Ecological site R058CY085ND
Sandy Claypan

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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 Sandy Claypan ecological site is formed in sandy alluvium and soft sedimentary bedrock located on hillslopes

and terraces. This site has a soil surface layer that ranges from 5 to 14 inches. The soil typifying this site exhibits claypan characteristics at depths ranging from 6 to 18 inches. These claypan characteristics are explained by the amount of salts that withhold water making it unavailable for plant use and sodium affecting the clay particles in the soil. Visible salts are between depths of 16 and 24 inches. This Sandy Claypan site is intermingled with the Thin Claypan ecological site that occurs in the micro-lows on the landform. Slopes for the Sandy Claypan site ranges from 0 to 9 percent. This site usually has a fine sandy loam surface texture, but can be as coarse as loamy fine sand and subsurface textures of sandy clay loam, loam, or fine sandy loam. Lower in the soil profile it may have stratified layers of loamy fine sand, fine sand, fine sandy loam, and sandy clay loam. Fine grained soft sandstone or mudstone may occur below depths of 20 inches in this ecological site.

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. The Sands ecological sites typically can be on the same landform and slope as the Sandy Claypan site. In some places the Sands and Sandy Claypan sites can be associated with the Choppy Sands ecological site on nearby hummocky dunes. The Sands site has more production than the Sandy Claypan 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 can be on the same landform and slope as the Sandy Claypan site. The Sandy site does not have a dense claypan layer above 18 inches and the salts are absent or deeper in the soil profile. 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 Sandy Claypan 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.
R058CY081ND	**Thin Claypan** These are soils with a varying range of textures that are well drained or moderately well drained soils on upland landforms that do not receive additional moisture from runoff. Soils on Thin Claypan sites are severely sodium-affected. Soils on Thin Claypan sites have a dense, root-limiting subsoil (claypan) layer that is fine sandy loam to clay, and will form a ribbon of 1 to 2 inches or greater in length when textured. The, sodium-affected claypan is typically within 6 inches of the soil surface and has columnar structure with visible salts and gypsum crystals above 16 inches. Sodium-affected landscapes in MLRA 58C exhibit the shallow micro-relief that is evident in the pock-marked appearance of the ground surface. The Sandy Claypan site is intermingled on the same landform as the Thin Claypan site in the micro-lows and Sandy Claypan sites on micro-highs. Another soil type is also included with this ecological site. This soil has all the same traits as the soil list above except the claypan is absent and it has carbonates at or near the soil surface. The soil formed in slope alluvium on fans from the nearby sparsely-vegetated, very steep, soft sedimentary bedrock, (i.e. Badlands). The soil is weakly developed with stratified layers of sediments apparent just below the surface layer. Indicator species are western wheatgrass and sandberg bluegrass with an understory of blue grama and buffalograss. Also present are heath aster, cudweed sagewort, and western yarrow along with a few shrubs of fringed sagewort, cactus and Gardner's saltbush.

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 Sandy Claypan sites are located on nearly level to moderately sloping hillslopes and terraces. Slopes are linear to concave and range from 0 to 9 percent.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,838–3,430 ft
Slope	0–9%
Ponding depth	0 in
Water table depth	72 in
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)	16 in

Climate stations used

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

Influencing water features

No significant water features influence this site.

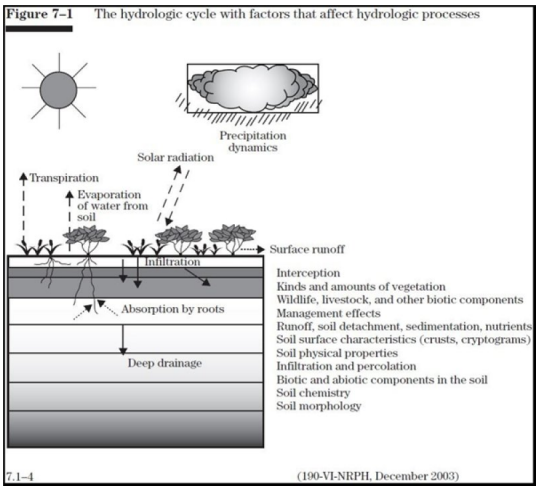


Figure 6. Fig.7-1 from National Range and Pasture Handbook.

