

# Restoring Native Plant Communities: Soil and Hydrology Suited Planning Tools (Iowa Case Study)

Jennifer Anderson-Cruz  
State Biologist

USDA Natural Resources Conservation Service  
Champaign, Illinois

[Jennifer.anderson@il.usda.gov](mailto:Jennifer.anderson@il.usda.gov)

(217) 353-6636

# It's More Than a Planting, Restore Communities!

No:



No:



Yes:



Yes:



Yes:



# Effects of Species Richness on Resident and

AGRICULTURE

2015 © The A

Tradi

## LETTER

Jonathan

Recent shif  
scape simp  
and respor  
ological co  
realistic co  
linkages in  
show that  
biological r  
biological d  
diversificat  
Bioinvento  
provide an  
biodiversity  
focal intera  
and nature

Lundgren a

JUNE 2007 Resto

### Biodiv produc

Forest Isbell<sup>1</sup>, D  
Catherine Bonit  
Andy Hector<sup>15</sup>,  
Shahid Naeem<sup>2</sup>,  
Melinda D. Smit  
Alexandra Weig

It remains uncle  
climate extremes  
wide<sup>1</sup>. Early res  
diverse grassland  
less during drou  
after drought, th  
subsequent expe  
use data from 4  
diversity to test  
and resilience a  
increased ecosys  
including wet or  
events. Across a  
low-diversity co  
approximately 5  
diversity comm  
changing by onl  
event, ecosystem  
shot, normal lev  
communities, le  
resilience on bi  
mainly stabiliz  
dependent ecosy  
events. Anthrope  
sity loss thus se

restoration of biodiversity to increase  
resistance of ecosystem productivity to  
Biodiversity stabilizes ecosystem prod

574 | NATURE | VOL 526 | 2

### Soil H Comm Ecolog

Sara G. Ba

#### Abstract

**Spatial hetero  
community co  
nities. We ma  
ent availability  
treatments (no  
ent heterogen  
replicated in a  
species. Our o  
heterogeneity  
tory of commu  
tion. The treat  
of available in  
light penetrati  
resource heter  
variability in  
belowground  
related with t**

JUNE 2005 Resto

## SOIL RESOURCES REGULATE PRODUCTIVITY AND DIVERSITY IN NEWLY ESTABLISHED TALLGRASS PRAIRIE

### More diverse plant communities have higher functioning over time due to turnover in complementary dominant species

Eric Allan<sup>a,b,1</sup>, Wolfgang Weisser<sup>a,c</sup>, Alexandra Weigelt<sup>a,d</sup>, Christiane Roscher<sup>e</sup>, Markus Fischer<sup>b</sup>, and Helmut Hillebrand<sup>f</sup>

<sup>a</sup>Institute of Ecology, University of Jena, 07743 Jena, Germany; <sup>b</sup>Institute of Plant Sciences, University of Bern, 3013 Bern, Switzerland; <sup>c</sup>Lehrstuhl für Terrestrische Ökologie, Department für Ökologie und Ökosystemmanagement, Technische Universität München, 85354 Freising, Germany; <sup>d</sup>Institute for Biology, University of Leipzig, 04103 Leipzig, Germany; <sup>e</sup>Department of Community Ecology, Helmholtz Centre for Environmental Research, 06120 Halle, Germany; and <sup>f</sup>Institute for Chemistry and Biology of the Marine Environment, Carl-von-Ossietzky University Oldenburg, 26382 Wilhelmshaven, Germany

Edited by Simon A. Levin, Princeton University, Princeton, NJ, and approved August 31, 2011 (received for review March 14, 2011)

More diverse communities have been shown to have higher and more temporally stable ecosystem functioning than less diverse ones, suggesting they should also have a consistently higher level of functioning over time. Diverse communities could maintain consistently high function because the species driving function change over time (functional turnover) or because they are more likely to contain key species with temporally stable functioning. Across 7 y in a large biodiversity experiment, we show that more diverse plant communities had consistently higher productivity, that is, a higher level of functioning over time. **We identify the mechanism for this as turnover in the species driving biomass production; this was substantial, and species that were rare in some years became dominant and drove function in other years. Such high turnover allowed functionally more diverse communities to maintain high biomass over time and was associated with higher levels of complementarity effects in these communities. In contrast, turnover in communities composed of functionally similar species did not promote high biomass production over time. Thus, turnover in species promotes consistently high ecosystem function when it sustains functionally complementary interactions between species. Our results strongly reinforce the argument for conservation of high biodiversity.**

Jena Experiment | redundancy | grassland | species richness | evenness

17034–17039 | PNAS | October 11, 2011 | vol. 108 | no. 41

**Key words:** aboveground net primary productivity (ANPP); diversity; grassland; Konza Prairie, Kansas (USA); nutrient enrichment; productivity; restoration; richness; tallgrass prairie.

# NRCS Conservation Practices

National Standards:

[https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/cp/ncps/?cid=nracs143\\_026849](https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/cp/ncps/?cid=nracs143_026849)

State Standards: [https://efotg.sc.egov.usda.gov/efotg\\_locator.aspx?map=](https://efotg.sc.egov.usda.gov/efotg_locator.aspx?map=)



United States Department of Agriculture

643-CPS-1

## Natural Resources Conservation Service

### Conservation Practice Standard

#### RESTORATION OF RARE OR DECLINING NATURAL COMMUNITIES

CODE 643

(Ac.)

#### DEFINITION

Reestablishment of abiotic (physical and chemical) and biotic (biological) conditions necessary to support rare or declining natural assemblages of native plants and animals.

#### PURPOSE

To restore the physical conditions and/or unique plant community on sites that partially support, or once supported, a rare or declining natural community. Application of this practice addresses resource concerns of a degraded plant condition and/or inadequate wildlife habitat.

#### CONDITIONS WHERE PRACTICE APPLIES

Applied on all lands, including degraded aquatic, terrestrial, or wetland sites, that historically supported a functional rare or declining (dwindling or imperiled) native plant or animal community, where restoration is needed to achieve identified abiotic and biotic target conditions. This practice can also be applied to efforts to restore natural communities of local cultural importance.

This practice does not apply where it is possible to meet target conditions solely through implementation of annual management actions such as prescribed burning, prescribed grazing, forest stand improvement, or pest management.

#### CRITERIA

Conduct a site assessment to determine baseline abiotic (nonliving, physical, and/or chemical components of the site) and biotic conditions (living characteristic, including native plants, wildlife, insects, and other organisms important to reaching the target conditions), and to identify restoration objectives for the abiotic and biotic target conditions.

Use reference sites, ecological site descriptions, or other appropriate references to determine appropriate target conditions and degree of restoration required.

Identify (i) the natural disturbance regime(s) that created the target conditions, and (ii) the ecological processes necessary to maintain such conditions.

Identify invasive and exotic species that many have contributed to the degraded conditions, and that may challenge restoration efforts.

When restoring abiotic conditions, the following criteria apply:

- Restore macro and/or microtopography where required to support natural communities. Microtopography features are elevational changes at the individual plant scale, often removed by

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State office](#) or visit the [Field Office Technical Guide](#).  
USDA is an equal opportunity provider, employer, and lender.

NRCS, NHCP  
March 2017

327 - 1

## NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

### CONSERVATION COVER

(Ac.)

CODE 327

#### DEFINITION

Establishing and maintaining permanent vegetative cover

#### PURPOSE

This practice is applied to support one or more of the following purposes:

- Reduce sheet, rill, and wind erosion and sedimentation.
- Reduce ground and surface water quality degradation by nutrients and surface water quality degradation by sediment.
- Reduce emissions of particulate matter (PM), PM precursors, and greenhouse gases. )
- Enhance wildlife, pollinator and beneficial organism habitat.
- Improve soil health.

#### CONDITION WHERE PRACTICE APPLIES

This practice applies on all lands needing permanent herbaceous vegetative cover. This practice does not apply to plantings for forage production or to critical area plantings. This practice can be applied on a portion of the field.

#### CRITERIA

##### General Criteria Applicable to All Purposes

Select species that are adapted to the soil, ecological sites, and climatic conditions that are suitable for the planned purpose and site conditions. Periodic removal of some products such as high value trees, medicinal herbs, nuts, and fruits is permitted provided the conservation purpose is not compromised by the loss of vegetation or harvesting

disturbance.

Inoculate legumes at planting time.

Choose seeding rates and planting methods that will be adequate to accomplish the planned purpose.

Planting date, planting methods and care in handling and planting of the seed or planting stock shall ensure that planted materials have an acceptable rate of survival.

Prepare the site by establishing a consistent seeding depth. Eliminate weeds that would impede the establishment and growth of selected species.

Base the timing and equipment selection on the site and soil conditions.

Apply nutrients as needed to ensure crop establishment and planned growth.

##### Additional Criteria to Reduce Sheet, Rill, and Wind Erosion and Sedimentation

Determine and maintain the amount of plant biomass and cover needed to reduce wind and water erosion to the planned soil loss objective by using the current approved wind and/or water erosion prediction technology.

##### Additional Criteria to Reduce Emissions of Particulate Matter (PM), PM Precursors, and Greenhouse Gases

In perennial crop systems such as orchards, vineyards, berries and nursery stock, establish vegetation to provide full ground coverage in the alleyway during mowing and harvest operations to minimize generation of particulate matter.

##### Additional Criteria to Enhance Wildlife, Pollinator and Beneficial Organism Habitat

Plant a diverse mixture grasses and forbs

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#) or visit the [Field Office Technical Guide](#).

NRCS, NHCP  
September 2014

# Abiotic Causes of Spatial Pattern in Plant and Animal Communities

- Local Uniqueness
  - Soils, water sources, nutrients
- Phase difference
  - Successional stage
- Dispersal
  - Corridors
  - barriers



# Landscape Pattern

- Matrix
  - Dominant cover type
  - background within which patches and corridors exist and which defines the flow of energy, matter and organisms.
- Patch
  - Area differing in appearance from its surroundings
  - Vary in size, shape, number, type, configuration and quality
  - Size and heterogeneity
- Ecotone
  - gradient between cover types
    - Edge effects
- Corridors
  - A linear patch that differs from its surroundings.

