

Ecological site R040XD034CA

Gravelly, Braided, Ephemeral Stream

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 040X–Sonoran Basin and Range

MLRA Statement: Major land resource area (MLRA) 31 is the Lower Colorado Desert. This area is in the extreme southeastern part of California, in areas along the Colorado River, and in Western Arizona. The area is comprised of rough, barren, steep, and strongly dissected mountain ranges, generally northwest to southwest trending that are separated by intermontane basins. Elevation ranges from approximately 275 feet below sea level at the lowest point in the Salton Trough to 2700 feet along low northwest to southeast trending mountain ranges. The average annual precipitation is 2 to 6 inches with high temporal and spatial variability. Winter temperatures are mild, summer temperatures are hot, and seasonal and diurnal temperature fluctuations are large. Monthly minimum temperature averages range from 40 to 80 degrees F (4 to 27 degrees C). Monthly maximum temperature averages range from 65 to 110 degrees F (18 to 43 degrees C) (WRCC 2002). Temperatures are rarely below 28 degrees F, and extremely rarely fall below 24 degrees F. Precipitation is bimodal, with approximately 20 to 40 percent of annual precipitation falling between July and September. This summer rainfall, in combination with very hot temperatures and very few to no days of hard freeze are what characterize this MLRA and distinguish it from the Mojave Desert (MLRA 30).

Ecological site concept

This ecological site occurs on mid portions of the fan piedmont, below order 3 or larger drainages, where flow from flash flood events dissipates and sediments are deposited on the fans. This site develops multiple braided channels, because low stream velocity and sediment deposition cause channel migrations. The majority of this site is occasionally flooded, but it includes a main channel with more frequent flooding frequency, and raised islands that rarely flood. Elevations range from 980 to 2900 feet. Soils are very deep gravelly to very gravelly sands. Surface cobbles are typical, and patches of cobbles are interspersed with patches of bare sand. The site is dominated by burrobush (*Hymenoclea salsola*), desert lavender (*Hyptis emoryi*), and brittlebrush (*Encelia farinosa*). Smoketree (*Psoralea argemone*) is present in active channels. Blue paloverde (*Parkinsonia florida*) and desert ironwood (*Olneya tesota*) are scattered throughout. Data ranges in the physiographic data, climate data, water features, and soil data sections of this Ecological Site Description are based on major and minor components, since it is often only associated with minor components.

Associated sites

R040XD001CA	Limy Hill 4-6" p.z. This ecological site is on steep side slopes of alluvial fans, with sparse creosote bush and burrobush.
R040XD009CA	Gravelly Fan Remnants And Fan Aprons This ecological site is on nearby fan aprons, which are not prone to flooding. Creosote bush, Schott's dalea, and brittlebrush are present.
R040XD030CA	Extremely Stony Fan Remnants This ecological site is on stony fan remnants, and teddy bear cholla is common.

R040XD200CA	Rarely Flooded Fans This ecological site is in sandier braided washes, with brittlebush dominant.
R040XD201CA	Cobbly Fan Remnants This ecological site is on rubble fan remnants with brittlebush and creosote bush dominant.
R040XD202CA	Stony, Occasionally Flooded Ephemeral Stream This ecological site is in rubbly drainageways among rubbly fan remnants. Schott's dalea and blue paloverde are dominant.

Similar sites

R030XY128CA	Broad, Gravelly, Hyperthermic Ephemeral Stream This ephemeral stream is similar, but is within the adjacent Mojave Desert. Blue paloverde is absent.
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Table 1. Dominant plant species

Tree	(1) <i>Parkinsonia florida</i> (2) <i>Olneya tesota</i>
Shrub	(1) <i>Hymenoclea salsola</i> (2) <i>Hyptis emoryi</i>
Herbaceous	Not specified

Physiographic features

This ecological site occurs on channels, drainageways, inset fans, and alluvial fans on fan piedmonts. Elevations range from 980 to 2900 feet. Slopes range from 2 to 30 percent, but slopes of 2 to 8 percent are typical.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Channel (3) Inset fan
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to frequent
Elevation	300 – 880 m

Slope	0 – 30 %
Aspect	Aspect is not a significant factor

Climatic features

The climate of this ecological site is characterized by hot temperatures, aridity, and a bimodal precipitation pattern. Precipitation falls as rain, with 30 percent falling in summer between July and October, and 60 percent falling in winter between November and March. The mean annual precipitation is 2 to 4 inches and mean annual air temperature is 73 to 79 degrees F. The frost free period is 360 to 365 days and the freeze period is 363 to 365 days.