Soil features

The soils characterizing the Sandy Claypan ecological site are deep to very deep, well drained that formed in stratified sandy alluvium from the surrounding residual hillslopes. Slope ranges for this site are from 0 to 9 percent. Soil texture for the surface is fine sandy loam followed by a loam, sandy clay loam, and fine sandy loam textures throughout the remaining horizons. Visible salts are between depths of 16 and 24 inches. The SAR ranges from 13 to 20 in the natric horizon that begins at 6 inches. Depth to carbonates ranges from 10 to 30 inches. The combined A and E horizon thickness ranges from 5 to 14 inches.

This site should show slight to no evidence of rills, wind scoured areas or pedestalled plants. Water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Sub-surface soil layers are restrictive to water movement and root penetration.

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 Sandy Claypan ecological site is Archin.

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).

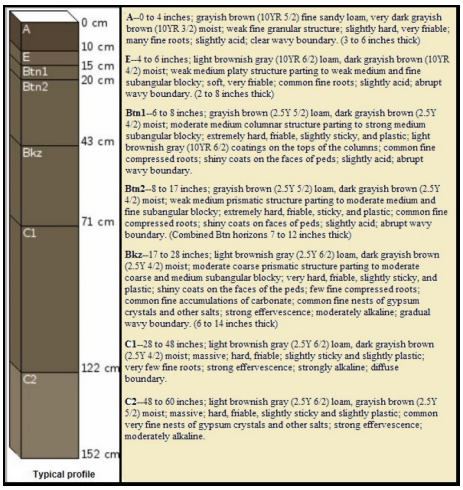


Figure 7. Typical pedon of Archin series.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–sandstone
Surface texture	(1) Fine sandy loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to very slow
Soil depth	20–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	2–6 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–20
Soil reaction (1:1 water) (0-40in)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

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 western wheatgrass, blue grama, sedges, cudweed sagewort, hairy golden aster, prairie coneflower, scurfpea and fringed sagewort will initially increase. Prairie sandreed, sand bluestem green needlegrass, false gromwell, vetch, penstemon and leadplant will decrease in frequency and production. 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. This 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 increases and infiltration will decrease. Soil erosion will be minimal.

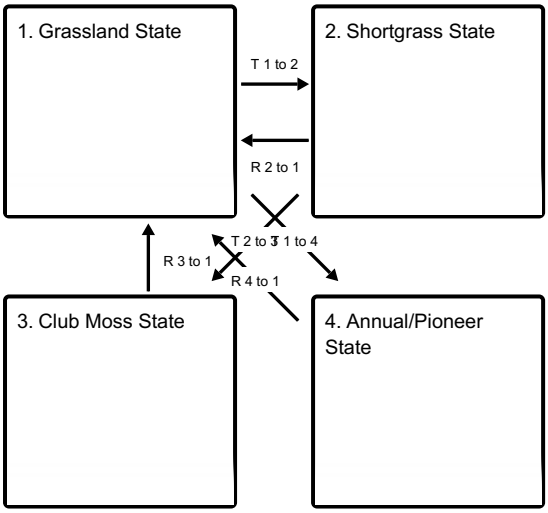
Extended periods of non-use and/or lack of fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and/or smooth bromegrass, and in time, shrubs such as western snowberry and silver sagebrush will increase.

Due to a general invasion of exotic species (such as Kentucky bluegrass and smooth bromegrass) across the MLRA within this site, returning to the 1.1 Western Wheatgrass/Tall Warm-Season Plant Community Phase may not be possible. Today, the 2.1 Blue Grama/Sedge/Western Wheatgrass Plant Community Phase most resembles the 1.1 Reference Plant Community Phase in appearance and function.

