Wetland Restoration: Vegetation - Species Selection

USDA United States Department of Agriculture
Natural Resources Conservation Service

MASWCD
Minnesota Association of Soil and Water Conservation Districts

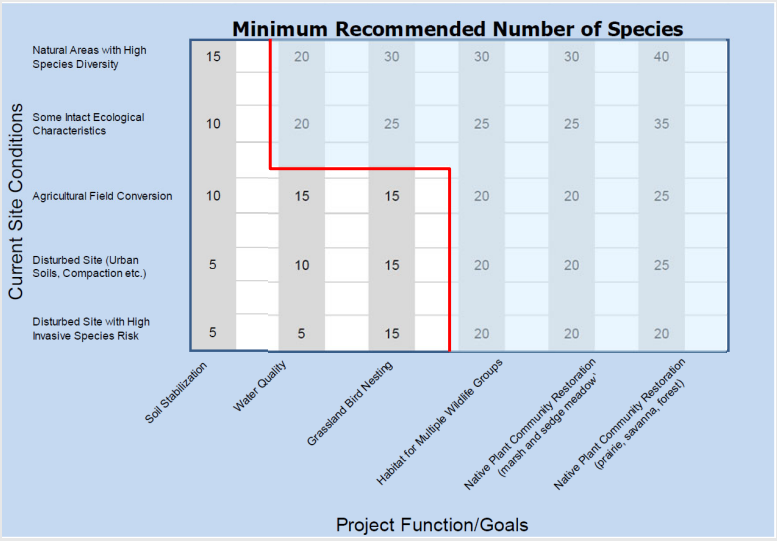
BWSR

Technical Training and Certification Program

Kelly Voigt | Regional Training Conservationist

Good morning, everybody! I am so happy to be here and see so many of you able to join us for wetland restoration training this week. For those of you who don't know me, I am Kelly Voigt, one of the regional training conservationists with BWSR, which means I provide training on the ecological sciences side of conservation practices - management practices and vegetation related practices. Today, I will be building off of Dan's presentation to discuss resources for species selection for planting wetland restoration sites.

Species Selection



- GOALS
  - Match native plant communities as closely as possible
  - Diversity

I will be approaching this part of the presentation from the perspective that we are trying to match the native plant community as closely as possible with as much diversity as possible. Especially for long term restorations/easements you'll want to spend the time and money to match seed mixes/planting plans to the site. We will be talking about creating mixes mostly to the right of the red line shown. As Dan discussed, the 657 practice standard also calls for more species. For shorter term projects with fewer species, you are not likely to spend a lot of time developing a mix. There are plenty of seeding plans and vendor mixes already around that can meet those requirements.

Native Plant Communities will vary based on climate, topography, geologic history, soil texture and moisture conditions, among other factors. Our goal is to match the native plant communities as closely as possible when we are doing restoration work because that plant community is the one that will thrive in those conditions. And we also know that the plant communities will transition across the soil moisture gradient – from wettest to driest. The engineering designs with pool elevations in combination with topographic surveys or maps are going to help you estimate those plant community boundaries as Dan discussed. Partially, this is about cost. We don't want to promote the use of seed that will not grow on a particular site. But it is also

about providing the full ecological function that the plants provide to the system- pollinator habitat, food sources, cover – that intricate web of a natural system. We also plan for diversity to promote resilience and habitat - resilience to seasonal and annual water fluctuations, resilience to longer term climate trends, providing for the successional nature of plant communities – their composition will change over time and we try to create wildlife habitat for multiple species – pollinators, amphibians, reptiles, birds, mammals. Diversity is built in in natural ecosystems. So, if we are doing "restoration" work, we need to restore the native plant community and we also need to build in the diversity.

Species Selection

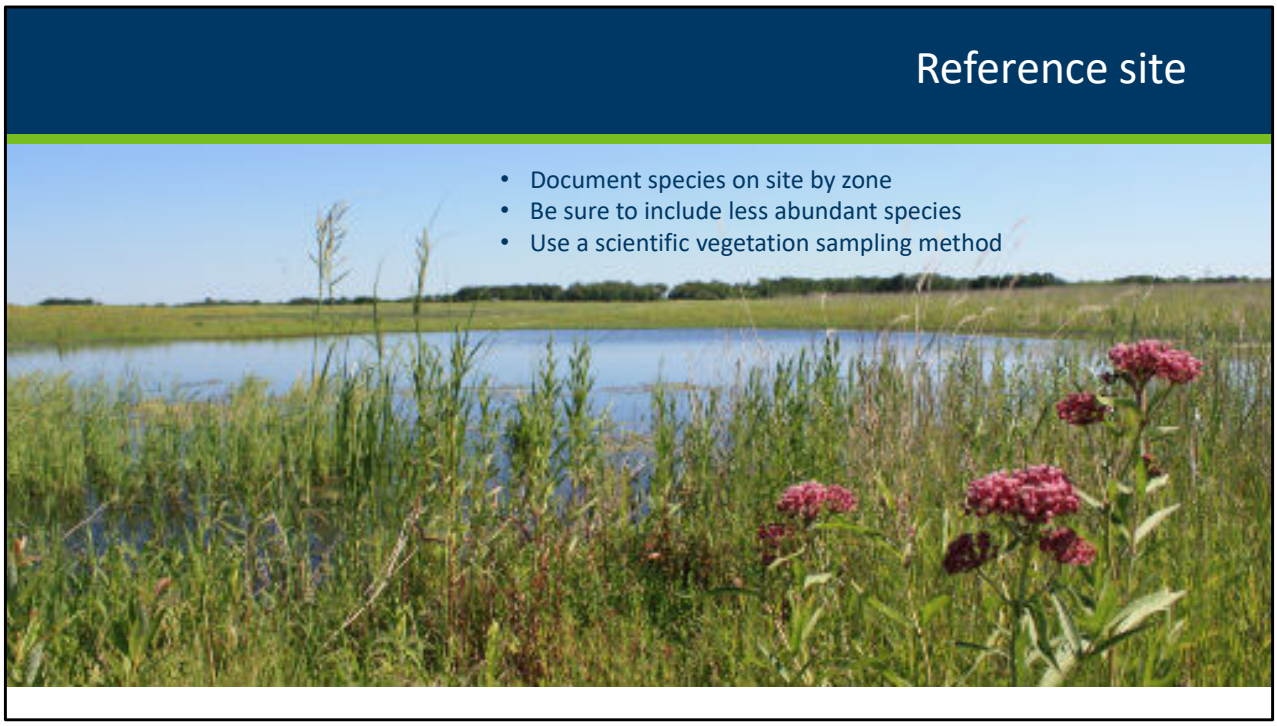
- Use a nearby reference site
- Minnesota Biological Survey/ Native Plant Communities
- Ecological Site Descriptions
- Native Plant Encyclopedia
- BWSR Seed Mixes

We are going to talk about a few different resources that may be used to help develop a list of species that would naturally occur on a site - using a nearby reference site, consulting the Minnesota Biological Survey and Native Plant Communities information, looking at the ecological site description, using the native plant encyclopedia tool or using BWSR developed seed mixes. We will also discuss some of the benefits and limitations of each. Each of these resources overlaps to more or less extent. I have noticed more integration happening over time. But there isn't one size fits all resource for selecting species on every site. It depends on the site. It is likely you will need to look at a several of these resources, and use what works for you, in your location, from each resource, to pull together a good vegetation establishment and management plan for a site.

Species Selection

- **Use a nearby reference site**
- Minnesota Biological Survey/ Native Plant Communities
- Ecological Site Descriptions
- Native Plant Encyclopedia
- BWSR Seed Mixes

Let's start with talking about using a nearby reference site.



It may take a bit of sleuthing to see if there are any native or restored reference sites near to your project site to identify plant species that will thrive on your restoration site.

You will want to look for similar soils, landscape positions and hydrology. You are in search of a high quality site. The best situation is a site that has never been disturbed – that's probably a lot to ask for in some parts of Minnesota -- so, something that has been protected or restored for a longer period of time and seems to have a diversity of native plants. Consider the history of that site, disturbance that may occur or have occurred and other factors that may be affecting species composition like nutrient or chemical effects from nearby.

Sometimes, if there is a high quality native site nearby, it may be worthwhile to check with the owner/manager. There are an increasing number of groups and organizations that are concerned about preserving the genetic integrity of local species and may prefer to provide you native seed harvested from their site rather than have seed brought in. Again, that might be a rare occurrence, but it's a

possibility worth mentioning, especially in the context of a restoration as part of a permanent easement. At a minimum, you can let them know what you are working on and receive permission to access their site.

Then, dust off your plant identification skills and document the species on the reference site to build a species list for revegetating your restoration site. If there are distinct zones of vegetation, you should document a list of species by zone. More than just making a list of species, you should also make notes about abundance and make

Use a Nearby Reference Site

- Benefits
  - Possibility of a close match to native plant community
- Limitations
  - Hard to find largely undisturbed communities
  - Need good Plant ID skills

The benefits of using a nearby reference site is that you have a higher possibility of a close match to the native plant community. However, that is only if you can find a high quality largely undisturbed plant community, which creates the first limitation to this methodology. Using a reference site also relies on good Plant ID skills, which can be a hard skill to keep honed if you don't do this type of work routinely – especially when it comes to identifying some of the less common plants. If your plant ID skills are fine tuned and you like to keep them that way, this is the option made for you!

Group experience with using a reference site

Have used

Never used

Now, I would like to hear from you. Have you used a reference site for determining a seed mix?

Please use your annotation tools – or you can use the green check for yes, red X for no.

I left more space on the “have used” side of the line for you to type in comments, you can also type comments into chat. What worked, what didn’t work?

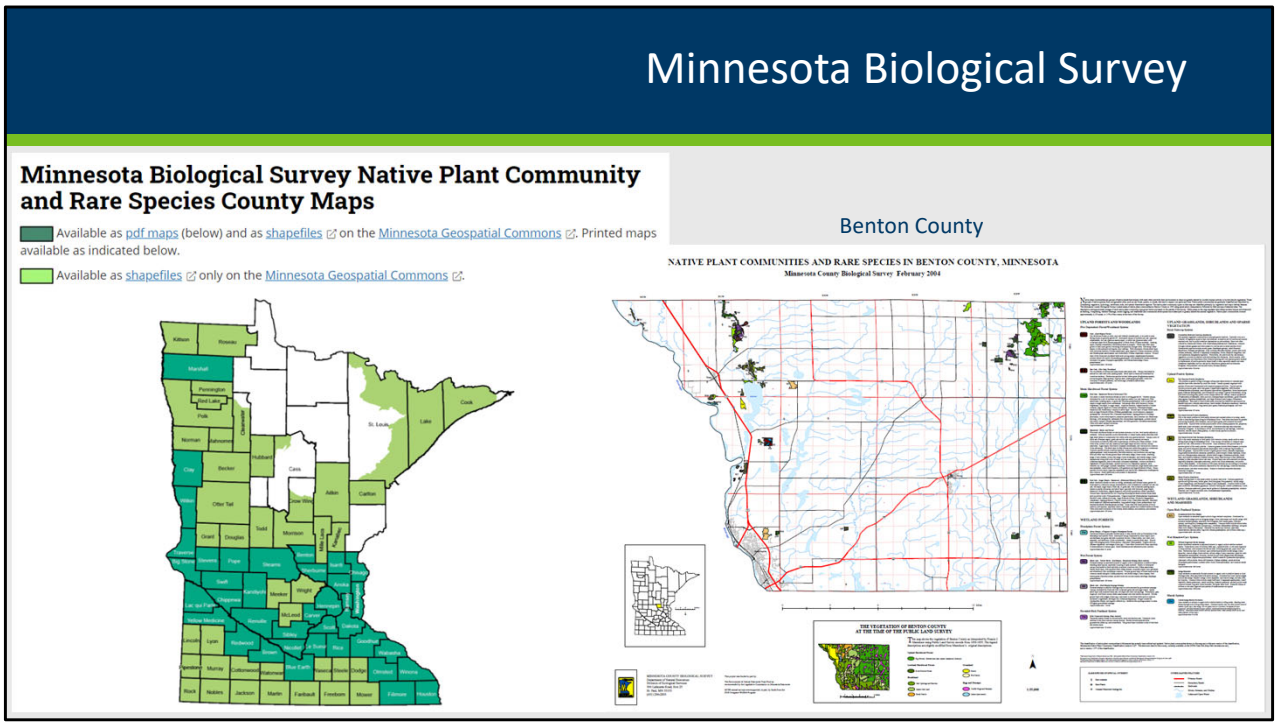
If you want to share a story, please raise your virtual hand and Jon can unmute you.

Species Selection

- Use a nearby reference site
- **Minnesota Biological Survey/ Native Plant Communities**
- Ecological Site Descriptions
- Native Plant Encyclopedia
- BWSR Seed Mixes

The next two resources we are going to take a look at are the Minnesota Biological Survey and Native Plant Communities. These two are linked through species data, but each provides different approaches to use to identify plant communities.

Minnesota Biological Survey

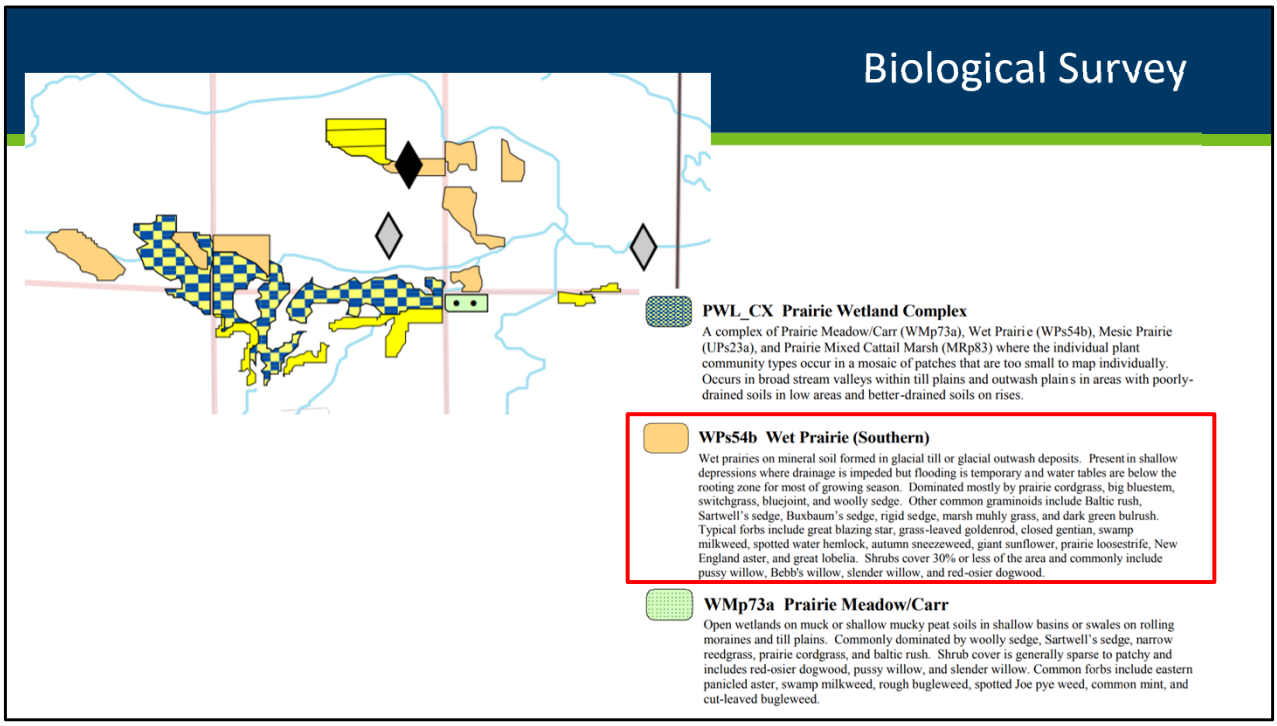


The Minnesota Biological Survey is led by MN DNR. The Biological Survey (I am going to quote from their website here) "systematically collects, interprets, monitors and delivers data on plant and animal distribution as well as the ecology of native plant communities and functional landscapes." Almost all counties in MN have biological surveys completed – all except the counties shown in white on the map. It's a work in progress.

One of the output products of the biological survey are county maps that show relatively intact native plant communities for which the biological survey crew has documented the plant species composition. The example county map shown is Benton County.

Minnesota Biological Survey communities can be used like a local reference site. Maybe you get lucky and the mapped community is actually near your site. But if the mapped community is farther away, you need to make sure the site conditions like soils, landscape position, hydrology match with your project site to figure out a species list.

https://www.dnr.state.mn.us/eco/mcbs/maps.html



Let's zoom in and look closer at an example – this one is from Watonwan County is south central MN. I am zoomed in on the map and have screen clipped some portions of the key that are relevant to this section of the map. Let's take a closer look at the key for the wet prairie.

Biological Survey

WPs54b Wet Prairie (Southern)

Wet prairies on mineral soil formed in glacial till or glacial outwash deposits. Present in shallow depressions where drainage is impeded but flooding is temporary and water tables are below the rooting zone for most of growing season. Dominated mostly by prairie cordgrass, big bluestem, switchgrass, bluejoint, and woolly sedge. Other common graminoids include Baltic rush, Sartwell's sedge, Buxbaum's sedge, rigid sedge, marsh muhly grass, and dark green bulrush. Typical forbs include great blazing star, grass-leaved goldenrod, closed gentian, swamp milkweed, spotted water hemlock, autumn sneezeweed, giant sunflower, prairie loosestrife, New England aster, and great lobelia. Shrubs cover 30% or less of the area and commonly include pussy willow, Bebb's willow, slender willow, and red-osier dogwood.

We'll talk about what the WPs54b designation in a minute.

Looking more closely at the descriptions, there is a list of species from the different guilds that Dan discussed - highlighted here are the dominant Grasses/Sedges – prairie cordgrass, big bluestem, switchgrass, bluejoint, and woolly sedge

Biological Survey

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Additional grasses, sedges and rushes are listed

Biological Survey

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And quite a few forbs are listed

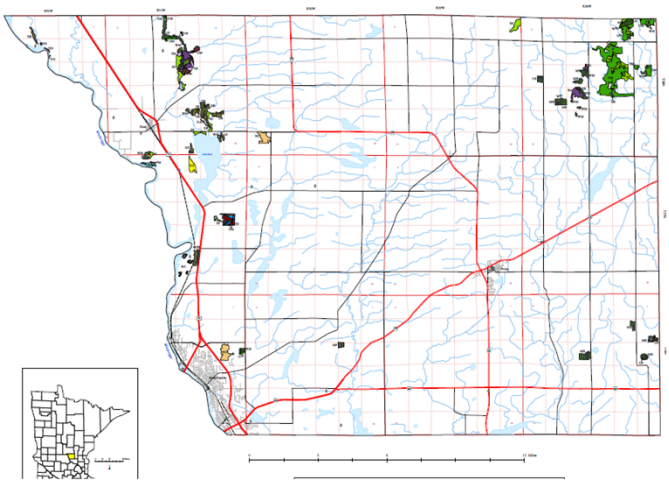
Biological Survey

WPs54b Wet Prairie (Southern)

Wet prairies on mineral soil formed in glacial till or glacial outwash deposits. Present in shallow depressions where drainage is impeded but flooding is temporary and water tables are below the rooting zone for most of growing season. Dominated mostly by prairie cordgrass, big bluestem, switchgrass, bluejoint, and woolly sedge. Other common graminoids include Baltic rush, Sartwell's sedge, Buxbaum's sedge, rigid sedge, marsh muhly grass, and dark green bulrush. Typical forbs include great blazing star, grass-leaved goldenrod, closed gentian, swamp milkweed, spotted water hemlock, autumn sneezeweed, giant sunflower, prairie loosestrife, New England aster, and great lobelia. Shrubs cover 30% or less of the area and commonly include pussy willow, Bebb's willow, slender willow, and red-osier dogwood.