Maximum and minimum monthly climate data for this ESD were generated by the Climate Summarizer (http://www.nm.nrcs.usda.gov/technical/handbooks/nrph/Climate_Summarizer.xls) using data from the following climate stations (results are weighted averages; numbers in square brackets represent relative weights):

42598, Eagle Mountain, CA (Period of record = 1933 to 2011) [2]

43855, Hayfield Reservoir, CA (Period of record = 1933 to 2011) [1]

The data from multiple weather were combined to most accurately reflect the climatic conditions of this ecological site.

Table 3 Representative climatic features

Frost-free period (average)	370 days
Freeze-free period (average)	370 days
Precipitation total (average)	100 mm

Influencing water features

This site is subject to frequent and occasional large flash flood events.

Soil features

The soils associated with this ecological site are very deep, somewhat excessively to excessively drained, and formed in alluvium from gneiss, granitoid, or igneous parent material. The surface textures are gravelly loamy coarse sand, gravelly coarse sand, extremely gravelly coarse sand, very cobbly coarse sand, loamy fine sand, and sandy loam. Subsurface horizons are composed of coarse sands and sands with very or extremely gravelly modifiers. Surface rock fragments less than 3 inches in diameter range from 20 to 84 percent cover, and fragments greater than 3 inches range from 1 to 37 percent cover. Subsurface (depths of 1 to 59 inches) percent by volume of rock fragments less than 3 inches ranges from 20 to 50, and greater than 3 inch fragments range from 0 to 14.

This ecological site is correlated with the Chemwash, Rizzo and Carsitas soil series. The Chemwash and Rizzo soils are Sandy skeletal, mixed, hyperthermic Typic Torriorthents. These soils both have greater than 35 percent rock fragments, but the Rizzo soils are dominated by >5 mm diameter rock fragments and Chemwash has smaller (3 to 5 mm) sized rock fragments in the particle control section. The Carsitas soils are mixed, hyperthermic, Typic Torripsamments. The Carsitas soils have two C horizons composed of layers of gravelly sand from 0 to 10 inches and gravelly coarse sand below 10 inches. It does not have large rock fragments and more developed soil horizons are absent.

This ecological site has been correlated to the following map units and soil components in the Joshua Tree National Park Soil Survey Area (CA794):

Map unit ID; Map unit name; Component; Percent

1504; Rizzo association, 4 to 15 percent slopes, rubbly; Rizzo; frequently flooded, rubbly; 7

1555; Goldrose-Carsitas-Chemwash complex, 4 to 8 percent slopes; Chemwash; rarely flooded; 25; and Chemwash; occasionally

flooded; 2

2404; Rizzo complex, 2 to 8 percent slopes, channeled; Rizzo; occasionally flooded; 60

and Rizzo; very rarely flooded; 35

and Rizzo; frequently flooded; 3

2409; Rizzo-Chemwash-Carsitas complex, 4 to 8 percent slopes; Carsitas; occasionally flooded, braided; 25

2421; Carsitas complex, 4 to 8 percent slopes; Carsitas; rarely flooded; 25 and Carsitas; occasionally flooded, braided; 10

2431; Chemwash complex, 2 to 8 percent slopes; Chemwash; rarely flooded; 10 and Chemwash; frequently flooded, braided; 60

2440; Rizzo complex, 8 to 15 percent slopes; Rizzo; occasionally flooded; 30

2835; Rock outcrop-Black eagle complex, 30 to 75 percent slopes; Rizzo; frequently flooded; 1

Table 4. Representative soil features

Surface texture	(1) Gravelly loamy coarse sand (2) Gravelly coarse sand (3) Extremely gravelly loamy coarse sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	150 cm
Surface fragment cover <=3"	20 – 80 %
Surface fragment cover >3"	0 – 40 %
Available water capacity (0-101.6cm)	2.03 – 6.1 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified

Soil reaction (1:1 water) (0-101.6cm)	6.6 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	20 – 50 %
Subsurface fragment volume >3" (Depth not specified)	0 – 10 %

