

# Evaluation of Ecological Site Classes and Community Classes for Regional Scale Modeling of Conservation Effects on Grazing Lands: MLRA 53B

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Report date: June 25, 2018

## INTRODUCTION

The Grazing Land Component of the Conservation Effects Assessment Project (CEAP-GL) is evaluating the development and use of Ecological Site Classes and Community Classes within Major Land Resource Areas for regional and national scale modeling of conservation effects. National Resources Inventory (NRI) data is correlated to proposed Ecological Site Classes to provide data for the Agricultural Policy/Environmental eXtender (APEX) model and other models. The Rangeland Hydrology and Erosion Model (RHEM) is used to assess runoff and erosion differences between Community Classes.

## CLASSIFICATION HIERARCHY AND DEFINITIONS

### Ecological Site Class

Ecological Site Classes are proposed subdivisions of a Major Land Resource Area (MLRA) or Land Resource Unit (LRU). They are similar in concept to a general soil survey map unit – a general grouping of ecological sites by major landforms and vegetation types. An Ecological Site Class differs from other kinds of land in the kinds and amounts of vegetation produced, in the responses to disturbances, in recovery mechanisms, and management responses.

### Plant Functional Groups

The Plant Functional/Structural Group indicator is defined in [Interpreting Indicators of Rangeland Health](#) (version 4) as, “A suite or group of species that because of similar shoot or root structure, photosynthetic pathways, nitrogen fixing ability, life cycle, etc., are grouped together on an ecological site basis.”

The presence, dominance and relative proportions of plant functional groups affect soil, hydrologic and biotic variables including:

- the kinds and amounts of canopy and foliar cover
- amount and arrangement of bare ground and litter cover
- plant spacing and amount of basal cover
- runoff and erosion rates
- structure and arrangement of vegetation which then influences the potential to carry fire and regulate fire intensity
- grazing preferences and distribution
- wildlife habitat values

The change in presence, dominance and/or proportion of plant functional groups is the primary attribute used to characterize States and Community Phases within an Ecological Site Description. Standardized plant functional

groups were developed based on growth forms and flowering period. All plant species found in the MLRA were assigned to a plant functional groups. Non-native species were assigned to functional groups designated with (I) - for introduced. Production by functional group was then calculated for each NRI Primary Sampling Unit (PSU) community in the MLRA. Refer to [Appendix E](#) for a list of common species and their assigned functional groups used for this project.

## Community Class

A Community Class is a proposed plant community classification for an ecological site class. The name of the Community Class is derived using the seven (7) dominant plant functional groups, listed in descending order by annual aboveground production on a dry weight basis. A Community Class is differentiated from other Community Classes by the presence and relative dominance of plant functional groups, and/or by significant differences in annual production.

## Plant Community

An actual plant community found at a given location, at a point in time.

## MAJOR LAND RESOURCE AREA 53B – CENTRAL DARK BROWN GLACIATED PLAINS

Major Land Resource Area 53B occurs in central North Dakota and South Dakota. This area is part of the Northern Great Plains Spring Wheat Region - Land Resource Region (LRR F). MLRA 53B is just over 12.5 million acres in size (50,900 square kilometers). The area is mostly glaciated portions of the Missouri Plateau. The MLRA is characterized by rolling plains, moraines, and glacial lakes. The Missouri River is on the western side of the MLRA. Elevations range from 1640 feet (500 meters) above mean sea level in the southeast portion to 1970 feet (600 meters) in the northwest portion.

This Major Land Resource Area is dominated by grassland vegetation. Important perennial grasses include western wheatgrass, needleandthread, big bluestem, sideoats grama, green needlegrass and little bluestem. Common native shrubs include prairie rose and western snowberry. Refer to Appendix E for scientific plant names and additional plant classification data used throughout the report.

Important wildlife includes pronghorn antelope, white-tailed deer, ring-necked pheasant, ducks, geese, sharp-tailed grouse, coyotes, and red fox. The Dakota skipper (*Hesperia dacotae*), monarch butterfly (*Danaus plexippus*), native bees, and Regal Fritillary (*Speyeria idalia*) are species of concern.

## Climate

The following climate information is excerpted from the Loamy Upland Ecological Site Description and characterizes the climate in MLRA 53B.

“MLRA 53B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic. The climate is the result of this MLRA’s location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature. Annual precipitation ranges



**Figure 1.** LRR F and MLRA 53B map. Source: Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296 (2006).

from 15 to 20 inches per year. The normal average annual temperature is about 41° F. January is the coldest month with average temperatures ranging from about 4° F (Powers Lake, ND) to about 10° F (Pollock, SD). July is the warmest month with temperatures averaging from about 67° F (Powers Lake, ND) to about 72° F (Pollock, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 62° F. This large annual range attests to the continental nature of this MLRA's climate. Winds average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour. Growth of native cool-season plants begins in late March and continues to early to mid-July. Native warm-season plants begin growth in mid-May and continue to the end of August. Green up of cool-season plants can occur in September and October when adequate soil moisture is present.”

## Averages

Frost-free period (days):	122
Freeze-free period (days):	142
Mean annual precipitation (inches):	20.0

**Table 1. Monthly Precipitation (Inches)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>High</b>	0.48	0.57	1.09	2.01	2.92	3.80	2.84	2.17	1.67	1.30	0.74	0.43
<b>Medium</b>	0.44	0.49	0.83	1.66	2.45	3.48	2.61	2.00	1.52	0.96	0.55	0.49
<b>Low</b>	0.41	0.41	0.57	1.31	1.98	3.17	2.38	1.82	1.37	0.62	0.53	0.43

**Table 2. Monthly Temperature (°F)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>High</b>	21.5	28.9	39.7	57.4	70.8	79.3	86.2	85.6	74.2	61.2	41.2	27.2
<b>Low</b>	0.00	0.70	12.0	27.0	38.6	48.4	52.9	50.8	39.9	28.3	13.7	0.30

The soil temperature regime is frigid and the soil moisture regime is ustic.

## Representative Climate Stations

- (1) ND3376, Garrison 1 NNW. Period of record 1948-2001
- (2) ND320819, Bismarck WB Airport. Period of record 1936 – Present\*
- (3) SD6712 Pollock Period of Record 1948-2001

\*This climate station was used for the Rangeland Hydrology and Erosion Model (RHEM) evaluations.

## AGRICULTURAL OPERATIONS

Cropland covers about 56 percent of the acres in this MLRA, while rangelands cover about 37 percent. The kind and size of livestock operations are variable, but a typical livestock operation is a cow-calf operation, about 2500-4500 acres in size, with about 200 mother cows. Stocking rates average 0.8-0.9 AUMs/Ac. Calves are born from January through March or early April. Most calves are born in the barns, or in lots later in the spring. Cattle graze on rangelands starting in mid-April to mid-May and typically come off from the end of October into November. If the operation includes cropland, livestock typically graze on crop residues in September prior to going to the lot and barn. Some operations are grazing cover crops – turnips, radishes and 4-5 other crops. Calves are usually kept

about a month after weaning, and shipped in mid- to late-October. During the winter, cattle are fed grass or wheat hay with alfalfa or protein supplement, and/or straight alfalfa hay.

Crops grown in this MLRA are mostly small grains (wheat, barley) planted in mid- to late-May and harvested from the end of July through August. Corn and alfalfa are common crops, and intermediate wheatgrass is grown for grass hay. Canola is grown in the northern portion of the MLRA. Potatoes and specialty crops are grown in some areas. Irrigation is used along the Missouri River.

## RESOURCE MANAGEMENT SYSTEMS

### Conservation Practices Applied

Table 3 shows the kinds and amounts of conservation practices that the landowners in MLRA 53B are investing in on grazing lands. The table shows the most common conservation practices applied with NRCS assistance on grazed rangeland during fiscal years 2006-2011.

**Table 3.** Common conservation practices applied on grazed rangeland in MLRA 53B from 2006-2011 (NRCS).

Practice Code	Practice Name (Units)	Practice Count	Amount Applied	Acres Benefitted
528	Prescribed Grazing (ac)	3,735	862,619	864,432
614	Watering Facility (no)	1,673	5,087	849,499
516	Pipeline (ft)	1,278	4,273,807	567,324
382	Fence (ft)	816	2,614,494	381,581
642	Water Well (no)	291	291	115,178
645	Upland Wildlife Habitat Management (ac)	291	49,339	51,227
533	Pumping Plant (no)	212	211	108,507
561	Heavy Use Area Protection (ac)	177	2,442	71,331
380	Windbreak/Shelterbelt Establishment (ft)	91	259,949	19,326
550	Range Planting (ac)	79	3,475	6,849
378	Pond (no)	67	67	25,817
472	Access Control (ac)	48	2,651	6,059
595	Integrated Pest Management (IPM) (ac)	45	6,752	26,426
351	Water Well Decommissioning (no)	29	29	7,082
574	Spring Development (no)	22	22	6,033
512	Forage and Biomass Planting (ac)	17	784	1,874
484	Mulching (ac)	14	3,811	3,339
500	Obstruction Removal (ac)	14	349	2,445

### Prescribed Grazing

Prescribed grazing is the most common conservation practice applied to address resource concerns on rangelands in this MLRA. A typical operation has 4-6 pastures that are each grazed once or twice during the growing season. Prescribed grazing focuses primarily on maintaining proper stocking rates and encouraging producers to change the season of use each year to maintain plant community production and diversity. The critical period for cool season species is the first two weeks of June. The critical season for warm season species is the first couple weeks of July. If grazing is regularly delayed until June 1, cool season non-native species such as Kentucky bluegrass and smooth brome will increase.

## **Watering Facilities**

Livestock water is provided mostly by dugouts and ponds. Wells and pipelines are becoming more common because of blue green algae issues in ponds. Wells average 150 to 200 feet in depth.

## **Brush Management**

This practice is rarely applied in this MLRA. Encroachment of woody species is not a significant resource concern.

## **Range Planting**

Range planting is not common in this MLRA. There is typically a sufficient seed source for the desirable species to become re-established with good grazing management.

## **Prescribed Burning**

Prescribed Burning is not commonly used in this MLRA, but it plays an important role the ecology of the prairie grasslands. Fire stimulates grass growth and promotes a greater diversity of forb species which benefits wildlife. The US Fish and Wildlife Service is using fire to help control Kentucky bluegrass and smooth brome on their refuges. The natural fire return interval is thought to be about 3 to 5 years.

## **Fencing**

Standard barbed wire fencing using 3-4 wires is the typical fencing used for livestock control. More 2-wire electric fence is being installed in the last few years.

## **Herbaceous Weed Control**

This practice is being used to control noxious weeds such as leafy spurge, wormwood, and Canada thistle. Biological control of leafy spurge with flea beetles or moths is successful. Leafy spurge is also controlled using 2,4-D, picloram and imazapic. Wormwood is controlled with imazapic and aminopyralid. Aminopyralid is used on Canada thistle as well. Ground spraying using trucks is the most common application method.

## **Upland Wildlife Habitat Management**

Most conservation plans manage grazing to benefit wildlife. Some operations diversify income with fee hunting for pheasant, whitetail deer and waterfowl.

## ECOLOGICAL SITE CLASSES AND COMMUNITY CLASSES

As of January 2017, there were 20 ecological sites correlated to soil map unit components in MLRA 53B. Those have been grouped into seven (7) ecological site classes using the expertise of the state and local NRCS soil and rangeland management scientists in MLRA 53B. The groupings are based on landscape position, soil characteristics, plant community composition, plant production and the response to climate, disturbance, use, and management. The ecological site names and numbers shown below are shared among the states (ND, SD, MT), with development of ecological site concepts, descriptions, and soil correlation occurring in partnership among those states.

### ECOLOGICAL SITE CLASSES FOR MAJOR LAND RESOURCE AREA 53B

#### Claypan Upland Ecological Site Class

- Claypan R053BY002ND
- Sandy Claypan R053BY026ND
- Thin Claypan R053BY013ND

#### Loamy Upland Ecological Site Class

- Clayey R053BY001ND
- Loamy R053BY011ND
- Loamy Overflow R053BY005ND

#### Saline Bottomland Ecological Site Class

- Closed Depression R053BY003ND
- Saline Lowland R053BY006ND

#### Sandy Upland Ecological Site Class

- Sandy R053BY008ND
- Sands R053BY007ND

#### Shallow Upland Ecological Site Class

- Thin Loamy R053BY015ND
- Shallow Loamy R053BY009ND
- Shallow Gravel R053BY010ND
- Thin Sands R053BY014ND
- Very Shallow R053BY017ND

#### Subirrigated Bottomland Ecological Site Class

- Limy Subirrigated R053BY004ND
- Subirrigated R053BY012ND

#### Wet Bottomland Ecological Site Class

- Linear Meadow R035BY018ND
- Wet Meadow R053BY019ND
- Shallow Marsh R053BY025ND

Each NRI Primary Sampling Unit (PSU) in the MLRA was correlated to a Community Class where possible. PSU data were not used when the species present or vegetation production was questionable. Soil erosion and runoff estimates were not performed by RHEM if the PSU indicated that the soil was not representative.

Community Classes that are not currently represented in the ecological site descriptions were added when present in the NRI data. These most commonly were non-native dominated communities. Community Class names are derived using the top seven (7) plant functional groups, listed in descending order of annual aboveground air-dry production. The production for the plant functional groups is calculated from the NRI PSUs that are correlated to the Community Class. Ecological site plant community production by functional group was used when NRI data was not available. Refer to [Appendix E](#) for plant taxonomy.

All species and plant community production values are shown as pounds per acre (lbs/ac) in the following ecological site class descriptions and refers to annual aboveground air-dried production.

The following sections describe the seven ecological site classes in MLRA 53B.

## CLAYPAN UPLAND ECOLOGICAL SITE CLASS

### General Description

The Claypan Upland ecological site class occurs on level to gently undulating to rolling residual uplands. They have moderately coarse to moderately fine textured surface layers underlain by a sodic subsoil. The subsoils are moderately fine to fine textured and are high in sodium. These dense sodic subsoils restrict root growth.

### Geomorphic Features

Landscape Positions: Till Plain, Lake Plain, Swale, Terrace, Outwash Plain, Delta Plain  
Slope (percent): 0 – 9

### Representative Soil Features

Soil Depth: Moderately Deep to Deep  
Parent Material Kind: Alluvium, Residuum  
Parent Material Origin: Mixed  
Surface Texture: Loam, Silty Clay Loam, Fine Sandy Loam  
Surface Texture Modifier: None  
Subsurface Texture Group: Loamy to Clayey  
Drainage Class: Moderately Well to Well  
Permeability Class: Very Slow to Moderate  
Chemistry: Moderate to Highly Sodic  
Available Water Capacity: 1 – 5 inches

### Vegetation Dynamics

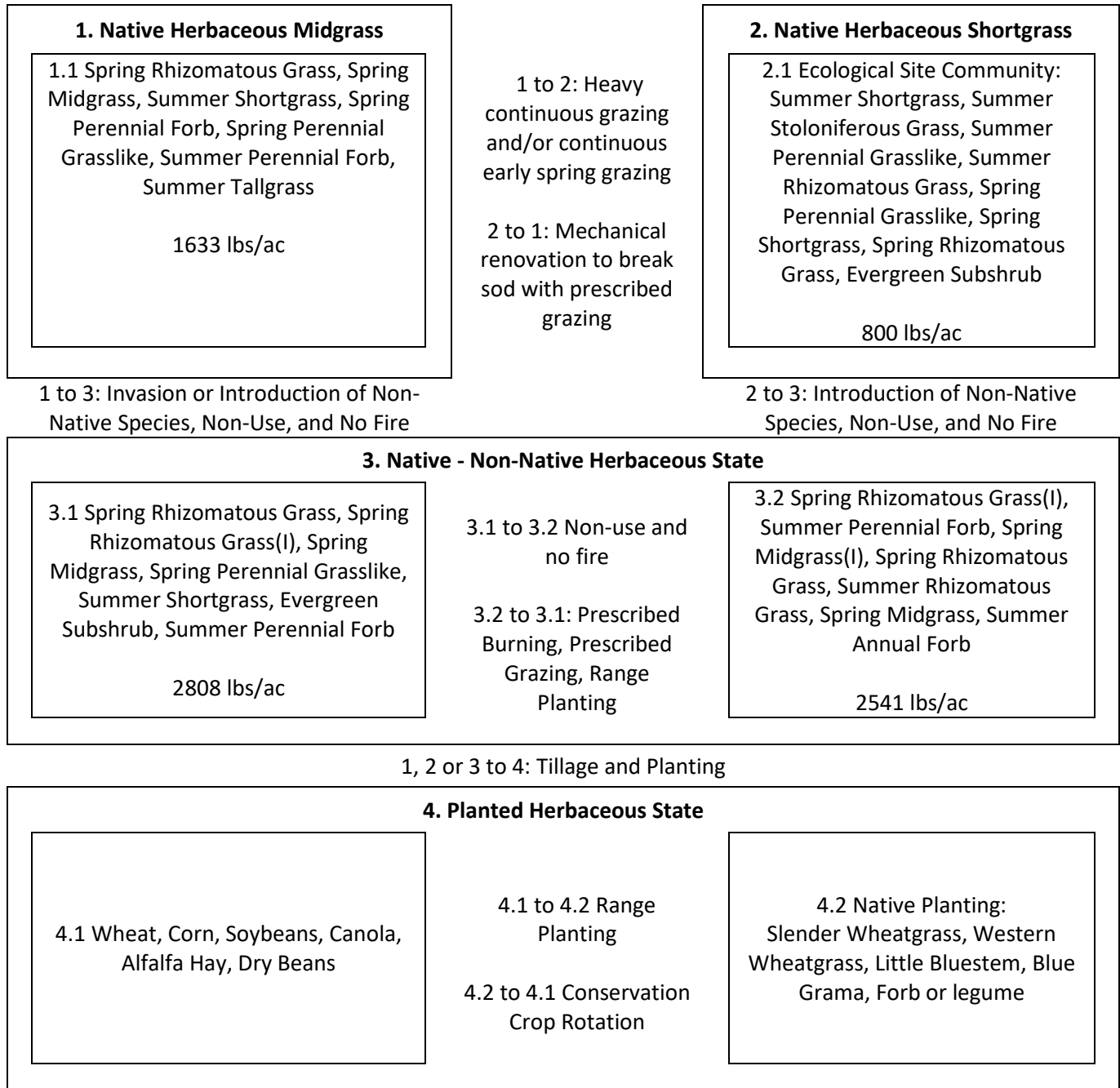
Community Class 1.1 in the State and Transition Model (Figure 2) was derived from the reference communities in the ecological site descriptions correlated to this ecological site class. The reference community for this ecological site class has an annual production of about 1633 lbs/ac/yr dominated by western wheatgrass, blue grama, needleandthread, green needlegrass, slender wheatgrass, prairie sandreed, threadleaf sedge, and needleleaf sedge. With heavy continuous grazing the site is likely to transition to a shortgrass community dominated by blue grama and buffalograss. Mechanical renovation and long term prescribed grazing may return the site to the reference state.

