USDA Natural Resources Conservation Service

Ecological site F108XC502IA Shallow Sandstone Backslope Glade

Last updated: 11/04/2024
Accessed: 05/13/2025

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): 108X–Illinois and Iowa Deep Loess and Drift

The Illinois and Iowa Deep Loess and Drift, West-Central Part (MLRA 108C) encompasses the eastern portion of the Southern Iowa Drift Plain and the Lake Calvin basin of the Mississippi Alluvial Plain landforms (Prior 1991). It lies entirely in one state (Iowa), containing approximately 9,805 square miles (Figure 1). The elevation ranges from approximately 1,110 feet above sea level (ASL) on the highest ridges to about 505 feet ASL in the lowest valleys. Local elevation difference is mainly 10 to 20 feet. However, some valley floors can range from 80 to 200 feet, while some upland flats and valley floors only range between 3 and 6 feet. The MLRA is underlain by Pre-Illinoian glacial till, deposited more than 500,000 years ago and since undergone extensive erosion and dissection. In the northern half of the area the till thickness ranges from 150 to 350 feet and grades to less than 150 feet thick in the southern half. The till is covered by a mantle of Peoria Loess on the hillslopes and Holocene alluvium in the drainageways. Paleozoic bedrock, comprised of limestone, shale, and mudstones, lies beneath the glacial material (USDA-NRCS 2006).

The vegetation in the MLRA has undergone drastic changes over time. Spruce forests dominated the landscape 30,000 to 21,500 years ago. As the last glacial maximum peaked 21,500 to 16,000 years ago, they were replaced with open tundras and parklands. The end of the Pleistocene Epoch saw a warming climate that initially prompted the return of spruce forests, but as the warming continued, spruce trees were replaced by deciduous trees (Baker et al. 1990). Not until approximately 9,000 years ago did the vegetation transition to prairies as climatic conditions continued to warm and subsequently dry. Between 4,000 and 3,000 years ago, oak savannas began intermingling within the prairie landscape, while the more wooded and forested areas maintained a foothold in sheltered areas. This prairie-forest transition ecosystem formed the dominant landscapes until the arrival of European settlers (Baker et al. 1992).

Classification relationships

USFS Subregions: Central Dissected Till Plains (251C) Section, Central Dissected Till and Loess Plain (251Cc), Mississippi River and Illinois Alluvial Plains (51Cf), Southeast Iowa Rolling Loess Hills (251Ch) Subsections (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Rolling Loess Prairies (47f), Upper Mississippi Alluvial Plain (72d) (USEPA 2013)

National Vegetation Classification – Ecological Systems: Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692); Central Interior Acidic Cliff and Talus (CES202.689) (NatureServe 2015)

National Vegetation Classification – Plant Associations: Schizachyrium scoparium – Aristida dichotoma – Croton willdenowii/Lichens Wooded Grassland (CEGL002242); Sandstone Midwest Moist Cliff Vegetation (CEGL002287); Sandstone Midwest Dry Cliff Sparse Vegetation (CEGL0022045) (Nature Serve 2015)

Biophysical Settings: Central Interior Highlands Dry Acidic Glade and Barrens (BpS 4313630) (LANDFIRE 2009)

Iowa Department of Natural Resources: Sandstone Glade (INAI 1984)

Ecological site concept

Shallow Sandstone Backslope Glades are located within the blue areas on the map (Figure 1). They occur on upland backslopes on slopes greater than 18 percent. The soils are Alfisols and Entisols that are well to excessively-drained formed in less than 30 inches of silty or loamy sediments over sandstone bedrock.

The historic pre-European settlement vegetation on this ecological site was dominated by sparse woody and herbaceous plants tolerant of very dry, acidic conditions (INAI 1984; LANDFIRE 2009). Black oak (Quercus velutina Lam.) and northern pin oak (Quercus ellipsoidalis E.J. Hill) are the dominant trees, and little bluestem (Schizachyrium scoparium (Michx.) Nash) and poverty oatgrass (Danthonia spicata (L.) P. Beauv. ex Roem. & Schult.) are the dominant understory grass species (J. Pearson, personal communication, 2018). Overall vegetation cover ranges from sparse to continuous and sandstone bedrock occasionally occurs at the surface. Fire is the primary disturbance factor that maintains this site, and drought and storm damage are secondary factors (LANDFIRE 2009; NatureServe 2015).