Ecological dynamics

This ecological site occurs on upper to medial portions of the fan piedmont, below order 3 or larger drainages, where flow from flash flood events dissipates and sediments are deposited on the fans. This site develops multiple braided channels because low stream velocity and sediment deposition causes channel migrations. The majority of this site is occasionally flooded, but it includes a small main channel with more frequent flooding frequency, and raised islands that rarely flood

Soil disturbance from flash flood events is the primary driver of plant community dynamics within this ecological site. Ephemeral streams lack permanent flow except in response to rainfall events (Bull 1997, Levick et al. 2008). These ephemeral streams are characterized by extreme and rapid variations in flooding regime, and a high degree of temporal and spatial variability in hydrologic processes (Bull 1997, Stanley et al. 1997, Shaw and Cooper 2008, Levick et al. 2008).

This site often experiences channel avulsion (defined as the “diversion of the majority of the surface flow to a different channel, with total or partial abandonment of the original channel” [Field, 2001]). As sediment deposits in the active drainageway the likelihood of channel avulsion increases because of decreased drainageway volume. Cycles of channel avulsion on alluvial fans are an ongoing and long-term process in the development of alluvial fans, and can occur after any substantial overland flow event when existing channel capacity is rapidly and dramatically exceeded. Channel avulsion of the main channel would cause high mortality of vegetation in the old channel due to water stress and lack of regeneration, but would initiate development of xeroriparian communities in the newly created channel.

The majority of this area is a broad, extensively braided drainageway. There are barren active channels dominated by fine sands and gravels, and low relief sediment bars with higher vegetative cover and larger rock fragments, primarily cobbles. The drought-tolerant vegetation that exists on ephemeral streams and drainageways is referred to as xeroriparian vegetation. It is distinct from the surrounding landforms due to a difference in species composition, size, and production (Levick et al. 2008, Johnson et al. 1984). Xeroriparian vegetation is present because the increased availability of water and flood disturbances in these drainageways. The braided area is dominated by burrobush, desert lavender, and brittlebush but a variety of shrubs and forbs are present. The main active channel has low cover of smoketree. Two notable larger trees, blue paloverde and desert ironwood, are scattered across the drainageway. Blue paloverde is a relatively fast growing, shorter lived tree which is confined to washes in the drier parts of the Sonoran Desert. It needs greater moisture than the average precipitation that this ecological site provides, and its hard shelled seeds need physical scarification from floods or a long time of weathering in the soils to enable germination. Desert ironwood is long lived, slow growing tree with very dense wood, which is also largely confined to washes in this area of the Sonoran Desert.

Many of the species present in this ecological site (Blue paloverde, desert ironwood, Schott's dalea, and desert lavender) are near their northern limit of distribution along the border of the Mojave and Sonoran Desert. These species are restricted to the warmer Sonoran Desert, and its bimodal precipitation pattern and absence of frost. The dominant species are frost-intolerant and rely on summer precipitation for seed germination. Climate data from the climate stations listed above indicate that temperatures below 28 degrees F may occur between late Dec to mid February, but do not occur every year. In the cooler areas (Hayfield Reservoir) temperatures may fall to the low 20s, approximately every 3 years. The Eagle Mountain station indicates closer to a 10-year period between frosts. Both stations indicate a prolonged period of freezing temperatures in January, 1950, with temperatures as low as 14 degrees F. at Hayfield Reservoir. The prolonged low temperatures in 1950 would likely have caused some mortality throughout this area. Less severe freezes of shorter durations or less severe temperatures will cause die back of frost-sensitive younger stems and branches, but may not kill the mature or hardened plants. The dynamics of frost is not included in the state and transition model (STM), because the incidence of frost is uncommon, and this site exists because of the relatively frost free conditions of this area.

Another climatic driver of this ecological site is summer precipitation. This area receives approximately 30 percent of its precipitation from July to October, from monsoons coming up from Mexico. Summer precipitation is important for the germination and survival of desert ironwood, blue paloverde, and desert lavender. Winter precipitation is important for seed production for desert ironwood and other species. Summer rains and warmer temperatures are needed to initiate germination for desert ironwood, desert lavender, and blue paloverde. Without summer rains and warmer temperatures some of these species would not regenerate well if at all.

