USDA Natural Resources Conservation Service

Ecological site R058CY095ND
Limy Sands

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

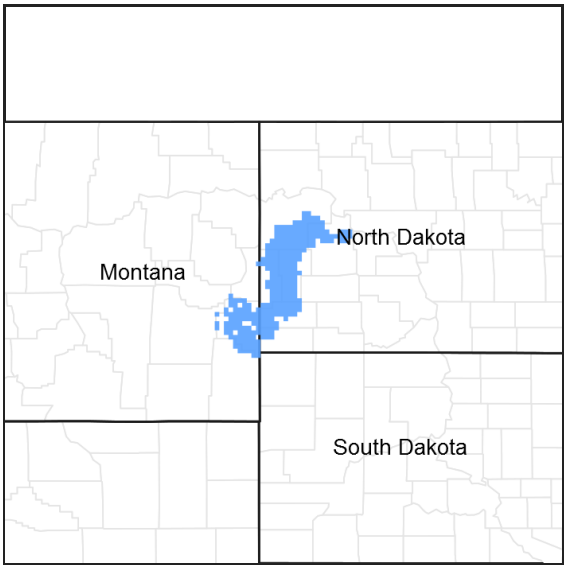


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 058C–Northern Rolling High Plains, Northeastern Part

MLRA 58C covers 2,780 square miles and encompasses approximately 1.8 million acres. MLRA 58C spans two states with 96% of the area in North Dakota and 4% in Montana. The acreage inside MLRA 58C is 54% privately owned and 44% federal land. The federal land consists of the Fort Berthold Indian Reservation, Little Missouri National Grasslands, and Theodore Roosevelt National Park. MLRA 58C landscape is characterized by steeply sloping, dissected badlands along the Little Missouri River and its tributaries. Tertiary marine shale, siltstone, and sandstone sediments are the most common soil parent materials in this MLRA. Primary land uses are rangeland for grazing and wildlife habitat. Micro-climates inherent in badlands landscapes influence both variety and abundance of vegetation in MLRA 58C. South- and west-facing exposures are dry, hot, and sparsely vegetated. More humid and cooler north- and east-facing exposures are favorable for abundant forage and woody vegetation.

Classification relationships

Major land resource area (MLRA): 058C-Northern Rolling High Plains, Northeastern Part

Ecological site concept

The Limy Sands ecological site is formed in sandy materials weathered from calcareous soft sandstone. These

sites are located on sedimentary uplands and have slopes of 3 to 40 percent. This site has a soil surface layer that ranges from 2 to 12 inches thick. The Limy Sands site has a loamy fine sand soil texture throughout the profile. Depth to calcium carbonates is 0 to 12 inches.

