

Identification of Native Plant Species for Cropping Systems

by

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Table of Contents

ACKNOWLEDGMENTS

ABSTRACT

CHAPTER ONE: LITERATURE REVIEW

Agroecology and Indigenous Agriculture

Revitalizing Interrupted Foodways

Native Species in Cropping Systems

Ecology of Wisconsin

Research Gap

References

CHAPTER TWO: PROJECT DESIGN AND FINAL MAP

Project Objectives

Criteria and Selection

Databases

Mapmaking Process

RESULTS

Final Map and StoryMap Website

Discussion

References

APPENDICES

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Chapter 1:

LITERATURE REVIEW

Abstract

Cover crops are used in agricultural systems to provide benefits such as reducing soil erosion, improving soil health, weed suppression, and supporting nutrient cycling. However, the current recommendations are limited to a number of conventional cover crops. Native plants may have the potential to provide some of these same functions, but they are often not considered in cropping systems. This project focuses on identifying native plant species of Wisconsin that may have potential use as cover crops, ground covers, or in other agricultural systems. The criteria for final selection of these plants were based on ecological traits and agricultural compatibility. Specifically, this project is intended for Tribal producers and individuals interested in exploring native plants in agricultural systems. Additionally, a map of the potential native plant species was created through ArcGIS Pro using four databases, the SSURGO soil drainage class, SSURGO soil hydrologic group, the National Land Cover Database, and USDA Frost Free Period. These four databases were selected to identify possible cropland in Wisconsin where these species could potentially be further investigated.

Agroecology and Indigenous Agriculture

Agroecology is a movement and practice that emphasizes the interconnected nature of agriculture, ecology, and people. Aspects of agroecology have existed in many indigenous agricultural systems or foodways for generations. Indigenous people have shaped ecological landscapes for thousands of years, including the development of agriculture in the Americas (Doolittle 2000; Ellis et al. 2021). Each community has distinct local knowledge of foodways which led to the cultivation and, in some cases, the domestication of several plants including sumpweed, sunflower, acorn squash, goosefoot, maygrass, little barley, and erect knotweed to name a few (Nabhan 2002; Mt. Pleasant 2015; Mueller 2025). This knowledge is rooted in culture, history, and identity for many Tribal nations. These foodways often

incorporate traditional ecological practices that can promote and maintain soil health. The history of stewardship by indigenous people does not just live within a nation's oral history, it can be seen in the landscape down to the soil. These practices significantly varied by nation, foodway, region, and ecological context. In the Great Lakes region, there is historical evidence of land stewardship by the Ho-Chunk, Menominee, Haudenosaunee, and Anishanaabe people that varied with traditional practices, seasons, and nation which included cultural burns, wild rice cultivation, maple syrup production, raised bed agriculture, ridged fields, and more (Gallagher et al. 1985; Whitney 2015; Seidel 2016; Lake et al., 2017; McLeester et al., 2023). These traditional food ways can support biodiversity through polyculture and the inclusion of both cultivated and wild species in food systems. What can be seen at the root of many of these practices is care, utilization of natural inputs, and connection to land. Stewardship was not just for the benefit of humans. These systems accounted for the relationship between plants, animals, soil, and other living beings.

Revitalizing Interrupted Foodways

Historically, the expansion of agriculture in the United States was closely tied to land dispossession and interrupted indigenous foodways greatly (McKinley and Jernigan 2023). In the United States, federal policies such as the Indian Removal Act of 1830, Homestead Act of 1862, Dawes Act of 1887, disrupted indigenous food systems that were ecologically connected to the land. These policies supported land conversion, eventually leading to the oversimplification of agricultural systems that did not favor indigenous foodways or native plant diversity. However, these foodways were never forgotten and are returning to communities. Tribal producers and communities continue to rekindle these traditional practices to restore their foodways. These foodways are being revitalized with the support of many organizations and agencies. In the Great Lakes, Tribal nations are providing food to their communities through revitalizing seed saving practices, traditional corn varieties, sugarbush, wild rice restoration, and more (Besaw et al. 2026).