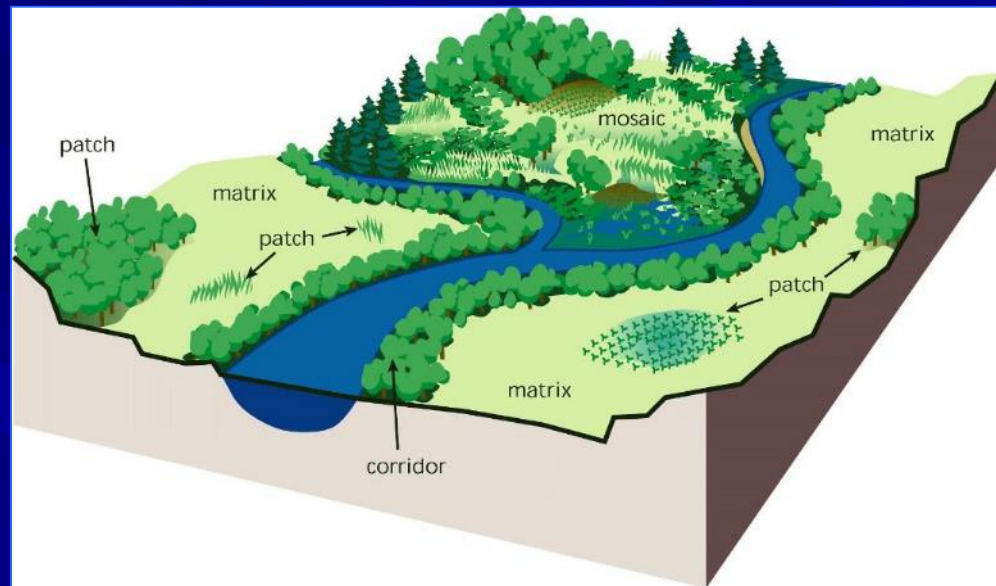
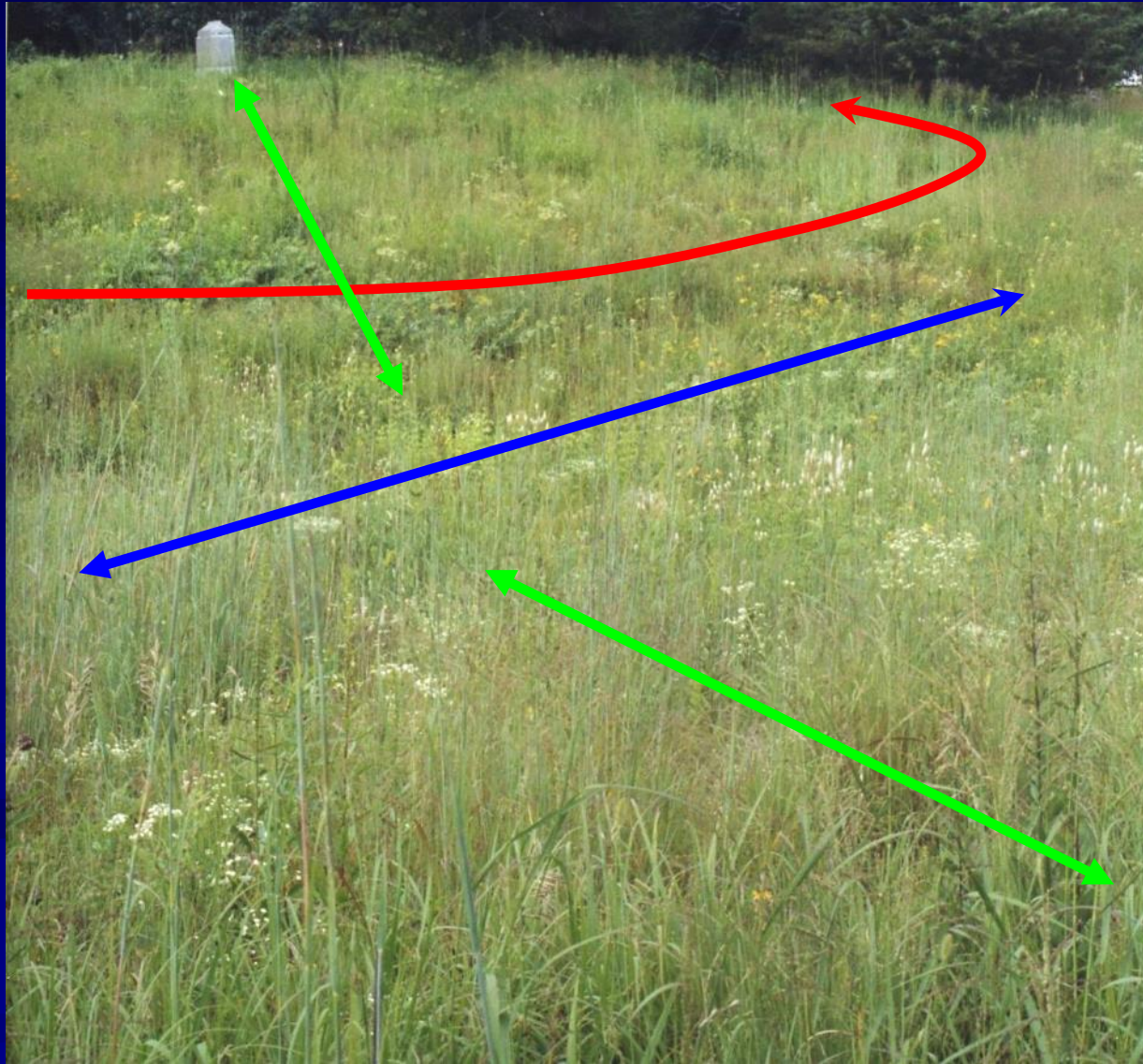


Fig. 1.4 -- Spatial structure. Landscapes can be described in terms of matrix, patch, corridor, and mosaic at various scales.  
In Stream Corridor Restoration: Principles, Processes, and Practices, 10/98.  
Interagency Stream Restoration Working Group (FISRWG)(15 Federal agencies of the US).

# Horizontal Patterns: Consider Slope and Aspect



Research site conditions  
and find high-quality  
remnant  
plant communities that  
occur under similar  
conditions.

2006 USDA CIR

1930's USDA Ortho Photo

Soil Hydrology Map – USDA Soil Survey

Depth to High Water Table – USDA Soil Survey

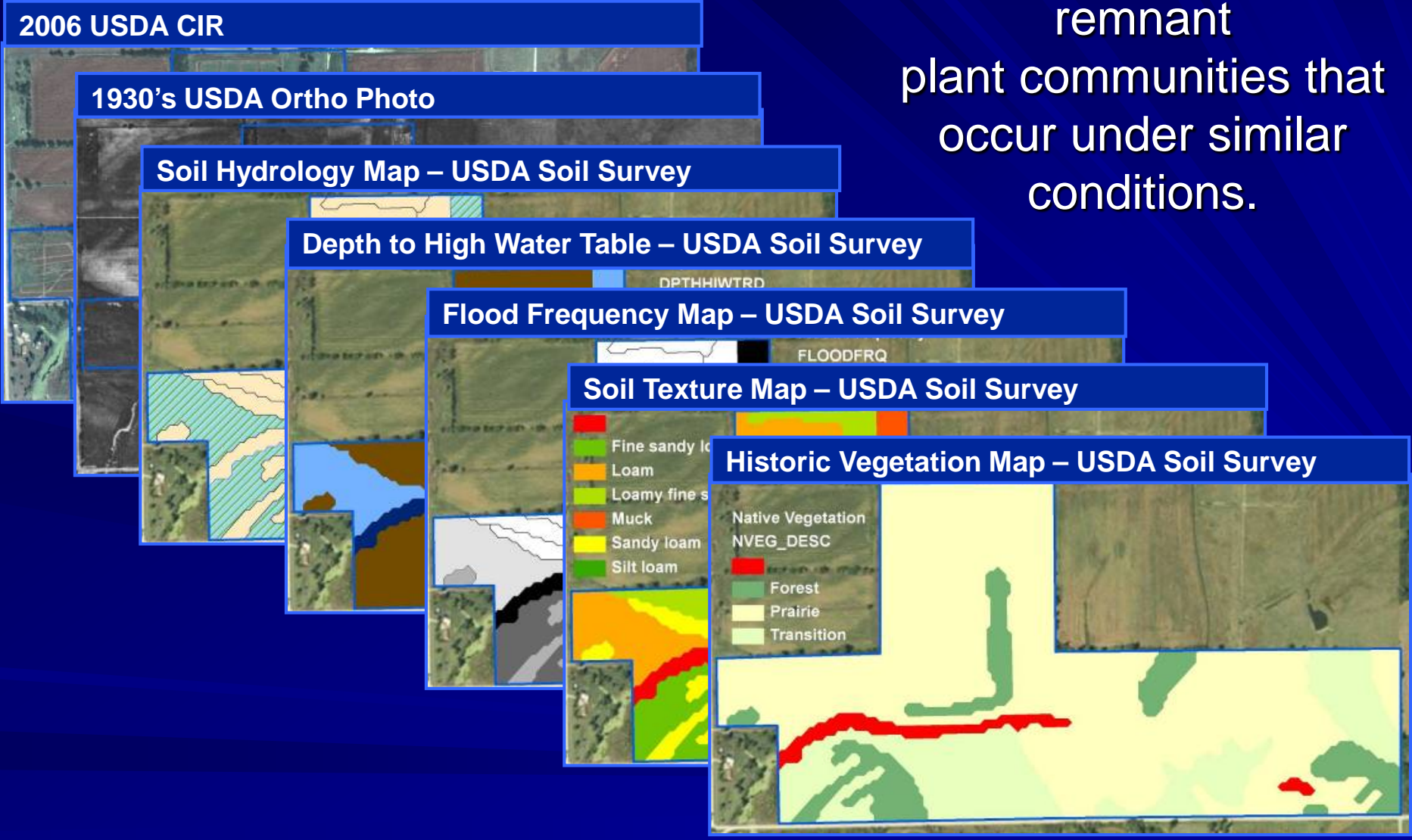
Flood Frequency Map – USDA Soil Survey

Soil Texture Map – USDA Soil Survey

Historic Vegetation Map – USDA Soil Survey

- Fine sandy loam
- Loam
- Loamy fine sand
- Muck
- Sandy loam
- Silt loam

- Native Vegetation  
NVEG\_DESC
- Forest
  - Prairie
  - Transition



# USDA NRCS Web Soil Survey

<http://websoilsurvey.sc.egov.usda.gov>

**USDA** United States Department of Agriculture  
Natural Resources Conservation Service

## Web Soil Survey

Home About Soils Help Contact Us

You are here: Web Soil Survey Home

Search  
Enter Keywords **Go**  
All NRCS Sites

Browse by Subject

- Soils Home
- National Cooperative Soil Survey (NCSS)
- Archived Soil Surveys
- Status Maps
- Official Soil Series Descriptions (OSD)
- Soil Series Extent Mapping Tool
- Geospatial Data Gateway
- eFOTG
- National Soil Characterization Data
- Soil Quality
- Soil Geography

The simple yet powerful way to access and use soil data.

**START WSS**

### Welcome to Web Soil Survey (WSS)

Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

Soil surveys can be used for general farm, local, and wider area planning. Onsite investigation is needed in some cases, such as soil quality assessments and certain conservation and engineering applications. For more detailed information, contact your local [USDA Service Center](#) or your [NRCS State Soil Scientist](#).

### Four Basic Steps

**1** Define...  
**Area of Interest (AOI)** Use the Area of Interest tab to define your area of interest.

**I Want To...**

- Start Web Soil Survey (WSS)
- Know the requirements for running Web Soil Survey – will Web Soil Survey work in my web browser?
- Know the Web Soil Survey hours of operation
- Find what areas of the U.S. have soil data
- Find information by topic
- Know how to hyperlink from other documents to Web Soil Survey
- Know the SSURGO data structure

**Announcements/Events**

- Web Soil Survey 3.2 has been released! View description of new features and fixes.
- Web Soil Survey Release History
- Sign up for e-mail updates via GovDelivery

**I Want Help With...**

- Getting Started With Web Soil Survey
- How to use Web Soil Survey

Generally, the NRCS Soil Survey provides information on soils in their unaltered condition.

If the restoration site has been significantly altered, consultation with a soil scientist may be necessary to take these changes into account prior to restoring plant communities.

# Delineate the Area of Interest (AOI)

The screenshot displays the USDA Web Soil Survey web application. The browser's address bar shows the URL <http://websoilsurvey.sc.egov.usda.gov>. The page features a navigation menu with options like "Area of Interest (AOI)", "Soil Map", "Soil Data Explorer", "Download Soils Data", and "Shopping Cart (Free)".