Associated sites

R058CY076ND	**Sands** The Sands ecological site is on hillslopes that do not receive additional moisture from runoff. The surface layer of the soil on the hillslopes is typically <12 inches. They are deep or very deep and somewhat excessive to excessively drained, carbonates may or may not be present in the soil profile. The soil textures contain high amounts of sand and will not form a ribbon, but may form a ball when squeezed. This ecological site is on backslopes and footslopes similar to Loamy, Sandy, and Clayey ecological sites. Limy Sands ecological site are usually above the Sands site. The Sands site has more production than the Limy Sands ecological site. Indicator species: sand bluestem and prairie sandreed evenly mixed, some Canada wildrye, penstemon, leadplant, and western snowberry.
R058CY077ND	**Sandy** These are coarse loamy, somewhat excessively to well drained soils on dry hillslopes that do not receive additional moisture from runoff. Soils on Sandy ecological sites are upslope from Sandy Terrace and Loamy Overflow sites, and downslope from Limy Sands and Shallow Sandy sites. Sandy sites are on similar landscape positions as Loamy, Sands, and Clayey ecological sites. The Sandy ecological sites typically have less sand and carbonates occur lower in the soil profile than the Limy Sands site. The soils on Sandy ecological sites when textured will make a weak ribbon less than 1 inch long before breaking. The Sandy site has more production then the Limy Sands ecological site. Indicator species are prairie sandreed with western wheatgrass and green needlegrass intermixed. This site has prairie sandreed and sand bluestem; more needleandthread and sedges, less blue grama, green needlegrass and western wheatgrass.
R058CY082ND	**Choppy Sands** The Choppy Sands ecological site occurs on hummocky dunes associated with hillslopes and may have blown-out areas associated with this site. The soils typically have a thin surface layer (<5 inches) and carbonates may be present lower in the soil profile (>36 inches). The soils on this site are excessively drained and very deep formed in eolian deposits. When this site occurs it is typically adjacent to the prevailing wind direction of the Limy Sands, Sands, Sandy, and Shallow Sandy ecological sites. There is high amounts of sand in the soil and will not form a ribbon, but will form a ball when squeezed. Indicator species: Sand bluestem, prairie sandreed and needleandthread evenly mixed, some Canada wildrye, penstemon, lemon scurfpea western ragweed, yucca, silky prairie clover, and leadplant.
R058CY088ND	**Shallow Sandy** The Shallow Sandy ecological site is on hillslopes. The soils on this ecological site have coarse or moderately coarse textures and are somewhat excessively drained. Soft, sandstone bedrock is between 10 inches and 20 inches below the soil surface. The sandstone beds are a root restrictive layer. The soils on Shallow Sandy sites may form a ribbon less than 1 inch long before breaking or will form a ball. The Shallow Sandy ecological site is upslope from the Limy Sands ecological site. The Shallow Sandy ecological site has less production than the Limy Sands ecological site due to its position on droughty shoulder slopes of steep hillslope landforms and the presence of a root restrictive layer above twenty inches. Indicator species are little bluestem, prairie sandreed, sand bluestem, and needle grasses, with dotted gayfeather, pasqueflower, purple coneflower and purple prairie clover, and shrubs like prairie rose and yucca.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

MLRA 58C is known as the Little Missouri Badlands, which formed when the Little Missouri River was diverted along a shorter, steeper course by Pleistocene glaciers. Due to the resulting increased gradient after its eastward diversion by the glaciers, the Little Missouri River began rapidly down cutting into the soft, calcareous sedimentary shale, siltstone, and sandstone of the Fort Union and Hell Creek geological formations. This rapid down cutting eroded and carved the badlands of MLRA 58C. This cycle of erosion and deposition continues today.

Most of the soils in MLRA 58C developed from residuum weathered in place. As a result of constant erosion and deposition, the majority of soils in MLRA 58C are Entisols and Inceptisols. Mollisols have formed on the high, stable drainage divides and plateaus above the steeper, dissected hillslopes and fans that define the Badlands. Elevation ranges from 1,838 feet (560 meters) to 3,430 feet (1,045 meters). The Little Missouri River flows through the entire length of MLRA 58C and empties into Lake Sakakawea that was formed by the Garrison Dam on the Missouri River.

The Limy Sands sites are located on gently sloping to very steep sedimentary uplands. Slope gradients range from 3 to 40 percent.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	560–1,045 m
Slope	3–40%
Ponding depth	0 cm
Water table depth	0 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 58C is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are common and characteristic of MLRA 58C. The continental 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, so air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 14 to 17 inches per year. The normal average annual temperature is about 41° F. January is the coldest month with an average temperature of about 17° F. July is the warmest month with an average temperature of about 70° F. The range of normal average monthly temperatures between the coldest and warmest months is 53° F. This large temperature range attests to the continental nature of MLRA 58C's climate. Daytime wind speeds are generally stronger than nighttime wind speeds, 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.

Table 3. Representative climatic features

Frost-free period (average)	107 days
Freeze-free period (average)	131 days
Precipitation total (average)	406 mm

Climate stations used

- (1) GRASSY BUTTE 2ENE [USC00323705], Grassy Butte, ND
- (2) MEDORA [USC00325813], Medora, ND
- (3) TROTTERS 3 SSE [USC00328812], Beach, ND
- (4) FAIRFIELD [USC00322809], Fairfield, ND
- (5) WATFORD CITY 14S [USC00329246], Grassy Butte, ND

Influencing water features

No significant water features influence this site.

