

# Mid Diversity Solar Array Dry Soil South and West Seed Mix



This mix has been designed to establish native plantings under solar panels that provide habitat for pollinators and other invertebrates, enhances water management, improves habitat for beneficial soil organisms and provides cooling of solar panels.

Updated: 2023



Partners also include stakeholder collaboration among Non-profits, Seed vendors, SWCD, Tribal Governments, Consultants, County and Cities. (see stakeholder list on [website](#))

Mid Diversity Solar Array Dry Soil South & West					
39-221					
Common Name	Scientific Name	Rate (lb/ac)	% of Mix (by weight)	% by Seed	Seeds/ sq ft
side-oats grama	<i>Bouteloua curtipendula</i>	3.18	36.93%	9.99%	7.00
blue grama	<i>Bouteloua gracilis</i>	0.68	7.90%	14.27%	10.00
kalm's brome	<i>Bromus kalmii</i>	0.20	2.32%	7.13%	5.00
nodding wild rye	<i>Elymus canadensis</i>	0.20	2.32%	2.85%	2.00
junegrass	<i>Koeleria macrantha</i>	0.14	1.63%	14.27%	10.00
little bluestem	<i>Schizachyrium scoparium</i>	1.45	16.84%	11.41%	8.00
rough dropseed	<i>Sporobolus compositus</i>	0.45	5.23%	7.13%	5.00
prairie dropseed	<i>Sporobolus heterolepis</i>	0.1	1.16%	0.86%	0.60
	<b>Grasses Subtotal</b>	<b>6.40</b>	<b>74%</b>	<b>68%</b>	<b>47.60</b>
lead plant	<i>Amorpha canescens</i>	0.06	0.65%	0.36%	0.25
partridge pea	<i>Chamaecrista fasciculata</i>	0.30	3.51%	0.43%	0.30
white prairie clover	<i>Dalea candida</i>	0.29	3.33%	2.85%	2.00
purple prairie clover	<i>Dalea purpurea</i>	0.41	4.74%	3.21%	2.25

	<b>Legumes Subtotal</b>	<b>1.06</b>	<b>12%</b>	<b>7%</b>	<b>4.25</b>
common yarrow	<i>Achillea millefolium</i>	0.03	0.35%	2.85%	2.00
Prairie Wild Onion	<i>Allium stellatum</i>	0.06	0.72%	0.36%	0.25
columbine	<i>Aquilegia canadensis</i>	0.01	0.12%	0.21%	0.15
butterfly milkweed	<i>Asclepias tuberosa</i>	0.06	0.74%	0.14%	0.10
whorled milkweed	<i>Asclepias verticillata</i>	0.04	0.43%	0.21%	0.15
narrow-leaved purple coneflower	<i>Echinacea angustifolia</i>	0.03	0.36%	0.11%	0.08
prairie smoke	<i>Geum triflorum</i>	0.01	0.12%	0.14%	0.10
stiff sunflower	<i>Helianthus pauciflorus</i>	0.04	0.47%	0.09%	0.06
rough blazing star	<i>Liatis aspera</i>	0.02	0.20%	0.14%	0.10
wild bergamot	<i>Monarda fistulosa</i>	0.02	0.18%	0.57%	0.40
large-flowered beard tongue	<i>Penstemon grandiflorus</i>	0.08	0.90%	0.57%	0.40
Prairie Cinquefoil	<i>Potentilla arguta</i>	0.01	0.12%	1.28%	0.90
prairie coneflower	<i>Ratibida columnifera</i>	0.13	1.51%	2.85%	2.00
black-eyed susan	<i>Rudbeckia hirta</i>	0.12	1.37%	5.71%	4.00
gray goldenrod	<i>Solidago nemoralis</i>	0.01	0.16%	2.14%	1.50
showy goldenrod	<i>Solidago speciosa</i>	0.03	0.40%	1.43%	1.00
skyblue aster	<i>Symphyotrichum oolentangiense</i>	0.06	0.75%	2.71%	1.90
bracted spiderwort	<i>Tradescantia bracteata</i>	0.01	0.16%	0.07%	0.05
hoary vervain	<i>Verbena stricta</i>	0.15	1.69%	2.14%	1.50
heart-leaved alexanders	<i>Zizia aptera</i>	0.09	1.05%	0.57%	0.40
	<b>Forbs Subtotal</b>	<b>1.01</b>	<b>12%</b>	<b>24%</b>	<b>17.04</b>
Bicknell's sedge	<i>Carex bicknellii</i>	0.03	0.37%	0.29%	0.20
short sedge	<i>Carex brevior</i>	0.05	0.55%	0.71%	0.50
Schweinitz's flatsedge	<i>Cyperis schweinitzii</i>	0.06	0.69%	0.71%	0.50
	<b>Sedges Subtotal</b>	<b>0.14</b>	<b>2%</b>	<b>2%</b>	<b>1.20</b>
	<b>Total</b>	<b>8.61</b>	<b>100%</b>	<b>101%</b>	<b>70.09</b>

