USDA Natural Resources
Conservation Service

Ecological site R030XD010CA
Frequently Flooded, Gravelly, Hyperthermic To Warm-Thermic Ephemeral Stream

Accessed: 05/19/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 030X–Mojave Basin and Range

MLRA statement:
Major Land Resource Area (MLRA) 30, Mojave Desert, is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The climate of the area is hot (primarily hyperthermic and thermic; however at higher elevations, generally above 5000 feet, mesic, cryic and frigid) and dry (aridic). Elevations range from below sea level to over 12,000 feet in the higher mountain areas found within the MLRA. Due to the extreme elevational range found within this MLRA, land resource units (LRUs) were designated to group the MLRA into similar land units.

"XY" LRU:
This LRU is found throughout the Mojave Desert MLRA. This LRU designation is set aside for ecological sites that are ubiquitous throughout the MLRA. These sites are driven by environmental or chemical features that override the climatic designations of the other LRU's or are atypical compared to the surrounding landscape. Common overriding XY characteristics within this MLRA include: ephemeral streams subject to flash flood events, riparian areas or other water features, and soils with strong chemical influence (Na, Ca, etc).

Ecological Site Concept:
This ecological site occurs on third order or larger ephemeral drainages. The landforms are drainageways, channels, and inset fans. Elevations range from 1030 to 3790 feet, with 0 to 8 percent slopes. This site is associated with hyperthermic and warm thermic soils. Large, occasional to frequent flash flood events shape this ecological site. Although this site has large drainage basins it is located on medial and distal positions of alluvial fans, where flow volume and velocity has slowed, and sediment transport is predominately sands and gravels. The main channels provide a deep water source and a frequent flooding regime, which support desert willow (*Chilopsis linearis*), catclaw acacia (*Acacia greggii*) and smoketree (*Psorothamnus spinosus*). A range of flooding intensities along and across the drainageway supports several community components.

Data ranges in the physiographic data, climate data, water features, and soil data sections of this Ecological Site Description are based on major components (15 percent of map unit or more).

Classification relationships

Sawyer, J.O. and T. Keeler-Wolf. 1995. Manual of California Vegetation - Catclaw Acacia Series

NDDB/Holland Type and Status: Mojavean Desert Scrub (43000), Riparian Scrubs (63000).
Mojave Wash Scrub (34250) G3 S3.2
Mojave Desert Wash Scrub (63700) G3 S2.1

Barry Type: G7411124

Brown Lowe Pase type: 143.153, 153.141, 154.123, 153.161
Cheatham & Haller type: Desert Dry Wash Woodland.
PSW-45 type: Catclaw Series.
Stone & Sumida (1983): Wash Community
Thorne Type: Desert Microphyll Woodland
WHR Type: Desert Wash

Associated sites

R030XD002CA	**Desert Pavement** This ecological site is on stable fan remnants with desert pavement.
R030XD015CA	**Hyper-Arid Fans** This ecological site is on adjacent alluvial fans, with hyperthermic soils and creosote bush and burrobrush are present.
R030XY159CA	**Gravelly Outwash** This ecological site is on adjacent fan aprons with creosote and desert senna.
R030XY188CA	**Slightly Alkaline, Rarely To Occasionally Flooded Ephemeral Stream** This ephemeral stream is on smaller drainageways, and Hall's shrubby spurge and creosote bush are common.

Similar sites

R030XY001CA	**Occasionally Flooded, Hyperthermic, Diffuse Ephemeral Stream** This ecological site has smaller drainage area, and has a diffuse braided channel, Schott's dalea and creosote bush dominate.
R040XD010CA	**Valley Wash** This ephemeral stream is similar to this site, but is in the Sonoran Desert, which is hotter and has more precipitation during summer from monsoons and blue paloverde is present.

Table 1. Dominant plant species

Tree	(1) *Chilopsis linearis* (2) *Psorothamnus spinosus*
Shrub	(1) *Hymenoclea salsola* (2) *Acacia greggii*
Herbaceous	(1) *Malacothrix glabrata* (2) *Pectocarya recurvata*

Physiographic features

This ecological site occurs on channels, drainageways, bars on drainageways, inset fans, and occasionally the adjacent fan apron. Elevations range from 1030 to 3790 feet. Slopes are generally 2 to 4 percent, but range from 0 to 8 percent.

Table 2. Representative physiographic features

Landforms	(1) Channel (2) Drainageway (3) Inset fan
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to frequent
Elevation	314–1,155 m
Slope	0–8%
Aspect	Aspect is not a significant factor

Climatic features

The climate is arid with hot, dry summers and warm, moist winters. The mean annual precipitation is 75 to 178 millimeters (3 to 7 inches) and the mean annual air temperature is 17 to 23 degrees C (63 to 73 degrees F.). The frost-free season is 280 to 340 days, and the freeze-free season is 310 to 360 days.

