USDA Natural Resources Conservation Service

Ecological site R058CY096ND
Clayey Terrace

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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.

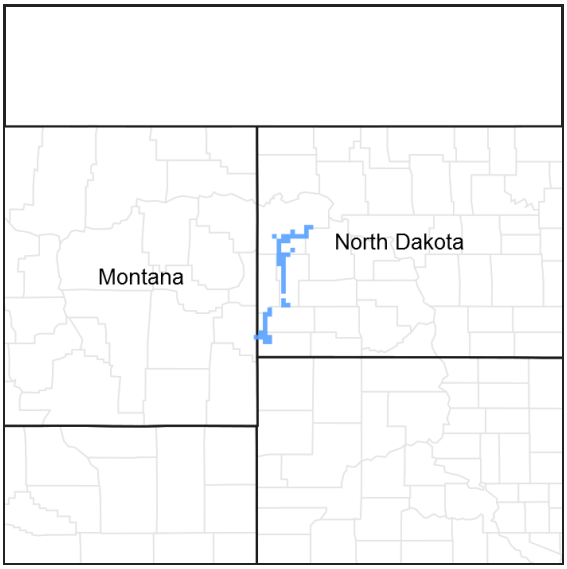


Figure 1. Mapped extent

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 Clayey Terrace ecological site occurs on occasional flooded steps with a slope range from 0 to 2 percent. This

site has greater than 27 percent clay in the surface horizon. A silty clay loam surface texture is followed by clay texture in the subsoil.

Associated sites

R058CY082ND	**Choppy Sands** The Choppy Sands ecological site is associated with the Clayey Terrace ecological site on floodplains along the major river systems in MLRA 58C. This site is on coarse-textured, natural levees that were deposited onto the floodplains by moving water and parallel the channel of the Little Missouri River and its major tributaries. These sandy alluvial deposits were then re-shaped into long, linear hummocky dunes by the prevailing winds. The more recently deposited dunes are near the river channel and run parallel to it. Older dunes are still parallel to the river channel, but are often no longer in close proximity to the channel due to natural meandering of the river across the landscape and constant establishment of new channels. When associated with the Clayey Terrace site, the Choppy Sands ecological site is also subject to occasional flooding events (> 5 times to 50 times in 100 years). Slopes vary from 3 to 9 percent. Soils on the Choppy Sands ecological site are very deep, excessively well drained, coarse textured soils that will not form a ribbon, but will form a ball when squeezed. Production on the Choppy Sands site is significantly lower than on the associated Clayey Terrace site. Indicator species are prairie sandreed, sand bluestem, needle and thread, penstemon, leadplant, and yucca.
R058CY089ND	**Sandy Terrace** The Sandy Terrace ecological site is in conjunction with and is in close proximity to the Clayey Terrace ecological site. This site is on floodplains, floodplain steps, and stream terraces that are subject to occasional flooding events (> 5 times to 50 times in 100 years). These floodplain steps generally have a seasonal high water table that fluctuates with the depth of the water in the river or stream channel. These floodplains receive periodic deposition from occasional flooding events, so carbonates may or may not be present at or near the surface. Sandy Terrace sites are typically down slope and closer to the associated river or stream channel than Clayey Terrace, Loamy Terrace, and Choppy Sands ecological sites. The Sandy Terrace site is up slope from Loamy Overflow (“Riparian Complex”) ecological sites. The Sandy Terrace ecological site has excessively well or well drained, very deep soils with coarse or moderately coarse textures and stratified layers in the subsoil. Production on Sandy Terrace sites is higher than on Clayey Terrace sites. Indicator species are prairie sandreed evenly mixed with sand bluestem, some Canada wildrye, penstemon, leadplant, and may include western snowberry, silver sagebrush, and possibly cottonwood trees.
R058CY091ND	**Loamy Terrace** The Loamy Terrace ecological site is adjacent to and in conjunction with the Clayey Terrace ecological site. This site is on floodplains, floodplain steps, and stream terraces that are subject to occasional flooding events (> 5 times to 50 times in 100 years). Slopes vary from 0 to 6 percent. Along the major river systems in MLRA 58C, the Loamy Terrace ecological sites are on slightly elevated geomorphic positions on the floodplains with Clayey Terrace sites on the slightly lower areas that are the remnants of old, abandoned meanders of the river channel that are now filled in with sediments. Soils on the Loamy Terrace ecological site are very deep, well-drained, medium textured soils that will form a ribbon less than 2 inches before breaking. These soils formed in alluvium and have a surface texture that typically is loam. Production on Loamy Terrace sites is higher than on Clayey Terrace sites. Indicator species are blue grama, western wheatgrass, and green needlegrass with forbs that include fringed sagewort, western yarrow, asters, and shrubs like western snowberry and silver sagebrush.