Native Species in Cropping Systems

Globally, there is growing interest in the use of native plant species within agricultural systems. While conventional cover crops such as rye, clover, and wheat are the most common species in agroecosystems, there is increasing research that assesses the potential of native species in these systems. Several studies have found that native plant species can enhance weed suppression, improve soil structure, and at times, outcompete conventional cover crops. In perennial and fruit tree production systems, research has shown that native species can perform the same functions as conventional cover crops. Researchers in California have investigated phacelia (*Phacelia tanacetifolia*), as a cover crop alternative to cereal rye. Phacelia was found to outcompete cereal rye in weed suppression. Additionally, phacelia enhanced soil microbial biomass, vine vigor, and offered better aggregate stability. These results suggest that native cover crops may provide multiple ecological benefits while reducing reliance on conventional species.

Studies in agroforestry cropping systems such as Hazelnut orchards have explored the use of several native plants as cover crops. In the Pacific Northwest, researchers evaluated a mixture of native annual and perennial species like fiddleneck (*Aminckia meziessii*), prairie burnet (*Sanguisorba annua*), yarrow (*Archillea millefolium*), barestem biscuitroot (*Lomatium nudicaule*) and compared their performance to conventional cover crops (Brambila et al., 2024). An evaluation on the crop performance, specifically effects on weeds, erosion potential, abundance and pollinator presence showed differences among the native annuals and perennials and conventional covers. Several of the native forbs formed canopies that successfully suppressed annual weed emergence. Some of the perennial natives such as the yarrow and biscuitroot improved soil structure and reduced erosion. Additionally, these perennials were more resilient to varying degrees of shade and moisture than conventional species. These researchers found that the native species often outperformed the conventional cover crops.

In annual row-crop and vegetable systems, some native species have also been evaluated. Partridge Pea (*Chamaecrista fasciculata*) is a native legume that has historically been used as a cover and forage crop since the 19th century and research has investigated its use in cropping systems since the 1940s. It is

recognized by the USDA as a beneficial species for erosion control and improving soil. Partridge pea can produce substantial biomass, contribute to soil organic matter, establish quickly on a range of soils, and attract pollinators and predatory insects. One study used partridge pea as a border planting around organic corn (Hunt, et al., 2021). Hunt found that partridge pea significantly increased the abundance of predatory insects along the field edges. However, it was concluded that it did not have measurable reductions in corn pest damage or increases in yield. These results show that spatial arrangement of cover crops is a key factor. Other research focusing on nitrogen fixation of partridge pea has shown that it is influenced by local soil and microbial conditions (Dorman, 2019). This could suggest that partridge pea may perform differently in large-scale commercial agriculture that are high-input systems with poor microbial communities. These findings suggest that partridge pea can play an important role as a cover crop but it is highly dependent on local conditions and spatial arrangement of the crop.

Another crop of interest, phacelia has also been used as an annual cover crop in vegetable systems. A study in an organic high-tunnel vegetable rotation found that phacelia produced high biomass which contained significant amounts of nitrogen (161 kg N/ha) (Lalewicz, et al., 2024). Phacelia increased the amount of ammonifiers and nitrifiers in the soil which are key soil microbial functional groups.

Interestingly, phacelia produced more aboveground biomass than buckwheat (*Fagopyrum Mill.*) at 58.2 t ha⁻¹ fresh matter and 33.0 t ha⁻¹. Phacelia can rapidly establish and form a dense canopy which are two key functional traits in cover crops. This shows phacelia's potential to contribute to soil health.

While prairie strips and filter strips are semi-permanent plantings, they provide examples that native plants can benefit agricultural systems. In agroecosystems, they both can reduce nutrient runoff, promote biodiversity, and increase pollinator habitat. Researchers have shown that converting at least 10% of a field to native vegetation can significantly reduce sediment runoff, supporting diverse insect communities (Schulte, et al., 2017). The deep perennial root systems of native species help stabilize the soil, enhance infiltration, and slow flooding. Filter strips have also been shown to reduce runoff from hillslopes under annual row-crop systems (Hernandez-Santana, et al., 2013). These are usually narrow strips that are

designed to slow runoff before it enters waterways. Both filter strips and prairie strips demonstrate how native vegetation can be used in agroecosystems on a long-term scale.