And shrubs. So, we can get a good idea of the diversity of plant guilds and species from Biological Survey data.

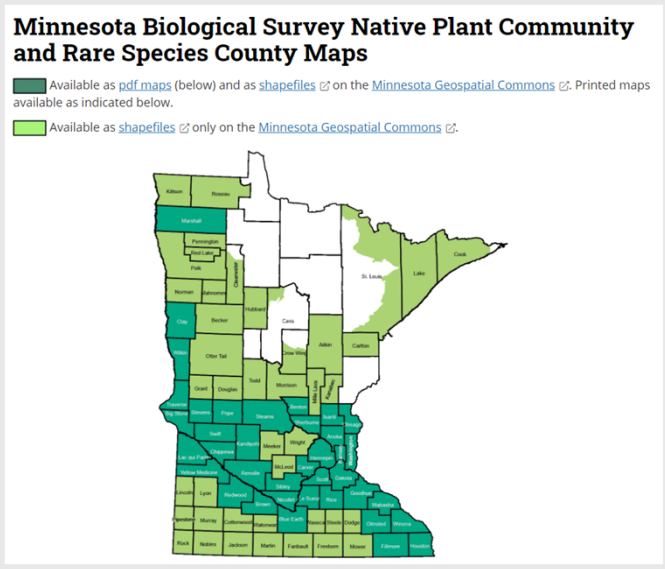
Minnesota Biological Survey



- **Benefits**
  - Research based
  - tied to climate, soils, hydrology, etc
- **Limitations**
  - Species lists may be limited, no info on quantities
  - Best to use with Native Plant Community guides/fact sheets
  - Limited locations, need to match your site to a mapped community

The benefit of using the Minnesota Biological Survey is that it is research based, county level data. It is literally experts that have done the species identification. Through the Native Plant Community system, these sites are systematically classified and tied to climate, soils, and hydrology and other factors that determine the community composition. One limitation of using these maps alone is that they may give you limited numbers of species on a list, with no information on quantities of plants by species. You will need to be thinking about quantities when it comes to seeding rates, or planting rates. So, it is best to use these mapped communities with the Native Plant Community Guides or Fact Sheets. The other limiting factor is that vast areas of counties may have extremely limited information on native plant communities – looking at this map, there are only a very few mapped communities in the central portion of the county. You need to do the work of making sure a mapped community matches the site conditions for your restoration location.

Your turn: Minnesota Biological Survey for your county



https://www.dnr.state.mn.us/eco/mcbs/maps.html

Now it's your turn to get this information for your county if you don't already have it.

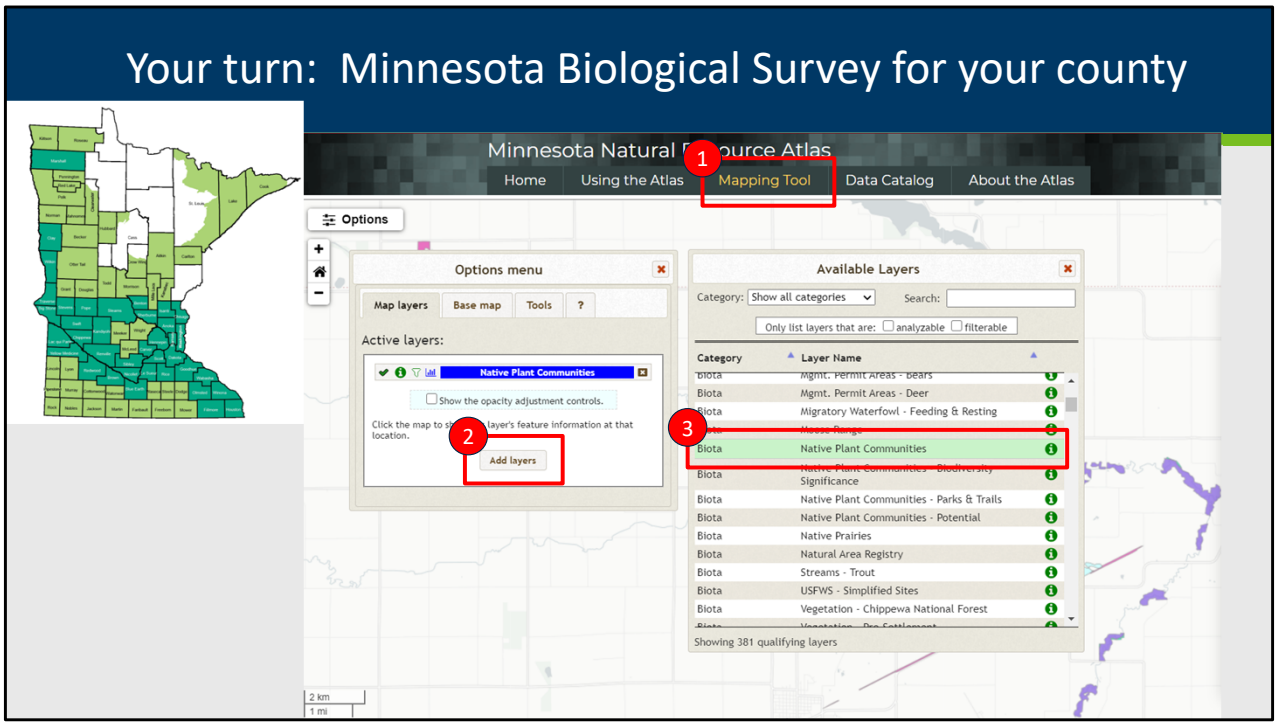
Those of you located in dark green counties – go to the DNR site and download your county map. [paste web address into chat box]
https://www.dnr.state.mn.us/eco/mcbs/maps.html

If your county is in the light green category and if you have ArcMap , you can download a copy of this map from the Minnesota geospatial commons. However, a map that utilizes the shapefile from the Minnesota Geospatial commons is also available on Mnatlas.org. For today, please go to mnatlas.org and bookmark it in your web browser. [paste web address in chat box and show next slide] mnatlas.org

Areas shown in white also have some shapefiles available within the Geospatial commons shapefile and MNAtlas.

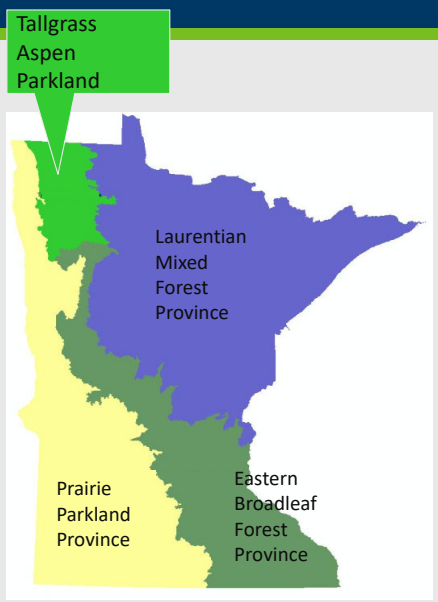
When you have completed either downloading your pdf or bookmarking mnatlas.org, please raise your virtual hand. We will move on when the majority of people have finished.

Your turn: Minnesota Biological Survey for your county



For those of you not familiar with mnatlas.org, I am going to give you this short, mini, micro demo of how to access the native plant community data. There is a recorded Tech Talk about MNAtlas if you are interested in learning more. From the MNAtlas home page, select mapping tool. You have to accept when the pop up box comes up. Then on the options menu, select add layers. When the available layers box opens, you can scroll down to the Native Plant Community layer. You can see in the background of my screen that the layer is open – with some light purple colored plant communities. You can click on those to learn which plant community is mapped at that location.

Native Plant Communities

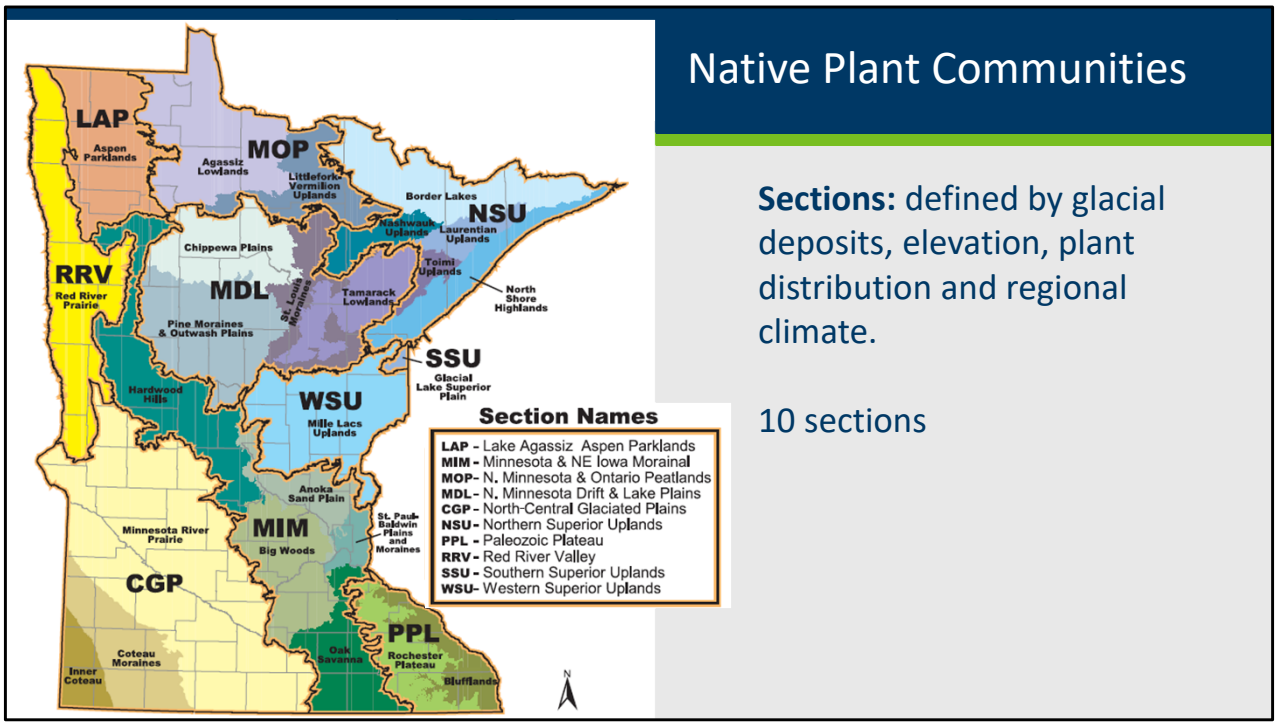


Minnesota uses a hierarchical, nested ecological land classification system.

Provinces: defined by major climatic zones, native vegetation and biomes

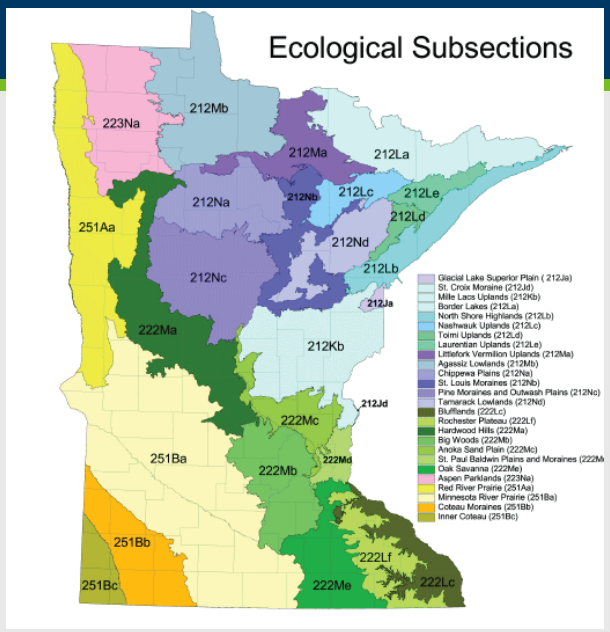
4 provinces

Let's move on to the Native Plant Communities side of the Minnesota Biological Survey. Minnesota has established a hierarchical nested system of ecological land classification. It starts with provinces, which are the largest level within the system. Most of us could probably recognize these major zones within the state based on vegetation alone. The ecological classification systems also defines them by climatic zone and biome in addition to the broad categories of predominant native vegetation.



The provinces are further broken down into sections. Each province has two or more sections. Each section is contained within one and only one province. There are 10 defined sections.

Native Plant Communities



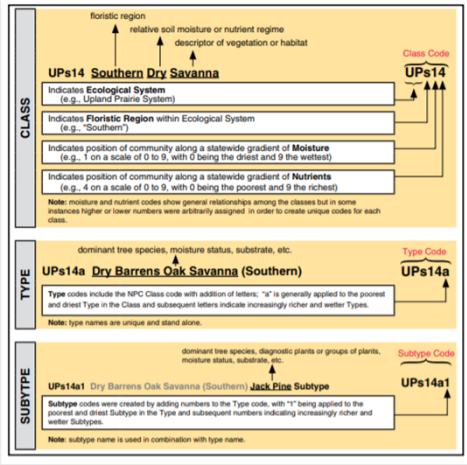
Subsections: defined by glacial deposits and features, surface bedrock, local climate, topography, distribution of plants

26 Subsections

Sections are further broken down into one or more subsections. There are 26 subsections.

Native Plant Communities

Example: UPs14a1



Land Type Associations: defined using glacial deposits and features, bedrock types, topographic roughness, lake and stream distributions, wetland patterns, depth to groundwater, soil parent material, and pre-European settlement vegetation (291 in MN).

Upland Prairie System
UPn12 Northern Dry Prairie
UPn13 Northern Dry Savanna
UPn23 Northern Mesic Prairie
UPn24 Northern Mesic Savanna
UPs13 Southern Dry Prairie
UPs14 Southern Dry Savanna
UPs23 Southern Mesic Prairie
UPs24 Southern Mesic Savanna

Native plant communities are defined within Land Type Associations within the ecological classification system and given a code that helps define their characteristics. There are 291 Land Type Associations within Minnesota. 8 of these found within the Upland Prairie Ecological System are shown in the box on the right. The box on the left gives information on the meaning of the symbology used to designate these land type associations. UP = upland prairie, s or n = southern or northern, The first number is a number that represents the moisture of the plant community on a gradient of 0 being driest and 9 being the wettest across the state. The second number represents the nutrient status of the plant community – 0 being poorest and 9 being the most nutrient rich.

Native Plant Community

Wet Prairie

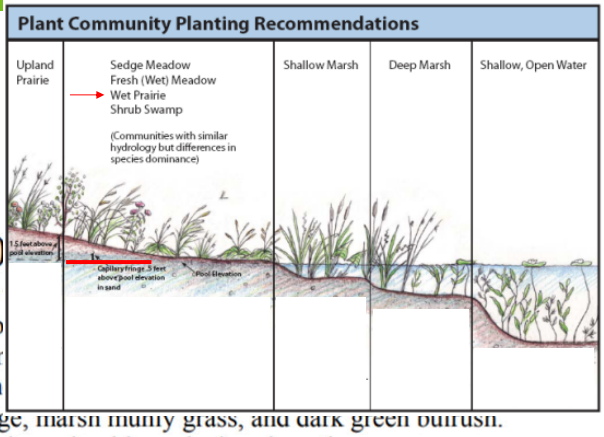
Southern floristic region

Moisture

Nutrients

WPs54b Wet Prairie (Southern)

Wet prairies on mineral soil formed in glacial depressions where drainage is impeded but flo rooting zone for most of growing season. Dor switchgrass, bluejoint, and woolly sedge. Oth Sartwell's sedge, Buxbaum's sedge, rigid sedge, marsh muhly grass, and dark green bulrush. Typical forbs include great blazing star, grass-leaved goldenrod, closed gentian, swamp milkweed, spotted water hemlock, autumn sneezeweed, giant sunflower, prairie loosestrife, New England aster, and great lobelia. Shrubs cover 30% or less of the area and commonly include pussy willow, Bebb's willow, slender willow, and red-osier dogwood.



Let's look back at the Minnesota Biological Survey Community we looked at previously.

WP = wet prairie, s = southern floristic region. (Remember, this was from Watonwan County)

Moisture is 5 on scale of 0 to 9 - so mid range. This is how we would know the placement of this plant community – wetter than upland but drier than wet meadow.

System Summaries & NPC Factsheets

Upland Forests and Woodlands

Wetland Forests

Upland Grasslands, Shrublands, and Sparse Vegetation

Wetland Grasslands, Shrublands, and Marshes

https://www.dnr.state.mn.us/npc/index.html

Details on each of the 291 land type associations can be found within factsheets on the DNR website. [put link in chat box] https://www.dnr.state.mn.us/npc/index.html This would be another good website to bookmark.

System Summaries & NPC Factsheets

Upland Forests and Woodlands

Wetland Forests

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Wetland Grasslands, Shrublands, and Marshes

https://www.dnr.state.mn.us/npc/index.html

There are system summaries and native plant community fact sheets available - Grouped by wetland and upland, forests and grasslands. We are going to look more closely at the wetland grassland, shrublands, and marshes resources.

Wetland Grassland, Shrublands and Marshes

Wet Meadow/Carr System Summaries→ LMF PDF EBF PDF PPA/TAP PDF

Class Fact Sheets

WMn82 Northern Wet Meadow/Carr PDF

WMs83 Southern Seepage Meadow/Carr PDF

WMs92 Southern Basin Wet Meadow/Carr PDF

WMp73 Prairie Wet Meadow/Carr PDF

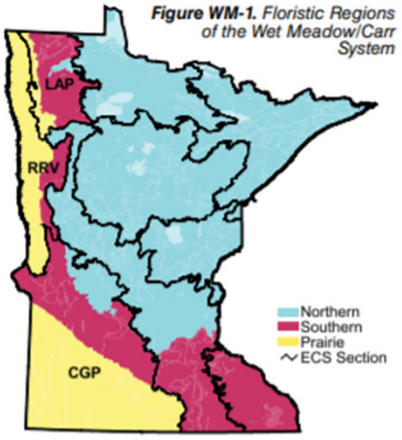


Figure WM-1. *Floristic Regions of the Wet Meadow/Carr System*

Within that Wetland Grassland, Shrublands and Marshes you will find Wet Meadow/Carr Class Fact Sheets – As you start to get to know the system – the alphanumeric symbology tells you a bit about each system – WM = wet meadow, north or south, p for prairie, with the floristic regions map shown here.

