	Number of acres	Price per Species in this mix	
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0.0%	0	0.000	1	\$0.00	
<i>Astragalus</i>	<i>canadensis</i>	Canada Milk Vetch	0.0%	0	0.000	1	\$0.00	
<i>Chamaecrista</i>	<i>fasciculata</i>	Partridge Pea	0.0%	0	0.000	1	\$0.00	
<i>Dalea</i>	<i>candida</i>	White Prairie Clover	0.0%	0	0.000	1	\$0.00	
<i>Dalea</i>	<i>purpurea</i>	Purple Prairie Clover	7.1%	2.5	0.454	1	\$20.42	
<i>Drymocallis</i>	<i>arguta</i>	Prairie Cinquefoil	0.0%	0	0.000	1	\$0.00	
<i>Helianthus</i>	<i>maximiliani</i>	Maximilian's Sunflower	2.3%	0.8	0.168	1	\$10.05	
<i>Heliopsis</i>	<i>helianthoides</i>	Early Sunflower	0.0%	0	0.000	1	\$0.00	
<i>Liatis</i>	<i>pycnostachya</i>	Prairie Blazing Star	0.0%	0	0.000	1	\$0.00	
<i>Lobelia</i>	<i>siphilitica</i>	Great Blue Lobelia	0.0%	0	0.000	1	\$0.00	
<i>Monarda</i>	<i>fistulosa</i>	Wild Bergamot	4.3%	1.5	0.058	1	\$11.20	
<i>Oenothera</i>	<i>biennis</i>	Common Evening Primros	10.0%	3.5	0.106	1	\$9.53	
<i>Oligoneuron</i>	<i>rigidum</i>	Stiff Goldenrod	2.1%	0.75	0.050	1	\$9.56	
<i>Penstemon</i>	<i>digitalis</i>	Foxglove Beardtongue	2.9%	1	0.021	1	\$5.03	
<i>Pycnanthemum</i>	<i>virginianum</i>	Mountain Mint	0.0%	0	0.000	1	\$0.00	
<i>Ratibida</i>	<i>pinnata</i>	Yellow Coneflower	2.9%	1	0.091	1	\$8.17	
<i>Rudbeckia</i>	<i>hirta</i>	Black-eyed Susan	7.7%	2.7	0.080	1	\$2.40	
<i>Solidago</i>	<i>speciosa</i>	Showy Goldenrod	0.0%	0	0.000	1	\$0.00	
<i>Symphyotrichum</i>	<i>laeve</i>	Smooth Blue Aster	0.0%	0	0.000	1	\$0.00	
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	0.0%	0	0.000	1	\$0.00	
<i>Tradescantia</i>	<i>ohiensis</i>	Ohio Spiderwort	0.1%	0.05	0.017	1	\$6.81	
<i>Verbena</i>	<i>hastata</i>	Blue Vervain	0.0%	0	0.000	1	\$0.00	
<i>Veronicastrum</i>	<i>virginicum</i>	Culver's Root	0.0%	0	0.000	1	\$0.00	
<i>Zizia</i>	<i>aurea</i>	Golden Alexanders	0.6%	0.2	0.050	1	\$7.43	
<i>Andropogon</i>	<i>gerardii</i>	Big Bluestem	15.7%	5.5	1.497	1	\$17.97	
<i>Bouteloua</i>	<i>curtipendula</i>	Side-oats Grama	8.6%	3	1.361	1	\$24.50	
<i>Elymus</i>	<i>canadensis</i>	Canada Wild Rye	5.7%	2	1.047	1	\$15.71	
<i>Panicum</i>	<i>virgatum</i>	Switch Grass	14.3%	5	0.972	1	\$14.58	
<i>Schizachyrium</i>	<i>scoparium</i>	Little Bluestem	0.0%	0	0.000	1	\$0.00	
<i>Sorghastrum</i>	<i>nutans</i>	Indian Grass	15.7%	5.5	1.248	1	\$22.46	
			100.0%	35			\$95.22	Price for forbs
Max 60% grasses							\$90.58	Price for grasses
40% forbs							\$185.81	Total
		Sum grasses		21				
5 grasses		Sum forbs		14				
10 forbs (1 legume)								