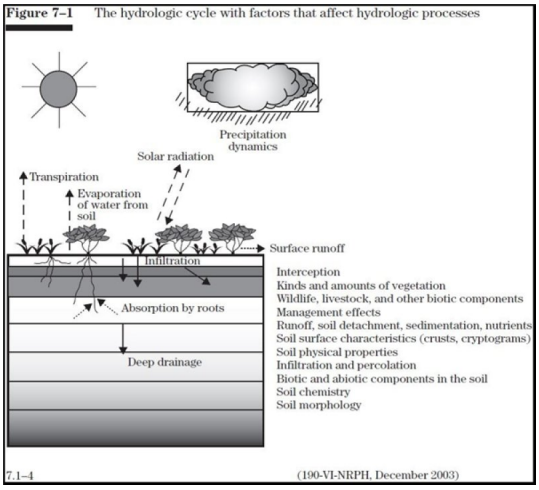


Figure 6. Fig.7-1 from National Range and Pasture Handbook.

Soil features

The soils characterizing the Limy Sands ecological site are moderately deep, somewhat excessively drained that formed in weakly consolidated sandstone bedrock. Slope ranges for this site are from 3 to 40 percent. Soil texture throughout the profile is loamy fine sand. Calcium carbonates are typically between depths of 0 and 12 inches. Depth to the paralithic contact is 20 to 40 inches. A typical soil pedon for this site has an A horizon thickness of 0 to 3 inches with a range of surface thickness 2 to 12 inches.

The soils representative of this site have a rapid infiltration rate. Water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers, and there is a risk of rills and eventually gullies if vegetative cover is not adequate. Pedestalling of plants occurs. The soil surface is potentially unstable therefore slumping, erosion, and deposition can occur on this site. Cryptobiotic crusts are present.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 6 percent. Loss of the soil surface layer can result in a shift in species composition and/or production.

The major soil series which characterize the Limy Sands ecological site is Tusler.

The following soil properties listed in the table below represent the soil profile from the surface of the soil to a depth of 40 inches (100 cm).

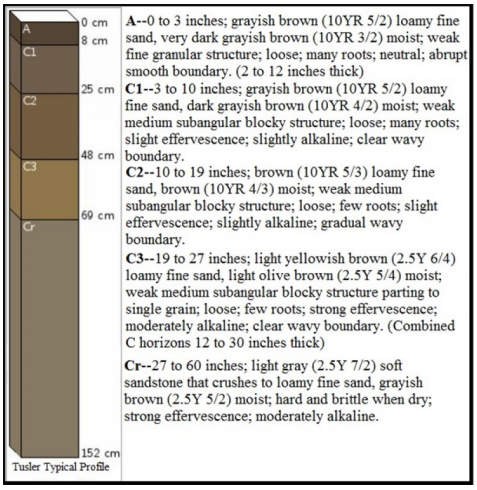


Figure 7. Tusler soil series.

Table 4. Representative soil features

Parent material	(1) Residuum–calcareous sandstone
Surface texture	(1) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained
Permeability class	Rapid
Soil depth	51–102 cm
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	2.54–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–9%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The site developed under Northern Great Plains climatic conditions, and included natural influence of large herbivores and occasional fire. Changes will occur in the plant communities due to climatic conditions and/or management actions. Due to the nature of the soils, the site is considered quite stable. Under continued adverse impacts, a slow decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments the site can quickly return to the Reference Plant Community.

The plant community upon which interpretations are primarily based is the Reference Plant Community. The Reference Plant Community has been determined by study of 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. Subclimax plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

Continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the Reference Plant Community. Species such as little bluestem, blue grama, and sedges will initially increase. Big bluestem, sand bluestem, porcupine grass, and sideoats grama will decrease in frequency and production. Heavy continuous grazing cause sedges, blue grama, and creeping juniper to increase while little bluestem stays in wolf plant colonies.

In time, heavy continuous grazing will likely cause upland sedges and blue grama to dominate and pioneer perennials, annuals, and club moss (in its range) to increase. The shortgrass plant community is relatively stable and the competitive advantage prevents other species from establishing. This plant community is less productive than the Reference Plant Community. Runoff and potential for soil erosion general increases and infiltration will decrease in this community.