The main interface is divided into several panels:

- Search:** Includes "Basic Search" and "Advanced Search" sections with input fields for keywords and "Clear" and "Search" buttons.
- Area of Interest:** Contains "Open All" and "Close All" buttons, and a "Clear AOI" button.
- AOI Properties:** A section for defining the area of interest.
- AOI Information:** Displays details for the selected area, including:
  - Name: [Empty field]
  - Map Unit Symbols:  Use Soil Survey Area Map Unit Symbols,  Use National Map Unit Symbols
  - Area (acres): 19.4
  - Soil Data Available from Web Soil Survey: Webster County, Iowa (IA187)
  - Data Availability: Tabular and Spatial, complete
  - Tabular Data: Version 24, Sep 22, 2016
  - Spatial Data: Version 16, Sep 15, 2015
- Quick Navigation:** Includes an "Address" section with a "View" button and the address "Fort Dodge, IA 50501".

The central "Area of Interest Interactive Map" shows a satellite-style map of a rural area. A large rectangular region is highlighted with a green diagonal hatching pattern, representing the delineated Area of Interest. The map includes a toolbar with navigation tools and a "View Extent" dropdown set to "Contiguous U.S.". The word "Webster" is visible on the map, indicating the county. The map's scale is set to "(not to scale)".

# Soil Map Tab

Search

Map Unit Legend

Webster County, Iowa (IA187)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6	Okoboji silty clay loam, 0 to 1 percent slopes	1.3	6.6%
55	Nicollet clay loam, 1 to 3 percent slopes	2.9	14.9%
107	Webster clay loam, 0 to 2 percent slopes	3.3	16.9%
138B	Clarion loam, 2 to 6 percent slopes	1.1	5.8%
507	Canisteo clay loam, 0 to 2 percent slopes	10.8	55.9%
<b>Totals for Area of Interest</b>		<b>19.4</b>	<b>100.0%</b>

Soil Map

Scale | (not to scale)

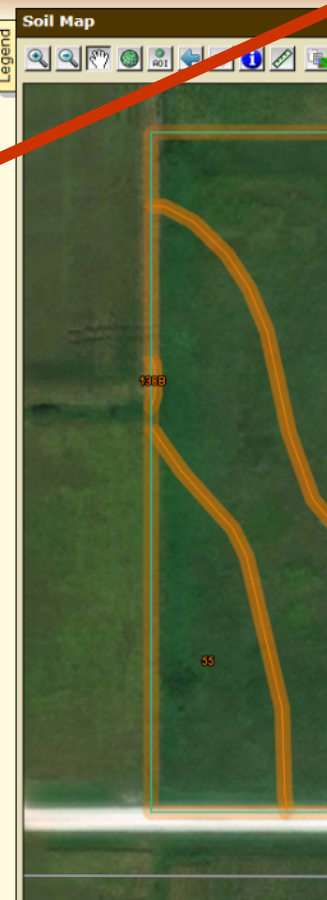
Search

Map Unit Legend

**Webster County, Iowa (IA187)**

Webster County, Iowa (IA187)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6	Okoboji silty clay loam, 0 to 1 percent slopes	1.3	6.6%
55	Nicollet clay loam, 1 to 3 percent slopes	2.9	14.9%
107	Webster clay loam, 0 to 2 percent slopes	3.3	16.9%
138B	Clarion loam, 2 to 6 percent slopes	1.1	5.8%
507	Canisteo clay loam, 0 to 2 percent slopes	10.8	55.9%
<b>Totals for Area of Interest</b>		<b>19.4</b>	<b>100.0%</b>



Map Unit Description

Printable Version

Report - Map Unit Description

**Webster County, Iowa**

**6—Okoboji silty clay loam, 0 to 1 percent slopes**

**Map Unit Setting**

National map unit symbol: 2tsjv  
 Elevation: 690 to 1,840 feet  
 Mean annual precipitation: 24 to 37 inches  
 Mean annual air temperature: 43 to 52 degrees F  
 Frost-free period: 140 to 180 days  
 Farmland classification: Farmland of statewide importance

**Map Unit Composition**

Okoboji and similar soils: 85 percent  
 Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

**Description of Okoboji**

**Setting**

Landform: Depressions  
 Down-slope shape: Concave  
 Across-slope shape: Concave  
 Parent material: Local alluvium over till

**Typical profile**

Ap - 0 to 8 inches: silty clay loam  
 A - 8 to 33 inches: silty clay loam  
 Bg - 33 to 38 inches: silty clay loam  
 Cg - 38 to 79 inches: silty clay loam

**Properties and qualities**

Slope: 0 to 1 percent  
 Depth to restrictive feature: More than 80 inches  
 Natural drainage class: Very poorly drained  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)  
 Depth to water table: About 0 to 6 inches  
 Frequency of flooding: None  
 Frequency of ponding: Occasional  
 Calcium carbonate, maximum in profile: 20 percent  
 Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
 Available water storage in profile: Very high (about 12.4 inches)

**Interpretive groups**

Land capability classification (irrigated): None specified  
 Land capability classification (nonirrigated): 3w  
 Hydrologic Soil Group: C/D  
 Ecological site: Depressional Marsh (R103XY015MN)  
 Other vegetative classification: Pondered If Not Drained (G103XS013MN)  
 Hydric soil rating: Yes

**Interpretive groups**

Land capability classification (irrigated): None specified  
 Land capability classification (nonirrigated): 3w  
 Hydrologic Soil Group: C/D  
 Ecological site: Depressional Marsh (R103XY015MN)  
 Other vegetative classification: Pondered If Not Drained (G103XS013MN)  
 Hydric soil rating: Yes

**Minor Components**

**Canisteo**

Percent of map unit: 10 percent  
 Landform: Ground moraines, rims on depressions  
 Landform position (three-dimensional): Tall  
 Down-slope shape: Linear, concave  
 Across-slope shape: Linear  
 Ecological site: Loamy Wet Prairies (R103XY001MN)  
 Other vegetative classification: Level Swale, Calcareous (G103XS009MN)  
 Hydric soil rating: Yes

**Harps**

Percent of map unit: 5 percent  
 Landform: Rims on depressions  
 Down-slope shape: Concave  
 Across-slope shape: Linear  
 Ecological site: Calcareous Rim Prairies (R103XY009MN)  
 Other vegetative classification: Level Swale, Calcareous (G103XS009MN)  
 Hydric soil rating: Yes

# Soil Data Explorer

## Water Features Report

The screenshot displays the USDA Web Soil Survey interface. At the top, the browser address bar shows the URL <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey>. The navigation menu includes 'Area of Interest (AOI)', 'Soil Map', 'Soil Data Explorer', 'Download Soils Data', and 'Shopping Cart (Free)'. The 'Soil Data Explorer' tab is selected and highlighted with a red box. Below the navigation, the 'View Soil Information By Use:' dropdown is set to 'All Uses'. The 'Soil Reports' section is also highlighted with a red box, showing options like 'Intro to Soils', 'Suitabilities and Limitations for Use', 'Soil Properties and Qualities', 'Ecological Site Assessment', and 'Soil Reports'. The 'Soil Map' section is active, displaying a map with soil boundaries and labels (e.g., 188B, 507, 6, 55, 107, 55). The left sidebar contains a search bar and a list of report categories. The 'Water Features' category is highlighted with a red box and expanded, showing 'Hydrologic Soil Group and Surface Runoff' and 'Water Features'. The 'Water Features' section includes a 'View Description' and 'View Soil Report' button, and an 'Options' section with a checked 'Include minor soils?' checkbox. The 'Water Management' category is also visible at the bottom of the sidebar.

USDA United States Department of Agriculture  
Natural Resources Conservation Service

Contact Us | Subscribe | Archived Soil Surveys | Soil Survey Status | Glossary | Preferences | Link | Logout | Help

Area of Interest (AOI) | Soil Map | **Soil Data Explorer** | Download Soils Data | Shopping Cart (Free)

View Soil Information By Use: All Uses | Printable Version | Add to Shopping Cart

Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Site Assessment | **Soil Reports**

Search

Soil Reports

Open All | Close All

- AOI Inventory
- Building Site Development
- Construction Materials
- Disaster Recovery Planning
- Land Classifications
- Recreational Development
- Sanitary Facilities
- Soil Chemical Properties
- Soil Erosion
- Soil Health
- Soil Physical Properties
- Soil Qualities and Features
- Vegetative Productivity
- Water Management

**Water Features**

Hydrologic Soil Group and Surface Runoff

**Water Features**

View Description | View Soil Report

Options

Include minor soils?

View Description | View Soil Report

Water Management

Soil Map

Scale: (not to scale)

188B, 507, 6, 55, 107, 55

# Water Features Report

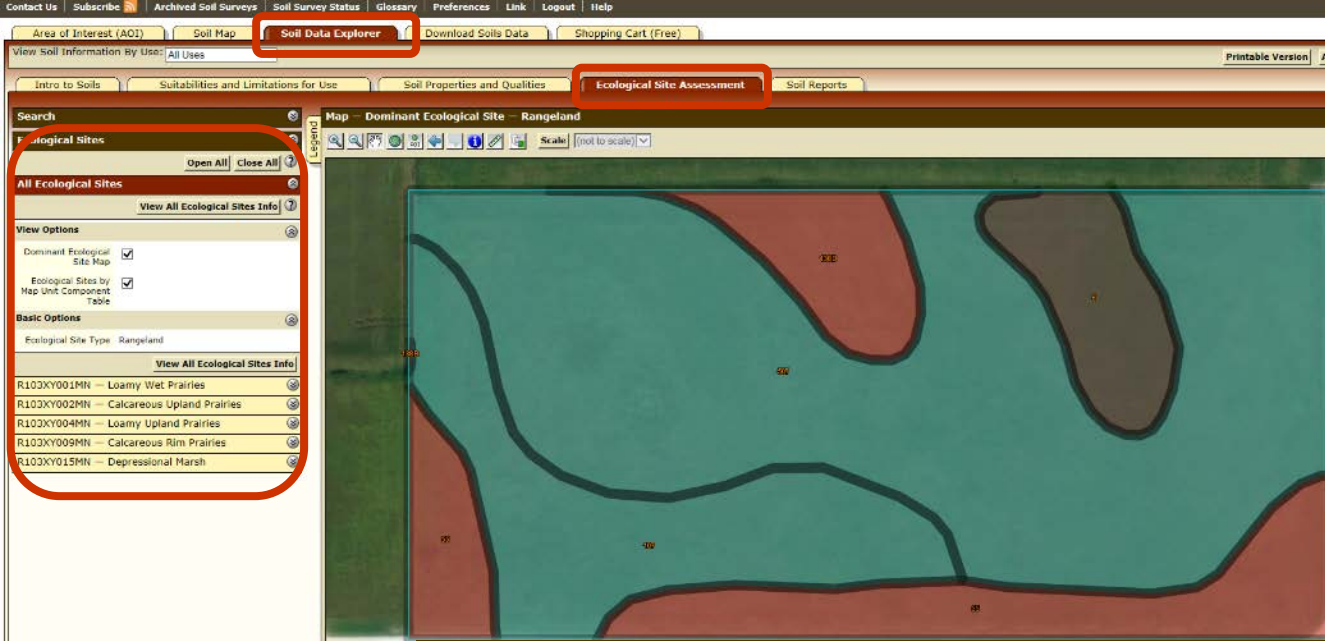
Water Features---Webster County, Iowa

Liska-Stanek Prairie

## Report—Water Features

Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table			Ponding			Flooding	
				Upper limit	Lower limit	Kind	Surface depth	Duration	Frequency	Duration	Frequency
				<i>Ft</i>	<i>Ft</i>		<i>Ft</i>				
6—Okoboji silty clay loam, 0 to 1 percent slopes											
Okoboji	C/D		Jan	1.0-2.0	6.0	Apparent	—	—	—	—	None
			Feb	1.3-2.0	6.0	Apparent	—	—	—	—	None
			Mar	0.2-1.0	6.0	Apparent	0.0-1.0	Brief (2 to 7 days)	Occasional	—	None
			Apr	0.0-0.5	6.0	Apparent	0.0-1.0	Brief (2 to 7 days)	Occasional	—	None
			May	0.2-0.5	6.0	Apparent	0.0-1.0	Brief (2 to 7 days)	Occasional	—	None
			Jun	0.5-1.0	6.0	Apparent	0.0-1.0	Brief (2 to 7 days)	Occasional	—	None
			Jul	1.0-1.6	6.0	Apparent	—	—	—	—	None
			Aug	1.3-3.0	6.0	Apparent	—	—	—	—	None
			Sep	1.0-1.6	6.0	Apparent	—	—	—	—	None
			Oct	0.7-1.3	6.0	Apparent	—	—	—	—	None
			Nov	0.3-1.0	6.0	Apparent	—	—	—	—	None