Temporary Cover Crop Option					
Oats	<i>Avena sativa</i>	15.00	95.12%	45.51%	6.68
red fescue	<i>Festuca rubra</i>	0.77	4.87%	54.49%	8.00
	<b>Cover Crop Subtotal</b>	<b>15.77</b>	<b>100%</b>	<b>100%</b>	<b>14.68</b>

# Mid Diversity Solar Array Dry Soil South and West Seed Mix Guidance

(MIX IMAGE)

**Seed mix name:** Mid Diversity Solar Array Dry Soil South and West 39-221

**Geographic area:** Southern and Western Minnesota

**Year of development:** 2023

**Year/s of update:** 2023

**Status (*Standard or Pilot mix*):** Pilot

**Primary and Secondary Functions:**

*Primary* – Establish habitat under solar panels that provides habitat for pollinators and other invertebrates, improves habitat for beneficial soil organisms and provides cooling of solar panels

*Secondary* – Carbon sequestration, habitat for birds and other wildlife

**Similar State Mixes:** 39-641 Mid Diversity Solar Array Mesic Soil Northeast, 39-241 Mid Diversity Solar Array Mesic Soil South and West, 39-551 Mid Diversity Solar Array Moist Soil South and West, 39-211A High Diversity Solar Array Mesic Soil South and West

**Compatible NRCS Practice Standards:** Not designed to meet a standard

**Compatible Minnesota CRP Practices:** None

**Suitable Site Conditions**

Areas with mesic soils and full sun for at least 70% of the day where land is being converted from other uses such as lawn or agricultural fields like row crops or pasture.

**Seed Mix Highlights**

This mix has been designed for solar projects as a groundcover under panel as part of solar arrays to provide benefits to a wide range of wildlife species. The mix includes combinations of grasses, sedges, and forbs to provide year-round cover and forage to pollinators.

**How to Customize the Mix for Unique Site Conditions and Goals**

Site conditions such as sunlight, soils, hydrology, and existing vegetation along with functional goals for the project such as pollinator habitat, carbon sequestration, and benefit to grassland bird species can all inform species selection and the modification of seed mixes. See the Additional Species List, which can be used to increase diversity. Use the [BWSR Seed Mix Substitution Table](#) when species are not available from vendors, or the landowner has alternative goals for the site.

**Site Preparation**

The primary goal of site preparation is to provide growing conditions that are good for native seed or plant establishment. Preparation methods may vary depending on site conditions. For example, sites with introduced perennial grasses such as smooth brome grass require different suppression techniques than sites that have been farmed with row crops. Site specific conditions should be considered when selecting site preparation techniques: current vegetation, potential desirable and undesirable species in the seed bank, previous pesticide use on site, and potential for soil erosion. Annual cover crops or row crops can be used in preparation for a native planting if they are not grown with persistent pesticides such as neonicotinoids or other long-lasting chemicals that may negatively impact pollinators or native vegetation establishment. For example, following soybean harvest, an un-tilled soybean field provides a good seedbed with potentially little plant residue for planting native prairie mixes. However, the

chemical program used to grow soybeans could include herbicides that have a lengthy herbicide carryover. Make sure to research which chemicals were used in crop production to determine if there is a rotation restriction prior to planting. For fields where persistent chemicals have been used (including neonicotinoids or long-lived herbicides) it is recommended to plant a temporary cover crop for one or two seasons to allow the chemicals to break down in the soil. For more details on organic or pesticide-free site preparation techniques, see the Xerces Society guide, [Organic Site Preparation for Wildflower Establishment](#).