Wetland Grassland, Shrublands and Marshes

Wet Meadow/Carr System Summaries→ LMF PDF EBF PDF PPA/TAP PDF

Class Fact Sheets

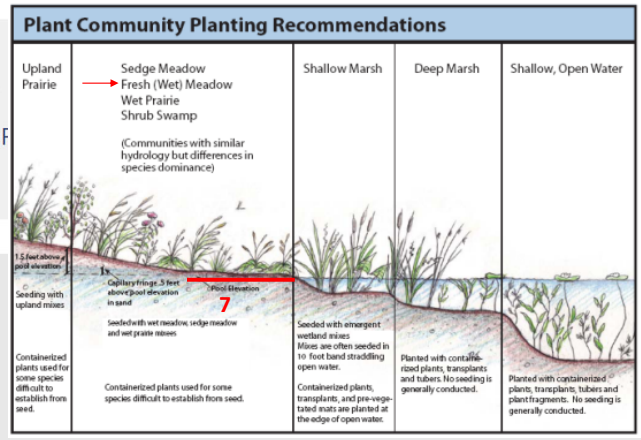
WMn82 Northern Wet Meadow/Carr PDF

WMs83 Southern Seepage Meadow/Carr PDF

WMs92 Southern Basin Wet Meadow/Carr PDF

WMp73 Prairie Wet Meadow/Carr PDF

7,8,9 = increasing wetness



The first number shows us the moisture regime of that plant community. WMp73 would be the community found in a wetter location that our previous example (which was a 5)

Wetland Grassland, Shrublands and Marshes

Wet Meadow/Carr System Summaries→ LMF PDF EBF PDF PPA/TAP PDF

Marsh System Summaries→

Class Fact Sheets

MRn83 Northern Mixed Cattail Marsh PDF

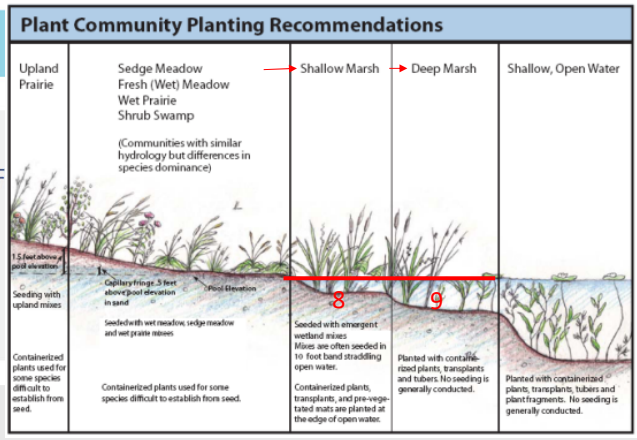
MRn93 Northern Bulrush-Spikerush Marsh PDF

MRu94 Lake Superior Coastal Marsh PDF

MRp83 Prairie Mixed Cattail Marsh PDF

MRp93 Prairie Bulrush-Arrowhead Marsh PDF

8,9 = most wet on scale of 1-9



Still on that same wetland grassland, shrublands and marshes web page, we also find the marsh system summaries and class fact sheets. MR = marsh, n = north, p = prairie. With our Watonwan County example, we are within the prairie floristic region for the marsh system also. So, MRp8 and MRp9 would be the wettest of the plant communities within that system.

Wetland Grassland, Shrublands and Marshes

Wet Meadow/Carr System Summaries→ LMF PDF EBF PDF PPA/TAP PDF

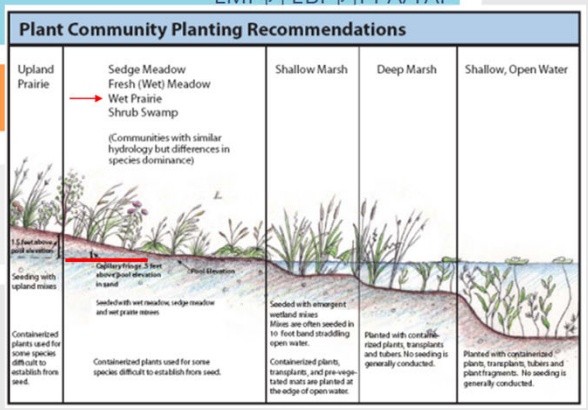
Marsh System Summaries→ LMF EBF PPA/TAP

Wetland Prairie System Summaries→

Class Fact Sheets

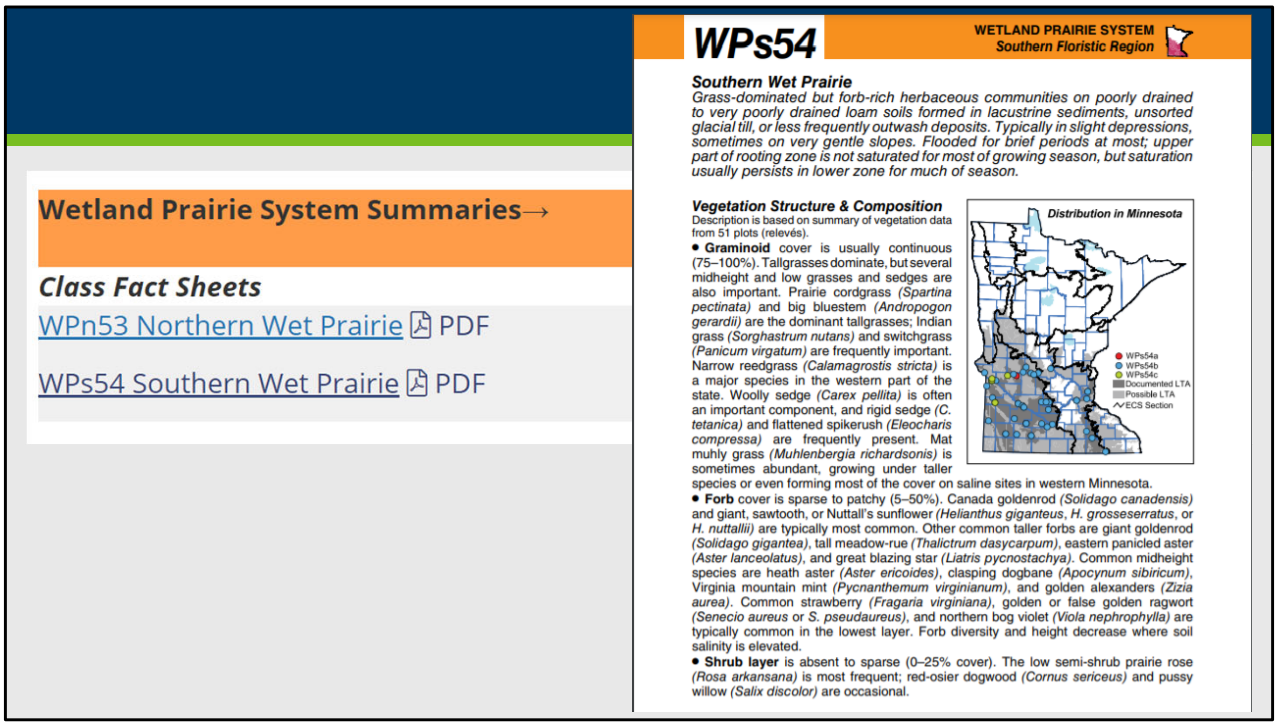
WPn53 Northern Wet Prairie PDF

WPs54 Southern Wet Prairie PDF



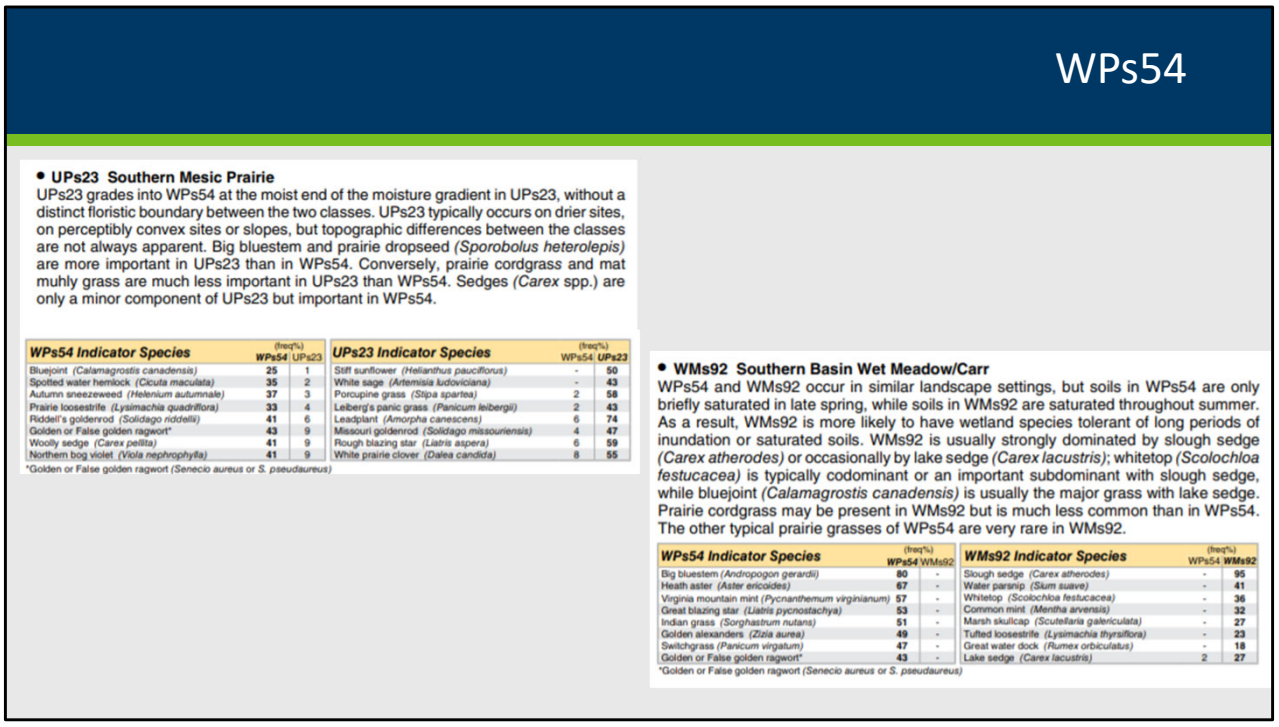
And it is here on this same web page that we find the fact sheet for the previous community we were looking at WPs54 – wetland prairie, southern floristic region, with mid range moisture regime.

Let's look at the fact sheet for Southern Wet Prairie.



The fact sheets available on DNR's website provide a summary of the class – they are about 5 to 7 pages long and include sections with a description, vegetation structure and composition, landscape setting and soils, natural history, similar native plant community classes, and subdivisions of the class into types (a, b, c) It is all very useful information for understanding the ecology of sites, I recommend reading those fact sheets that are relevant to your work area.

WPs54



• **UPs23 Southern Mesic Prairie**

UPs23 grades into WPs54 at the moist end of the moisture gradient in UPs23, without a distinct floristic boundary between the two classes. UPs23 typically occurs on drier sites, on perceptibly convex sites or slopes, but topographic differences between the classes are not always apparent. Big bluestem and prairie dropseed *(Sporobolus heterolepis)* are more important in UPs23 than in WPs54. Conversely, prairie cordgrass and mat muhly grass are much less important in UPs23 than WPs54. Sedges *(Carex* spp.) are only a minor component of UPs23 but important in WPs54.

WPs54 Indicator Species	(freq%) WPs54	UPs23
Bluejoint *(Calamagrostis canadensis)*	25	1
Spotted water hemlock *(Cicuta maculata)*	35	2
Autumn sneezeweed *(Helenium autumnale)*	37	3
Prairie loosestrife *(Lysimachia quadriflora)*	33	4
Riddell's goldenrod *(Solidago riddellii)*	41	6
Golden or False golden ragwort*	43	9
Woolly sedge *(Carex pellita)*	41	9
Northern bog violet *(Viola nephrophylla)*	41	9

UPs23 Indicator Species	(freq%) WPs54	UPs23
Stiff sunflower *(Helianthus pauciflorus)*	-	50
White sage *(Artemisia ludoviciana)*	-	43
Porcupine grass *(Stipa spartea)*	2	58
Leiberg's panic grass *(Panicum leibergii)*	2	43
Leadplant *(Amorpha canescens)*	6	74
Missouri goldenrod *(Solidago missouriensis)*	4	47
Rough blazing star *(Liatris aspera)*	6	59
White prairie clover *(Dalea candida)*	8	55

*Golden or False golden ragwort *(Senecio aureus or S. pseudaureus)*

• **WMs92 Southern Basin Wet Meadow/Carr**

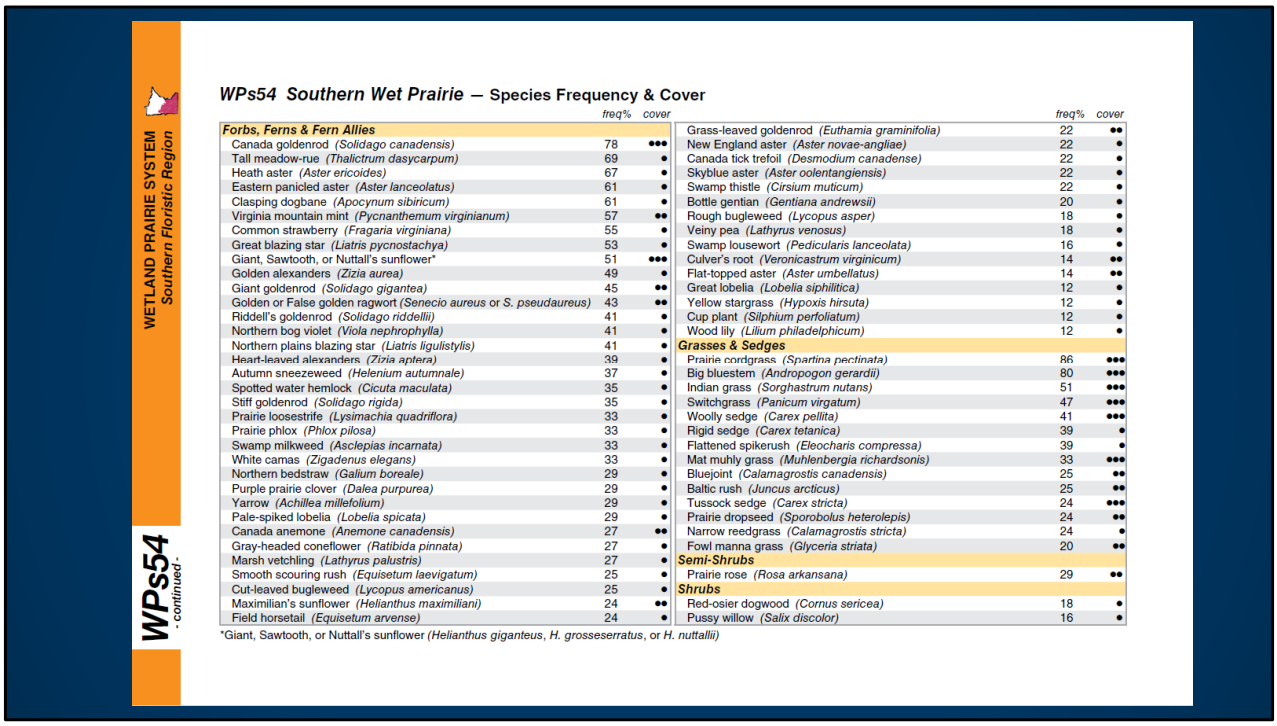
WPs54 and WMs92 occur in similar landscape settings, but soils in WPs54 are only briefly saturated in late spring, while soils in WMs92 are saturated throughout summer. As a result, WMs92 is more likely to have wetland species tolerant of long periods of inundation or saturated soils. WMs92 is usually strongly dominated by slough sedge *(Carex atherodes)* or occasionally by lake sedge *(Carex lacustris)*; whitetop *(Scolochloa festucacea)* is typically codominant or an important subdominant with slough sedge, while bluejoint *(Calamagrostis canadensis)* is usually the major grass with lake sedge. Prairie cordgrass may be present in WMs92 but is much less common than in WPs54. The other typical prairie grasses of WPs54 are very rare in WMs92.

WPs54 Indicator Species	(freq%) WPs54	WMs92
Big bluestem *(Andropogon gerardii)*	80	-
Heath aster *(Aster ericoides)*	67	-
Virginia mountain mint *(Pycnanthemum virginianum)*	57	-
Great blazing star *(Liatris pycnostachya)*	53	-
Indian grass *(Sorghastrum nutans)*	51	-
Golden alexanders *(Zizia aurea)*	49	-
Switchgrass *(Panicum virgatum)*	47	-
Golden or False golden ragwort*	43	-

WMs92 Indicator Species	(freq%) WPs54	WMs92
Slough sedge *(Carex atherodes)*	-	95
Water parsnip *(Sium suave)*	-	41
Whitetop *(Scolochloa festucacea)*	-	36
Common mint *(Mentha arvensis)*	-	32
Marsh skullcap *(Scutellaria galericulata)*	-	27
Tufted loosestrife *(Lysimachia thyrsiflora)*	-	23
Great water dock *(Rumex orbiculatus)*	-	18
Lake sedge *(Carex lacustris)*	2	27

*Golden or False golden ragwort *(Senecio aureus or S. pseudaureus)*

Within the fact sheet, you get a description of which plant community would be found upslope and which community would be found downslope. (or in terms of moisture -- drier and wetter) Looking on the drier side at UPs23 – 2 indicates drier than 5 – the narrative says that UPs23 grades into WPs54 at the moist end of the moisture gradient without a distinct floristic boundary…… On the wetter side – WMs92 – you can note that 9 is wetter than 5 and the narrative reads…. [They] occur in similar landscape settings, but soils in WPs54 are only briefly saturated in late spring, while soils in WMs92 are saturated throughout the summer……..