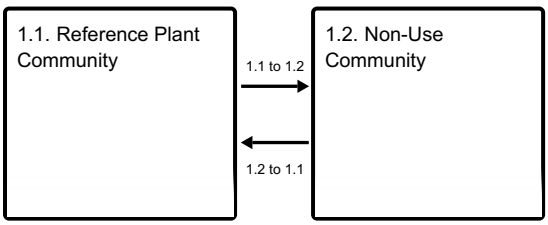
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best 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

2.1. Shortgrass Community

State 3 submodel, plant communities

3.1. Club Moss Community

State 4 submodel, plant communities

4.1. Pioneer Community

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- and midgrasses, forbs, shrubs. Plant Community 2 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 82% grasses or grass-like plants, 10% forbs, and 8% shrubs. Cool-season and tall warm-season grasses dominate the plant community. The co-dominant grasses include western wheatgrass and prairie sandreed. Other grasses and grass-like plants occurring on the site include needleandthread, green needlegrass, blue grama, prairie junegrass and sedges. Significant forbs include stiff sunflower, false gromwell, silverleaf scurfpea, western yarrow and goldenrod. In many areas western snowberry is the principle shrub and occurs in patchy mosaic. In other areas, silver sagebrush is the dominant shrub and occurs more evenly dispersed across the site. Other shrubs include prairie rose, leadplant and fringed sagewort. 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. Low available water capacity coupled with high accumulations of sodium and slow permeability strongly influences the soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1030	1425	1730
Forb	75	120	160
Shrub/Vine	10	50	80
Moss	0	5	20
Total	**1115**	**1600**	**1990**

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 properly stocked pastures grazed season-long. Plant litter accumulates in large amounts as this community develops. Litter buildup reduces plant vigor and density, and seedling recruitment declines. Eventually litter levels become abundant enough to crowd out living plants and reduce plant density. Annual and/or biennial forbs, annual grasses, and cryptogams commonly fill these interspaces. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. Heavy 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. Non-native grasses, such as Kentucky bluegrass, crested wheatgrass, smooth bromegrass and cheatgrass tend to dominant this plant community. Other grasses that may be present include western wheatgrass, needleandthread, green needlegrass and Sandberg bluegrass. The common forbs include sweetclover, green sagewort, cudweed sagewort and heath aster. Fringed sagewort, snowberry and/or silver sagebrush are the principal shrubs and tend to increase in density and cover. This plant community is resistant to change without prescribed grazing or fire. The combination of both grazing and fire is most effective in moving this plant community towards the Reference Plant Community. Soil erosion is low. Compared to the Reference Plant Community, infiltration is reduced to the lower root zone. Runoff is similar to the Reference Plant Community. This plant community tends to be moisture loving and usually tends to utilize the spring moisture quickly causing forage base to become dry and not very palatable early in the summer. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in the diversity 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 Western Wheatgrass/Tall Warm-Season 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
Shortgrass State

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 western wheatgrass remains. Species

diversity has been reduced further. Water infiltration is reduced due to the sod nature of the buffalograss and blue grama. Runoff is increased.

Community 2.1
Shortgrass Community

This plant community can quickly develop from the adverse effects of heavy, continuous grazing and/or annual, early spring seasonal grazing. Annual grazing too early in the spring depletes stored carbohydrates, resulting in weakening and eventual death of the cool season mid-grasses. Short grasses and grass-likes and forbs increase to dominate the site and annual production decreases dramatically. Lack of litter and reduced plant vigor result in higher soil temperatures, poor water infiltration rates, and high evapotranspiration, which gives blue grama and sedges a competitive advantage over 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. Blue grama, sedges and western wheatgrass are the dominant species. Other grasses that may be present include Sandberg bluegrass, red threeawn, needleandthread, prairie junegrass and annual grasses. Forbs such as hairy goldaster, cudweed sagewort, heath aster, Lambert crazyweed, prairie coneflower, scurfpea and western yarrow may also be present. There is usually less than 10% bare ground. This plant community is relatively stable. The thick sod and competitive advantage prevents other species from establishing. This plant community is less productive than the Reference Plant Community. Runoff increases and infiltration will decrease. Soil erosion will be minimal due to the sod forming habit of blue grama.

