Ecological site R102CY053NE
LIMY SUBIRRIGATED

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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 ecological site is found in lowlands, has limy subirrigated soils and a reference community dominated by warm season grasses. The foremost diagnostic feature of this site is the high carbonate levels that begin at or near the surface and a seasonally high-water table from 60 to 102 centimeters (24 to 40 inches), with additional moisture received from higher adjacent areas as run-on. The high-water table increases plant production. This site predominantly occurs on nearly level to gently sloping floodplains and stream terraces (0-2% slopes). A few areas are on upland drains or interdunal areas in uplands that can range up to 5% slopes. It predominantly receives runoff from adjacent sites, has a seasonally high-water table from 60 to 102 centimeters (24 to 40 inches) from November-May, does not pond, and may flood occasionally for a brief duration. These are predominantly very deep, somewhat poorly to moderately well drained soils. The surface texture is predominantly silt loam, loam, loamy fine sand or fine sandy loam from 0 to 20 centimeters (0 to 8 inches) and the Subsurface Texture Groups are Loamy, Silty or Sandy from 18 to 203 centimeters (7 to 80 inches). The plant community consists of 80-95% grasses and grass-likes, 5-10% forbs and 0-5% shrubs. Dominant grasses include Big bluestem, Little bluestem, Indiangrass, Switchgrass, Sideoats grama and Porcupinegrass. Other grasses and grass-likes are Prairie junegrass, Scribner panicum, Tall dropseed, Blue grama and sedges. Forb species are diverse and often include Black Samson and Common yarrow.

Associated sites

R102CY044NE	**WET LAND** Typically occurs in the lowest areas, or where hydrology otherwise supports a community heavily dominated by hydrophytic vegetation.

R102CY045NE	**WET SUBIRRIGATED** Occurs on lower relief with a seasonally high-water table within 24 inches and a marked increase in hydrophytic vegetation.
R102CY048NE	**Loamy Overflow** Seasonally saturated 24 to 40 inches of the surface

Similar sites

R102CY048NE	**Loamy Overflow** Seasonally saturated 24 to 40 inches of the surface.
R102CY045NE	**WET SUBIRRIGATED** Seasonally saturated 0 to 24 inches of the surface and not normally ponded.

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 gently sloping floodplains and stream terraces (0-2% slopes). A few areas are on upland drains or interdunal areas in uplands that can range up to 5% slopes. It predominantly receives runoff from adjacent sites, has a seasonally high-water table from 60 to 102 centimeters (24 to 40 inches) from November-May, does not pond, and may flood occasionally for extremely brief to brief duration.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Terrace (3) Upland slope
Runoff class	Negligible to medium
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional

Elevation	340 – 420 m
Slope	0 – 10 %
Water table depth	60 – 100 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)	690-760 mm
Frost-free period (actual range)	120-140 days
Freeze-free period (actual range)	140-170 days
Precipitation total (actual range)	690-810 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days
Precipitation total (average)	740 mm

- (1) FLANDREAU [USC00392984], Flandreau, SD
- (2) SIOUX FALLS [USW00014944], Sioux Falls, SD

- (3) ROCK RAPIDS [USC00137147], Rock Rapids, IA
- (4) HAWARDEN [USC00133718], Hawarden, IA
- (5) GAVINS POINT DAM [USC00253165], Yankton, NE
- (6) VERMILLION 2 SE [USC00398622], Vermillion, SD
- (7) CREIGHTON [USC00251990], Creighton, NE
- (8) WAKEFIELD [USC00258915], Wakefield, NE
- (9) ELGIN [USC00252595], Elgin, NE
- (10) WEST POINT [USC00259200], West Point, NE
- (11) GENOA 2 W [USC00253185], Genoa, NE
- (12) VALLEY NWS [USC00258795], Valley, NE

Influencing water features

The proximity to the water table facilitates an increase in vegetative production, and mitigates adverse effects of precipitation patterns on the vegetative community. This site does not pond but can be influenced by occasional flooding of a brief duration.

Soil features

These are predominantly very deep, somewhat poorly to moderately well drained soils. The surface texture is predominantly silt loam, loam, loamy fine sand or fine sandy loam from 0 to 20 centimeters (0 to 8 inches) and the Subsurface Texture Groups are Loamy, Silty or Sandy from 18 to 203 centimeters (7 to 80 inches). These are limy soils with higher calcium carbonate equivalent and higher relative pH.

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

Major soils assigned to this site include Gibbon, Chaska, Ord, Wann, Saltine and Ovina.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian sands
Surface texture	(1) Silt loam (2) Loam (3) Fine sandy loam (4) Loamy fine sand
Drainage class	Somewhat poorly drained to moderately 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)	2.54 – 22.86 cm

Calcium carbonate equivalent (Depth not specified)	0 – 40 %
Electrical conductivity (Depth not specified)	0 – 10 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0 – 10
Soil reaction (1:1 water) (Depth not specified)	5.6 – 10
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 carbonate levels that begin at or near the surface and a seasonally high-water table from 60 to 102 centimeters (24 to 40 inches), with additional moisture received from higher adjacent areas as run-on. The high-water table increases plant production while also “buffering” variability caused by fluctuating weather conditions. Relatively minor changes in local elevation can dramatically affect the plant community. This site often occurs in complex with other sites, particularly Wet Land, Subirrigated, and Wet Subirrigated. Plant community composition may also experience similar changes through disturbances that affect the water table itself, such as extended dry or wet cycles.

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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Approval

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Acknowledgments

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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.

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

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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 5 percent or less. 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 crust (e.g., lichen, mosses, algae).

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** None. Litter falls 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 4 to 6 and vary with the degree of calcareousness of the soil.

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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 varies significantly with soil series and ranges from 7 to 24 inches (18 – 61 cm) thick. Soil colors may be very dark gray, dark gray, gray, dark grayish brown, or light brownish gray (10YR 3 to 6/1 or 2) when dry and black, very dark gray, dark gray, very dark grayish brown, or dark grayish brown (10YR 2 to 6/1 or) when moist. Soil structures in the A-horizon are weak very fine granular, very fine granular to weak fine granular parting to very fine granular, weak fine and medium subangular blocky structure, weak coarse blocky parting to moderate medium granular, and weak moderate subangular blocky parting to weak fine granular. See Official Soils Descriptions for additional details; major soil series correlated to the site are Chaska, Gibbon, Ord, Ovina, Saltine, and Wann.

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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 85 to 95 percent grasses or grass-like plants, 5 to 10 percent forbs, and 0-5 percent shrubs and trees which optimizes infiltration on the site. The grass and grass-like component is composed of warm-season (C4), tallgrass, warm-season (C4), midgrass, cool-season (C3) grasses, and grass-likes (5-10%). The 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. Tree encroachment may also negatively 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 on this site.

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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 (4 species minimum): big bluestem, switchgrass, Indiangrass, composite dropseed, prairie cordgrass. Phase 1.2 1. Native, perennial, warm-season tallgrass (4 species minimum): big bluestem, switchgrass, Indiangrass, composite dropseed, prairie cordgrass.

Sub-dominant: Phase 1.1 1. Native, perennial, warm-season midgrass (2 species minimum): little bluestem, sideoats grama. 2. Native, perennial, cool-season bunchgrass (2 species minimum): Slender wheatgrass, plains bluegrass, Canada wildrye, porcupinegrass, needle and thread. Phase 1.2 1. Native, perennial, cool-season bunchgrass (2 species minimum): Slender wheatgrass, plains bluegrass, Canada wildrye, porcupinegrass, needle and thread, reed canarygrass. 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, scratchgrass, buffalograss. 3. Grass-likes: sedges. 4. Native forbs: forbs present vary from location to location. 5. Shrubs: shrubs present vary from location to location. Minor - Phase 1.2 1. Native, perennial, warm-season midgrass: little bluestem, sideoats grama. 2. Grass-likes: sedges 3. Native, perennial, warm-season shortgrass: blue grama, scratchgrass, buffalograss, purple lovegrass. 4. Native forbs: forbs present vary from location to location. 5. Shrubs: shrubs present vary from location to location.

Additional: The Native Tallgrass Community or Reference Community (1.1) includes eight F/S groups which include in order of relative abundance, native, perennial, warm-season (C4) tallgrass; native, perennial, cool-season (C3) bunchgrass; native, perennial, warm-season (C4) midgrass; native, perennial, cool-season (C3) rhizomatous grass; grass-likes, native, perennial, warm-season (C4) shortgrass; native forbs; and shrubs. The Prairie Cordgrass – Big Bluestem Community (1.2) includes eight F/S groups which include in order of relative abundance, native, perennial, warm-season (C4) tallgrass; native, perennial, cool-season (C3), bunchgrass; native, perennial, cool-season (C3), rhizomatous grass; native, perennial, warm-season (C4) mid-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 60 to 80 percent and at a depth of approximately 0.25 to 0.5 inch (0.65 to 1.3 cm).**

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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 3,250 pounds per acre in a year with normal precipitation and temperatures. Low and High production years should yield 2,500 and 4,000 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. Canada thistle, Russian thistle, kochia, and eastern red cedar, 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.**