Ecology of Wisconsin

Landscapes are shaped by several factors including climate, weathering processes, natural disasters, and ecological interactions. Wisconsin's landscapes can be defined by something called the Tension Zone, where oak savanna and prairies meet the northern forests. Approximately two-thirds of the state was covered by ice during the last glacial period which left behind unique landscapes including, drumlins, moraines, outwash plains, and till plains (Clayton et al., 1997; Wisconsin Geological and Natural History Survey). The glaciated portion of Wisconsin contains soils derived from glacial till, outwash or wind deposited sediments (of which some have traveled quite far) which has resulted in productive soils that are often fertile, well drained, and vary greatly in texture.

A distinct portion of Wisconsin, named the Driftless area, fell outside of the bounds of the glacier and is known for its drastic landscapes with soils that have been shaped by weathered bedrock. Prior to colonization, Wisconsin's landscapes looked much different. The state consisted of extensive oak savannas, forests, prairies, and wetlands. Wisconsin's Department of Natural Resources further defines these landscapes into eighteen distinct ecological landscapes. These landscapes were influenced by disturbance regimes and stewarded by indigenous people through cultural burning, indigenous harvesting techniques and historic foodways.

Two of the most historically widespread ecosystems, especially in Southern Wisconsin where agriculture is most prevalent, were prairie and oak savanna ecosystems. A broad overview of the diverse communities of plants that grow in prairie ecosystems include a mixture of cool/warm season grasses and forbs which vary in growth patterns, rooting depth, and role in the structure of soils. Oak savannas also contain prairie plant species with the inclusion of oak species such as bur and white, both of which are well adapted to fire regimes (Abrams 1992). Both of these ecosystems were quickly converted to agricultural land due to their high productivity as listed in the early land surveys of Wisconsin.

At the turn of the 19th century, large portions of land were cleared for agriculture and resource extraction. These diverse ecosystems were largely replaced with annual cropping systems much like the rest of the landscapes that could withstand agriculture. Now, these historic landscapes make up a small fraction of the state's current land cover. Estimates suggest that less than 10,000 acres (<0.5%) of native prairie (DNR 2025), and less than 500 acres (<0.01%) of oak savanna remain today (EPA 2016). Despite this severe reduction, there are Tribal nations, nonprofit organizations, state parks, universities, researchers, private landowners, and a growing number of farmers and ranchers that are working to protect and restore these landscapes.

Research Gap

Recent agricultural research and conservation practices have been focusing on agricultural practices that use native plants in agricultural systems to improve ecological health. These practices include prairie strips, buffers, filter strips, and expanded applications of cover crops. Prairie strips are a studied conservation practice that exemplifies how native vegetation can be incorporated into croplands. The experimental corn and soybean fields reduced water runoff, reduced soil erosion, increased native bird species richness, and increased pollinator populations (Schulte, et al. 2017). These buffers and filters are often situated along the edges of fields and conservation zones. As mentioned earlier, other agricultural systems have explored native plants in cropping systems and provided evidence of its ecological benefits (Brambila et al. 2024; Hunt et al. 2021; Lalewicz et al. 2024). Each practice has its advantages, limitations, and uses that vary depending on the system in question. What can be gleaned through each of these examples is that the inclusion of native species in agroecosystems is possible and can be beneficial. These practices also align with concepts of land stewardship found in indigenous agricultural food ways, especially through supporting biodiversity, soil health, and ecological relationships. However, research of native plants functioning as ground cover and/or cover crops is limited and recommendations are often confined to a narrow list of widely adopted species such as cereal rye, wheat, and clovers. Although agroecology addresses the significance of ecological health in agricultural settings, there is little discussion around native plants in agroecosystems. Some of the

functions once provided by Wisconsin's diverse ecosystems are being replicated by conservation practices and other agroecological approaches. There are a large number of conservation practices that have been identified and proven to assist in improving soil health, reducing nutrient loss, and enhancing biodiversity.