Precipitation in this ecological site is very limited, with approximately 2 to 4 inches falling in a given year. The amount of total precipitation, and the timing and frequency of precipitation, highly is variable from year to year. In addition, the spatial distribution of precipitation is variable, as squalls may downpour on one area, but completely miss adjacent mountains or valleys. Hereford et al. (2004) describes shifts from dry to wet periods which may last several decades. During wetter cycles plant species show increased cover, size, and regeneration, while during drier periods and droughts, regeneration is low and shorter-lived shrubs have high mortality (Miriti et al. 2007). In the State-and-Transition model below, the drought phase is referring to severe droughts which cause high mortality, lack of regeneration and affect plant community composition. Although it is somewhat ambiguous to define, the Reference plant community phase implies that the area is receiving average (2 to 4 inches) or higher precipitation, and vegetation is not in decline due to drought.

When precipitation events occur, these ephemeral streams provide important hydrologic functions, such as maintaining water quality by allowing energy dissipation during high water flow. They transport nutrients and sediments, store sediments and nutrients in deposition zones, provide temporary storage of surface water, and longer duration storage of subsurface water. These streams are important ecologically because they provide water and habitat for a variety of plant and animal species. The structure and forage provided by xeroriparian vegetation, and the availability of water (although brief), significantly increases animal abundance along ephemeral streams relative to upland areas. The open channels also provide important migration corridors for wildlife (Levick et al. 2008).

Historically fire was very uncommon in these ephemeral drainages; however the presence of continuous and flashy fuels from non-native grasses in adjacent upland sites can increase the possibility of fire. Invasion by non-native annual grasses has increased the flammability of desert vegetation communities (Brooks 1999, Brooks et al. 2004), and after fire, desert ecosystems appear to be more susceptible to invasion by exotic grasses, leading to a grass-fire cycle (D'Antonio and Vitousek 1992). Very wet (El Nino) years followed by severe drought produce conditions where large areas where of creosote scrub may burn (Brown and Minnich 1986).

When modifications affect the hydrologic function of this ephemeral stream system, this ecological site has the potential to transition to a hydrologically altered state (State 3). Once this threshold is crossed, it is extremely difficult to repair the hydrologic system.

Modifications to hydrology such as surface flow alterations, ground water depletion, and loss of the xeroriparian vegetation can have irreversible impacts on hydrologic processes (Nishikawa et al. 2004, and Levick et al. 2008). An increase in cover of impermeable surfaces (such as pavement, homes, malls, etc.) reduces the amount of runoff that can infiltrate into the soil, creating higher surface runoff and greater peak flows. The runoff is collected in ditches, culverts, and drainage networks, and diverted to the nearest ephemeral stream. In some areas, retaining walls are built along ephemeral streams to reduce damage to property from flood events. These confined channels reduce the ability for the stream to spread out and decrease flow velocity to allow sediment deposition. As a result, the channels will generally incise, with a higher volume of concentrated flows. These processes eventually cause higher peak flows due to increased runoff and concentrated flows. Higher flow velocities may cause uprooting, stem breakage or scour under the roots of xeroriparian vegetation. This loss of root structure along the stream increases scour potential, and the loss of above ground vegetation will increase flow velocity. When the xeroriparian community is lost, important animal species dependent upon this community may be lost from the area as well. Ground water drawdown from household wells (Nishikawa et al. 2004) can deplete the water source for phreotophytes, such as desert lavender, blue paloverde, ironwood, and smoketree and may eliminate these species in affected areas.

State and transition model

Figure 3. R031XY034CA model

Additional community tables

Table 5. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Tree					
1	Trees			22-62	
	blue paloverde	PAFL6	<i>Parkinsonia florida</i>	22-50	0-3
	smoketree	PSSP3	<i>Psorothamnus spinosus</i>	0-17	0-2
	desert ironwood	OLTE	<i>Olneya tesota</i>	0-6	0-1
Shrub/Vine					
2	Native shrubs			89-146	
	burrobrush	HYSA	<i>Hymenoclea salsola</i>	56-146	1-5
	brittlebush	ENFA	<i>Encelia farinosa</i>	17-67	1-4
	desert lavender	HYEM	<i>Hyptis emoryi</i>	16-28	1-5
	Schott's dalea	PSSC5	<i>Psorothamnus schottii</i>	0-22	0-2
	sweetbush	BEJU	<i>Bebbia juncea</i>	0-9	0-1