### ***Temporary Cover Crops***

Short-lived temporary cover crops help stabilize soils in preparation for planting native seed mixes. This option can stabilize soil, and limit compaction and control weed pressure before installing permanent seed mixes. Cover crops such as oats (commonly used) should be mowed to 4-6 inches before seeds mature (or harvested upon maturity) to prevent re-seeding. Residue from temporary cover crops should be minimized prior to seeding to increase seed to soil contact. It is common to seed into cover crop stubble as part of a fall dormant seeding.

### **Seedbed preparation**

Methods used to prepare seedbeds vary depending on the type of seeding equipment used. If a traditional native seed drill will be used, a smooth, firm seedbed is required. Soybean fields usually are sufficiently prepared for a native seed drill. Sites that were recently tilled will require additional soil treatment such as light disking, field cultivation, harrowing and rolling to prepare a firm seedbed and prevent seed from being buried too deep. Native seeds have difficulty germinating if they are buried more than ¼" deep. Broadcast seeding can be done on any crop field. Fields that have been disked, should be cultipacked or allowed to settle before seeding.

### **Seeding Methods**

A variety of seeding equipment is used for upland native solar mixes including broadcast seeders, no-till native seed drills, Brillion seeders and Trillion seeders. Specialized native seed drills can handle a wide variety of seed (fluffy, smooth, large and small) and low seeding rates. Conventional grain drills are not capable of handling diverse seed sizes and are not recommended. Broadcast seeding is common for planting high or mid-diversity mixes. Broadcast seeding equipment should be used that is designed to spread mixes with different sized seeds (e.g., Vicon Seeders). For solar projects it is common to use either a drill or broadcast seeder between panels and broadcast seeding under and around panels.

### **Seeding Dates**

Forb-dominated solar high and mid-diversity seed mixes, including this mix, can be installed in the spring or fall. Fall dormant plantings are preferred and allow seeds to naturally stratify and settle into the soil through periods of freezing and thawing over the winter. Spring seedings should be done on or around May 1-July 1 when soil temperatures are at least 60 degrees Fahrenheit or higher. Fall seeding should occur when soil temperatures are consistently below 50 degrees Fahrenheit (usually around October 15 in the northern half of the state and November 1 in the southern half of the state). Fall dormant seedings reduce weed pressure during the first year of growth because native cool-season grasses and forbs germinate earlier and compete with weed species right away. Frost seedings are also an option if the snow cover is shallow, ice-free, and winds are calm. For a frost seeding, seeding rates may need to be increased by 25-50 percent due to lower germination rates and loss of seed consumed by wildlife.

## Management Methods

*Establishment Mowing and Grazing*— Mowing or grazing can be an important step during the establishment of native seed mixes (first three to five years). The frequency and duration of mowing will vary depending on the local climate and weed pressure at the site. Expect to mow or graze at least twice during the first season and once during the second season to decrease weed competition and to provide sufficient sunlight for seedlings. Mowing or grazing should be conducted before weeds mature and seed out. It is important that mowed vegetation does not smother the planting; therefore, very productive sites may need to be mowed more often in the first year to reduce the mulching effect. Flail mowers are preferred because they cut the vegetation into smaller pieces and doesn't leave a thick layer of thatch. Vegetation should be mowed or grazed to between four and six inches before seed is allowed to set (usually as weeds reach knee-height or 12-18 inches). Mower height should be raised as native plants establish, to avoid cutting buds or flowers. Mowing or grazing new plantings too short can reduce beneficial outcomes of a successful planting. Some grassland managers see native planting establishment success without mowing, but this varies depending on site conditions (such as soil productivity) and weed pressure. If mowing large sections of the planting, consider waiting until after July 15 to protect game and songbird nesting habitat. Mowing after October 1 assists Monarch butterflies by maintaining flower resources as they migrate south

*Spot Mowing* – As the native planting is establishing, it may be beneficial to spot mow or weed trim areas with invasive or noxious plants. Spot-mowing should be done at a raised height between 4-6 inches to target invasive plants and to avoid damaging nearby native species. Spot mowing to minimize the abundance and frequency of invasive or noxious weeds can be done every year to increase diversity and functionality of the planting. A list of noxious/invasive weed species that should be addressed can be viewed at the [Minnesota Department of Agriculture's website](#).