WETLAND PRAIRIE SYSTEM
Southern Floristic Region

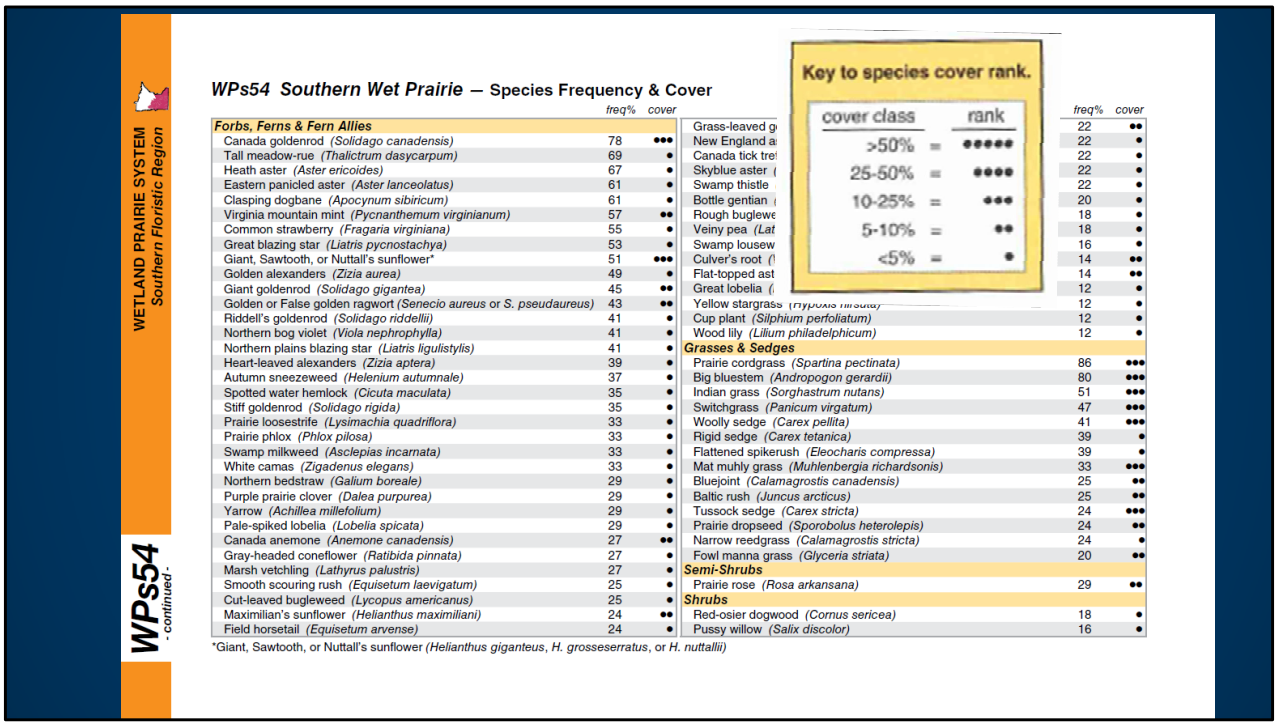
WPs54 - continued -

WPs54 Southern Wet Prairie — Species Frequency & Cover

	freq%	cover
Forbs, Ferns & Fern Allies		
Canada goldenrod *(Solidago canadensis)*	78	●●●
Tall meadow-rue *(Thalictrum dasycarpum)*	69	●
Heath aster *(Aster ericoides)*	67	●
Eastern panicled aster *(Aster lanceolatus)*	61	●
Clasping dogbane *(Apocynum sibiricum)*	61	●
Virginia mountain mint *(Pycnanthemum virginianum)*	57	●●
Common strawberry *(Fragaria virginiana)*	55	●
Great blazing star *(Liatris pycnostachya)*	53	●
Giant, Sawtooth, or Nuttall's sunflower*	51	●●●
Golden alexanders *(Zizia aurea)*	49	●
Giant goldenrod *(Solidago gigantea)*	45	●●
Golden or False golden ragwort *(Senecio aureus or S. pseudaureus)*	43	●●
Riddell's goldenrod *(Solidago riddellii)*	41	●
Northern bog violet *(Viola nephrophylla)*	41	●
Northern plains blazing star *(Liatris ligulistylis)*	41	●
Heart-leaved alexanders *(Zizia aptera)*	39	●
Autumn sneezeweed *(Helenium autumnale)*	37	●
Spotted water hemlock *(Cicuta maculata)*	35	●
Stiff goldenrod *(Solidago rigida)*	35	●
Prairie loosestrife *(Lysimachia quadriflora)*	33	●
Prairie phlox *(Phlox pilosa)*	33	●
Swamp milkweed *(Asclepias incarnata)*	33	●
White camas *(Zigadenus elegans)*	33	●
Northern bedstraw *(Galium boreale)*	29	●
Purple prairie clover *(Dalea purpurea)*	29	●
Yarrow *(Achillea millefolium)*	29	●
Pale-spiked lobelia *(Lobelia spicata)*	29	●
Canada anemone *(Anemone canadensis)*	27	●●
Gray-headed coneflower *(Ratibida pinnata)*	27	●
Marsh vetchling *(Lathyrus palustris)*	27	●
Smooth scouring rush *(Equisetum laevigatum)*	25	●
Cut-leaved bugleweed *(Lycopus americanus)*	25	●
Maximilian's sunflower *(Helianthus maximiliani)*	24	●●
Field horsetail *(Equisetum arvense)*	24	●
Grass-leaved goldenrod *(Euthamia graminifolia)*	22	●●
New England aster *(Aster novae-angliae)*	22	●
Canada tick trefoil *(Desmodium canadense)*	22	●
Skyblue aster *(Aster oolentangiensis)*	22	●
Swamp thistle *(Cirsium muticum)*	22	●
Bottle gentian *(Gentiana andrewsii)*	20	●
Rough bugleweed *(Lycopus asper)*	18	●
Veiny pea *(Lathyrus venosus)*	18	●
Swamp lousewort *(Pedicularis lanceolata)*	16	●
Culver's root *(Veronicastrum virginicum)*	14	●●
Flat-topped aster *(Aster umbellatus)*	14	●●
Great lobelia *(Lobelia siphilitica)*	12	●
Yellow stargrass *(Hypoxis hirsuta)*	12	●
Cup plant *(Silphium perfoliatum)*	12	●
Wood lily *(Lilium philadelphicum)*	12	●
Grasses & Sedges		
Prairie cordgrass *(Spartina pectinata)*	86	●●●
Big bluestem *(Andropogon gerardii)*	80	●●●
Indian grass *(Sorghastrum nutans)*	51	●●●
Switchgrass *(Panicum virgatum)*	47	●●●
Woolly sedge *(Carex pellita)*	41	●●●
Rigid sedge *(Carex tetanica)*	39	●
Flattened spikerush *(Eleocharis compressa)*	39	●
Mat muhly grass *(Muhlenbergia richardsonis)*	33	●●●
Bluejoint *(Calamagrostis canadensis)*	25	●●
Baltic rush *(Juncus arcticus)*	25	●●
Tussock sedge *(Carex stricta)*	24	●●●
Prairie dropseed *(Sporobolus heterolepis)*	24	●●
Narrow reedgrass *(Calamagrostis stricta)*	24	●
Fowl manna grass *(Glyceria striata)*	20	●●
Semi-Shrubs		
Prairie rose *(Rosa arkansana)*	29	●●
Shrubs		
Red-osier dogwood *(Cornus sericea)*	18	●
Pussy willow *(Salix discolor)*	16	●

*Giant, Sawtooth, or Nuttall's sunflower *(Helianthus giganteus, H. grosseserratus, or H. nuttallii)*

And finally, on the last page of the fact sheet – a species list! This gives us a fairly long list of species to choose from. And…..



WETLAND PRAIRIE SYSTEM
Southern Floristic Region

WPs54 *- continued -*

WPs54 Southern Wet Prairie — Species Frequency & Cover

	freq%	cover
Forbs, Ferns & Fern Allies		
Canada goldenrod *(Solidago canadensis)*	78	●●●
Tall meadow-rue *(Thalictrum dasycarpum)*	69	●
Heath aster *(Aster ericoides)*	67	●
Eastern panicled aster *(Aster lanceolatus)*	61	●
Clasping dogbane *(Apocynum sibiricum)*	61	●
Virginia mountain mint *(Pycnanthemum virginianum)*	57	●●
Common strawberry *(Fragaria virginiana)*	55	●
Great blazing star *(Liatris pycnostachya)*	53	●
Giant, Sawtooth, or Nuttall's sunflower*	51	●●●
Golden alexanders *(Zizia aurea)*	49	●
Giant goldenrod *(Solidago gigantea)*	45	●●
Golden or False golden ragwort *(Senecio aureus or S. pseudaureus)*	43	●●
Riddell's goldenrod *(Solidago riddellii)*	41	●
Northern bog violet *(Viola nephrophylla)*	41	●
Northern plains blazing star *(Liatris ligulistylis)*	41	●
Heart-leaved alexanders *(Zizia aptera)*	39	●
Autumn sneezeweed *(Helenium autumnale)*	37	●
Spotted water hemlock *(Cicuta maculata)*	35	●
Stiff goldenrod *(Solidago rigida)*	35	●
Prairie loosestrife *(Lysimachia quadriflora)*	33	●
Prairie phlox *(Phlox pilosa)*	33	●
Swamp milkweed *(Asclepias incarnata)*	33	●
White camas *(Zigadenus elegans)*	33	●
Northern bedstraw *(Galium boreale)*	29	●
Purple prairie clover *(Dalea purpurea)*	29	●
Yarrow *(Achillea millefolium)*	29	●
Pale-spiked lobelia *(Lobelia spicata)*	29	●
Canada anemone *(Anemone canadensis)*	27	●●
Gray-headed coneflower *(Ratibida pinnata)*	27	●
Marsh vetchling *(Lathyrus palustris)*	27	●
Smooth scouring rush *(Equisetum laevigatum)*	25	●
Cut-leaved bugleweed *(Lycopus americanus)*	25	●
Maximilian's sunflower *(Helianthus maximiliani)*	24	●●
Field horsetail *(Equisetum arvense)*	24	●
Grass-leaved g	22	●●
New England a	22	●
Canada tick tre	22	●
Skyblue aster (	22	●
Swamp thistle	22	●
Bottle gentian (	20	●
Rough buglewe	18	●
Veiny pea *(Lat*	18	●
Swamp lousew	16	●
Culver's root ('	14	●●
Flat-topped ast	14	●●
Great lobelia (	12	●
Yellow stargrass *(Hypoxis hirsuta)*	12	●
Cup plant *(Silphium perfoliatum)*	12	●
Wood lily *(Lilium philadelphicum)*	12	●
Grasses & Sedges		
Prairie cordgrass *(Spartina pectinata)*	86	●●●
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Switchgrass *(Panicum virgatum)*	47	●●●
Woolly sedge *(Carex pellita)*	41	●●●
Rigid sedge *(Carex tetanica)*	39	●
Flattened spikerush *(Eleocharis compressa)*	39	●
Mat muhly grass *(Muhlenbergia richardsonis)*	33	●●●
Bluejoint *(Calamagrostis canadensis)*	25	●●
Baltic rush *(Juncus arcticus)*	25	●●
Tussock sedge *(Carex stricta)*	24	●●●
Prairie dropseed *(Sporobolus heterolepis)*	24	●●
Narrow reedgrass *(Calamagrostis stricta)*	24	●
Fowl manna grass *(Glyceria striata)*	20	●●
Semi-Shrubs		
Prairie rose *(Rosa arkansana)*	29	●●
Shrubs		
Red-osier dogwood *(Cornus sericea)*	18	●
Pussy willow *(Salix discolor)*	16	●

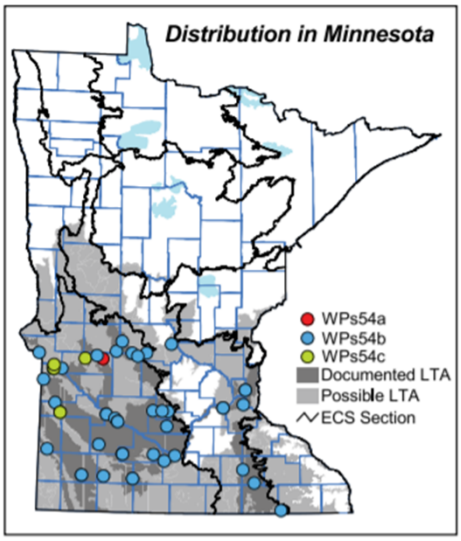
*Giant, Sawtooth, or Nuttall's sunflower *(Helianthus giganteus, H. grosseserratus,* or *H. nuttallii)*

Key to species cover rank.

cover class		rank
>50%	=	●●●●●
25-50%	=	●●●●
10-25%	=	●●●
5-10%	=	●●
<5%	=	●

Maybe more importantly – this table starts to give you some idea of how much of each species. The species cover rank is a breakdown of how much of an area that species would typically cover during the plant surveys that were conducted. The Biological Survey crew uses releves and these species lists are based on their data. It helps you to start to think about how much seed for that species should be in the seed mix. Species frequency represents how many plots a species was found within – not the number of plants within the plot (or the amount of area that was covered by that plant) so the "cover rank" is more accurate for helping develop seed quantities in a mix. You will notice that the species lists are also broken out in grasses and sedges, forbs, ferns and fern allies, as well as semi-shrubs and shrubs so that you can consider the plant guilds during your seeding mix design.

Native Plant Communities



- **Benefits**
  - Thorough species lists and species cover ranks
  - Insight into associated plant communities
- **Limitations**
  - Harder to match native plant community to your site once site is disturbed
  - Use with Minnesota Biological Survey or become proficient at using guides to identify sites

The benefits of using the Native Plant Communities information is that you can get a fairly long list of species along with an idea of quantities of seed to use that will be appropriate for that plant community. The fact sheets also give you insight into the spatially associated plant communities. The limitation to using them is that the guides are designed to identify the native plant community based on the plants present. On a disturbed site with no plants, it is more difficult to identify the native plant community. You either need to use the Minnesota Biological Survey or become pretty proficient at using the dichotomous keys within the NPC guidebooks to narrow down the native plant community based on ecological region, soils, topography, hydrology, etc. There is an upcoming Tech Talk on the topic of how to use the guidebooks if you are interested.

Challenge –Native Plant Communities on landscape

- Which of these native plant community systems would most likely be found on saturated or inundated soils? (Mark all that you think are correct)

MHs39

FDn12

FPn82

UPs13

APn90

Use your annotation tools and mark the ones you think are correct.

Activity –Native Plant Communities on landscape

- Which of these native plant community systems would most likely be found on saturated or inundated soils? (Mark all that you think are correct)

MHs39
Southern Mesic
Maple Basswood
Forest

FDn12
Northern Dry-Sand
Pine Woodland

FPn82
Northern Rich
Tamarack Swamp

UPs13
Southern Dry Prairie

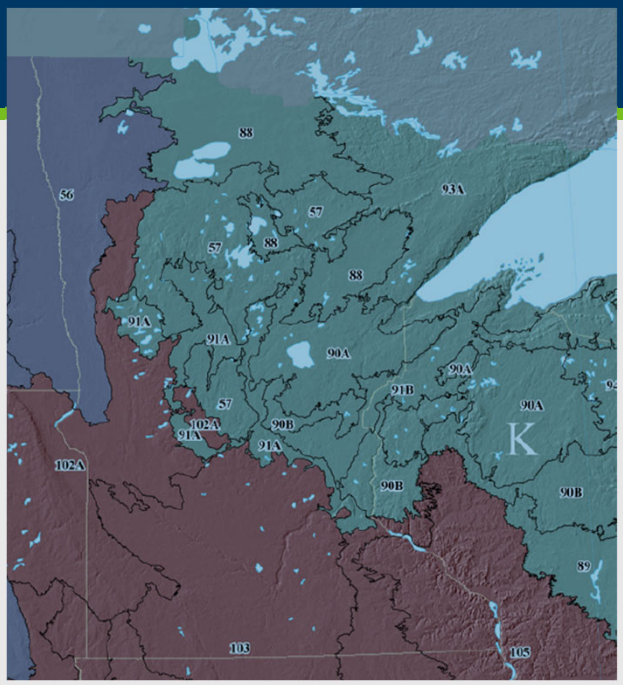
APn90
Northern Spruce
Bog

Species Selection

- Use a nearby reference site
- Minnesota Biological Survey/ Native Plant Communities
- **Ecological Site Descriptions**
- Native Plant Encyclopedia
- BWSR Seed Mixes

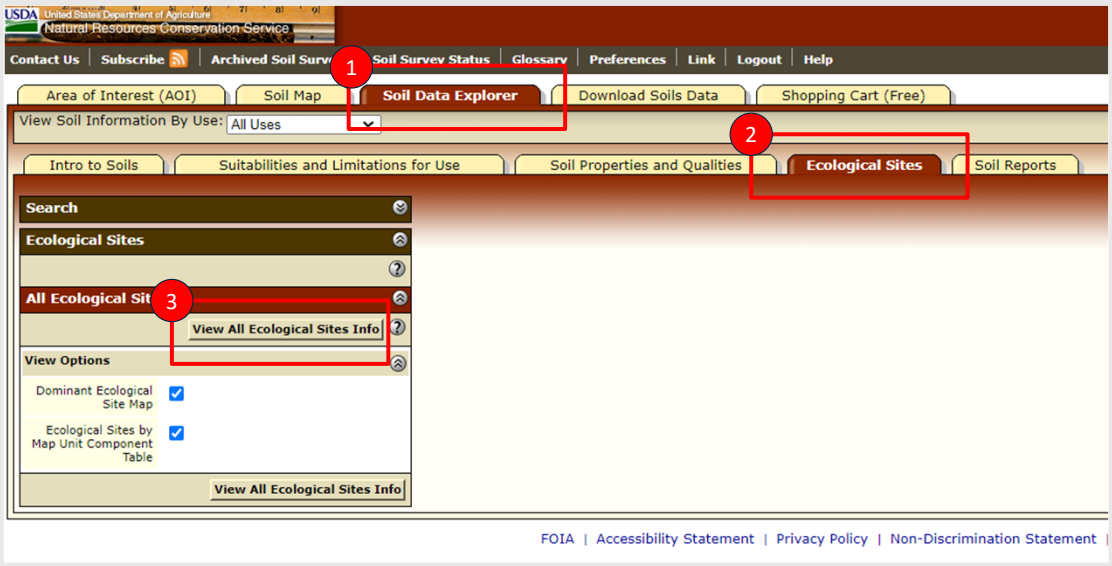
Moving on, we are going to take a look at Ecological Site Descriptions next.

Ecological Site Descriptions



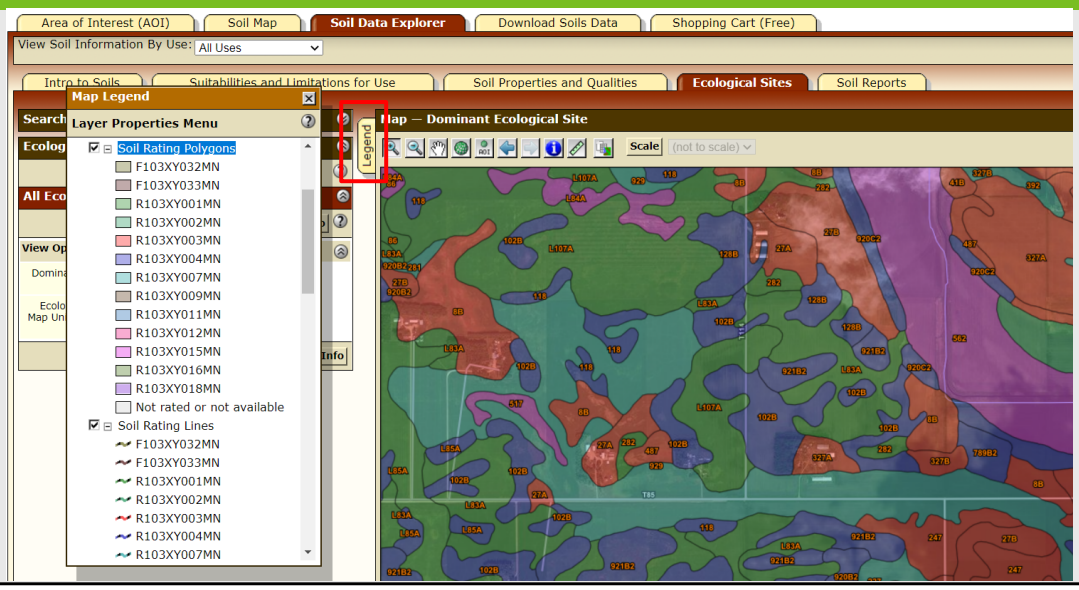
Ecological Site Descriptions (ESDs) are an effort being led by NRCS and are a work in progress for Minnesota. ESDs are being completed by Major Land Resource Area (MLRA) and are linked to soil map units. The US is divided into Land Resource Regions (colors on US map) and LRRs are further broken down in Major Land Resource Areas (numbers on Minnesota map). Divisions are based on soils, geography, and climate but are also influenced by agricultural cropping systems so the lines end up in similar but different locations than the DNR ecological classification system boundaries. If I counted correctly, there are 16 MLRAs in Minnesota. The only MLRA that I know has ecological site descriptions completed is MLRA 56 – in the Red River Valley.

Ecological Site Descriptions



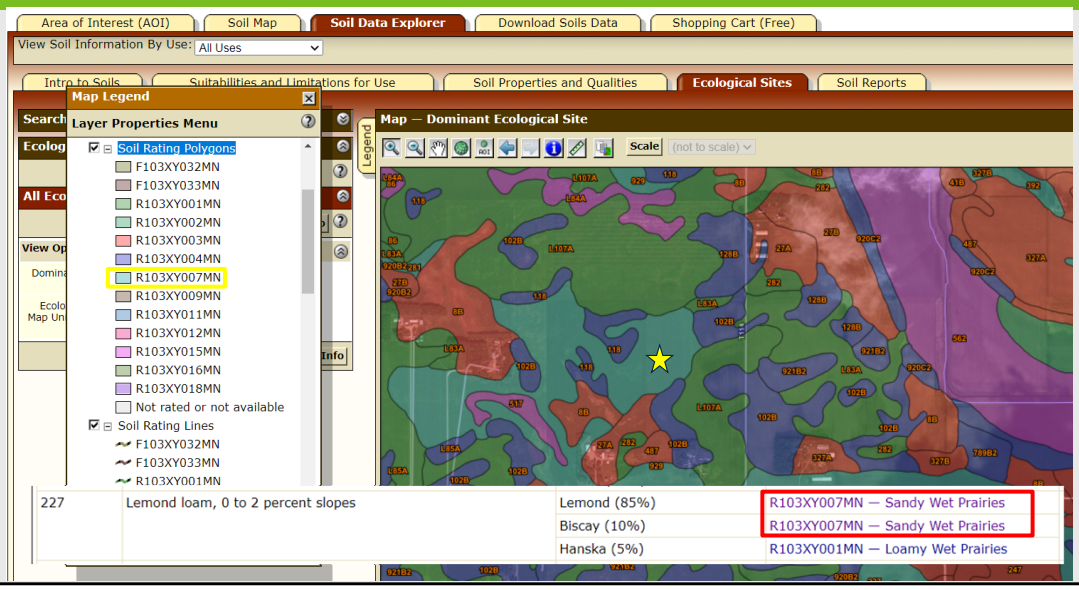
You can access Ecological Sites information from Web Soil Survey. Define your area of interest, then select Soil Data Explorer, Ecological Sites and then View All Ecological Sites Info.