The tabular climate summary for this ESD was generated by the Climate Summarizer (http://www.nm.nrcs.usda.gov/technical/handbooks/nrph/Climate_Summarizer.xls) using data from the climate stations listed below (results are with Twentynine palms weighted twice).

Table 3. Representative climatic features

Frost-free period (average)	340 days
Freeze-free period (average)	360 days
Precipitation total (average)	178 mm

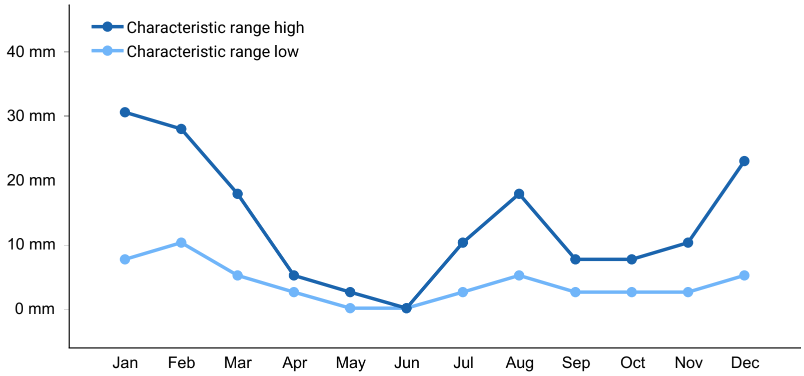

Figure 1. Monthly precipitation range

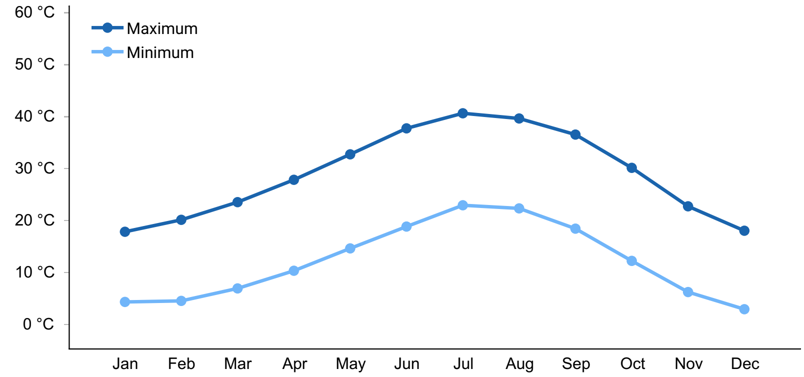

Figure 2. Monthly average minimum and maximum temperature

Influencing water features

This ecological site is associated with moderate to large-sized ephemeral stream systems subject to occasional to frequent flash flood events.

Soil features

The soils associated with this ecological site are very deep, well to excessively drained, and formed in alluvium from granitoid, gneiss and igneous rock or mixed parent material. The surface textures are very gravelly loamy sand, gravelly loamy sand, sand, gravelly coarse sand and gravelly sand. Subsurface horizons (1 to 59 inches) are composed of sandy textures with gravelly to extremely gravelly modifiers. Surface rock fragments less than 3 inches range from 20 to 75 percent cover, and fragments greater than 3 inches range from 0 to 35 percent cover. Subsurface percent by volume of rock fragments less than 3 inches ranges from 5 to 65, and greater that 3 inch fragments range from 0 to 20.

Soils with thermic soil temperature regimes associated with this site include: Arizo and Dragonwash– sandy-skeletal, mixed, thermic Typic Torriorthents; and Burntshack – loamy, mixed, superactive, thermic Arenic Haplargids. The Burntshack soils are an unusual soil for ephemeral streams, because they have soil development indicating soil stability. However, there is almost 23 inches of coarse sand over the argillic horizons, which is from more recent alluvium. The lower horizons have gravelly sandy loam and gravelly loamy sand textures. The presence of xeroriparian vegetation and obvious flood disturbance may indicate that the channel has recently migrated to this area, or that by the time stream flow reaches this point, it does not have enough power to erode the deeper soils or transport large volumes of sediment. The difference between the Arizo soils and the Dragonwash soils is that the Dragonwash soils are dominated by fine gravel (2 to 5 millimeters) within the particle size control section.

Soils with hyperthermic soil temperature regimes associated with this site include: Carrizo – sandy-skeletal, mixed, hyperthermic Typic Torriorthents and Pintobasin – mixed, hyperthermic Typic Torripsamments.

The Pintobasin and Burntshack soils are non-skeletal (<35 percent rock fragments in the particle control section, while the other soils are skeletal.