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Chapter 2: Project Design and Final Map

Project Objectives

In agroecosystems, cover crops are valued for their benefits to the soil and the main crop including: erosion control, nutrient cycling, nitrogen fixation, weed suppression, and soil aeration. While there are extensive studies assessing conventional cover crops, research exploring the use of native plant

species as cover crops has been limited. Some reasons for this may be that a number of native plant species are perennial, require additional resources, and have complex establishment needs. However, research assessing the potential of native plant species as cover crops is growing.

The primary objective of this project was to identify alternative species that may enhance biodiversity and support ecosystem functions within agroecosystems. To do this, native plants of Wisconsin were evaluated and selected according to their capacity to function as cover crops (traits, characteristics, and benefits). This project intends to identify native species that can complement conventional cover crops, not replace conventional cover crops.

A second objective was to develop resources that could support Tribal producers and others interested in incorporating native species into agricultural systems. The result is the creation of a map that contains the selected species according to their respective preferred habitat.

Introduction

Agricultural systems in North America have gone through major transitions over time which has been influenced by farmers, ranchers, researchers, climate, economy, policies, and society. Early agricultural practices largely relied on local and traditional agricultural practices. These systems may not have been thought of in strict terms of maximum yield capacity, maximum profitability, or synthetic input applications. However, these systems often maintained high levels of biodiversity and strong connections to the land and its ecological processes.

Over time, agriculture has been the subject of research that has developed cultivars, hybrids, genetically modified crops, creation of synthetic fertilizers, and more. These advancements have led to improvements in yield, profitability, timed application of synthetic fertilizers, and more. They have also contributed to environmental issues, especially in intensive large scale agricultural systems. Nutrient losses, declining biodiversity, soil degradation and an increased reliance on inputs have impacted ecosystems greatly.

Unfortunately, these systems are reaching their limits and their impacts to the environment are well

documented. In fact, there are studies that show that corn, soybean and other staple crops experience a limit in which nitrogen uptake is possible, nitrogen use efficiency (NUE) which does not exceed 50% of total applied nitrogen (Xiao et al. 2019). The remaining 50% is lost to the environment through leaching and volatilization. Additionally, while pesticide usage has become more efficient and regulated, it is still a major issue particularly, pesticide resistance, affected non-target species, and its broader impact on the environment. Extensive and repeated pesticide applications have led to species that have evolved with pesticides, reducing their effectiveness. This problem has reinforced this cycle of dependence on pesticides. Adding to the problem is climate change which contributes to pesticide resistance and the ever-changing presence of pests (Ma et al. 2026). As these pest populations continue to migrate and exploit new habitats, sole reliance on pesticides becomes more difficult.

To address these issues, agencies like the USDA NRCS, researchers, grassroots and nonprofit organizations, tribal producers, ranchers, farmers, and individuals alike are investing in conservation practices and programs. Practices such as cover cropping, reduced tillage, crop rotations, prairie strips, and more are intended to improve aspects of soil health, reduce nutrient losses, and support biodiversity. Most of these approaches are not new to agriculture and reflect aspects of indigenous agricultural methods. Indigenous foodways and agricultural systems have been developed by Tribal nations that combine cultural knowledge, seasonal patterns, and ecological conditions. The focus on ecological health is the inspiration for this project.

Criteria and Selection

The species list was compiled by searching through the Flora of Wisconsin Consortium of Wisconsin Herbaria. All specimens are verified voucher specimens which is an important factor for local relevance and species presence data. The species were identified according to their taxonomic family under the County Floras section of the herbaria.

Three plant families were selected due to their role in midwestern prairies and similar ecosystems which were the Poaceae, Fabaceae, and the Asteraceae family. Each of these families already exist in agricultural systems. Families that fell outside of the scope of interest were excluded, such as the Pinaceae

and Betulaceae family. Moreover, species were removed from consideration if they were listed as endangered, threatened, hazardous, or had growth habits that were unsuitable for agroecosystems such as high sensitivity to disturbances.