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 Clayey Terrace ecological site is located on nearly level floodplains, flood-plain steps, and stream terraces. Slopes range from 0 to 2 percent.

Table 2. Representative physiographic features

Landforms	(1) Flood plain
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Occasional
Ponding frequency	None to occasional
Elevation	1,838–3,430 ft
Slope	0–2%
Ponding depth	0–12 in
Water table depth	48–72 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) MEDORA [USC00325813], Medora, ND
- (2) TROTTERS 3 SSE [USC00328812], Beach, ND
- (3) GRASSY BUTTE 2ENE [USC00323705], Grassy Butte, ND
- (4) WATFORD CITY 14S [USC00329246], Grassy Butte, ND
- (5) FAIRFIELD [USC00322809], Fairfield, ND

Influencing water features

A seasonal water table (between about 4 and 6 feet from the soil surface) and the adjacent perennial water table can influence the kinds and amounts of vegetation on this site. Overland flow from flooding of the adjacent river or stream and runoff from melting snow may result in occasional ponding on this site that remains until the ponded water is depleted by evaporation.

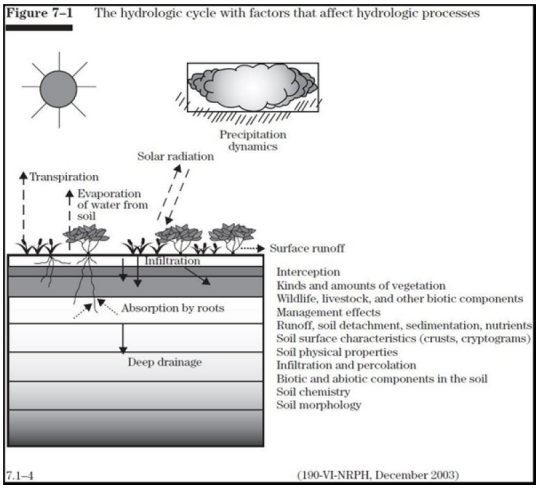


Figure 6. Fig.7-1 from National Range and Pasture Handbook.

Soil features

Common features of the soils on this site are surface textures that are dominantly silty clay loam, but may also be silty clay, clay, or clay loam. Combined surface horizons are 3 to 12 inches thick. Subsoil textures generally range from silty clay loam to clay, but some pedons have coarser textures below 40 inches. Slopes range from 0 to 2 percent. The soils on this site are well to moderately well drained, have a slow infiltration rate, and formed in calcareous clayey alluvium. Depth to carbonates ranges from 0 to 10 inches. These soils range from neutral in the upper horizons to moderately alkaline in the lower horizons. When dry, these soils can crack. When wet, surface compaction can occur with heavy traffic.

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 non-restrictive to water movement and root penetration.

The major soil series which characterize the Clayey Terrace ecological site is Wolf Point.

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).

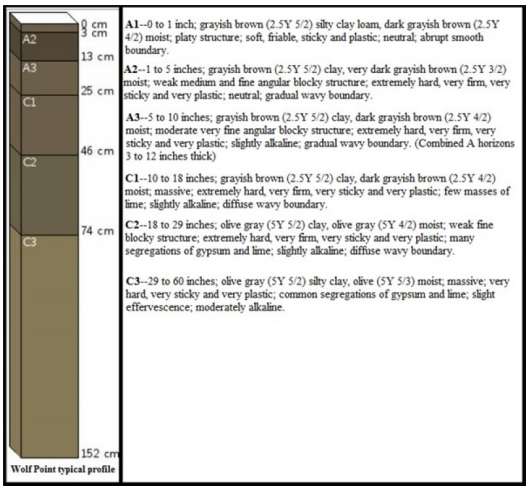


Figure 7. Typical soil profile of Wolf Point series.

Table 4. Representative soil features

Surface texture	(1) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained to moderately well drained
Permeability class	Slow
Soil depth	60–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–7 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–8 mmhos/cm
Sodium adsorption ratio (0-40in)	0–15
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
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 and blue grama will initially increase. Big bluestem, green needlegrass, sideoats grama and porcupine grass will decrease in frequency and production. Heavy continuous grazing causes blue grama to increase.