Note: Water features for a soil type may vary by location



Turquoise = Loamy Wet Prairies

Red = Loamy Upland Prairies

Gray = Depressional Marsh

Table - Ecological Sites by Map Unit Component - Rangeland

Webster County, Iowa

Map unit symbol	Map unit name	Component name (percent)	Ecological site	Acres in AOI	Percent of AOI
6	Okoboji silty clay loam, 0 to 1 percent slopes	Okoboji (85%)	R103XY015MN - Depressional Marsh	1.3	6.6%
		Canisteo (10%)	R103XY001MN - Loamy Wet Prairies		
		Harps (5%)	R103XY009MN - Calcareous Rim Prairies		
55	Nicollet clay loam, 1 to 3 percent slopes	Nicollet (85%)	R103XY004MN - Loamy Upland Prairies	2.9	14.9%
		Clarion (5%)	R103XY004MN - Loamy Upland Prairies		
		Okoboji (5%)	R103XY015MN - Depressional Marsh		
		Webster (5%)	R103XY001MN - Loamy Wet Prairies		
107	Webster clay loam, 0 to 2 percent slopes	Webster (85%)	R103XY001MN - Loamy Wet Prairies	3.3	16.9%
		Nicollet (5%)	R103XY004MN - Loamy Upland Prairies		
		Okoboji (5%)	R103XY015MN - Depressional Marsh		
		Glencoe (3%)	R103XY015MN - Depressional Marsh		
		Canisteo (2%)	R103XY001MN - Loamy Wet Prairies		
138B	Clarion loam, 2 to 6 percent slopes	Clarion (85%)	R103XY004MN - Loamy Upland Prairies	1.1	5.8%
		Nicollet (5%)	R103XY004MN - Loamy Upland Prairies		
		Storden, moderately eroded (5%)	R103XY002MN - Calcareous Upland Prairies		
		Webster (5%)	R103XY001MN - Loamy Wet Prairies		
507	Canisteo clay loam, 0 to 2 percent slopes	Canisteo (75%)	R103XY001MN - Loamy Wet Prairies	10.8	55.9%
		Okoboji (13%)	R103XY015MN - Depressional Marsh		
		Harps (5%)	R103XY009MN - Calcareous Rim Prairies		
		Webster (5%)	R103XY001MN - Loamy Wet Prairies		
		Glencoe (2%)	R103XY015MN - Depressional Marsh		
<b>Totals for Area of Interest</b>				<b>19.4</b>	<b>100.0%</b>

Search

All Plant Community Photos — R103XY001MN — Loamy Wet Prairies Ecological Site

Ecological Sites

Open All Close All

All Ecological Sites

R103XY001MN — Loamy Wet Prairies

This Ecological Site

1.1 High Diversity Prairie

1.2 Old Growth Prairie

2.1 Cool Season Grassland

2.2 Warm Season Grassland

3.1 Scrub Woodland with Grassland Openings

3.2 Closed Scrub Woodland

4.1 Conventional Tillage Field

4.2 Conservation Tillage Field

4.3 Conservation Tillage / Alternative Crop Field

R103XY002MN — Calcareous Upland Prairies

No plant community data available for this ecological site. For more information, please contact your local NRCS office.

R103XY004MN — Loamy Upland Prairies

No plant community data available for this ecological site. For more information, please contact your local NRCS office.

R103XY009MN — Calcareous Rim Prairies

No plant community data available for this ecological site. For more information, please contact your local NRCS office.

R103XY015MN — Depressional Marsh

No plant community data available for this ecological site. For more information, please contact your local NRCS office.

High Diversity Prairie



Old Growth Prairie



Cool Season Grassland



Warm Season Grassland



Scrub Woodland with Grassland Openings



Closed Scrub Woodland



Conventional Tillage Field



Conventional Tillage Field



Conservation Tillage Field



Conservation Tillage / Alternative Crop Field



**Grass/Grasslike**

Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	
			Low	High
2: Graminoids			1000	2500
	big bluestem	Andropogon gerardii	300	900
	Bicknell's sedge	Carex bicknellii	10	300
	Buxbaum's sedge	Carex buxbaumii	10	100
	Hayden's sedge	Carex haydenii	0	350
	woolly sedge	Carex pellita	10	250
	sedge	Carex	100	350
	upright sedge	Carex stricta	0	350
	rigid sedge	Carex tetanica	0	100
	Leiberg's panicum	Dichanthelium leibergii	0	100
	flatstem spikerush	Eleocharis compressa	0	100
	Virginia wildrye	Elymus virginicus	0	100
	rush	Juncus	0	100
	switchgrass	Panicum virgatum	100	400
	fowl bluegrass	Poa palustris	0	100
	little bluestem	Schizachyrium scoparium	100	400
	Indiangrass	Sorghastrum nutans	100	400
	prairie dropseed	Sporobolus heterolepis	100	400
	prairie cordgrass	Spartina pectinata	100	400

**Forb**

Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	
			Low	High
3: Forbs			1200	3000
	common yarrow	Achillea millefolium	0	250
	Canadian anemone	Anemone canadensis	100	400
	Indianhemp	Apocynum cannabinum	100	300
	swamp milkweed	Asclepias incarnata	200	400
	prairie milkweed	Asclepias sullivantii	0	250
	common milkweed	Asclepias syriaca	200	400
	butterfly milkweed	Asclepias tuberosa	0	250
	scarlet Indian paintbrush	Castilleja coccinea	0	250
	tall thistle	Cirsium altissimum	0	250
	spotted water hemlock	Cicuta maculata	0	400
	stiff tickseed	Coreopsis palmata	0	250
	bastard toadflax	Comandra umbellata	0	250
	white lady's slipper	Cypripedium candidum	0	250
	purple prairie clover	Dalea purpurea	100	300
	showy ticktrefoil	Desmodium canadense	100	300
	smooth horsetail	Equisetum laevigatum	0	250
	button eryngo	Eryngium yuccifolium	0	250
	flat-top goldentop	Euthamia graminifolia	0	250

**Shrub/Vine**

Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	
			Low	High
1: Shrub/Vine			0	500
	leadplant	Amorpha canescens	100	300
	dogwood	Cornus	0	150
	prairie rose	Rosa arkansana	100	300
	willow	Salix	0	300

**Vegetative Cover Type**

	Minimum	Maximum
Grass/grasslike	15.000%	30.000%
Forb	15.000%	30.000%
Shrub/vine/liana	—	1.000%
Tree	—	—
Non-vascular plants	—	1.000%
Biological crust	—	2.000%

# Vegetative Productivity

The image shows a screenshot of the USDA Web Soil Survey website. The interface includes a top navigation bar with links like 'Contact Us', 'Subscribe', 'Archived Soil Surveys', 'Soil Survey Status', 'Glossary', 'Preferences', 'Link', 'Logout', and 'Help'. Below this is a search bar and a 'View Soil Information By Use:' dropdown menu. The main content area is divided into several sections, with 'Soil Reports' highlighted in a red box. On the left side, there is a sidebar with a 'Search' section and a list of report categories. The 'Vegetative Productivity' section is expanded, and the report 'Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition' is selected, also highlighted in a red box. Below the selected report, there are 'View Description' and 'View Soil Report' buttons, and an 'Options' section with a checked box for 'Include minor soils?'. The main map area shows a soil map with various soil units outlined in orange, including 18B, 50, 107, and 55. The map is titled 'Soil Map' and includes a legend and a scale dropdown menu.

USDA United States Department of Agriculture  
Natural Resources Conservation Service

Web Soil Survey

Contact Us | Subscribe | Archived Soil Surveys | Soil Survey Status | Glossary | Preferences | Link | Logout | Help

Area of Interest (AOI) | Soil Map | **Soil Data Explorer** | Download Soils Data | Shopping Cart (Free)

View Soil Information By Use: All Uses | Printable Version | Add to Shopping Cart

Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Site Assessment | **Soil Reports**

Search

Soil Reports

Open All | Close All

- AOI Inventory
- Building Site Development
- Construction Materials
- Disaster Recovery Planning
- Land Classifications
- Recreational Development
- Sanitary Facilities
- Soil Chemical Properties
- Soil Erosion
- Soil Health
- Soil Physical Properties
- Soil Qualities and Features
- Vegetative Productivity**
- Forestland Productivity
- Iowa Corn Suitability Rating (CSR2) (IA)
- Nonirrigated Yields by Map Unit
- Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition**
- View Description | View Soil Report
- Options
- Include minor soils?
- View Description | View Soil Report
- Waste Management
- Water Features
- Water Management

Soil Map

Scale: [not to scale]

Map showing soil units: 18B, 50, 107, 55

# Forestland Productivity Report

(example from a different restoration site)

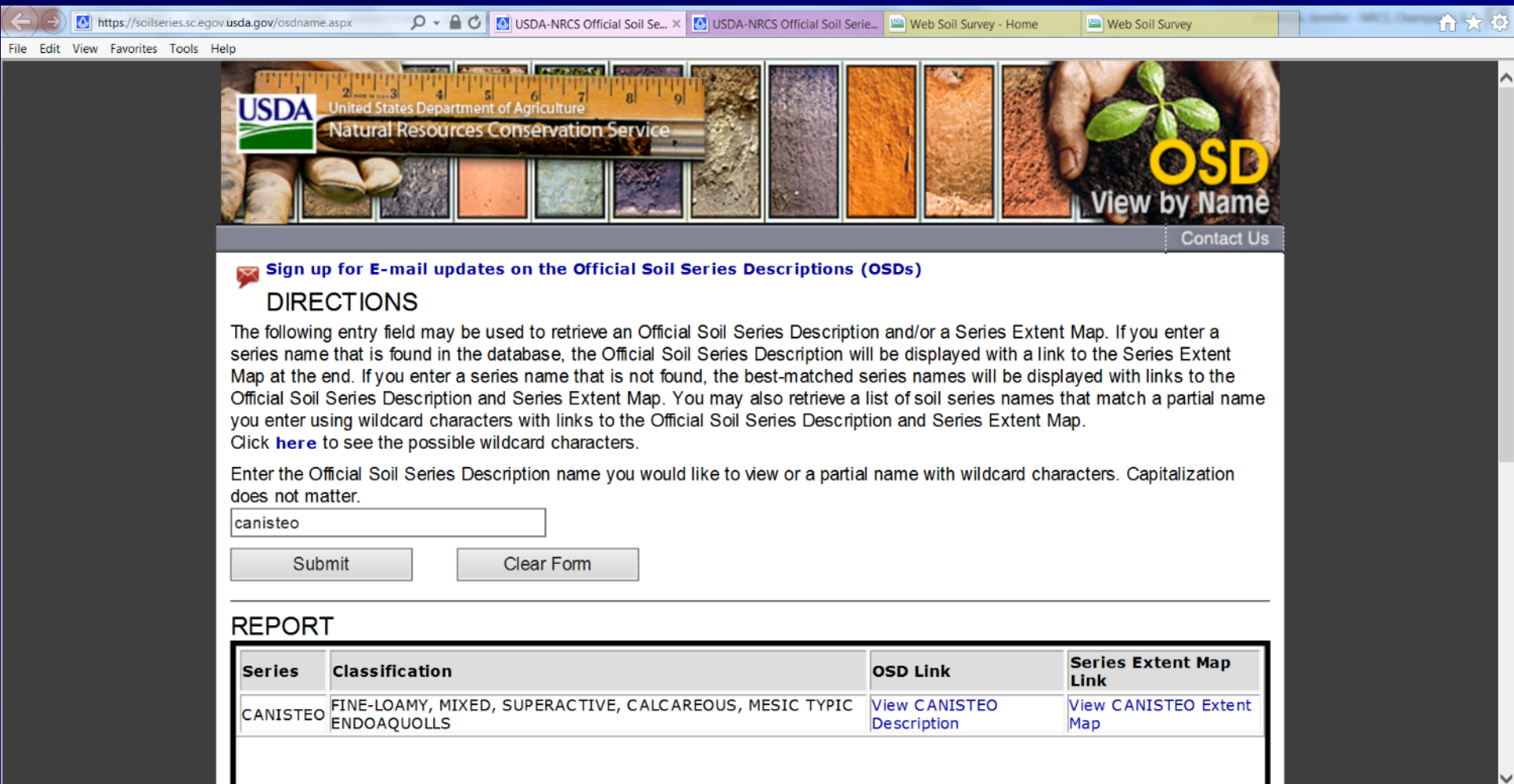
http://websoilsurvey.sc.egov.usda.gov/WssProduct/kkas2zriv4b Web Soil Survey Web Soil Survey - Home websoilsurvey.sc.egov.usda...