Under extended periods of non-use and/or lack of fire will result in a plant community having low plant densities and

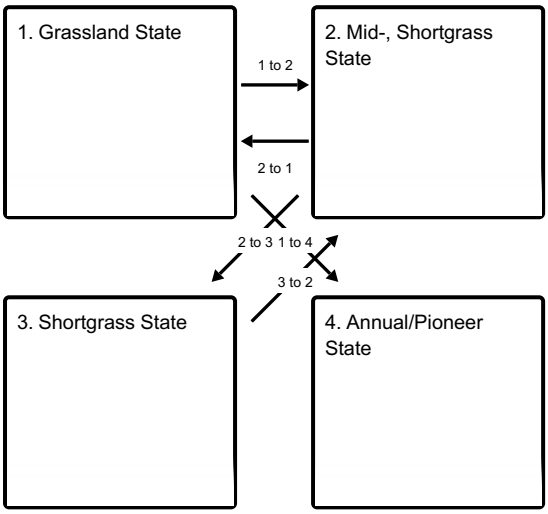
open spaces, which favors an increase in annuals, biennials, and pioneering perennials. Such species are red threeawn, sweetclover, cheatgrass, sand dropseed, and Scribner's panicum. In time, shrubs such as cactus and creeping juniper can increase.

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities.

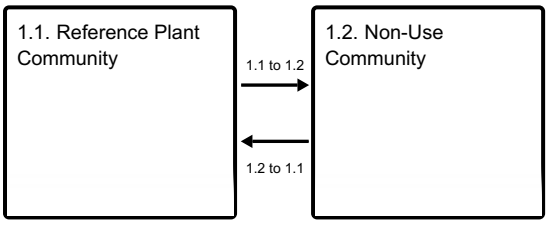
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

State and transition model

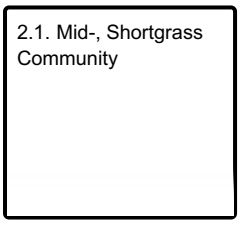
Ecosystem states



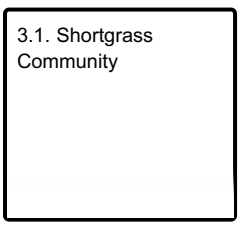
State 1 submodel, plant communities



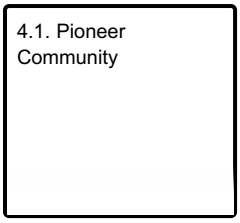
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Grassland State

The Grassland State is supported by empirical data, historical data, local expertise, and photographs. This state is defined by two native plant communities that are a result of periodic fire, drought, and grazing. These events are part of the natural disturbance regime and climatic process. The Reference Plant Community consists of both warm- and cool-season, tall-, mid-, shortgrasses, forbs, and shrubs. The Non-use plant community consists of decadent plants or excessive litter, and few remnant native grasses and forbs.

Community 1.1
Reference Plant Community

This is the interpretive plant community and is considered to be the Reference Plant Community. This community evolved with grazing by large herbivores and occasional prairie fire. It is well suited for grazing by domestic livestock and can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use, and adequate recovery periods following each grazing event. The potential vegetation is about 84% grasses or grass-like plants, 10% forbs, 5% shrubs and 1% trees. Warm season grasses dominate the plant community. The co-dominant grasses include prairie sandreed, little bluestem, big bluestem and sand bluestem. Other grasses and grass-like plants occurring on the site include needleandthread, blue grama, porcupine grass, sideoats grama, and sedges. Significant forbs include penstemon, American vetch, dotted gayfeather, prairie coneflower, pasqueflower, green sagewort, silverleaf scurfpea, and spiderwort. Leadplant, yucca, dwarf false indigo, rose, western sandcherry, and creeping juniper are the principal shrubs. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Run-off from adjacent sites and moderate or high available water capacity provides a favorable soil-water-plant relationship. This is considered a healthy and sustainable plant community.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	880	1429	1821
Forb	78	123	151
Shrub/Vine	34	56	78
Tree	–	11	17
Total	**992**	**1619**	**2067**