From the curated list, plants were selected by cross-referencing the USDA Plants Database, NRCS Plant Guides, and USDA Forest Service FEIS to assess their habitat preferences. The data derived from these sources include species temperature range, growing season (warm, cool, or mid-season), flowering period, moisture and drought tolerance. Lastly, the selected species were defined by their functional group traits of cover crop systems including: nitrogen fixation, biomass production and root systems, and rapid establishment for weed suppression. In order to account for seed availability, the selected species were included if local seeds were available for purchase. The curated list of native species can be found in the Appendices A, B, and C.

Databases

To match region specific native cover crop species to their respective habitats in Wisconsin, a map was developed using five datasets: Wisconsin county boundaries, soil drainage class from the USDA SSURGO soil database, the 2024 CroplandCROS data for the state of Wisconsin, and the USDA SSURGO Frost Free Period map. Four of these datasets represent important factors that help to define plant distribution which include moisture conditions, land use patterns, and growing season length.

The 2024 CroplandCROS data only included a subsection of the total croplands in Wisconsin. The subset included: sweet corn, pop or ornamental corn, fallow/idle cropland, cherries, peaches, grassland/pasture, double crop winter wheat/corn, double crop oats/corn, and double crop barley/corn. These cropping systems were selected because they present a feasible opportunity to potentially incorporate these native covers. Idle lands could immediately integrate these species; double cropping systems may benefit from cover species during transition periods. Fruit tree crops benefit from pollinators and integrating ground covers in these systems can enhance ecosystem services.

Mapmaking Process

The objective of this project was to develop a map that showcases where native covers could grow within agricultural landscapes across Wisconsin. The map was created in ArcGIS Pro and the four databases were imported as layers and projected to the NAD 1983 Wisconsin Transverse Mercator (Meters) coordinate system. The soil drainage, cropland data and frost-free period were converted into raster format and resampled to the same spatial resolution of 30 meters for consistency. Using the ArcGIS Pro reclassification tool, a binary classification was created for the cropland layer (suitable=1, unsuitable=0). The soil drainage and frost free period were reclassified into a suitability scale ranging from 1 to 5, where 5 represents the most suitable conditions and 1 represents the least suitable conditions for native cover establishment. This scale refers to the moisture and drainage metrics that are defining factors for plant populations. Finally, the layers were combined using the intersect tool to create the map that represents the overall environmental suitability for the native covers in agricultural landscapes. An attribute table was created on Microsoft Excel and converted to a CSV file to be used as an attribute table and linked to the map via ArcGIS Map Viewer to provide context for the map (Appendix A, B, C).

The final product is a map that showcases the selected native covers within the context of the cropland subset was developed via ArcGIS Pro and subsequently published to ArcGIS Map Viewer. The map was further processed and embedded within an ArcGIS StoryMaps website. This allows users to interact with the layers and locate suitable species on a county level. Information regarding their functional traits and benefits can be found within the map by interacting with the map.

Results

The final map defines suitability for native covers within the context of the cropland subset from low (1) to high (5) across Wisconsin. High suitability areas were mostly in southern and central Wisconsin and overall had a higher number of native species suitable for planting. The lower suitability areas were more common in the northern regions of the state which reflects the shorter frost free period and moisture conditions present in this area. A total of 19 species were included in the final assessment

that represented three functional groups: grasses (7), legumes (5), and forbs (7). Species that are considered generalists can be found in many counties, whereas a wetland specialist like swamp aster is only found in a few. Additionally, due to Wisconsin's extensive grasslands, many grass species were found in nearly all counties. Most counties contained species for all three functional groups.

The suitability values across Wisconsin gradually increased from north to south. Central and southern Wisconsin, where agricultural systems are most concentrated, tended to have higher suitability scores and a higher number of species.