Forestland Productivity—Scott County, Iowa				
Map unit symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site Index	Volume of wood fiber	
			<i>Cu ft/ac</i>	
175B—Dickinson fine sandy loam, 2 to 5 percent slopes				
Dickinson	—	—	—	Black cherry, Black oak, Black walnut, Blue spruce, Bur oak, Chinkapin oak, Common hackberry, Eastern white pine, Green ash, Jack pine, Northern red oak, Norway spruce, Red cedar, Red pine, White ash, White oak, White spruce
Sparta	Eastern white pine	—	0.00	Black oak, Blue spruce, Bur oak, Common hackberry, Eastern white pine, Green ash, Hickory, Jack pine, Northern red oak, Red cedar, Red pine, White ash, White fir, White oak
	Jack pine	—	0.00	
	Northern red oak	70	57.00	
	Red pine	—	0.00	
354—Aquolls, ponded				
Aquolls	—	—	—	American sycamore, Bur oak, Common hackberry,

1:23 PM 10/21/2016

# NRCS Official Soil Series Description


Not as site specific as Web Soil Survey Reports



USDA United States Department of Agriculture Natural Resources Conservation Service

OSD View by Name

Contact Us

 Sign up for E-mail updates on the Official Soil Series Descriptions (OSDs)

### DIRECTIONS

The following entry field may be used to retrieve an Official Soil Series Description and/or a Series Extent Map. If you enter a series name that is found in the database, the Official Soil Series Description will be displayed with a link to the Series Extent Map at the end. If you enter a series name that is not found, the best-matched series names will be displayed with links to the Official Soil Series Description and Series Extent Map. You may also retrieve a list of soil series names that match a partial name you enter using wildcard characters with links to the Official Soil Series Description and Series Extent Map. Click [here](#) to see the possible wildcard characters.

Enter the Official Soil Series Description name you would like to view or a partial name with wildcard characters. Capitalization does not matter.

Submit Clear Form

### REPORT

Series	Classification	OSD Link	Series Extent Map Link
CANISTEO	FINE-LOAMY, MIXED, SUPERACTIVE, CALCAREOUS, MESIC TYPIC ENDOAQUOLLS	<a href="#">View CANISTEO Description</a>	<a href="#">View CANISTEO Extent Map</a>

LOCATION CANISTEO

MN+IA IL SD

Established Series

Rev. AGG-TCJ

06/2015

## CANISTEO SERIES

The Canisteo series consists of very deep, poorly and very poorly drained soils that formed in calcareous, loamy till or in a thin mantle of loamy or silty sediments and the underlying calcareous, loamy till. These soils are on rims of depressions, depressions and flats on moraines or till plains. Slope ranges from 0 to 2 percent. Mean air annual temperature is about 9 degrees C. Mean annual precipitation is about 785 millimeters.

**TAXONOMIC CLASS:** Fine-loamy, mixed, superactive, calcareous, mesic Typic Endoaquolls

**TYPICAL PEDON:** Canisteo clay loam, on a nearly level to slightly convex slope, on a ground moraine, in a cultivated field. (Colors are for moist soil unless otherwise noted.)



### **DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:**

Drainage class--poorly drained and very poorly drained--in an undrained condition, a frequently saturated zone occurs at the surface to a depth of 0.3 meters during the wettest periods of years when precipitation is within one standard deviation of 30 year mean annual precipitation

Saturated hydraulic conductivity--1.00 to 10.00 micrometers per second and 0.10 to 1.00 micrometers per second in the firm till, when present

### **USE AND VEGETATION:**

Most areas are artificially drained and cultivated. The principal crops are corn, soybeans, small grains, and legume hay. Reed canarygrass commonly dominates partially drained pasture. Native vegetation is predominantly wet-site tall prairie species such as prairie cordgrass, switchgrass, big bluestem, woolly sedge, giant goldenrod and Canada goldenrod. The native vegetation on very poorly drained ponded phases is herbaceous marsh species tolerant of excessive wetness such as, cattails, bulrushes, giant burreed, giant reed grass and hydrophytic sedges.

# Native Plant Community Query, Community Descriptions, and a Native Seeding Calculator

## Iowa Native Plant Community Query Database

Version 3

Click on the button below to enter the soil characteristics for your query. You will be prompted to match the text in the soil surface texture, soil drainage class, and soil parent material boxes below.

[Click here to begin your query](#)

### Soil Surface Texture Options

Clay  
Clay Loam  
E...

### Central Cordgrass Wet Prairie



**Site Characteristics:** Stands occur on lowland areas that are flooded in spring and saturated for much of the growing season. The soils are typically deep, fine-textured, poorly drained, and have high organic content. On some sites there is an impermeable subsurface layer that impedes soil drainage. Stands of this wide-ranging alliance are found on level to gently sloping sites with sand, loam, or clay soils. Wet sand prairies may be more acidic and more likely to become dry in summer; however, floristic characteristics that reflect those factors are not known. Stands may occur near lakes or rivers or in depressions. Locations supporting this alliance are sometimes slightly - moderately alkaline areas along ephemeral, intermittent or perennial streams, and on the margins of large river floodplains. This alliance can also be found in swales, meadows, and on the margins of typically flooded for part of the winter and spring. Soil water movement is rapid enough to preclude the accumulation of salts in the surface horizon.

**Vegetation Characteristics:** A dense layer of graminoids dominates this community. Forbs (mainly 40% cover) and small trees or shrubs are also common. The vegetation is typically 1-2 m tall. Canada Bluejoint and Prairie Cordgrass are the two most abundant species. Several common Sedge species (*Carex spp.*) found in this community include Common Lake Sedge, Water Sedge, Woolly Sedge, and Haary-leaved Lake Sedge. Other species that occur with less frequency in this community include Big Bluestem, New England Aster, Wild Strawberry, Northern Bedstraw, Saw-tooth Sunflower, Blue Flag Iris, Prairie Blazing Star, Winged Loosestrife, Cowbane, Switchgrass, Virginia Mountain Mint, Smooth Goldenrod, Purple Meadow-rue, and Culver's root.

**Range:**  
Un...  
Nat...

**Conservation Status:** G3 - Vulnerable

**Management Considerations:** Periodic prolonged flooding and fire prevent woody vegetation from dominating this community. Prairie Cordgrass is an early colonizer of suitable habitat and is tolerant of Cordgrass have high production rates, however the rough-edged leaves make for poor forage quality, and tall height and thick growth provide shade and cover for wildlife and certain bird species.

Iowa NRCS Plant Community Description  
This community description is a compilation of the Community Association and it's over-riding Community Alliance description.

### Iowa NRCS Plant Community Query

on the Community Association and it's over-riding Community Alliance description (e.g., NatureServe Explorer). Where necessary, community site conditions were adapted as recommended by NatureServe experts.

### Seeding Plan

Central Cordgrass Wet Prairie  
John Doe  
Jennifer Anderson-Cruz  
Field Area (acres): 20.000

IA-CPA-4 REV February-98 (File Code 189-12-12)  
Date: 1/20/2015  
Tract No: 1563  
Field No: 2  
Contract No: 2

#### Seeding Mix Summary

Grasses	Scientific Name	Common Name	PLS Lbs/Acre	PLS Lbs	Estimated Cost
1	<i>Chloris pectinacea</i>	Bluejoint	0.019	0.39	\$145.85
2	<i>Carex acutirostris</i>	Wheat Sedge	0.0076	0.47	\$300.41
3	<i>Carex debilis</i>	Bebb's Sedge	0.049	2.40	\$190.17
4	<i>Carex echinocarpa</i>	Hairyfruit Sedge	0.041	0.79	\$172.80
5	<i>Carex pellita</i>	Woolly Sedge	0.026	0.82	\$173.37
6	<i>Carex scoparia</i>	Flour Sedge	0.049	0.51	\$175.02
7	<i>Glyceria striata</i>	Fowl Mangrass	0.041	0.51	\$98.01
8	<i>Sperberia pedicularis</i>	Prairie Cordgrass	0.17	3.30	\$297.71
SUBTOTAL GRASSES			0.47	9.40	\$2,017.34
1	<i>Apocynum tenellum</i>	Spurred False Foxglove	0.0034	0.068	\$41.50
2	<i>Aster multiflorus</i>	Swamp Milkweed	0.067	1.13	\$204.19
3	<i>Asplenium platyneuron</i>	White Wild Indigo	0.017	0.34	\$102.09
4	<i>Baptisia alba</i>	Hooding Eggplant	0.065	0.32	\$96.09
5	<i>Bidens cernua</i>	Rattlesnake Master	0.030	1.30	\$155.67
6	<i>Eryngium yuccifolium</i>	Northern Bedstraw	0.18	0.59	\$355.11
7	<i>Galium boreale</i>	Saw-tooth Sunflower	0.0007	3.63	\$26.70
8	<i>Helianthus grosseserratus</i>	Blue Flag	0.018	0.019	\$26.75
9	<i>Iris sibirica</i>	False Indigo	0.068	0.36	\$167.35
SUBTOTAL FORBS			0.46	1.36	\$204.19
TOTAL			0.93	18.67	\$3,771

# Iowa NRCS Plant Community Restoration Tools

The screenshot shows a web browser window displaying the USDA Natural Resources Conservation Service Iowa website. The page is titled "Plant Community Restoration Tools" and is part of the "Technical Resources" section. The browser's address bar shows the URL: <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ia/technical>. The website header includes the USDA logo, "Natural Resources Conservation Service Iowa", and "United States Department of Agriculture". Navigation links include "Topics", "Programs", "Newsroom", and "Contact Us". A search bar is present with a magnifying glass icon. Below the header, a breadcrumb trail reads: "You are Here: [Home](#) / [Technical Resources](#) / [Plant Community Restoration Tools](#)". Social media icons for Facebook, Twitter, YouTube, and Flickr are displayed under the heading "Stay Connected". The main content area features a sidebar with "Technical Resources" and a list of tools under the heading "Plant Community Restoration Tools".