*Spot Management of Weeds* – Some persistent perennial weeds may require digging, pulling, girdling, smothering or spot treatment with herbicides for sufficient control. Some persistent perennial plants include: reed canary grass, smooth brome, quack grass, purple loosestrife, Canada thistle, Kentucky bluegrass, crown vetch, birds-foot trefoil, and woody species, such as box elder, common buckthorn, Siberian elm, and Tartarian honeysuckle. Methods should be conducted carefully during the early establishment phase, to avoid adverse impacts to native plant seedlings. Herbicides should only be used on persistent perennial weeds; most other weeds will be excluded or occur in low frequencies and abundance over time as the native planting matures. Herbicide use should be species specific, sprayed in a discriminating and targeted way (minimizing non-target organisms), and applied according to rates specified on the label. A licensed applicator may be needed to apply herbicide(s). All pesticides should be selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment. Plantings that include both grasses and forbs should never be broadcast-sprayed. Minimal herbicide use is recommended the first year of planting. Targeted spot spraying can begin in year 2 unless significant problem weeds show up.

[The Midwest Invasive Plant Control Database](#) provides a compilation of control methods for many common invasive plants. Some noxious or invasive weeds do not respond well to spraying so managers are encouraged to consider the method that will do the least amount of harm to overall planting health. To prevent inadvertent aerial spraying of the prairie, it may be advantageous to be placed on the do not spray list at the local farm co-op. This will help prevent damage to your prairie planting.

### **What to Expect in Year 1**

During the first year of establishment, many perennial native grasses, sedges and flowers will remain about one to three inches tall depending on site conditions. Most of their growth occurs below ground as they develop extensive root systems. Annual species will flower and grow to maturity. Mowing annual agricultural weeds (foxtail, barnyard grass, ragweed etc.) reduces competition, allowing native plant seedlings to receive sufficient water and sunlight. The planting may have a somewhat weedy appearance in the first year (see establishment mowing paragraph above).

(IMAGE)

### **What to Expect in Year 2**

During year two, some of the perennial native grasses, sedges and flowers may reach their mature height and some may even flower. Depending on when the seeding occurred (spring or dormant), there may be many first-year native seedlings germinating alongside established native plants. Mowing or grazing may still play a key role in managing weeds and promoting native seedling growth.

(IMAGE)

### **What to Expect in Year 3 and Beyond**

By the end of year three many of the native plants should start flowering. There may be some long-lived species that are slow to establish and may not show up for several years.

### **Problem Solving**

*Poor Establishment After Year 1* – It is often difficult to determine if seeding is successful during the first year, as establishment may vary depending on weather conditions, site preparation, and site conditions. Species germinate and establish at different rates, and some may be slow to establish. Seed establishment is often delayed during drought conditions. Corrective actions should generally not occur until year 2. Look for species such as Black-Eyed Susan seedlings in year 1 for confirmation the seeding was a success.

*Poor Establishment After Year 2* – If native plant seedlings are not establishing about every one to two feet it may be necessary to interseed the planting. Monitor the site during the growing season to determine which species are present, and which species may need to be supplemented. Interseeding should be conducted after the second growing season.

*High Annual and Biennial Weed Competition* – Annual and biennial weed competition is generally not a concern as they are short lived and frequent mowing in the first year of establishment reduces their contributions to the seed bank. Even without mowing, perennial native plants tend to outcompete annual and biennial weeds as the planting matures.

*High Perennial Weed Competition* – Dense establishment of perennial weed species can be a problem as they can prevent the establishment of native species. Prescribed burning, prescribed grazing, and/or spot herbicide application may be needed to manage perennial weeds.

*Low Forb Diversity After Year 3* – If grasses and sedges are successfully establishing but there is a lack of forbs, it is recommended to inter-seed additional forbs in late fall or after spring mowing or grazing. See the [Xerces Society guide](#) for additional information and guidance about inter-seeding wildflowers.