With invasion or introduction of non-native species such as Kentucky bluegrass, the site will transition to a Native - Non-Native Herbaceous State. Community 3.1 is dominated by native species. With the introduction of non-native species, non-use and no-fire, the native dominated community (3.1) will transition to a non-native dominated community (3.2). With long term prescribed grazing and regular natural or prescribed burning, the site may return to the native dominated community class 2.1. The site will not transition from the Native -- Non-Native Herbaceous State back to the Native Herbaceous State.

Plowing and tillage convert the site to a Planted Herbaceous State. Cropping and harvesting of annual and perennial crops maintain a Cropland community class (Community Class 4.1). When seeded to native perennial grasses, the site transitions to a Native Planted community class (Community Class 4.2). Native planting species shown are those recommended for the Conservation Reserve Program (CRP).



## State and Transition Model



**Figure 2.** State and Transition Model, MLRA 53B Claypan Upland ecological site class.

NRI Primary Sampling Units (PSUs) were correlated to these community classes where possible. Community class production, functional group dominance, and dominant species based on available NRI data are shown in Table 4. Ground and canopy cover from the NRI PSUs was used to estimate average annual erosion and percent runoff using the Rangeland Hydrology and Erosion Model (RHEM). No data for runoff and erosion are shown where NRI data indicates that the ecological site description does not match the soil at the PSU.

**Table 4.** NRI Community Class Data and RHEM Results - MLRA 53B Claypan Upland ecological site class.

Comm Class ID	Community Class (Lbs/Ac)	Dominant Species (Symbol)(Lbs/Ac)	Production Lbs/Ac	Soil Loss T/Ac/Yr	% Runoff	# PSUs
053B.27.3.1	Spring Rhizomatous Grass(1420), Spring Rhizomatous Grass(l)(509), Spring Midgrass(324), Spring Perennial Grasslike(155), Summer Shortgrass(151), Evergreen Subshrub(130), Summer Perennial Forb(33)	western wheatgrass(PASM)(1420), Kentucky bluegrass(POPR)(380), prairie Junegrass(KOMA)(199), inland rush(JUIN2)(155), blue grama(BOGR2)(151), prairie sagewort(ARFR4)(130), Canada bluegrass(POCO)(129), green needlegrass(NAVI4)(125)	2808			1
053B.27.3.2	Spring Rhizomatous Grass(l)(1819), Summer Perennial Forb(200), Spring Midgrass(l)(154), Spring Rhizomatous Grass(95), Spring Midgrass(58), Summer Rhizomatous Grass(52), Summer Annual Forb(41)	Kentucky bluegrass(POPR)(1405), quackgrass(ELRE4)(218), smooth brome(BRIN2)(196), crested wheatgrass(AGCR)(154), white heath aster(SYER)(145), western wheatgrass(PASM)(95), inland saltgrass(DISP)(52), curlycup gumweed(GRSQ)(41)	2541	0.09	4.24%	5

### Supporting Information

The following publication supports the STM. Although this study is specifically examining monitoring methods, the vegetation which is sampled matches the description the STM provides for this MLRA.

**Prosser, C.W., K.M. Skinner, K.K. Sedivec. 2003. Comparison of 2 techniques for monitoring vegetation on military lands. Journal of Range Management 56(5): 446-454.**

The objective of this study was to compare the U.S. Army Land Coalition-Trend Analysis (LCTA) monitoring technique with quadrat sampling to describe species richness and percent composition of vegetation on an installation in east-central North Dakota. The vegetation in this area is part of a transitional grassland, meaning that it is a combination of mixed-grass and tallgrass prairie of wheatgrass-bluestem-needlegrass characteristics.

The LCTA vegetation surveys consist of 3 main components: line point transect aerial cover surveys, line point transect ground cover surveys, and belt transect surveys. Forty-five, 100m transects were randomly located on the prairie and 100 points were sampled along each transect. Quadrats were also sampled every 5 meters along the 100m transect.

In determining results, *Carex*, *Stipa*, *Artemisia frigida*, *Helianthus rigidus*, and *Bouteloua gracilis* were selected as dominant species and representative of the communities. The results found that quadrat sampling determined significantly higher values for species richness, than the LCTA program. Percent composition of sedges was greater when sampling with quadrats than the LCTA in most transects. However, the LCTA found higher species composition of *Stipa* and *Poa pratensis*. Percent composition of blue grama was greater when measured in quadrats than with LCTA. The LCTA method detected shrubs more often than quadrats, but failed to detect sizable portions of forbs. Ultimately, the raw data revealed strengths and weaknesses of both sampling methods.

## LOAMY UPLAND ECOLOGICAL SITE CLASS

### General Description

The Loamy Upland ecological site class occurs on gently undulating, rolling to hilly, or nearly level uplands. This site class also includes terraces that may occasionally receive additional water from overland flow of intermittent streams or runoff from adjacent slopes.

### Geomorphic Features

Landscape Positions: Till Plain, Lake Plain, Flat, Terrace, Swale  
Slope (percent): 1 – 20

### Representative Soil Features

Soil Depth: Moderately Deep to Deep  
Parent Material Kind: Alluvium  
Parent Material Origin: Mixed  
Surface Texture: Loam, Silt Loam, Silty Clay Loam  
Surface Texture Modifier: None  
Subsurface Texture Group: Loamy to Clayey  
Drainage Class: Moderately Well to Well  
Permeability Class: Very Slow to Moderately Rapid  
Chemistry: None  
Available Water Capacity: 5 – 9 inches

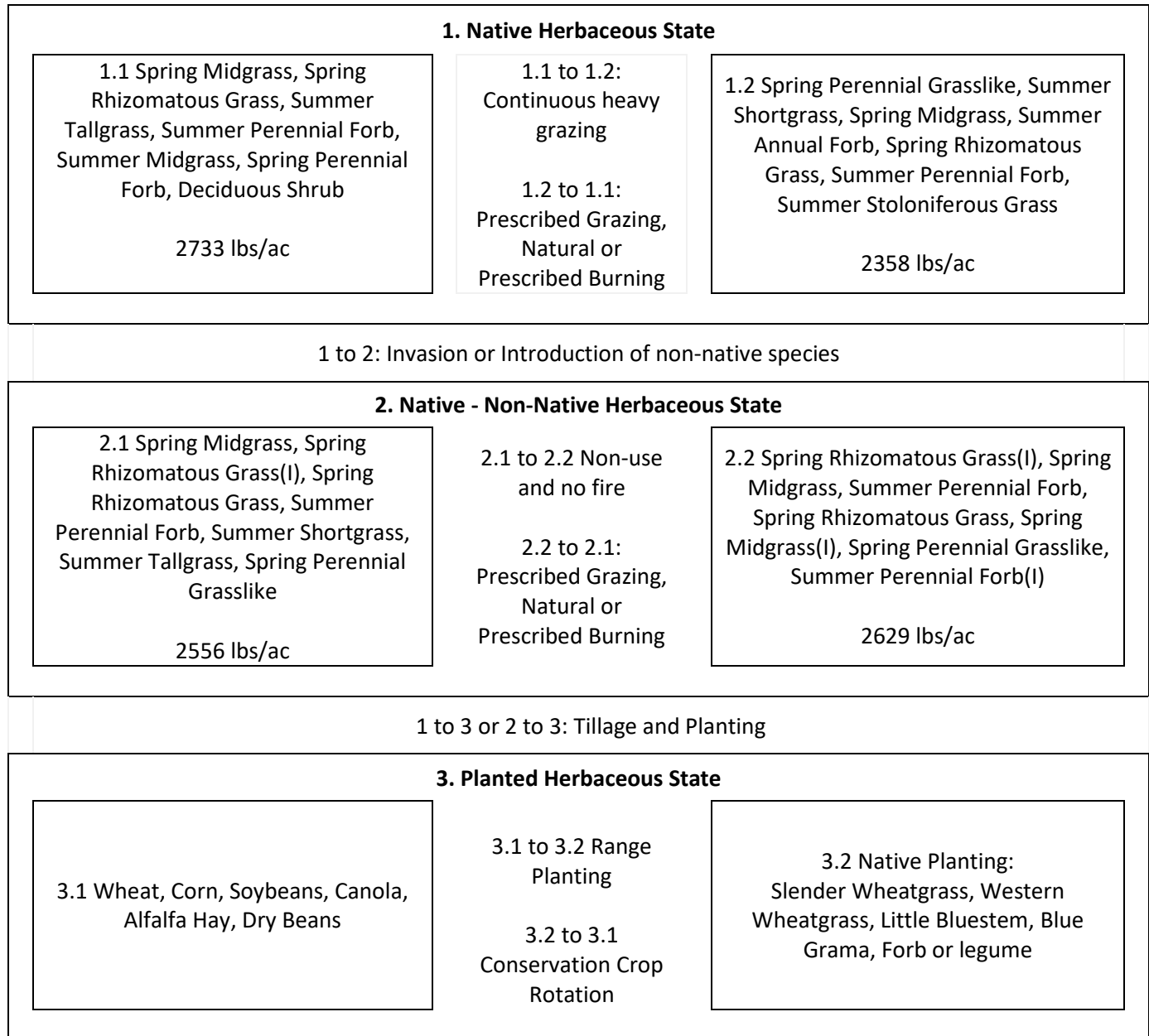
### Vegetation Dynamics

Community 1.1 in the State and Transition Model (Figure 3) was derived from the reference communities in the ecological site descriptions correlated to this ecological site class. This community produces approximately 2733 lbs/ac/yr., dominated by western wheatgrass, big bluestem, green needlegrass, porcupinegrass, blue grama, slender wheatgrass, needleandthread, and sideoats grama. With heavy continuous grazing and/or continuous spring grazing, the site is likely to transition to a shortgrass dominated community class (1.2) with an average production of about 2358 lbs/ac. The shortgrass community class is dominated by sedge, and blue grama. This community may return to reference with long term prescribed grazing and a regular interval of natural fire or prescribed burning.

With the introduction of non-native species, non-use, and no fire, the site will transition to a Native -- Non-Native Herbaceous state with some production coming from non-natives such as smooth brome, and Kentucky bluegrass. With non-use and no-fire, the native dominated community (2.1) in this state will transition to a non-native dominated community (2.2). With long term prescribed grazing and a regular interval of natural or prescribed burning, the site may return to the native dominated community class.

Plowing and tillage convert the site to a Planted Herbaceous state. Cropping and harvesting of annual and perennial crops maintain a cropland community class (Community Class 3.1). When seeded to native perennial grasses, the site transitions to a native planted community class (3.2). Native planting species shown are those recommended for the Conservation Reserve Program (CRP).

## State and Transition Model



**Figure 3.** State and Transition Model, MLRA 53B Loamy Upland ecological site class.

NRI Primary Sampling Units (PSUs) were correlated to these community classes where possible. Community class production, functional group dominance, and dominant species based on available NRI data are shown in Table 5. For RHEM modeling purposes, PSUs that include a minor presence of non-native species were correlated to the reference state communities to help characterize runoff and erosion. Ground and canopy cover from the NRI PSUs was used to estimate average annual erosion and percent runoff using the Rangeland Hydrology and Erosion Model (RHEM).

**Table 5.** NRI Community Class Data and RHEM Results - MLRA 53B Loamy Upland ecological site class.

Comm Class ID	Community Class (Lbs/Ac)	Dominant Species (Symbol)(Lbs/Ac)	Production Lbs/Ac	Soil Loss T/Ac/Yr	% Runoff	# PSUs
053B.6.1.1	Spring Midgrass(1016), Spring Rhizomatous Grass(302), Summer Perennial Forb(215), Summer Shortgrass(181), Spring Perennial Grasslike(137), Spring Rhizomatous Grass(I)(70), Spring Perennial Forb(23)	slender wheatgrass(ELTR7)(715), western wheatgrass(PASM)(302), blue grama(BOGR2)(181), green needlegrass(NAVI4)(148), prairie Junegrass(KOMA)(89), sedge(CAREX)(77), Kentucky bluegrass(POPR)(70), western ragweed(AMPS)(62)	2007	0.07	2.72%	4
053B.6.1.2	Spring Perennial Grasslike(853), Summer Shortgrass(403), Spring Midgrass(222), Summer Annual Forb(209), Spring Rhizomatous Grass(204), Summer Perennial Forb(190), Summer Stoloniferous Grass(131)	sedge(CAREX)(762), blue grama(BOGR2)(377), western wheatgrass(PASM)(204), American bird's-foot trefoil(LOUN)(189), prairie Junegrass(KOMA)(133), Buffalograss(BODA2)(131), white sagebrush(ARLUL2)(109), purple threeawn(ARPU9)(82)	2358	0.21	5.54%	6
053B.6.2.1	Spring Midgrass(701), Spring Rhizomatous Grass(I)(594), Spring Rhizomatous Grass(321), Summer Perennial Forb(265), Summer Shortgrass(180), Summer Tallgrass(142), Spring Perennial Grasslike(114)	Kentucky bluegrass(POPR)(467), western wheatgrass(PASM)(320), needleandthread(HECO26)(312), green needlegrass(NAVI4)(241), blue grama(BOGR2)(160), smooth brome(BRIN2)(122), big bluestem(ANGE)(112), porcupinegrass(HESP11)(74)	2556	0.12	3.71%	29
053B.6.2.2	Spring Rhizomatous Grass(I)(1501), Spring Midgrass(260), Summer Perennial Forb(231), Spring Rhizomatous Grass(133), Spring Midgrass(I)(106), Spring Perennial Grasslike(77), Summer Perennial Forb(I)(75)	Kentucky bluegrass(POPR)(1105), smooth brome(BRIN2)(372), green needlegrass(NAVI4)(152), western wheatgrass(PASM)(133), crested wheatgrass(AGCR)(92), needleandthread(HECO26)(76), blue grama(BOGR2)(45), sweetclover(MEOF)(41)	2629	0.11	3.47%	143

### Supporting Information

No literature was found that dealt with this ecological site class.

## SALINE BOTTOMLAND ECOLOGICAL SITE CLASS

### General Description

The Saline Bottomland ecological site class occurs in the lowest portion of the landscape on level shallow lake basins, flat enclosed upland depressions and along floodplains. It may be a closed depression or open to further drainage. Flooding and ponding is common, and there may be a seasonal water table providing water for plant growth. Salinity and sodic conditions limit plant growth and response to management actions.

### Geomorphic Features

Landscape Positions: Depression, Till Plain, Lake Plain, Flood Plain  
Slope (percent): 0 - 3

### Representative Soil Features

Soil Depth: Moderately Deep to Deep  
Parent Material Kind: Alluvium  
Parent Material Origin: Mixed  
Surface Texture: Loam, Silt Loam, Silty Clay Loam  
Surface Texture Modifier: None  
Subsurface Texture Group: Clayey to Loamy  
Drainage Class: Poorly to Moderately Well Drained  
Permeability Class: Very Slow to Moderate  
Chemistry: Moderately Saline to Saline  
Available Water Capacity: 3 - 5 inches

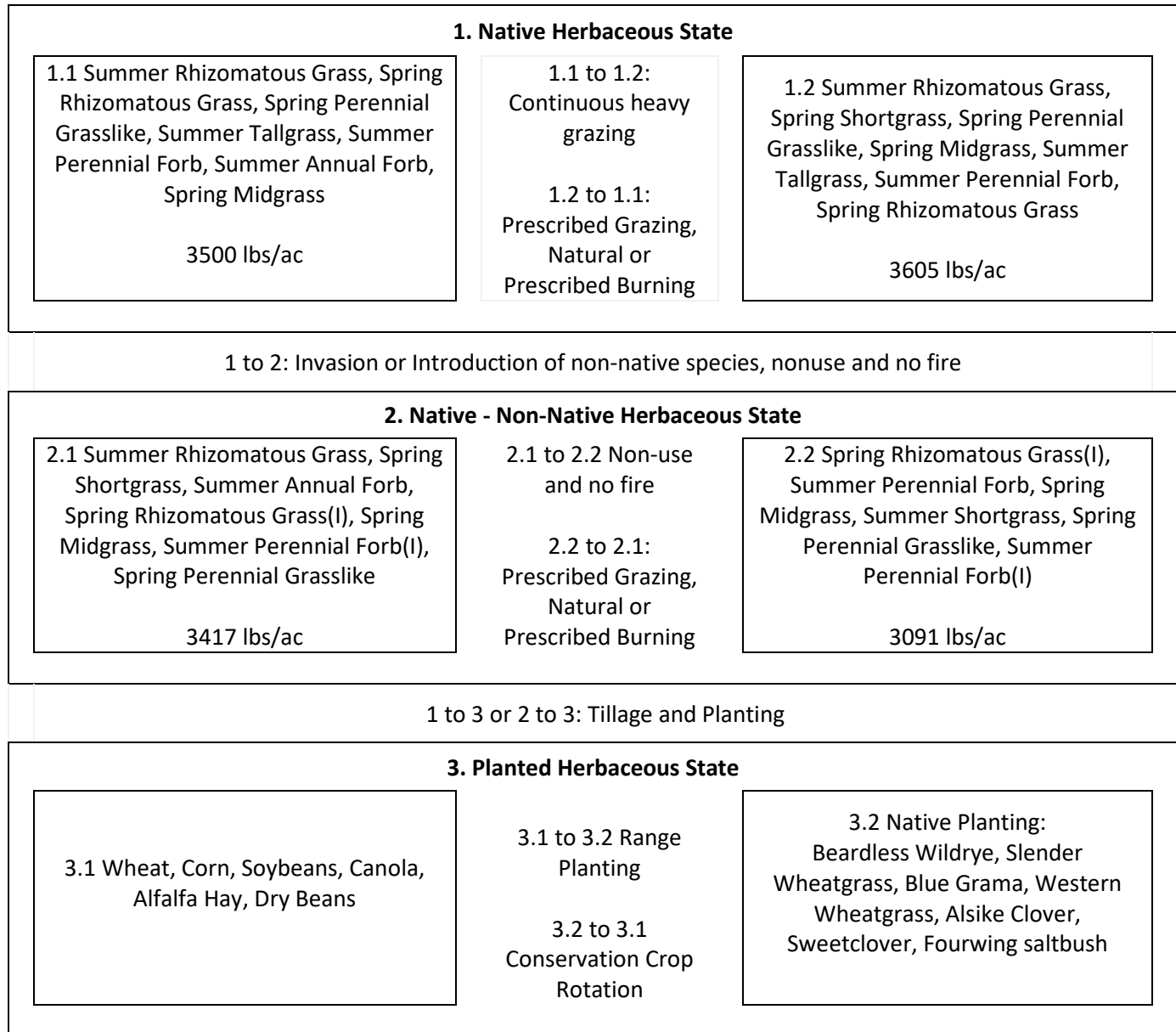
### Vegetation Dynamics

Community Class 1.1 in the State and Transition Model (Community 1.1, Figure 4) was derived from the reference communities in the ecological site descriptions correlated to this ecological site class. This community has an average annual production of 3500 lbs/ac/yr. dominated by western wheatgrass, Nuttall's alkaligrass, prairie cordgrass, alkali cordgrass, inland saltgrass, sedge, and Pursh seepweed. With heavy continuous grazing and/or continuous spring grazing, the site is likely to transition to a community with less production from western wheatgrass, and increased production from foxtail barley, Nuttall's alkaligrass, and inland saltgrass. This community may return to reference with long term prescribed grazing and a normal return interval of natural or prescribed burning.