Associated sites

F108XC513IA	**Till Backslope Forest** Glacial till parent material on mid to lower backslopes including Bertrand, Douds, Galland, Inton, Lindley, and Russell
F108XC501IA	**Shallow Limestone Backslope Glade** Silty or loamy sediments over limestone on backslopes including Dubuque, Dunbarton, and Nordess
F108XC505IA	**Loess Upland Woodland** Loess parent material on upland summits, shoulders, and upper to mid backslopes including Clinton, Exette, Hayette, Mula, Rozetta, Seaton, and Timula

Similar sites

F108XC501IA	**Shallow Limestone Backslope Glade** Shallow Limestone Backslope Glades occur in similar landscape positions but over limestone bedrock

Table 1. Dominant plant species

Tree	(1) *Quercus velutina* (2) *Quercus ellipsoidalis*
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Danthonia spicata*

Physiographic features

Shallow Sandstone Backslope Glades occur on upland backslopes on slopes greater than 18 percent. They are situated on elevations ranging from approximately 680 to 1900 feet. This site does not experience flooding but rather generates runoff to adjacent, downslope ecological sites.

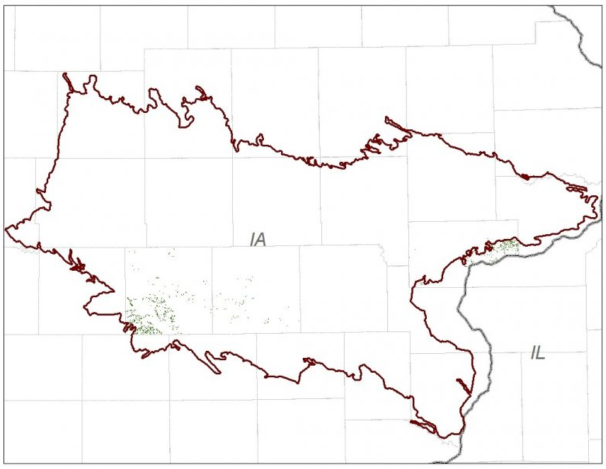


Figure 2. Figure 1. Location of Shallow Sandstone Backslope Glade ecological site within MLRA 108C.