Ecological Site Descriptions – Web Soil Survey



Web Soil Survey will generate the map. The Ecological Sites are tied directly to the soil map unit.

Ecological Site Descriptions – Web Soil Survey

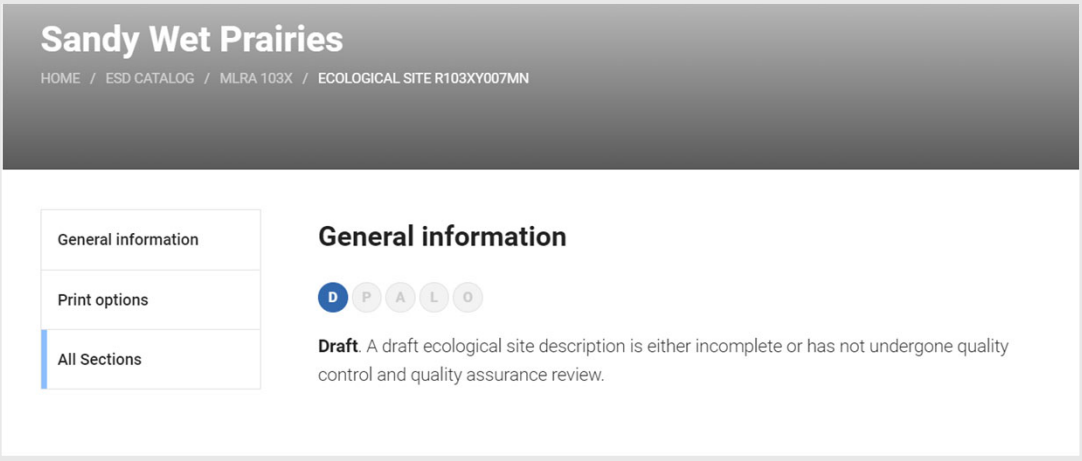


If you scroll down beneath the map, you will be able to see the Ecological Sites assigned to each soil map unit – including if the map unit has inclusions of other soil types (and other ecological sites). In this case, Soil Map Unit 227, Lemond loam has three components – Lemond, Biscay and Hanska soils – and the ecological site descriptions are matched to the component.

When you are looking at the soil map, think about the scale of mapping, many times, maybe most of the time with wetland restorations, we are working within the inclusions in the map unit, not the dominant component of the map unit.

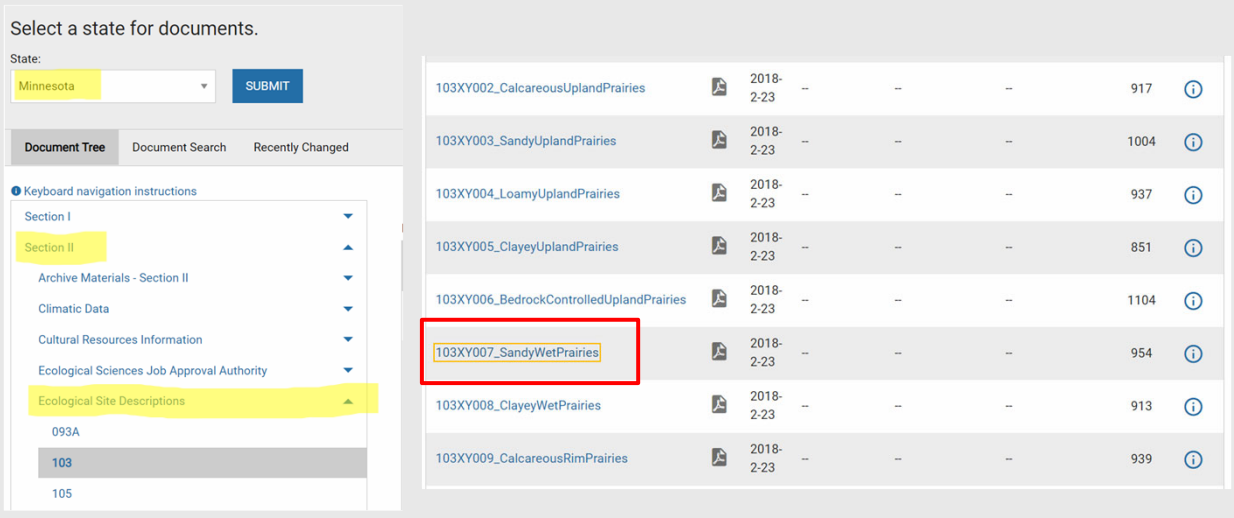
For us, today, I am going to select the Sandy Wet Prairies R103XY007MN ESD directly from within Web Soil Survey – So you can being to become familiar with the naming system -- 103 in R103XY…… is the MLRA number, so you know this ecological site description falls within that MLRA area on the Minnesota map.

Ecological Site Descriptions



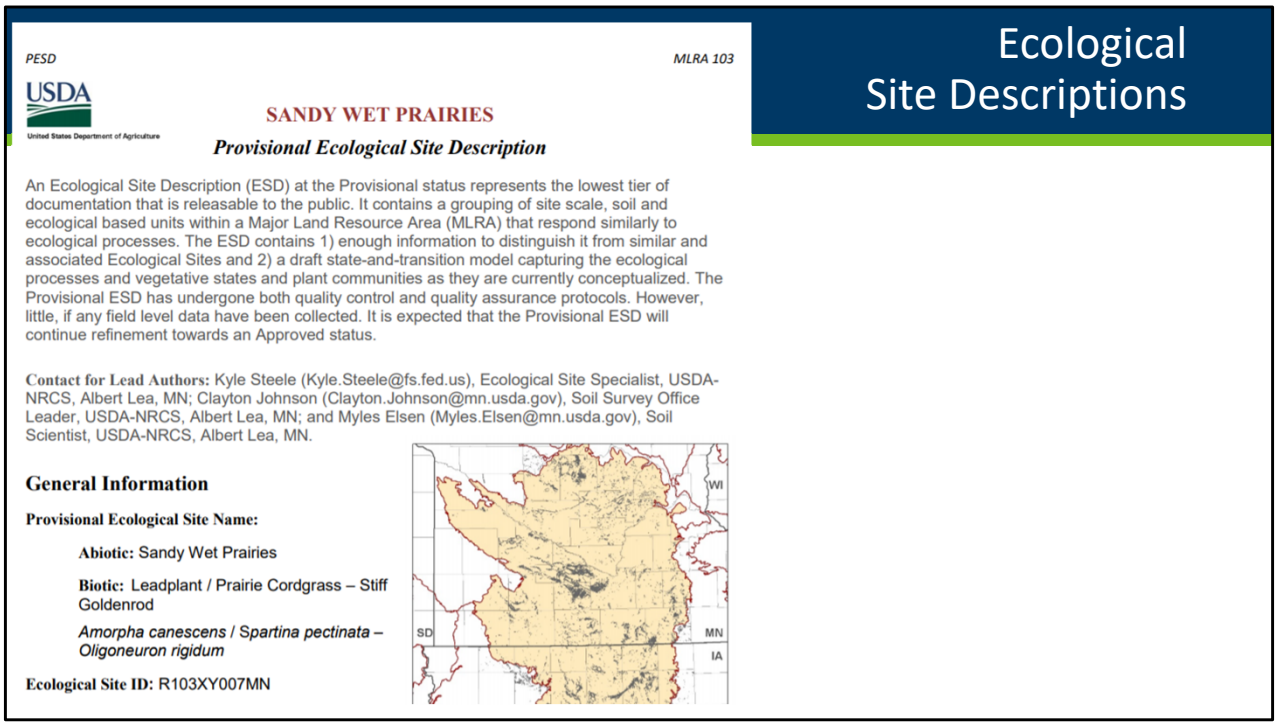
Selecting the Sandy Wet Prairie from within Web Soil Survey gives us this. Not very helpful. Again, ESDs are a work in progress.

Field Office Technical Guide - ESDs



We can also access Ecological Site Description Information from within the Field Office Technical Guide. We find it in Section II under Ecological Site Descriptions.

Ecological Site Descriptions



PESD MLRA 103

USDA
United States Department of Agriculture

SANDY WET PRAIRIES

Provisional Ecological Site Description

An Ecological Site Description (ESD) at the Provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of site scale, soil and ecological based units within a Major Land Resource Area (MLRA) that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated Ecological Sites and 2) a draft state-and-transition model capturing the ecological processes and vegetative states and plant communities as they are currently conceptualized. The Provisional ESD has undergone both quality control and quality assurance protocols. However, little, if any field level data have been collected. It is expected that the Provisional ESD will continue refinement towards an Approved status.

Contact for Lead Authors: Kyle Steele (Kyle.Steele@fs.fed.us), Ecological Site Specialist, USDA-NRCS, Albert Lea, MN; Clayton Johnson (Clayton.Johnson@mn.usda.gov), Soil Survey Office Leader, USDA-NRCS, Albert Lea, MN; and Myles Elsen (Myles.Elsen@mn.usda.gov), Soil Scientist, USDA-NRCS, Albert Lea, MN.

General Information

Provisional Ecological Site Name:

Abiotic: Sandy Wet Prairies

Biotic: Leadplant / Prairie Cordgrass – Stiff Goldenrod

Amorpha canescens / *Spartina pectinata* – *Oligoneuron rigidum*

Ecological Site ID: R103XY007MN

Selecting 103XY007_Sandy Wet Prairie gives us a multipage pdf document with information for the ecological site. The information is similar to that found in the Native Plant Community Fact Sheets – physiographic features, climate features, influencing water features, soil features, etc. Including plant community information.

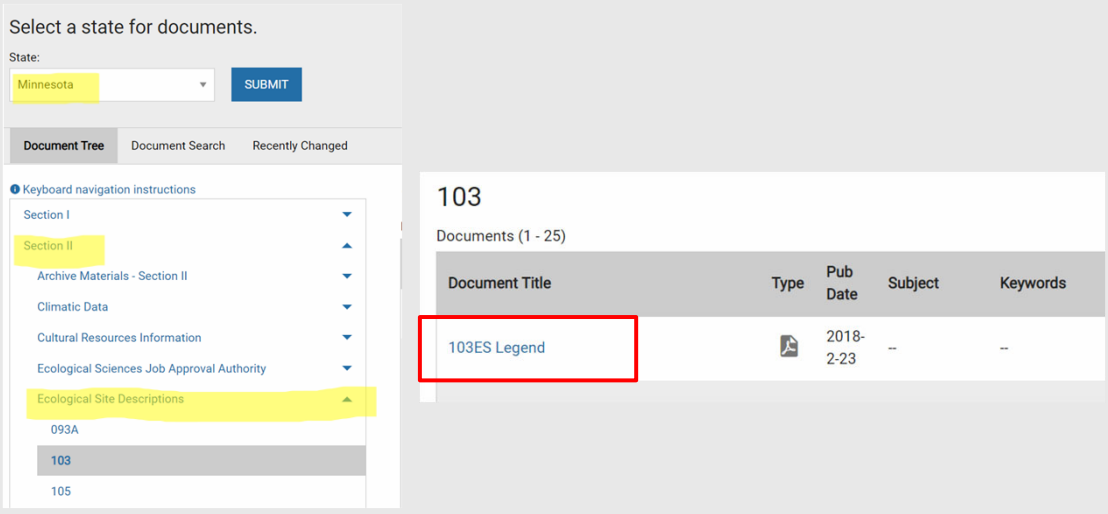
Ecological Site Descriptions

Ecological Dynamics

Reference plant communities are characterized as wet to wet-mesic prairie, which include a diversity of grasses, sedges, and forbs characteristic of poorly drained conditions. Variation in water table allows both wetland and non-wetland species to thrive. Historically, prairie cordgrass (*Spartina pectinata* Bosc ex Link) was a common species indicative of wetland conditions. Other important and often dominant grasses are those characteristic of the tallgrass prairie, especially big bluestem (*Andropogon gerardii* Vitman) and Indiangrass (*Sorghastrum nutans* (L.) Nash)). Sedges are an important component as well, particularly on the wetter end of this Provisional Ecological Site. Several dozen species are possible. The most noteworthy species are Bicknell's sedge (*Carex bicknellii* Britton), woolly sedge (*Carex pellita* Muhl ex. Willd.), and Buxbaum's sedge (*Carex buxbaumii* Wahlen B.). Tussock-forming species like Hayden's sedge (*Carex haydenii* Dewey) and upright sedge (*Carex stricta* Lam.) may also be important in extremely wet conditions. Common forbs include classic tallgrass prairie species like prairie blazing star (*Liatris pycnostachya* Michx.) and compassplant (*Silphium laciniatum* L.), as well as species typical of wetland conditions like fourflower yellow loosestrife (*Lysimachia quadriflora* Sims) and swamp milkweed (*Asclepias incarnata* L.). Shrub cover was typically low and likely included leadplant (*Amorpha canescens* Pursh), willows (*Salix* L.) and dogwoods (*Cornus* L.), which quickly spread in the absence of frequent fire.

Here I have scrolled down to the Ecological Dynamics section of the site description. It provides us with a list of species in our different guilds and functional groups. In this case, this isn't a full list as seen in other ecological site descriptions, we'll get to that in a minute……

Ecological Site Descriptions

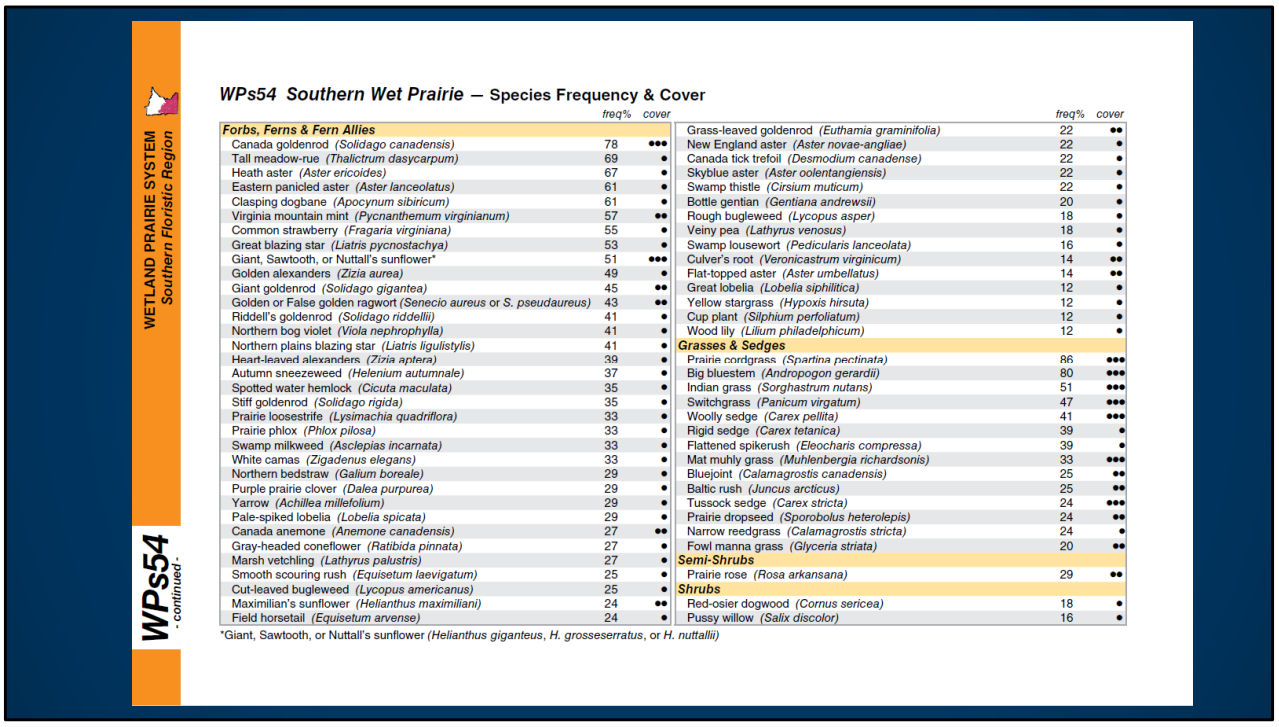


Interestingly, though, if you go to the legend document in the FOTG for MLRA 103

103ES Legend

ES SEQ	ES_NAME - Number	STM Type	MN NPC (best fit)	Concept
6	Sandy Wet Prairies - R103XY007MN	wet prairie	WPs54/ UPs23	Moderate. Wet to wet-mesic prairie. Poorly drained Endoaquolls with sandy or coarse loamy textures, derived from outwash parent materials, including loamy-mantled outwash. These sites are not ponded, and are located on flats and slight depressions, primarily on outwash plains and valley trains along modern river valleys. Biscay, Darfur, Granby, Hanska, Lemond, Mayer, and Talcot are the dominant soil series. HGM criteria: recharge, Mineral Soil Flat.
7	Loamy Wet Prairies - R103XY001MN	wet prairie	WPs54	Strong. Wet prairie. Widely distributed and extensive. Medium-textured, poorly drained Endoaquolls derived from fine loamy till and lacustrine parent materials. Webster and Canisteo are the central concept soil series. These sites are not ponded, and are located on inter-depressional flats and slight depressions on till plains, moraines, and short-lived lake plains. HGM criteria: recharge, Mineral Soil Flat.
8	Clayey Wet Prairies - R103XY008MN	wet prairie	WPs54	Strong. Wet prairie. Fine and very fine, clayey textured lacustrine materials classified either epi or endosaturated Vertisols and Mollisols. These sites are not ponded, and are located on flats on glacial lake plains, particularly Glacial Lake Minnesota. Brownton, Marna, and Waldorf are the predominant soil series. HGM criteria: recharge, Mineral Soil Flat.