With the introduction of non-native species, non-use, and no fire, the state will transition to a Native -- Non-Native Herbaceous State. From this state, the site will not transition back to the native herbaceous state. The native dominated community (2.1) will be similar to the reference community but will include non-natives such as Kentucky bluegrass and smooth brome. With continued non-use and no fire, the site will become dominated by non-natives such as Kentucky bluegrass (2.2). With long term prescribed grazing and natural or prescribed burning, the site may return to the native dominated community class (2.1).

Plowing and tillage convert the reference state to a "Planted Herbaceous" state. Cropping and harvesting of annual and perennial crops maintain a cropland community class (Community Class 3.1). When seeded to native perennial grasses, the site transitions to a native planted community class (Community Class 3.2). Native planting species shown are those recommended for the Conservation Reserve Program (CRP).

## State and Transition Model



**Figure 4.** State and Transition Model, MLRA 53B Saline Bottomland ecological site class.

NRI Primary Sampling Units (PSUs) were correlated to these community classes where possible. Community class production, functional group dominance, and dominant species based on available NRI data are shown in Table 6. Ground and canopy cover from the NRI PSUs was used to estimate average annual erosion and percent runoff using the Rangeland Hydrology and Erosion Model (RHEM).

**Table 6.** NRI Community Class Data and RHEM Results - MLRA 53B Saline Bottomland ecological site class.

Comm Class ID	Community Class (Lbs/Ac)	Dominant Species (Symbol)(Lbs/Ac)	Production Lbs/Ac	Soil Loss T/Ac/Yr	% Runoff	# PSUs
053B.35.1.1	Spring Rhizomatous Grass(412), Spring Midgrass(101), Spring Perennial Forb(80), Summer Shortgrass(22), Spring Perennial Grasslike(12), Spring Rhizomatous Grass(l)(11)	western wheatgrass(PASM)(412), fowl bluegrass(POPA2)(101), broadleaf cattail(TYLA)(52), common yarrow(ACMI2)(28), blue grama(BOGR2)(22), (RUMEX)(12), sedge(CAREX)(11), foxtail barley(HOJU)(11)	661	0.12	4.88%	2
053B.35.1.2	Summer Rhizomatous Grass(1291), Spring Shortgrass(888), Spring Perennial Grasslike(513), Spring Midgrass(194), Summer Tallgrass(186), Summer Perennial Forb(113), Spring Rhizomatous Grass(98)	foxtail barley(HOJU)(888), Nuttall's alkaligrass(PUNU2)(658), inland saltgrass(DISP)(591), slender wheatgrass(ELTR7)(188), prairie cordgrass(SPPE)(186), clustered field sedge(CAPR5)(175), sedge(CAREX)(169), Baltic rush(JUURL)(108)	3605	0.04	4.06%	9
053B.35.2.1	Summer Rhizomatous Grass(737), Spring Shortgrass(516), Summer Annual Forb(345), Spring Rhizomatous Grass(l)(309), Spring Midgrass(292), Summer Perennial Forb(l)(265), Spring Perennial Grasslike(233)	foxtail barley(HOJU)(516), inland saltgrass(DISP)(486), Kentucky bluegrass(POPR)(254), Nuttall's alkaligrass(PUNU2)(251), silverscale saltbush(ATAR2)(185), shortawn foxtail(ALAE)(172), Canada thistle(CIAR4)(169), curly dock(RUCR)(157)	3417	0.03	2.96%	8
053B.35.2.2	Spring Rhizomatous Grass(l)(1835), Summer Perennial Forb(235), Spring Midgrass(200), Summer Shortgrass(133), Spring Perennial Grasslike(115), Summer Perennial Forb(l)(103)	Kentucky bluegrass(POPR)(736), quackgrass(ELRE4)(582), smooth brome(BRIN2)(389), Canada bluegrass(POCO)(126), blue grama(BOGR2)(125), needleandthread(HECO26)(103), white heath aster(SYER)(85)	3091	0.08	3.66%	9

### Supporting Information

No literature was found that dealt with this ecological site class.



## SANDY UPLAND ECOLOGICAL SITE CLASS

### General Description

The Sandy Upland ecological site class occurs on level to nearly level, gently rolling to strongly sloping sedimentary uplands and occasionally floodplains and terraces. These are typically areas of sand dunes or sand sheets. The soils in this site class are well to somewhat excessively drained and formed from soft sandstone, aeolian deposits or alluvium.

### Geomorphic Features

Landscape Positions: Dune, Till Plain, Outwash Plain, Stream Terrace  
Slope (percent): 0 – 45

### Representative Soil Features

Soil Depth: Moderately Deep to Deep  
Parent Material Kind: Alluvium, Eolian  
Parent Material Origin: Mixed  
Surface Texture: Fine Sandy Loam, Sandy Loam, Coarse Sandy Loam, Loamy Fine Sand, Loamy Sand  
Surface Texture Modifier: None  
Subsurface Texture Group: Sandy  
Drainage Class: Well to Excessively  
Permeability Class: Moderate to Very Rapid  
Chemistry: None  
Available Water Capacity: 4 – 7 inches

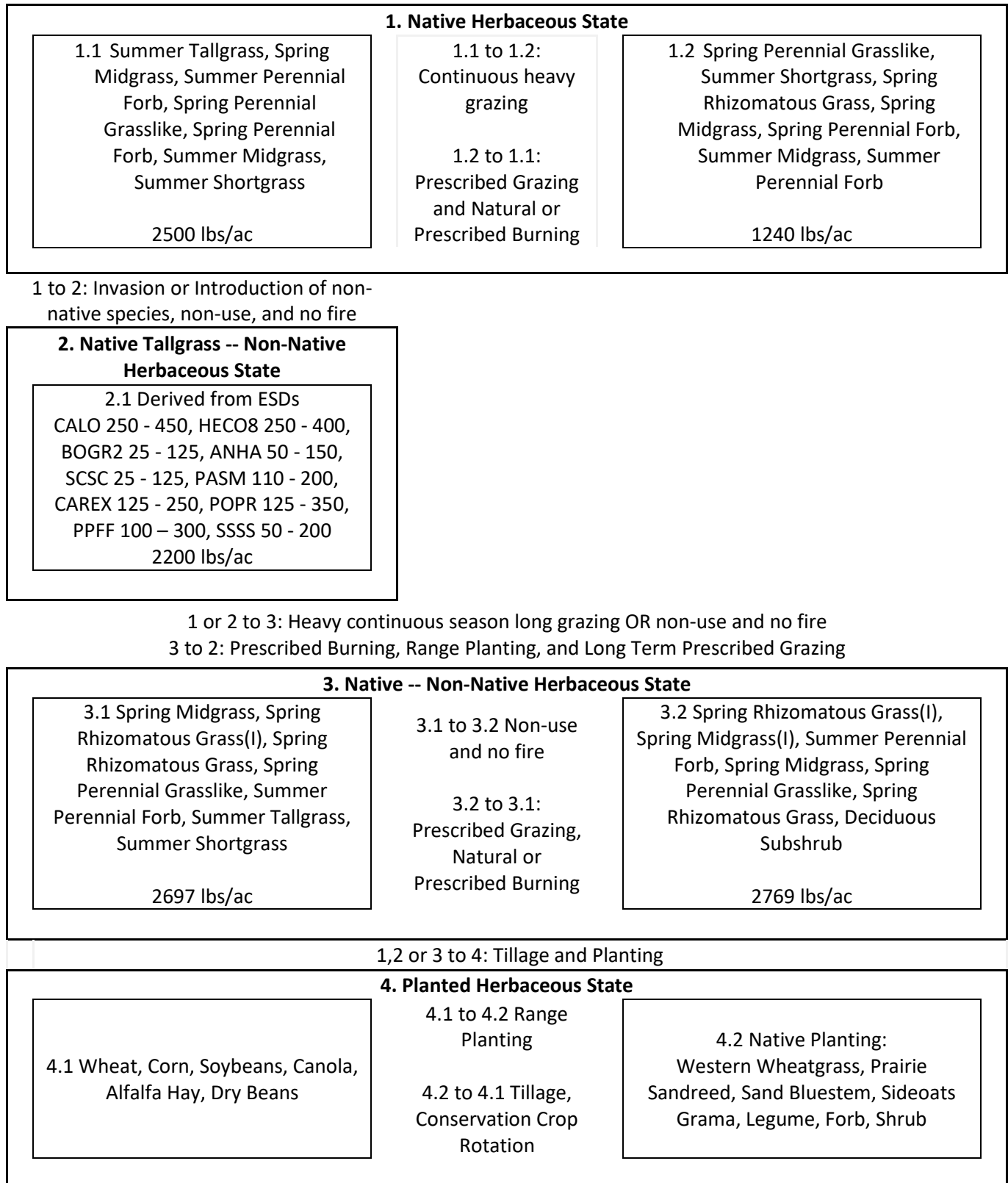
### Vegetation Dynamics

Community 1.1 in the State and Transition Model (Figure 5) was derived from the reference communities in the ecological site descriptions correlated to this ecological site class. This community has an average annual production of 2500 lbs/ac/yr., dominated by prairie sandreed, needleandthread, sand bluestem, blue grama, threadleaf sedge, western wheatgrass, little bluestem, and big bluestem. With continuous heavy grazing, the site is likely to transition to a grasslike and shortgrass dominated community with increases in sedges and blue grama. Long term Prescribed Grazing and the return of normal fire intervals may return the site to Community Class 1.1.

With the introduction of non-native species, non-use and no fire, the site will transition to a Native – Non-Native Herbaceous state. The ecological site description describes native tallgrass – non-native state (State 2) producing about 2200 lbs/ac/yr with some of the annual production coming from non-native species such as Kentucky bluegrass and smooth brome. Once invaded by non-native species, the site will not transition back to the Native Herbaceous State. With heavy continuous season long grazing, and the introduction of non-native species, the site will transition to a the Native – Non-Native Herbaceous State (State 3). Planting combined with prescribed grazing and fire may return the site to the tallgrass - non-native herbaceous state (State 2).

Plowing and tillage convert the reference state to a Planted Herbaceous state. Cropping and harvesting of annual and perennial crops maintain a cropland community class (Community Class 4.1). When seeded to native perennial grasses, the site transitions to a native planted community class (Community Class 4.2).

## State and Transition Model



**Figure 5.** State and Transition Model, MLRA 53B Sandy Upland ecological site class.

NRI Primary Sampling Units were correlated to these community classes where possible. Community class production, functional group dominance, and dominant species based on available NRI data are shown in Table 7. Cover from the NRI PSUs was used to estimate average annual erosion and percent runoff using RHEM.

**Table 7.** NRI Community Class Data and RHEM Results - MLRA 53B Sandy Upland ecological site class.

Comm Class ID	Community Class (Lbs/Ac)	Dominant Species (Symbol)(Lbs/Ac)	Production Lbs/Ac	Soil Loss T/Ac/Yr	% Runoff	# PSUs
053B.29.1.1	Spring Midgrass(1430), Summer Perennial Forb(644), Spring Perennial Grasslike(175), Summer Shortgrass(146), Spring Perennial Forb(118), Summer Annual Forb(I)(16), Evergreen Subshrub(14)	needleandthread(HECO26)(1057), prairie Junegrass(KOMA)(294), upright prairie coneflower(RACO3)(159), tarragon(ARDR4)(126), blue grama(BOGR2)(121), blue lettuce(LATA)(103), threadleaf sedge(CAFI)(96), blacksamson echinacea(ECAN2)(89)	2543			1
053B.29.1.2	Spring Perennial Grasslike(223), Summer Shortgrass(222), Spring Rhizomatous Grass(161), Spring Midgrass(147), Spring Perennial Forb(137), Summer Midgrass(121), Summer Perennial Forb(101)	blue grama(BOGR2)(222), western wheatgrass(PASM)(161), threadleaf sedge(CAFI)(138), prairie Junegrass(KOMA)(125), sideoats grama(BOCU)(89), long-stolon sedge(CAIN9)(85), Kentucky bluegrass(POPR)(73), field pussytoes(ANNE)(54)	1230	0.22	3.26%	1
053B.29.3.1	Spring Midgrass(666), Spring Rhizomatous Grass(I)(603), Spring Rhizomatous Grass(474), Spring Perennial Grasslike(240), Summer Perennial Forb(178), Summer Tallgrass(165), Summer Shortgrass(132)	Kentucky bluegrass(POPR)(603), needleandthread(HECO26)(602), western wheatgrass(PASM)(474), prairie sandreed(CALO)(165), threadleaf sedge(CAFI)(139), blue grama(BOGR2)(111), long-stolon sedge(CAIN9)(101), white sagebrush(ARLU)(62)	2697	0.11	1.77%	3
053B.29.3.2	Spring Rhizomatous Grass(I)(1630), Spring Midgrass(I)(270), Summer Perennial Forb(252), Spring Midgrass(178), Spring Perennial Grasslike(109), Spring Rhizomatous Grass(108), Deciduous Subshrub(57)	Kentucky bluegrass(POPR)(1217), smooth brome(BRIN2)(345), crested wheatgrass(AGCR)(266), green needlegrass(NAVI4)(124), western wheatgrass(PASM)(108), long-stolon sedge(CAIN9)(72), Canada bluegrass(POCO)(59), leadplant(AMCA6)(52)	2769	0.09	1.88%	6

## Supporting Information

The following publications support the STM. The first publication is in accordance with the STM, as grazing impacts have similar results in the study as with the estimation of the STM. Although the second publication is in MLRA 56, the close proximity will likely render similar conclusions. Therefore, this study was in accordance with the STM, such that implementing prescribed fire yielded similar results as with the conclusions of the STM. Additionally, the invasive grasses that the STM stated would be common occurred within this study. The third publication had similar findings as the second. Again, this study examined the effect of fire and herbicide with an invasion of smooth brome and Kentucky bluegrass. As indicated in the STM, the use of fire for management was successful in returning the site to closer proximity of its reference state.

**Bahm, M.A., T.G. Barnes, K.C. Jensen. 2011. Herbicide and Fire Effects on Smooth Brome (*Bromus inermis*) and Kentucky Bluegrass (*Poa Pratensis*) in Invaded Prairie Remnants. *Invasive Plant Science and Management* 4(2): 189-197.**

The objective of this study was to evaluate the effectiveness of herbicide and burning treatments for removing smooth brome and Kentucky bluegrass from native prairie remnants and to record the native plant community response to removal treatments. The study occurred on six sites in Deuel County, South Dakota. Vegetation species present included big bluestem, switchgrass, Indiangrass, little bluestem, porcupine grass, green needlegrass, blazing stars, white heath aster, purple prairie clover, upright prairie coneflower, goldenrods, Maximillian sunflower, false boneset, and prairie rose.

The experimental design established 12 plots at each site that were of randomized design with one replication per site. Ten random subsamples were collected prior to the initiation of the study to determine percent cover of smooth brome, Kentucky bluegrass and native species. Herbicides were applied with an ATV-mounted unit in late September 2005 and mid-May 2006. Burning occurred in early October of 2005. Vegetative response was visually estimated at the end of the 2006, 2007, and 2008 growing seasons.

The results indicated that all herbicide treatments resulted in smooth brome decrease after the initial growing season, but began to increase by the end of the third. After the second and third growing seasons, all herbicides and prescribed burning sites resulted in significantly less cover of smooth brome compared to control plots. The effectiveness of treatments to reduce cover of Kentucky bluegrass varied widely throughout the three growing seasons. There was no detected difference in native graminoid cover among treatments. Native forb response varied by treatments after the first growing season. Species richness varied by treatment after the first, second, and third growing seasons. Although there were statistical differences in treatment, the amount of Kentucky bluegrass still left aboveground would require retreatment. However, native grass cover increased in all treatments at the end of the second and third growing seasons and stayed relatively similar in the control as well. Big bluestem, switchgrass, and little bluestem showed the greatest increase across sites.

**Brand, M.D. and H. Goetz. 1986. Vegetation of Exclosure in Southwestern North Dakota. *Journal of Range Management* 39(5): 434-437.**

This study began in 1976, in an effort to study the vegetation of 4 livestock exclosures to garner insight into secondary succession with the exclusion of grazing. The study took place in the Little Missouri Badlands of southwestern North Dakota, with the grassland species of blue grama, thread-leaf sedge, western wheatgrass, and needleandthread. One grazed plot was established adjacent to the 4 exclosures.