**USDA Natural Resources Conservation Service Iowa**  
United States Department of Agriculture

[Topics](#) | [Programs](#) | [Newsroom](#) | [Contact Us](#)

Search:

[Browse By Audience](#) | [A-Z Index](#) | [Help](#)

You are Here: [Home](#) / [Technical Resources](#) / [Plant Community Restoration Tools](#)

*Stay Connected*

## Plant Community Restoration Tools

- Plant Community Query - Version 3** (MDB, 49 MB)
  - [Plant Community Query - How to](#) (PDF, 1 MB)
- Plant Community Species List for Iowa** (PDF, 2.1 MB)
  - [Arrowhead - Rice Cutgrass Marsh](#) (PDF, 108 KB)
    - [Example Seed Mix](#) (XLS, 713 KB)
  - [Bluejoint - Woolly Sedge Wet Meadow](#) (PDF, 131 KB)
    - [Example Seed Mix](#) (XLS, 724 KB)
  - [Bog Birch Willow Prairie Fen](#) (PDF)
  - [Bulrush-Cattail-Bur-Reed Shallow Marsh](#) (PDF, 122 KB)

# Nature Serve Explorer

<http://explorer.natureserve.org/>



An Online Encyclopedia of Life



Search About the Data About Us Contact Us Help

**Search Results:** 21 - 40 of 168 records matching [your criteria](#).  
[Systems: 18](#) | [Associations: 91](#) | [Alliances: 59](#)

Show Details:  Yes  No

[<< Prev](#) | [Next >>](#)

[Deselect All](#) [Select All](#) [Show Selected Only](#)

[Download Systems PDF](#)

[New Search](#) [Change Criteria](#)

**Association Records**  = Selected for report browsing.

Browse <input checked="" type="checkbox"/> (Unique ID)	Scientific Name Common Name Translated Name	NatureServe Status	Distribution: United States & Canada	Classification Code	 Image Available
<b>Temperate &amp; Boreal Forest &amp; Woodland</b>					
<i>Quercus macrocarpa</i> - <i>Quercus velutina</i> / <i>Andropogon gerardii</i> Savanna & Barrens Group Central Midwest Oak Openings & Barrens					
<input checked="" type="checkbox"/> CEGL002020	<a href="#">Quercus macrocarpa</a> - ( <a href="#">Quercus alba</a> , <a href="#">Quercus velutina</a> ) / <a href="#">Andropogon gerardii</a> Wooded <a href="#">Grassland</a> North-Central Bur Oak Openings Bur Oak - (White Oak, Black Oak) / Big Bluestem Wooded Grassland	G1	USA: IA <sup>?</sup> , IL, IN, MI <sup>?</sup> , MN, WI	1.B.2.Na.4.a	
<input checked="" type="checkbox"/> CEGL002158	<a href="#">Quercus macrocarpa</a> <a href="#">Northern Tallgrass Wooded Grassland</a> Northern Tallgrass Bur Oak Openings Bur Oak Northern Tallgrass Wooded Grassland	G1G2	CAN: MB, ON USA: IA <sup>?</sup> , MN, ND, NE, SD	1.B.2.Na.4.a	
<input checked="" type="checkbox"/> CEGL002492	<a href="#">Quercus velutina</a> - <a href="#">Quercus ellipsoidalis</a> - ( <a href="#">Quercus alba</a> ) / <a href="#">Schizachyrium scoparium</a> - <a href="#">Lupinus perennis</a> Wooded Grassland Black Oak / Lupine Barrens Black Oak - Northern Pin Oak - (White Oak) / Little Bluestem - Sundial Lupine Open Woodland	G3	CAN: ON USA: IA <sup>?</sup> , IL, IN, MI, MN, OH, PA <sup>?</sup> , WI	1.B.2.Na.4.a	

**Temperate & Boreal Open Rock Vegetation**

*Central Midwest-Interior Cliff & Rock Vegetation Group*

# NatureServe Community Association Record

## Vegetation

---Jump to Section---

**Vegetation Summary:** These savannas exhibit a mosaic of physiognomies, with smaller patches of grassland and forest interdigitating in complex patterns. Typically, there are two main structural layers, tree canopy and herbaceous, though shrubs could be scattered or clumped. Tree densities for stems greater than 10 cm dbh may historically have been between 1 and 40 stems per hectare (Wing 1937, Cottam 1949, Curtis 1959, Brewer and Kitler 1989). Structure in this community ranges from large open-grown trees 10-12 m tall, to gnarled trees 2-4 m tall. Shrub cover can become significant, and even predominant, over graminoid cover. Smaller gnarled trees tend to be found on drier soils which preclude even moderate tree growth. Canopy cover ranges from 10-30%, with higher canopy cover more likely to form in areas of slightly lower fire frequency, areas with greater microtopographic variability that allows for more fire protection, and areas under less grazing pressure. The tree layer is composed of *Quercus macrocarpa*, *Quercus alba*, and *Quercus velutina*, with some *Carya ovata*. *Quercus velutina* is more common on sandier soils. The ground layer is dominated by graminoids, especially *Andropogon gerardii* and *Schizachyrium scoparium*, accompanied by a large diversity of forbs. Shrub cover can range widely from 0-100%, with *Ceanothus americanus* and *Amorpha canescens* being two of the most important shrub species. Understory species typical of oak openings require some direct sunlight throughout the growing season and are quickly reduced when heavily shaded by either tree or shrub canopy. Common shrubs in this community are adapted to the moderate fire frequencies found in oak openings, and resprout vigorously after burning.

Macroclimate, as expressed in relative moisture stress levels, is thought to play an important role in species composition variation from east to west in the Oak Openings region. Although an oak opening in Iowa and Ohio may have soils of the same water-holding capacity, plants in the Iowa site will experience more drought stress than plants in the more humid climate of Ohio. Thus, species that compete best in droughty situations will require a more open canopy to compete in an eastern oak opening than they will in a western one of similar soil type. Conversely, species that compete best in sunny but moist situations will require a less open canopy to compete in an eastern oak opening than they will in a western one of similar soil type.

### Vegetation Composition (incomplete)

Species Name	Rounded Global Status	Growth Form	Stratum	Characteristic	Dominant	Constant	Cover Class %	Constancy %
<i>Quercus alba</i>	G1	Broad-leaved deciduous tree	Tree canopy	✓				
<i>Quercus macrocarpa</i>	G1	Broad-leaved deciduous tree	Tree canopy	✓	✓			
<i>Quercus velutina</i>	G1	Broad-leaved deciduous tree	Tree canopy	✓				
<i>Andropogon gerardii</i>	G1	Graminoid	Herb (field)	✓	✓			
<i>Schizachyrium scoparium</i>	G1	Graminoid	Herb (field)		✓			

**Vegetation Structure Summary:** Structure in this community ranges from large open-grown trees 10-12 m tall, to gnarled trees 2-4 m tall. Shrub cover can become significant, and even predominant, over graminoid cover. Smaller gnarled trees tend to be found on drier soils which preclude even moderate tree growth. Canopy cover ranges from 10-30%, with higher canopy cover more likely to form in areas of slightly lower fire frequency, areas with greater microtopographic variability that allows for more fire protection, and areas under less grazing pressure.

### Vegetation Structure

Stratum	Growth Form	Height of Stratum (m)	Cover Class %	Min Cover %	Max Cover %
Tree canopy	Broad-leaved deciduous tree				
Herb (field)	Graminoid				

## Environmental Setting

---Jump to Section---

### Wetland Indicator: N

**Environmental Summary:** This community occurs on level to rolling topography on well-drained outwash plains and coarse-textured end moraines, as well as steep, fire-prone, shallow-to-bedrock hills in the Driftless Area. The pH varies from 6.1-7.3. Soils are excessively to moderately well-drained and range from loams to sandy loams, and include silt loams close to bedrock in the Driftless Area. Soils tend to be Alfisols with a mollic epipedon, also known as transitional soils (Grimm 1984). Oak openings are also found on Mollisols ("prairie" soils) and Alfisols ("forest" soils). Vegetatively caused changes in soil structure (development of a mollic epipedon, the leaching of bases in an Alfisol) appear to occur at much slower rates (on the order of perhaps scores if not hundreds of years) than does turnover of plant communities, so oak openings recently supplanting prairies or woodlands can be found on soils more typical of these communities. The water table remains well below the soil surface (at least 0.6 m) throughout the year.

## Dynamic Processes

---Jump to Section---

**Dynamics:** The abundance of oak openings has historically shifted back and forth from east to west over the past 10,000 years (Anderson 1983, Grimm 1984). Pollen records indicate that deciduous forests dominated the western Midwest 9000 years before present (BP). The climate became drier about 8300 BP, with graminoid-dominated communities (prairie, savanna, and oak woodland) becoming predominant. About 5000 BP, the climate started becoming more moist again and forest development renewed. It is thought that a much greater proportion of the forest-prairie transition zone would have grown up to forest during the last few thousand years if it were not for repeated burning of the region by Native Americans.

Following European settlement fire was almost entirely eliminated from the landscape. Observers in the mid to late 1800s noted that nearly all of the former prairies and oak openings which had not yet been converted to agriculture were growing up into oak brush and eventually oak woodlands due to lack of fire. Most of the oak forests extant today in the Upper Midwest were oak openings or oak woodlands during the early European settlement era.

Oak openings have been able to persist only where fires have been allowed to occur. One such site is railroad rights-of-way. Another is formerly burned woodlots. Burning of sparse oak openings to provide pasture was a common practice in parts of the Upper Midwest (notably the Driftless Area) before World War II (Pruka 1994). However, since the popularization of Smokey the Bear, total fire suppression has become standard and the dry-mesic oak opening remnants which survived as sparsely wooded pastures until the early 1940s have since grown up into oak woodlands and forests. Some of these sites may still be recoverable as oak openings, especially those on shallow-to-bedrock soils. Such soils prevent fast canopy regrowth rates. This delays the time before full canopy closure and thereby increases the period of persistence for oak opening understory flora.

Fire and grazing are the two important natural disturbances which encourage savanna formation. Fire appears to be the most important of these two, since woody growth release was not commonly noted until fire suppression began in the early European-settlement period, well after the period of massive reduction of bison and elk herds (Pruka 1994). Fire eliminates intolerant tree species. Fires in areas of oak opening were infrequent enough to allow certain species (*Quercus alba*, *Quercus macrocarpa*, *Quercus velutina*, and occasionally *Carya* spp.) to reach a fire-resistant size. *Quercus alba*, being less fire-tolerant than *Quercus macrocarpa*, is limited mostly to more hilly, dry and dry-mesic areas, since these less fertile soils support less grass fuel (and hence less intense/frequent fires) and are less prone to fire. In flatter, mesic areas, with their higher fuel loads, only *Quercus macrocarpa* was able to persist. *Quercus velutina* is less fire-tolerant (but more drought-tolerant) than *Quercus alba* and is favored on the most sandy/least fertile soils (Anderson 1991).

Before European settlement, fires were frequently and intentionally set by Native Americans to create conditions favorable for travel and for supporting large game. This may have led to larger expanses of savanna than would have occurred without human presence. It also probably encouraged savanna formation farther into the humid east than would have occurred without human-set fire (Pyne 1982). Several authors have suggested that Native American fires were most often set in the fall (Chapman 1984, Schwegman and McClain 1985, Swink and Wilhelm 1994). Grimm (1984) noted that several early European settlers recorded summer burns ignited by lightning.