15 species =
\$185

Adding diversity
doesn't
necessarily mean
adding cost

30 species =
\$185

Genus	Species	Common Name	% of MIX (seeds/ sq. ft.)	Seeding rate (seeds/sq. ft.)	Seeding rate (lbs seed/ac)	Number of acres	Price per Species in this mix
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0.1%	0.05	0.034	1	\$4.08
<i>Astragalus</i>	<i>canadensis</i>	Canada Milk Vetch	0.3%	0.1	0.016	1	\$1.92
<i>Chamaecrista</i>	<i>fasciculata</i>	Partridge Pea	0.3%	0.1	0.101	1	\$3.03
<i>Dalea</i>	<i>candida</i>	White Prairie Clover	1.4%	0.5	0.072	1	\$4.30
<i>Dalea</i>	<i>purpurea</i>	Purple Prairie Clover	2.0%	0.7	0.127	1	\$5.72
<i>Drymocallis</i>	<i>arguta</i>	Prairie Cinquefoil	6.0%	2.1	0.025	1	\$9.32
<i>Helianthus</i>	<i>maximiliani</i>	Maximilian's Sunflower	0.3%	0.1	0.021	1	\$1.26
<i>Heliopsis</i>	<i>helianthoides</i>	Early Sunflower	0.3%	0.1	0.043	1	\$2.59
<i>Liatris</i>	<i>pycnostachya</i>	Prairie Blazing Star	0.1%	0.05	0.012	1	\$3.96
<i>Lobelia</i>	<i>siphilitica</i>	Great Blue Lobelia	2.0%	0.7	0.004	1	\$3.66
<i>Monarda</i>	<i>fistulosa</i>	Wild Bergamot	2.9%	1	0.039	1	\$7.47
<i>Oenothera</i>	<i>biennis</i>	Common Evening Primros	7.1%	2.5	0.076	1	\$6.81
<i>Oligoneuron</i>	<i>rigidum</i>	Stiff Goldenrod	0.9%	0.3	0.020	1	\$3.82
<i>Penstemon</i>	<i>digitalis</i>	Foxglove Beardtongue	1.4%	0.5	0.010	1	\$2.51
<i>Pycnanthemum</i>	<i>virginianum</i>	Mountain Mint	0.3%	0.1	0.001	1	\$0.79
<i>Ratibida</i>	<i>pinnata</i>	Yellow Coneflower	0.9%	0.3	0.027	1	\$2.45
<i>Rudbeckia</i>	<i>hirta</i>	Black-eyed Susan	7.7%	2.7	0.080	1	\$2.40
<i>Solidago</i>	<i>speciosa</i>	Showy Goldenrod	0.3%	0.1	0.003	1	\$2.29
<i>Symphyotrichum</i>	<i>laeve</i>	Smooth Blue Aster	0.3%	0.1	0.005	1	\$2.23
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	0.3%	0.1	0.004	1	\$2.64
<i>Tradescantia</i>	<i>ohiensis</i>	Ohio Spiderwort	0.1%	0.05	0.017	1	\$6.81
<i>Verbena</i>	<i>hastata</i>	Blue Vervain	0.3%	0.1	0.003	1	\$0.26
<i>Veronicastrum</i>	<i>virginicum</i>	Culver's Root	4.4%	1.55	0.005	1	\$5.91
<i>Zizia</i>	<i>aurea</i>	Golden Alexanders	0.3%	0.1	0.025	1	\$3.71
<i>Andropogon</i>	<i>gerardii</i>	Big Bluestem	11.4%	4	1.089	1	\$13.07
<i>Bouteloua</i>	<i>curtipendula</i>	Side-oats Grama	8.6%	3	1.361	1	\$24.50
<i>Elymus</i>	<i>canadensis</i>	Canada Wild Rye	4.3%	1.5	0.785	1	\$11.78
<i>Panicum</i>	<i>virgatum</i>	Switch Grass	10.0%	3.5	0.681	1	\$10.21
<i>Schizachyrium</i>	<i>scoparium</i>	Little Bluestem	15.7%	5.5	0.998	1	\$21.96
<i>Sorghastrum</i>	<i>nutans</i>	Indian Grass	10.0%	3.5	0.794	1	\$14.29
			100.0%	35			\$95.81
							Price for forbs
Max 60% grasses 40% forbs							\$89.94
							Price for grasses
							\$185.75
							Total
6 grasses		Sum grasses		21			
24 forbs (4 legumes)		Sum forbs		14			