State 3
Club Moss State

The Club Moss 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 3.1
Club Moss Community

A dense sod of club moss dominates this plant community. Club moss occupies bare soil areas within deteriorated or disturbed higher successional plant communities due to long-term repeated disturbances. Club moss cover is often 25% or greater. Club moss creates a more arid microclimate, resulting in extreme competition for available moisture. Initial runoff rates are low but then increase as clubmoss becomes saturated. Once clubmoss has been saturated then runoff increases and infiltration decreases as compared Reference Plant Community. Vigor and production of other species are reduced dramatically. Grasses and grass-like plants include western wheatgrass, blue grama, Sandberg bluegrass and upland sedges. Forbs commonly found in this plant community include cudweed sagewort, hairy goldenaster, heath aster, prairie coneflower, scurfpea, annual deervetch and western yarrow. When compared to the Western Wheatgrass/Tall Warm-Season Plant Community, blue grama and club moss have increased, while western wheatgrass has decreased and the tall warm-season grasses have disappeared.

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 T 1 to 2
State 1 to 2

Heavy, continuous grazing or continuous seasonal grazing will convert the plant community to the Blue Grama/Sedge/Western Wheatgrass Plant Community.

Transition T 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 plant community to the Annual/Pioneer Perennial Plant Community.

Restoration pathway R 2 to 1
State 2 to 1

Long-term prescribed grazing that includes changing season of use and allowing adequate recovery periods to enhance cool season grasses will lead this plant community back to the Western Wheatgrass/Tall Warm-Season Plant Community.

Conservation practices

Prescribed Grazing

Transition T 2 to 3
State 2 to 3

Heavy, continuous grazing may cause further deterioration resulting in a shift to the Club Moss Plant Community.

Restoration pathway R 3 to 1
State 3 to 1

Fertilization combined with prescribed grazing will move this plant community subsequently through the successional stages leading toward the Western Wheatgrass/Tall Warm-Season Plant Community. Mechanical renovation followed by prescribed grazing will reduce club moss, increase western wheatgrass, and eventually shift this plant community back toward the Western Wheatgrass/Tall Warm-Season Plant Community. Prescribed burning followed by prescribed grazing may eventually convert this plant community back to the Western Wheatgrass/Tall Warm-Season Plant Community. Long-term prescribed grazing may eventually moves this plant community through the successional stages leading toward the Western Wheatgrass/Tall Warm-Season Plant Community.

Conservation practices

Prescribed Grazing

Restoration pathway R 4 to 1
State 4 to 1

Under long-term prescribed grazing and/or removal of disturbance, including adequate rest periods, this plant community will move through the successional stages, and may eventually lead to the Western Wheatgrass/Tall Warm-Season Plant Community. Depending on the slope, aspect, and size, and if adequate perennial plants exist, this change can occur more rapidly. This process will likely take a long period of time (50+ years). Range seeding with deferment and long term prescribed grazing can convert this to a plant community resembling the Western Wheatgrass/Tall Warm-Season Plant Community.

