Ecological site R102CY059NE
Limy Upland

Accessed: 05/15/2024

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.

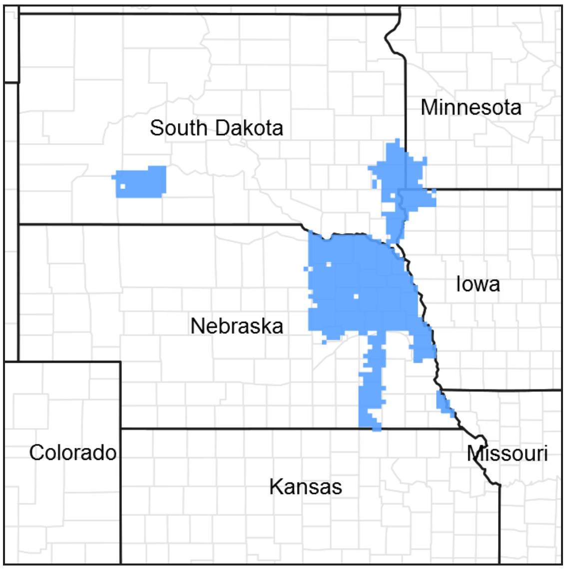

Figure 1. Mapped extent

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.

Classification relationships

"Limy Upland" range sites for NE NRCS Vegetation Zones 3 & 4

NE Natural Heritage Program/NE Game & Parks Commission: "Upland 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 site occurs on upland slopes and unstable summits that cause precipitation to runoff rather than infiltrate such that percolation is insufficient to leach carbonates near the surface. Sheet flow across the soil surface also results in the redistribution of nutrients and material to downslope areas maintaining a relatively thin soil surface layer. Relative to the more stable upland areas, less soil moisture is available for plant growth, production is lower, and species composition will tend towards species that are more drought resistant.

Associated sites

R102CY058NE	**Loamy Upland** This site is generally flatter and broader, and typically occurs immediately upslope.
R102CY063NE	**Loess Breaks** This site is occurs in the same landscape position, but is exceptionally steep (>30% slope).

Similar sites

R102CY063NE	**Loess Breaks** Soils share a range of characteristics, but this site is, in effect, an exceptionally steep (>30% slope) Limy Upland. Soil development and plant production/composition are indicative of drier conditions due to run-off.
R102CY058NE	**Loamy Upland** This site will have a mollic surface without carbonates within 10" of the surface.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site predominantly occurs on nearly level to steep upland hillslopes on interfluves (1-30% slopes). The slope shape is predominantly convex, generates runoff, has a water table greater than 203 centimeters deep, and does not flood or pond.

Refer to the 102C Ecosite Key for field verification.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Interfluve
Flooding frequency	None
Ponding frequency	None
Elevation	305–610 m
Slope	1–30%

Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. Peak precipitation occurs from the middle of spring to early in autumn. Winter precipitation occurs as snow (USDA/NRCS 2006).

The average annual temperature gradient trends higher from north (45°F/7°C) to south (51°F/11°C).

The average annual precipitation gradient trends higher from northwest (25”/64cm) to southeast (31”/79cm).

The annual snowfall ranges from about 24" (60cm) in the southern part of the area to 34" (85cm) in the northern part.

The following data summary includes weather stations representing the full geographic extent of the MLRA, and is based on 70% probabilities (NOAA/UNL) meaning that actual observed climate conditions may fall outside these ranges 30% of the time. Furthermore, climatic events can manifest many different 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 manner in which climatic variability is realized in interaction with past and current land management.

Table 3. Representative climatic features

Frost-free period (average)	161 days
Freeze-free period (average)	181 days
Precipitation total (average)	787 mm

Influencing water features

No riparian or wetland features are associated with this site.

Soil features

These are predominantly very deep (moderately deep where residuum is present), well drained soils and have a 5% minimum calcium carbonate equivalent within 25 centimeters of the soil surface. The surface texture is predominantly silt loam, loam, or clay loam from 0 to 16 centimeters and the Subsurface Texture Group is Loamy from 16 to 203 centimeters.

Major soils assigned to this site include Betts, Crofton, Redstoe, and Steinauer.

Table 4. Representative soil features

Parent material	(1) Residuum–calcareous siltstone
Surface texture	(1) Silt loam (2) Loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	51 cm

Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–3%
Available water capacity (0-101.6cm)	10.41–22.61 cm
Calcium carbonate equivalent (0-101.6cm)	5–45%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–8%
Subsurface fragment volume >3" (Depth not specified)	0–3%

Ecological dynamics

The slopes inherent to this site decrease infiltration, production, and soil development. The foremost diagnostic characteristic is the presence of calcium carbonates (lime) in the upper 10" of the soil profile as an indication of this increased run-off. Some species, particularly switchgrass and smooth brome, are less tolerant of carbonates and can be expected to grow sparser as lime content increases. (USDA 2012B).

This site developed with fire as an integral part of the ecological processes and grassland maintenance. It is presumed that the historic fires generally occurred every 3-4 years, were randomly distributed, and ignited by lightning at various times throughout the summer when thunderstorms were likely to occur. Furthermore, it is also believed that pre-European inhabitants often used fire as a management tool for attracting herds of large migratory herbivores (bison, elk, and/or deer) as well as for warfare. However, the impact of fire over the past 100 years has been diminished due to human prevention and suppression of wildfire and the pervasive lack of cultural acceptance of prescribed fire as a surrogate (Helzer 2010).

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; however, herbivory by species such as insects, rodents, and root feeding organisms also impacted the vegetation historically and continue to this day (Helzer 2010). Human control of large herbivore impacts through grazing of domestic livestock and/or manipulation of wildlife populations has been a major contemporary influence on the ecological dynamics of the site (USDA/SCS 1977) and this management coupled with climate largely dictates the plant communities observed.

The reference state characterizes the historic natural condition, and has been determined by the study of rangeland relic areas, areas protected from excessive disturbance, and/or areas under compatible grazing regimes. Trends in plant community dynamics ranging from heavily grazed to unused areas, seasonal use pastures, and historical accounts have also been considered.

The following is a diagram illustrating predictable and recurring plant communities inherent to this site, and the pathways of change between them (Bestelmeyer 2010). The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

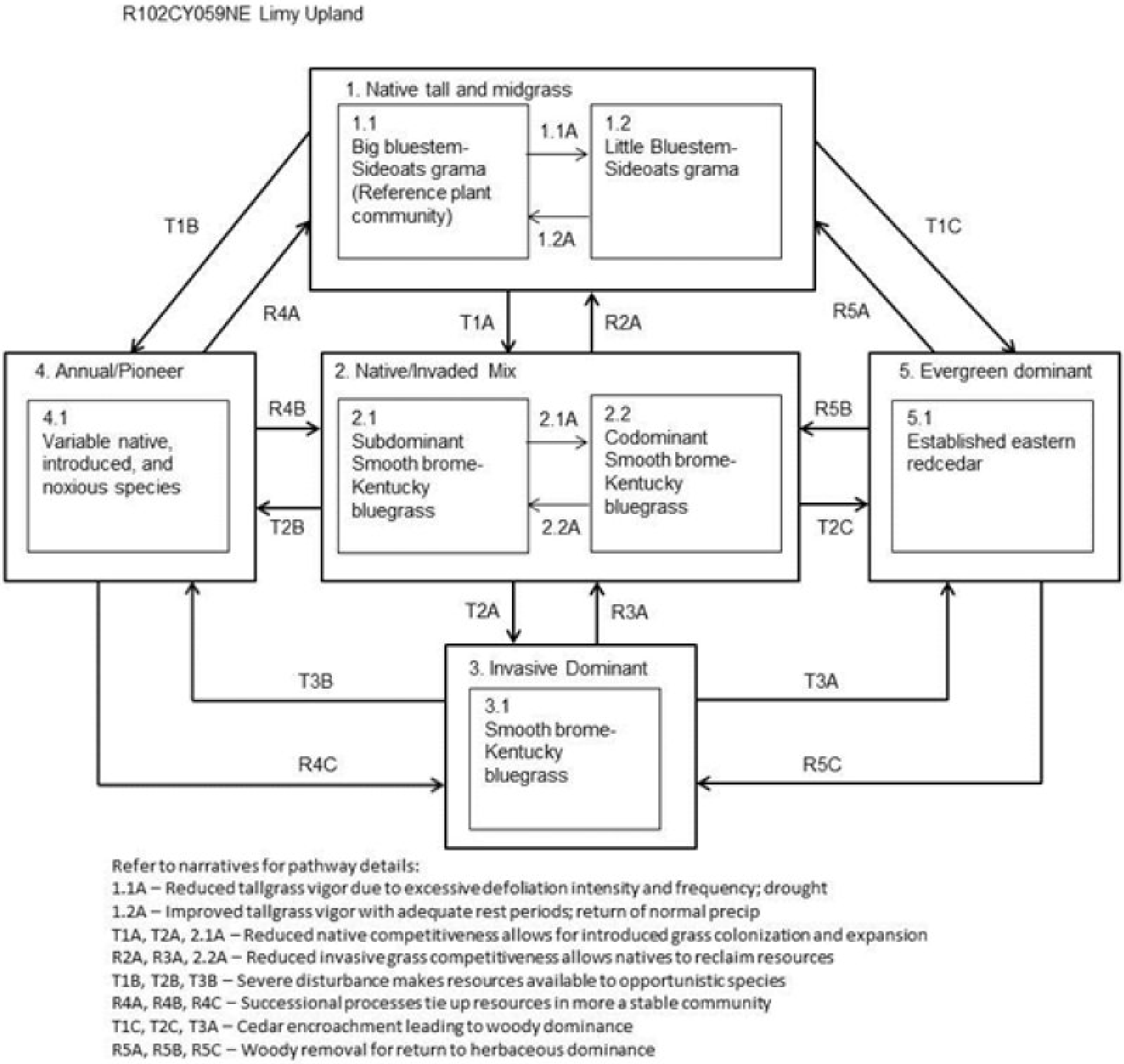

Figure 4. R102CY059NE Limy Upland

State 1
Native tall and midgrass

This state comprises the communities within the range of natural variability under historic conditions and disturbance regimes. Patterns created by wildlife use and fire would have created a mosaic of communities across the landscape; however, tall and/or mid warm-season grasses would remain dominant, with a subdominant contribution from native cool-season grasses, forbs, and shrubs. The cool-season contribution increases with latitude, with species such as needleandthread and green needlegrass becoming more prevalent northward. Fire and bison herbivory were the dominant disturbance regimes that historically maintained the tallgrass dominance with a diverse forb component. Furthermore, bison grazing was closely linked to fire patterns as the animals preferred grazing burned areas offering lush regrowth devoid of decadence and of higher nutritive quality. Thus, historic plant communities were subjected to occasional burning and grazing, with substantial rest/recovery periods as the fuel load rebuilt to eventually start the process again. Fire return intervals of 3-4 years served to suppress woody species, particularly non-sprouting eastern redcedar. The degree to which observed conditions represent this state largely depends on how closely the management has mimicked these past disturbance effects.

Community 1.1
Big bluestem-Sideoats grama (Andropogon gerardii-Bouteloua curtipendula)

Figure 5. Limy Upland 1.1

This is the reference plant community and can be found on areas that are managed to allow for adequate recovery periods following defoliation or drought stress. In addition to tallgrass vigor, suppression of woody species either through natural (e.g. fire) or artificial (e.g. chainsaw) methods is necessary to maintain herbaceous dominance. The plant community consists of 75-90% grasses and grass-likes, 5-10% forbs and 1-5% shrubs. Dominant grasses include big bluestem, little bluestem, porcupinegrass, and sideoats grama. Other grasses and grass-likes are blue grama, prairie junegrass, and sedges. Indiangrass and switchgrass contributions are notably sparse compared to Loamy Upland. Forb species are diverse and include prairieclovers, scurfpeas, and goldenrods. Common shrubs include leadplant and New Jersey tea (Kaul 2006, Steinauer 2010, USDA/NRCS 2012A). This plant community is diverse, stable, and productive with nutrient and water cycles, and energy flow functioning near full potential. Plant litter is properly distributed with negligible movement off-site and natural plant mortality is very low. This community is resistant to many disturbances except continuous season-long heavy grazing, tillage, or non-use. Broadcast herbicide application will dramatically reduce non-target forb diversity and abundance. Total annual production, during an average year, ranges from 2,100 to 3,400 pounds per acre air-dry weight and will average 3,000 pounds.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2275	3009	3396
Forb	151	252	387
Shrub/Vine	28	101	185
Total	**2454**	**3362**	**3968**

Figure 7. Plant community growth curve (percent production by month).
NE1021, 102C Warm-season. Warm-season grass, MLRA 102C.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	7	18	23	26	16	6	2	0	0

Community 1.2
Little bluestem-Sideoats grama (Schizachyrium scoparium-Bouteloua curtipendula)

Figure 8. Limy Upland 1.2

This community largely resembles central Great Plains mixed-grass prairies where rainfall is more limiting and overall conditions are relatively drier. Tallgrasses remain an important component, but midgrasses - typically sideoats grama and little bluestem - dominate site structure and function. While still within the range of natural variability, energy capture, nutrient cycling, and hydrology are not functioning at their full potential relative to the reference condition. Reduced photosynthetic biomass does not capture as much light energy, less lignified plant material produces lower quality litter (e.g. less persistent, more easily transported), and reduced soil protection impairs the site''s ability to capture and retain moisture.

Figure 9. Plant community growth curve (percent production by month).
NE1021, 102C Warm-season. Warm-season grass, MLRA 102C.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	7	18	23	26	16	6	2	0	0

Pathway 1.1A
Community 1.1 to 1.2

Big bluestem-Sideoats grama (Andropogon gerardii-Bouteloua curtipendula)

Little bluestem-Sideoats grama (Schizachyrium scoparium-Bouteloua curtipendula)

Events which remove tallgrass growing points and photosynthetic tissues without adequate recovery periods will shift community composition towards shorter statured species, particularly little bluestem and sideoats grama. Likewise, shortgrasses such as hairy and/or blue grama may also proliferate. As cattle grazing pressure increases/persists, rhizomatous grasses may assume a more sodbound growth habit which can further reduce overall diversity and adversely affect both infiltration and litter. Periods of extended drought can have similar impacts on species composition and bring about a shift towards mixed/shortgrass prairie species more tolerant of drier conditions.

Pathway 1.2A
Community 1.2 to 1.1

Little bluestem-Sideoats grama (Schizachyrium scoparium-Bouteloua curtipendula)

Big bluestem-Sideoats grama (Andropogon gerardii-Bouteloua curtipendula)

Management that provides adequate recovery periods and does not annually prevent tallgrass seedset or otherwise impair vigor will facilitate a return to community phase 1.1. In the case of dought, the return to more typical precipitation patterns will promote shift towards tallgrass species.

State 2
Native/invaded mix

This state can manifest three ways: 1) the appearance of introduced cool-season grasses, 2) the expansion of deciduous shrubs and/or trees, or 3) some combination of these. Kentucky bluegrass and smooth brome are the primary cool-season grass invaders in this region, commonly found in roadsides, disturbed areas, and pastures intentionally seeded for cool-season forage. Management practices and/or environmental conditions that are not favorable to native grass vigor may allow introduced grasses to invade the site thereby decreasing native diversity and abundance, particularly of forbs. In the absence of the historic fire regime, woody deciduous species may also expand to become an influential component of the community. The invasive component tends to have very high reslience, is extremely difficult to eradicate, and what might be considered a new "contemporary" range of natural variability is seen as competition between the native grasses and introduced/woody species for space and resources.

Community 2.1
Subdominant Smooth brome-Kentucky bluegrass (Bromus inermis-Poa pratensis)

Figure 10. Limy Upland 2.1

While native grasses still dominate the site, introduced cool-season species have established a foothold in the system and can be found interspersed throughout the stand. The stand may still have a native tallgrass appearance overall, but bluegrass and/or brome can be easily found. Deciduous shrub/tree species may also have begun to expand into areas where they did not persist historically, but the overall appearance can vary depending on the propagation method of a particular species. Seed propagated species, such as Siberian elm, tend to colonize further from the parent plant and affect larger areas, but in lower densities. In contrast, rhizomatous species such as smooth sumac tend to progress as a higher-density encroachment spreading directly from the parent plants.

Figure 11. Plant community growth curve (percent production by month). NE1022, Warm-season dominant, cool-season subdominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	9	19	23	24	13	7	3	0	0

Community 2.2
Codominant Smooth brome-Kentucky bluegrass (Bromus inermis-Poa pratensis)

Figure 12. Limy Upland 2.2

This community is comprised of a relatively even mix of native grasses and invasive species overall. This may manifest as a well-distributed interspersion of natives and invaders, as distinct patches wherein competitors dominate locally, or some combination. Forb diversity and abundance is further diminished.

Figure 13. Plant community growth curve (percent production by month). NE1023, Warm-season, cool-season codominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	26	16	10	7	4	1	0

Pathway 2.1A
Community 2.1 to 2.2

Subdominant Smooth brome-Kentucky bluegrass (Bromus inermis-Poa pratensis)

Codominant Smooth brome-Kentucky bluegrass (Bromus inermis-Poa pratensis)

Management and/or environmental conditions have afforded a persisting competitive advantage to introduced cool-season grasses, and they begin to dominate the ecological dynamics of the site. The robust invasive component is able to quickly and effectively exploit opportunities to outcompete and displace natives. Repeated summer use of an area will place the bulk of stressor impacts on native plants, reducing native vigor and allowing invaders to thrive. Likewise, a climate pattern limiting natural moisture to the spring and fall months coincides with peak cool-season growth and may support a similar process.

Pathway 2.2A
Community 2.2 to 2.1

Codominant Smooth brome-Kentucky bluegrass (Bromus inermis-Poa pratensis)

Subdominant Smooth brome-Kentucky bluegrass (Bromus inermis-Poa pratensis)

The native component remains in an abundance that can facilitate a return towards more historic conditions if management is modified to shift stressor impacts to the invasive species, and promote warm-season grass vigor. Environmental conditions and/or disturbance regimes that strongly favor warm-season grasses can also trend the site towards the reference.

State 3
Invasive dominant

Introduced cool-season invasion has progressed to the point that native species comprise a negligible portion of the community and the aggressively rhizomatous invasives preclude native germination and seedling survival. The native component may be completely absent, and the site resembles a seeded pasture. Alternatively, the dominant invasives may be deciduous woody species. Woody competitiveness for sunlight, water, space, and other resources continues to increase as desirable herbaceous species are shaded out, crowded out, or otherwise suppressed.

Community 3.1
Smooth brome-Kentucky bluegrass (Bromus inermis-Poa pratensis)

Figure 14. Loamy Upland 3.1

This community is typically composed of smooth brome with bluegrass interspersed among the brome tillers. Warm-season natives, if present, are sparse yet often conspicuous due to pronounced differences in growth habits and metabolic pathways. Community structure and function have been dramatically simplified relative to the reference condition, and very few biotic functional groups are represented in amounts that would influence ecological function. The invasive grass root skein provides good site stability; however, replacement of the deeper roots and complex bunchgrass canopy with the shallower roots and erect tiller canopy of the invaders results in reduced interception and infiltration rates.

Figure 15. Plant community growth curve (percent production by month).
NE1024, Cool-season. Smooth brome/Kentucky bluegrass.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	13	25	28	8	6	9	5	2	0

State 4
Annual/pioneer

Nutrient cycling, hydrologic function, and/or soil stability have been severely altered, and possibly compromised. This is a highly variable state in which the specific plants observed will depend largely on the original community and the nature of the disturbance. This condition encompasses (but is not necessarily limited to) events such as severe fire impacts, heavy continuous grazing, heavy nutrient inputs, and abandoned cropland.

Community 4.1
Variable native and introduced

Figure 16. Limy Upland 4.1 (long-term heavy grazing)

Figure 17. Limy Upland 4.1 (after mechanical cedar removal)

This community is heavily dominated by annual plants that thrive in disturbed areas and often includes snow-on-the-mountain, annual ragweed, Texas croton, nightshades, and/or hoary verbena. It is also particularly vulnerable to noxious weed invasion with the most common species being plumeless, musk, and Canada thistles. Leafy spurge becomes more common northward in the MLRA.

State 5
Evergreen dominant

Left unchecked, the spatial extent of eastern redcedar encroachment has expanded, and the individual trees have grown substantially. The areas under and near individual cedars experience profoundly altered function through shading, evergreen litter, and suppressed herbaceous understory. The woody overstory now dictates certain disturbance responses, and prescribed fire options become increasingly problematic as any fire will be largely carried by the volatile evergreen canopy instead of the herbaceous understory.

Community 5.1
Eastern redcedar (Juniperus virginiana)

Figure 18. Limy Upland 5.1

Cedars have reached stature and abundance that is beyond the range of natural variability, and the remaining herbaceous component is restricted to cedar interspaces. Evergreen canopy and litter serve to dramatically increase interception, capture, and eventual evaporation of precipitation thereby further reducing the resources available for grasses and forbs. Without intervention, woody canopy will progress towards complete closure under which herbaceous species will eventually disappear completely.

Transition T1A
State 1 to 2

In the presence of introduced cool-season grasses, environmental conditions and/or management that reduces native vigor and stand resilience, and frees up resources (space, sunlight, nutrients, water) will allow for colonization of Kentucky bluegrass and smooth brome. Likewise, similar processes may also allow for deciduous woody shrubs and trees such as smooth sumac, roughleaf dogwood, and Siberian elm to expand.

Transition T1B
State 1 to 4

There are many possible triggers for this transition that may occur as acute events (e.g. plowing) or cumulative impacts of chronic events (e.g. long-term undermanaged grazing.) The absence of deep-rooted perennial cover exposes the site to topsoil loss, open nutrient cycle, and free space which collectively allow for opportunistic annual species to dominate.

Transition T1C
State 1 to 5

The presence of an invasion source coupled with fire exclusion allows cedar seeds to germinate and establish within the herbaceous stand. This typically begins near fencerows, woody draws, etc, and accelerates outward as propagules increase. Lack of intervening action allows cedar expansion to continue, and tree sizes to increase. Cedar will eventually modify site function in ways that promote further encroachment such as rainfall interception and stemflow, heavy duff litter, and shading of the herbaceous understory.

Restoration pathway R2A
State 2 to 1

Eradication of introduced cool-season grasses from this site will require long-term, targeted management efforts to create an adverse environment during the spring and late fall when bluegrass and brome are most actively growing, with favorable conditions during the summer to promote native warm-season species. Targeted practices such as prescribed burning, flash grazing, and herbicide are often employed at strategic times of the year to set back undesirable species. The combination of practices should strive to mimic the historic disturbance regimes to which the desirable native species are best adapted.

Transition T2A
State 2 to 3

If the conditions which initiated and fomented the colonization and expansion of cool-season invasion are not removed or mitigated, stand composition will continue to shift in this direction and begin to resemble a monoculture of bluegrass and/or brome. Due to the dense rhizomatous root mat of brome and bluegrass, native species suffer decreasing opportunities to contribute propagules, and individual plants lost are not replaced by desirable natives.

Transition T2B
State 2 to 4

There are many possible triggers for this transition that may occur as acute events (e.g. plowing) or cumulative impacts of chronic events (e.g. long-term undermanaged grazing.) The absence of deep-rooted perennial cover exposes the site to topsoil loss, open nutrient cycle, and free space which collectively allow for opportunistic annual species to dominate.

Transition T2C
State 2 to 5

The presence of an invasion source coupled with fire exclusion allows cedar seeds to germinate and establish within the herbaceous stand. This typically begins near fencerows, woody draws, etc, and accelerates outward as propagules increase. Lack of intervening action allows cedar expansion to continue, and tree sizes to increase. Cedar will eventually modify site function in ways that promote further encroachment such as rainfall interception and stemflow, heavy duff litter, and shading of the herbaceous understory.

Restoration pathway R3A
State 3 to 2

Aggressive intervening actions will be required to simultaneously recolonize native grasses and suppress vigor in undesirable species. Restoration follows the same principles as the R2A pathway, but may also require native range seeding if the latent seedbank is inadequate.

Transition T3B
State 3 to 4

Nutrient cycling, hydrologic function, and/or soil stability have been severely altered, and possibly compromised. This is a highly variable state in which the specific plants observed will depend largely on the original community and the nature of the disturbance.

Transition T3A
State 3 to 5

The presence of an invasion source coupled with fire exclusion allows cedar seeds to germinate and establish within the herbaceous stand. This typically begins near fencerows, woody draws, etc, and accelerates outward as propagules increase. Lack of intervening action allows cedar expansion to continue, and tree sizes to increase. Cedar will eventually modify site function in ways that promote further encroachment such as rainfall interception and stemflow, heavy duff litter, and shading of the herbaceous understory.

Restoration pathway R4A/B/C
State 4 to 1

With favorable weather and site stability, it may take just a few years for the site to naturally return to a perennial community. Range seeding can “jump start” the recolonization of desirable species and may re-establish a near reference grass community; although, forb diversity may take longer to recover. Depending on the nature of the disturbance(s), additional ameliorative efforts may be necessary to mitigate accelerated erosion and weedy competition until the seeded perennial community has stabilized. It is possible for a disturbance and/or subsequent processes (e.g. accelerated erosion) to profoundly, and even permanently, alter fundamental soil properties in such a way that the site may never again exhibit its historic structure or function without extraordinary restoration inputs.

Restoration pathway R5A/B/C
State 5 to 1

Tree mortality is required to restore a grassland state, however the herbaceous response will depend on many factors such as method(s) used, mortality rates, and the remnant herbaceous species. Mechanical and chemical methods can remove cedars but will have little if any notable impact on the herbs. Reintroducing the historic fire regime will provide the most profound and beneficial effects, and seasonal timing and burn intensity can have significant influence on the herbaceous outcome. As a general rule, hot spring burns will not only kill trees but also stress shallower-rooted invasive cool-season grasses and promote a ahift in favor of the reference community.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall warm-season**			1177–2018	
	big bluestem	ANGE	*Andropogon gerardii*	673–1009	–
	switchgrass	PAVI2	*Panicum virgatum*	0–336	–
	Indiangrass	SONU2	*Sorghastrum nutans*	168–336	–
	dropseed	SPORO	*Sporobolus*	0–168	–
2	**Mid warm-season**			1345–1961	
	sideoats grama	BOCU	*Bouteloua curtipendula*	841–1345	–
	little bluestem	SCSC	*Schizachyrium scoparium*	588–1177	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–168	–
3	**Shortgrasses**			0–336	
	blue grama	BOGR2	*Bouteloua gracilis*	0–336	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–168	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–168	–
4	**Cool-season**			280–729	
	porcupinegrass	HESP11	*Hesperostipa spartea*	168–336	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	34–168	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–168	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	34–168	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–168	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–168	–
	needle and thread	HECO26	*Hesperostipa comata*	0–168	–
5	**Grass-like**			34–336	
	heavy sedge	CAGR4	*Carex gravida*	0–168	–
	Mead's sedge	CAME2	*Carex meadii*	0–168	–
	sedge	CAREX	*Carex*	0–168	–
Forb					
6	**Forb**			196–336	
	white prairie clover	DACA7	*Dalea candida*	34–101	–
	purple prairie clover	DAPU5	*Dalea purpurea*	34–101	–

	compassplant	SILA3	*Silphium laciniatum*	34–101	–
	Canada goldenrod	SOCA6	*Solidago canadensis*	0–34	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–34	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–34	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	0–34	–
	hoary verbena	VEST	*Verbena stricta*	0–34	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–34	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–34	–
	candle anemone	ANCY	*Anemone cylindrica*	0–34	–
	field pussytoes	ANNE	*Antennaria neglecta*	0–34	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–34	–
	Canadian milkvetch	ASCA11	*Astragalus canadensis*	0–34	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–34	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–34	–
	snow on the mountain	EUMA8	*Euphorbia marginata*	0–34	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–34	–
	dotted blazing star	LIPU	*Liatris punctata*	0–34	–
	cutleaf evening primrose	OELA	*Oenothera laciniata*	0–34	–
	stiff goldenrod	OLRI	*Oligoneuron rigidum*	0–34	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–34	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–34	–
	prairie groundsel	PAPL12	*Packera plattensis*	0–34	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–34	–
	prairie blue-eyed grass	SICA9	*Sisyrinchium campestre*	0–34	–
Shrub/Vine					
7	**Shrub**			34–168	
	Jersey tea	CEHE	*Ceanothus herbaceus*	0–168	–
	prairie rose	ROAR3	*Rosa arkansana*	0–168	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–168	–
	leadplant	AMCA6	*Amorpha canescens*	34–101	–
	smooth sumac	RHGL	*Rhus glabra*	0–34	–

Animal community

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 browsing livestock such as goats or sheep that will more heavily utilize invasive forbs and brush. Carrying capacity and production estimates are conservative estimates that should be used only as guidelines in initial stages of grazing lands planning.

Often, the plant community does not entirely match any particular plant community (as described in the ecological site description). Because of this, a resource inventory is necessary to document plant composition and production.

Proper interpretation of this inventory data will permit the establishment of a safe, initial stocking rate for the type and class of animals and level of grazing management. Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage for cattle, sheep, or horses. During the dormant period, the protein levels of the forage may be lower than the minimum needed to meet livestock (primarily cattle and sheep) requirements.

Suggested stocking rates (carrying capacity*) for cattle under continuous season-long grazing under normal growing conditions are listed below:

- 1.1 Big bluestem-Sideoats grama; 3000 lbs/acre production and 0.82 AUM/acre

- 1.2 Little bluestem-Sideoats grama; 2450 lbs/acre production and 0.67 AUM/acre

- 2.1 Subdominant smooth brome-KY bluegrass; 2100 lbs/acre production and 0.58 AUM/acre

- 2.2 Codominant smooth brome-KY bluegrass; 1750 lbs/ac and 0.48 AUM/acre with 50% or more introduced cool-season component

- 3.1 Smooth brome-KY bluegrass; 2300 lbs/ac and .63 AUM/ac, unfertilized, non-irrigated naturalized community. Refer to Forage Suitability Groups for cool-season pasture under a higher management level.

*Carrying capacity based on continuous season-long grazing by cattle under average growing conditions, 25% harvest efficiency. Air dry forage requirements based on 3% of animal body weight, or 912 lbs/AU/month.

If grazing distribution problems occur, stocking rates must be reduced to maintain plant health and vigor. Carrying capacity and production estimates are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Utilizing a rotational grazing system that allows for adequate rest and recovery will increase plant vigor and carrying capacity. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended to document plant composition and production. More precise carrying capacity estimates can be calculated based on actual site information along with animal preference data, particularly when livestock other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Inventory data references

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:
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Cassidy Gerdes, Biologist
Dirk Schultz, Soil Conservationist
Dan Shurtliff, Asst State Soil Scientist

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Minnesota NRCS:
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Gerry Steinauer, Botanist
Scott Wessel, Biologist
Russ Hamer, Biologist
Rebekah Jessen, Biologist

Nebraska Forest Service:
Steve Rasmussen, District Forester

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Resources Conservation Service, Colorado Ecological Sciences.

Contributors

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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)	Stu McFarland, Nadine Bishop
Contact for lead author	
Date	08/01/2013
Approved by	Nadine Bishop
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

2. **Presence of water flow patterns:** None; possibly slight, short, and disconnected as slope approaches upper limit for this site.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** <5% as very small (<3") patches, however, bare ground can be expected to be much higher if litter has been consumed by recent fire.

5. **Number of gullies and erosion associated with gullies:** None.

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

7. **Amount of litter movement (describe size and distance expected to travel):** None; possibly slight with short movement of the smallest litter class as slope approaches upper limit for this site.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability rating of 5-6

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** An A horizon is apparent but does not qualify as mollic (i.e. less than 25cm.) Refer to the Official Series Description for the range of characteristics of site-specific soils.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Robust herbaceous canopy provides nearly 100% coverage reducing raindrop energy, and abundant litter slows overland flow for improved infiltration.

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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.

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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: warm-season midgrasses = warm-season tallgrasses

    Sub-dominant: cool-season grasses >

    Other: forbs > grasslikes = shrubs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of perennial decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):** However, litter cover could be much lower if consumed by recent fire.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 2,100 - 3,400 lbs/ac (air-dry weight) depending on climatic conditions. The reference representative value production is 3,000 lbs/ac (air-dry weight).

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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:** Eastern redcedar, Kentucky bluegrass, smooth brome, plumeless thistle, musk thistle, Canada thistle, smooth sumac, roughleaf dogwood, buckbrush, and Siberian elm are some of the more common invaders. Other

species of concern that may be encountered include: absinth wormwood, sulfur cinquefoil, downy and Japanese brome, perennial sow thistle, spotted and diffuse knapweeds, and Autumn olive. Refer to state and county weed agencies for a comprehensive list.

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17. **Perennial plant reproductive capability:** Flowering, seed production, and rhizomatous/stoloniferous growth are apparent and not hindered by plant stress/reduced vigor.
