USDA Natural Resources Conservation Service

Ecological site R048AY015NM
Mountain Shale Dry

Last updated: 3/05/2024
Accessed: 05/12/2025

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.

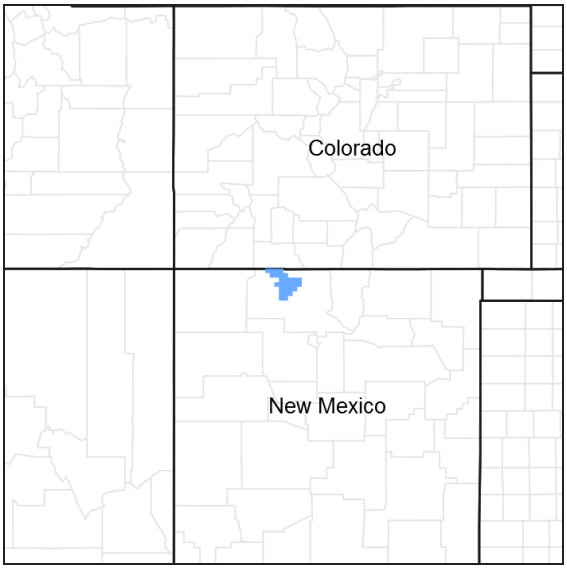


Figure 1. Mapped extent

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): 048A–Southern Rocky Mountains

This area is in Colorado (76 percent), New Mexico (11 percent), Utah (8 percent), and Wyoming (5 percent). It makes up about 45,920 square miles (119,000 square kilometers). The towns Jemez Springs, Los Alamos, Red River and Eagle Nest, New Mexico, are in this MLRA. This MLRA has numerous national forests, the Carson National Forest and part of the Santa Fe National Forest in New Mexico. The Jemez, Picuris, Santa Clara, and Taos Indian Reservations are in this MLRA. Most of this area is in the Southern Rocky Mountains Province of the Rocky Mountain System. Small parts of the southwest corner and some isolated areas farther west are in the Canyon Lands Section of the same province and division. The Southern Rocky Mountains consist primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. The ranges include the Sangre de Cristo Mountains, Jemez Mountains, and Tusas Mountains. Elevation typically ranges from 6,500 to 13,167 feet (1,980 to 1,039 meters) in this area. The Rio Grande is a National Wild and Scenic River in northern New Mexico, which is in the southern part of this MLRA.

The mountains in this area were formed mainly by crustal uplifts during the late Cretaceous and early Tertiary periods. The rocks exposed in the mountains are mostly Precambrian igneous and metamorphic rocks, which in many places are flanked by steeply dipping Mesozoic sedimentary rocks. Younger igneous rocks, primarily basalt and andesitic lava flows, tuffs, breccias, and conglomerates, are throughout this area. Representative formations in this area are the Silver Plume and Pikes Peak granites, San Juan Volcanics, and Mancos Shale. Many of the

highest mountain ranges were reshaped by glaciation during the Pleistocene. Alluvial fans at the base of the mountains are recharge zones for local basin and valley fill aquifers. They also are important sources of sand and gravel.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an ustic or udic soil moisture regime. Mineralogy is typically mixed, smectitic, or paramicaceous. In areas with granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on mountain slopes. Dystrocryepts (Leighcan and Mummy series) formed on mountain slopes and summits at the higher elevations. In areas of andesite and rhyolite bedrock, Dystrocryepts (Endlich and Whitecross series) formed in colluvium on mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on mountain slopes at low elevations and with low precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in colluvium on mountain slopes at high elevations.

LRU notes

This site is part of the RM-2 sub-resource area. This site is found on the west side of Sangre de Cristo mountains, Tusas Mountains (southern San Juan mountains) and Jemez Mountains.

Classification relationships

This ecological site is correlated to soil components at the Major Land Resource Area (MLRA) level which is further described in USDA AgHandbook 296.

Ecological site concept

This site occurs on nearly level to sloping landscapes below steeper slopes of interbedded sandstone and shale. Slopes range from 1 to 35 percent. Elevation ranges from 6,800 to 7,700 feet above sea level.

Soil depths range from shallow to moderately deep. Surface textures are generally clay loam and are very thin. Subsoils are generally clays. The amount of surface skeletal fragments varies from no fragments to very channery and erosion pavement forms as the surface is eroded. Permeability is slow to very slow.

This ecological site used to have the ID number of R048BY008NM in RM-2 subresource area in 1982.