Overall, the map showcased that the potential species are not evenly distributed across Wisconsin and compatibility varies. The results of the map highlight the importance of considering environmental factors when identifying native plant species for potential integration into agricultural systems.

Final Map and StoryMap Website

Website Link: <https://storymaps.arcgis.com/stories/0c4d8b47445f4a8d9152c2b7f8fa2172>

QR CODE:



Example: Portage County



- PURPLE CONEFLOWER (ECHINACEA PURPUREA)
Type: Forbs
Trait: Deep rooted, perennial, pollinator support
Season: Warm (mid)
- HEATH ASTER (SYMPHYOTRICHUM ERICOIDES)
Type: Forbs
Trait: Pollinator support
Season: Warm (late)
- SWAMP ASTER (SYMPHYOTRICHUM PUNICEUM)
Type: Forbs
Trait: Wetland specialist, pollinator support
Season: Warm (late)

- Recommended Species for Portage County:
- PURPLE PRAIRIE CLOVER (DALEA PURPUREA)
Type: Legume
Trait: Nitrogen fixing, deep rooted perennial
Season: Warm (mid)
 - CANADA WILD RYE (ELYMUS CANADENSIS)
Type: Grass
Trait: Rapid Growth, early cover, erosion control
Season: Cool (early)
 - SLENDER WHEATGRASS (ELYMUS TRACHYCAULUS)
Type: Grass
Trait: Fast establishment, short-lived perennial
Season: Cool (early-mid)
 - LITTLE BLUESTEM (SCHIZACHYRIUM SCOPARIUM)
Type: Grass
 - PRAIRIE DROPSEED (SPOROBOLUS HETEROLEPIS)
Type: Grass
Trait: Deep roots, soil stabilization
Season: Warm (late)
 - PRAIRIE JUNEGRASS (KOELERIA MACRANTHA)
Type: Grass
Trait: Short stature, quick green-up
Season: Cool (early)
 - COMMON SUNFLOWER (HELIANTHUS ANNUUS)
Type: Forbs
Trait: Rapid Growth, annual, pollinator support
Season: Warm (mid)
 - MAXIMILIAN SUNFLOWER (HELIANTHUS MAXIMILIANI)
Type: Forbs
Trait: Tall perennial, deep rooted

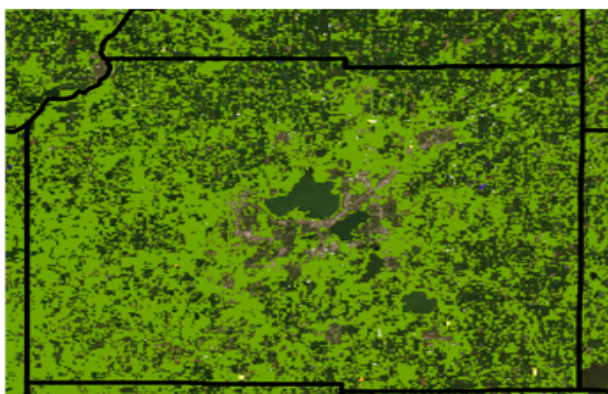
cropland Type

cropland_type_ProjectRaster

Class_Name

- Sweet Corn
- Pop or Orn Corn
- Fallow/Idle Cropland
- Cherries
- Peaches
- Grassland/Pasture
- Double Crop Winter Wheat/Corn
- Double Crop Oats/Corn
- Double Crop Barley/Corn

Example: Dane County



Recommended Species for Dane County:

• AMERICAN VETCH (*VICIA AMERICANA*)

Type: Legume

Trait: Nitrogen fixing, vining perennial

Season: Cool (early to mid)

• PURPLE PRAIRIE CLOVER (*DALEA PURPUREA*)

Type: Legume

Trait: Nitrogen fixing, deep rooted perennial

Season: Warm (mid)

• WHITE PRAIRIE CLOVER (*DALEA CANDIDA*)

Type: Legume

Trait: Nitrogen fixing, deep rooted perennial

Season: Warm (mid)

• LITTLE BLUESTEM (*SCHIZACHYRIUM SCOPARIUM*)