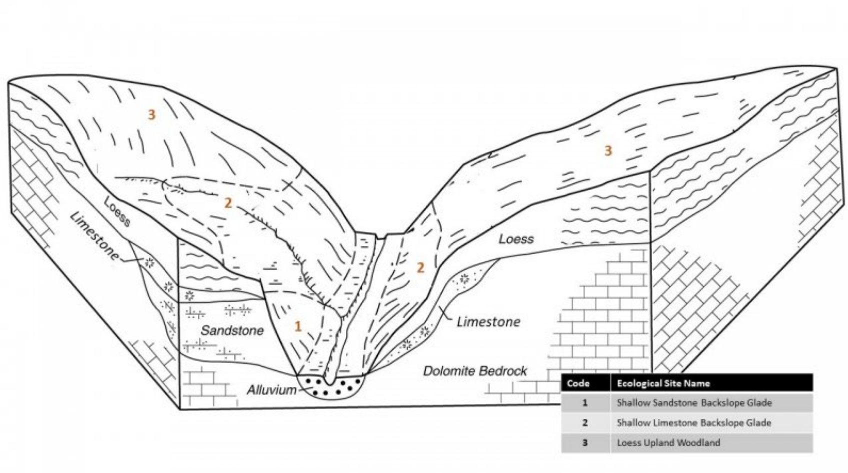


Figure 3. Figure 2. Representative block diagram of Shallow Sandstone Backslope Glade and associated ecological sites.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope
Slope shape across	(1) Linear (2) Convex
Slope shape up-down	(1) Convex
Landforms	(1) Upland > Hillslope
Runoff class	High
Flooding frequency	None
Ponding frequency	None
Elevation	680–1,900 ft
Slope	18–40%
Water table depth	80 in
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The Illinois and Iowa Deep Loess and Drift, West-Central Part falls into the hot humid continental climate (Dfa) Köppen-Geiger climate classification (Peel et al. 2007). In winter, dry, cold air masses periodically shift south from Canada. As these air masses collide with humid air, snowfall and rainfall result. In summer, moist, warm air masses from the Gulf of Mexico migrate north, producing significant frontal or convective rains. Occasionally, hot, dry winds originating from the Desert Southwest will stagnate over the region, creating extended droughty periods in the summer from unusually high temperatures. Air masses from the Pacific Ocean can also spread into the region and dominate producing mild, dry weather in the autumn known as Indian Summers (NCDC 2006).

The soil temperature regime of MLRA 108C is classified as mesic, where the mean annual soil temperature is between 46 and 59°F (USDA-NRCS 2006). Temperature and precipitation occur along a north-south gradient, where temperature and precipitation increase the further south one travels. The average freeze-free period of this ecological site is about 172 days, while the frost-free period is about 153 days (Table 2). The majority of the precipitation occurs as rainfall in the form of convective thunderstorms during the growing season. Average annual precipitation is approximately 39 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 38 and 59°F, respectively. Climate data and analyses are derived from 30-year averages gathered from two National Oceanic and Atmospheric Administration (NOAA) weather stations contained within the range of this ecological site (Table 4).

Table 3. Representative climatic features

Frost-free period (characteristic range)	133-138 days
Freeze-free period (characteristic range)	158-164 days
Precipitation total (characteristic range)	38 in
Frost-free period (actual range)	132-139 days
Freeze-free period (actual range)	157-166 days
Precipitation total (actual range)	37-38 in
Frost-free period (average)	136 days
Freeze-free period (average)	161 days
Precipitation total (average)	38 in

Climate stations used

- (1) OSKALOOSA [USC00136327], Oskaloosa, IA
- (2) MARSHALLTOWN [USC00135198], Marshalltown, IA

Influencing water features

Shallow Sandstone Backslope Glades are not influenced by wetland or riparian features. Precipitation is the main source of water for this ecological site. Infiltration is moderate to slow (Hydrologic Soil Group B and C), and surface runoff is high. Water enters the sandstone through percolation where it is stored and moves throughout the bedrock (Prior et al. 2003). Surface runoff contributes some water to downslope ecological sites (Figure 5).

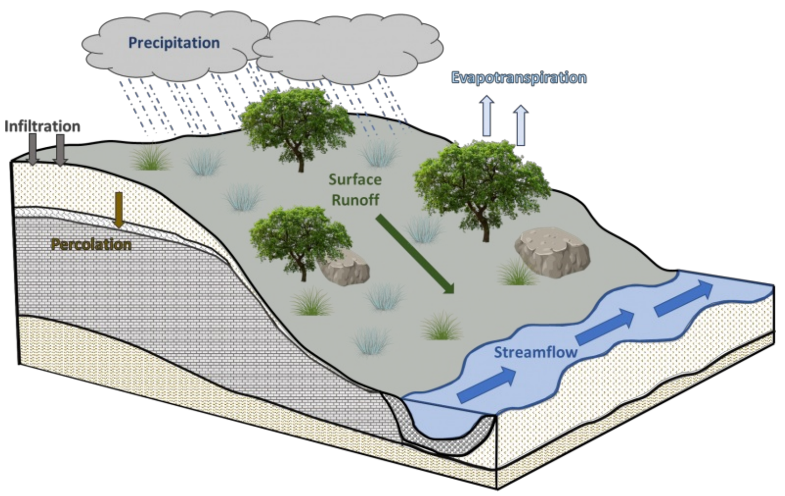


Figure 10. Figure 5. Hydrologic cycling in Shallow Sandstone Backslope Glade.