Associated sites

R048AY238CO	**Brushy Loam** This site occurs on hills, mountains, complex landslides, and benches. Slopes is between 3 to 35%. Soils are moderately deep to deep (20 to 60+ inches), soils derived from colluvium, residuum, slope alluvium and alluvium from sandstone and shale. Soil surface texture is loam or clay loam with fine-textured subsurface. It is a Gambel's oak – slender wheatgrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.
R048AY012NM	**Mountain Loam Dry** This site occurs on gently sloping to moderately rolling uplands below or ranging into the ponderosa pine-Douglas fir woodlands. It may occur on open parks within the true woodlands. Slopes range from 1 to 20 percent. Elevation ranges from 7,200 to 9,200 feet above sea level. The soils are deep. Surface textures are loam or silt loam with subsoils varying from gravelly loam. very gravelly sandy clay loam, extremely cobbly clay loam. clay loam, or loam. Permeability is moderate slow to moderately rapid. This ecological site used to have the ID number of R048BY004NM in RM-2 subresource area in 1982.
R048AY013NM	**Mountain Slopes** This site occurs on valley sides and hills ranging from relatively uniform, long slopes to short and choppy. Exposure is usually southern and/or western, which creates a relatively droughty site. Slopes range from 15 to 45 percent. Elevation ranges from 7,200 to 8,600 feet above sea level. The soils are generally moderately deep to deep over interbedded shale and sandstone parent materials. Surface textures is usually a loam. Subsoils range from sandy clay loam, clay loam to clay. This ecological site used to have the ID number of R048BY006NM in RM-2 subresource area in 1982.

F048AY925CO	**Ponderosa Pine Forest** This site occurs on hillsides, mountain-slopes, mesas, structural benches and cuestas. Slopes are 3 to 30%. Soils are moderately deep to very deep (20 to 60+ inches). Soils are derived from slope alluvium from sandstone and/or shale, colluvium from sandstone and/or shale, or residuum from sandstone and shale. Soil surface texture is a loam, clay loam, sandy loam, fine sandy loam, very stony loam, cobbly sandy loam, or very boulder sandy loam with fine textured subsurface. It is a Ponderosa Pine - Muttongrass – squirreltail community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

Similar sites

R048AY007NM	**Mountain Shale** This site is in mountainous terrain on mountain slopes and hillslopes. Slopes are dominantly moderately steep to steep with gradients varying from 15 to 75 percent. Topography varies from relatively uniform slopes of considerable length to short, steep, choppy terrain. Elevation ranges from 7,000 to 9,000 feet above sea level. This site consists of soils that are shallow to moderately deep and are well drained. The surface texture is very stony clay, very stony clay loam, cobbly loam, and stony silty clay loam soils. The soils are derived from shale parent material. The effective rooting depth is 5 to 40 inches. Shale and sandstone outcrops are common. The subsoil is typically compacted clay, which restricts root penetration. This site is in subresource area RM-1.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Sporobolus airoides*

Physiographic features

This site occurs on nearly level to sloping landscapes below steeper slopes of interbedded sandstone and shale. Slopes range from 1 to 35 percent. Elevation ranges from 6,800 to 7,700 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Hill
Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,073–2,347 m
Slope	1–35%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by cold, wet winters in which more than 50 percent of the total annual precipitation is received during the winter. The balance of the precipitation is received in the summer months, some of it in the form of high intensity thunderstorms. Average annual precipitation is about 22 inches but ranges from 16 to 30 inches and yearly fluctuations are common.

The average frost-free period is about 80 days but ranges from 60 days at the highest elevations to 110 days at the lowest elevations; however, the period lengths vary. The average last killing frost in the spring occurs about June 10th. The average first killing frost in the fall occurs about September 20th. Average annual air temperature is 22.6 degrees F in January and 64.5 degrees F in July with extremes ranging from -40 degrees F to 95 degrees F.

Climate data was obtained from http://www.wrcc.sage.dri.edu/summary/climsmnm.html web site using 50%

probability for freeze-free and frost-free seasons using 28.5 degrees F and 32.5 degrees F respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	48-124 days
Freeze-free period (characteristic range)	88-152 days
Precipitation total (characteristic range)	406-762 mm
Frost-free period (actual range)	47-125 days
Freeze-free period (actual range)	82-157 days
Precipitation total (actual range)	406-762 mm
Frost-free period (average)	86 days
Freeze-free period (average)	120 days
Precipitation total (average)	584 mm

Climate stations used

- (1) WOLF CANYON [USC00299820], Jemez Springs, NM
- (2) JEMEZ SPRINGS [USC00294369], Jemez Springs, NM
- (3) LOS ALAMOS 13 W [USW00003062], Jemez Springs, NM
- (4) LOS ALAMOS [USC00295084], Los Alamos, NM
- (5) RED RIVER [USC00297323], Questa, NM

Influencing water features

None.

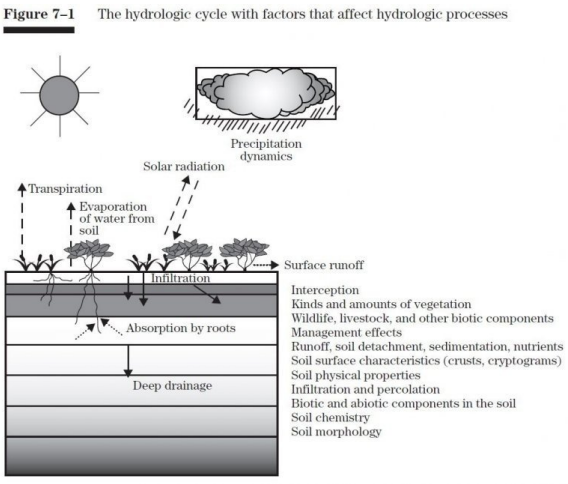


Figure 8.

Soil features

Soil depths range from shallow to moderately deep. Surface textures are generally clay loam and are very thin. Subsoils are generally clays. The amount of surface skeletal fragments varies from no fragments to very channery and erosion pavement forms as the surface is eroded. Permeability is slow to very slow.

Soils correlated to this site include:
Horselake and Quimera

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Colluvium–sandstone and shale (3) Residuum–sandstone and shale
Surface texture	(1) Channery clay loam (2) Clay loam
Family particle size	(1) Clayey (2) Fine
Drainage class	Well drained
Permeability class	Slow to moderately slow
Depth to restrictive layer	20–102 cm
Soil depth	20–102 cm
Surface fragment cover <=3"	5–40%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	7.62–13.97 cm
Calcium carbonate equivalent (Depth not specified)	0%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Deterioration of the potential plant community is indicated by a decrease in western wheatgrass, muttongrass, prairie junegrass, alkali sacaton and fourwing saltbush. Species that increase include little and big sagebrush, blue grama, galleta and ring muhly. Brush infestation and severe gullying of the site indicate severe deterioration.

Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include grazing gradients to water sources, fence-line contrasts, patches with differing dates and intensities of fire, herbicide treatment, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

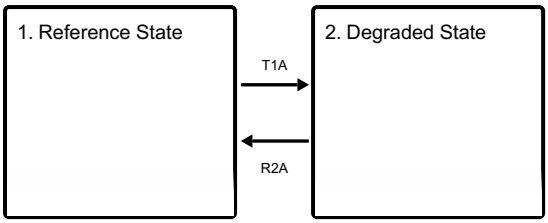
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram.

The plant communities shown in this State and Transition Model may not represent every possibility but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and/or new ones may be added.

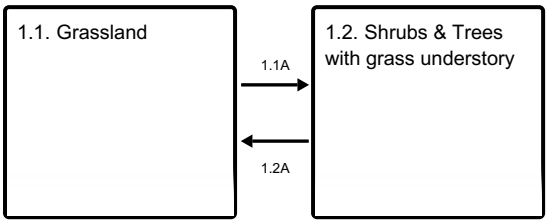
The state and transition model was added to comply with the provisional ecological site instruction. It is a very general model.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference State

This state represents the natural range of variability on the site. The plant communities within the reference state were shaped and maintained by disturbances such as grazing, browsing, drought, wet years, and fire. The removal or alteration of these processes can cause a shift to an alternative state.

Community 1.1
Grassland

The vegetation on this site appears as a mixed grassland-shrubland with scattered trees. Cool-season grasses dominate, but alkali sacaton and spike muhly are warm-season grasses common to the site. The shrub component is mostly low and big sagebrush. Rocky Mountain juniper is the most common tree. Forbs are visually conspicuous on the site. Other species that could appear on this site include: pine dropseed, Arizona fescue, Kentucky bluegrass, threadleaf groundsel, black sagebrush, pingue, rabbitbrush, broom snakeweed, Gambel oak, fleabane and penstemon. Trees, shrubs, and half-shrub canopy on this site averages 18 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	471	628	942
Shrub/Vine	135	179	269
Forb	67	90	135
Total	**673**	**897**	**1346**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	23-27%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	8-12%
Surface fragments >0.25" and <=3"	0%

Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	46-50%

Figure 10. Plant community growth curve (percent production by month). NM3308, R048AY015NM Mountain Shale Dry HCPC. R048AY015NM Mountain Shale Dry HCPC Cool-season dominated grassland/shrubland with a minor component of forbs. .

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	5	5	10	25	30	15	7	0	0

Community 1.2
Shrubs & Trees with grass understory

Western wheatgrass, muttongrass, prairie junegrass, alkali sacaton and fourwing saltbush have decreased. Species that have increase include little and mountain big sagebrush, blue grama, galleta and ring muhly. Two needle pinyon and Rocky Mountain Juniper have established on the site.

Pathway 1.1A
Community 1.1 to 1.2

Lack of fire, improper grazing of herbaceous species, and/or drought.

Pathway 1.2A
Community 1.2 to 1.1

Proper grazing, browsing of shrubs, fire and/or wet climatic cycles.

State 2
Degraded State

This state represents a shift from the reference state. The site has crossed a threshold that will require significant inputs to return to reference conditions, if possible. This has altered the hydrology and energy flow of the plant community.

Transition T1A
State 1 to 2

Excessive drought periods may also favor certain species. Improper grazing will cause desirable species to decrease and less desirable species to increase. Fire exclusion may lead to an increase in woody canopy scattered across the site.

Restoration pathway R2A
State 2 to 1

Fire, wetter climatic cycles, and/or proper grazing management can help return the plant community back to grassland. Shrub management may be needed to decrease shrubs.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				179–224	
	western wheatgrass	PASM	*Pascopyrum smithii*	179–224	–
2				45–135	
	alkali sacaton	SPAI	*Sporobolus airoides*	45–135	–
3				45–135	
	prairie Junegrass	KOMA	*Koeleria macrantha*	45–135	–
	muttongrass	POFE	*Poa fendleriana*	45–135	–
4				27–63	
	spike muhly	MUWR	*Muhlenbergia wrightii*	27–63	–
5				27–63	
	blue grama	BOGR2	*Bouteloua gracilis*	27–63	–
	James' galleta	PLJA	*Pleuraphis jamesii*	27–63	–
6				27–45	
	squirreltail	ELEL5	*Elymus elymoides*	27–45	–
7				27–45	
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	27–45	–
8				27–90	
	sleepygrass	ACRO7	*Achnatherum robustum*	27–90	–
	dropseed	SPORO	*Sporobolus*	27–90	–
	Grass, native	2GN	*Grass, native*	27–90	–
Forb					
9				9–45	
	Grass, native	2GN	*Grass, native*	9–45	–
	buckwheat	ERIOG	*Eriogonum*	9–45	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	9–45	–
Shrub/Vine					
10				45–90	
	little sagebrush	ARAR8	*Artemisia arbuscula*	45–90	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	45–90	–
11				45–90	
	prairie sagewort	ARFR4	*Artemisia frigida*	45–90	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	45–90	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	45–90	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–18	–
Tree					
12				0–20	
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–18	–
	twoneedle pinyon	PIED	*Pinus edulis*	0–18	–

Animal community

Grazing:
Approximately 85 percent of the vegetation produced on this site are suitable for use by domestic livestock and wildlife. Grazing distribution need not be a problem as long as water and salt are adequately located.

A planned grazing system with periodic grazing and rest is best to maintain a friable soil surface on this site, which is susceptible to soil capping and subsequent sheet, rill and gully erosion. Such a system also is beneficial to plant growth, since it results in periodic defoliation and rest, which stimulate increased plant production.

Habitat for Wildlife:
This site provides habitats which support a resident animal community that is characterized by elk, mule deer, coyote, mountain cottontail, Stephan's woodrat, western harvest mouse, vesper sparrow, gray headed junco, plain titmouse and fence lizard. Elk will use these sites during the winter months.

Hydrological functions

The runoff curve numbers are determined by field investigations using hydrologic cover conditions and hydrologic soil groups.

Recreational uses

This site is not noted for its beauty and offers little in the way of recreation.

Wood products

No significant wood products are produced on this site on a sustained yield basis.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index----------Ac/AUM
100 - 76----------2.4 – 3.2
75 – 51----------3.1 – 4.8
50 – 26----------4.7 – 9.5
25 – 0----------9.5+

Inventory data references

Data collection for this site was done in conjunction with the progressive soil surveys within the State of New Mexico. This site is found in the following soil survey areas: Taos, Sante Fe, Sandoval, Los Alamos, Rio Arriba, Santa Fe National Forest (Coyote, Cuba, Jemez Springs, and Espanola Ranger Districts) and Carson National Forest
.
These site descriptions were developed as part of a Provisional ESD project using historic soil survey manuscripts, available range site descriptions.

Other references

United States Department of Agriculture, Natural Resources Conservation Service. 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.

Contributors

Don Sylvester
Elizabeth Wright
John Tunberg

Approval

Kirt Walstad, 3/05/2024

Acknowledgments

Site Development and Testing Plan:

Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document. Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

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	05/12/2025
Approved by	Kirt Walstad
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:**