Conservation practices

Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Western Wheatgrass**			240–400	
	western wheatgrass	PASM	*Pascopyrum smithii*	240–400	–
2	**Tall warm-season grasses**			160–240	
	prairie sandreed	CALO	*Calamovilfa longifolia*	80–160	–
	sand bluestem	ANHA	*Andropogon hallii*	15–80	–
	big bluestem	ANGE	*Andropogon gerardii*	0–50	–
3	**Needlegrass**			160–240	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	160–240	–
	green needlegrass	NAVI4	*Nassella viridula*	30–80	–
4	**Grama**			80–160	
	blue grama	BOGR2	*Bouteloua gracilis*	80–160	–
5	**Other Native Grasses**			80–145	
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	30–50	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–50	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	15–30	–
	Sandberg bluegrass	POSE	*Poa secunda*	15–30	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–15	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–15	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–15	–
6	**Grass-Likes**			80–160	
	threadleaf sedge	CAFI	*Carex filifolia*	80–130	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	30–80	–
Forb					
7	**Forbs**			80–160	
	scurfpea	PSORA2	*Psoralidium*	15–30	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	15–30	–
	soft-hair marbleseed	ONBEB	*Onosmodium bejariense var. bejariense*	15–30	–

	soft-hair marbleseed	ONBEB	*Onosmodium bejarense var. bejarense*	15–30	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–15	–
	beardtongue	PENST	*Penstemon*	0–15	–
	spiny phlox	PHHO	*Phlox hoodii*	0–15	–
	cinquefoil	POTEN	*Potentilla*	0–15	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–15	–
	blazing star	LIATR	*Liatris*	0–15	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–15	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–15	–
	common yarrow	ACMI2	*Achillea millefolium*	0–15	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–15	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–15	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–15	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–15	–
	prairie clover	DALEA	*Dalea*	0–15	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–15	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–15	–
	blanketflower	GAAR	*Gaillardia aristata*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	goldenrod	SOLID	*Solidago*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–15	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	0–15	–
	American vetch	VIAM	*Vicia americana*	0–15	–
Shrub/Vine					
8	**Shrubs**			15–80	
	rose	ROSA5	*Rosa*	15–30	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	15–30	–
	leadplant	AMCA6	*Amorpha canescens*	15–30	–
	silver sagebrush	ARCA13	*Artemisia cana*	15–30	–
	prairie sagewort	ARFR4	*Artemisia frigida*	15–30	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–15	–
	pricklypear	OPUNT	*Opuntia*	0–15	–
Moss					
9	**Cryptogams**			0–15	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–15	–

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 group D. Infiltration varies from moderate to slow and runoff potential varies from medium to high 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

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

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 Sandy Claypan ecological site comes from adjacent MLRA 54 Sandy Claypan 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 Sandy Claypan ecological site originates from adjacent MLRA 54 Sandy Claypan 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 Sandy Claypan ecological site description include: Dennis Froemke, Jeff Printz, Stan Boltz, Darrell Vanderbusch, L. Michael Stirling, Josh Saunders, Jody Forman, David Dewald, and Brad Podoll.

Ocular estimates 4 1998 -2001 ND; SD Dunn, Hettinger, Morton

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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.

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 Sandy Claypan on 10/18/2017. 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.

2. **Presence of water flow patterns:** Barely observable.

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3. **Number and height of erosional pedestals or terracettes:** Not evident on slopes < 8%. Erosional pedestals may be present with small terracettes present at debris dams on slopes 9%.

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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 is 25 to 45%.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. If litter movement occurs, it is only for a short distance.

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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 45% or greater of soil surface and maintains soil surface integrity. Stability class anticipated to be 5 or greater.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth, color and structure of A-horizon.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Moderate plant canopy (50 to 70% maximum), deeper surface layer and a healthy plant community contribute to reduced runoff. Infiltration rates are slow to moderately slow.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer would be expected except for the naturally occurring pan below the surface layer.

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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, cool-season rhizomatous grasses >

    Sub-dominant: tall, warm-season rhizomatous grasses = mid, cool-season bunchgrasses >

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

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

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some plant mortality and decadence (less than 5%) is expected on this site.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative value = 1600 lbs/ac with a range of 1115 lbs/ac to 1990 lbs/ac (air dry weight) depending upon growing conditions

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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/local noxious, Kentucky bluegrass, smooth bromegrass

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17. **Perennial plant reproductive capability:** No limitations.