Vegetation was sampled with 10-pin point frames systematically placed 300 times in each plot each year. Herbaceous production was sampled in August each year with 10 quadrats, randomly located and clipped at ground level. Foliar cover of shrubs was measured with four 50-m line transects randomly located in each plot.

The results found mean belowground biomass was significantly lower at some of the shallower depths in the ungrazed than in the grazed in plots in the Sagebrush Flat and East Tracy Mountain sites. Only one site had greater dominance of midgrass and tallgrass in the exclosure. In the grazed Sagebrush flat site, a decrease in shortgrass, blue grama occurred. Species composition results generally indicated a decrease of production blue grama and an increase of sedges in ungrazed plots.

**Link, A. B. Kobiela, S. DeKeyser, M. Huffington. 2017. Effectiveness of Burning, Herbicide, and Seeding Toward Restoring Rangelands in Southeastern North Dakota. *Rangeland Ecology and Management* 70 (5): 599-603.**

This study was conducted on a grassland invaded by Kentucky bluegrass and smooth brome in Richland County, North Dakota. The site had been cultivated and reseeded in the 1970's, then grazed by cattle. In 2010, five treatments were applied: 1) control, 2) interseed (drilled native seeds), 3) spring burn before drilling, 4) glyphosate application before drilling, and 5) spring burn and glyphosate application before drilling. In 2015, above ground biomass and species richness were estimated with quadrats.

The results found that total biomass of smooth brome and grass species richness responded to all five treatments. However, Kentucky bluegrass did not respond. Total biomass was greater in plots that were treated with herbicide before seeding than in control plots. In contrast, smooth brome was greater in control plots than those treated with herbicide. Smooth brome biomass was also greater in plots that were burned before seeding than plots treated with herbicide. Furthermore, native warm-season grass biomass was greater in plots treated with herbicide than control plots. For all treatments, mean grass species richness was greater after 5 years. However, grass species richness in all seeded plots was approximately equal, regardless of treatment.

## SHALLOW UPLAND ECOLOGICAL SITE CLASS

### General Description

The Shallow Upland ecological site class typically occurs on shallow, well drained, medium and moderately fine textured soils overlying weathered mudstone or siltstone at less than 20 inches.

### Geomorphic Features

Landscape Positions: Hill, Escarpment, Ridge, Outwash Plain, Beach Ridge, Till Plain, Moraine, Hill  
Slope (percent): 0 - 60

### Representative Soil Features

Soil Depth: Very Shallow to Moderately Deep  
Parent Material Kind: Alluvium, Residuum  
Parent Material Origin: Mixed  
Surface Texture: Loam, Silt Loam, Silty Clay Loam, Loamy Sand, Loamy Fine Sand, Fine Sand, Gravelly Sandy Loam  
Surface Texture Modifier: None  
Subsurface Texture Group: Sandy to Loamy  
Drainage Class: Well to Excessively Drained  
Permeability Class: Moderately Slow to Very Rapid  
Chemistry: Moderately Saline to Saline  
Available Water Capacity: 1 – 8 inches

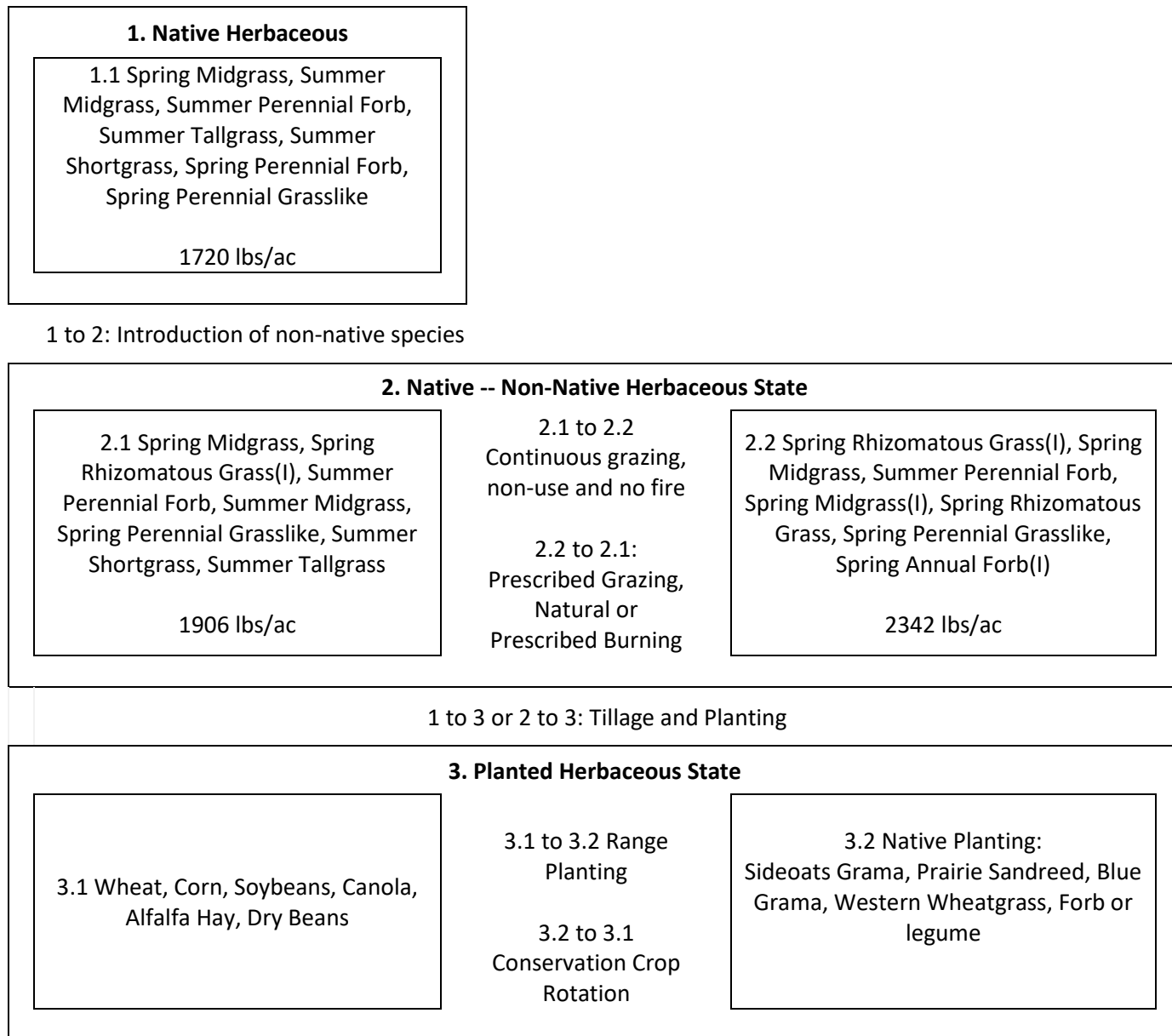
### Vegetation Dynamics

Community Class 1.1 in the State and Transition Model (Figure 6) was derived from the reference communities in the ecological site descriptions correlated to this community class. This community class produces about 1720 lbs/ac/yr. dominated by needleandthread, little bluestem, porcupinegrass, blue grama, green needlegrass, prairie sandreed, western wheatgrass, and sideoats grama.

With the introduction of non-native species, non-use and no fire, the site will transition to a Native – Non-Native Herbaceous State. The native dominated community class (2.1) includes the native grasses in community class 1.1, with the addition of non-native species such as Kentucky bluegrass and smooth brome. With continued heavy season long grazing or non-use and no fire, the site will transition to non-native dominated community (2.2). Long term prescribed grazing and a normal return interval of natural or prescribed burning may return the site to the native dominated community (2.1). The site will not transition from this state back to the Native Herbaceous State.

Plowing and tillage convert the reference state to a Planted Herbaceous State. Cropping and harvesting of annual and perennial crops maintain a cropland community class (Community Class 3.1). When seeded to native perennial grasses, the site transitions to a native planted community class (Community Class 3.2).

## State and Transition Model



**Figure 6.** State and Transition Model, MLRA 53B Shallow Upland ecological site class.

NRI Primary Sampling Units (PSUs) were correlated to these community classes where possible. Community class production, functional group dominance, and dominant species based on available NRI data are shown in Table 8. Ground and canopy cover from the NRI PSUs was used to estimate average annual erosion and percent runoff using the Rangeland Hydrology and Erosion Model (RHEM).

**Table 8.** NRI Community Class Data and RHEM Results - MLRA 53B Shallow Upland ecological site class.

Comm Class ID	Community Class (Lbs/Ac)	Dominant Species (Symbol)(Lbs/Ac)	Production Lbs/Ac	Soil Loss T/Ac/Yr	% Runoff	# PSUs
053B.18.1.1	Spring Midgrass(731), Summer Midgrass(272), Summer Shortgrass(173), Spring Perennial Grasslike(159), Summer Perennial Forb(157), Spring Rhizomatous Grass(148), Summer Tallgrass(108)	needleandthread(HECO26)(497), blue grama(BOGR2)(173), little bluestem(SCSC)(166), western wheatgrass(PASM)(146), threadleaf sedge(CAFI)(122), porcupinegrass(HESP11)(88), prairie sandreed(CALO)(86), Kentucky bluegrass(POPR)(77)	1943	0.79	6.65%	17
053B.18.2.1	Spring Midgrass(558), Spring Rhizomatous Grass(I)(458), Summer Perennial Forb(193), Summer Midgrass(173), Spring Perennial Grasslike(111), Summer Shortgrass(96), Summer Tallgrass(85)	Kentucky bluegrass(POPR)(410), needleandthread(HECO26)(215), green needlegrass(NAVI4)(141), blue grama(BOGR2)(93), prairie sandreed(CALO)(85), needlegrass(HESPE11)(81), threadleaf sedge(CAFI)(78)	1906	0.28	5.54%	14
053B.18.2.2	Spring Rhizomatous Grass(I)(1154), Spring Midgrass(289), Summer Perennial Forb(216), Spring Midgrass(I)(197), Spring Rhizomatous Grass(88), Spring Perennial Grasslike(69), Spring Annual Forb(I)(68)	Kentucky bluegrass(POPR)(870), smooth brome(BRIN2)(240), crested wheatgrass(AGCR)(185), needleandthread(HECO26)(130), green needlegrass(NAVI4)(130), western wheatgrass(PASM)(88), sweetclover(MELIL)(66), blue grama(BOGR2)(45)	2342	0.59	5.48%	31

## Supporting Information

The following publication supports the information depicted in the STM. Although this study addresses grazing, and the STM does not, the effects of disturbance would have similar outcomes.

**Sharif, A.R., M.E. Biondini, C.E. Grygiel. 1994. Grazing intensity effects on litter decomposition and soil nitrogen mineralization. *Journal of Range Management* 47(6): 444-449.**

The objective of this study was to examine the effect of grazing intensity on: 1) litter and root decomposition and N release; and 2) soil N mineralization and immobilization. It was conducted at the Central Grasslands Research Center, northwest of Streeter, North Dakota. The soils of the site were dominated by silty range sites. Vegetation consisted of graminoid dominated, with blue grama, needleandthread, sun sedge, western wheatgrass and a variety of forbs and shrubs.

The experimental design was randomized with three treatments: ungrazed control, moderate grazing, and heavy grazing. The litter and root decomposition were evaluated using the litter bag technique. Soil N mineralization and immobilization were determined using the buried polyethylene bag technique.



Results found that litter decomposition was steadily higher in the moderate grazing than on the long-term not grazed and heavy grazing treatments. The long-term not grazed had higher decomposition than the heavy grazed for several periods of the study. More than 80% of the litter decomposition occurred during the growing season for all treatments. Root decomposition demonstrated a similar pattern to that of litter. The moderate grazing had consistently higher decomposition rates than the long-term grazed and not grazed treatments. More than 60% of the root decomposition occurred during the June to September period. The release of N from the moderate grazing treatment was consistently lower than the releases from heavy grazed and long-term not grazed treatments.

## SUBIRRIGATED BOTTOMLAND ECOLOGICAL SITE CLASS

### General Description

The Subirrigated Bottomland ecological site class occurs on level, nearly level, slightly concave and gently undulating lowlands, till plains and lake plains and on slightly convex slopes adjacent to shallow depressions. These soils have a high water table (1.5 to 3.5 feet from the surface) which keeps the rooting zone moist for most of the growing season.

### Geomorphic Features

Landscape Positions: Till Plain, Lake Plain, Outwash Plain  
Slope (percent): 0 - 6

### Representative Soil Features

Soil Depth: Deep  
Parent Material Kind: Alluvium  
Parent Material Origin: Mixed  
Surface Texture: Loam, Silt Loam, Silty Clay Loam  
Surface Texture Modifier: None  
Subsurface Texture Group: Loamy  
Drainage Class: Somewhat Poorly Drained  
Permeability Class: Moderately Slow to Moderately Rapid  
Chemistry: None  
Available Water Capacity: 4 – 8 inches

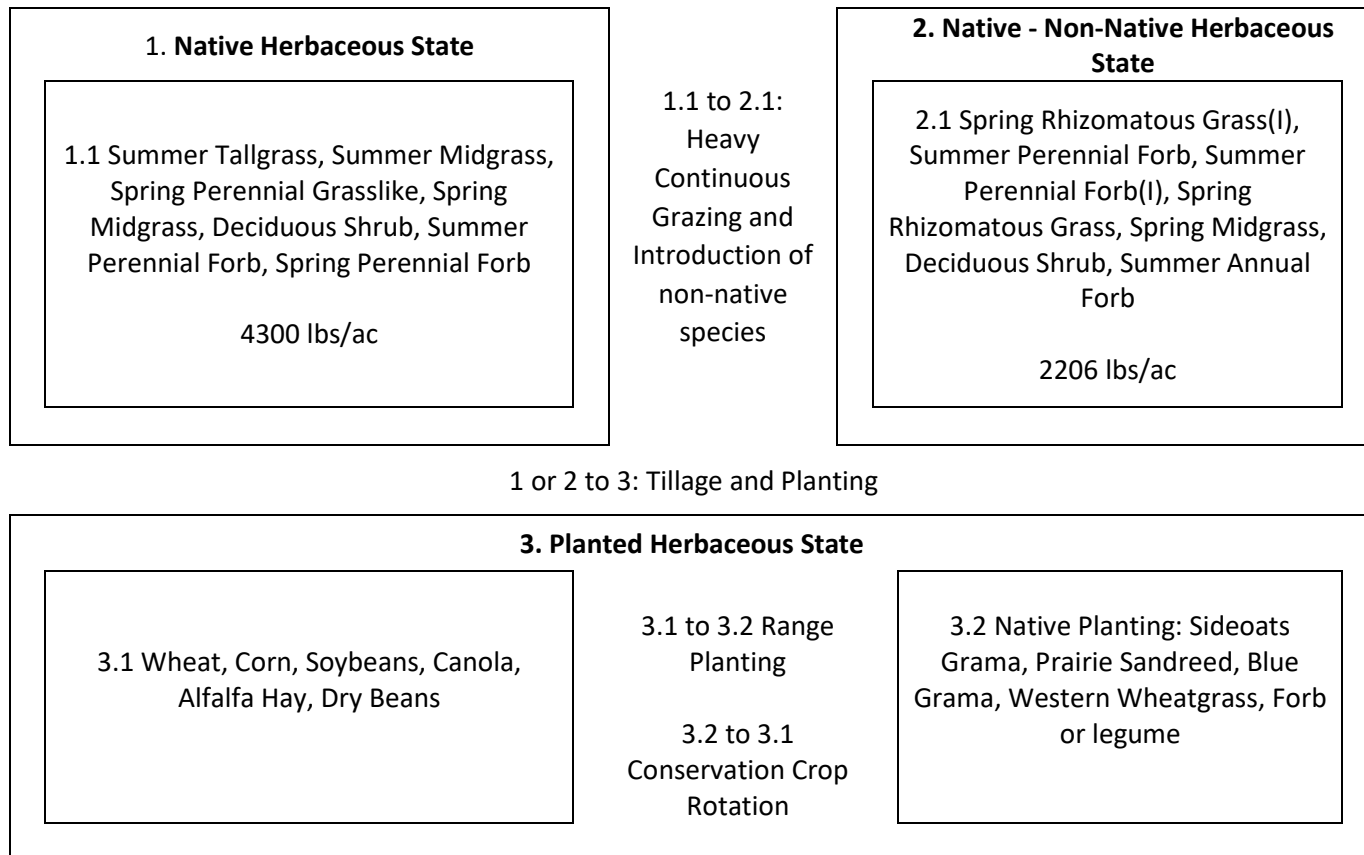
### Vegetation Dynamics

Community Class 1.1 in the State and Transition Model (Figure 7) was derived from the ecological site descriptions that were correlated to this ecological site class. This community produces about 4300 lbs/ac/yr, dominated by big bluestem, little bluestem, switchgrass, Indiangrass, western wheatgrass, green needlegrass, porcupinegrass, and sedges.

With the heavy continuous grazing and the introduction of non-native species, the site will transition to a Native – Non-Native Herbaceous State (State 2) that includes production from non-native species including Kentucky bluegrass, smooth brome, and white sweetclover. The site will not transition from this state back to the Native Herbaceous State.

Plowing and tillage convert the reference state to a Planted Herbaceous state. Cropping and harvesting of annual and perennial crops maintains a cropland community class (Community Class 3.1). When seeded to native perennial grasses, the site transitions to a native planted community class (Community Class 3.2).

## State and Transition Model



**Figure 7.** State and Transition Model, MLRA 53B Subirrigated Bottomland ecological site class.

NRI Primary Sampling Units (PSUs) were correlated to these community classes where possible. Community class production, functional group dominance, and dominant species based on available NRI data are shown in Table 9. Ground and canopy cover from the NRI PSUs was used to estimate average annual erosion and percent runoff using the Rangeland Hydrology and Erosion Model (RHEM). No data is shown when the NRI data indicates that the ecological site description does not match the soil at the PSU.