Soil features

Soils of Shallow Sandstone Backslope Glades are in the Alfisols and Entisols orders, further classified as Typic Hapludalfs and Typic Quartzipsamments with slow to moderate infiltration and high runoff potential. The soil series associated with this site includes Boone, Eleva, and Gale (Figure 6). The parent material is less than 30 inches of silty or loamy sediments over sandstone bedrock, and the soils are well to excessively-drained. Soil pH classes are extremely acid to neutral (Table 5).

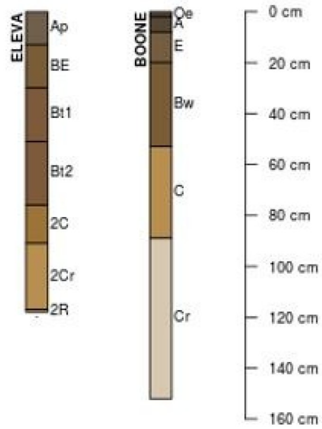


Figure 11. Figure 6. Profile sketches of soil series associated with Shallow Sandstone Backslope Glade.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone
Surface texture	(1) Loamy sand (2) Sandy loam (3) Silt loam
Family particle size	(1) Coarse-loamy (2) Fine-silty over sandy or sandy-skeletal
Drainage class	Well drained to excessively drained
Permeability class	Slow to moderate
Soil depth	20–40 in
Surface fragment cover <=3"	0–14%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	1.5–4 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	3.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–14%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

The MLRA lies within the transition zone between the eastern deciduous forests and the tallgrass prairies. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn are able to support prairies, savannas, woodlands, and forests. Shallow Sandstone Backslope Glades form an aspect of this vegetative continuum. This ecological site occurs on upland backslopes on well to excessively-drained soils. Species characteristic of this ecological site consist of sparse woody and herbaceous vegetation adapted to dry, acidic, root-restrictions.

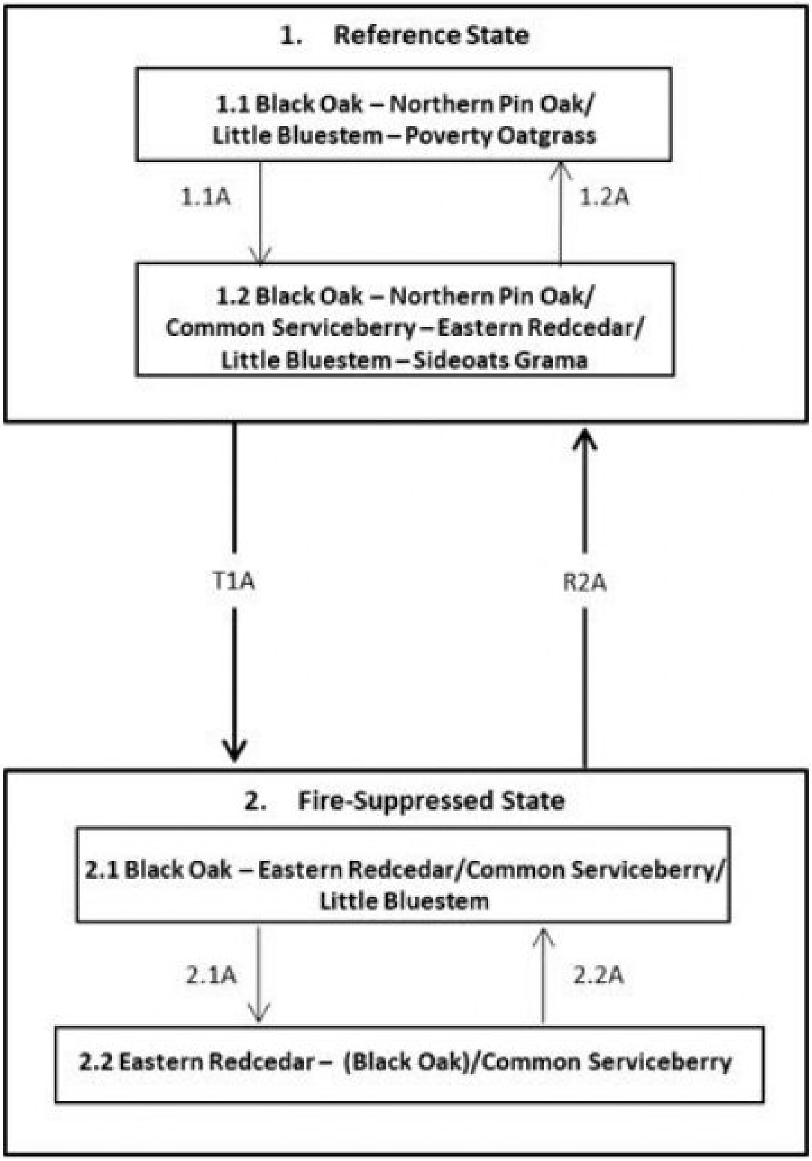
Fire is the dominant ecosystem driver for maintaining the vegetation of Shallow Sandstone Backslope Glades. Fire intensity typically comprised mixed, surface, and replacement fires occurring approximately every 5 to 88 years (LANDFIRE 2009). Ignition sources included summertime lightning strikes from convective storms and possibly, to a more limited extent, human-driven ignitions.

Drought, wind, and ice damage have also played a role in shaping this ecological site (LANDFIRE 2009). The periodic episodes of reduced soil moisture in conjunction with the well-drained, shallow soils have favored the proliferation of plant species tolerant of such conditions. Drought can slow the growth of plants and result in dieback of certain species. Damage to trees from storms can vary from minor, patchy effects of individual trees to stand effects that temporarily affect community structure and species richness and diversity (Irland 2000; Peterson 2000). When coupled with fire, periods of drought and seasonal storms can eliminate or greatly reduce the occurrence of woody vegetation, substantially altering the extent of shrubs and trees (Pyne et al. 1996).

Today, Shallow Sandstone Backslope Glades are limited in their extent, having been reduced as a result of eastern redcedar (*Juniperus virginiana* L.) encroachment from long-term fire suppression. The state-and-transition model that follows provides a detailed description of each state, community phase, pathway, and transition. This model is based on available experimental research, field observations, literature reviews, professional consensus, and interpretations.

State and transition model

F108CY502IA Shallow Sandstone Backslope Glade



Code	Process
T1A	Fire suppression (+70 years)
1.1A	Reduced fire return interval
1.2A	Increased fire return interval
R2A	Restore natural fire regime
2.1A	Woody species succession as fire suppression continues
2.2A	Single disturbance event

State 1
Reference State

The reference plant community is categorized as an open woodland community, dominated by scrubby woody and herbaceous vegetation. The two community phases within the reference state are dependent on a combination of surface, mixed, and replacement fires. Low intensity surface fires are the dominant fire regime, comprising more than 80 percent of all fires and occurring every 2 to 7 years. Mixed and replacement fires comprise the remaining 20 percent, occurring approximately every 88 and 37 years, respectively (LANDFIRE 2009). Fire intensity and return intervals alter species composition, cover, and extent, while regular fire intervals keep woody species from closing the canopy. Episodic droughts and storm damage have more localized impacts in the reference phases, but do contribute to overall species composition, diversity, cover, and productivity.

Community 1.1
Black Oak – Northern Pin Oak/Little Bluestem – Poverty Oatgrass

Sites in this reference community phase consist of an open canopied woodland, with black oak and northern pin oak as the dominant trees. White oak (*Quercus alba* L.) may be a common canopy associate. Tree size class is typically medium (9 to 21-inch DBH) and heights are less than 30 feet tall (LANDFIRE 2009). The understory is also sparse with a relatively simple species composition. Common understory species include little bluestem, poverty oatgrass, tall blazing star (*Liatris aspera* Michx.), and woman's tobacco (*Antennaria plantaginifolia* (L.) Richardson) (J. Pearson, personal communication, 2018). Areas of exposed sandstone can occur across the site, often inhabited by various lichen species.

Community 1.2
Black Oak – Northern Pin Oak/Common Serviceberry – Eastern Redcedar/Little Bluestem – Poverty Oatgrass

This reference community phase can occur when the average fire return intervals are extended such as from drought. Under a reduced fire return interval, common serviceberry (*Amelanchier arborea* (Michx. f.) Fernald) and eastern redcedar become prominent in the shrub layer, overtopping the herbaceous component. Tree size class remains stunted due to the severe edaphic conditions, but shrubs can reach heights nearly 10 feet tall (LANDFIRE 2009). The return of fire will top-kill the shrubs, returning the community to phase 1.2 (Snyder 1992).

Pathway 1.1A
Community 1.1 to 1.2

Reduced fire return interval

Pathway 1.2A
Community 1.2 to 1.1

Increased fire return interval

State 2
Fire-suppressed State

Fire suppression can transition the reference plant community into a closed canopy state dominated by eastern redcedar (Briggs et al. 2002; Anderson 2003). Eastern redcedar is a species native to the eastern half of North America with a range spanning from Ontario east to Nova Scotia, south across the Great Plains into eastern Texas, and east to the Atlantic coast (Lawson 1990; Lee 1996). It is a long-lived (450+ years), slow-growing, fire-intolerant dioecious conifer historically found in areas that were protected from fire (e.g., bluffs, rocky hillsides, sandstone cliffs, granite outcrops, etc.) (Ferguson et al. 1968; Anderson 2003). Today, however, decades of fire suppression have allowed this species to spread, and it can now be found occupying sites with highly variable aspects, topography, soils, and formerly stable plant communities (Anderson 2003).

Community 2.1
Black Oak – Eastern Redcedar/Common Serviceberry/Little Bluestem

This community phase represents the early stages of eastern redcedar invasion and maturity. In the long-term absence of fire, eastern redcedar can become highly competitive, co-dominating with the hardwoods. The native understory may persist in pockets that haven't been completely shaded out.

Community 2.2
Eastern Redcedar – (Black Oak)/Common Serviceberry

Sites falling into this community phase have an established eastern redcedar tree canopy following numerous years of fire suppression. Eastern redcedar is the dominant tree, and black oak and northern pin oak either become minor components or non-existent as these species cannot reproduce under a closed canopy (Carey 1992; Colandonato 1993).

Pathway 2.1A
Community 2.1 to 2.2

Woody species succession as fire suppression continues.

Pathway 2.2A
Community 2.2 to 2.1

Single disturbance event.

Transition T1A
State 1 to 2

Fire suppression in excess of 70 years will transition the site to the fire-suppressed state (2).

Restoration pathway R2A
State 2 to 1

Selective removal of eastern redcedars and re-establishing natural fire regime will transition the site to the reference state (1).

Additional community tables

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description.

Other references

Anderson, M.D. 2003. *Juniperus virginiana*. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at: https://www.feis-crs.org/feis/. (Accessed 12 February 2018).

Baker, R.G., C.A. Chumbley, P.M. Witinok, and H.K. Kim. 1990. Holocene vegetational changes in eastern Iowa. Journal of the Iowa Academy of Science 97: 167-177.

Baker, R.G., L.J. Maher, C.A. Chumbley, and K.L. Van Zant. 1992. Patterns of Holocene environmental changes in the midwestern United States. Quarternary Research 37: 379-389.

Briggs, J.M., A.K. Knapp, and B.L. Brock. 2002. Expansion of woody plants in tallgrass prairie: a fifteen-year study of fire and grazing-interactions. The American Midland Naturalist 147: 287-294.

Carey, J.H. 1992. Quercus velutina. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at https://www.crs-feis.org/feis/. (Accessed 19 February 2018).

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Coterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC. 92 pps.

Colandonato, M. 1993. Quercus ellipsoidalis. In: Fire Effects Information System [Online]. U.S. Department of

Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at https://www.crs-feis.org/feis/. (Accessed 19 February 2018).

Ferguson, E.R., E.R. Lawson, W.R. Maple, and C. Mesavage. 1968. Managing Eastern Redcedar. Research paper SO-37. U.S. Department of Agriculture, Forest Service, Southern Forest Experimental Station, New Orleans, LA. 14 pps.

Iowa Natural Areas Inventory [INAI]. 1984. An Inventory of Significant Natural Areas in Iowa: Two year Progress Report of the Iowa natural Areas Inventory. Iowa Natural Areas Inventory, Iowa Department of Natural Resources, Des Moines, IA.

Irland, L.C. 2000. Ice storms and forest impacts. The Science of the Total Environment 262:231-242.

LANDFIRE. 2009. Biophysical Setting 4313630 Central Interior Highlands Dry Acidic Glade and Barrens. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

Lawson, E.R. 1990. *Juniperus virginiana* L. eastern redcedar. In: R.M. Burns and B.H. Honkala, technical coordinators. Silvics of North America, Volume I: Conifers. Agricultural Handbook 654. Washington, DC: U.S. Department of Agriculture, Forest Service.

Lee, S.A. 1996. Propagation of Juniperus for conservation plantings in the Great Plains. M.S. Thesis. University of Nebraska, Lincoln, NE. 91 pps.

National Climate Data Center [NCDC]. 2006. Climate of Iowa. Central Region Headquarters, Climate Services Branch, National Climatic Data Center, Asheville, NC.

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at http://explorer.natureserve.org. (Accessed 13 February 2017).

Peel, M.C., B.L. Finlayson, and T.A. McMahon. 2007. Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences 11: 1633-1644.

Peterson, C.J. 2000. Catastrophic wind damage to North American forests and the potential impact of climate change. The Science of the Total Environment 262: 287-311.

Prior, J.C. 1991. Landforms of Iowa. University of Iowa Press for the Iowa Department of Natural Resources, Iowa City, IA. 153 pps.

Prior, J.C., J.L. Boekhoff, M.R. Howes, R.D. Libra, and P.E. VanDorpe. 2003. Iowa's Groundwater Basics. Iowa Department of Natural Resources, Iowa Geological Survey Educational Series 6. 92 pps.

Pyne, S.J., P.L. Andrews, and R.D. Laven. 1996. Introduction to Wildland Fire, Second Edition. John Wiley and Sons, Inc. New York, New York. 808 pps.

Snyder, S.A. 1992. *Amelanchier arborea*. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at https://www.crs-feis.org/feis/. (Accessed 19 February 2018).

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 682 pps.

U.S. Environmental Protection Agency [EPA]. 2013. Level III and Level IV Ecoregions of the Continental United States. Corvallis, OR, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1: 3,000,000. Available at http://www.epa.gov/eco-research/level-iii-andiv-ecoregions-continental-united-states. (Accessed 1 March 2017).

Contributors

Lisa Kluesner
Ryan Dermody

Approval

Suzanne Mayne-Kinney, 11/04/2024

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Organization Name Title Location
Drake University:
Dr. Tom Rosburg Professor of Ecology and Botany Des Moines, IA

Iowa Department of Natural Resources:
Kevin Andersen Private Lands Biologist Fairfield, IA
John Pearson Ecologist Des Moines, IA

LANDFIRE (The Nature Conservancy):
Randy Swaty Ecologist Evanston, IL

Natural Resources Conservation Service:
Rick Bednarek Iowa State Soil Scientist Des Moines, IA
Leland Camp Soil Scientist Waverly, IA
Stacey Clark Regional Ecological Site Specialist St. Paul, MN
Ryan Dermody Soil Survey Leader Waverly, IA
Tonie Endres Senior Regional Soil Scientist Indianapolis, IN
John Hammerly Soil Data Quality Specialist Indianapolis, IN
Lisa Kluesner Ecological Site Specialist Waverly, IA
Sean Kluesner Earth Team Volunteer Waverly, IA
Jeff Matthias State Grassland Specialist Des Moines, IA
Kevin Norwood Soil Survey Regional Director Indianapolis, IN
Doug Oelmann Soil Scientist Des Moines, IA
James Phillips GIS Specialist Des Moines, IA
Jason Steele Area Resource Soil Scientist Fairfield, IA
Doug Wallace Ecologist ACES Program Columbia, MO

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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)	
Contact for lead author	

Date	11/04/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