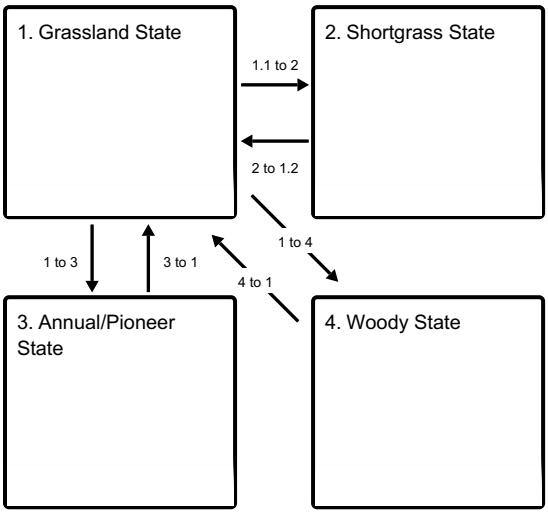
In time, heavy continuous grazing will likely cause blue grama to dominate and pioneer perennials, annuals, and club moss (in its range) to increase. This plant community is relatively stable and the competitive advantage prevents other species from establishing. This plant community is less productive 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 and trees such as western snowberry, chokecherry and green ash.

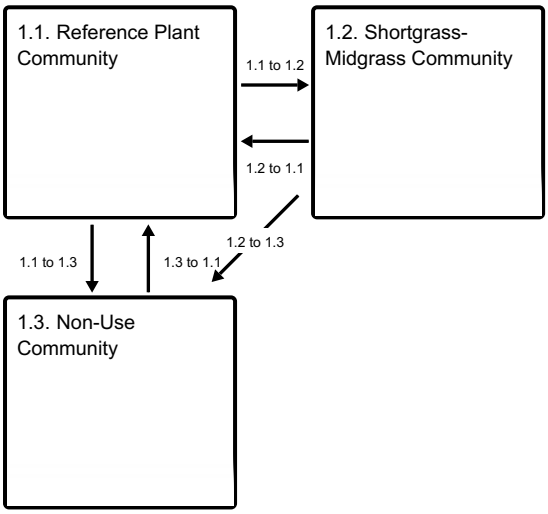
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best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

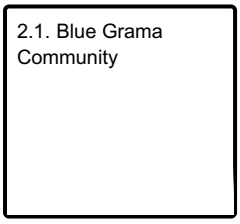
Ecosystem states



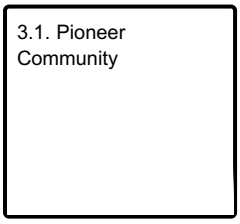
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities

4.1. Juniper Community

State 1
Grassland State

The Grassland State is supported by empirical data, historical data, local expertise, and photographs. This state is defined by three 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. The shortgrass-midgrass plant community is dominated by warm-season shortgrass and cool-season midgrass. Non-use plant Community consists of decadent plants or excessive litter, and few remnant native grasses or 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 adequate recovery periods following each grazing event. The potential vegetation is about 73% grasses and grass-like plants, 10% forbs, 15% shrubs, and 2% trees. The dominant grass species is western wheatgrass. Other grasses occurring on this community includes green needlegrass, bearded wheatgrass, needleandthread, sideoats grama, blue grama, big bluestem, and porcupine grass. Major forbs and shrubs include American vetch, purple prairie clover, cudweed sagewort, western yarrow, sunflower, western snowberry, and/or silver sagebrush and fringed sagewort. Scattered green ash, plains cottonwood and American elm may occur. 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.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1315	1835	2370
Shrub/Vine	175	290	365
Forb	110	175	275
Total	**1600**	**2300**	**3010**

Community 1.2
Shortgrass-Midgrass Community

This plant community can slowly develop from the adverse effects of continuous grazing without adequate recovery periods between each grazing event during the growing season. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. Blue grama and western wheatgrass are the dominant species. Green needlegrass has been greatly reduced. Big bluestem, porcupine grass and sideoats grama may have been removed. Forb species include western yarrow, asters, prairie coneflower, silverleaf scurfpea, wavyleaf thistle, and western salsify. Western snowberry, chokecherry, juneberry, and plum are greatly reduced while other shrub species would tend to be heavily browsed. If silver sagebrush is the principle shrub it would be sustaining. This plant community is relatively stable and less productive than the Reference Plant Community. Reduction of litter and reduced plant vigor result in higher soil temperatures, poor

water infiltration rates, increased runoff, and high evapo-transpiration rates. This plant community can occur throughout the site, on spot grazed areas, and around water sources where season-long grazing patterns occur. Soil erosion will be minimal due to the sod-forming habit of blue grama.

Community 1.3
Non-Use Community

This plant community develops after an extended period (10 to 20 years or more) of non-use and exclusion of fire. Eventually litter levels become high enough to reduce native grass vigor, diversity, and density. Kentucky bluegrass and/or smooth bromegrass tend to invade and may dominate this plant community. Common forbs include sweetclover, cudweed sagewort, and goldenrod species. Shrubs such as western snowberry and/or silver sagebrush, buffaloberry, and chokecherry will increase in density and cover and eventually tree species such as green ash. This plant community is resistant to change without prescribed grazing and/or fire. The combination of both grazing and fire is most effective in moving this plant community toward the Reference Plant Community. Soil erosion is low. Runoff is similar to the Reference Plant Community. Once the advanced stage of 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

Continuous grazing without adequate recovery periods between grazing events will shift this plant community to the Shortgrass-Midgrass Plant Community.

Pathway 1.1 to 1.3
Community 1.1 to 1.3

Non-use and no fire will move this plant community to the Decadent Plants, Excessive Litter Plant Community.

Pathway 1.2 to 1.1
Community 1.2 to 1.1

Prescribed grazing that includes adequate recovery opportunities will shift this plant community back to the Reference Plant Community.

Conservation practices

Prescribed Grazing

Pathway 1.2 to 1.3
Community 1.2 to 1.3

Extended periods (>10 years) of non-use and no fires will convert a plant community dominated by blue grama and western wheatgrass to a plant community of excessive litter and/or shrubs.

Pathway 1.3 to 1.1
Community 1.3 to 1.1

Prescribed grazing or prescribed burning followed by prescribed grazing will move this plant community 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
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.

Community 2.1
Blue Grama Community

This plant community can slowly develop from the adverse effects of continuous grazing without adequate recovery periods between each grazing event during the growing season. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. Blue grama and western wheatgrass are the dominant species. Green needlegrass has been greatly reduced. Big bluestem, porcupine grass, and sideoats grama may have been removed. Forb species include western yarrow, asters, prairie coneflower, silverleaf scurfpea, wavyleaf thistle, and western salsify. Western snowberry, chokecherry, juneberry, and plum are greatly reduced while other shrub species would tend to be heavily browsed. If silver sagebrush is the principle shrub it would be sustaining. This plant community is relatively stable and less productive than the Reference Plant Community. Reduction of litter and reduced plant vigor result in higher soil temperatures, poor water infiltration rates, increased runoff, and high evapo-transpiration rates. This plant community can occur throughout the site, on spot grazed areas, and around water sources where season-long grazing patterns occur. Soil erosion will be minimal due to the sod-forming habit of blue grama.

State 3
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 3.1
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 foxtail barley, which will dominate along with fowl bluegrass, Nuttall’s alkaligrass, annual brome and western wheatgrass. The dominant forbs include curly dock, kochia, and other early successional salt tolerant species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of non-native species due to severe soil disturbances and relatively high percent of bare ground. This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. Soil erosion is potentially high in this plant community. 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.

State 4
Woody State

This state is characterized by a dominance of Rocky Mountain juniper. Depending upon tree density, the herbaceous understory (grasses and forbs) will be minimal to non-existent. The combination of factors including a detritus layer of juniper, shading, changes to soil chemistry, interception of rainfall by tree canopies, and shallow rooting morphology of the juniper inhibit the herbaceous layer. The hydrologic function of this state has been altered

from that of State 1. The shallow rooting structure of the juniper and lack of native perennial grass species alters infiltration and increases potential of erosion.

Community 4.1
Juniper Community

This community is characterized by the complete dominance of juniper with an understory of herbaceous vegetation completely different from the reference plant community state. As Juniper increase in size and number, they further reduce the potential for a ground fire by reducing amount of available fine fuel.

Transition 1.1 to 2
State 1 to 2

Heavy continuous grazing without adequate recovery opportunity between grazing events or continuous seasonal (i.e. spring) grazing will move this plant community across an ecological threshold to the Shortgrass State.

Transition 1 to 3
State 1 to 3

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.

Transition 1 to 4
State 1 to 4

Elimination of fire is the major contributor to this transition.

Restoration pathway 2 to 1.2
State 2 to 1

Long-term (>10 years) prescribed grazing with adequate recovery periods between grazing events and proper stocking will shift this plant community toward the Inland Saltgrass/Western Wheatgrass Plant Community, and eventually to the Reference Plant Community or associated successional plant community stages assuming an adequate seed/vegetative source is available. This transition may take up to 20 years or more to accomplish depending on the degree of degradation.

Conservation practices

Prescribed Grazing

Restoration pathway 3 to 1
State 3 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 a plant community resembling one of the Grassland State Plant Communities. This process will take a long period of time (20+ years). Range seeding into mulch followed with prescribed grazing can be used to convert this plant community to one that may resemble the Reference Plant Community.

Conservation practices

Prescribed Grazing

Restoration pathway 4 to 1
State 4 to 1

For this retrogression to occur, an agent of change is needed such as the use of prescribed fire(s) and mechanical

treatment to gradually reduce the dominance of juniper to prevent seedlings from becoming established. Prescribed grazing is required. Wildfire (stand replacing) is also an agent of change that could aid in this restoration pathway. Reseeding to native species may also be required.

Conservation practices

Prescribed Burning
Range Planting
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	**Wheatgrass**			230–465	
	western wheatgrass	PASM	*Pascopyrum smithii*	230–465	–
2	**Needlegrass**			230–465	
	green needlegrass	NAVI4	*Nassella viridula*	230–465	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–230	–
3	**Grama**			90–185	
	blue grama	BOGR2	*Bouteloua gracilis*	90–185	–
4	**Other Warm-Season**			90–230	
	big bluestem	ANGE	*Andropogon gerardii*	90–160	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	70–160	–
5	**Other Native Perennials**			115–230	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	70–115	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	70–115	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	45–90	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	20–70	–
	Sandberg bluegrass	POSE	*Poa secunda*	20–70	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	20–70	–
	saltgrass	DISP	*Distichlis spicata*	0–20	–
6	**Grass-Likes**			20–115	
	needleleaf sedge	CADU6	*Carex duriuscula*	20–70	–
	Pennsylvania sedge	CAPE6	*Carex pensylvanica*	45–70	–
	threadleaf sedge	CAFI	*Carex filifolia*	20–45	–
Forb					
7	**Forbs**			115–230	
	goldenrod	SOLID	*Solidago*	20–45	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–45	–
	American vetch	VIAM	*Vicia americana*	20–45	–
	common yarrow	ACMI2	*Achillea millefolium*	20–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–45	–
	purple prairie clover	DAPU5	*Dalea purpurea*	20–45	–

	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	20–45	–
	dotted blazing star	LIPU	*Liatris punctata*	5–20	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–20	–
	mint	MENTH	*Mentha*	5–20	–
	bluebells	MERTE	*Mertensia*	5–20	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	10–20	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	5–20	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	5–20	–
	larkspur	DELPH	*Delphinium*	0–20	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–20	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	5–20	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	5–20	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–20	–
	onion	ALLIU	*Allium*	0–20	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	5–20	–
Shrub/Vine					
8	**Shrubs**			230–350	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	20–230	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–230	–
	prairie sagewort	ARFR4	*Artemisia frigida*	20–70	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–70	–
	American plum	PRAM	*Prunus americana*	20–45	–
	chokecherry	PRVI	*Prunus virginiana*	20–45	–
	prickly rose	ROAC	*Rosa acicularis*	20–45	–
	prairie rose	ROAR3	*Rosa arkansana*	20–45	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–45	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	20–45	–
	currant	RIBES	*Ribes*	5–20	–

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 C. Infiltration varies from moderately slow to slow and runoff potential varies from medium to very high for this site depending on soil surface texture 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 shortgrasses 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 increase 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 Clayey Terrace ecological site comes from adjacent MLRA 54 Clayey Terrace 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 Clayey Terrace ecological site originates from adjacent MLRA 54 Loamy Terrace 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 loamy terrace 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.

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(2) fax: (202) 690-7442; or

(3) email: program.intake@usda.gov

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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 of this reference sheet derived from MLRA 58C Loamy Terrace on 11/06/2017. J. Printz, S. Boltz, R. Kilian, D. Froemke, M. Rasmusson original authors of MLRA 54 Loamy Terrace 5-12-2011.
Contact for lead author	Mark Hayek, USDA-NRCS, State Rangeland Management Specialist, Bismarck, ND. Mark.Hayek@nd.usda.gov
Date	11/06/2017
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:** Barely observable.

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3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

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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 less than 10%.

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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:** None.

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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.

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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 90% 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):** A1--0 to 1 inch; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; platy structure; soft, friable, sticky and plastic; neutral; abrupt smooth boundary.

   A2--1 to 5 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak medium and fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; neutral; gradual wavy boundary.

   A3--5 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; slightly alkaline; gradual wavy boundary. (Combined A horizons 3 to 12 inches thick)

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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.

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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 or soil surface crusting should be evident.

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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 = mid, cool-season bunchgrasses >

Sub-dominant: shrubs >

Other: tall, rhizomatous warm-season grasses = forbs > short, warm-season grasses > grass-likes > trees

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):** Very low.

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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 = 2300 lbs/ac with a range of 1600 lbs/ac to 3010 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 and local noxious, smooth bromegrass, Kentucky bluegrass, Russian Olive.

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