The legend ties the Ecological Site Description to a Native Plant Community. If you remember – WPs54 is……



WETLAND PRAIRIE SYSTEM
Southern Floristic Region

WPs54 - continued -

WPs54 Southern Wet Prairie — **Species Frequency & Cover**

	freq%	cover
Forbs, Ferns & Fern Allies		
Canada goldenrod *(Solidago canadensis)*	78	●●●
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Heath aster *(Aster ericoides)*	67	●
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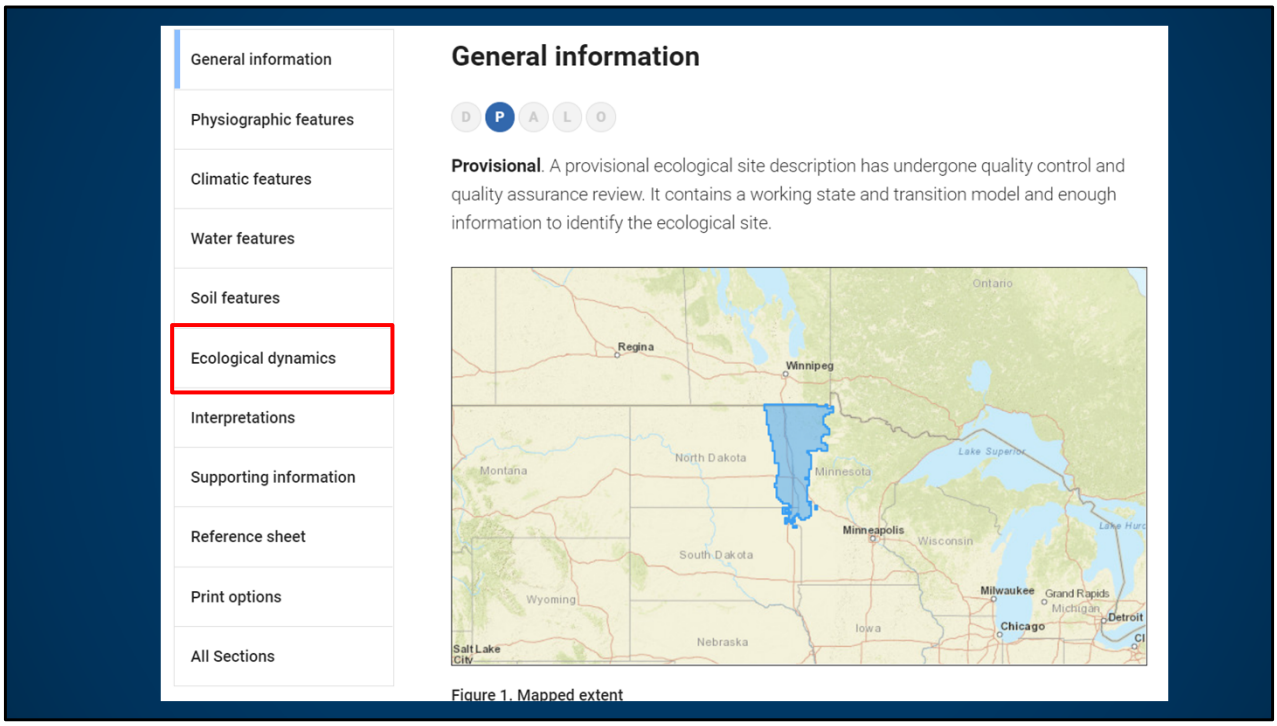
Clasping dogbane *(Apocynum sibiricum)*	61	●
Virginia mountain mint *(Pycnanthemum virginianum)*	57	●●
Common strawberry *(Fragaria virginiana)*	55	●
Great blazing star *(Liatris pycnostachya)*	53	●
Giant, Sawtooth, or Nuttall's sunflower*	51	●●●
Golden alexanders *(Zizia aurea)*	49	●
Giant goldenrod *(Solidago gigantea)*	45	●●
Golden or False golden ragwort *(Senecio aureus or S. pseudaureus)*	43	●●
Riddell's goldenrod *(Solidago riddellii)*	41	●
Northern bog violet *(Viola nephrophylla)*	41	●
Northern plains blazing star *(Liatris ligulistylis)*	41	●
Heart-leaved alexanders *(Zizia aptera)*	39	●
Autumn sneezeweed *(Helenium autumnale)*	37	●
Spotted water hemlock *(Cicuta maculata)*	35	●
Stiff goldenrod *(Solidago rigida)*	35	●
Prairie loosestrife *(Lysimachia quadriflora)*	33	●
Prairie phlox *(Phlox pilosa)*	33	●
Swamp milkweed *(Asclepias incarnata)*	33	●
White camas *(Zigadenus elegans)*	33	●
Northern bedstraw *(Galium boreale)*	29	●
Purple prairie clover *(Dalea purpurea)*	29	●
Yarrow *(Achillea millefolium)*	29	●
Pale-spiked lobelia *(Lobelia spicata)*	29	●
Canada anemone *(Anemone canadensis)*	27	●●
Gray-headed coneflower *(Ratibida pinnata)*	27	●
Marsh vetchling *(Lathyrus palustris)*	27	●
Smooth scouring rush *(Equisetum laevigatum)*	25	●
Cut-leaved bugleweed *(Lycopus americanus)*	25	●
Maximilian's sunflower *(Helianthus maximiliani)*	24	●●
Field horsetail *(Equisetum arvense)*	24	●
Grass-leaved goldenrod *(Euthamia graminifolia)*	22	●●
New England aster *(Aster novae-angliae)*	22	●
Canada tick trefoil *(Desmodium canadense)*	22	●
Skyblue aster *(Aster oolentangiensis)*	22	●
Swamp thistle *(Cirsium muticum)*	22	●
Bottle gentian *(Gentiana andrewsii)*	20	●
Rough bugleweed *(Lycopus asper)*	18	●
Veiny pea *(Lathyrus venosus)*	18	●
Swamp lousewort *(Pedicularis lanceolata)*	16	●
Culver's root *(Veronicastrum virginicum)*	14	●●
Flat-topped aster *(Aster umbellatus)*	14	●●
Great lobelia *(Lobelia siphilitica)*	12	●
Yellow stargrass *(Hypoxis hirsuta)*	12	●
Cup plant *(Silphium perfoliatum)*	12	●
Wood lily *(Lilium philadelphicum)*	12	●
Grasses & Sedges		
Prairie cordgrass *(Spartina pectinata)*	86	●●●
Big bluestem *(Andropogon gerardii)*	80	●●●
Indian grass *(Sorghastrum nutans)*	51	●●●
Switchgrass *(Panicum virgatum)*	47	●●●
Woolly sedge *(Carex pellita)*	41	●●●
Rigid sedge *(Carex tetanica)*	39	●
Flattened spikerush *(Eleocharis compressa)*	39	●
Mat muhly grass *(Muhlenbergia richardsonis)*	33	●●●
Bluejoint *(Calamagrostis canadensis)*	25	●●
Baltic rush *(Juncus arcticus)*	25	●●
Tussock sedge *(Carex stricta)*	24	●●●
Prairie dropseed *(Sporobolus heterolepis)*	24	●●
Narrow reedgrass *(Calamagrostis stricta)*	24	●
Fowl manna grass *(Glyceria striata)*	20	●●
Semi-Shrubs		
Prairie rose *(Rosa arkansana)*	29	●●
Shrubs		
Red-osier dogwood *(Cornus sericea)*	18	●
Pussy willow *(Salix discolor)*	16	●

*Giant, Sawtooth, or Nuttall's sunflower *(Helianthus giganteus, H. grosseserratus, or H. nuttallii)*

The same Southern Wet Prairie system that was our previous example in the Minnesota Biological Survey and Native Plant Community sections. If this is the path that ecological site description work continues on, this is like the holy grail for vegetation restoration – each soil map unit tied to one or more native plant communities that are based on research and ecological science. One giant leap for….. Vegetation restoration!



Just to give you an idea of an ecological site description that is not draft and you might find linked to Web Soil Survey, here's an example, This one comes from the Red River Valley area and as far as I know, if that is your work area, you can access all your ecological site descriptions directly from Web Soil Survey. There are all the categories of information about that ecological site as shown on the menu on the left. I am going to show you a part of the ecological dynamics section.

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass-likes**			2080–2600	
	woolly sedge	CAPE42	*Carex pellita*	1560–2080	–
	wheat sedge	CAAT2	*Carex atherodes*	780–1300	–
	shortbeak sedge	CABR10	*Carex brevior*	780–1300	–
	limestone meadow sedge	CAGR3	*Carex granularis*	52–260	–
	bottlebrush sedge	CAHY4	*Carex hystericina*	52–260	–
	smoothcone sedge	CALA12	*Carex laeviconica*	52–260	–
	Bicknell's sedge	CABI3	*Carex bicknellii*	52–260	–
	water sedge	CAAQ	*Carex aquatilis*	52–260	–
	Sartwell's sedge	CASA8	*Carex sartwellii*	52–260	–
	upright sedge	CAST8	*Carex stricta*	52–260	–
	rigid sedge	CATE6	*Carex tetanica*	52–260	–
	fox sedge	CAVU2	*Carex vulpinoidea*	52–260	–

Within the ecological dynamics section, you can get a species list. Notice, there isn't foliar cover % but there is annual production data – the data was gathered from a grazing production perspective. Still, there is a nice long list of species, starting with sedges…..

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
2	**Cool-Season Grasses**			1300–1820	
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	780–1560	–
	fowl bluegrass	POPA2	*Poa palustris*	52–260	–
	prairie wedgescale	SPOB	*Sphenopholis obtusata*	0–156	–
	Grass, native	2GN	*Grass, native*	0–156	–
	American sloughgrass	BESY	*Beckmannia syzigachne*	0–104	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–104	–
3	**Warm-Season Grasses**			260–780	
	prairie cordgrass	SPPE	*Spartina pectinata*	52–260	–
	switchgrass	PAVI2	*Panicum virgatum*	52–156	–
	Grass, perennial	2GP	*Grass, perennial*	0–104	–
	Mexican muhly	MUME2	*Muhlenbergia mexicana*	0–52	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–52	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–52	–

Including cool season and warm season grasses

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
4	**Other Grass-likes**			52–260	
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	52–156	–
	spikerush	ELEOC	*Eleocharis*	52–156	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–104	–
	Dudley's rush	JUDU2	*Juncus dudleyi*	0–52	–
	Torrey's rush	JUTO	*Juncus torreyi*	0–52	–
	spikesedge	KYLLI2	*Kyllinga*	0–52	–
	American water-willow	JUAM	*Justicia americana*	0–52	–
	cloaked bulrush	SCPA8	*Scirpus pallidus*	0–52	–
	common threesquare	SCPUB	*Schoenoplectus pungens var. badius*	0–52	–

Grasslike species such as rushes

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Forb					
5	**Forbs**			520–1040	
	Forb, native	2FN	*Forb, native*	52–104	–
	Canadian anemone	ANCA8	*Anemone canadensis*	52–104	–
	flat-top goldentop	EUGRG	*Euthamia graminifolia var. graminifolia*	52–104	–
	hempnettle	GALEO	*Galeopsis*	52–104	–
	American water horehound	LYAM	*Lycopus americanus*	52–104	–
	rough bugleweed	LYAS	*Lycopus asper*	52–104	–
	wild mint	MEAR4	*Mentha arvensis*	52–104	–
	northern bog violet	VINE	*Viola nephrophylla*	52–104	–
	water knotweed	POAM8	*Polygonum amphibium*	52–104	–
	white panicle aster	SYLAL4	*Symphyotrichum lanceolatum ssp. lanceolatum var. lanceolatum*	52–104	–
	Canada germander	TECA3	*Teucrium canadense*	52–104	–
	broadleaf cattail	TYLA	*Typha latifolia*	0–52	–
	swamp verbena	VEHA2	*Verbena hastata*	0–52	–
	tall cinquefoil	POAR7	*Potentilla arguta*	0–52	–

Forbs

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Forb					
5	**Forbs**			520–1040	
	swamp smartweed	POHY2	*Polygonum hydropiperoides*	0–52	–
	alkali buttercup	RACY	*Ranunculus cymbalaria*	0–52	–
	western dock	RUAQ	*Rumex aquaticus*	0–52	–
	blue skullcap	SCLA2	*Scutellaria lateriflora*	0–52	–
	hedgenettle	STACH	*Stachys*	0–52	–
	Great Plains white fringed orchid	PLPR4	*Platanthera praeclara*	0–52	–
	dogbane	APOCY	*Apocynum*	0–52	–
	swamp milkweed	ASIN	*Asclepias incarnata*	0–52	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–52	–

More forbs

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
7	**Shrubs**			0–260	
	Shrub, other	2S	*Shrub, other*	0–52	–
	Bebb willow	SABE2	*Salix bebbiana*	0–52	–
	narrowleaf willow	SAEX	*Salix exigua*	0–52	–
	willow	SALIX	*Salix*	0–52	–
	meadow willow	SAPE5	*Salix petiolaris*	0–52	–
	white meadowsweet	SPAL2	*Spiraea alba*	0–52	–

And shrubs

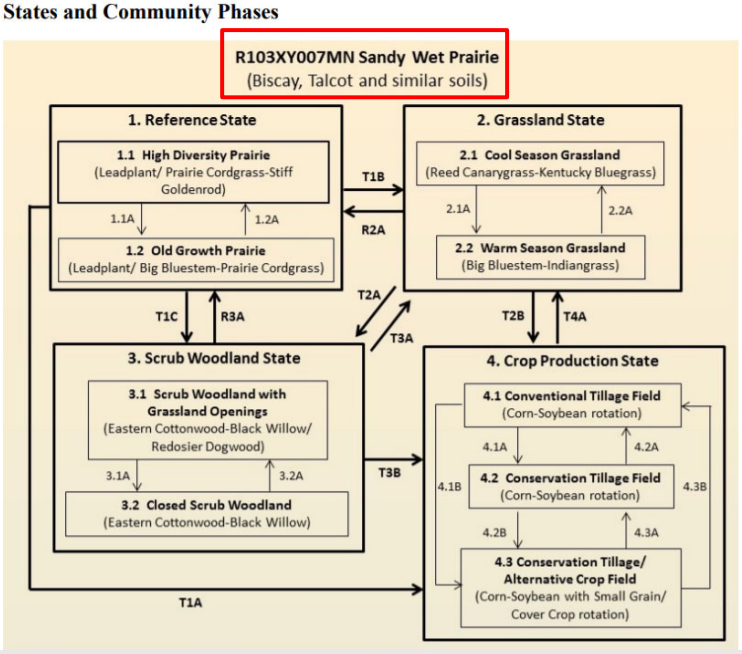
Agronomy Technical Note #31 guidance – 657 practice standard

Seed Planting Density - Wetland seed mixes shall provide seed densities ranging from 110 to 200 seeds/ft^2. Wet/sedge meadow seed mixes shall contain 20-30 species. Shallow emergent marsh communities may be seeded with mixes of 10-20 species. Refer to Table 21 for recommended species and optional seeding calculator on the MN NRCS Home Page at Technical Resources/Seeding Tools. Higher diversity mixes will help support pollinators and other invertebrates that play a key role in the health of wetland habitats. Recommended composition of mixes, based on seeds/ft^2:

EMERGENT FRINGE		SEDGE MEADOW		WET MEADOW	
Grasses	20 – 65%	Grasses	20 – 50%	Grasses	20 – 60%
Sedges - Rushes	20 – 65%	Sedges - Rushes	40 – 70%	Sedges - Rushes	15 – 60%
Forbs	15 – 30%	Forbs	15 – 35%	Forbs	15 – 35%

So folks in that Red River Valley work area, and hopefully soon in other work areas will be able to view a list of plants directly out of web soil survey and that list has enough species to develop a seeding plan that meets the 657 practice standard and provides you with grasses, sedges-rushes, and forbs options.

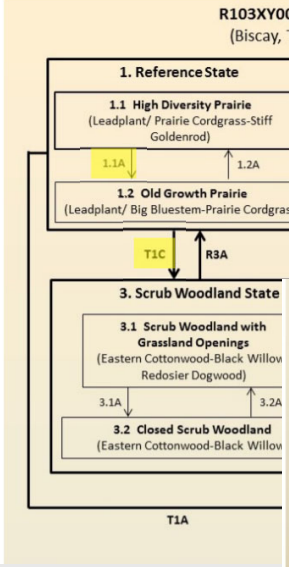
Community Phases



Another item of interest found in the ecological dynamics section of the ecological site description documentation is the community phases. These can be thought of as the successional states or disturbance states of the plant community.

State and Transition Diagram

Helps formulate future management strategies to maintain the site in the desired phase.



Code	Process
T1A, T2B	Tillage; artificial drainage; removal of fire and native grazers.
T1B	Seeding or invasion of cool season grasses; lack of fire; some hydrologic alteration; possible over-grazing.
T1C, T2A	Lack of fire and grazing; time.
T3A	Removal of overstory; seeding of grasses.
T3B	Removal of overstory; artificial drainage; tillage and conversion to row crop agriculture.
T4A	Removal of tillage activities, seeding of grasses; possible restoration of hydrology.
R2A	Long term ecological restoration; potentially impossible.
R3A	Removal of overstory; long term restoration; uncommon.

Code	Process
1.1A	Fire-free period 3-5 years.
1.2A	Fire-free period <3 years.
2.1A	Removal of cool season grasses; seeding of native grasses.
2.2A	Invasion of cool season grasses.
3.1A	Succession, development of forest structure.
3.2A	Partial removal of canopy.
4.1A	Less tillage; residue management; crop rotation.
4.1B, 4.2B	Less tillage (none in the fall) or no tillage; increased plant diversity; crop rotation; continuous soil cover.
4.2A, 4.3B	Intensive tillage; less residue; monoculture cropping.
4.3A	Additional tillage; less residue; no cover crops.

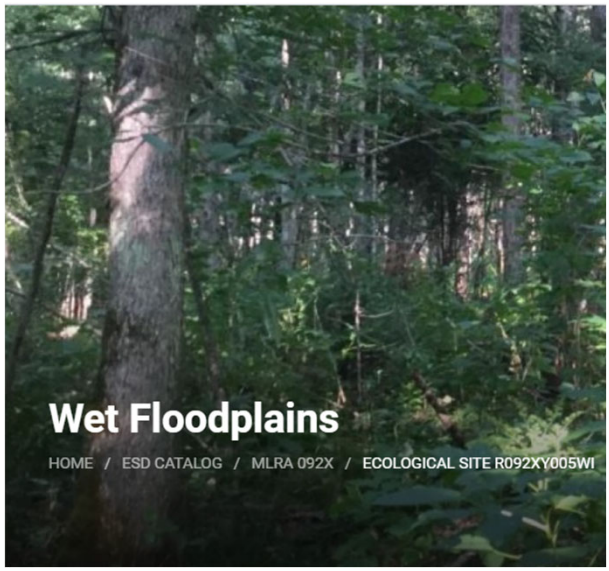
Figure 4. State-and-transition diagram for Sandy Wet Prairies Provisional Ecological Site.

With the help of the key, you can determine a cause and effect between actions and community response. This may help you to consider how to restore a degraded site, or it may help to consider long term scheduled maintenance activities.

For example, If the 1.1 High Diversity Prairie is left without fire or other disturbance, it will convert to 1.2 Old Growth Prairie in 3 to 5 years. Even longer without fire or grazing and it will convert to a scrub woodland state. If you are putting the time, effort and money into a 40 species restoration mix, you shouldn't expect to see that nice highly diverse prairie ecosystem on site in 15 to 20 years if no management occurs on site.

This States and Community phases diagrams are really helpful to match management activities to the long term goals for the site.

Ecological Site Descriptions



- **Benefits**
  - Will be tied to every soil map unit in the state and full state coverage, ease of identifying via WSS
- **Limitations**
  - Not fully developed, work in progress
  - Production, not foliar cover

The benefit of using the ecological site descriptions is that they are tied to soil map units and the data is accessible directly from Web Soil Survey. Eventually this will be true statewide. In the meantime, this is also a limitation in the parts of the state where they are not complete and not accessible even through the field office technical guide. The data within the ecological site description itself is tied to production rather than a percent cover so that is a little less transparent for calculating seeding rates.

Activity - Ecological Site Descriptions

- Go to Web Soil Survey https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
- Create an area of interest for about six townships in your county
- Generate an Ecological Sites map (soil data explorer, ecological sites)
- Report what you find – type in one or more of the Ecological Site IDs you find - either in chat or type on screen.