**Table 9.** NRI Community Class Data and RHEM Results - MLRA 53B Subirrigated Bottomland ecological site class.

Comm Class ID	Community Class (Lbs/Ac)	Dominant Species (Symbol)(Lbs/Ac)	Production Lbs/Ac	Soil Loss T/Ac/Yr	% Runoff	# PSUs
053B.34.1.1	Summer Perennial Grasslike(837), Summer Tallgrass(810), Summer Midgrass(513), Fern, Fern Allies(212), Summer Perennial Forb(79), Spring Rhizomatous Grass(l)(63), Lichen()	common threesquare(SCPU10)(837), big bluestem(ANGE)(621), little bluestem(SCSC)(513), scouringrush horsetail(EQHY)(212), switchgrass(PAVI2)(189), Missouri goldenrod(SOMI2)(79), quackgrass(ELRE4)(63), biological crust(SDH_BIO)()	2514			1
053B.34.2.1	Spring Rhizomatous Grass(l)(1039), Summer Perennial Forb(277), Summer Perennial Forb(l)(250), Spring Rhizomatous Grass(184), Spring Midgrass(117), Deciduous Shrub(63), Summer Annual Forb(60)	Kentucky bluegrass(POPR)(725), smooth brome(BRIN2)(313), white sweetclover(MEOF)(250), western wheatgrass(PASM)(184), white heath aster(SYER)(164), rough bentgrass(AGSC5)(86), western snowberry(SYOC)(63), curlycup gumweed(GRSQ)(57)	2206	0.13	4.29%	2

## Supporting Information

**Patton, B.D., X. Dong, P.E. Nyren, and A. Nyren. 2007. Effects of Grazing Intensity, Precipitation, and Temperature on Forage Production. Rangeland Ecology & Management 60(6): 656-665.**

This study took place northwest of Streeter, North Dakota, examining the effect of five intensities of grazing on the long-term productivity of the grassland. Additionally, the study examined how productivity is influenced by crop-year precipitation and growing degree days. The range sites were dominated by silty and overflow range sites. The silty site was moderately grazed and dominated by Kentucky bluegrass, green needlegrass, sun sedge, and western wheatgrass. The overflow sites consisted of Kentucky bluegrass, smooth brome, western snowberry, and stiff goldenrod.

The site was divided into 12 pastures which were stocked with cattle to attain four different grazing intensities: light, moderate, heavy and extreme. No grazing was established as a control via three exclosures in the silty site, and three in the overflow. Forage production and utilization were determined using the cage comparison method. Caged plots were clipped before grazing, as well as throughout the study.

The results found that for all measures of biomass, there was a significant difference in production on the various range sites. Additionally, there was a significant difference between the range sites and grazing intensity. On silty sites, the light treatment maintained the highest level of production, but there was no difference between light, moderate and heavy treatments. The average total production for the season was less on the ungrazed treatment. On the overflow sites, the heavy treatment caused the most production, but there was no significant difference between the light, moderate, and heavy treatments. Production was higher on the grazed treatment in comparison with the ungrazed. However, grazing on the extreme treatments, caused less production than the ungrazed.

## WET BOTTOMLAND ECOLOGICAL SITE CLASS

### General Description

The Wet Bottomland ecological site class occurs on level to nearly level, or concave closed basins and depressions in low lying positions. Water tables on this site class range from 1 foot above to 2 feet below the surface several weeks during the growing season. The site normally receives additional water from surface runoff and/or underground seepage.

### Geomorphic Features

Landscape Positions: Till Plain, Lake Plain, Outwash Plain, Depression, Drainageway, Swale  
Slope (percent): 0 - 3

### Representative Soil Features

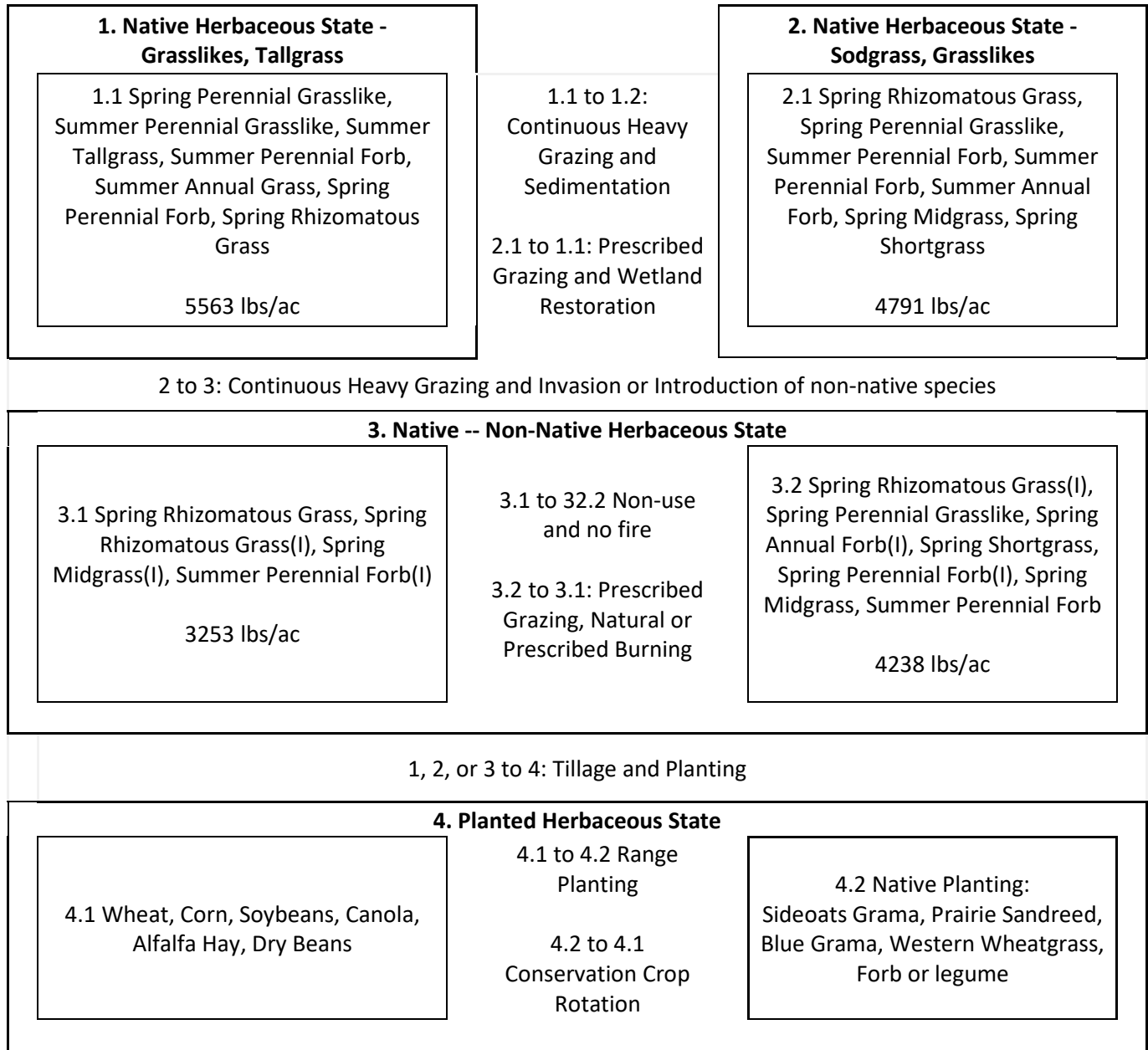
Soil Depth: Deep  
Parent Material Kind: Alluvium  
Parent Material Origin: Mixed  
Surface Texture: Loam, Silt Loam, Silty Clay Loam, Silty Clay  
Surface Texture Modifier: None  
Subsurface Texture Group: Loamy  
Drainage Class: Poorly Drained  
Permeability Class: Very Slow to Rapid  
Chemistry: None  
Available Water Capacity: 4 – 8 inches

### Vegetation Dynamics

Community Class 1.1 in the State and Transition Model (Figure 8) was derived from the reference communities in the ecological site descriptions that were correlated to this ecological site class. This community class produces about 5,633 lbs/ac/yr. dominated by wheat sedge, prairie cordgrass, American sloughgrass, woolly sedge, spikerush, and northern reedgrass. With heavy continuous grazing and sedimentation, the site will transition to a sodgrass and rush dominated state (State 2) dominated by reed canarygrass, and sedges. With wetland restoration, and long term prescribed grazing the site may transition back to the reference community class.

With continuous heavy grazing and the introduction of non-native species, the site is likely to transition to a Native – Non-Native Herbaceous state. The native dominated community (3.1) includes the native species plus non-native species such as Kentucky bluegrass and smooth brome. With non-use and no fire, the site will transition to a non-native dominated community class (3.2) that includes non-natives such as quackgrass, Kentucky bluegrass, sweetclover, and slender wheatgrass.

## State and Transition Model



**Figure 8.** State and Transition Model MLRA 53B Wet Bottomland ecological site class.

NRI Primary Sampling Units (PSUs) were correlated to these community classes where possible. Community class production, functional group dominance, and dominant species based on available NRI data are shown in Table 10. No runoff and erosion values are included because the RHEM model was not designed for use on saturated soils. Most erosion and runoff in this site class is related to flood events.

**Table 10.** NRI Community Class Data and RHEM Results - MLRA 53B Wet Bottomland ecological site class.

Comm Class ID	Community Class (Lbs/Ac)	Dominant Species (Symbol)(Lbs/Ac)	Production Lbs/Ac	Soil Loss T/Ac/Yr	% Runoff	# PSUs
053B.22.1.1	Summer Tallgrass(1663), Spring Rhizomatous Grass(962), Spring Perennial Forb(458), Spring Perennial Forb(I)(189), Lichen()	prairie cordgrass(SPPE)(1663), reed canarygrass(PHAR3)(962), broadleaf cattail(TYLA)(458), curly dock(RUCR)(189), (CICUT)(44), biological crust(SDH_BIO)()	3316			1
053B.22.2.1	Spring Rhizomatous Grass(1694), Spring Perennial Grasslike(1079), Summer Perennial Forb(706), Summer Perennial Forb(I)(506), Summer Annual Forb(317), Spring Midgrass(204), Spring Shortgrass(165)	reed canarygrass(PHAR3)(1694), sedge(CAREX)(1068), sweetclover(MEOF)(477), Nuttall's sunflower(HENU)(350), curlytop knotweed(POLA4)(243), Canada goldenrod(SOCA6)(242), bluejoint(CACA4)(204), foxtail barley(HOJU)(165)	4791			3
053B.22.3.1	Spring Rhizomatous Grass(2380), Spring Rhizomatous Grass(I)(662), Spring Midgrass(I)(192), Summer Perennial Forb(I)(19)	reed canarygrass(PHAR3)(2380), Kentucky bluegrass(POPR)(384), smooth brome(BRIN2)(278), orchardgrass(DAGL)(192), Canada thistle(CIAR4)(19)	3253			1
053B.22.3.2	Spring Rhizomatous Grass(I)(951), Spring Perennial Grasslike(803), Spring Annual Forb(I)(615), Spring Shortgrass(554), Spring Perennial Forb(I)(350), Spring Midgrass(307), Summer Perennial Forb(228)	quackgrass(ELRE4)(616), sweetclover(MELIL)(615), foxtail barley(HOJU)(554), wheat sedge(CAAT2)(426), curly dock(RUCR)(350), Kentucky bluegrass(POPR)(335)	4238			2

### Supporting Information

No literature was found that dealt with this ecological site class.

APPENDIX A. MLRA 53B, ECOLOGICAL SITE CLASSES SHOWING THE ECOLOGICAL SITES, ECOLOGICAL SITE IDS, AND PLANT COMMUNITY CLASSES THAT WERE CORRELATED TO EACH SITE CLASS.

MLRA	Ecological Site Class Name	Ecological Site Names	Ecological Site ID
53B	Claypan Upland	Claypan	R053BY002ND
		Sandy Claypan	R053BY026ND
		Thin Claypan	R053BY013ND
		<b>Plant Community Class Names</b>	<b>Plant Community Class ID</b>
		Spring Rhizomatous Grass, Spring Midgrass, Summer Shortgrass, Spring Perennial Forb, Spring Perennial Grasslike, Summer Perennial Forb, Summer Tallgrass	053B.27.1.1
		Ecological Site Community: Summer Shortgrass, Summer Stoloniferous Grass, Summer Perennial Grasslike, Summer Rhizomatous Grass, Spring Perennial Grasslike, Spring Shortgrass, Spring Rhizomatous Grass, Evergreen Subshrub	053B.27.2.1
		Spring Rhizomatous Grass, Spring Rhizomatous Grass(I), Spring Midgrass, Spring Perennial Grasslike, Summer Shortgrass, Evergreen Subshrub, Summer Perennial Forb	053B.27.3.1
Spring Rhizomatous Grass(I), Summer Perennial Forb, Spring Midgrass(I), Spring Rhizomatous Grass, Spring Midgrass, Summer Rhizomatous Grass, Summer Annual Forb	053B.27.3.2		



Ecological Site			
MLRA	Class Name	Ecological Site Names	Ecological Site ID
53B	Loamy Upland	Clayey	R053BY001ND
		Loamy	R053BY011ND
		Loamy Overflow	R053BY005ND
	<b>Plant Community Class Names</b>		<b>Plant Community Class ID</b>
	Spring Midgrass, Spring Rhizomatous Grass, Summer Tallgrass, Summer Perennial Forb, Summer Midgrass, Spring Perennial Forb, Deciduous Shrub	053B.6.1.1	
Spring Perennial Grasslike, Summer Shortgrass, Spring Midgrass, Summer Annual Forb, Spring Rhizomatous Grass, Summer Perennial Forb, Summer Stoloniferous Grass	053B.6.1.2		
Spring Midgrass, Spring Rhizomatous Grass(I), Spring Rhizomatous Grass, Summer Perennial Forb, Summer Shortgrass, Summer Tallgrass, Spring Perennial Grasslike	053B.6.2.1		
Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb, Spring Rhizomatous Grass, Spring Midgrass(I), Spring Perennial Grasslike, Summer Perennial Forb(I)	053B.6.2.2		
Ecological Site			
MLRA	Class Name	Ecological Site Names	Ecological Site ID
53B	Saline Bottomland	Closed Depression	R053BY003ND
		Saline Lowland	R053BY006ND
	<b>Plant Community Class Names</b>		<b>Plant Community Class ID</b>
	Summer Rhizomatous Grass, Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Tallgrass, Summer Perennial Forb, Summer Annual Forb, Spring Midgrass	053B.35.1.1	
	Summer Rhizomatous Grass, Spring Shortgrass, Spring Perennial Grasslike, Spring Midgrass, Summer Tallgrass, Summer Perennial Forb, Spring Rhizomatous Grass	053B.35.1.2	
Summer Rhizomatous Grass, Spring Shortgrass, Summer Annual Forb, Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb(I), Spring Perennial Grasslike	053B.35.2.1		
Spring Rhizomatous Grass(I), Summer Perennial Forb, Spring Midgrass, Summer Shortgrass, Spring Perennial Grasslike, Summer Perennial Forb(I)	053B.35.2.2		

<b>MLRA</b>	<b>Ecological Site Class Name</b>	<b>Ecological Site Names</b>	<b>Ecological Site ID</b>
53B	<b>Sandy Upland</b>	Sandy	R053BY008ND
		Sands	R053BY007ND
		<b>Plant Community Class Names</b>	<b>Plant Community Class ID</b>
		Summer Tallgrass, Spring Midgrass, Summer Perennial Forb, Spring Perennial Grasslike, Spring Perennial Forb, Summer Midgrass, Summer Shortgrass	053B.29.1.1
		Spring Perennial Grasslike, Summer Shortgrass, Spring Rhizomatous Grass, Spring Midgrass, Spring Perennial Forb, Summer Midgrass, Summer Perennial Forb	053B.29.1.2
		Ecological Site Community: Summer Tallgrass, Summer Shortgrass, Spring Midgrass, Summer Midgrass, Spring Rhizomatous Grass, Spring Perennial Grasslike, Perennial Forbs, Shrubs	053B.29.2.1
		Spring Midgrass, Spring Rhizomatous Grass(I), Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Perennial Forb, Summer Tallgrass, Summer Shortgrass	053B.29.3.1
		Spring Rhizomatous Grass(I), Spring Midgrass(I), Summer Perennial Forb, Spring Midgrass, Spring Perennial Grasslike, Spring Rhizomatous Grass, Deciduous Subshrub	053B.29.3.2
<b>MLRA</b>	<b>Ecological Site Class Name</b>	<b>Ecological Site Names</b>	<b>Ecological Site ID</b>
53B	<b>Shallow Upland</b>	Shallow Gravel	R053BY010ND
		Shallow Loamy	R053BY009ND
		Thin Loamy	R053BY015ND
		Thin Sands	R053BY014ND
		Very Shallow	R053BY017ND
		<b>Plant Community Class Names</b>	<b>Plant Community Class ID</b>
		Spring Midgrass, Summer Midgrass, Summer Perennial Forb, Summer Tallgrass, Summer Shortgrass, Spring Perennial Forb, Spring Perennial Grasslike	053B.18.1.1
		Spring Midgrass, Spring Rhizomatous Grass(I), Summer Perennial Forb, Summer Midgrass, Spring Perennial Grasslike, Summer Shortgrass, Summer Tallgrass	053B.18.2.1
	Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb, Spring Midgrass(I), Spring Rhizomatous Grass, Spring Perennial Grasslike, Spring Annual Forb(I)	053B.18.2.2	

<b>Ecological Site</b>			
<b>MLRA</b>	<b>Class Name</b>	<b>Ecological Site Names</b>	<b>Ecological Site ID</b>
53B	<b>Subirrigated Bottomland</b>	Limy Subirrigated	R053BY004ND
		Subirrigated	R053BY012ND
	<b>Plant Community Class Names</b>		<b>Plant Community Class ID</b>
	Summer Tallgrass, Summer Midgrass, Spring Perennial Grasslike, Spring Midgrass, Deciduous Shrub, Summer Perennial Forb, Spring Perennial Forb		053B.34.1.1
Spring Rhizomatous Grass(I), Summer Perennial Forb, Summer Perennial Forb(I), Spring Rhizomatous Grass, Spring Midgrass, Deciduous Shrub, Summer Annual Forb		053B.34.2.1	
<b>Ecological Site</b>			
<b>MLRA</b>	<b>Class Name</b>	<b>Ecological Site Names</b>	<b>Ecological Site ID</b>
53B	<b>Wet Bottomland</b>	Shallow Marsh	R053BY025ND
		Wet Land	R053BY018ND
		Wet Meadow	R053BY019ND
	<b>Plant Community Class Names</b>		<b>Plant Community Class ID</b>
Spring Perennial Grasslike, Summer Perennial Grasslike, Summer Tallgrass, Summer Perennial Forb, Summer Annual Grass, Spring Perennial Forb, Spring Rhizomatous Grass		053B.22.1.1	
Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Perennial Forb, Summer Perennial Forb(I), Summer Annual Forb, Spring Midgrass, Spring Shortgrass		053B.22.2.1	
Spring Rhizomatous Grass, Spring Rhizomatous Grass(I), Spring Midgrass(I), Summer Perennial Forb(I)		053B.22.3.1	
Spring Rhizomatous Grass(I), Spring Perennial Grasslike, Spring Annual Forb(I), Spring Shortgrass, Spring Perennial Forb(I), Spring Midgrass, Summer Perennial Forb		053B.22.3.2	

APPENDIX B. MLRA 53B, ECOLOGICAL SITE CLASS AND COMMUNITY CLASS SUMMARY

Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
Claypan Upland	Native Herbaceous Midgrass	053B.27.1.1	Spring Rhizomatous Grass, Spring Midgrass, Summer Shortgrass, Spring Perennial Forb, Spring Perennial Grasslike, Summer Perennial Forb, Summer Tallgrass	1633				
	Native Herbaceous Shortgrass	053B.27.2.1	Ecological Site Community: Summer Shortgrass, Summer Stoloniferous Grass, Summer Perennial Grasslike, Summer Rhizomatous Grass, Spring Perennial Grasslike, Spring Shortgrass, Spring Rhizomatous Grass, Evergreen Subshrub	800				
Claypan Upland	Native - Non-Native Herbaceous	053B.27.3.1			Spring Rhizomatous Grass, Spring Rhizomatous Grass(I), Spring Midgrass, Spring Perennial Grasslike, Summer Shortgrass, Evergreen Subshrub, Summer Perennial Forb	western wheatgrass(PASM), Kentucky bluegrass(POPR), prairie Junegrass(KOMA), inland rush(JUIN2), blue grama(BOGR2), prairie sagewort(ARFR4), Canada bluegrass(POCO), green needlegrass(NAVI4)	2808	1

Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
Claypan Upland	Native - Non-Native Herbaceous	053B.27.3.2			Spring Rhizomatous Grass(I), Summer Perennial Forb, Spring Midgrass(I), Spring Rhizomatous Grass, Spring Midgrass, Summer Rhizomatous Grass, Summer Annual Forb	Kentucky bluegrass(POPR), quackgrass(ELRE4), smooth brome(BRIN2), crested wheatgrass(AGCR), white heath aster(SYER), western wheatgrass(PASM), inland saltgrass(DISP), curlycup gumweed(GRSQ)	2541	5
Loamy Upland	Native Herbaceous	053B.6.1.1	Spring Midgrass, Spring Rhizomatous Grass, Summer Tallgrass, Summer Perennial Forb, Summer Midgrass, Spring Perennial Forb, Deciduous Shrub	2733	Spring Midgrass, Spring Rhizomatous Grass, Summer Perennial Forb, Summer Shortgrass, Spring Perennial Grasslike, Spring Rhizomatous Grass(I), Spring Perennial Forb	slender wheatgrass(ELTR7), western wheatgrass(PASM), blue grama(BOGR2), green needlegrass(NAVI4), prairie Junegrass(KOMA), sedge(CAREX), Kentucky bluegrass(POPR), western ragweed(AMPS)	2007	4
Loamy Upland	Native Herbaceous	053B.6.1.2			Spring Perennial Grasslike, Summer Shortgrass, Spring Midgrass, Summer Annual Forb, Spring Rhizomatous Grass, Summer Perennial Forb, Summer Stoloniferous Grass	sedge(CAREX), blue grama(BOGR2), western wheatgrass(PASM), American bird's-foot trefoil(LOUN), prairie Junegrass(KOMA), Buffalograss(BODA2), white sagebrush(ARLUL2), purple threeawn(ARPU9)	2358	6
Loamy Upland	Native - Non-Native Herbaceous	053B.6.2.1			Spring Midgrass, Spring Rhizomatous Grass(I),	Kentucky bluegrass(POPR), western wheatgrass(PASM), needleandthread(HECO26), green needlegrass(NAVI4), blue grama(BOGR2),	2556	29

Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
					Spring Rhizomatous Grass, Summer Perennial Forb, Summer Shortgrass, Summer Tallgrass, Spring Perennial Grasslike	smooth brome(BRIN2), big bluestem(ANGE), porcupinegrass(HESP11)		
Loamy Upland	Native - Non-Native Herbaceous	053B.6.2.2			Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb, Spring Rhizomatous Grass, Spring Midgrass(I), Spring Perennial Grasslike, Summer Perennial Forb(I)	Kentucky bluegrass(POPR), smooth brome(BRIN2), green needlegrass(NAVI4), western wheatgrass(PASM), crested wheatgrass(AGCR), needleandthread(HECO26), blue grama(BOGR2), sweetclover(MEOF)	2629	143
Saline Bottomland	Native Herbaceous	053B.35.1.1	Summer Rhizomatous Grass, Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Tallgrass, Summer Perennial Forb, Summer Annual Forb, Spring Midgrass	3500	Spring Rhizomatous Grass, Spring Midgrass, Spring Perennial Forb, Summer Shortgrass, Spring Perennial Grasslike, Spring Rhizomatous Grass(I)	western wheatgrass(PASM), fowl bluegrass(POPA2), broadleaf cattail(TYLA), common yarrow(ACMI2), blue grama(BOGR2), (RUMEX), sedge(CAREX), foxtail barley(HOJU)	661	2
Saline Bottomland	Native Herbaceous	053B.35.1.2			Summer Rhizomatous Grass, Spring Shortgrass, Spring Perennial Grasslike, Spring Midgrass, Summer Tallgrass, Summer	foxtail barley(HOJU), Nuttall's alkaligrass(PUNU2), inland saltgrass(DISP), slender wheatgrass(ELTR7), prairie cordgrass(SPPE), clustered field sedge(CAPR5), sedge(CAREX), Baltic rush(JUARL)	3605	9

Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
					Perennial Forb, Spring Rhizomatous Grass			
Saline Bottomland	Native - Non-Native Herbaceous	053B.35.2.1			Summer Rhizomatous Grass, Spring Shortgrass, Summer Annual Forb, Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb(I), Spring Perennial Grasslike	foxtail barley(HOJU), inland saltgrass(DISB), Kentucky bluegrass(POPR), Nuttall's alkaligrass(PUNU2), silverscale saltbush(ATAR2), shortawn foxtail(ALAE), Canada thistle(CIAR4), curly dock(RUCR)	3417	8
Saline Bottomland	Native - Non-Native Herbaceous	053B.35.2.2			Spring Rhizomatous Grass(I), Summer Perennial Forb, Spring Midgrass, Summer Shortgrass, Spring Perennial Grasslike, Summer Perennial Forb(I)	Kentucky bluegrass(POPR), quackgrass(ELRE4), smooth brome(BRIN2), Canada bluegrass(POCO), blue grama(BOGR2), needleandthread(HECO26), white heath aster(SYER)	3091	9
Sandy Upland	Native Herbaceous	053B.29.1.1	Summer Tallgrass, Spring Midgrass, Summer Perennial Forb, Spring Perennial Grasslike, Spring Perennial Forb, Summer Midgrass, Summer Shortgrass	2500	Spring Midgrass, Summer Perennial Forb, Spring Perennial Grasslike, Summer Shortgrass, Spring Perennial Forb, Summer Annual Forb(I), Evergreen Subshrub	needleandthread(HECO26), prairie Junegrass(KOMA), upright prairie coneflower(RACO3), tarragon(ARDR4), blue grama(BOGR2), blue lettuce(LATA), threadleaf sedge(CAFI), blacksamson echinacea(ECAN2)	2543	1
Sandy Upland	Native Herbaceous	053B.29.1.2			Spring Perennial Grasslike, Summer Shortgrass,	blue grama(BOGR2), western wheatgrass(PASM), threadleaf sedge(CAFI), prairie Junegrass(KOMA), sideoats grama(BOCU),	1230	1

Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
					Spring Rhizomatous Grass, Spring Midgrass, Spring Perennial Forb, Summer Midgrass, Summer Perennial Forb	long-stolon sedge(CAIN9), Kentucky bluegrass(POPR), field pussytoes(ANNE)		
Sandy Upland	Native - Non-Native Herbaceous	053B.29.3.1			Spring Midgrass, Spring Rhizomatous Grass(I), Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Perennial Forb, Summer Tallgrass, Summer Shortgrass	Kentucky bluegrass(POPR), needleandthread(HECO26), western wheatgrass(PASM), prairie sandreed(CALO), threadleaf sedge(CAFI), blue grama(BOGR2), long-stolon sedge(CAIN9), white sagebrush(ARLU)	2697	3
Sandy Upland	Native - Non-Native Herbaceous	053B.29.3.2			Spring Rhizomatous Grass(I), Spring Midgrass(I), Summer Perennial Forb, Spring Midgrass, Spring Perennial Grasslike, Spring Rhizomatous Grass, Deciduous Subshrub	Kentucky bluegrass(POPR), smooth brome(BRIN2), crested wheatgrass(AGCR), green needlegrass(NAVI4), western wheatgrass(PASM), long-stolon sedge(CAIN9), Canada bluegrass(POCO), leadplant(AMCA6)	2769	6
Shallow Upland	Native Herbaceous	053B.18.1.1	Spring Midgrass, Summer Midgrass, Summer Perennial Forb, Summer Tallgrass, Summer Shortgrass, Spring Perennial	1720	Spring Midgrass, Summer Midgrass, Summer Shortgrass, Spring Perennial Grasslike, Summer Perennial Forb, Spring	needleandthread(HECO26), blue grama(BOGR2), little bluestem(SCSC), western wheatgrass(PASM), threadleaf sedge(CAFI), porcupinegrass(HESP11), prairie sandreed(CALO), Kentucky bluegrass(POPR)	1943	17



Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
			Forb, Spring Perennial Grasslike		Rhizomatous Grass, Summer Tallgrass			
Shallow Upland	Native - Non-Native Herbaceous	053B.18.2.1			Spring Midgrass, Spring Rhizomatous Grass(I), Summer Perennial Forb, Summer Midgrass, Spring Perennial Grasslike, Summer Shortgrass, Summer Tallgrass	Kentucky bluegrass(POPR), needleandthread(HECO26), green needlegrass(NAVI4), blue grama(BOGR2), prairie sandreed(CALO), needlegrass(HESPE11), threadleaf sedge(CAFI)	1906	14
Shallow Upland	Native - Non-Native Herbaceous	053B.18.2.2			Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb, Spring Midgrass(I), Spring Rhizomatous Grass, Spring Perennial Grasslike, Spring Annual Forb(I)	Kentucky bluegrass(POPR), smooth brome(BRIN2), crested wheatgrass(AGCR), needleandthread(HECO26), green needlegrass(NAVI4), western wheatgrass(PASM), sweetclover(MELIL), blue grama(BOGR2)	2342	31
Subirrigated Bottomland	Native Herbaceous	053B.34.1.1	Summer Tallgrass, Summer Midgrass, Spring Perennial Grasslike, Spring Midgrass, Deciduous Shrub, Summer Perennial Forb, Spring Perennial Forb	4300	Summer Perennial Grasslike, Summer Tallgrass, Summer Midgrass, Fern, Fern Allies, Summer Perennial Forb, Spring Rhizomatous Grass(I), Lichen	common threesquare(SCPU10), big bluestem(ANGE), little bluestem(SCSC), scouringrush horsetail(EQHY), switchgrass(PAVI2), Missouri goldenrod(SOMI2), quackgrass(ELRE4), biological crust(SDH_BIO)	2514	1
Subirrigated Bottomland	Native - Non-Native Herbaceous	053B.34.2.1			Spring Rhizomatous Grass(I), Summer Perennial	Kentucky bluegrass(POPR), smooth brome(BRIN2), white sweetclover(MEOF), western wheatgrass(PASM), white heath aster(SYER),	2206	2

Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
					Forb, Summer Perennial Forb(I), Spring Rhizomatous Grass, Spring Midgrass, Deciduous Shrub, Summer Annual Forb	rough bentgrass(AGSC5), western snowberry(SYOC), curlycup gumweed(GRSQ)		
Wet Bottomland	Native Herbaceous	053B.22.1.1	Spring Perennial Grasslike, Summer Tallgrass, Summer Perennial Grasslike, Summer Perennial Forb, Summer Annual Grass, Spring Perennial Forb, Spring Rhizomatous Grass	5563	Summer Tallgrass, Spring Rhizomatous Grass, Spring Perennial Forb, Spring Perennial Forb(I), Lichen	prairie cordgrass(SPPE), reed canarygrass(PHAR3), broadleaf cattail(TYLA), curly dock(RUCR), (CICUT), biological crust(SDH_BIO)	3316	1
Wet Bottomland	Native Herbaceous	053B.22.2.1			Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Perennial Forb, Summer Perennial Forb(I), Summer Annual Forb, Spring Midgrass, Spring Shortgrass	reed canarygrass(PHAR3), sedge(CAREX), sweetclover(MEOF), Nuttall's sunflower(HENU), curlytop knotweed(POLA4), Canada goldenrod(SOCA6), bluejoint(CACA4), foxtail barley(HOJU)	4791	3
Wet Bottomland	Native - Non-Native Herbaceous	053B.22.3.1			Spring Rhizomatous Grass, Spring Rhizomatous Grass(I), Spring Midgrass(I), Summer Perennial Forb(I)	reed canarygrass(PHAR3), Kentucky bluegrass(POPR), smooth brome(BRIN2), orchardgrass(DAGL), Canada thistle(CIAR4)	3253	1
Wet Bottomland	Native - Non-Native Herbaceous	053B.22.3.2			Spring Rhizomatous Grass(I),	quackgrass(ELRE4), sweetclover(MELIL), foxtail barley(HOJU), wheat	4238	2

Site Class Name	State	Comm Class ID	ESD Comm Class	ESD Lbs/Ac	NRI Community Class	NRI Dominant Species (Symbol)	NRI Lbs/Ac	# PSUs
					Spring Perennial Grasslike, Spring Annual Forb(l), Spring Shortgrass, Spring Perennial Forb(l), Spring Midgrass, Summer Perennial Forb	sedge(CAAT2), curly dock(RUCR), Kentucky bluegrass(POPR)		

APPENDIX C. MLRA 53B, NRI PERCENT COVER VALUES BY COMMUNITY CLASS

Site Class Name	Comm Class ID	Bunch-grass	Sodgrass	Shrub	Forb + AnnGrass	Lichen	BareGrnd	Rock	Litter	Basal	Avg Plant Ht (ft)	Avg % Slope
Claypan Upland	053B.27.32	10%	82%	2%	5%	1%	3%	0%	80%	14%	1.1	3
	Spring Rhizomatous Grass(I), Summer Perennial Forb, Spring Midgrass(I), Spring Rhizomatous Grass, Spring Midgrass, Summer Rhizomatous Grass, Summer Annual Forb											
Loamy Upland	053B.6.1.1	55%	36%	4%	2%	0%	1%	0%	96%	1%	1.4	2
	Spring Midgrass, Spring Rhizomatous Grass, Summer Perennial Forb, Summer Shortgrass, Spring Perennial Grasslike, Spring Rhizomatous Grass(I), Spring Perennial Forb											
Loamy Upland	053B.6.1.2	43%	34%	0%	19%	0%	17%	0%	74%	1%	0.6	4
	Spring Perennial Grasslike, Summer Shortgrass, Spring Midgrass, Summer Annual Forb, Spring Rhizomatous Grass, Summer Perennial Forb, Summer Stoloniferous Grass											
Loamy Upland	053B.6.2.1	41%	39%	3%	14%	1%	3%	0%	86%	3%	1.0	6
	Spring Midgrass, Spring Rhizomatous Grass(I), Spring Rhizomatous Grass, Summer Perennial Forb, Summer Shortgrass, Summer Tallgrass, Spring Perennial Grasslike											
Loamy Upland	053B.6.2.2	23%	59%	3%	11%	0%	1%	0%	94%	2%	1.0	5
	Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb, Spring Rhizomatous Grass, Spring Midgrass(I), Spring Perennial Grasslike, Summer Perennial Forb(I)											
Saline Bottomland	053B.35.1.1	2%	78%	0%	12%	0%	13%	0%	81%	6%	0.7	4
	Spring Rhizomatous Grass, Spring Midgrass, Spring Perennial Forb, Summer Shortgrass, Spring Perennial Grasslike, Spring Rhizomatous Grass(I)											
Saline Bottomland	053B.35.1.2	34%	24%	1%	33%	0%	13%	0%	78%	7%	1.2	1
	Summer Rhizomatous Grass, Spring Shortgrass, Spring Perennial Grasslike, Spring Midgrass, Summer Tallgrass, Summer Perennial Forb, Spring Rhizomatous Grass											
Saline Bottomland	053B.35.2.1	31%	39%	0%	28%	0%	1%	0%	89%	7%	1.2	1
	Summer Rhizomatous Grass, Spring Shortgrass, Summer Annual Forb, Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb(I), Spring Perennial Grasslike											
Saline Bottomland	053B.35.2.2	10%	73%	2%	14%	1%	3%	0%	78%	13%	1.3	2
	Spring Rhizomatous Grass(I), Summer Perennial Forb, Spring Midgrass, Summer Shortgrass, Spring Perennial Grasslike, Summer Perennial Forb(I)											
Sandy Upland	053B.29.1.2	34%	34%	8%	12%	0%	20%	0%	69%	2%	0.8	11
	Spring Perennial Grasslike, Summer Shortgrass, Spring Rhizomatous Grass, Spring Midgrass, Spring Perennial Forb, Summer Midgrass, Summer Perennial Forb											
Sandy Upland	053B.29.3.1	10%	42%	21%	23%	0%	2%	0%	95%	2%	0.9	6
	Spring Midgrass, Spring Rhizomatous Grass(I), Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Perennial Forb, Summer Tallgrass, Summer Shortgrass											
Sandy Upland	053B.29.3.2	32%	50%	6%	9%	0%	0%	0%	96%	4%	1.3	8
	Spring Rhizomatous Grass(I), Spring Midgrass(I), Summer Perennial Forb, Spring Midgrass, Spring Perennial Grasslike, Spring Rhizomatous Grass, Deciduous Subshrub											
Shallow Upland	053B.18.1.1	57%	25%	7%	4%	3%	13%	1%	57%	3%	1.1	19
	Spring Midgrass, Summer Midgrass, Summer Shortgrass, Spring Perennial Grasslike, Summer Perennial Forb, Spring Rhizomatous Grass, Summer Tallgrass											
Shallow Upland	053B.18.2.1	47%	37%	4%	8%	1%	4%	2%	74%	4%	1.1	9
	Spring Midgrass, Spring Rhizomatous Grass(I), Summer Perennial Forb, Summer Midgrass, Spring Perennial Grasslike, Summer Shortgrass, Summer Tallgrass											
Shallow Upland	053B.18.2.2	31%	54%	10%	3%	1%	5%	0%	78%	2%	1.0	11
	Spring Rhizomatous Grass(I), Spring Midgrass, Summer Perennial Forb, Spring Midgrass(I), Spring Rhizomatous Grass, Spring Perennial Grasslike, Spring Annual Forb(I)											

Site Class Name	Comm Class ID	Bunch-grass	Sodgrass	Shrub	Forb + AnnGrass	Lichen	BareGrnd	Rock	Litter	Basal	Avg Plant Ht (ft)	Avg % Slope
<b>Subirrigated Bottomland</b>	053B.34.2.1	0%	89%	1%	10%	0%	1%	0%	90%	4%	0.5	4
	Spring Rhizomatous Grass(I), Summer Perennial Forb, Summer Perennial Forb(I), Spring Rhizomatous Grass, Spring Midgrass, Deciduous Shrub, Summer Annual Forb											
<b>Wet Bottomland</b>	053B.22.2.1	0%	44%	0%	40%	2%	0%	0%	95%	0%	2.1	3
	Spring Rhizomatous Grass, Spring Perennial Grasslike, Summer Perennial Forb, Summer Perennial Forb(I), Summer Annual Forb, Spring Midgrass, Spring Shortgrass											
<b>Wet Bottomland</b>	053B.22.3.1	0%	78%	0%	19%	0%	0%	0%	99%	1%	0.7	1
	Spring Rhizomatous Grass, Spring Rhizomatous Grass(I), Spring Midgrass(I), Summer Perennial Forb(I)											

## APPENDIX D. MLRA 53B, REPRESENTATIVE SOIL MAP UNIT COMPONENTS

### Claypan Upland Ecological Site Class

Area Symbol	Soil Survey Area	Map Unit	Component	Component Acres
ND015	Burleigh County, North Dakota	C591A	Rhoades	6,540
ND051	McIntosh County, North Dakota	C194A	Noonan	2,621
ND093	Stutsman County, North Dakota	C667B	Noonan	949
ND093	Stutsman County, North Dakota	C661A	Noonan	904
ND043	Kidder County, North Dakota	C557A	Noonan	818

### Loamy Upland Ecological Site Class

Area Symbol	Soil Survey Area	Map Unit	Component	Component Acres
ND047	Logan County, North Dakota	C135D	Williams	28,502
ND093	Stutsman County, North Dakota	C135D	Williams	23,882
ND051	McIntosh County, North Dakota	C135D	Williams	19,040
ND015	Burleigh County, North Dakota	C135D	Williams	16,667
ND051	McIntosh County, North Dakota	C814A	Bowdle	11,871

### Saline Bottomland Upland Ecological Site Class

Area Symbol	Soil Survey Area	Map Unit	Component	Component Acres
ND101	Ward County, North Dakota	C75A	Vallers	3,419
ND101	Ward County, North Dakota	C3A	Heil	643
ND029	Emmons County, North Dakota	C665B	Heil	461
ND093	Stutsman County, North Dakota	C3A	Heil	363
ND015	Burleigh County, North Dakota	C3A	Heil	275

### Sandy Upland Ecological Site Class

Area Symbol	Soil Survey Area	Map Unit	Component	Component Acres
ND015	Burleigh County, North Dakota	C761B	Lihen	6,407
ND029	Emmons County, North Dakota	C761B	Lihen	4,364
ND043	Kidder County, North Dakota	C800B	Lihen	3,709
ND043	Kidder County, North Dakota	C800D	Appam	3,260
ND043	Kidder County, North Dakota	C368C	Livona	2,547

### Shallow Upland Ecological Site Class

Area Symbol	Soil Survey Area	Map Unit	Component	Component Acres
ND043	Kidder County, North Dakota	C156F	Zahl	58,154
ND093	Stutsman County, North Dakota	C156F	Zahl	48,812
ND101	Ward County, North Dakota	C156F	Zahl	45,827
ND015	Burleigh County, North Dakota	C132C	Zahl	31,527
ND101	Ward County, North Dakota	C132C	Zahl	30,417

### Subirrigated Bottomland Ecological Site Class

Area Symbol	Soil Survey Area	Map Unit	Component	Component Acres
ND043	Kidder County, North Dakota	C311B	Ulen	4,945
ND015	Burleigh County, North Dakota	C210A	Hamerly	2,237
ND043	Kidder County, North Dakota	C210A	Hamerly	1,387
ND101	Ward County, North Dakota	C210A	Hamerly	1,309
ND055	McLean County, North Dakota	C210A	Hamerly	1,111

### Wet Bottomland Ecological Site Class

Area Symbol	Soil Survey Area	Map Unit	Component	Component Acres
ND043	Kidder County, North Dakota	C42A	Arveson	4,175
ND093	Stutsman County, North Dakota	C276A	Tonka	2,790
ND043	Kidder County, North Dakota	C165F	Vallers	2,269
ND029	Emmons County, North Dakota	C2A	Tonka	2,094
ND101	Ward County, North Dakota	C2A	Tonka	1,670

## APPENDIX E. MLRA 53B, COMMON PLANTS AND FUNCTIONAL GROUPS

Common Name	Accepted Symbol	Scientific Name	Functional Group
alfalfa	MESA	Medicago sativa	Spring Perennial Forb(I)
alkali cordgrass	SPGR	Spartina gracilis	Summer Rhizomatous Grass
alpine golden buckwheat	ERFLF	Eriogonum flavum var. flavum	Summer Perennial Forb
American bird's-foot trefoil	LOUN	Lotus unifoliolatus	Summer Annual Forb
American elm	ULAM	Ulmus americana	Deciduous Tree
American licorice	GLLE3	Glycyrrhiza lepidota	Summer Perennial Forb
American plum	PRAM	Prunus americana	Deciduous Tree
American sloughgrass	BESY	Beckmannia syzigachne	Summer Annual Grass
American vetch	VIAM	Vicia americana	Herbaceous Vine
annual ragweed	AMAR2	Ambrosia artemisiifolia	Summer Annual Forb
Apocynum	APOCY	Apocynum	Summer Perennial Forb
arumleaf arrowhead	SACU	Sagittaria cuneata	Summer Perennial Forb
aster	SYMPH4	Symphotrichum	Summer Perennial Forb
aster	ASTER	Aster	Spring Perennial Forb
autumn onion	ALST	Allium stellatum	Monocot Forb
Baltic rush	JUARL	Juncus balticus	Spring Perennial Grasslike
barnyardgrass	ECCR	Echinochloa crus-galli	Spring Annual Grass(I)
bastard toadflax	COUM	Comandra umbellata	Spring Perennial Forb
bearded wheatgrass	ELCA11	Elymus caninus	Spring Midgrass(I)
bearded wheatgrass	ELTRS	Elymus subsecundus	Summer Perennial Grasslike
bedstraw	GALIU	Galium	Spring Perennial Forb
big bluestem	ANGE	Andropogon gerardii	Summer Tallgrass
black medick	MELU	Medicago lupulina	Summer Annual Forb(I)
blackeyed Susan	RUH12	Rudbeckia hirta	Summer Annual Forb
blacksamson echinacea	ECAN2	Echinacea angustifolia	Summer Perennial Forb
bladderpod	LESQU	Lesquerella	Spring Perennial Forb
blanketflower	GAAR	Gaillardia aristata	Spring Perennial Forb
blazing star	LIATR	Liatris	Summer Perennial Forb
blue grama	BOGR2	Bouteloua gracilis	Summer Shortgrass
blue lettuce	LATA	Lactuca tatarica	Summer Perennial Forb
bluebunch wheatgrass	PSSP6	Pseudoroegneria spicata	Spring Midgrass
Bluegrass	POA	Poa	Spring Shortgrass
bluejoint	CACA4	Calamagrostis canadensis	Spring Midgrass
boxelder	ACNE2	Acer negundo	Deciduous Tree
brittle pricklypear	OPFR	Opuntia fragilis	Cacti
broadleaf cattail	TYLA	Typha latifolia	Spring Perennial Forb
broom snakeweed	GUSA2	Gutierrezia sarothrae	Evergreen Subshrub
Buffalograss	BODA2	Buchloe dactyloides	Summer Stoloniferous Grass
Canada bluegrass	POCO	Poa compressa	Spring Rhizomatous Grass(I)
Canada goldenrod	SOCA6	Solidago canadensis	Summer Perennial Forb
Canada thistle	CIAR4	Cirsium arvense	Summer Perennial Forb(I)
Canada wildrye	ELCA4	Elymus canadensis	Spring Midgrass
Canadian anemone	ANCA8	Anemone canadensis	Spring Perennial Forb
Canadian horseweed	COCA5	Conyza canadensis	Spring Annual Forb



<b>Common Name</b>	<b>Accepted Symbol</b>	<b>Scientific Name</b>	<b>Functional Group</b>
candle anemone	ANCY	Anemone cylindrica	Summer Perennial Forb
catnip	NECA2	Nepeta cataria	Summer Perennial Forb(I)
chairmaker's bulrush	SCAM6	Schoenoplectus americanus	Summer Perennial Grasslike
cheatgrass	BRTE	Bromus tectorum	Spring Annual Grass(I)
chokecherry	PRVI	Prunus virginiana	Deciduous Shrub
cinquefoil	POTEN	Potentilla	Summer Perennial Forb
clustered field sedge	CAPR5	Carex praegracilis	Spring Perennial Grasslike
common chickweed	STME2	Stellaria media	Spring Annual Forb(I)
common cowparsnip	HEMA80	Heracleum maximum	Summer Perennial Forb
common dandelion	TAOF	Taraxacum officinale	Spring Perennial Forb
common hackberry	CEOC	Celtis occidentalis	Deciduous Shrub
common pepperweed	LEDE	Lepidium densiflorum	Spring Annual Forb
common snowberry	SYAL	Symphoricarpos albus	Deciduous Shrub
common spikerush	ELPA3	Eleocharis palustris	Spring Perennial Grasslike
common sunflower	HEAN3	Helianthus annuus	Summer Annual Forb
common yarrow	ACMI2	Achillea millefolium	Spring Perennial Forb
common yellow oxalis	OXST	Oxalis stricta	Summer Perennial Forb
Conyza	CONYZ	Conyza	Spring Annual Forb
cosmopolitan bulrush	SCMA8	Schoenoplectus maritimus	Summer Perennial Grasslike
Crataegus	CRATA	Crataegus	Deciduous Shrub
creeping juniper	JUHO2	Juniperus horizontalis	Evergreen Subshrub
creeping meadow foxtail	ALAR	Alopecurus arundinaceus	Spring Rhizomatous Grass(I)
crested wheatgrass	AGCR	Agropyron cristatum	Spring Midgrass(I)
curly dock	RUCR	Rumex crispus	Spring Perennial Forb(I)
curlycup gumweed	GRSQ	Grindelia squarrosa	Summer Annual Forb
curlytop knotweed	POLA4	Polygonum lapathifolium	Summer Annual Forb
Dalea spp.	DALEA	Dalea	Deciduous Subshrub
dotted blazing star	LIPU	Liatis punctata	Summer Perennial Forb
downy gentian	GEPUS	Gentiana puberulenta	Summer Perennial Forb
dwarf false indigo	AMNA	Amorpha nana	Deciduous Subshrub
eastern pasqueflower	PUPA5	Pulsatilla patens	Spring Perennial Forb
eastern poison ivy	TORA2	Toxicodendron radicans	Deciduous Subshrub
fall rosette grass	DIWI5	Dichanthelium wilcoxianum	Summer Shortgrass
false boneset	BREU	Brickellia eupatorioides	Summer Perennial Forb
false gromwell	ONBEB	Onosmodium molle	Spring Perennial Forb
false indigo bush	AMFR	Amorpha fruticosa	Deciduous Shrub
fescue	FESTU	Festuca	Spring Midgrass
field bindweed	COAR4	Convolvulus arvensis	Summer Perennial Forb(I)
field chickweed	CEAR4	Cerastium arvense	Summer Perennial Forb
field pussytoes	ANNE	Antennaria neglecta	Spring Perennial Forb
field sagewort	ARCA12	Artemisia campestris	Summer Perennial Forb
field sowthistle	SOAR2	Sonchus arvensis	Summer Perennial Forb(I)
fireberry hawthorn	CRCH	Crataegus chrysocarpa	Deciduous Shrub
flax	LINUM	Linum	Spring Perennial Forb
flexile milkvetch	ASFL2	Astragalus flexuosus	Summer Perennial Forb
Flodman's thistle	CIFL	Cirsium flodmanii	Summer Perennial Forb

<b>Common Name</b>	<b>Accepted Symbol</b>	<b>Scientific Name</b>	<b>Functional Group</b>
Forb	2FORB		Spring Perennial Forb
Forb, annual	2FA		Spring Annual Forb
Forb, perennial	2FP		Spring Perennial Forb
fowl bluegrass	POPA2	<i>Poa palustris</i>	Spring Midgrass
fox sedge	CAVU2	<i>Carex vulpinoidea</i>	Spring Perennial Grasslike
foxtail barley	HOJU	<i>Hordeum jubatum</i>	Spring Shortgrass
giant sumpweed	CYXA	<i>Iva xanthifolia</i>	Summer Annual Forb
goatsbeard	TRAGO	<i>Tragopogon</i>	Summer Perennial Forb
golden currant	RIAU	<i>Ribes aureum</i>	Deciduous Shrub
goldenaster	CHRY57	<i>Chrysopsis</i>	Summer Perennial Forb
goldenrod	SOLID	<i>Solidago</i>	Summer Perennial Forb
Grass, annual	2GA		Spring Annual Grass
Grass, perennial	2GP		Summer Perennial Grasslike
Grass-like	2GL		Spring Perennial Grasslike
green ash	FRPE	<i>Fraxinus pennsylvanica</i>	Deciduous Tree
green carpetweed	MOVE	<i>Mollugo verticillata</i>	Spring Annual Forb
green molly	BAAM4	<i>Kochia americana</i>	Evergreen Subshrub
green needlegrass	NAVI4	<i>Nassella viridula</i>	Spring Midgrass
groundplum milkvetch	ASCR2	<i>Astragalus crassicaarpus</i>	Spring Perennial Forb
hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	Spring Perennial Forb
hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	Summer Shortgrass
hardstem bulrush	SCAC3	<i>Schoenoplectus acutus</i>	Spring Perennial Grasslike
Heller's rosette grass	DIOL	<i>Dichanthelium oligosanthes</i>	Spring Midgrass
herb sophia	DESO2	<i>Descurainia sophia</i>	Spring Annual Forb
hoary puccoon	LICA12	<i>Lithospermum canescens</i>	Spring Perennial Forb
Horsetail	EQUIS	<i>Equisetum</i>	Fern
Indiangrass	SONU2	<i>Sorghastrum nutans</i>	Summer Tallgrass
Indianhemp	APCA	<i>Apocynum cannabinum</i>	Spring Midgrass
inland saltgrass	DISP	<i>Distichlis spicata</i>	Summer Rhizomatous Grass
Kentucky bluegrass	POPR	<i>Poa pratensis</i>	Spring Rhizomatous Grass(I)
knotweed	POLYG4	<i>Polygonum</i>	Summer Perennial Forb
lacy tansyaster	MAPI	<i>Machaeranthera pinnatifida</i>	Spring Perennial Forb
lambquarters	CHAL7	<i>Chenopodium album</i>	Spring Annual Forb
lambstongue ragwort	SEIN2	<i>Senecio integerrimus</i>	Spring Perennial Forb
large Indian breadroot	PEES	<i>Pediomelum esculentum</i>	Summer Perennial Forb
leadplant	AMCA6	<i>Amorpha canescens</i>	Deciduous Subshrub
leafy spurge	EUES	<i>Euphorbia esula</i>	Summer Perennial Forb(I)
leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	Summer Perennial Forb
lemon scurfpea	PSLA3	<i>Psoralidium lanceolatum</i>	Spring Perennial Forb
lesser spikemoss	SEDE2	<i>Selaginella densa</i>	Fern
lettuce	LACTU	<i>Lactuca</i>	Summer Annual Forb(I)
lilac penstemon	PEGR5	<i>Penstemon gracilis</i>	Spring Perennial Forb
little bluestem	SCSC	<i>Schizachyrium scoparium</i>	Summer Midgrass
little hogweed	POOL	<i>Portulaca oleracea</i>	Summer Annual Forb(I)
locoweed	OXYTR	<i>Oxytropis</i>	Spring Annual Forb
Lomatium	LOMAT	<i>Lomatium</i>	Spring Perennial Forb

<b>Common Name</b>	<b>Accepted Symbol</b>	<b>Scientific Name</b>	<b>Functional Group</b>
longbract spiderwort	TRBR	Tradescantia bracteata	Summer Perennial Forb
long-stolon sedge	CAIN9	Carex inops	Spring Perennial Grasslike
marsh muhly	MURA	Muhlenbergia racemosa	Summer Rhizomatous Grass
mat muhly	MURI	Muhlenbergia richardsonis	Summer Rhizomatous Grass
mat sandbur	CELO3	Cenchrus longispinus	Summer Annual Forb
Maximilian sunflower	HEMA2	Helianthus maximiliani	Summer Annual Forb
meadow zizia	ZIAP	Zizia aptera	Spring Perennial Forb
milkvetch	ASTRA	Astragalus	Spring Perennial Forb
milkweed	ASCLE	Asclepias	Spring Perennial Forb
mint	MENTH	Mentha	Spring Perennial Forb
Missouri goldenrod	SOMI2	Solidago missouriensis	Summer Perennial Forb
Missouri gooseberry	RIMI	Ribes missouriense	Deciduous Shrub
Missouri milkvetch	ASMI10	Astragalus missouriensis	Spring Perennial Forb
muttongrass	POFE	Poa fendleriana	Spring Shortgrass
narrowleaf goosefoot	CHLE4	Chenopodium leptophyllum	Summer Annual Forb
narrowleaf stoneseed	LIIN2	Lithospermum incisum	Summer Perennial Forb
Nebraska sedge	CANE2	Carex nebrascensis	Spring Perennial Grasslike
needle spikerush	ELAC	Eleocharis acicularis	Spring Perennial Grasslike
needleandthread	HECOC8	Hesperostipa comata ssp. comata	Spring Midgrass
needleandthread	HECO26	Hesperostipa comata	Spring Midgrass
needlegrass	HESPE11	Hesperostipa	Spring Midgrass
needleleaf sedge	CADU6	Carex duriuscula	Summer Perennial Grasslike
New England aster	SYNO2	Symphotrichum novae-angliae	Summer Perennial Forb
northern bedstraw	GABO2	Galium boreale	Spring Perennial Forb
northern reedgrass	CASTI3	Calamagrostis stricta ssp. inexpansa	Spring Perennial Grasslike
Norwegian cinquefoil	PONO3	Potentilla norvegica	Summer Annual Forb
Nuttall's alkaligrass	PUNU2	Puccinellia nuttalliana	Summer Rhizomatous Grass
Nuttall's saltbush	ATNU2	Atriplex nuttallii	Evergreen Subshrub
Nuttall's sensitive-briar	MINU6	Mimosa nuttallii	Summer Perennial Forb
Nuttall's sunflower	HENU	Helianthus nuttallii	Summer Perennial Forb
old man's whiskers	GETR	Geum triflorum	Spring Perennial Forb
Onion spp.	ALLIU	Allium	Spring Perennial Forb
Opuntia spp.	OPUNT	Opuntia	Cacti
orchardgrass	DAGL	Dactylis glomerata	Spring Midgrass(I)
peachleaf willow	SAAM2	Salix amygdaloides	Deciduous Shrub
Pennsylvania cinquefoil	POPE8	Potentilla pensylvanica	Summer Perennial Forb
Pennsylvania sedge	CAPE6	Carex pensylvanica	Spring Perennial Grasslike
pennycress	MICRO18	Microthlaspi	Spring Annual Forb(I)
Penstemon spp.	PENST	Penstemon	Summer Perennial Forb
pepperweed	LEPID	Lepidium	Spring Annual Forb
Philadelphia fleabane	ERPH	Erigeron philadelphicus	Spring Perennial Forb
plains bluegrass	POAR3	Poa arida	Spring Rhizomatous Grass
plains cottonwood	PODEM	Populus deltoides ssp. monilifera	Deciduous Tree
plains milkvetch	ASGI5	Astragalus gilviflorus	Spring Perennial Forb
plains muhly	MUCU3	Muhlenbergia cuspidata	Summer Midgrass

<b>Common Name</b>	<b>Accepted Symbol</b>	<b>Scientific Name</b>	<b>Functional Group</b>
plains pricklypear	OPPO	Opuntia polyacantha	Cacti
plains reedgrass	CAMO	Calamagrostis montanensis	Spring Rhizomatous Grass
pleated gentian	GEAF	Gentiana affinis	Summer Perennial Forb
porcupinegrass	HESP11	Hesperostipa spartea	Spring Midgrass
povertyweed	IVAX	Iva axillaris	Spring Perennial Forb
prairie bluebells	MELA3	Mertensia lanceolata	Spring Perennial Forb
prairie cordgrass	SPPE	Spartina pectinata	Summer Tallgrass
prairie dropseed	SPHE	Sporobolus heterolepis	Summer Midgrass
prairie fleabane	ERST3	Erigeron strigosus	Summer Annual Forb
prairie ironweed	VEFA2	Vernonia fasciculata	Summer Perennial Forb
prairie Junegrass	KOMA	Koeleria macrantha	Spring Midgrass
prairie rose	ROAR3	Rosa arkansana	Deciduous Subshrub
prairie sagewort	ARFR4	Artemisia frigida	Evergreen Subshrub
prairie sandreed	CALO	Calamovilfa longifolia	Summer Tallgrass
prairie spiderwort	TROC	Tradescantia occidentalis	Summer Perennial Forb
prickly lettuce	LASE	Lactuca serriola	Spring Annual Forb(I)
purple dalea	DALA4	Dalea lasiathera	Spring Perennial Forb
purple locoweed	OXLA3	Oxytropis lambertii	Summer Perennial Forb
purple milkvetch	ASAG2	Astragalus agrestis	Spring Perennial Forb
purple prairie clover	DAPU5	Dalea purpurea	Summer Perennial Forb
purple threeawn	ARPU9	Aristida purpurea	Summer Midgrass
Pursh seepweed	SUCA2	Suaeda calceoliformis	Summer Annual Forb
pussytoes	ANTEN	Antennaria	Spring Perennial Forb
quackgrass	ELRE4	Elymus repens	Spring Rhizomatous Grass(I)
Ranunculus	RANUN	Ranunculus	Spring Perennial Forb
rayless sunflower	HERA	Helianthus radula	Summer Perennial Forb
red threeawn	ARPUL	Aristida purpurea var. longiseta	Summer Shortgrass
redosier dogwood	COSE16	Cornus sericea	Deciduous Shrub
redwool plantain	PLER	Plantago eriopoda	Summer Perennial Forb
reed canarygrass	PHAR3	Phalaris arundinacea	Spring Rhizomatous Grass
reedgrass	CALAM	Calamagrostis	Spring Rhizomatous Grass
river bulrush	SCFL11	Schoenoplectus fluviatilis	Summer Perennial Grasslike
Rocky Mountain beeplant	CLSE	Cleome serrulata	Spring Perennial Forb
rose	ROSA5	Rosa	Deciduous Shrub
rosy pussytoes	ANRO2	Antennaria rosea	Summer Perennial Forb
rough bentgrass	AGSC5	Agrostis scabra	Spring Midgrass
rough false pennyroyal	HEHI	Hedeoma hispida	Summer Annual Forb
rush	JUNCU	Juncus	Spring Perennial Grasslike
rush skeletonplant	LYJU	Lygodesmia juncea	Spring Perennial Forb
Russian thistle	SAKA	Salsola kali	Spring Annual Forb(I)
saline saltbush	ATSU2	Atriplex subspicata	Spring Annual Forb
Salix	SALIX	Salix	Deciduous Tree
sand bluestem	ANHA	Andropogon hallii	Summer Tallgrass
sand dropseed	SPCR	Sporobolus cryptandrus	Summer Midgrass
Sandberg bluegrass	POSE	Poa secunda	Spring Shortgrass
sanddune wallflower	ERCA14	Erysimum capitatum	Spring Perennial Forb
sanddune wallflower	ERCAC	Erysimum capitatum var. capitatum	Spring Perennial Forb

<b>Common Name</b>	<b>Accepted Symbol</b>	<b>Scientific Name</b>	<b>Functional Group</b>
Saskatoon serviceberry	AMAL2	Amelanchier alnifolia	Deciduous Shrub
scaly blazing star	LISQ	Liatris squarrosa	Summer Perennial Forb
scarlet beeblossom	GACO5	Gaura coccinea	Summer Perennial Forb
scarlet globemallow	SPCO	Sphaeralcea coccinea	Spring Perennial Forb
Schweinitz's flatsedge	CYSC3	Cyperus schweinitzii	Summer Perennial Grasslike
scouringrush horsetail	EQHY	Equisetum hyemale	Fern
scratchgrass	MUAS	Muhlenbergia asperifolia	Summer Rhizomatous Grass
Scribner's rosette grass	DIOLS	Dichanthelium oligosanthos var. scribnerianum	Summer Midgrass
scurfpea	PSORA2	Psoralidium	Spring Perennial Forb
sedge	CAREX	Carex	Spring Perennial Grasslike
sedge	CYPER	Cyperus	Summer Perennial Grasslike
seepweed	SUAED	Suaeda	Evergreen Subshrub
sheep fescue	FEOV	Festuca ovina	Spring Midgrass
shortawn foxtail	ALAE	Alopecurus aequalis	Spring Midgrass
shortbeak sedge	CABR10	Carex brevior	Spring Perennial Grasslike
shortbristle nneedleandthread	HECU9	Hesperostipa curtisetata	Spring Midgrass
shy wallflower	ERIN7	Erysimum inconspicuum	Spring Perennial Forb
Siberian elm	ULPU	Ulmus pumila	Deciduous Tree
sideoats grama	BOCU	Bouteloua curtipendula	Summer Midgrass
silky prairie clover	DAVI	Dalea villosa	Summer Perennial Forb
silver cinquefoil	POAR8	Potentilla argentea	Summer Perennial Forb(I)
silverberry	ELCO	Elaeagnus commutata	Deciduous Shrub
silverleaf Indian breadroot	PEAR6	Pediomelum argophyllum	Summer Perennial Forb
silverscale saltbush	ATAR2	Atriplex argentea	Summer Annual Forb
silverweed cinquefoil	ARAN7	Argentina anserina	Spring Perennial Forb
Sisyrinchium	SISYR	Sisyrinchium	Summer Perennial Forb
sixweeks fescue	VUOC	Vulpia octoflora	Spring Annual Grass
skeletonplant	LYGOD	Lygodesmia	Spring Perennial Forb
skunkbush sumac	RHTR	Rhus trilobata	Deciduous Shrub
sleepydaisy	XANTH	Xanthisma	Spring Perennial Forb
slender cinquefoil	POGR9	Potentilla gracilis	Spring Perennial Forb
slender cinquefoil	POGRF2	Potentilla gracilis var. fastigiata	Spring Perennial Forb
slender goldenweed	MAGR10	Machaeranthera gracilis	Spring Annual Forb
slender milkvetch	ASGR3	Astragalus gracilis	Spring Perennial Forb
slender wheatgrass	ELTR7	Elymus trachycaulus	Spring Midgrass
slimflower scurfpea	PSTE5	Psoralidium tenuiflorum	Summer Perennial Forb
slimstem reedgrass	CAST36	Calamagrostis stricta	Spring Midgrass
smooth blue aster	SYLA3	Symphotrichum laeve	Summer Perennial Forb
smooth brome	BRIN2	Bromus inermis	Spring Rhizomatous Grass(I)
smooth horsetail	EQLA	Equisetum laevigatum	Fern
smoothsheath sedge	CALA14	Carex laevivaginata	Summer Perennial Grasslike
snowberry	SYMPH	Symphoricarpos	Deciduous Shrub

<b>Common Name</b>	<b>Accepted Symbol</b>	<b>Scientific Name</b>	<b>Functional Group</b>
soapweed yucca	YUGL	Yucca glauca	Monocot Shrub
spiderwort	TRADE	Tradescantia	Summer Perennial Forb
spikeoat	AVHO3	Helictotrichon hookeri	Spring Midgrass
spikerush	ELEOC	Eleocharis	Spring Perennial Grasslike
spiny phlox	PHHO	Phlox hoodii	Spring Perennial Forb
spinystar	ESVIV	Escobaria vivipara var. vivipara	Cacti
Sporobolus spp.	SPORO	Sporobolus	Summer Midgrass
sticky cinquefoil	POGL9	Potentilla glandulosa	Summer Perennial Forb
stiff goldenrod	OLRI	Oligoneuron rigidum	Summer Perennial Forb
stiff sunflower	HEPA19	Helianthus pauciflorus	Summer Perennial Forb
stiffstem flax	LIRI	Linum rigidum	Summer Annual Forb
streamside fleabane	ERGLP	Erigeron glabellus var. pubescens	Spring Perennial Forb
Subshrub (<.5m)	2SUBS		Deciduous Subshrub
sun sedge	CAINH2	Carex inops ssp. heliophila	Spring Perennial Grasslike
sunflower	HELIA3	Helianthus	Summer Annual Forb
sweetclover	MELIL	Melilotus	Spring Annual Forb(I)
sweetclover	MEOF	Melilotus officinalis	Summer Perennial Forb(I)
switchgrass	PAVI2	Panicum virgatum	Summer Tallgrass
tall cinquefoil	POAR7	Potentilla arguta	Summer Perennial Forb
tall yellow sweetclover	MEAL3	Melilotus altissimus	Summer Perennial Forb(I)
tarragon	ARDR4	Artemisia dracunculus	Summer Perennial Forb
textile onion	ALTE	Allium textile	Spring Perennial Forb
thickspike wheatgrass	ELLA3	Elymus lanceolatus	Spring Rhizomatous Grass
thickspike wheatgrass	ELLAL	Elymus lanceolatus ssp. lanceolatus	Spring Rhizomatous Grass
thistle	CIRSI	Cirsium	Summer Perennial Forb
threadleaf sedge	CAFI	Carex filifolia	Spring Perennial Grasslike
Threeawn	ARIST	Aristida	Summer Midgrass
Tree	2TREE		Deciduous Tree
triangle orache	ATPR	Atriplex prostrata	Summer Annual Forb
tufted hairgrass	DECE	Deschampsia caespitosa	Spring Annual Grass
tumblegrass	SCPA	Schedonnardus paniculatus	Summer Midgrass
upright prairie coneflower	RACO3	Ratibida columnifera	Summer Perennial Forb
velvety goldenrod	SOMO	Solidago mollis	Summer Perennial Forb
vetch	VICIA	Vicia	Herbaceous Vine
violet woodsorrel	OXVI	Oxalis violacea	Spring Perennial Forb
wavyleaf thistle	CIUN	Cirsium undulatum	Summer Perennial Forb
western dock	RUAQ	Rumex aquaticus	Summer Perennial Forb
western ragweed	AMPS	Ambrosia psilostachya	Summer Perennial Forb
western sandcherry	PRPUB	Prunus pumila var. besseyi	Deciduous Shrub
western snowberry	SYOC	Symphoricarpos occidentalis	Deciduous Shrub
western wheatgrass	PASM	Pascopyrum smithii	Spring Rhizomatous Grass
western yarrow	ACMIO	Achillea millefolium var. occidentalis	Spring Perennial Forb
wheat sedge	CAAT2	Carex atherodes	Spring Perennial Grasslike
white heath aster	SYER	Symphyotrichum ericoides	Summer Perennial Forb
white panicle aster	SYLA6	Symphyotrichum lanceolatum	Summer Perennial Forb
white pasqueflower	PUOC	Pulsatilla occidentalis	Spring Perennial Forb
white prairie aster	SYFA	Symphyotrichum falcatum	Summer Perennial Forb
white sagebrush	ARLUL2	Artemisia ludoviciana ssp. ludoviciana	Summer Perennial Forb
white sagebrush	ARLU	Artemisia ludoviciana	Summer Perennial Forb

<b>Common Name</b>	<b>Accepted Symbol</b>	<b>Scientific Name</b>	<b>Functional Group</b>
whorled milkweed	ASVE	<i>Asclepias verticillata</i>	Summer Perennial Forb
whorled milkwort	POVE	<i>Polygala verticillata</i>	Summer Annual Forb
whorled milkwort	POAM9	<i>Polygala ambigua</i>	Summer Annual Forb
wild mint	MEAR4	<i>Mentha arvensis</i>	Summer Perennial Forb
windflower	ANEMO	<i>Anemone</i>	Summer Perennial Forb
witchgrass	PACA6	<i>Panicum capillare</i>	Summer Annual Grass
wood lily	LIPH	<i>Lilium philadelphicum</i>	Summer Perennial Forb
Woods' rose	ROWO	<i>Rosa woodsii</i>	Deciduous Shrub
woolly plantain	PLPA2	<i>Plantago patagonica</i>	Spring Annual Forb
woolly sedge	CAPE42	<i>Carex pellita</i>	Spring Perennial Grasslike
wormwood	ARAB3	<i>Artemisia absinthium</i>	Spring Perennial Forb(I)
Xanthium	XANTH2	<i>Xanthium</i>	Spring Annual Forb
yellow owl's-clover	ORLU2	<i>Orthocarpus luteus</i>	Spring Annual Forb
yellow salsify	TRDU	<i>Tragopogon dubius</i>	Spring Annual Forb(I)
yellow sundrops	CASE12	<i>Calylophus serrulatus</i>	Summer Perennial Forb

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## ACKNOWLEDGEMENTS

This material is based upon work supported by the Conservation Effects Assessment Project Grazing Lands component (CEAP-GL), Natural Resources Conservation Service, U.S. Department of Agriculture, under agreement number 67-3A75-16-794.

It was developed in Calendar Year 2017 using NRI Rangeland On-Site Data from 2004-2014, and ecological site and soil survey data available in that year.

Many highly dedicated and talented individuals helped with this project. At the risk of leaving out some of the individuals who contributed, Loretta Metz, Steve Barker, and Pat Shaver would like to thank the following people for their input and support.

Brandon Bestelmeyer, ARS Las Cruces NM  
Carol Peterson, ESI Specialist, Jamestown, ND  
Chris Tecklenburg, Ecological Site Inventory Specialist, SSR 5, Hutchinson, KS  
Chuck Stanley, Rangeland Management Specialist, CNTSC, Fort Worth, TX  
Craig Stange, State Forester, Bismarck, ND  
Curt Bradbury, State Biologist, Bismarck, ND  
Dave Dewald, NRCS ACES, ND  
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Jeff Printz, NRCS ACES, ND  
Jody Forman, Bowman, ND  
Joel Brown, NRCS NEST, Las Cruces, NM  
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Steve Sieler, State Soil Liaison, Bismarck, ND  
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