Ecological site R102CY057NE
CLAYEY

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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.

MLRA notes

Major Land Resource Area (MLRA): 102C–Loess Uplands

Most of this area is in the Dissected Till Plains part of the Central Lowland Province of the Interior Plains. This MLRA has broad, undulating to rolling ridgetops and hilly to steep valley sides. The valleys are generally narrow, but broad flood plains and terraces are along the major rivers and the large tributaries. Elevation ranges from 335 to 610 meters (1,100 to 2,000 feet) increasing from southeast to northwest. Peorian age loess covers most of the area with depths ranging from 2 to 20 meters (6 to 70 feet). Glacial till underlies the loess in most areas. Bedrock can be found at or near the surface predominantly along the Missouri River valley found on the eastern side of the MLRA, but some bedrock can also be found in the northern part of 102C in Minnesota and South Dakota. The soils are predominantly Mollisols but Entisols are prominent in the floodplains of the area. Nearly all the area is farmed with 70% of the area being used as cropland for corn and soybeans. Feed grains and hay crops are also grown. The major resource concerns are wind erosion, water erosion, maintenance of organic matter and soil tilth, and soil moisture management. (USDA/NRCS 2006)

Classification relationships

NE Natural Heritage Program/NE Game & Parks Commission: "Lowland Tallgrass Prairie" General information for MLRA 102C: *Fenneman (1916) Physiographic Regions* Division - Interior Plains East: Province - Central Lowland Section - Till Plains West: Province - Great Plains Section - High Plains *USFS (2007) Ecoregions* Domain - Humid Temperate Division - Prairie Province - Prairie Parkland (Temperate) Section - North-Central Glaciated Plains (251B) *EPA Ecoregions (Omernik 1997)* I - Great Plains (9) II - Temperate Prairies (9.2) III - Western Corn Belt Plains (9.2.3) IV - Loess Prairies (47a) IV - Northeastern Nebraska Loess Hills (47k) IV - Transitional Sandy Plain (47l)

Ecological site concept

This upland ecological site has clayey soils and a reference community dominated by warm season grasses. The foremost diagnostic feature of this site is the high clay content that begins at or near the surface. The sites do not receive additional moisture from higher adjacent areas and are subject to significant runoff. This site predominantly occurs on nearly level to slightly sloping upland positions (0-15% slopes). Water typically runs off these sites to adjacent overflow or upland sites. Most areas have a seasonally high-water table that is below 180 centimeters (71 inches) year around; however, a few sites are not as well drained and have a seasonally high-water table between 50 and 75 centimeters (20 and 30 inches). The site does not pond or flood. These are predominantly very deep, somewhat poorly drained to well drained soils. The surface texture is predominantly silty clay from 10 to 28 centimeters (4 to 11 inches) and the Subsurface Texture Groups are fine from 20 to 203 centimeters (8 to 80 inches). The reference plant community consists of 80-95% grasses and grass-likes, 5-10% forbs and 0-5% shrubs. Dominant grasses include Big bluestem, Little bluestem, Porcupinegrass, and Switchgrass. Other grasses and grass-likes are Kentucky bluegrass, Prairie dropseed, Western wheatgrass, Prairie junegrass, Sideoats grama, Tall dropseed, and numerous forbs and shrubs

Associated sites

R102CY059NE	**Limy Upland** Occurs on similar upland positions but has higher CaCO3 content.

R102CY048NE	**Loamy Overflow** Occurs on surrounding upland drainage areas.
R102CY058NE	**Loamy Upland** Occurs on similar upland positions but has silty or loamy textural class.

Similar sites

R102CY058NE	**Loamy Upland** Silty or loamy textural class

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Schizachyrium scoparium*

Physiographic features

This site predominantly occurs on nearly level to slightly sloping upland positions (0-15% slopes). Water typically runs off these sites to adjacent overflow or upland sites. Most areas have a seasonally high-water table that is below 180 centimeters (71 inches) year around; however, a few sites are not as well drained and have a seasonally high-water table between 50 and 75 centimeters (20 and 30 inches). The site does not pond or flood.

Table 2. Representative physiographic features

Landforms	(1) Upland
Runoff class	Medium to very high
Elevation	380 – 490 m
Slope	0 – 20 %
Water table depth	50 – 180 cm
Aspect	Aspect is not a significant factor

Climatic features

Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from the middle of spring to early in autumn. Precipitation in winter occurs as snow. The annual snowfall ranges from about 60 centimeters (24 inches) in the southern part of the area to 85 centimeters (34 inches) in the northern part. The average annual temperature gradient trends higher from north (7°C / 45°F) to south (11°C / 51°F), and the average annual precipitation gradient trends higher from northwest (64 centimeters / 25 inches) to southeast (79 centimeters / 31 inches).

The following data summary includes weather stations representing the full geographic extent of the MLRA and is based on 70% probabilities. This means that actual observed climate conditions may fall outside these ranges 30% of the time. Furthermore, climatic events can manifest many ways. For example, abnormally dry periods could occur as 3 consecutive drought years out of 10, 3 individual years separated by “normal” years, or some combination. Tree-ring records indicate that portions of the Great Plains have also historically experienced droughts lasting several decades, so plant community response will largely depend on the way climatic variability is realized in interaction with past and current land management.

Table 3 Representative climatic features

Frost-free period (characteristic range)	130-130 days
Freeze-free period (characteristic range)	140-150 days
Precipitation total (characteristic range)	690-740 mm
Frost-free period (actual range)	120-130 days
Freeze-free period (actual range)	140-150 days
Precipitation total (actual range)	690-760 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days
Precipitation total (average)	710 mm

- (1) FLANDREAU [USC00392984], Flandreau, SD
- (2) SIOUX FALLS 14 NNE [USW00004990], Garretson, SD
- (3) SIOUX FALLS [USW00014944], Sioux Falls, SD
- (4) LUVERNE [USC00214937], Luverne, MN
- (5) HAWARDEN [USC00133718], Hawarden, IA
- (6) YANKTON 2 E [USW00094911], Yankton, SD
- (7) VERMILLION 2 SE [USC00398622], Vermillion, SD
- (8) ROCK RAPIDS [USC00137147], Rock Rapids, IA
- (9) CREIGHTON [USC00251990], Creighton, NE
- (10) NE NEBRASKA EXP STN [USC00256018], Concord, NE
- (11) WAKEFIELD [USC00258915], Wakefield, NE
- (12) STANTON 7NE [USC00258117], Stanton, NE
- (13) ELGIN [USC00252595], Elgin, NE

Influencing water features

No riparian or wetland features are associated with this site.

Soil features

These are predominantly very deep, somewhat poorly drained to well drained soils. The surface texture is predominantly silty clay from 10 to 28 centimeters (4 to 11 inches) and the Subsurface Texture Groups are fine from 20 to 203 centimeters (8 to 80 inches).

Rills, gullies, and water flow patterns are not inherent to this site. Pedestalling is none to slight. Soil aggregate stability should be high due to the high clay amounts.

Major soils assigned to this site include: Boyd, Butler, Corson, and Labu.

Table 4. Representative soil features

Parent material	(1) Glaciolacustrine deposits (2) Loess
Surface texture	(1) Silty clay
Drainage class	Somewhat poorly drained to well drained
Permeability class	Very slow to slow
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (Depth not specified)	7.62 – 15.24 cm
Calcium carbonate equivalent (Depth not specified)	0 – 20 %
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	5.1 – 8.4

Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The foremost diagnostic feature of this site is the high clay content that begins at or near the surface. The sites do not receive additional moisture from higher adjacent areas and are subject to significant runoff. Relatively minor changes in local elevation can dramatically affect the plant community since somewhat poorly drained soils do occur in this predominantly well drained ecological site. This site often occurs in complex with the Loamy Upland, Loamy Overflow and Limy Upland sites.

This site developed with occasional fires being part of the ecological processes. It is presumed that the historic fires generally occurred every 3-4 years, were randomly distributed, and started by lightning at various times throughout the season when thunderstorms were likely to occur. It is also believed that pre-European inhabitants may have used fire as a management tool for attracting herds of large migratory herbivores (bison, elk, and/or deer.) The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool.

The degree of herbivory (feeding on herbaceous plants) has a significant impact on the dynamics of the site. Historically, periodic grazing by herds of large migratory herbivores was a primary influence. Secondary influences of herbivory by species such as grasshoppers and root feeding organisms impacted the vegetation historically and continue to this day. The management of herbivory by humans through grazing of domestic livestock and/or manipulation of wildlife populations has been a major influence on the ecological dynamics of the site. This management coupled with climate largely dictates the plant communities for the site.

The plant community for this site is dynamic due to the complex interaction of many ecological processes. The interpretive plant community for this site is the reference state. The reference state has been determined by the study of rangeland relic areas, areas protected from excessive disturbance and areas under long term rotational grazing strategies. Trends in plant community dynamics ranging
from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways among communities. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 11. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Inventory data references

Meetings and comments of local, state and regional experts convene and created the ES concepts and STMs. Information presented here has been derived from RANGE-417 archives, Rangeland NRI, and other inventory data. Field observations from range-trained personnel were also used. In addition to the multitude of NRCS field office employees and private landowners that helped with site visits and local knowledge, those involved in developing this site include: Nebraska NRCS: Nadine Bishop, State Rangeland Management Specialist Patrick Cowsert, Resource Soil Scientist Cassidy Gerdes, Biologist Dirk Schultz, Soil Conservationist Dan Shurtliff, Asst. State Soil Scientist (retired) South Dakota NRCS: Stan Boltz, State Rangeland Management Specialist Shane Deranleau, Area Rangeland Management Specialist Kevin Luebke, State Biologist Iowa NRCS: Jess Jackson, Area Grazing Specialist Minnesota NRCS: Lance Smith, Area Grazing Specialist MLRA Office 10: Stu McFarland, Ecological Site Inventory Specialist Stacey Clark, Ecological Site Inventory Specialist, QA Michael Whited, Region 10 Director (retired) Jo Parsley, Soil Scientist/ Soil Data Quality Specialist National Soil Survey Center: Mike Kucera, National Agronomist, Soil Quality & Ecosystems Steve Peaslee, GIS Specialist, Soil Survey Interpretations Nebraska Game & Parks Commission: Gerry Steinauer, Botanist Scott Wessel, Biologist Russ Hamer, Biologist Rebekah Jessen, Biologist Nebraska Forest Service: Steve Rasmussen, District Forester

Other references

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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.

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Date	12/04/2024
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills: None. Rills are not expected on this site.**

2. **Presence of water flow patterns: None. Water flow patterns are not expected on this site.**

3. **Number and height of erosional pedestals or terracettes: None. Pedestals and terracettes are not expected to occur on this site.**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground): Bare ground is typically 5 percent or less. Bare ground may increase up to 10 percent during and immediately after multi-year drought. Bare ground is exposed mineral soil that is not covered by vegetation (basal and/or foliar canopy), litter, standing dead vegetation, gravel/rock, and visible biological curst (e.g., lichen, mosses, algae).**

5. **Number of gullies and erosion associated with gullies: None. Gullies are not expected on this site.**

6. **Extent of wind scoured, blowouts and/or depositional areas: None. Wind-scoured and/or depositional areas should not be present.**

7. **Amount of litter movement (describe size and distance expected to travel):** None. Litter should fall into place. Litter movement is not expected on this site.

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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):** Soil stability ratings will be 5 to 6, typically 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The thickness of the A-horizon is highly variable depending upon soil series and ranges from 6 to 51 inches (15 to 130 cm) thick. Soil surface color ranges from grayish brown, very dark gray to dark gray (hue: 10 YR, value: 3, 4 or 5, chroma: 1 or 2) when dry and black, very dark grayish brown, or very dark brown, (hue: 10 YR, value: 2 or 3, chroma: 1 or 2) when moist. Structure varies significantly with soil series from weak fine or weak medium fine granular, moderate fine or moderate fine and medium or weak fine subangular blocky, weak fine and medium subangular blocky, weak fine or weak and medium subangular blocky parting to weak fine granular, to moderate fine or moderate medium prismatic structure parting to moderate fine subangular blocky. See Official Soil Descriptions for more information.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community composition is approximately 80 to 95 percent grasses and grass-likes, 5 to 10 percent forbs, and 0 to 5 percent shrubs which optimizes infiltration on the site. The grass and grass-like portion is composed warm-season (C4) tall grasses, warm-season (C4) mid-grasses, cool-season (C3) bunchgrasses, cool-season (C3) rhizomatous grasses, warm-season (C4) short grasses, and grass-likes. These functional/structural groups provide a combination of rooting depths and structure which positively influences infiltration. Invasion of introduced cool-season grasses such as Kentucky bluegrass and smooth brome may have an adverse impact infiltration and 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):** None. No compaction layers are expected for this site. When dry, the B-horizons can be hard and appear to be compacted, but no platy structure will be present. Heavy traffic (livestock or vehicular) when these soils are wet can produce a compaction layer. This is not expected in the reference state.

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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: Phase 1.1 1. Native, perennial, warm-season tallgrass (3 species minimum): big bluestem, Indiangrass, switchgrass, composite dropseed. 2. Native, perennial, warm-season, midgrass, (2 species minimum): little bluestem, sideoats grama. Phase 1.2 1. Native, perennial, warm-season, midgrass (1 species minimum): Little bluestem, sideoats grama. 2. Native, perennial, cool-season grass (3 species minimum): needleandthread, western wheatgrass, Canada wildrye, Scribner’s rosettegrass, prairie Junegrass.

    Sub-dominant: Phase 1.1 1. Native, perennial, cool-season bunchgrass (2 species minimum): needleandthread, porcupinegrass, Canada wildrye, Scribner’s rosettegrass, prairie Junegrass Phase 1.2 1. Native, perennial, warm-season tallgrass, (2 species minimum): sand bluestem, Indiangrass, switchgrass, prairie sandreed. 2. Native, perennial, cool-season rhizomatous grass (1 species minimum): western wheatgrass.

    Other: Minor - Phase 1.1 1. Native, perennial, cool-season rhizomatous grass: western wheatgrass. 2. Native, perennial, warm-season shortgrass: blue grama, hairy grama, Fendler threeawn, thin paspalum. 3. Native forbs: forbs present vary from location to location. 4.

Grass-likes: sedges. 5. Shrubs: shrubs present vary from location to location. Minor - Phase 1.2 1. Native, perennial, warm-season, shortgrass (1 species minimum): Blue grama, buffalograss, hairy grama, threeawn. 2. Native forbs: forbs present vary from location to location. 3. Grass-likes: sedges. 4. Shrubs: shrubs present vary from location to location.

Additional: The Big Bluestem – Little Bluestem Reference Community (1.1) includes eight F/S groups which include in order of relative abundance, native, perennial, warm-season (C4) tallgrass; native, perennial, warm-season (C4) midgrass; native, perennial, cool-season (C3) bunchgrass; native, perennial, cool-season (C3), rhizomatous grass; native forbs; grass-likes; shrubs. The Little Bluestem – Porcupinegrass Community (1.2) includes eight F/S groups which include in order of relative abundance, native, perennial, warm-season (C4) midgrass; native, perennial, cool-season (C3) bunchgrass; native, perennial, warm-season (C4) tallgrass; native, perennial, cool-season (C3) rhizomatous grass; native, perennial, warm-season (C4) shortgrass; native forbs; grass-likes; and shrubs.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence): Bunchgrasses have strong, healthy centers with few (less than 3 percent) dead centers. Shrubs may show some dead branches (less than 5 percent) as plants age.**

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14. **Average percent litter cover (%) and depth (in): Plant litter cover is evenly distributed throughout the site and is expected to be 70 to 90 percent and at a depth of 0.25 to 0.50 inch (0.65-1.3 cm). Kentucky bluegrass excessive litter may negatively impact the functionality of this site.**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): The representative value (RV) for annual production is 3,500 pounds per acre in a year with normal precipitation and temperatures. Low and High production years should yield 2,750 and 4,500 pounds per acre respectively.**

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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: No non-native invasive species are present. Annual bromes, Kentucky bluegrass, smooth brome, musk thistle, Canada thistle, plumeless thistle, spotted and diffuse knapweed, eastern redcedar, roughleaf dogwood, smooth sumac, Siberian elm, and autumn olive are known invasives that have the potential to become dominant or co-dominant on the site. Note: species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants.**

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17. **Perennial plant reproductive capability: All perennial species exhibit high vigor relative to climatic conditions. Perennial grasses should have vigorous rhizomes or tillers; vegetative and reproductive structures are not stunted. All perennial species should be capable of reproducing annually.**