	bladderpod spiderflower	CLIS	<i>Cleome isomeris</i>	0-1	0-1
	beloperone	JUCA8	<i>Justicia californica</i>	0-1	0-1
	beavertail pricklypear	OPBA2	<i>Opuntia basilaris</i>	0-1	0-1
	Schott's pygmycedar	PESC4	<i>Peucephyllum schottii</i>	0-1	0-1
	Thurber's sandpaper plant	PETHT	<i>Petalonyx thurberi ssp. thurberi</i>	0-1	0-1
	jojoba	SICH	<i>Simmondsia chinensis</i>	0-1	0-1
	brownplume wirelettuce	STPA4	<i>Stephanomeria pauciflora</i>	0-1	0-1
	California barrel cactus	FECY	<i>Ferocactus cylindraceus</i>	0-1	0-1
	ocotillo	FOSP2	<i>Fouquieria splendens</i>	0-1	0-1
Forb					
3	Native forbs			0-17	
	cryptantha	CRYPT	<i>Cryptantha</i>	0-4	0-1
	buckwheat	ERIOG	<i>Eriogonum</i>	0-1	0-1
	Western Mojave buckwheat	ERMO3	<i>Eriogonum mohavense</i>	0-1	0-1
	smooth desrtdandelion	MAGL3	<i>Malacothrix glabrata</i>	0-1	0-1
	sowthistle desrtdandelion	MASO	<i>Malacothrix sonchoides</i>	0-1	0-1
	birdcage evening primrose	OEDE2	<i>Oenothera deltoides</i>	0-1	0-1
	chia	SACO6	<i>Salvia columbariae</i>	0-1	0-1
	whitemargin sandmat	CHAL11	<i>Chamaesyce albomarginata</i>	0-1	0-1
	pincushion flower	CHFR	<i>Chaenactis fremontii</i>	0-1	0-1
4	non-native forb			0-1	
	Asian mustard	BRT0	<i>Brassica tournefortii</i>	0-1	0-1
	redstem stork's bill	ERIC6	<i>Erodium cicutarium</i>	0-1	0-1
Grass/Grasslike					
5	Non-native grass			0-1	
	Mediterranean grass	SCHIS	<i>Schismus</i>	0-1	0-1

Table 6. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

Small animals live in this ecological site. Animal diversity in this ecological site may be greater than in other areas due to the heterogeneity of the site. Large trees, such as blue paloverde, smoketree, and desert ironwood provide structural diversity and additional food sources that may support a higher diversity of fauna. Ephemeral drainages are important wildlife migration corridors.

Hydrological functions

Ephemeral drainages provide some similar hydrologic functions as perennial streams. A properly functioning system will maintain water quality by allowing energy dissipation during high water flow. These systems transport nutrients and sediments, and store sediments and nutrients in deposition zones. Ephemeral drainages provide temporary storage of surface water, and longer duration storage of subsurface water (Levick et al. 2008).

Recreational uses

Large drainageways in which this ecological site is provide open travel corridors for hiking trails, with a diversity of vegetation and wildlife to observe.

Wood products

Desert ironwood wood is very dense, and has been used for firewood and wood carvings, but due to its slow growth rate and low recruitment it is unsustainable and illegal to collect in some areas (Phillips et al. 2000). Blue paloverde wood is used for fire wood, but is not very strong (Pavek 1994).

Other products

Blue paloverde and desert ironwood seeds are edible after being prepared and cooked properly (Pavek 1994, and Phillips et al. 2000). Desert lavender is used in landscaping, because it has a pleasant aroma and it attracts bees and hummingbirds.

Inventory data references

The following NRCS vegetation plots were used to describe this ecological site: CC1-Frequently flooded 1249704207 CC2-Occasionally flooded 1248617604- Type location 1249704401- Soil modal, but below aqueduct 1249704404 1250014905 1250015101 1249704211 (oculars only) CC3-rarely to very rarely flooded 1248617605 Possibly State 3 1249704402 (potentially altered, floods diverted away from plot by HW10) 124861766B (potentially altered, flow diverted away from plot by road)

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3727759
UTM easting	609669
General legal description	The type location is about 1.25 miles west of the Bajada Nature Trail Parking lot, on Cottonwood Springs Road in Joshua Tree National Park.

Other references

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Contributors

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Approval

Kendra Moseley, 3/11/2025

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	08/20/2026
Approved by	
Approval date	

Composition (Indicators 10 and 12) based on	Annual Production
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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:
