

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

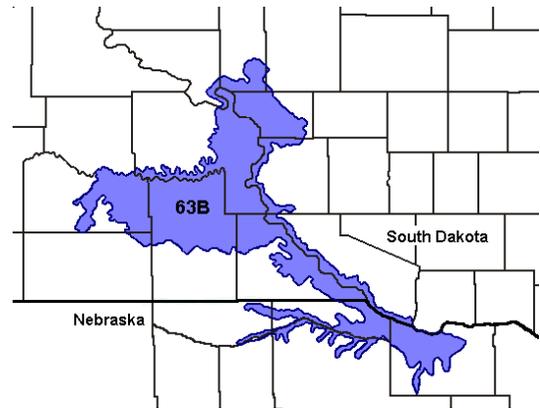
Site Name: Loamy Overflow

Site ID: R063BY020SD

Major Land Resource Area: 63B – Southern Rolling Pierre Shale Plains

Physiographic Features

This site occurs on nearly level lowlands and drainageways.



Landform: flood plain, swale, plain

Aspect: N/A

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	1300	2000
Slope (percent):	1	3
Water Table Depth (inches):	48	80
Flooding:		
Frequency:	Rare	Frequent
Duration:	Very brief	Brief
Ponding:		
Depth (inches):	None	None
Frequency:	None	None
Duration:	None	None
Runoff Class:	Negligible	Medium

Climatic Features

MLRA 63B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 19 to 24 inches per year. The average annual temperature is about 48° F. January is the coldest month with average temperatures ranging from about 15° F (Stephan, SD) to about 22° F (Winner, SD). July is the warmest month with temperatures averaging from about 73° F (Stephan, SD) to about 76° F (Winner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 56° F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to 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 cool season plants begins in early to mid March, slowing or ceasing in late June. Warm season plants begin growth about mid May and continue to early or mid September. Green up of cool season plants may occur in September and October when adequate soil moisture is present.

	<u>Minimum</u>	<u>Maximum</u>
Frost-free period (days):	130	162
Freeze-free period (days):	148	180
Mean Annual Precipitation (inches):	19	24

Average Monthly Precipitation (inches) and Temperature (°F):

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.39	0.45	3.1	33.0
February	0.54	0.71	8.9	38.7
March	1.11	1.59	18.7	47.5
April	1.90	2.72	31.4	62.0
May	2.80	3.40	42.7	73.1
June	3.05	3.60	53.0	82.6
July	2.70	3.16	58.5	89.9
August	2.03	2.69	56.2	88.4
September	1.76	2.51	45.8	78.9
October	1.47	1.55	33.2	65.7
November	0.59	0.94	19.2	47.8
December	0.35	0.62	8.1	36.5

Climate Stations		Period	
Station ID	Location or Name	From	To
NE5040	Lynch	1948	2007
NE5960	Niobrara	1948	2005
SD7992	Stephan	1948	2007
SD9367	Winner	1948	2007

For local climate stations that may be more representative, refer to <http://www.wcc.nrcs.usda.gov>.

Riparian and Wetland Features

Stream Type: B6, C6
(Rosgen System)

Representative Soil Features

The soils in this site are moderately well to well drained and formed in alluvium or loess. The silt loam to silty clay loam surface layer is 4 to 20 inches thick. The soils have a moderately slow to slow infiltration rate. This site should show no evidence of rills, wind scoured areas or pedestalled plants. If present, water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and/or production.

Access Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov/app/>) for specific local soils information.

Parent Material Kind: alluvium, loess
Parent Material Origin: sedimentary, unspecified
Surface Texture: silt loam, silty clay loam
Surface Texture Modifier: none
Subsurface Texture Group: loamy
Surface Fragments ≤ 3" (% Cover): 0-3
Surface Fragments > 3" (%Cover): 0
Subsurface Fragments ≤ 3" (% Volume): 0-4
Subsurface Fragments > 3" (% Volume): 0-2

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	moderately well	well
Permeability Class:	slow	moderately slow
Depth (inches):	80	80
Electrical Conductivity (mmhos/cm)*:	0	4
Sodium Absorption Ratio*:	0	1
Soil Reaction (1:1 Water)*:	5.6	8.4
Soil Reaction (0.1M CaCl₂)*:	NA	NA
Available Water Capacity (inches)*:	7	8
Calcium Carbonate Equivalent (percent)*:	0	15

* - These attributes represent from 0-40 inches or to the first restrictive layer.

Plant Communities

Ecological Dynamics of the Site:

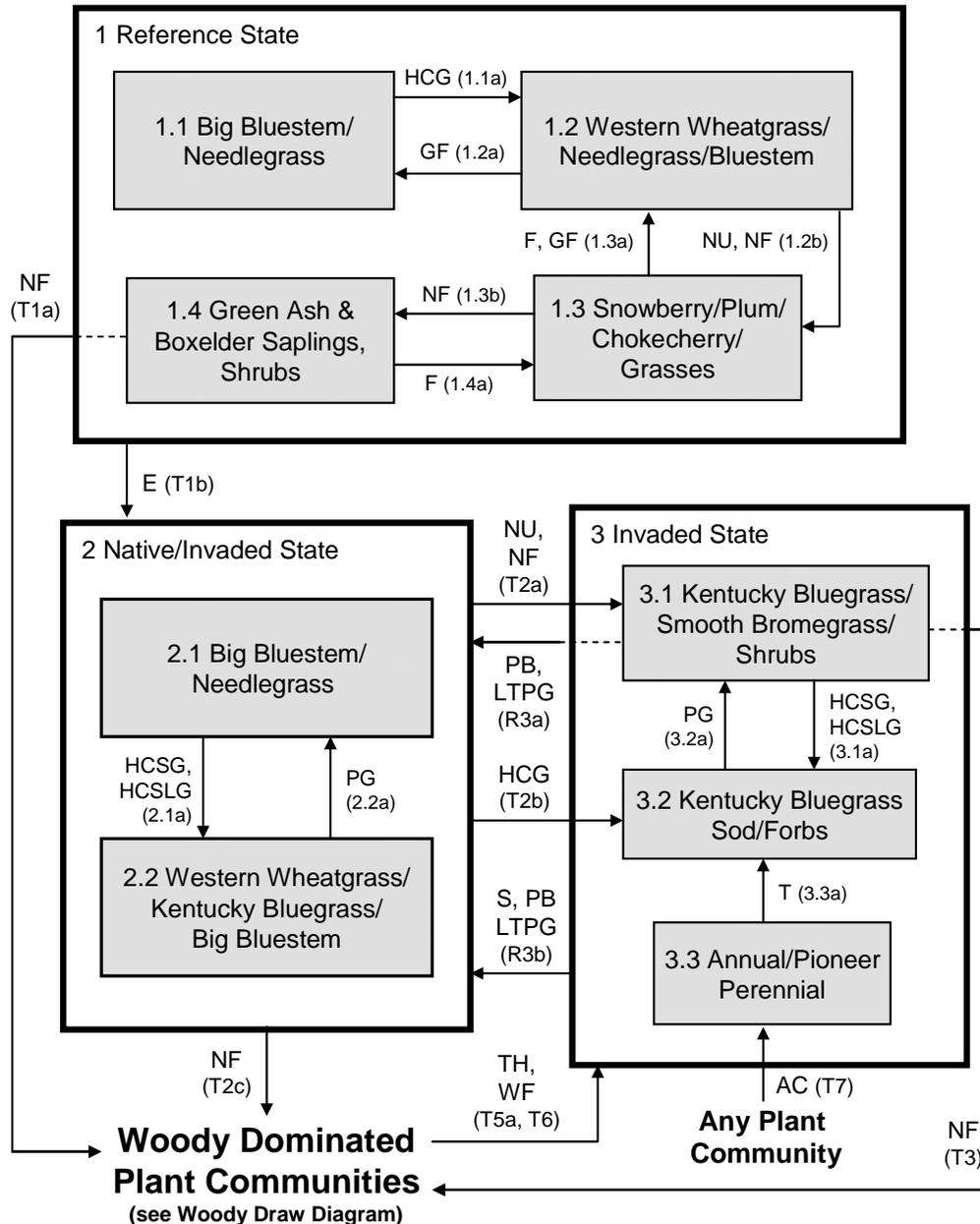
This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

Continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the climax plant community. Species such as western wheatgrass will initially increase. Big bluestem, little bluestem and green needlegrass will decrease in frequency and production. Heavy continuous grazing causes Kentucky bluegrass to increase and eventually develops into a sod condition. Extended periods of non-use and no fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and smooth brome grass. In time, shrubs such as western snowberry and chokecherry will also increase. Flooding can create conditions suitable for establishment of various tree species, which if attaining sapling height may grow to maturity and develop a tree overstory.

The plant community upon which interpretations are primarily based is the Big Bluestem/Needlegrass Plant Community Phase, which is considered to be climax. The climax community has been determined by studying rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

Plant Communities and Transitional Pathways



Refer to narratives for descriptions of transitions and pathways: **AC** – Abandonment of cropping; **E** – Encroachment of non-native species; **F** – Fire; **GF** – Grazing and fire at normal disturbance levels; **HCG** – Heavy continuous grazing; **HCSG** – Heavy continuous seasonal grazing; **HCSLG** – Heavy continuous season-long grazing; **LTPG** – Long-term prescribed grazing; **NF** – No fire; **NU** – Non-use; **PB** – Prescribed burning; **PG** – Prescribed grazing; **S** – Seeding; **T** – Time; **TH** – Timber harvest; **WF** – Wildfire.

Plant Community Composition and Group Annual Production

			1.1 Big Bluestem/Needlegrass		
COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				2720 - 3060	80 - 90
TALL WARM-SEASON GRASSES			1	1020 - 1530	30 - 45
big bluestem	Andropogon gerardii	ANGE	1	850 - 1530	25 - 45
switchgrass	Panicum virgatum	PAVI2	1	102 - 510	3 - 15
Indiangrass	Sorghastrum nutans	SONU2	1	68 - 340	2 - 10
green muhly	Muhlenbergia racemosa	MURA	1	0 - 170	0 - 5
COOL-SEASON BUNCHGRASSES			2	340 - 680	10 - 20
green needlegrass	Nassella viridula	NAVI4	2	170 - 680	5 - 20
porcupine grass	Hesperostipa spartea	HESP11	2	68 - 340	2 - 10
Canada wildrye	Elymus canadensis	ELCA4	2	0 - 170	0 - 5
WHEATGRASS			3	170 - 510	5 - 15
western wheatgrass	Pascopyrum smithii	PASM	3	170 - 510	5 - 15
slender wheatgrass	Elymus trachycaulus	ELTR7	3	0 - 170	0 - 5
MID WARM-SEASON GRASSES			4	170 - 510	5 - 15
little bluestem	Schizachyrium scoparium	SCSC	4	170 - 510	5 - 15
sideoats grama	Bouteloua curtipendula	BOCU	4	68 - 340	2 - 10
OTHER NATIVE GRASSES			5	68 - 170	2 - 5
prairie junegrass	Koeleria macrantha	KOMA	5	34 - 102	1 - 3
Scribner panicum	Dichanthelium oligosanthes var. scribnerianum	DIOLS	5	0 - 68	0 - 2
other grasses		2GRAM	5	34 - 170	1 - 5
GRASS-LIKES			6	170 - 340	5 - 10
sedge	Carex spp.	CAREX	6	68 - 340	2 - 10
other grass-likes		2GL	6	0 - 102	0 - 3
FORBS			8	170 - 340	5 - 10
American licorice	Glycyrrhiza lepidota	GLLE3	8	0 - 68	0 - 2
blue verbena	Verbena hastata	VEHA2	8	0 - 34	0 - 1
cudweed sagewort	Artemisia ludoviciana	ARLU	8	34 - 102	1 - 3
dotted gayfeather	Liatris punctata	LIPU	8	34 - 68	1 - 2
false boneset	Brickellia eupatorioides	BREU	8	0 - 68	0 - 2
false Solomon's-seal	Maianthemum stellatum	MAST4	8	0 - 34	0 - 1
flatspine stickseed	Lappula occidentalis	LAOC3	8	0 - 34	0 - 1
heartleaf Alexanders	Zizia aptera	ZIAP	8	0 - 34	0 - 1
heath aster	Symphyotrichum ericoides	SYER	8	34 - 68	1 - 2
Illinois bundleflower	Desmanthus illinoensis	DEIL	8	0 - 34	0 - 1
Maximilian sunflower	Helianthus maximiliani	HEMA2	8	34 - 102	1 - 3
Missouri goldenrod	Solidago missouriensis	SOMI2	8	34 - 68	1 - 2
northern bedstraw	Galium boreale	GABO2	8	0 - 34	0 - 1
purple prairie clover	Dalea purpurea	DAPU5	8	0 - 34	0 - 1
scarlet gaura	Gaura coccinea	GACO5	8	0 - 34	0 - 1
scurfpea	Psoralegium spp.	PSORA2	8	34 - 68	1 - 2
wavyleaf thistle	Cirsium undulatum	CIUN	8	34 - 68	1 - 2
western ragweed	Ambrosia psilostachya	AMPS	8	34 - 68	1 - 2
western yarrow	Achillea millefolium var. occidentalis	ACMIO	8	34 - 68	1 - 2
native forbs		2FN	8	34 - 102	1 - 3
SHRUBS			9	68 - 272	2 - 8
American plum	Prunus americana	PRAM	9	0 - 102	0 - 3
chokecherry	Prunus virginiana	PRVI	9	0 - 102	0 - 3
golden currant	Ribes aureum	RIAU	9	0 - 102	0 - 3
leadplant	Amorpha canescens	AMCA6	9	34 - 102	1 - 3
poison ivy	Toxicodendron rydbergii	TORY	9	34 - 68	1 - 2
rose	Rosa spp.	ROSA5	9	34 - 68	1 - 2
western snowberry	Symphoricarpos occidentalis	SYOC	9	34 - 136	1 - 4
other shrubs		2SHRUB	9	0 - 102	0 - 3
TREES			10	0 - 68	0 - 2
American elm	Ulmus americana	ULAM	10	0 - 68	0 - 2
boxelder	Acer negundo	ACNE2	10	0 - 68	0 - 2
bur oak	Quercus macrocarpa	QUMA2	10	0 - 68	0 - 2
green ash	Fraxinus pennsylvanica	FRPE	10	0 - 68	0 - 2
other trees		2TREE	10	0 - 68	0 - 2

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	2385 -	2941	-3415
FORBS	150 -	255	-400
SHRUBS	65 -	170	-315
TREES	0 -	34	-70
TOTAL	2600 -	3400	-4200

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SYMBOL	1.1 Big Bluestem/ Needlegrass			2.2 Western Wheatgrass/ Kentucky Bluegrass/Big Bluestem			3.1 Kentucky Bluegrass/ Smooth Bromegrass/Shrubs			3.2 Kentucky Bluegrass Sod/ Forbs		
		Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES			2720 - 3060	80 - 90		2240 - 2520	80 - 90		1820 - 2240	65 - 80		1260 - 1530	70 - 85
TALL WARM-SEASON GRASSES		1	1020 - 1530	30 - 45	1	56 - 420	2 - 15	1	0 - 140	0 - 5	1		
big bluestem	ANGE	1	850 - 1530	25 - 45	1	56 - 420	2 - 15	1	0 - 140	0 - 5			
switchgrass	PAVI2	1	102 - 510	3 - 15	1	0 - 140	0 - 5	1	0 - 56	0 - 2			
Indiangrass	SONU2	1	68 - 340	2 - 10	1	0 - 84	0 - 3						
green muhly	MURA	1	0 - 170	0 - 5									
COOL-SEASON BUNCHGRASSES		2	340 - 680	10 - 20	2	56 - 280	2 - 10	2	0 - 280	0 - 10	2	0 - 36	0 - 2
green needlegrass	NAVI4	2	170 - 680	5 - 20	2	28 - 224	1 - 8	2	0 - 280	0 - 10	2	0 - 36	0 - 2
porcupine grass	HESP11	2	68 - 340	2 - 10	2	0 - 140	0 - 5						
Canada wildrye	ELCA4	2	0 - 170	0 - 5	2	0 - 56	0 - 2	2	0 - 28	0 - 1			
WHEATGRASS		3	170 - 510	5 - 15	3	420 - 840	15 - 30	3	0 - 280	0 - 10	3	0 - 90	0 - 5
western wheatgrass	PASM	3	170 - 510	5 - 15	3	420 - 840	15 - 30	3	0 - 280	0 - 10	3	0 - 90	0 - 5
slender wheatgrass	ELTR7	3	0 - 170	0 - 5									
MID WARM-SEASON GRASSES		4	170 - 510	5 - 15	4	0 - 140	0 - 5	4					
little bluestem	SCSC	4	170 - 510	5 - 15	4	0 - 140	0 - 5						
sideoats grama	BOCU	4	68 - 340	2 - 10	4	0 - 140	0 - 5						
OTHER NATIVE GRASSES		5	68 - 170	2 - 5	5	56 - 140	2 - 5	5	0 - 140	0 - 5	5	0 - 54	0 - 3
prairie junegrass	KOMA	5	34 - 102	1 - 3	5	28 - 56	1 - 2	5	0 - 28	0 - 1	5	0 - 18	0 - 1
Scribner panicum	DIOLS	5	0 - 68	0 - 2	5	0 - 84	0 - 3	5	0 - 28	0 - 1	5	0 - 18	0 - 1
other grasses	2GRAM	5	34 - 170	1 - 5	5	28 - 140	1 - 5	5	0 - 140	0 - 5	5	0 - 54	0 - 3
GRASS-LIKES		6	170 - 340	5 - 10	6	56 - 280	2 - 10	6	28 - 140	1 - 5	6	90 - 270	5 - 15
sedge	CAREX	6	68 - 340	2 - 10	6	56 - 280	2 - 10	6	28 - 140	1 - 5	6	90 - 270	5 - 15
other grass-likes	2GL	6	0 - 102	0 - 3	6	0 - 84	0 - 3	6	0 - 56	0 - 2	6	0 - 90	0 - 5
OTHER NATIVE GRASSES		7			7	280 - 560	10 - 20	7	700 - 1400	25 - 50	7	720 - 1170	40 - 65
annual bromegrass	BROMU				7	0 - 140	0 - 5	7	0 - 140	0 - 5	7	0 - 144	0 - 8
Kentucky bluegrass	POPR				7	280 - 560	10 - 20	7	280 - 1120	10 - 40	7	630 - 1170	35 - 65
smooth bromegrass	BRIN2				7	28 - 224	1 - 8	7	280 - 1120	10 - 40	7	0 - 144	0 - 8
FORBS		8	170 - 340	5 - 10	8	140 - 280	5 - 10	8	140 - 280	5 - 10	8	180 - 360	10 - 20
American licorice	GLLE3	8	0 - 68	0 - 2	8	0 - 84	0 - 3	8	0 - 56	0 - 2			
blue verbena	VEHA2	8	0 - 34	0 - 1	8	0 - 28	0 - 1	8	0 - 28	0 - 1			
cudweed sagewort	ARLU	8	34 - 102	1 - 3	8	28 - 112	1 - 4	8	28 - 140	1 - 5	8	18 - 108	1 - 6
dotted gayfeather	LIPU	8	34 - 68	1 - 2	8	0 - 28	0 - 1						
false boneset	BREU	8	0 - 68	0 - 2									
false Solomon's-seal	MAST4	8	0 - 34	0 - 1									
flatspine stickseed	LAOC3	8	0 - 34	0 - 1									
heartleaf Alexanders	ZIAP	8	0 - 34	0 - 1									
heath aster	SYER	8	34 - 68	1 - 2	8	28 - 84	1 - 3	8	28 - 84	1 - 3	8	18 - 72	1 - 4
Illinois bundleflower	DEIL	8	0 - 34	0 - 1									
Maximilian goldenflower	HEMA2	8	34 - 102	1 - 3	8	0 - 28	0 - 1						
Missouri goldenrod	SOMI2	8	34 - 68	1 - 2	8	28 - 84	1 - 3	8	28 - 84	1 - 3	8	18 - 72	1 - 4
northern bedstraw	GABO2	8	0 - 34	0 - 1									
purple prairie clover	DAPU5	8	0 - 34	0 - 1									
scarlet gaura	GACO5	8	0 - 34	0 - 1									
scurfpea	PSORA2	8	34 - 68	1 - 2	8	28 - 56	1 - 2	8	0 - 56	0 - 2			
wavyleaf thistle	CIUN	8	34 - 68	1 - 2	8	28 - 56	1 - 2	8	28 - 56	1 - 2	8	0 - 18	0 - 1
western ragweed	AMPS	8	34 - 68	1 - 2	8	28 - 84	1 - 3	8	28 - 84	1 - 3	8	18 - 126	1 - 7
western yarrow	ACMO	8	34 - 68	1 - 2	8	28 - 84	1 - 3	8	28 - 56	1 - 2	8	18 - 90	1 - 5
native forbs	2FN	8	34 - 102	1 - 3	8	28 - 56	1 - 2	8	0 - 56	0 - 2	8	0 - 54	0 - 3
introduced forbs	2FI				8	0 - 84	0 - 3	8	0 - 140	0 - 5	8	54 - 270	3 - 15
SHRUBS		9	68 - 272	2 - 8	9	56 - 280	2 - 10	9	280 - 560	10 - 20	9	36 - 144	2 - 8
American plum	PRAM	9	0 - 102	0 - 3	9	0 - 84	0 - 3	9	0 - 224	0 - 8	9	0 - 36	0 - 2
chokecherry	PRVI	9	0 - 102	0 - 3	9	0 - 56	0 - 2	9	0 - 140	0 - 5			
golden currant	RIAU	9	0 - 102	0 - 3	9	0 - 56	0 - 2	9	0 - 140	0 - 5			
leadplant	AMCA6	9	34 - 102	1 - 3	9	0 - 56	0 - 2	9	0 - 84	0 - 3			
poison ivy	TORY	9	34 - 68	1 - 2	9	28 - 84	1 - 3	9	28 - 112	1 - 4	9	0 - 54	0 - 3
rose	ROSA5	9	34 - 68	1 - 2	9	28 - 56	1 - 2	9	28 - 84	1 - 3	9	18 - 54	1 - 3
western snowberry	SYOC	9	34 - 136	1 - 4	9	28 - 168	1 - 6	9	28 - 420	1 - 15	9	18 - 90	1 - 5
other shrubs	2SHRUB	9	0 - 102	0 - 3	9	0 - 84	0 - 3	9	0 - 140	0 - 5	9	0 - 36	0 - 2
TREES		10	0 - 68	0 - 2	10	0 - 56	0 - 2	10	0 - 112	0 - 4	10	0 - 36	0 - 2
American elm	ULAM	10	0 - 68	0 - 2	10	0 - 56	0 - 2	10	0 - 112	0 - 4	10	0 - 36	0 - 2
boxelder	ACNE2	10	0 - 68	0 - 2	10	0 - 56	0 - 2	10	0 - 112	0 - 4	10	0 - 36	0 - 2
bur oak	QUMA2	10	0 - 68	0 - 2	10	0 - 56	0 - 2	10	0 - 112	0 - 4	10	0 - 36	0 - 2
green ash	FRPE	10	0 - 68	0 - 2	10	0 - 56	0 - 2	10	0 - 112	0 - 4	10	0 - 36	0 - 2
other trees	2TREE	10	0 - 68	0 - 2	10	0 - 56	0 - 2	10	0 - 112	0 - 4	10	0 - 36	0 - 2
Annual Production lbs./acre			LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH
GRASSES & GRASS-LIKES			2385 - 2941 - 3415		1820 - 2394 - 2700		1635 - 2114 - 2285		1005 - 1422 - 1780				
FORBS			150 - 255 - 400		125 - 210 - 320		125 - 210 - 320		160 - 270 - 420				
SHRUBS			65 - 170 - 315		55 - 168 - 320		240 - 420 - 670		35 - 90 - 160				
TREES			0 - 34 - 70		0 - 28 - 60		0 - 56 - 125		0 - 18 - 40				
TOTAL			2600 - 3400 - 4200		2000 - 2800 - 3400		2000 - 2800 - 3400		1200 - 1800 - 2400				

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value. Refer to PLANTS database for scientific names and codes: <http://plants.usda.gov>

Plant Community and Vegetation State Narratives

Reference State (State 1)

This state description represents the natural range of variability that dominated the dynamics of this ecological site. Historically, this state ranged from a tall, warm-season grass dominated site to one dominated by deciduous saplings and shrubs depending upon disturbance regime. The primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Dominance during the herbaceous phases of this state shifted between warm-season and cool-season grasses. Although slight shifts may occurred in timing of energy capture, hydrologic function and nutrient cycling between plant community phases within the Reference State, overall the ecological processes were functioning at near optimum levels. High basal density and deep root systems resulted in low runoff rates and high infiltration rates.

Small areas of trees and shrubs may have existed within this state due to irregularity of burn patterns. Small areas which escaped fire may have permitted trees/shrubs to become established. These areas may have served as a seed source for further expansion of the woody dominated plant community as the fire frequency was altered after settlement.

1.1 Bluestem/Needlegrass Plant Community Phase

The plant community upon which interpretations are primarily based is the Big Bluestem/Needlegrass plant community phase. This community evolved with grazing by large herbivores and occasional prairie fire. The vegetation was about 80 percent grasses and grass-like plants, 10 percent forbs, 8 percent shrubs, and 2 percent trees. Major grasses included big bluestem, green needlegrass, Indiangrass, switchgrass and western wheatgrass. Other grasses that occurred within this community included porcupine grass, Canada wildrye, and slender wheatgrass. Major forbs and shrubs included American licorice, sunflower, goldenrod, and western snowberry. Scattered green ash, American elm and other native tree species may have occurred.

This plant community was well adapted to the Northern Great Plains climatic conditions. Individual species varied greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle and energy flow were properly functioning. Due the diversity of warm- and cool-season species within this plant community phase, energy capture was spread more evenly throughout the growing season compared to other plant community phases within this state. Plant litter was properly distributed, in contact with the soil surface and with very little movement off-site. Natural plant mortality was very low. The diversity in plant species allowed for high drought tolerance. Run-off from adjacent sites and moderate or high available water capacity provided a favorable soil-water-plant relationship.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6304

Growth curve name: Pierre Shale Plains, warm-season dominant, cool-season sub-dominant.

Growth curve description: Warm-season dominant, cool-season sub-dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	18	25	25	15	7	1	0	0

Transitions or pathways leading to other plant communities were as follows:

- 1.1a – Heavy continuous grazing (grazing for extended portions of the growing season without adequate recovery periods, often following fire), or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing would have shifted this community to the *1.2 Western Wheatgrass/Needlegrass/Bluestem Plant Community Phase*.

1.2 Western Wheatgrass/Needlegrass/Bluestem Plant Community Phase

The pathway described in 1.1a reduced the tall warm-season grass component in stature and extent while the grazing tolerant mid statured, cool-season bunchgrasses and rhizomatous grasses increased. The tall warm-season grasses did not disappear from the plant community but were reduced in vigor. The vegetation was about 80 percent grasses and grass-like plants, 10 percent forbs, 8 percent shrubs, and 2 percent trees. Major grasses included western wheatgrass, green needlegrass, and porcupine grass. Other significant grasses include big bluestem, little bluestem, switchgrass and sideoats grama. Forbs such as western yarrow, goldenrod, and western ragweed would have increased in extent and proportions. Due to the increase in the cool-season grass component of the plant community, energy capture shifted to the early portion of the growing season. Nutrient cycling and hydrological processes still functioned at expected levels.

The plant composition of this plant community phase would have been similar to the 2.2 Western Wheatgrass/Kentucky Bluegrass/Big Bluestem Plant Community Phase (refer to the plant composition table). The main difference is that the needlegrasses would have been stronger in this plant community phase.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6302

Growth curve name: Pierre Shale Plains, cool-season dominant, warm-season sub-dominant.

Growth curve description: Cool-season dominant, warm-season sub-dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	10	23	34	15	6	5	4	0	0

Transitions or pathways leading to other plant communities are as follows:

- 1.2b – Non-use and no fire for extended periods would cause cooler, moister conditions at the surface, result in reduced browse levels, and allow shrubs to increase leading to the *1.3 Snowberry/Plum/Chokecherry/Grasses Plant Community Phase*.
- 1.2a – Grazing and fire returned to normal disturbance regime levels and frequencies or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the *1.1 Western Wheatgrass/Needlegrass/Bluestem Plant Community Phase*.

1.3 Snowberry/Plum/Chokecherry/Grasses Plant Community Phase

Although this community phase appeared shrub dominated, grasses still constituted the majority of the production for this community phase. The vegetation was about 50 to 75 percent grasses and grass-like plants, 5 to 10 percent forbs, 15 to 30 percent shrubs, and 2 to 10 percent trees. Major grasses included western wheatgrass, green needlegrass, slender wheatgrass and Canada wildrye. Big bluestem, switchgrass and Indiangrass were minor components. Prominent forbs would have included meadow anemone, goldenrods, and American licorice. Shrub species would have included snowberry, plum, chokecherry, leadplant, and rose. Within this plant community phase, scattered mature trees such as American elm, boxelder and green ash would have been present, but a majority of tree species would have been maintained at the seedling and sapling stage.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6302

Growth curve name: Pierre Shale Plains, cool-season dominant, warm-season sub-dominant.

Growth curve description: Cool-season dominant, warm-season sub-dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	10	23	34	15	6	5	4	0	0

Transitions or recovery pathways leading to other plant communities are as follows:

- 1.3a – Fire, or grazing and fire at normal disturbance regime levels and frequencies would have reduced shrub canopy allowing for an increase in warm-season grasses and a return to the *1.2 Western Wheatgrass/Needlegrass/Bluestem Plant Community Phase*.
- 1.3b – A continuation of extended periods of non-use and no fire would have resulted in an increase in favorable conditions for establishment of trees within the shrub cover, and would have led to the *1.4 Green Ash & Boxelder Saplings, Shrubs Plant Community Phase*.

1.4 Green Ash & Boxelder Saplings, Shrubs Plant Community Phase

This plant community phase is dominated by woody plant species. Visually, saplings of green ash, boxelder and cottonwood would have been prominent, but shrub species would have been the most productive component of this plant community phase. Herbaceous species would have constituted a sub-dominant component in the early stages of this phase, declining as tree canopy increased. The vegetation was about 30 to 40 percent grasses and grass-like plants, 5 to 10 percent forbs, 40 to 50 percent shrubs, and 5 to 15 percent trees.

As canopy levels increased, the grass component would have decreased significantly, especially the warm-season component. Litter levels increased as well, and the soil surface continued to become cooler and moister. The result would have been even reduced likelihood of fire.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6301

Growth curve name: Pierre Shale Plains, cool-season dominant.

Growth curve description: Cool-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	4	12	25	36	10	5	4	4	0	0

Transitions or restoration pathways leading to other states are as follows:

- T1a – No fire for extended periods of time as a result of fire suppression following settlement resulted in a change in fire frequency allowing woody plant species to grow large enough to escape the next fire event. As trees increased in size, canopy cover increased which altered micro-climate and reduced fine fuel amounts resulting in reduced fire intensity and frequency. As tree canopy cover increased, a threshold would have been crossed leading to the *Wooded State (State 4)*.
- 1.4a – Fire of sufficient intensity while trees were still susceptible would have shifted this plant community phase back to *1.3 Snowberry/Plum/Chokecherry/Grasses Plant Community Phase*.

Transition from Reference State (State 1) to the Native/Invaded State (State 2)

- T1b – Encroachment of non-native grasses such as Kentucky bluegrass and smooth bromegrass, and disruption of natural disturbance regimes such as periodic fire followed by short-term high intensity grazing will lead this plant community phase over a threshold to the *Native/Invaded State (2)*. This occurs as natural and/or management actions (altered grazing and/or fire regime) favor a decline in the composition of the warm-season native species and an increase in cool-season sod grasses. Chronic season-long or heavy late season grazing facilitates this transition. Complete rest from grazing and no fire events can also lead to this transition.

Native/Invaded State (State 2)

This state is very similar to the reference state. The invasion of introduced cool-season sod grasses alters the natural range of variability for this ecological site. This state is still dominated by mid and tall native warm- and cool-season grasses, but invasive introduced cool-season sod grasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and infrequent fires. Timing and intensity of grazing events coupled with weather dictate the dynamics that occur within this state. The cool-season native grass can decline and an increase in introduced sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire followed by short-term intensive grazing. This state is dominated by cool- and warm-season grasses. It can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. Warm-season species can decline and a corresponding increase in cool-season grasses will occur.

2.1 Big Bluestem/Needlegrass Plant Community Phase

This plant community phase is similar to 1.1 Big Bluestem/Needlegrass Plant Community Phase, but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 20 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community is dominated by warm-season grasses with cool-season grasses being subdominant. The major grasses include big bluestem, green needlegrass, Indiangrass, switchgrass and western wheatgrass. Other grasses that occur within this community included porcupine grass, Canada wildrye, and slender wheatgrass. Major forbs and shrubs include American licorice, sunflower, goldenrod, and western snowberry. Scattered green ash, American elm and other native tree species may also occur. Refer to the 1.1 Big Bluestem/Needlegrass Plant Community Phase for details of the plant composition for this community phase. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6304

Growth curve name: Pierre Shale Plains, warm-season dominant, cool-season sub-dominant.

Growth curve description: Warm-season dominant, cool-season sub-dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	18	25	25	15	7	1	0	0

Transitions or pathways leading to other plant communities are as follows:

- 2.1a – Heavy continuous seasonal grazing (grazing at moderate to heavy stocking levels at the same time of year each year), heavy continuous season-long grazing, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will shift this community to the *2.2 Western Wheatgrass/Kentucky Bluegrass/Big Bluestem Plant Community Phase*.

2.2 Western Wheatgrass/Kentucky Bluegrass/Big Bluestem Plant Community Phase

This plant community phase is characterized by a shift to mid cool-season rhizomatous grasses with lesser amounts of tall warm-season and mid cool-season bunchgrasses. The vegetation is about 80 percent grasses and grass-like plants, 10 percent forbs, and 10 percent shrubs. Dominant grasses would include western wheatgrass and Kentucky bluegrass with minor amounts of needlegrasses, big bluestem and switchgrass. Major forbs would include western ragweed, goldenrods and western yarrow. Chokecherry and snowberry would be the dominate shrubs. Scattered green ash and American elm trees may be present. Energy capture by this plant community phase has shifted from late spring and summer to early spring through early summer. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6302

Growth curve name: Pierre Shale Plains, cool-season dominant, warm-season sub-dominant.

Growth curve description: Cool-season dominant, warm-season sub-dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	10	23	34	15	6	5	4	0	0

Transitions or pathways leading to other plant communities are as follows:

- 2.2a – Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the *2.1 Big Bluestem/Needlegrass Plant Community Phase*.

Transitions from the Native/Invaded State (State 2) to the Invaded State (State 3)

- T2a – Non-use and no fire for extended periods of time (typically for 10 or more years) will likely lead this state over a threshold resulting in the *3.1 Kentucky Bluegrass/Smooth Bromegrass/Shrubs Plant Community Phase* within the *3.0 Invaded State*.
- T2b – Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year, typically beginning early in the season) will convert this plant community to the *3.2 Kentucky Bluegrass Sod/Forbs Plant Community Phase* and the *3.0 Invaded State*.
- T2c – No fire for extended periods of time as a result of fire suppression results in a change in fire frequency allowing woody plant species to grow large enough to escape the next fire event. As trees increase in size, canopy cover increases which alters micro-climate and reduces fine fuel amounts resulting in reduced fire intensity and frequency. As tree canopy cover increases, a threshold will be crossed leading to the *Wooded State (State 4)*.

3.1 Kentucky Bluegrass/Smooth Bromegrass/Shrubs Plant Community Phase

This plant community phase is a result of extended periods of non-use and no fire. It is characterized by a dominance of Kentucky bluegrass and smooth bromegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. When dominated by smooth bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6301

Growth curve name: Pierre Shale Plains, cool-season dominant.

Growth curve description: Cool-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	4	12	25	36	10	5	4	4	0	0

Transitions or pathways leading to other plant communities are as follows:

- 3.1a – Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year) or heavy continuous season-long grazing will convert this plant community to the *3.2 Kentucky Bluegrass Sod/Forbs Plant Community Phase*.
- T3 – No fire for extended periods of time as a result of fire suppression results in a change in fire frequency allowing woody plant species to grow large enough to escape the next fire event. As trees increase in size, canopy cover increases which alters micro-climate and reduces fine fuel amounts resulting in reduced fire intensity and frequency. As tree canopy cover increases, a threshold will be crossed leading to the *Wooded State (State 4)*.

3.2 Kentucky Bluegrass Sod/Forbs Plant Community Phase

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short, as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD6301

Growth curve name: Pierre Shale Plains, cool-season dominant.

Growth curve description: Cool-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	4	12	25	36	10	5	4	4	0	0

Transitions or pathways leading to other plant communities are as follows:

- 3.2a – Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the *3.1 Kentucky Bluegrass/Smooth Bromegrass/Shrubs Plant Community Phase*.

Restoration Pathways, Invaded State (State 3) to the Native/Invaded State (State 2)

- R3a - Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) may lead this plant community phase over a threshold to the *2.0 Native/Invaded State*. Prescribed burning may also be needed to suppress cool-season invasive grasses. This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.
- R3b – Seeding of native species may restore the functioning of the ecological processes and lead across a threshold back to the *Native/Invaded State (State 2)*. Application of other practices such as prescribed burning, pest management (chemical control of invasive species), and/or long-term prescribed grazing may also be required to result in a plant community resembling those of the *Native/Invaded State*.

Transition from Any Plant Community to Invaded State (State 3)

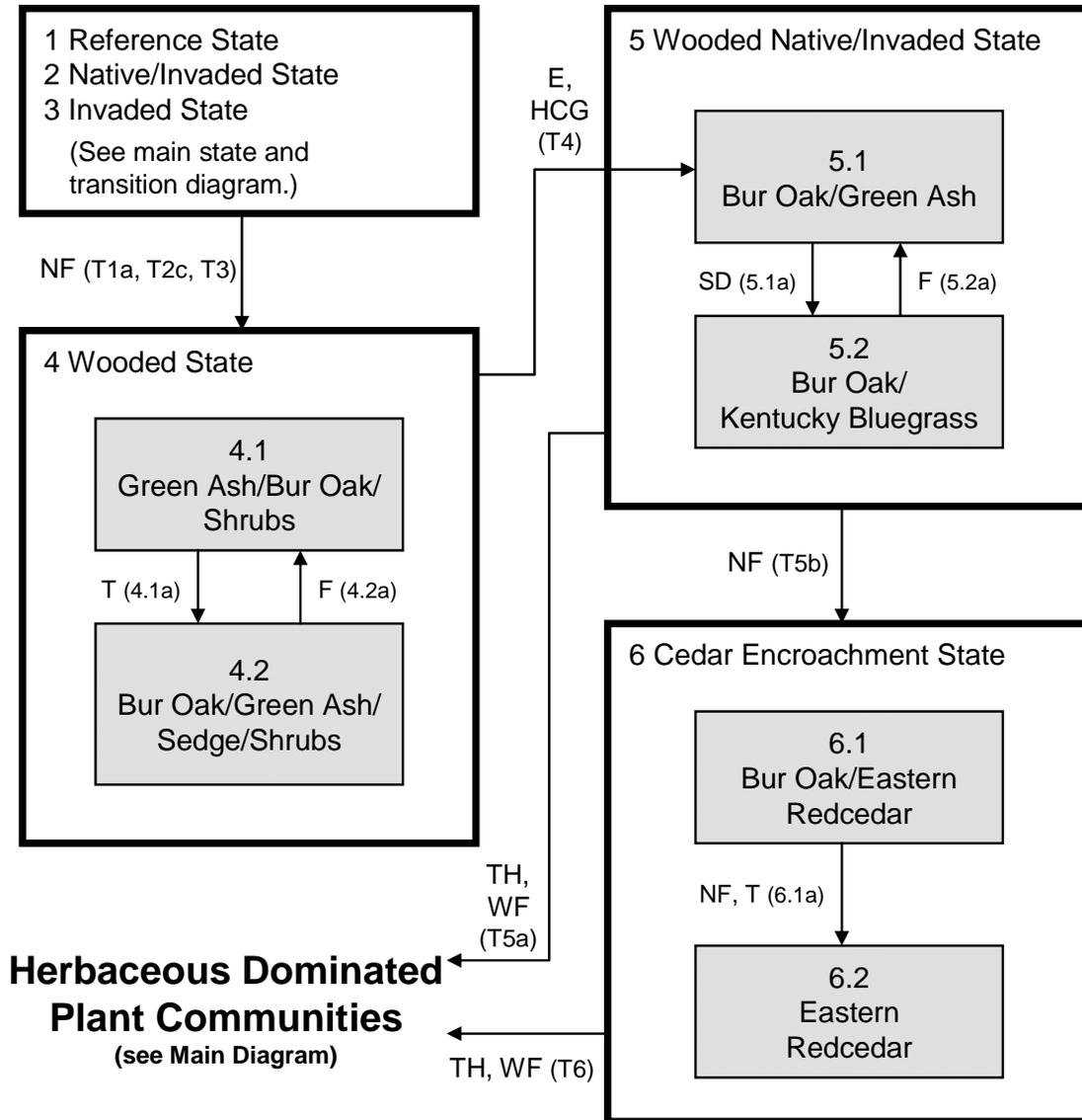
- T5 – Abandonment after cropping will result in early succession and lead to the *Annual/Pioneer Perennial Plant Community Phase*.

Wooded State (State 4)

Historically, this state existed as small patches of trees and shrubs scattered across the site. For simplification purposes, the pre-European transition returning from the wooded state to the reference state is not shown on the state and transition diagrams. Repeated intense disturbances (e.g., fire, fire coupled with grazing) would have reverted these smaller patches of trees to the herbaceous dominated plant community phases in the Reference State (State 1).

Alterations to the historic fire and grazing disturbance regimes have resulted in these scattered tree/shrub patches forming almost continuous woody dominated plant communities across the site in some areas. This state is characterized by an overstory of tall trees, an understory of shrubs and, depending upon the amount of canopy cover, an herbaceous understory of sedges, Kentucky bluegrass and/or a few native perennial grass species such as Canada wildrye.

The following diagram depicts the successional changes, and the pathways and transitions that are likely to occur on this site when the dominant vegetation is composed of tall, mature trees that have formed a nearly closed canopy. Following this diagram are narrative descriptions of each of the plant community phases that would likely occur.



Refer to narratives for descriptions of transitions and pathways: **E** – Encroachment of non-native species; **F** – Fire; **HCG** – Heavy continuous grazing; **NF** – No fire; **SD** – Stand decline, no regeneration; **TH** – Timber harvest; **T** – Time; **WF** – Wildfire.

4.1 – Green Ash/Bur Oak/Shrubs Plant Community Phase

This plant community phase is characterized by a dominance of green ash and bur oak with lesser amounts of American elm, boxelder, hackberry and occasional plains cottonwood. Shrubs may include leadplant, chokecherry, American plum, western snowberry, and gooseberry. The herbaceous understory will still be relatively productive in this phase. When compared to the 1.1 Big Bluestem/Needlegrass Plant Community Phase, the warm-season component will be somewhat reduced and the cool-season component will be somewhat increased. This phase is characterized by a relatively full canopy cover, and the trees are of mixed age but nearing maturity. Regeneration will normally be evident (i.e., seedlings and saplings should be present). As the trees mature and canopy cover increases herbaceous production declines and shrubs/vines associated with mature woodlands may begin to occupy the understory.

Transitions or pathways leading to other plant communities are as follows:

- 4.1a – With time and relatively normal disturbance levels (light to moderate grazing and possibly periodic fire) this plant community will move towards the *4.2 Bur Oak/Green Ash/Sedge/Shrubs Plant Community Phase*.

4.2 – Bur Oak/Green Ash/Sedge/Shrubs Plant Community Phase

This plant community phase is characterized by a dominance of bur oak and green ash with lesser amounts of American elm, hackberry, and boxelder. The tree canopy has become essentially closed at this phase, and the understory is significantly reduced. Shrubs and/or vines may include chokecherry, American plum, poison ivy, American bittersweet, and gooseberry. The herbaceous understory will largely consist of sedges, Canada wildrye, and scattered needlegrasses, and will be significantly reduced in production. Non-native species such as Kentucky bluegrass and annual bromegrass will likely begin to invade and become evident. When compared to the 1.1 Big Bluestem/Needlegrass Plant Community Phase, the tall/mid warm- and cool-season grasses will be greatly reduced. This phase is characterized by a nearly closed tree canopy, and the trees are of mostly a single age class. Regeneration will still occur, but will be reduced.

Transitions or pathways leading to other plant communities are as follows:

- 4.2a – Fire of light to moderate intensity will stimulate new growth and encourage openings in the canopy, leading to the *4.1 Green Ash/Bur Oak/Shrubs Plant Community Phase*.
- T4 – Encroachment of non-native species and heavy continuous grazing increases competition to tree seedlings and reduces number of seedlings by herbivory, and changes the ecological processes leading across a threshold to the *Wooded Native/Invaded State (State 5)* and to the *5.1 Bur Oak/Green Ash Plant Community Phase*.

Wooded Native/Invaded State (State 5)

This state is characterized by over-mature deciduous trees and a lack of regeneration. Shrubs are generally decadent and decreasing, and the herbaceous understory is greatly reduced in number of species and production. In addition, invasive species such as Kentucky bluegrass, cheatgrass, and Japanese bromegrass become established and increase significantly. The hydrologic functions of this state are often impaired, as the shallow-rooted sod forming grasses and grass-like species reduce infiltration and increase runoff. This exacerbates the effect of competition by decreasing soil moisture and further reducing the likelihood of regeneration of the deciduous trees.

5.1 – Bur Oak/Green Ash Plant Community Phase

This plant community phase is characterized by a dominance of bur oak and green ash with lesser amounts of American elm and hackberry. The tree canopy is virtually closed at this phase, and the understory is significantly reduced. Shrubs become decadent, and begin to decrease significantly with the exception of vines such as American bittersweet. Kentucky bluegrass begins to dominate the herbaceous component of the understory. Heavy continuous grazing often accompanies the transition that leads to this plant community. In some areas where a seed source is nearby, eastern redcedar and/or Rocky Mountain juniper will begin to occupy this phase.

Transitions or pathways leading to other plant communities are as follows:

- 5.1a – Stand decline continues as a result of a lack of regeneration (due to a combination of grazing and competition by invasive species) and eventually leads to the *5.2 Bur Oak/Kentucky Bluegrass Plant Community Phase*.

5.2 – Bur Oak/Kentucky Bluegrass Plant Community Phase

This plant community phase is characterized by a dominance of bur oak with lesser amounts of green ash and hackberry. With the lack of regeneration and the death of trees over time, the tree canopy begins to open up. Trees are scattered, and the site may have a “park-like” appearance with few trees and reduced understory. This stagnant phase may appear to last indefinitely, as the dominant bur oak can survive to considerably old ages. The understory is made up mostly of Kentucky bluegrass, while introduced forbs such as Canada thistle, burdock, curly dock and others will likely invade the site. In areas where eastern redcedar and/or Rocky Mountain juniper have begun to occupy, these shade-tolerant conifer species will begin to increase in size and density.

Transitions or pathways leading to other plant communities are as follows:

- 5.2a – Fire of light to moderate intensity combined with light to moderate grazing levels allowing for adequate recovery may lead this plant community phase to the *5.1 Bur Oak/Green Ash Plant Community Phase*.
- T5 – No fire for extended periods of time in areas where eastern redcedar and/or Rocky Mountain juniper have begun to occupy the site will allow the conifer species to increase in size and density to the point of avoiding damage by fire, and lead to the *Cedar Encroachment State (State 6)* and the *6.1 Bur Oak/Eastern Redcedar Plant Community Phase*.

Cedar Encroachment State (State 6)

This state is characterized by declining over-mature deciduous trees and a gradual increase in the size and density of shade-tolerant conifer species such as eastern redcedar and Rocky Mountain juniper. The conifer trees have reached sufficient size to withstand all but the most intense crown fires. The hydrologic functions of this state are often impaired, as the shallow-rooted sod forming grasses and grass-like species reduce infiltration and increase runoff. As the conifer species increase, a corresponding increase in bare ground results in increased erosion and a reduction in soil/site stability. The nature of the conifer litter also leads to hydrophobicity of the soil surface, further reducing infiltration.

6.1 – Bur Oak/Eastern Redcedar Plant Community Phase

This plant community phase is characterized by declining over-mature deciduous trees and a gradual increase in the size and density of shade-tolerant conifer species such as eastern redcedar and Rocky Mountain juniper. The conifer trees have reached sufficient size to withstand all but the most intense crown fires. Eastern redcedar and/or Rocky Mountain juniper attain heights of 6 to 12 feet or greater, and begin to fill in the gaps of the secondary stand of conifers. As the conifer density increases, the herbaceous understory decreases, bare ground increases, and the available soil moisture decreases. The bur oak begin to rapidly decline in the stand.

Transitions or pathways leading to other plant communities are as follows:

- T5 – No fire for extended periods of time and simply the passage of time allows the eastern redcedar and/or Rocky Mountain juniper to increase further in size and density and begin to overtop the deciduous trees leading to the *6.2 Bur Oak/Eastern Redcedar Plant Community Phase*.

6.2 – Eastern Redcedar Plant Community Phase

This plant community phase is characterized by a dominance of eastern redcedar and/or Rocky Mountain juniper. The understory is nearly absent of herbaceous species, with only a few shrubs lingering in small openings. Bare ground has increased, and soil erosion is evident. The tree canopy becomes completely closed, reaching as high as 80 to 90 percent.

Transition from Wooded Native/Invaded State (State 5) to Invaded State (State 3)

- T5a – Wildfire (crown fire), timber harvest or other catastrophic events (e.g., disease, pests) which result in the removal of the tree canopy will lead across a threshold to the *Invaded State (State 3)*.

Transition from Cedar Encroachment State (State 6) to Invaded State (State 3)

- T6 – Wildfire (crown fire), timber harvest or other catastrophic events (e.g., disease, pests) which result in the removal of the tree canopy will lead across a threshold to the *Invaded State (State 3)*.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Big Bluestem/Needlegrass Plant Community Phases (1.1 & 2.1):

Western Wheatgrass/Kentucky Bluegrass/Big Bluestem Plant Community Phase (2.2):

Kentucky Bluegrass/Smooth Bromegrass/Shrubs Plant Community Phase (3.1):

Kentucky Bluegrass Sod/Forbs Plant Community Phase (3.2):

Annual/Pioneer Perennial Plant Community Phase (3.3):

Green Ash/Bur Oak/Shrubs Plant Community Phase (4.1):

Bur Oak/Green Ash/Sedge/Shrubs Plant Community Phase (4.2):

Wooded Native/Invaded State (State 5):

Cedar Encroachment State (State 6):

Animal Preferences (Quarterly – 1,2,3,4[†])

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses and Grass-likes							
big bluestem	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
Canada wildrye	U D U U	N U N N	U D U U	N U N N	N U N N	U D U U	U D U U
green muhly	U D D U	N U N N	U D D U	N U N N	N U N N	U D D U	U D D U
green needlegrass	U P U D	N P N P	U P U D	N P N P	N P N P	U P U D	U P U D
Indiangrass	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
little bluestem	U D D U	N D N N	U D D U	N D N N	N D N N	U D D U	U D D U
porcupine grass	U P U D	N D N U	U P U D	N D N U	N D N U	U P U D	U P U D
prairie junegrass	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
Scribner panicum	U U D U	N U N N	U U D U	N U N N	N U N N	U U D U	U U D U
sedge	U D U D	U P N D	U D U D	U D U D	U D U D	U D U D	U D U D
sideoats grama	U D P U	U P D U	U D P U	U P D U	U P D U	U D P U	U D P U
slender wheatgrass	U P U U	N D U N	U P U U	N D U N	N D U N	U P U U	U P U U
switchgrass	U D D U	U D U U	U D D U	N N N N	N N N N	U D D U	U D D U
western wheatgrass	U P D U	N D N N	U P D U	N D N N	N D N N	U P D U	U P D U
Forbs							
American licorice	U U D U	N U U N	U U D U	N U U N	N U U N	U U D U	N U U N
blue verbena	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
cudweed sagewort	U U U U	U U D U	U U U U	U U D U	U U D U	U U U U	U U D U
dotted gayfeather	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
false boneset	U U D U	N D U N	U U D U	N D U N	N D U N	U U D U	N D U N
false Solomon's-seal	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
flatspine stickseed	N N N N	N U D N	N N N N	N U D N	N U D N	N N N N	N N N N
heartleaf Alexanders	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U
heath aster	U U D U	U U P U	U U D U	U U P U	U U P U	U U D U	U U P U
Illinois bundleflower	U D U U	U D D U	U D U U	U D D U	U D D U	U D U U	U D D U
Maximilian sunflower	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U
Missouri goldenrod	U U D U	N U U N	U U D U	N U U N	N U U N	U U D U	N U U N
northern bedstraw	N N N N	N U D N	N N N N	N U D N	N U D N	N N N N	N N N N
purple prairie clover	U D P U	U P P U	U D P U	U P P U	U P P U	U D P U	U P P U
scarlet gaura	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
scurfpea	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
wavyleaf thistle	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
western ragweed	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
western yarrow	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
Shrubs and Trees							
American elm	N N N N	N N N N	N N N N	N U D N	N N N N	N N N N	N N N N
American plum	D U U D	D U U D	D U U D	P U D D	D U U D	D U U D	D U U D
boxelder	N N N U	N N U U	N N N U	N N U U	N N U U	N N N U	N N U U
bur oak	T T T T	T T T T	N N N N	N U D U	N N N N	T T T T	N U D U
chokecherry	D T T D	D T T D	D T T D	P U D P	D U U D	D T T D	P U U P
golden currant	U D D U	U P P D	U D D U	U P P D	U U U U	U D D U	U P P D
green ash	N U D U	N D D U	N U D U	N D D U	N U D U	N U D U	N D D U
leadplant	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U
poison ivy	N N N N	U U U U	N N N N	U U U U	U U U U	N N N N	U U U U
rose	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U
western snowberry	U U U U	U U U U	U U U U	D U D D	U U U U	U U U U	D U U U

N = not used; **U** = undesirable; **D** = desirable; **P** = preferred; **T** = toxic

[†] Quarters: 1 – Jan., Feb., Mar.; 2 – Apr., May, Jun.; 3 – Jul., Aug., Sep.; 4 – Oct., Nov., Dec.

Animal Community – Grazing Interpretations

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community	Average Annual Production (lbs./acre, air-dry)	Stocking Rate* (AUM/acre)
Big Bluestem/Needlegrass (1.1 & 2.1)	3400	0.93
Western Wheatgrass/Kentucky Bluegrass/Big Bluestem (2.2)	2800	0.77
Kentucky Bluegrass/Smooth Bromegrass/Shrubs (3.1)	2800	0.77
Kentucky Bluegrass Sod/Forbs (3.2)	1800	0.49

* Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25% harvest efficiency (refer to USDA NRCS, National Range and Pasture Handbook).

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements, and added protein will allow ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrology Functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B, with localized areas in hydrologic group C. Infiltration is moderately slow to slow, and runoff potential for this site varies from low to high depending on soil hydrologic group, slope and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by bluegrass and/or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational Uses

This site provides hunting, hiking, photography, bird watching and other opportunities. The wide variety of plants that bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products

No appreciable wood products are typically present on this site.

Other Products

Seed harvest of native plant species can provide additional income on this site.

Supporting Information

Associated Sites

Loamy (R063BY010SD), Thin Upland (R063BY012SD)

Similar Sites

(R063BY010SD) – Loamy [less big bluestem and shrubs; lower production]

Inventory Data References

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: April Boltjes, Range Management Specialist, NRCS; Stan Boltz, Range Management Specialist, NRCS; Dana Larsen, Range Management Specialist, NRCS.

State Correlation

This site has been correlated with Nebraska and South Dakota in MLRA 63B.

Field Offices/Counties

Ainsworth, NE	Keya Paha/Rock	Highmore, SD	Hyde	Pierre, SD	Hughes
Bloomfield, NE	Knox	Kennebec, SD	Lyman	Spencer, NE	Boyd
Burke, SD	Gregory	Lake Andes, SD	Charles Mix	White River, SD	Todd/Mellette
Chamberlain, SD	Brule/Buffalo	O'Neill, NE	Holt		

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 42h - Southern River Breaks.

Other References

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (<http://www.hprcc.unl.edu/>)
USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (<http://wcc.nrcs.usda.gov>)
USDA, NRCS. National Range and Pasture Handbook, September 1997
USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (<http://nasis.nrcs.usda.gov>)
USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Site Description Approval

SD, State Range Management Specialist

Date

NE, State Range Management Specialist

Date