Here's another activity. I would like you to go to Web Soil Survey and choose an area of about 6 townships and see if you have ecological site data available. Report back to the group – either type an example of an ecological site ID that you find, or type NONE if they aren't available yet for your county. You can put it in chat or type on the screen. [copy and paste web soil survey link in chat box] The link for the web soil survey is in the chat box.

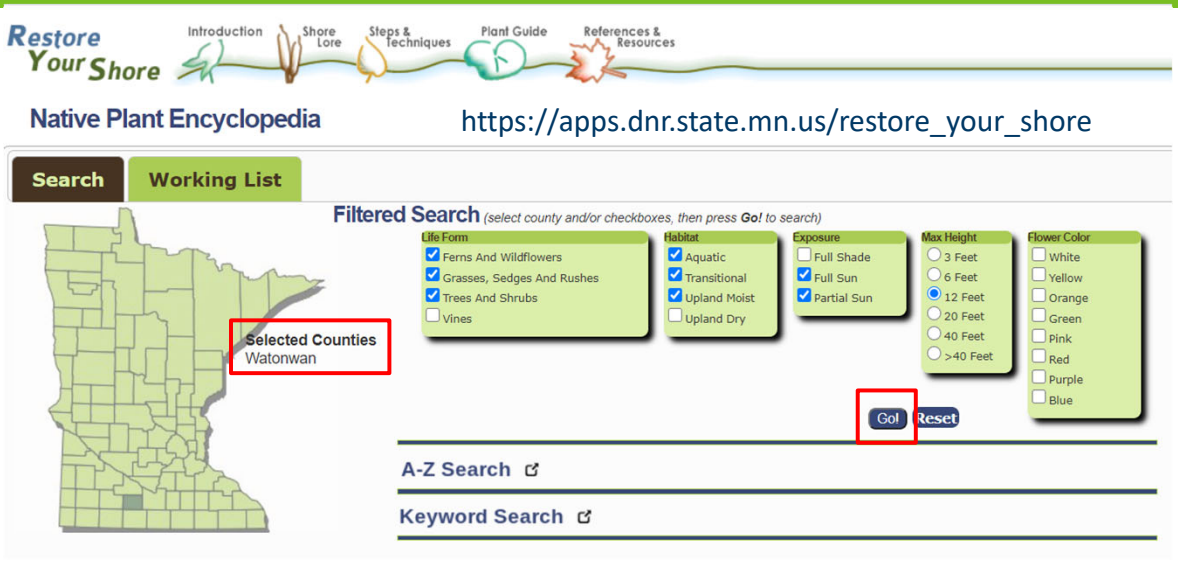
https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Species Selection

- Use a nearby reference site
- Minnesota Biological Survey/ Native Plant Communities
- Ecological Site Descriptions
- **Native Plant Encyclopedia**
- BWSR Seed Mixes

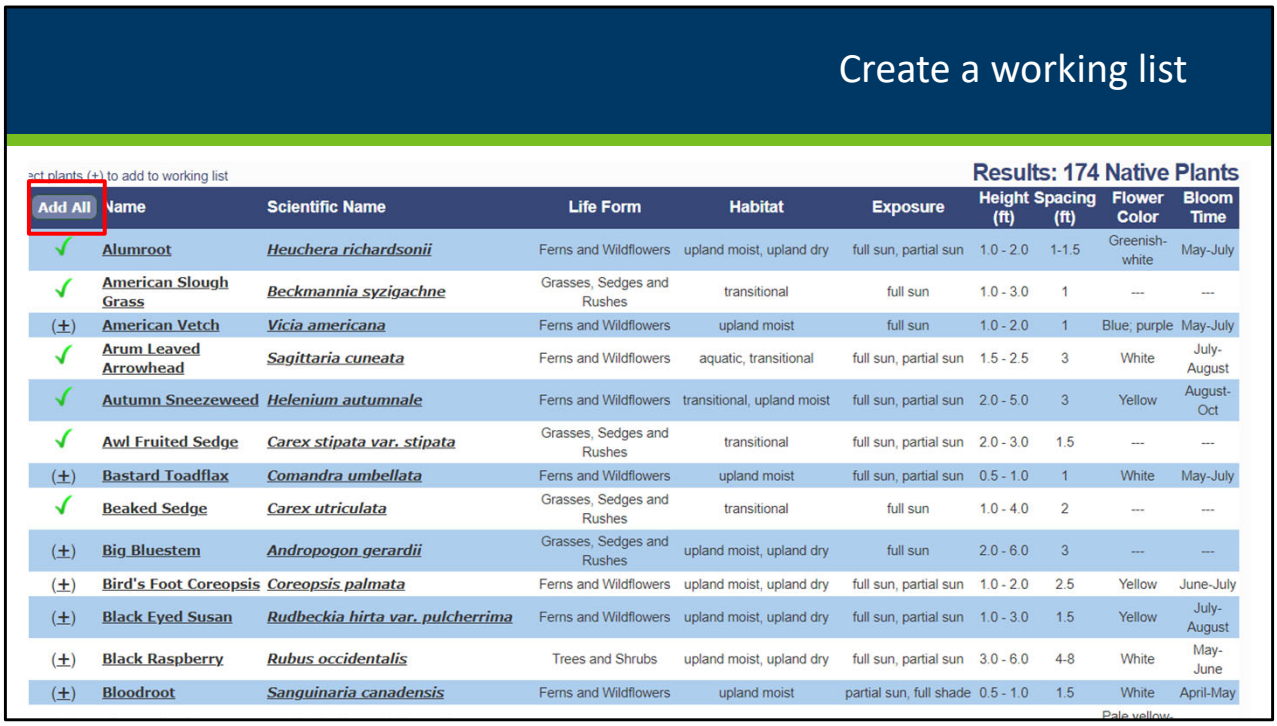
We have two more resources to look at fairly quickly. The first is the Native Plant Encyclopedia.

Native Plant Encyclopedia – Restore Your Shore



The Native Plant Encyclopedia is a part of DNRs Restore Your Shore website. You can generate a list of native species for your county that meet certain criteria. You select your county and your options and “Go”.

Create a working list



ect plants (+) to add to working list

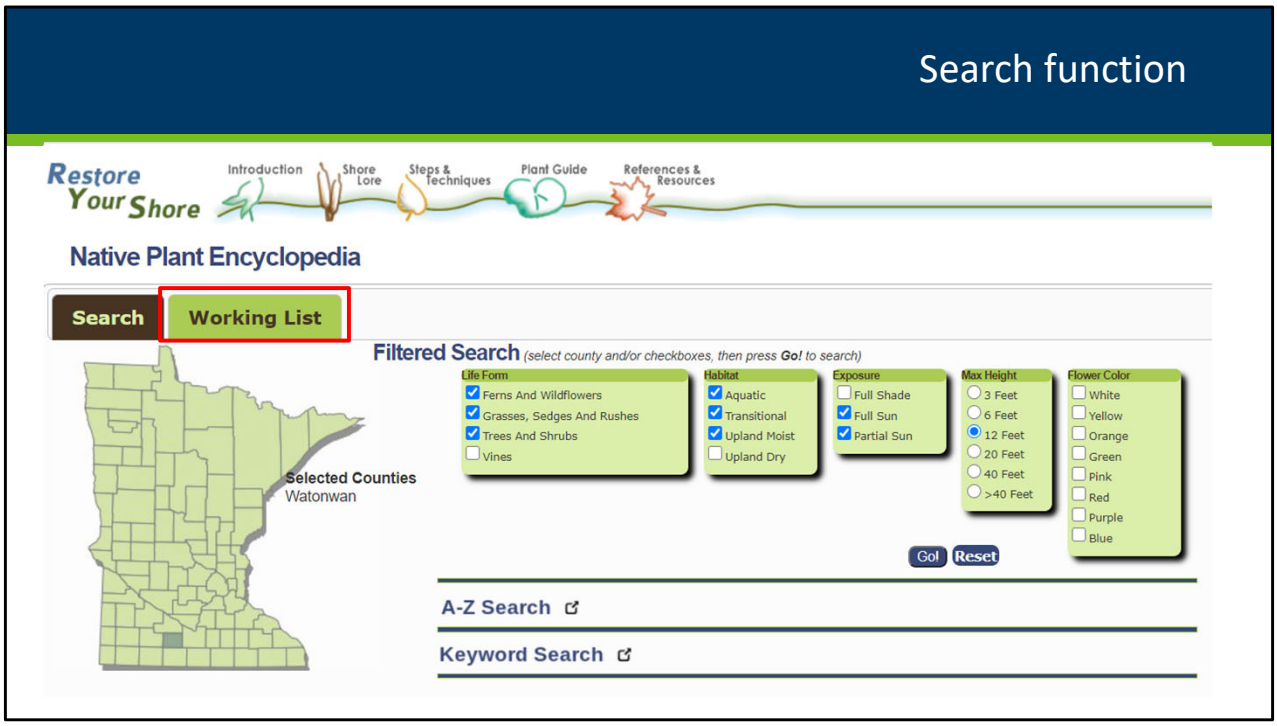
Results: 174 Native Plants

Add All	Name	Scientific Name	Life Form	Habitat	Exposure	Height (ft)	Spacing (ft)	Flower Color	Bloom Time
✓	Alumroot	*Heuchera richardsonii*	Ferns and Wildflowers	upland moist, upland dry	full sun, partial sun	1.0 - 2.0	1-1.5	Greenish-white	May-July
✓	American Slough Grass	*Beckmannia syzigachne*	Grasses, Sedges and Rushes	transitional	full sun	1.0 - 3.0	1	---	---
(+)	American Vetch	*Vicia americana*	Ferns and Wildflowers	upland moist	full sun	1.0 - 2.0	1	Blue; purple	May-July
✓	Arum Leaved Arrowhead	*Sagittaria cuneata*	Ferns and Wildflowers	aquatic, transitional	full sun, partial sun	1.5 - 2.5	3	White	July-August
✓	Autumn Sneezeweed	*Helenium autumnale*	Ferns and Wildflowers	transitional, upland moist	full sun, partial sun	2.0 - 5.0	3	Yellow	August-Oct
✓	Awl Fruited Sedge	*Carex stipata var. stipata*	Grasses, Sedges and Rushes	transitional	full sun, partial sun	2.0 - 3.0	1.5	---	---
(+)	Bastard Toadflax	*Comandra umbellata*	Ferns and Wildflowers	upland moist	full sun, partial sun	0.5 - 1.0	1	White	May-July
✓	Beaked Sedge	*Carex utriculata*	Grasses, Sedges and Rushes	transitional	full sun	1.0 - 4.0	2	---	---
(+)	Big Bluestem	*Andropogon gerardii*	Grasses, Sedges and Rushes	upland moist, upland dry	full sun	2.0 - 6.0	3	---	---
(+)	Bird's Foot Coreopsis	*Coreopsis palmata*	Ferns and Wildflowers	upland moist, upland dry	full sun, partial sun	1.0 - 2.0	2.5	Yellow	June-July
(+)	Black Eyed Susan	*Rudbeckia hirta var. pulcherrima*	Ferns and Wildflowers	upland moist, upland dry	full sun, partial sun	1.0 - 3.0	1.5	Yellow	July-August
(+)	Black Raspberry	*Rubus occidentalis*	Trees and Shrubs	upland moist, upland dry	full sun, partial sun	3.0 - 6.0	4-8	White	May-June
(+)	Bloodroot	*Sanguinaria canadensis*	Ferns and Wildflowers	upland moist	partial sun, full shade	0.5 - 1.0	1.5	White	April-May

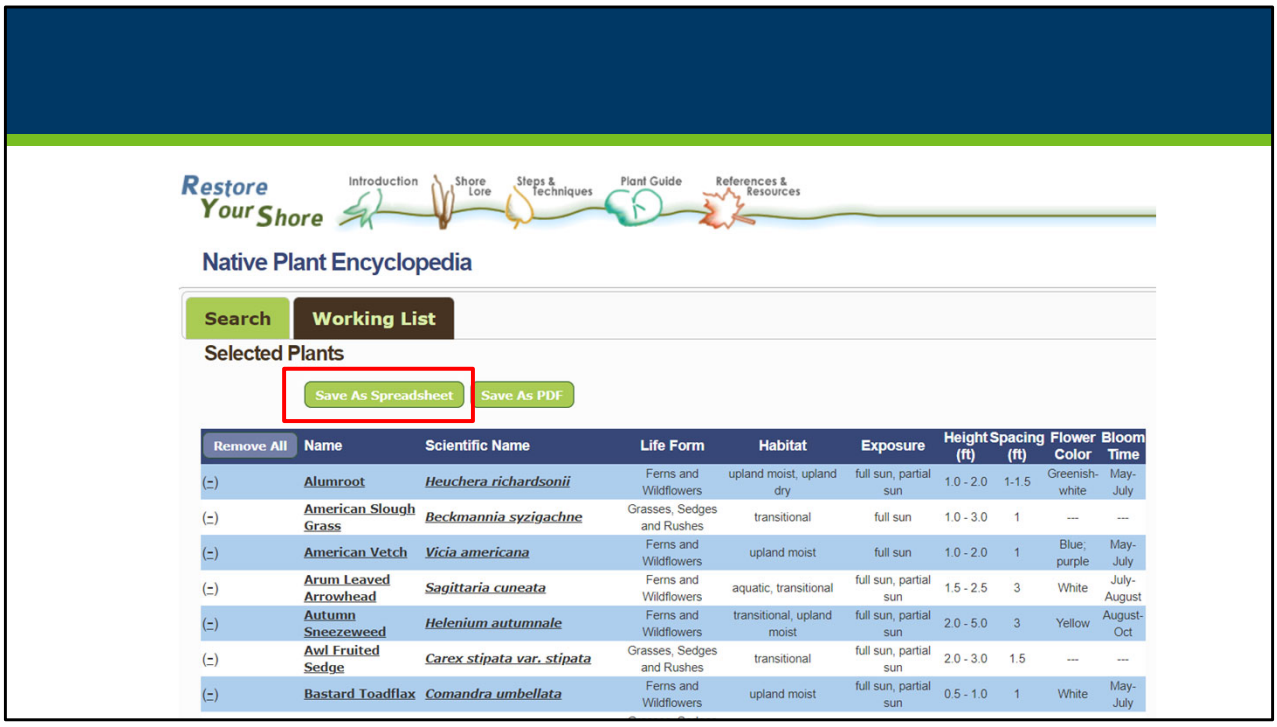
Pale yellow

And the site will generate a complete list of plants.

Search function

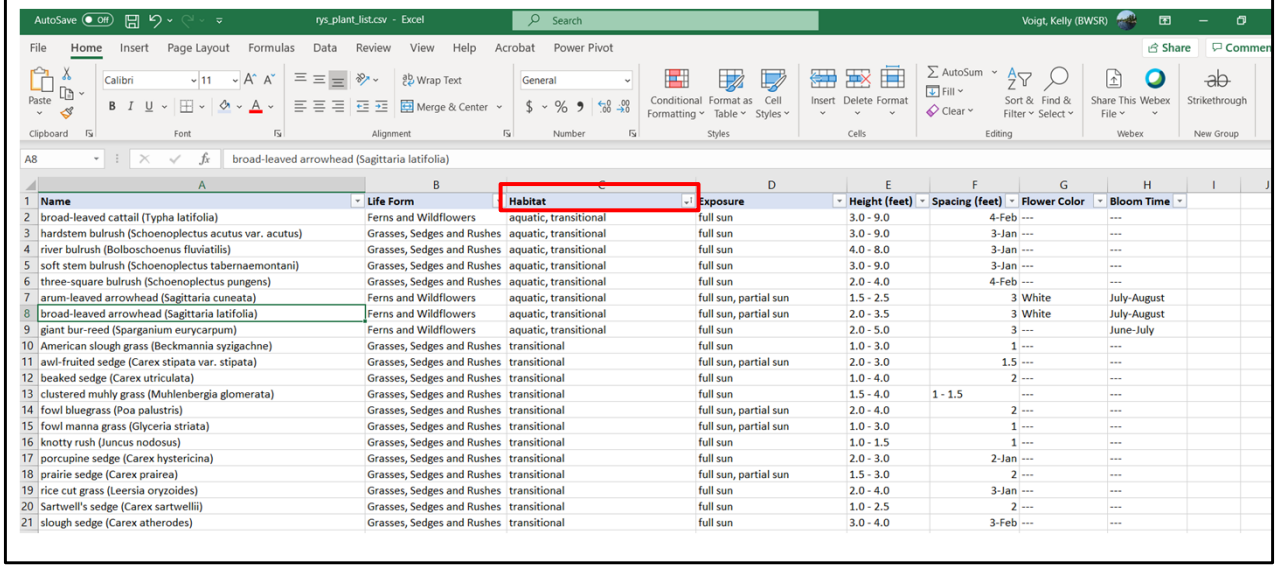


You can create a working list of plants in Excel by selecting “working list”



And save as spreadsheet.

Sort by habitat

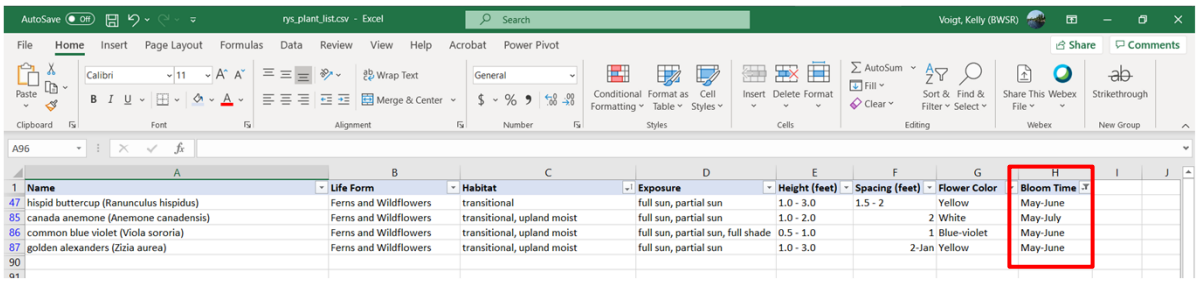


broad-leaved arrowhead (Sagittaria latifolia)

	A	B	C	D	E	F	G	H	I
1	Name	Life Form	Habitat	Exposure	Height (feet)	Spacing (feet)	Flower Color	Bloom Time	
2	broad-leaved cattail (Typha latifolia)	Ferns and Wildflowers	aquatic, transitional	full sun	3.0 - 9.0	4-Feb	---	---	
3	hardstem bulrush (Schoenoplectus acutus var. acutus)	Grasses, Sedges and Rushes	aquatic, transitional	full sun	3.0 - 9.0	3-Jan	---	---	
4	river bulrush (Bolboschoenus fluviatilis)	Grasses, Sedges and Rushes	aquatic, transitional	full sun	4.0 - 8.0	3-Jan	---	---	
5	soft stem bulrush (Schoenoplectus tabernaemontani)	Grasses, Sedges and Rushes	aquatic, transitional	full sun	3.0 - 9.0	3-Jan	---	---	
6	three-square bulrush (Schoenoplectus pungens)	Grasses, Sedges and Rushes	aquatic, transitional	full sun	2.0 - 4.0	4-Feb	---	---	
7	arum-leaved arrowhead (Sagittaria cuneata)	Ferns and Wildflowers	aquatic, transitional	full sun, partial sun	1.5 - 2.5	3	White	July-August	
8	broad-leaved arrowhead (Sagittaria latifolia)	Ferns and Wildflowers	aquatic, transitional	full sun, partial sun	2.0 - 3.5	3	White	July-August	
9	giant bur-reed (Sparganium eurycarpum)	Ferns and Wildflowers	aquatic, transitional	full sun	2.0 - 5.0	3	---	June-July	
10	American slough grass (Beckmannia syzigachne)	Grasses, Sedges and Rushes	transitional	full sun	1.0 - 3.0	1	---	---	
11	awl-fruited sedge (Carex stipata var. stipata)	Grasses, Sedges and Rushes	transitional	full sun, partial sun	2.0 - 3.0	1.5	---	---	
12	beaked sedge (Carex utriculata)	Grasses, Sedges and Rushes	transitional	full sun	1.0 - 4.0	2	---	---	
13	clustered muhly grass (Muhlenbergia glomerata)	Grasses, Sedges and Rushes	transitional	full sun	1.5 - 4.0	1 - 1.5	---	---	
14	fowl bluegrass (Poa palustris)	Grasses, Sedges and Rushes	transitional	full sun, partial sun	2.0 - 4.0	2	---	---	
15	fowl manna grass (Glyceria striata)	Grasses, Sedges and Rushes	transitional	full sun, partial sun	1.0 - 3.0	1	---	---	
16	knotty rush (Juncus nodosus)	Grasses, Sedges and Rushes	transitional	full sun	1.0 - 1.5	1	---	---	
17	porcupine sedge (Carex hystericina)	Grasses, Sedges and Rushes	transitional	full sun	2.0 - 3.0	2-Jan	---	---	
18	prairie sedge (Carex prairea)	Grasses, Sedges and Rushes	transitional	full sun, partial sun	1.5 - 3.0	2	---	---	
19	rice cut grass (Leersia oryzoides)	Grasses, Sedges and Rushes	transitional	full sun	2.0 - 4.0	3-Jan	---	---	
20	Sartwell's sedge (Carex sartwellii)	Grasses, Sedges and Rushes	transitional	full sun	1.0 - 2.5	2	---	---	
21	slough sedge (Carex atherodes)	Grasses, Sedges and Rushes	transitional	full sun	3.0 - 4.0	3-Feb	---	---	

This is the reason I like to use this site. You can sort the list by “habitat” and it will give you a list of plants by moisture zone – aquatic, transitional, upland moist and upland.