## Plot Sampling & Classification Analysis

---Jump to Section---

# VEGBANK

<http://vegbank.org/vegbank/index.jsp>



[LOGIN](#) | [DATASETS](#) | [LOGOUT](#)

Jump to...

find  containing

[HOME](#) [FAQ](#)

[SUBMIT DATA](#) [ABOUT](#)

[MY ACCOUNT](#) [SITE MAP](#)

[download 0 items](#)

[advanced search](#) | [browse data](#)

## Comprehensive View of a Plot

[click to update datacart](#)

[Configure View](#)

[Less Plot Detail](#) -- [Stems Detail](#) -- [Configure data displayed on this page](#)

FTHD.338	
» Citation URL: <a href="http://vegbank.org/cite/VB.ob.27944.FTHD338">http://vegbank.org/cite/VB.ob.27944.FTHD338</a>	
» <a href="#">Citing info</a>	
Plot ID Fields:	
Author Plot Code	FTHD.338
Author Observation Code	FTHD.338
Original Data Location	Fort Hood Project, The Nature Conservancy, PO Box 5190, Fort Hood, TX 76544-0190
Location Fields:	
MAP: <a href="#">Google</a>   <a href="#">Yahoo</a>   <a href="#">TopoZone</a>   <a href="#">MapQuest</a>	
Confidentiality Status	1 km radius (nearest 0.01 degree)
Latitude	31.15 °
Longitude	-97.67 °
Author Location	FTHD -- post oak mountain -- ERC32
Location Narrative	post oak mountain
State or Province	Texas
Country	United States
Named Places	<a href="#">area/country/territory: United States</a> <a href="#">region/state/province: Texas</a> <a href="#">county: Bell</a>
Layout Fields:	

Taxa occurring on this plot-observation								
Change plant label: <input type="text" value="--Choose a value--"/>								
Change Strata Shown: <input type="text" value="show strata"/>								
ord	Current Interpretation, Scientific Name without authors	Stratum	Cover	Original Cover Code	Basal Area	Biomass	Inference Area	Stem Diameters (graphically):
1	<a href="#">Ulmus crassifolia</a>	Short Shrub	1.5 %	3				
2	<a href="#">Bothriochloa ischaemum var. songarica</a>	Herbaceous	37.5 %	7				
3	<a href="#">Bromus japonicus</a>	Herbaceous	17.5 %	6				
4	<a href="#">Schedonnardus paniculatus</a>	Herbaceous	17.5 %	6				
5	<a href="#">Nassella leucotricha</a>	Herbaceous	17.5 %	6				

# Iowa Native Plant Community Query Database

Canisteo: Clay Loam Surface Soil Texture, Poorly Drained, Glacial Till Parent Material

## Iowa Native Plant Community Query Database Version 3

Click on the button below to enter the soil characteristics for your query. Your spelling must exactly match the text in the soil surface texture, soil drainage class, and soil parent material option boxes below.

[Click here to begin your query](#)

### Soil Surface Texture Options

- Clay
- Clay Loam**
- Exposed Bedrock
- Gravel
- Loam
- Loamy Clay
- Loamy Sand
- Muck
- Mucky Silt Loam
- Mucky Silty Clay Loam
- Organic
- Ponded Aquoll
- Sand
- Sandy Clay
- Sandy Clay Loam
- Sandy Loam
- Silt
- Silt Loam
- Silty Clay
- Silty Clay Loam

### Soil Drainage Class Options

- Excessively Drained
- Somewhat Excessively Drained
- Well Drained
- Moderately Well Drained
- Somewhat Poorly Drained
- Poorly Drained**
- Very Poorly Drained

### Soil Parent Material Options


- Aeolian Sand
- Alluvium
- Bedrock
- End Moraines
- Glacial Till**
- Gravel
- Lacustrine
- Limestone/Dolostone
- Loess
- Muck
- Outwash
- Peat
- Sand
- Sandstone
- Shallow to Bedrock

### NRCS Native Plant Community Restoration Tools

- Click here to access the Iowa NRCS Native Plant Community Restoration Tools website where you can find plant community descriptions, example seed mixes, and a native plant material vendors list.

### Additional Information and Resources

- Click here For a tutorial on how to use the Iowa Native Plant Community Query Database during restoration site planning.
- Click here to generate a soil map of your restoration site using the NRCS Web Soil
- Click here to access online copies of the NRCS County Soil Surveys in Iowa.
- Click here to access the Official Soil Series Descriptions for the soils within your restoration site.
- Click here to access the NatureServe Explorer Database.



United States Department of Agriculture  
Natural Resources Conservation Service

Iowa NRCS Plant Community Query

This community query is based on the Community Association and it's over-riding Community Alliance descriptions as provided by NatureServe

Record: 1 of 1

# Iowa Native Plant Community Query

## *Plant Communities Suited for Restoration*

Access the plant community descriptions to determine which recommended plant community best suits the restoration site and objectives. Plant community descriptions and example seed mixes can be found on the Iowa Natural Resources Conservation Service technical resources website at [www.ianrcs.usda.gov/technical/RestorationTools.html](http://www.ianrcs.usda.gov/technical/RestorationTools.html).

### *Queried Soil Characteristics:*

*Soil Texture:* Clay Loam

*Drainage Class:* Poorly Drained

*Parent Material:* Glacial Till

<i>Recommended Plant Community</i>	<i>Site Hydrology</i>	<i>Flood Frequency</i>	<i>Flood Duration</i>	<i>High Water Table</i>	<i>Community Risk Status</i>
Forest, Aspen - American Hazel	Upland	None	None	<input checked="" type="checkbox"/>	Secure
Marsh, Midwest Cattail Deep	Semi-permanent	Very Frequent	Long	<input checked="" type="checkbox"/>	Secure
Prairie, Northern Wet-Mesic Tallgrass	Temporary	Occasional	Brief	<input type="checkbox"/>	Vulnerable
Wet Prairie, Northern Cordgrass	Temporary	Frequent	Brief	<input checked="" type="checkbox"/>	Vulnerable



Iowa NRCS Plant Community Query

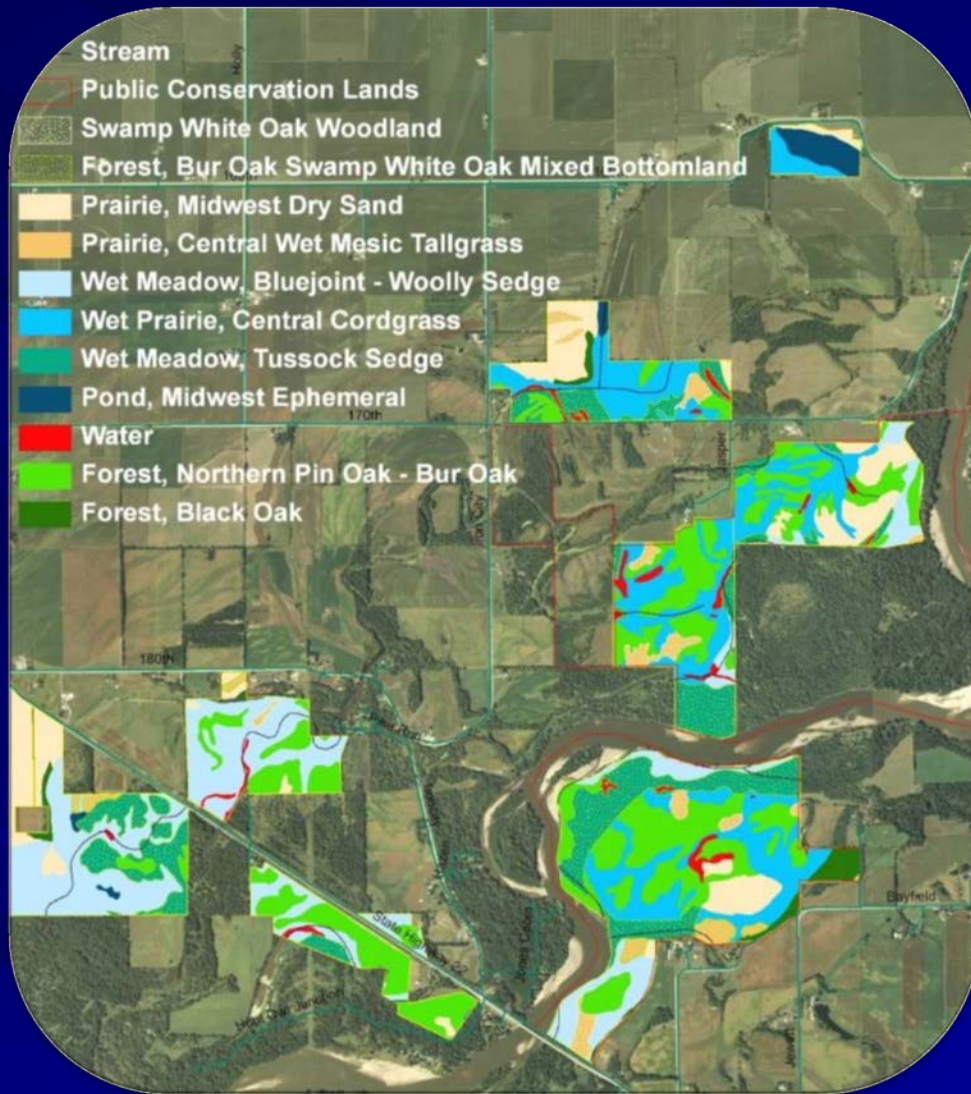
This community query is based on the Community Association and it's over-riding Community Alliance descriptions as provided by NatureServe ([www.natureserve.org/explorer](http://www.natureserve.org/explorer)). Where necessary, community site conditions were adapted as recommended by Iowa plant community experts.

This process is repeated for each soil type and site-suited plant communities are assigned accordingly. On the example site, a minimum of three plant communities can be restored.

Note: small inclusions may occur that could be restored to other community types if desired.



# What You Get for the Extra Effort:



Implementing the ecological restoration approach outlined in this presentation could result in this 703 ha. restoration complex being restored to 11 native plant communities, 195 species, and 11 functional plant groups with an overall floristic quality index of 73.7 and community similarity to nearby remnants. Furthermore, 75% of the complex would be restored to imperiled plant community types.

Comparatively, this is a 680% increase in species richness, a 120% increase in functional diversity, and a 241% increase in floristic quality over the restoration mixes actually seeded within this complex, which did not resemble nearby remnants.

# Matching Appropriate Seed to Conservation Practices

<http://www.conservationwebinars.net/webinars/matching-appropriate-seed-to-conservation-practices/?searchterm=sudie>

The screenshot shows the website interface for the Science & Technology Training Library. At the top, there are navigation links for Contact, Privacy Policy, and Administrators. Below this is a header with the USDA logo and the text 'Science & Technology Training Library Webinar Portal for Conservation of Natural Resources'. A search bar is located in the top right of the header. The main navigation menu includes Home, Live Webinars, On-demand Webinars, Calendar, FAQ, and About Us. The current page is titled 'Matching Appropriate Seed to Conservation Practices' and features a five-star rating. The main content area includes a 'View' button, a description of the webinar, a photo of a field, and a 'Green Savings!' section with a bar chart and a 'View' button. The footer includes the Xerces Society logo and tagline.

Contact Privacy Policy Administrators

USDA

Science & Technology Training Library  
Webinar Portal for Conservation of Natural Resources

Search Webinars Search

Home Live Webinars On-demand Webinars Calendar FAQ About Us

You are here: Home → Webinars → Matching Appropriate Seed to Conservation Practices

**Matching Appropriate Seed to Conservation Practices**  
★★★★★

You can **View** this on-demand webinar at any time. **Help** for tablet and mobile device users.