Community 1.2
Non-Use Community

This plant community develops after an extended period of 15 or more years of non-use by herbivores and exclusion of fire. This plant community is dispersed throughout the pasture, encircling spot grazed areas, and areas distant from water sources. This is a typical pattern found in pastures grazed season-long. Plant litter may accumulate as this plant community first develops. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to colonies. Standing decadent plants and moderate litter covers shorter understory species (i.e. short grasses and sedges), restricting

their ability to capture adequate sunlight for photosynthesis. Vigor and diversity of native plants are reduced. Annual and/or biennial forbs, annual grasses, and cryptogams commonly fill interspaces once occupied by desirable species. Kentucky bluegrass, crested wheatgrass, smooth bromegrass, cheatgrass and/or sweetclover tend to invade and may dominate this plant community. Other grasses present include needleandthread, western wheatgrass, Scribner panicum, sand dropseed, red threeawn, and threadleaf sedge. The common forbs include green sagewort, prairie coneflower, and hairy golden aster. Fringed sagewort, rose, yucca, cactus, creeping juniper, and Rocky Mountain juniper are principal shrubs and tend to increase in density and cover. This plant community is resistant to change without prescribed grazing or fire. Grazing is most effective in moving this plant community towards the Reference Plant Community. Soil erosion is low due to the amount of litter and standing dead vegetation. Compared to the Reference Plant Community, infiltration is reduced to the lower root zone. Runoff is similar to that of the Reference Plant Community. Once this plant community is reached, any of the preferred treatments can readily return the diversity and production of the site.

Pathway 1.1 to 1.2
Community 1.1 to 1.2

Non-use and no fire for extended periods of time will convert this plant community to the Excessive Litter Plant Community.

Pathway 1.2 to 1.1
Community 1.2 to 1.1

With prescribed grazing and/or prescribed burning, this plant community will move toward the Reference Plant Community. This would require long-term management with prescribed grazing and/or prescribed burning under controlled conditions.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Mid-, Shortgrass State

The Mid-, Shortgrass State is supported by empirical data, historical data, local expertise, and photographs. This state represents a plant community change as well as changes to the energy flow and nutrient cycling processes. This state is defined by one plant community. Species diversity and composition has been reduced relative to that of the reference plant community.

Community 2.1
Mid-, Shortgrass Community

This plant community is the result of long-term, heavy, continuous grazing and/or annual, early spring seasonal grazing. Short grasses, grass-likes, little bluestem, and forbs increase to dominate the site and annual production decreases dramatically. Ungrazed little bluestem seed stalks resist grazing pressure from most grazing animals causing a “red grass” patchy appearance amongst larger areas dominated by short grasses. Lack of litter and reduced plant vigor in the short grass areas result in higher soil temperatures, poor water infiltration rates, and high evapotranspiration, which gives the early growth sedges and drought resistant blue grama a competitive advantage over the tall warm-season grasses and cool season mid-grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. Sedges, blue grama and patches of little bluestem are the dominant species with the balance being a few species of cool-season grasses and warm-season grasses including red threeawn, sand dropseed, needleandthread, and Scribners panicum. Forbs such as western ragweed, green sagewort, hairy goldaster, American pasqueflower, Lambert crazyweed, scurfpea, and prairie coneflower may also be present. Dominant shrubs are cactus, yucca, fringed sagewort, and creeping juniper. There is usually less than 15% bare ground. This plant community is very stable. The likelihood of this plant community to head away from the Reference Plant Community is greater than moving towards the Reference Plant Community if management does not change. Runoff has increased and infiltration has

decreased due to species composition and production changes. Soil erosion is apparent as per many pedestalled plants and debris dams existing throughout the site, especially on the steeper slopes.

State 3
Shortgrass State

The Shortgrass State is supported by empirical data, historical data, local expertise, and photographs. This state represents a plant community change as well as changes to the energy flow and nutrient cycling processes. This state is defined by one plant community. With heavy, continuous grazing blue grama will become the dominant species and have a sod bound appearance. Unable to withstand the grazing pressure, only a remnant population of native tall- and midrass species remains. Species composition and diversity has been reduced relative to state 2 and the Reference State. Water infiltration is reduced due to the sod nature of the blue grama and runoff is increased.