Sort by bloom time



	A	B	C	D	E	F	G	H	I	J
1	Name	Life Form	Habitat	Exposure	Height (feet)	Spacing (feet)	Flower Color	Bloom Time		
47	hispid buttercup (Ranunculus hispidus)	Ferns and Wildflowers	transitional	full sun, partial sun	1.0 - 3.0	1.5 - 2	Yellow	May-June		
85	canada anemone (Anemone canadensis)	Ferns and Wildflowers	transitional, upland moist	full sun, partial sun	1.0 - 2.0	2	White	May-July		
86	common blue violet (Viola sororia)	Ferns and Wildflowers	transitional, upland moist	full sun, partial sun, full shade	0.5 - 1.0	1	Blue-violet	May-June		
87	golden alexanders (Zizia aurea)	Ferns and Wildflowers	transitional, upland moist	full sun, partial sun	1.0 - 3.0	2-Jan	Yellow	May-June		
90										

The other sort function I like is to be able to sort by bloom time. In this case, I know that early blooming species for pollinators are always in short supply, so I may want to be sure to include these species in my mix to benefit pollinators.

Native Plant Encyclopedia

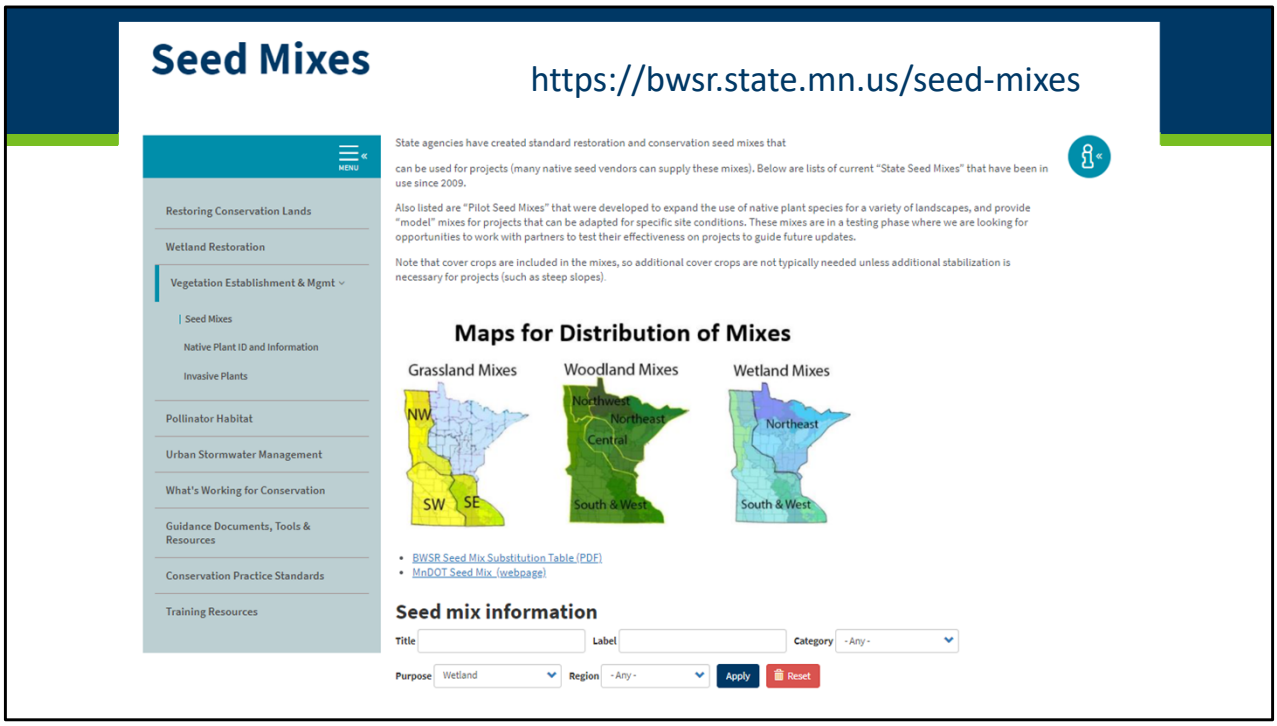
- **Benefits**
  - Easy query, county based data
  - Ability to sort by aquatic, transitional, upland or bloom time
- **Limitations**
  - Does not group natural communities of plants
  - No indications of prevalence by species

The benefits of using the Native Plant Encyclopedia is that it is an easy query and gives you county based data and you can do some custom sorts of the species lists. If you notice on the left, they also have great pictures. One of the limitations is that it doesn't give you the natural groupings that occur in native plant communities and you are still left without an idea of quantity for developing a seed mix.

Species Selection

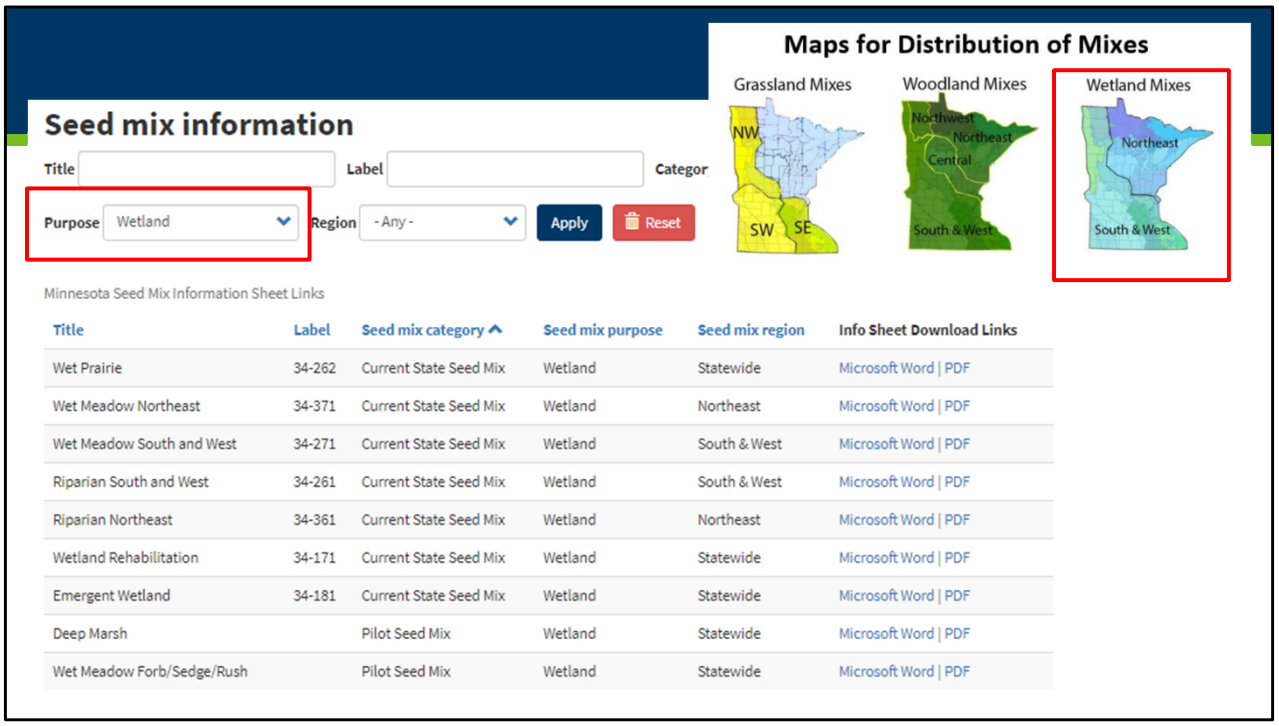
- Use a nearby reference site
- Minnesota Biological Survey/ Native Plant Communities
- Ecological Site Descriptions
- Native Plant Encyclopedia
- **BWSR Seed Mixes**

The last, but definitely not least, resource we are going to take a look at are the BWSR seed mixes.



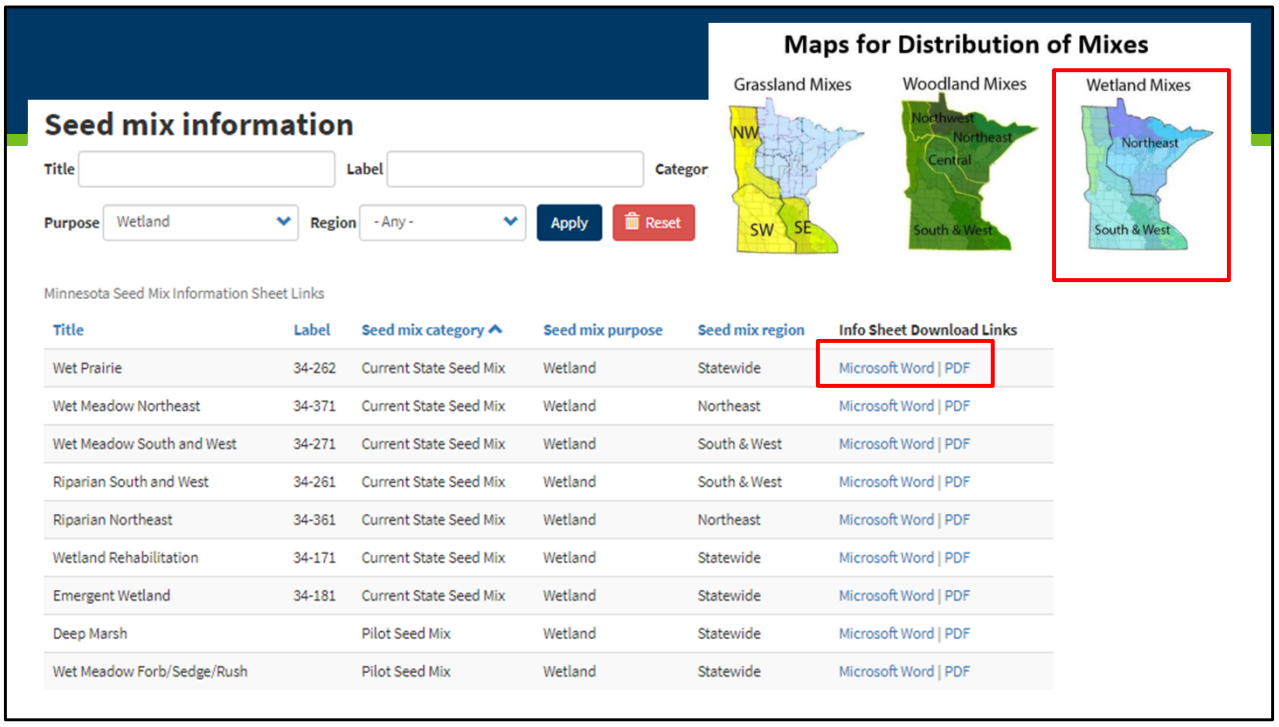
The seed mixes are available on the BWSR web site. And you can see with the map on the right there are wetland specific mixes.

https://bwsr.state.mn.us/seed-mixes



Title	Label	Seed mix category	Seed mix purpose	Seed mix region	Info Sheet Download Links
Wet Prairie	34-262	Current State Seed Mix	Wetland	Statewide	Microsoft Word | PDF
Wet Meadow Northeast	34-371	Current State Seed Mix	Wetland	Northeast	Microsoft Word | PDF
Wet Meadow South and West	34-271	Current State Seed Mix	Wetland	South & West	Microsoft Word | PDF
Riparian South and West	34-261	Current State Seed Mix	Wetland	South & West	Microsoft Word | PDF
Riparian Northeast	34-361	Current State Seed Mix	Wetland	Northeast	Microsoft Word | PDF
Wetland Rehabilitation	34-171	Current State Seed Mix	Wetland	Statewide	Microsoft Word | PDF
Emergent Wetland	34-181	Current State Seed Mix	Wetland	Statewide	Microsoft Word | PDF
Deep Marsh		Pilot Seed Mix	Wetland	Statewide	Microsoft Word | PDF
Wet Meadow Forb/Sedge/Rush		Pilot Seed Mix	Wetland	Statewide	Microsoft Word | PDF

If you select “wetland” as the purpose and click apply, you will see the list of available seed mixes - we have deep marsh, emergent wetland, a couple wet meadow options, and wet prairie mixes for the different zones of moisture along the gradient.



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Let's take a look at the wet prairie– to look at something consistent with our previous examples.

Wet Prairie

34-262

Common Name	Scientific Name	Rate (kg/ha)	Rate (lb/ac)	% of Mix (% by wt)	Seeds/ sq ft
big bluestem	*Andropogon gerardii*	1.12	1.00	6.89%	3.67
fringed brome	*Bromus ciliatus*	1.68	1.50	10.38%	6.08
bluejoint	*Calamagrostis canadensis*	0.04	0.04	0.27%	4.00
Virginia wild rye	*Elymus virginicus*	1.96	1.75	12.07%	2.70
tall manna grass	*Glyceria grandis*	0.17	0.15	1.02%	3.80
fowl manna grass	*Glyceria striata*	0.12	0.11	0.73%	3.50
switchgrass	*Panicum virgatum*	0.84	0.75	5.16%	3.85
fowl bluegrass	*Poa palustris*	0.22	0.20	1.39%	9.60
Indian grass	*Sorghastrum nutans*	0.56	0.50	3.44%	2.20
prairie cordgrass	*Spartina pectinata*	0.56	0.50	3.41%	1.20
	Total Grasses	**7.29**	**6.50**	**44.76%**	**40.60**
wooly sedge	*Carex pellita*	0.06	0.05	0.32%	0.47
tussock sedge	*Carex stricta*	0.02	0.02	0.17%	0.48
fox sedge	*Carex vulpinoidea*	0.11	0.10	0.66%	3.50
dark green bulrush	*Scirpus atrovirens*	0.11	0.10	0.72%	17.74
woolgrass	*Scirpus cyperinus*	0.03	0.03	0.18%	16.00
	Total Sedges and Rushes	**0.34**	**0.30**	**2.05%**	**38.19**

Grasses, sedges, rushes…….. Some of the species look familiar from our previous lists – like big bluestem, prairie cordgrass, Indian grass, switchgrass, woolly sedge, tussock sedge….. And this is an actual seed mix with quantities of seed and percentages of the mix – not just a species list.

Canada anemone	*Anemone canadensis*	0.03	0.03	0.21%	0.09
marsh milkweed	*Asclepias incarnata*	0.09	0.08	0.55%	0.14
Canada tick trefoil	*Desmodium canadense*	0.56	0.50	3.41%	1.00
flat-topped aster	*Doellingeria umbellata*	0.06	0.05	0.34%	1.20
common boneset	*Eupatorium perfoliatum*	0.03	0.03	0.23%	2.00
grass-leaved goldenrod	*Euthamia graminifolia*	0.02	0.02	0.11%	2.00
spotted Joe pye weed	*Eutrochium maculatum*	0.04	0.04	0.30%	1.50
autumn sneezeweed	*Helenium autumnale*	0.06	0.05	0.35%	2.39
sawtooth sunflower	*Helianthus grosseserratus*	0.06	0.05	0.38%	0.30
great blazing star	*Liatris pycnostachya*	0.02	0.02	0.17%	0.10
great lobelia	*Lobelia siphilitica*	0.01	0.01	0.05%	1.40
blue monkey flower	*Mimulus ringens*	0.01	0.01	0.05%	6.40
Virginia mountain mint	*Pycnanthemum virginianum*	0.09	0.08	0.55%	6.50
red-stemmed aster	*Symphyotrichum puniceum*	0.09	0.08	0.56%	2.40
blue vervain	*Verbena hastata*	0.17	0.15	1.06%	5.25
bunched ironweed	*Vernonia fasciculata*	0.03	0.03	0.23%	0.30
Culver's root	*Veronicastrum virginicum*	0.02	0.02	0.14%	6.00
golden alexanders	*Zizia aurea*	0.28	0.25	1.76%	1.03
	Total Forbs	**1.68**	**1.50**	**10.45%**	**40.00**
Oats	*Avena sativa*	6.95	6.20	42.74%	2.76
	Total Cover Crop	**6.95**	**6.20**	**42.74%**	**2.76**
	Totals:	**16.25**	**14.50**	**100.00%**	**121.55**
Purpose:	Wet prairie reconstruction for wetland mitigation or ecological restoration.				
Planting Area:	Tallgrass Aspen Parklands, Prairie Parkland, and Eastern Broadleaf Forest Provinces. Mn/DOT Districts 2(west), 3B, 4, Metro, 6, 7 & 8.				

And quite a few forbs. This definitely meets the number of species requirements and diversity of species. If this matches the plant community you are working within, choosing one of these seed mixes is a great option.

BWSR Seed Mixes

- **Benefits**
  - **Seed quantities are given**
  - **Widely used**
  - **Commercially available**
- **Limitations**
  - **Current mixes are designed for mitigation**
  - **Cost**

The benefits of using these seed mixes are that they are widely used and the seed is commercially available. Vendors will specifically make sure they have seed available to create these mixes and fulfill these orders. The mixes are currently designed for wetland mitigation projects and may be expensive for conservation projects. Cost could be an issue with any of the mixes we have talked about today with a higher number of species – Minnesota does have the best native restoration vendor network of any state, but some species of seeds are still hard to grow, or harvest, or expensive for other reasons.

Species Selection

- Use a nearby reference site
- Minnesota Biological Survey/ Native Plant Communities
- Ecological Site Descriptions
- Native Plant Encyclopedia
- BWSR Seed Mixes

That wraps up our section on resources for species selection. As mentioned at the beginning and as we have discussed along the way, each of these has it's own benefits and limitations. One resource will probably not work for every project site you work on. It is probably best to use two or more resources together to determine the best species to be used for a mix…… And use multiple mixes to cover the different moisture zones. Hopefully, this presentation has helped you to understand what information you can gather from each of these resources. Thank you for your attention and participation!