Type: Grass

Trait: Deep roots, drought tolerant, soil building

Season: Warm (late)

• SIDE OATS GRAMA (*BOUTELOUA CURTIPENDULA*)

Type: Grass

Trait: Erosion control, drought tolerant

Season: Warm (late)

• PRAIRIE DROPSEED (*SPOROBOLUS HETEROLEPIS*)

Type: Grass

Trait: Deep roots, soil stabilization

Season: Warm (late)

• PRAIRIE JUNEGRASS (*KOeleria MACRANTHA*)

Type: Grass

Trait: Short stature, quick green-up

Season: Cool (early)

• PARTRIDGE PEA (*CHAMAECRISTA FASCICULATA*)

Type: Legume

Trait: Nitrogen fixing, annual, rapid establishment

Season: Warm (mid)

• CANADA WILD RYE (*ELYMUS CANADENSIS*)

Type: Grass

Trait: Rapid Growth, early cover, erosion control

Season: Cool (early)

• VIRGINIA WILD RYE (*ELYMUS VIRGINICUS*)

Type: Grass

Trait: Shade tolerant, quick establishment

Season: Cool (early)

• SLENDER WHEATGRASS (*ELYMUS TRACHYCAULUS*)

Type: Grass

Trait: Fast establishment, short-lived perennial

Season: Cool (early-mid)

• COMMON SUNFLOWER (*HELIANTHUS ANNUUS*)

Type: Forbs

Trait: Rapid Growth, annual, pollinator support

Season: Warm (mid)

• MAXIMILIAN SUNFLOWER (*HELIANTHUS MAXIMILIANI*)

Type: Forbs

Trait: Tall perennial, deep rooted

Season: Warm (late)

• PURPLE CONEFLOWER (*ECHINACEA PURPUREA*)

Type: Forbs

Trait: Deep rooted, perennial, pollinator support

Season: Warm (mid)

• HEATH ASTER (*SYMPHYOTRICHUM ERICOIDES*)

Type: Forbs

Trait: Pollinator support

Season: Warm (late)

Discussion

The list of native plant species identified in this project reflect a subset of Wisconsin's overall plant diversity. It is not a comprehensive list and was limited by the availability of native seeds by seed producers. Species were mapped according to their habitat suitability and rooted in actual presence data which was the purpose of searching through the Wisconsin State Herbarium. Several ecological landscapes could not be included due to time and species data. Increasing spatial resolution and the inclusion of other environmental parameters such as soil chemistry and disturbance regimes likely will improve the accuracy of the map. Both soil chemistry and disturbance regimes are highly detailed and independent to land use and soil type. Additionally, the herbarium data limited the number of species that could be recommended by county due to gaps in data.

The interactive map created through this project provides a starting point. These materials were designed to provide examples of potential alternatives or complementary ground cover options. This project is not intended to promote widespread adoption of native cover crops and/or ground cover over conventional covers especially in input intensive industrialized agricultural systems. Its purpose is to provide producers, researchers and land managers with a list of identified native plant species that have the potential to function as ground cover.

The applicability of native ground covers is dependent on cropping systems, management practices, and land use. Additionally, there are limitations to incorporating native ground cover crops such as seed cost, agricultural management styles, and time constraints. This project is intended to provide a starting point for further research into these plant species in a cropping system. Field trials, on-farm experimentation and research will help to refine the species recommendations and further include native ground cover crops into agroecological practices.

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Appendices

Legumes

Species Name	Functional Trait	Season	Flowering Period	Frost Sensivity	Dry Toleranc e	Wet Tolerance	Source
American vetch (<i>Vicia</i>	Nitrogen fixing, vining	Cool (early to mid)	Late Spring to Early	Low	Medium	Medium	1, 2

<i>americana</i> (na)	perennia l		Summer				
Illinois bunblefl ower (<i>Desma nthus illinoens is</i>)	Deep rooted, nitrogen fixing perennia l	Warm (mid)	Mid to late Summer	Moderate to High	High	Low	2, 3
Purple prairie clover (<i>Dalea purpure a</i>)	Nitroge n fixing, deep rooted perennia l	Warm (mid)	Mid to late Summer	Moderate to High	High	Low	1, 2
White prairie clover (<i>Dalea candida</i>)	Nitroge n fixing, deep rooted perennia l	Warm (mid)	Early to mid Summer	Moderate to High	High	Low	2, 4
Partridg e pea	Nitroge n fixing,	Warm (mid)	Mid to late	High	Medium	Low to Medium	1, 2

(<i>Chamaecrista fasciculata</i>)	annual, rapid establishment		Summer				
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Appendix A - Legume Species List

Grasses

Species Name	Functional Trait	Season	Flowering Period	Frost Sensitivity	Dry Tolerance	Wet Tolerance	Source
Canada Wild Rye (<i>Elymus canadensis</i>)	Rapid Growth, early cover, erosion control	Cool (early)	Late Spring	Low	Medium	Medium	1
Virginia Wild Rye (<i>Elymus virginicus</i>)	Shade tolerant, quick establishment	Cool (early)	Late spring to early Summer	Low	Low to Medium	Medium to High	2
Slender Wheatgrass	Fast establishment	Cool (early-mid)	Early to mid	Low	Medium	Medium	1

s (<i>Elymus</i> <i>trachycaulus</i>)	ent, short-lived perennial	)	Summer				
Little Bluestem (<i>Schizachyrium</i> <i>scoparium</i>)	Deep roots, drought tolerant, soil building	Warm (late)	Late Summer to Fall	Moderate	High	Low	1
Side Oats Grama (<i>Bouteloua</i> <i>curtipendula</i>)	Erosion control, drought tolerant	Warm (late)	Late Summer to early fall	Moderate	High	Low	1
Prairie dropseed (<i>Sporobolus</i> <i>heterolepis</i>)	Deep roots, soil stabilization	Warm (late)	Late Summer to early Fall	Moderate	High	Low	1, 2
Prairie	Short	Cool	Late	Low	Medium	Low to	1, 2

Junegrass (<i>Koeleria macrantha</i>)	stature, quick green-up	(early)	Spring to early Summer		to High	Medium	
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Appendix B - Grass Species List

Forbs

Species Name	Function al Trait	Season	Flowerin g Period	Frost Sensitivit y	Dry Tolerance	Wet Tolerance	Source
Common Sunflower (<i>Helianthu s annuus</i>)	Rapid Growth, annual, pollinator support	Warm (mid)	Mid to Late Summer	High	Medium to High	Low	2, 3
Maximilia n Sunflower (<i>Helianth us maximilia ni</i>)	Tall perennial, deep rooted	Warm (late)	Late Summer to Fall	Moderate	High	Low to Medium	1
Prairie	Annual,	Warm	Mid to	High	High	Low	2, 5

Sunflower (<i>Helianthus petiolaris</i>)	fast establishment	(mid)	Late Summer				
Purple Coneflower (<i>Echinacea purpurea</i>)	Deep rooted, perennial, pollinator support	Warm (mid)	Mid to Late Summer	Moderate	Medium to High	Low to Medium	3, 4
Plains Coreopsis (<i>Coreopsis tinctoria</i>)	Annual, rapid flowering, pollinator support	Warm (mid)	Early to Mid Summer	High	Medium	Low to Medium	2, 3
Heath Aster (<i>Symphyotrichum ericoides</i>)	Pollinator support	Warm (late)	Late Summer to Fall	Moderate	High	Low	2, 3
Swamp aster (<i>Symphyot</i>)	Wetland specialist, pollinator	Warm (late)	Late summer to Fall	Moderate	Low	High	2, 3

<i>richum</i> <i>puniceum</i>)	support						
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Appendix C - Forbs (Asteraceae family) Species List

Sources for Appendices A, B, and C are: 1 = USDA Forest Service, 2= USDA NRCS; 3 = Missouri Botanical Garden; 4 = University Extension; 5 = Minnesota Wildflowers.

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