Community 3.1
Shortgrass Community

This plant community can quickly develop due to the adverse effects of continuous, heavy grazing over several years. Diversity and production is lost as the short grasses become dominant in this plant community. Little bluestem and needleandthread have been reduced greatly compared to the Mid-, Shortgrass Plant Community. These species are now replaced by the grazing tolerant blue grama and sedges. Sideoats grama remains in the plant community, but is less productive because of the mid-summer grazing pressure. Because they are less palatable, American pasqueflower and green sagewort become more prevalent in the plant community. The herbaceous species present are less suitable to grazing. There is more than 20% bare ground. Litter is usually non-existent which reduces infiltration, increasing run-off and soil erosion. The soil temperature is hot early and continues throughout the rest of the growing season. These management induced environmental factors greatly influence this plant community and is why this vegetation state is very resistant to change. Once this plant community is reached, any of the preferred treatments will very slowly return the diversity and production of the site. This will take 25+ years.

State 4
Annual/Pioneer State

The Annual/Pioneer State is supported by empirical data, historical data, local expertise, and photographs. This state represents a plant community change as well as changes to the energy flow and nutrient cycling processes. This state is defined by one plant community.

Community 4.1
Pioneer Community

This plant community develops under severe disturbance and/or excessive defoliation. This can result from heavy livestock or wildlife concentration, and cropping abandonment (go-back land). The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include red threeawn, smooth bromegrass, crested wheatgrass, annual brome, needleandthread, prairie junegrass and western wheatgrass. The dominant forbs include curlycup gumweed, marestail, salsify, kochia, field bindweed, thistles, western ragweed, pussytoes, prostrate verbena and other early successional species. Shrubs that may be present include prairie rose, fringed sagewort and broom snakeweed. Plant species from adjacent ecological sites may become minor components of this plant community. The community also is susceptible to invasion of non-native species due to severe soil disturbances and relatively high percent of bare ground. Many annual and perennial forbs, including non-native species, have invaded the site. This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persist, thus holding back secondary plant succession. Soil erosion is potentially high in this vegetation state. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased water infiltration, increased runoff, and accelerated erosion rates. Significant economic inputs, management and time would be required to move this plant community toward a higher successional stage and a more productive plant community. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities. This plant community can be renovated to improve the

production capability, but management changes would be needed to maintain the new plant community.

Transition 1 to 2
State 1 to 2

Long-term, heavy, continuous grazing or continuous seasonal grazing will convert the Grassland State to Mid-, Shortgrass State.

Transition 1 to 4
State 1 to 4

Excessive defoliation (i.e., areas of heavy animal concentration) or cropped go-back land with continuous grazing will convert the Grassland State to the Annual/Pioneer State.

Restoration pathway 2 to 1
State 2 to 1

Long-term prescribed grazing that includes changing season of use and allowing adequate recovery periods will lead this plant community back to the Grassland State.

Conservation practices

Prescribed Grazing

Transition 2 to 3
State 2 to 3

Long-term, heavy, continuous grazing or continuous seasonal grazing will convert Mid-, Shortgrass State to the Shortgrass State.

Restoration pathway 3 to 2
State 3 to 2

Long-term (+25 years) of prescribed grazing with adequate rest and recovery of the key forage species. Prescribed burning may be a necessary management tool.