**Learn about ecotypes and ecological restoration planning tools for greater long term conservation planting success.**

Participate in this training to learn ways to improve the long term success of conservation plantings. The webinar will highlight ecological restoration tools aimed at restoring native plant communities; examine broad benefits of plant community restoration; and illustrate how seed choices can improve (or harm) plantings. Potential impacts of local ecotype, source identified, and cultivar seed choices as they relate to conservation goals will be reviewed. A conservation planning approach developed in Iowa that combines data on site characteristics with native plant communities to provide reference communities for restoration planning will be introduced. This webinar is aimed at NRCS conservation planners and partners, particularly those less familiar with ecologically based planning.

Photo: *Sudie Daves Thomas*

This webinar is presented by the USDA NRCS East National Technology Support Center.  
Presented in partnership with The Xerces Society.

**THE XERCES SOCIETY**  
FOR INVERTEBRATE CONSERVATION  
Protecting the life that sustains us

**Green Savings!**  
Click on the graph below or click **here** for a detailed Green Savings analysis of this webinar.

**When:**  
Nov 18, 2015 2:00 pm US/Eastern  
**Length:** 01:00 (hh:mm) **View**  
**View now on-demand.**

**Presenter(s):**

## High Species Diversity results in:

- Facilitation
- Complementarity
- More efficient acquisition and utilization of available resources

# Ecotype Plant Materials

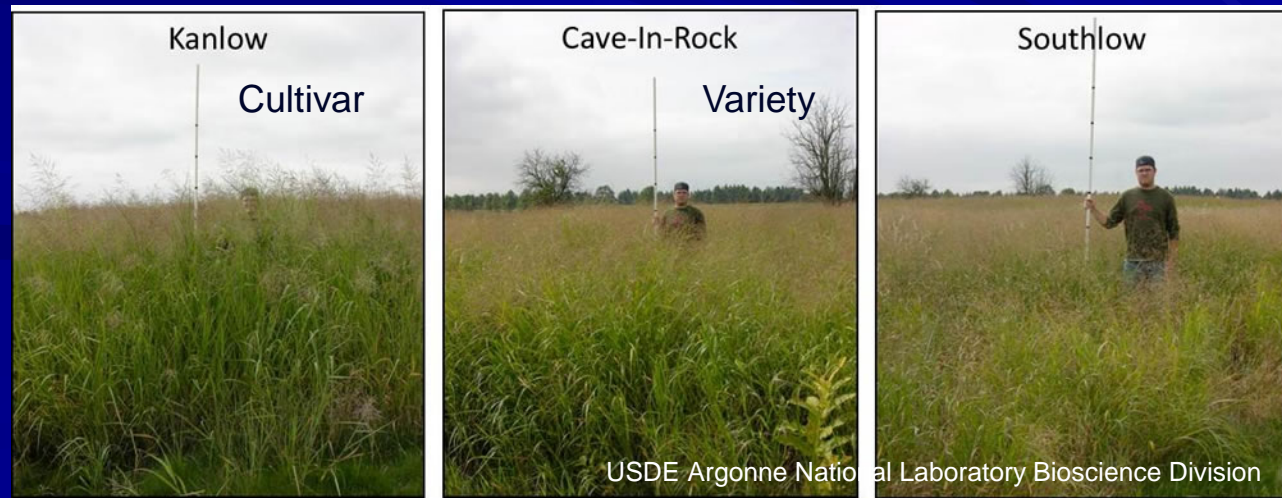
- Characteristics are not distributed randomly throughout a species range
  - clustered into ecological regions (ecoregions)/ seed transfer zones/provenances.
    - Vary in soil type, elevation, exposure, seed dispersal mechanisms, moisture & hydrology, etc.
  - Plants within these ecological regions are known as **ecotypes**.
- Individual species having a large geographical distribution vary considerably in such characteristics as
  - plant height
  - growth habits
  - maturation dates
  - leaf appearance
  - reproductive habits

# Beyond Ecotypes: Source Identified

- No anthropogenic genetic manipulation or selection
- Greater genetic compatibility with local, remnant populations
- Better establishment success
- Bloom synchronization with local fauna and pollinators
- Greater pest and disease resistance
- Greater resistance and resilience to natural disturbance
  - long-term persistence
- Less likely to become an invasive pest

# Cultivar, Tested, and Selected Releases

- Bred to behave consistently and uniformly
- Typically selected to exhibit improved characteristics for a minimum number of generations
- Can be overly competitive within ecological restorations.
- Can pose genetic pollution concerns.




# Pure Live Seed (PLS)

All NRCS recommendations are expressed in pounds of pure live seed (PLS). PLS is defined as the percentage of pure seed that will germinate expressed as a percentage of a given weight of seed. It provides a common basis for comparing seed lots that differ in purity and germination.

## How to calculate:

**PLS** = (percent purity × percent total germination (germination+hard)) x100

**Bulk seeding rate /acre =Lbs PLS**  
recommended rate per acre/ Percent PLS



Crop/Species: <i>Elymus virginicus</i> / Virginia wildrye		
Lot Number: SG0-02-F12		
Test Date: 12/5/02	Pure Seed: 72.66%	
Germination: 70%	Inert: 27.22%	
Hard Seed: 17%	Other Crop: 0.06%	Origin: Field 12 PMC
Total Viability: 87%	Weed Seed: 0.06%	Year Grown: 2002
TZ Tested: No	Noxious Seed: 0%	
PLS: 63.2142%	Net Weight: <b>8#</b>	

Labeled by USDA-Natural Resource Conservation Service  
Elsberry Plant Materials Center

Frc

Example based on a recommended PLS seeding rate of 2lbs/acre for *Elymus virginicus*:

$$\text{PLS} = (0.7266 \times (0.70 + 0.17)) \times 100 = 63.2142\%$$

$$\text{Bulk seeding rate/ac} = 2\text{lbs} / 0.632142 = 3.16 \text{ bulk lbs/acre}$$

# Species Richness

- Total number of species represented in the seeding mix.

<u>Community 1</u>	<u>Community 2</u>
Species A	Species A
Species B	Species B
Species C	Species C
Species D	Species D
<u>Species Richness</u>	
4	4

# Species Diversity

- Total number of species (species richness) and their abundance in the seeding mix.

<u>Community 1</u>	<u>Community 2</u>
Species A = 25	Species A = 80
Species B = 50	Species B = 10
Species C = 10	Species C = 7
Species D = 15	Species D = 3
<u>Evenness</u>	
87%	50%

# Diverse Seeding Mixtures

- High Species Richness
  - $\geq 10$  grasses
  - $\geq 20$  forbs
- Community-listed Dominant and Co-dominant species must be represented in the mix
- Functional groups that may occur in reference communities and should be represented in respective seeding plans:
  - Annual & Biannual forbs and graminoids
  - Perennial forbs & graminoids
  - Warm and cool season graminoids
  - Tall, mid, and short height classes of forbs and graminoids
  - Ferns and Fern Allies
  - Legumes
  - Hemiparasitic plants
  - Woody and herbaceous Vines
  - Shrubs and subshrubs
  - Trees



# Balanced Seeding Mixtures

- Theoretically, seed mixes should be as even as possible
  - A 20 graminoid seeds/ft<sup>2</sup> and 20 forb seeds/ft<sup>2</sup> mix, minimum 5 grasses and 10 forbs
    - use 4 seeds/ sq ft for each grass species and 2 seeds/sq ft for each forb species
- Research has found that rare or under-represented species in uneven seed mixes go extinct on the site within several years.
- More aggressive species may need to be seeded at a lower rate.
  - Research indicating that reducing the larger, more aggressive grasses to less than 4 seeds/ft<sup>2</sup> will result in more diverse restorations with a greater forb component.

# Conservatism Guilds

- All conservatism guilds should be represented
  - Colonizing 15-33% of mix
  - Matrix 45-65% of mix
  - Conservative 15-33% of mix
- It is important to have the colonizing guild represented to fill gaps after disturbances.
  - Otherwise, disturbance may increase stand vulnerability to invasion.
- Data suggests that increasing seeding rates (density) reduces susceptibility to invasion.

# Example Seed Mixes

- A comparison of three 20:20 seed mixes of differing Species Richness (evenness = 100%):
  - 5 graminoid and 10 forb
    - Cost/ac = \$901 FQI = 16.3 CC = 4.2
  - 10 graminoid and 20 forb
    - Cost/ac = \$747 (\$154) FQI = 26.5 (10.2) CC = 4.8 (0.6)
  - 15 graminoid and 30 forb
    - Cost/ac = \$684 (\$217) FQI = 33.4 (17.1) CC = 5.0 (0.8)
- Species Richness of a mix is not always positively correlated with cost.
- Species Rich mixes have significantly greater integrity.
- Rare, less competitive species are more likely to persist in the long-term.

# Germination Requirements

- Typical germination requirements:
  - Cold moist conditions
  - Warm moist conditions
  - Alternating cold and warm moist conditions
  - Light
  - Scarification

- Determine how and when you plant:
  - No-till drill vs. broadcast seeding
  - Dormant (temps below 55° F) vs growing season
    - Split seeding



# Don't forget key plants necessary for healthy animal communities



## Nectar chemistry mediates the behavior of parasitized bees: consequences for plant fitness

LEIF L. RICHARDSON,<sup>1,3,5</sup> M. DEANE BOWERS,<sup>2</sup> AND REBECCA E. IRWIN<sup>1,4</sup>

<sup>1</sup>Department of Biological Sciences, Dartmouth College, Hanover, New Hampshire 03755, USA

<sup>2</sup>Ecology and Evolutionary Biology and Museum of Natural History, University of Colorado at Boulder, UCB 334, Boulder, Colorado 80309, USA

**Abstract.** Plants produce an array of secondary metabolites that play important ecological roles as anti-herbivore and anti-pathogen defenses. Many herbivores experience physiological costs when they consume secondary metabolites, yet some also benefit, for example when these chemicals confer resistance to parasites and predators. Secondary metabolites are often present in nectar and pollen, which is paradoxical given that floral rewards are important in the attraction of mutualists rather than deterrence of antagonists. Motivated by studies of interactions among plants, herbivores, and parasites, as well as research showing that secondary metabolites can reduce bee disease, we characterized the occurrence of two iridoid glycosides, aucubin and catalpol, in floral rewards and other tissues of the bee pollinated plant, *Chelone glabra*. We then experimentally investigated effects of nectar iridoid glycoside concentrations on the foraging behavior of bumble bee pollinators naturally afflicted by a parasitoid fly and a protozoan intestinal parasite, and subsequent effects on an estimate of plant reproduction. We found that floral nectar had lower iridoid glycoside concentrations than leaves, pollen, and corollas, and that, compared to those plant parts, the relative ratio of the two primary iridoid glycosides, aucubin and catalpol, was reversed in nectar. Whether bees carried parasitoid fly larvae did not affect their response to nectar chemistry; however, there was a significant interaction between protozoan parasite infection and nectar treatment, with infected bees foraging longer at flowers with high compared to low nectar iridoid glycoside concentrations. Parasitized bees were also more likely to return to inflorescences with high iridoid glycoside nectar. Consequently, flowers in the high iridoid glycoside nectar treatment donated significantly more pollen to conspecific stigmas than did flowers in the low iridoid glycoside treatment, suggesting an increase in male plant fitness. Taken together, these results demonstrate that nectar secondary metabolites can mediate the behavior of pollinators with subsequent benefits for estimates of plant reproduction.

**Key words:** bees; iridoid glycosides; multispecies interactions; parasitism; parasitoids; pollination; secondary metabolites.

*Ecology*, 97(2), 2016, pp. 325–337

- "The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer."