Ecological site NX119X01Y019
Rarely Flooded Terrace

Last updated: 9/22/2023
Accessed: 05/02/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 119X–Ouachita Mountains

Major Land Resource Area 119, the Ouachita Mountains, is in Arkansas and Oklahoma. This MLRA is about 11,885 square miles (30,800 square kilometers). Hot Springs National Park and the Ouachita National Forest reside in this MLRA.

This MLRA is located in the Ouachita Mountains section of the Ouachita Province of the Interior Highlands. The steep mountains are underlain by folded and faulted sedimentary and metamorphic rocks. Most of the valleys are narrow and have steep gradients while wide terraces and flood plains border the Ouachita River. Elevation ranges from 130 feet (40 meters) in the bottomlands to 2,670 feet (810 meters) on the mountain peaks.

These steep mountains are underlain by folded and faulted formations, dominantly of shale and sandstone. Ordovician-age shale and sandstone are included in the Collier Shale, Crystal Mountain Sandstone, and Womble Shale. Mississippian-age shale, sandstone, novaculite, and chert are included in the Arkansas Novaculite and the Stanley Shale. Pennsylvanian-age shale, slate, quartzite, and sandstone are included in the Jackfork Sandstone, Johns Valley Shale, and upper Atoka Formations. Alluvial deposits of silt, sand, and gravel are on the wide terraces and flood plains that border the Ouachita River.

The dominant soil orders in this MLRA are Ultisols and Inceptisols. The soils in this MLRA have a thermic soil temperature regime, a udic soil moisture regime, and mixed or siliceous mineralogy.

Ecological site concept

The Rarely Flooded Terrace ecological site is in river valleys along terraces. The soils associated with this site are very deep and formed in alluvium derived from sandstone and shale. This site has slopes between 0 and 3 percent with elevations ranging from 300 to 1,000 feet (91 to 304 meters). Important abiotic characteristics associated with this site are rare flooding events occurring for very brief to brief durations.

Associated sites

NX119X01Y012	**Drainageway** This ecological site is differentiated from the Rarely Flooded Terrace Ecological Site by an irregular decrease in organic matter throughout the soil profile and occasional to frequent flooding events.

Similar sites

NX119X01Y018	**Poorly Drained Flood Plain** This ecological site is differentiated from the Rarely Flooded Terrace Ecological Site by very poor drainage characteristics.

Table 1. Dominant plant species

Tree	(1) *Pinus echinata* (2) *Quercus*
Shrub	(1) *Betula nigra* (2) *Alnus*
Herbaceous	(1) *Andropogon gerardii* (2) *Panicum virgatum*

Legacy ID

F119XY019AR

Physiographic features

This ecological site is in river valleys along terraces. This site has slopes between 0 and 3 percent. Elevations range from 300 to 1,000 feet (91 to 304 meters). Runoff class varies from to negligible to low, with no ponding. Rare flooding events occur for very brief to brief durations.

Table 2. Representative physiographic features

Landforms	(1) River valley > Terrace
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	91–305 m
Slope	0–3%
Water table depth	30–183 cm
Aspect	Aspect is not a significant factor

Climatic features

This ecological site is characterized by hot summers, cool winters, and mild spring and fall temperatures. Mean annual precipitation is 54 inches. The average frost-free period is 182 days, and the average freeze-free period is 207 days. The highest precipitation occurs in May (6.4 inches), and the lowest occurs in August (3.4 inches). Precipitation varies greatly across this ecological site, with increasing precipitation from west to east. The warmest month of the year is August (93°F average high), and the coolest is January (26°F average low).

Thunderstorms and heat waves are common and occur frequently during summer months. Catastrophic storm events, such as tornados, ice-storms, floods, and hail-storms are also known to occasionally occur within this ecological site. According to the Oklahoma Water Resource Board, drought occurs on 5 to 10 year cycles. The Environmental Protection Agency (EPA) predicts that droughts will become more severe throughout Arkansas due to longer periods without rain and an increase in very hot days (EPA, 2016).

Data was provided by the Alum Fork, Battiest, Wilburton, Murfreesboro, Waldron, and Hot Springs climate stations. Site specific data should be obtained by accessing the database provided by the National Centers for Environmental Information (https://www.ncdc.noaa.gov/cdo-web/search).

Table 3. Representative climatic features

Frost-free period (characteristic range)	176-194 days
Freeze-free period (characteristic range)	206-217 days
Precipitation total (characteristic range)	1,295-1,422 mm
Frost-free period (actual range)	173-198 days
Freeze-free period (actual range)	198-228 days
Precipitation total (actual range)	1,245-1,422 mm
Frost-free period (average)	186 days
Freeze-free period (average)	212 days
Precipitation total (average)	1,346 mm

Climate stations used

- (1) NIMROD DAM [USC00035200], Perryville, AR
- (2) TUSKAHOMA [USC00349023], Tuskahoma, OK
- (3) MCGEE CREEK DAM [USC00345713], Atoka, OK
- (4) MOUNT IDA ASOS [USW00053921], Mount Ida, AR
- (5) BLAKELY MTN DAM [USC00030764], Mountain Pine, AR

Influencing water features

This ecological is subject to rare or occasional flooding (1 to 5 times in 100 years or greater than 5 to 50 times in 100 years).

Wetland description

This ecological site is not significantly influenced by wetlands.

Soil features

The soils associated with this ecological site are formed in alluvium derived from sandstone and shale. These soils are very deep, moderately well to well drained, and have a moderate to moderately rapid permeability class. A fine sandy loam or silt surface texture is common.

The soil series associated with this site are Speer, Spadra, and Tione.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Fine sandy loam (2) Silt
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderate to moderately rapid
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–1%
Available water capacity (Depth not specified)	10.92–19.81 cm
Soil reaction (1:1 water) (Depth not specified)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Rarely Flooded Terrace reference state consists of a shortleaf pine, hardwood forest. The common trees species for this state are shortleaf pine, oaks, and hickory (Eldredge, 1937).

Fire has a significant influence on this ecological site. The historical average fire return interval was likely between 3 and 25 years (Guyette, 2002; Hallgren, 2011). These wildfires would occur naturally through lightning strikes, but the majority were probably ignited by anthropogenic sources (DeSantis, 2010). Native species evolved with and responded well to fires (Spetich, 2008; Engle, 2001).

Fire has a significant influence on this ecological site. The historical average fire-return interval was likely between 3 and 25 years (Guyette and Spetich, 2003; Hallgren, DeSantic, and Burton, 2012). These fires would occur naturally through lightning strikes, but the majority were probably ignited by anthropogenic sources (DeSantis, Hallgren, and Stahle, 2010). Native species evolved with and responded well to fires (Spetich and Hong He, 2008; Engle and Bidwell, 2001). Fires on upland ecological sites are likely moderate to low severity, due to forested conditions and lower amounts of ground vegetation (Carey, 1992).

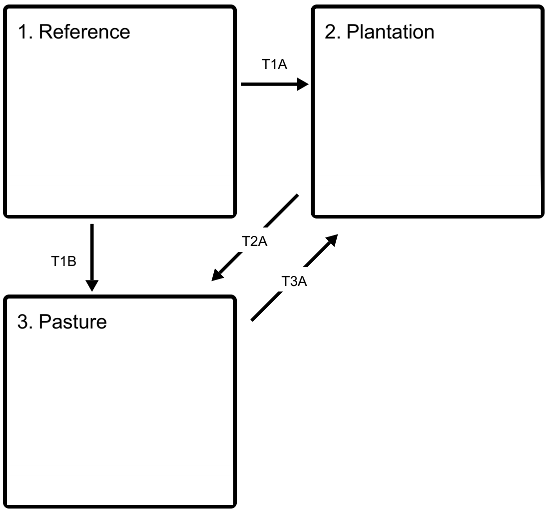
Grazing and farming can occur on this ecological site. Changes to the ecological dynamics are proportional to the intensity of livestock grazing and can be accelerated by overgrazing (Angerer, Fox, and Wolfe, 2013; Kohl, 2016). For example, desirable grasses and forbs are repeatedly grazed by livestock, weakening, and potentially killing or replacing these species with less desirable species (Smith, 1940).

Climate related events, such as hail-storms, tornados, thunderstorms, and extreme precipitation, occur on these sites. Hail-storms can reduce canopy size, increase litter deposition, and increase tree bark removal. When paired with other disturbances, such as fire, the effects on tree species were much greater than in areas not affected by hail-storms (Gower et al., 2015). Tornados have been shown to change plant community compositions in savanna ecosystems, favoring hardwoods and eliminating softwoods (Liu et al., 1997). Thunderstorms greatly effect ecosystem dynamics. Thunderstorms generally occur during summer months but can occur during every season. If a fire is started by a lightning strike, there will be different effects in the ecosystem depending on the season (Hiers, Wyatt, and Mitchell, 2000).

A state and transition model has been created to explain this Ecological Site. However, sparse data availability only allowed basic principles to be explored and a small number of species to be recorded. More data will be collected to provide a greater understanding of the ecological dynamics, as well as the resources consumption and distribution.

State and transition model

Ecosystem states



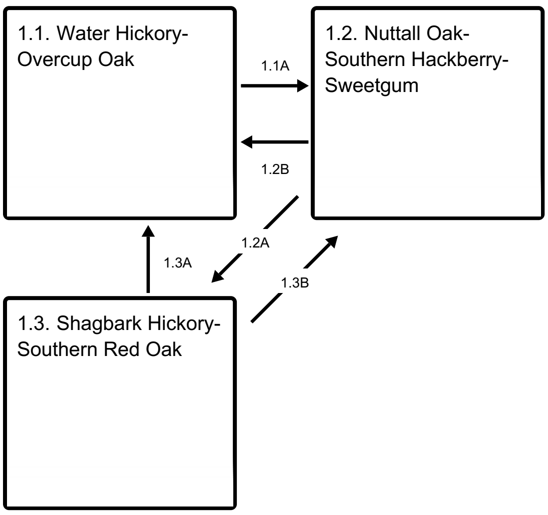
T1A - Tree removal, brush management, plantation tree establishment and management.

T1B - Tree removal, mechanical and chemical woody vegetation suppression, tillage, introduce annual or perennial forage species.

T2A - Woody species removal, prescribed fire, seeding, and grazing.

T3A - Forage species suppression, brush management, plantation tree establishment and management.

State 1 submodel, plant communities



1.1A - Less water during vegetation establishment.

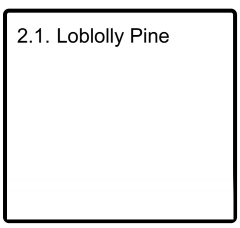
1.2B - More water during vegetation establishment.

1.2A - Less water during vegetation establishment.

1.3A - More water during vegetation establishment.

1.3B - More water during vegetation establishment.

State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Bermudagrass

State 1
Reference

The reference state is considered to be representative of the natural range of variability without major anthropogenic influences. Drivers: Climate (decadal scale), insect and disease presence or establishment, wildlife grazing or browsing, and wildfire frequency and intensity. Feedbacks: Water tolerant tree species dominate this ecological site, rare flooding events limit what species can grow and survive inundation.

Characteristics and indicators. The reference state consists of a bottomland hardwood forest. The common trees species for this state are oak, hickory, and hackberry.

Dominant plant species

- oak (*Quercus*), tree
- hybrid hickory (*Carya*), tree
- hackberry (*Celtis*), tree
- sycamore (*Platanus*), tree
- pine (*Pinus*), tree
- sweetgum (*Liquidambar*), tree

Community 1.1
Water Hickory-Overcup Oak

Community 1.2
Nuttall Oak- Southern Hackberry- Sweetgum

Community 1.3
Shagbark Hickory- Southern Red Oak

Pathway 1.1A
Community 1.1 to 1.2

This pathway consists of less water during vegetation establishment.

Pathway 1.2B
Community 1.2 to 1.1

This pathway consists of more water during vegetation establishment.

Pathway 1.2A
Community 1.2 to 1.3

This pathway consists of less water during vegetation establishment.

Pathway 1.3A
Community 1.3 to 1.1

This pathway consists of more water during vegetation establishment.

Pathway 1.3B
Community 1.3 to 1.2

This pathway consists of more water during vegetation establishment.

State 2
Plantation

The plantation state is characterized by the planting of merchantable trees species. The most common species for a plantation is loblolly pine. Community phases differ by tree type (softwood or hardwood) and the harvesting process. Drivers: Prescribed fires, pest management, vegetation management, canopy density. Feedbacks: Timber harvesting. Planted tree species dominate this ecological site, shading out other vegetation. Anthropogenic management decreases competition with other species and assists in growth.

Characteristics and indicators. A plantation state consists of tree species that are planted and managed to maximize the production of merchantable timber. The most common plantation species is loblolly pine, followed by hardwood trees. Community phases differ by tree type (softwood or hardwood), timber harvest method, management, and reforesting practices.

Dominant plant species

- loblolly pine (*Pinus taeda*), tree
- oak (*Quercus*), tree

Community 2.1
Loblolly Pine

Loblolly pine is planted to maximize timber production.

State 3
Pasture

The Pasture State is characterized by the dominance of improved forage species. The quality and quantity of forb, grass, and legume species within this state will depend on the level of management inputs including seeding, weed management, and land uses. Species of both warm-season and cool-season grasses are feasible for these sites. Drivers: Mechanical soil disturbance and seed planting, climate (decadal scale), seed dispersal, and wildlife or livestock grazing or browsing. Feedbacks: Land managers use mechanical and chemical equipment to increase forage. Inputs of fertilizer and brush management are required to maintain high productivity. Wildlife and livestock grazing and browsing decrease the amount of available forage.

Characteristics and indicators. The Pasture State consists of species that are grown for specific management goals, mainly livestock grazing. Common pasture species include buffalograss, western wheatgrass, little bluestem, sideoats grama, Bermudagrass, and bahiagrass. Quality and quantity of forb, grass, and legume species within this state depend on the level of management inputs (seeding, weed management, and land uses). Species of both warm-season and cool-season grasses are feasible for these sites.

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass
- red clover (*Trifolium pratense*), grass

Community 3.1
Bermudagrass

Herbaceous species have been planted to maximize forage production for grazing livestock.

Transition T1A
State 1 to 2

Trigger: Merchantable tree planting, targeted vegetation suppression, prescribed fire, and fertilization. Slow Variables: Increased production and management of merchantable trees. Tree thinning when appropriate. Thresholds: Vegetation is removed and timber species are planted.

Transition T1B
State 1 to 3

Trigger: Tree removal, mechanical and chemical woody vegetation suppression, tillage, introduce annual or perennial forage species. Slow Variables: Increase production and management of forage species. Thresholds: Changes in soil properties, such as structure, organic matter, and nutrient cycling, as well as changes in type and frequency of disturbance.

Transition T2A
State 2 to 3

Trigger: Tree removal, mechanical and chemical woody vegetation suppression, tillage, introduce annual or perennial forage species. Slow Variables: Increase production and management of forage species. Thresholds: Changes in soil properties such as structure, organic matter, and nutrient cycling as well as changes in type and frequency of disturbance.

Transition T3A
State 3 to 2

Trigger: Merchantable tree planting, targeted vegetation suppression, prescribed fire, and fertilization. Slow Variables: Increased production and management of merchantable trees. Tree thinning when appropriate. Thresholds: Introduced forage species are suppressed due to management strategies and shading.

Additional community tables

Animal community

Common wildlife species in this area include coyote, whitetail deer, bobcat, beaver, raccoon, otter, skunk, opossum, muskrat, mink, cottontail, armadillo, gray squirrel, and turkey. The species of fish in the area include largemouth bass, bluegill, redear sunfish, channel catfish, spotted bass, white bass, crappie, flathead catfish, sucker, bullhead, bowfin, and gar.

Hydrological functions

Following are the estimated withdrawals of freshwater by use in this MLRA:

Public supply— surface-water, 26.5%; ground-water, 0.3%
Livestock— surface-water, 9.6%; ground-water, 0.3%
Irrigation— surface-water, 0.6%; ground-water, 0.0%
Other— surface-water, 62.6%; ground-water, 0.0%

The total withdrawals average 155 million gallons per day (585 million liters per day). About 1 percent is from ground-water sources, and 99 percent is from surface-water sources. The high precipitation, perennial streams, and reservoirs provide abundant water. Several large reservoirs are used for water storage, flood control, and recreation. In the valleys, small ponds and springs are the main sources of water for domestic use and for livestock. The surface-water is typically of very good quality in this mountainous area.

In the valleys, shallow wells in alluvium are the main sources of water for domestic use and for livestock. None of the bedrock aquifers in Arkansas or Oklahoma occur in this area. The quality of the shallow ground-water is very similar to the quality of the water in the streams and rivers. The ground-water is suitable for drinking.

Recreational uses

Mountain biking, camping, fishing, hiking, horseback riding, hunting, mineral prospecting, nature viewing, off-highway vehicle riding, and water activities can all be enjoyed throughout this MLRA on public land where permitted and on private land where allowed. The Ouachita National Forest is throughout this MLRA, encompassing nearly 1.8 million acres of public land.

Wood products

Public and private timberland comprise large areas throughout this MLRA. Loblolly pine is the most popular species to harvest and produces products such as lumber, pulpwood, posts, and poles. Hardwood species are also harvested and used to produce lumber, flooring, and pulpwood.

Other products

Poultry production is a major industry throughout the MLRA. Small grains, soybeans, and hay are major crops.

References

Angerer, J., W. Fox, and J. Wolfe. 2016. Land Degradation in Rangeland Ecosystems. Biological and Environmental hazards, Risks, and Disasters. Academic Press.

Cannon, J.B. and J.S. Brewer. 2013. Effects of Tornado Damage, Prescribed Fire, and Salvage Logging on Natural Oak Regeneration in a Xeric Southern USA Coastal Plain Oak and Pine Forest.

Carey, J. 1992. Quercus stellata, Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fire Sciences Laboratory.

Clark, J.A. and K.R. Covey. 2012. Tree species richness and the logging of natural forests: A meta analysis. Forest Ecology and Management. Elsevier, Yale School of Forestry and Environmental Studies. 146–153.

DeSantis, R.D., S.W. Hallgreen, and D.W. Stahle. 2010. Historic Fire Regime of an Upland Oak Forest in South Central North America. Fire Ecology. USDA Forest Service, Northern Research Station, Saint Paul, Minnesota.

Eldredge, I. 1937. Forest Resources of Southern Arkansas. Southern Forest Experiment Station. US Forest Service.

Engle, D. and T. Bidwell. 2001. The response of central North American prairies to seasonal fire. Range Management 54:2–10.

Engle, D.M. 2017. Fire in North American Tallgrass Prairies. Weed Technology 5:247–248.

Gower, K., J. Fontaine, C. Birnbaum, and N. Enright. 2015. Sequential Disturbance Effects of Hailstorms and Fire on Vegetation in a Mediterranean-Type Ecosystem. Ecosystems 18:1121–1134.

Guldin, J.M. and M.W. Fitzpatrick. 1991. Comparison of Log Quality from Even-Aged and Uneven-Aged Loblolly Pine Stands in South Arkansas. Southern Journal of Applied Forestry 15:10–17.

Guyette, R.P. and M. A. Spetich. 2003. Fire History of Oak-Pine Forests in the Lower Boston Mountains, Arkansas, USA. Forest Ecology and Management. Elsevier. 463–474.

Guyette, R.P., M.A. Spetich, and M.C. Stambaugh. 2006. Historic fire regime dynamics and forcing factors in the Boston Mountains, Arkansas, USA. Forest Ecology and Management 234:293–304.

Hallgren, S.W., DeSantis. R. D., and J.A. Burton. 2012. Fire and vegetation Dynamics in the Cross Timbers Forests of South-Central North America. Proceedings of the 4th Fire in Eastern Oak Forests Conference. USDA Forest Service General Techincal Report NRS-P-102, Springfield, Missouri. 52–66.

Heikens, A. 2007. Glade Communities of the Ozark Plateaus Province. Pages 220–230 in Savannas, Barrens, and Rock Outcrop Plant Communities of North America.

Hiers, K., R. Wyatt, and R. Mitchell. 2000. The effects of fire regime on legume reproduction in longleaf pine savannas: is a season selective?. Oecologia 125:521–530.

Jenks, J.A., Leslie, R.L. Lochmiller, M.A. Melchiors, and McCollum. 1996. Competition in sympatric white-tailed deer and cattle populations in southern pine forests of Oklahoma and Arkansas, USA. Acta Theriologica 41:287–306.

Klos, R.J. and G.G. Wang. 2009. Drought impact on forest growth and mortality in the southeast USA: an analysis using Forest Health and Monitoring data. Ecological Applications 19:699–708.

Kohl, M., P. Krausman, K. Kunkel, and D. Williams. 2013. Bison Versus Cattle: Are They Ecologically Synonymous. Rangeland Ecology and Management 66:721–731.

Linzon, S.N. 1962. Hail Damage to White Pine and Other Trees. The Forestry Chronicle. Canadian Institute of Forestry.

Liu, C., J. Glitzenstein, P. Harcombe, and R. Knox. 1997. Tornado and fire effects on tree species composition in a savanna in the Big Thicket National Preserve, southeast Texas, USA. Forest Ecology and Management 91:279–289.

Owens, D. 2005. First report of a geological reconnaissance of the northern counties of Arkansas, made during the years 1857 and 1858. Arkansas Geological Survey.

Siemann, E., J.A. Carrillo, C.A. Gabler, R. Zipp, and W.E. Rogers. 2009. Experimental test of the impacts of feral hogs on forest dynamics and processes in the southeastern US. Forest Ecology and Management. Elsevier. 546–553.

Smith, C. 1940. The Effects of Overgrazing and Erosion Upon the Biota of the Mixed-Grass Prairie of Oklahoma. Ecology. Wiley. 381–397.

Spetich, M. and H. He. 2008. Oak decline in the Boston Mountains, Arkansas, USA: Spatial and temporal patterns under two fire regimes. Forest Ecology and Management 254:454–462.

Varner, J.M., D.R. Gordon, F.E. Putz, and J.K. Hiers. 2005. Restoring Fire to Long-Unburned Pinus palustris Ecosystems: Novel Fire Effects and Consequences for Long-Unburned Ecosystems. Restoration Ecology 13:536–544.

Warrillow, M. and P. Mou. 1999. Ice Storm Damage to Forest Tree Species in the Ridge and Valley Region of Southwestern Virginia. The Journal of the Torrey Botanical Society. Torrey Botanical Society. 147–158.

Zou, C., D. Twidwell, and C. Bielski. 2018. Impact of Eastern Redcedar Proliferation on Water Resources in the Great Plains USA- Current State of Knowledge.

Other references

Arkansas Soil Survey
Ouachita National Forest
Arkansas State Parks
The Nature Conservancy
US Fish and Wildlife Service
Encyclopedia of Arkansas
United States Forest Service Southern Research Station
NatureServe
Oklahoma Water Resource Board
National Centers For Environmental Information
University of Arkansas
Oklahoma State University
Arkansas Department of Forestry
Oklahoma Department of Forestry

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Approval

Bryan Christensen, 9/22/2023

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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	05/02/2024
Approved by	Bryan Christensen
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:

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

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

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

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:**

17. **Perennial plant reproductive capability:**