Conservation practices

Prescribed Burning
Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Bluestem**			163–241	
	sand bluestem	ANHA	*Andropogon hallii*	163–241	–
	big bluestem	ANGE	*Andropogon gerardii*	0–78	–
2	**Sandreed and Bluestem**			241–404	
	prairie sandreed	CALO	*Calamovilfa longifolia*	78–325	–
	little bluestem	SCSC	*Schizachyrium scoparium*	78–325	–
3	**Needlegrass**			78–163	

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	67–129	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	34–129	–
4	**Grama**			78–241	
	sideoats grama	BOCU	*Bouteloua curtipendula*	78–163	–
	blue grama	BOGR2	*Bouteloua gracilis*	78–129	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–78	–
5	**Other native grasses**			50–112	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	17–34	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	17–34	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	17–34	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	17–34	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	17–34	–
6	**Grass-likes**			112–191	
	threadleaf sedge	CAFI	*Carex filifolia*	95–163	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	34–50	–
Forb					
7	**Forbs**			78–163	
	silky prairie clover	DAVI	*Dalea villosa*	0–34	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	17–34	–
	green hellebore	HEVI	*Helleborus viridis*	17–34	–
	blazing star	LIATR	*Liatris*	17–34	–
	tarragon	ARDR4	*Artemisia dracunculus*	17–34	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	17–34	–
	scurfpea	PSORA2	*Psoralidium*	17–34	–
	eastern pasqueflower	PUPA5	*Pulsatilla patens*	17–34	–
	beardtongue	PENST	*Penstemon*	17–34	–
	goldenrod	SOLID	*Solidago*	17–34	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–17	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	0–17	–
	spiny phlox	PHHO	*Phlox hoodii*	0–17	–
	pussytoes	ANTEN	*Antennaria*	0–17	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–17	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–17	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–17	–
	plains milkvetch	ASGI5	*Astragalus gilviflorus*	0–17	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–17	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–17	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–17	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–17	–
	buckwheat	ERIOG	*Eriogonum*	0–17	–
	old man's whiskers	GETR	*Geum triflorum*	0–17	–

	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–17	–
Shrub/Vine					
8	**Shrubs**			34–78	
	leadplant	AMCA6	*Amorpha canescens*	17–34	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–17	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–17	–
	shrubby cinquefoil	DAFRF	*Dasiphora fruticosa ssp. floribunda*	0–17	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–17	–
	pricklypear	OPUNT	*Opuntia*	0–17	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–17	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–17	–
	rose	ROSA5	*Rosa*	0–17	–
	soapweed yucca	YUGL	*Yucca glauca*	0–17	–
Tree					
9	**Trees**			0–17	
	juniper	JUNIP	*Juniperus*	0–17	–

Animal community

Grazing Interpretations:

This site is well adapted to managed grazing by domestic livestock. The predominance of herbaceous plants across all plant community phases best lends these sites to grazing by cattle, but other domestic grazers with differing diet preferences may also be a consideration depending upon management objectives.

Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. In addition to usable forage, safe stocking rates should consider ecological condition, trend of the site, past grazing use history, season of use, stock density, kind and class of livestock, forage digestibility, forage nutritional value, variation of harvest efficiency based on desirability preference of plant species and/or grazing system and site graze ability factors (such as steep slopes, site inaccessibility, or distance to drinking water).

Often the current plant community does not entirely match any particular Community Phase as described in this Ecological Site Description. Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of inventory data will permit the establishment of a safe initial stocking rate.

No two years have exactly the same weather conditions. For this reason, year-to-year and season-to season fluctuations in forage production are to be expected on grazing lands. Livestock producers must make timely adjustments in the numbers of animals or in the length of grazing periods to avoid overuse of forage plants when production is unfavorable and to make advantageous adjustments when forage supplies are above average.

Initial stocking rates should be improved through the use of vegetation monitoring and actual use records that include number and type of livestock, the timing and duration of grazing, and utilization levels. Actual use records over time will assist in making stocking rate adjustments based on the variability factors.

Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

Hydrological functions

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic groups A. Infiltration rate is rapid and runoff potential for this site varies from very low to medium depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest

potential for high infiltration and lower runoff. An exception would be where short grasses form a dense sod and dominate the site. 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 opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

None.

Other information

Site Development and Testing Plan.

Chris Tecklenburg (Natural Resource Specialist, Ecological Sites, Kansas NRCS) assumed responsibilities for development of provisional ESDs in MLRA 58C on 8-17-2017. Most information for the provisional Limy Sands ecological site comes from adjacent MLRA 54 Limy Sands site.

This site is going through the Provisional ESD process. It contains information above and beyond what is required of a provisional due to foundational work completed in adjacent MLRA 54 during the early 2000s. This site is scheduled to go through the approval process fiscal year 2021.

Future work (for approved ESD) includes field visits to verify ecological site concepts with field staff. Field staff include but not limited to project office leader, area soil scientist, state soil scientist, ecological site specialist, state rangeland conservationist, area rangeland management specialist, and local field personnel. This site should include collaboration between North Dakota and Montana. Field visits are to be determined by spatial extent of the site as well as personal knowledge of the site. Activity during field visits will include but not limited to: identifying the soil, landform, plant community, and verifying existing site concepts. Data collection will be determined by the MLRA 58C technical team.

Inventory data references

Chris Tecklenburg (Natural Resource Specialist, Ecological Sites, Kansas NRCS) was assigned responsibilities for the development of provisional ESDs in MLRA 58C on 8-17-2017.

Information for the provisional Limy Sands ecological site originates from adjacent MLRA 54 Limy Sands site.

Information presented here has been derived from NRCS clipping and other inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field tested by various private, state and federal agency specialist.

NRCS individuals involved in developing MLRA 54 Limy Sands ecological site description include: Dennis Froemke, Jeff Printz, Stan Boltz, Darrell Vanderbusch, L. Michael Stirling, Josh Saunders, Jody Forman, David Dewald, and Brad Podoll.

Other references

High Plains Regional Climate Center, Weather data, web site http://hprcc.unl.edu. Available online. Accessed 9/25/2017.

National Water and Climate Center. https://www.wcc.nrcs.usda.gov/ Available online. Accessed 9/25/2017.

National Range and Pasture Handbook, USDA-NRCS, Chapter 7, Rangeland and Pastureland Hydrology and Erosion. September 1997.

National Soil Information System, USDA-NRCS, Information Technology Center, https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053552. Available online. Accessed 9/25/2017.

PLANTS Database, USDA-NRCS, http://plants.usda.gov. Available online. Accessed 9/25/2017.

USDA-Natural Resources Conservation Service—Soil Surveys and Web Soil Survey. Available online. Accessed 9/25/2017.

Contributors

Chris Tecklenburg

Approval

David Kraft, 10/31/2018

Acknowledgments

The ecological site development process is a collaborative effort, conceptual in nature, dynamic and is never considered complete.

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Chris Tecklenburg Revision/Copy of this reference sheet derived from MLRA 54 Limy Sands on 10/26/2017. J. Printz, S. Boltz, R. Kilian, D. Froemke, M. Rasmusson original authors 5/12/2011.
Contact for lead author	Mark Hayek, USDA-NRCS, State Rangeland Management Specialist, Bismarck, ND. Mark.Hayek@nd.usda.gov
Date	05/12/2011
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams.

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3. **Number and height of erosional pedestals or terracettes:** Few and scattered.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground 20 to 25% consisting of randomly scattered small patches no greater than 2 inches in diameter.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present. Existing gullies should be “healed” with a good vegetative cover.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Active blowouts should not be present although a few, small, scattered scour sites may be observed. Historic blowouts should be “healed” with a good vegetative cover.

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 70% or greater of soil surface and maintains soil surface integrity. Stability class anticipated to be 4 - 5.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A--0 to 3 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose; many roots; neutral; abrupt smooth boundary. (2 to 12 inches thick)

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** High grass canopy and basal cover and small gaps between plants should reduce raindrop impact and slow overland flow, providing increased time for infiltration to occur. Healthy, deep rooted native grasses enhance infiltration and reduce runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mid, warm-season grasses = tall, rhizomatous warm-season grasses >

    Sub-dominant: mid, cool-season bunchgrasses >

    Other: short, warm-season grasses = grass-likes > forbs > shrubs > short, cool-season grasses

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very low.

14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative value = 1445 lbs/acre with a range of 885 lbs/ac to 1845 lbs/ac (air dry weight) depending upon growing conditions.

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if**

their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: State and local noxious, Kentucky bluegrass, smooth bromegrass

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17. **Perennial plant reproductive capability:** All species are capable of reproducing.