This ecological site has been correlated with major components in the following map units within the Joshua Tree National Park Soil Survey (CA794):

Map unit ID; Map unit name; Component; Phase; Percent
2405; Carrizo complex, 0 to 4 percent slopes; Carrizo; occasionally flooded; 25
2406; Pintobasin-Carrizo association, 0 to 2 percent slopes;Carrizo; occasionally flooded;40 and Pintobasin; frequently flooded; 50
2407; Pintobasin-Carrizo association, 2 to 4 percent slopes; Carrizo; occasionally flooded; 30
and Carrizo; frequently flooded; 20
3526; Cajon-Hypoint-Arizo association, 1 to 4 percent slopes; Arizo;occasionally flooded; 15
3612; Burntshack association, 2 to 4 percent slopes; Burntshack; occasionally flooded; 20
4440; Dragonwash association, 2 to 4 percent slopes; Dragonwash; frequently flooded; 35
and Dragonwash; occasionally flooded; 55

This ecological site is associated with an additional 16 map units with minor components including: Arizo, frequently flooded; Arizo, occasionally flooded; Carrizo, frequently flooded; Carrizo, occasionally flooded; Carrizo, occasionally flooded, channeled; Joetree, frequently flooded; Pintobasin, frequently flooded; and Pintobasin occasionally flooded, broad. The Joetree soil is a unique soil similar to Pintobasin, except is has a buried argillic horizon below 100 cm (39 inches).

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Very gravelly loamy sand (2) Gravelly sand (3) Gravelly loamy sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Very slow to rapid
Soil depth	150 cm
Surface fragment cover <=3"	20–75%
Surface fragment cover >3"	0–35%
Available water capacity (0-101.6cm)	1.02–13.72 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%

Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–4
Soil reaction (1:1 water) (0-101.6cm)	6–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–65%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

This ecological site occurs on third order or larger ephemeral drainages. The landforms are drainageways, channels, and inset fans. This site is associated with hyperthermic and warm thermic soils. Large, occasional to frequent flash flood events shape this ecological site. Although this site has large drainage basins, it is located on medial and distal positions of alluvial fans where volume and velocity of the stream flow has slowed, and sediment transport is predominately fine materials (such as sands and gravels). The main channels provide a deep water source and a frequent flooding regime, which support desert willow (*Chilopsis linearis*), catclaw acacia (*Acacia greggii*) and smoketree (*Psorothamnus spinosus*). A range of flooding intensities along and across the drainageway supports several community components.

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, Levick et al. 2008, Shaw and Cooper 2008).

Flood intensity, scour and sediment transport vary across the drainageway and channel segments, which creates a complex of plant communities. 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 (Johnson et al. 1984, Levick et al. 2008). Xeroriparian vegetation is present because of the increased availability of water and flood disturbances in these drainageways. Desert willow, smoketree, and catclaw acacia are present along active channel margins. These species are phreatophytes, that is, they have deep roots and primarily rely on a deep water source. A deep water source typically refers to a water table or a zone of saturated soils. However, these ephemeral desert streams do not generally have water tables within reach of plant roots, and here plants are accessing deep ground water (Nilsen et al. 1984). Catclaw acacia and mixed shrubs are present on adjacent overflow flood zones, and upland shrubs are present on stable islands. Collectively, all of these plant communities are part of the xeroriparian vegetation, and provide xeroriparian habitat.

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)]) dynamics include a constant flux of balancing erosional and depositional channel reaches. As sediment deposits in the main channel of the depositional zone, the likelihood of channel avulsion increases because of decreased channel volume. Cycles of channel avulsion on fan piedmonts is an ongoing and a long-term process in the development of alluvial fans and associated landforms, and can occur after any substantial overland flow event when existing channel capacity is very rapidly and dramatically exceeded.

If channel avulsion occurs at the apex of the alluvial fan, it is more likely to capture the majority of the stream flow. Upper fans extend into the base of mountains, which provide a direct sediment source which is transported over time, by larger flood events, to distal reaches of the drainage. This ecological site generally occurs on the medial to distal positions of a fan apron, or in broad valley bottoms, at the low point between the opposing fan aprons. At the distal reaches of the fan aprons, surface flow dissipates and percolates out of the channel into substratum. Below this point the active channel becomes vegetated with stable upland vegetation, such as creosote bush (*Larrea tridentata*).

Water availability, sediment flux, and channel migrations result in a dynamic complex of hydrologically and disturbance determined plant communities. Physical disturbance of soils as a result of flash flooding makes predictability of temporary channel development and configuration very low except when considered at a very coarse scale. Typical runoff events may result in an apparently stable mosaic of plant species distribution and channel configuration while more extreme events may completely reconfigure the mosaic and establish the foundation of a new or modified plant community mosaic until the next extreme runoff event occurs.

The associated plant communities occur on microfeatures within the drainageway that are related to flooding frequency and intensity, but are also influenced by other disturbances such as fire and drought.

A properly functioning ephemeral drainage will provide some similar hydrologic functions as perennial streams. Ephemeral streams maintain 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. 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 provide important migration corridors for wildlife (Levick et al. 2008).

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 hydrology of the system.

Offsite as well as onsite 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, 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 generally scour and incise. 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 phreatophytes, such as desert willow and catclaw acacia, potentially eliminating this species from certain areas.

State and transition model

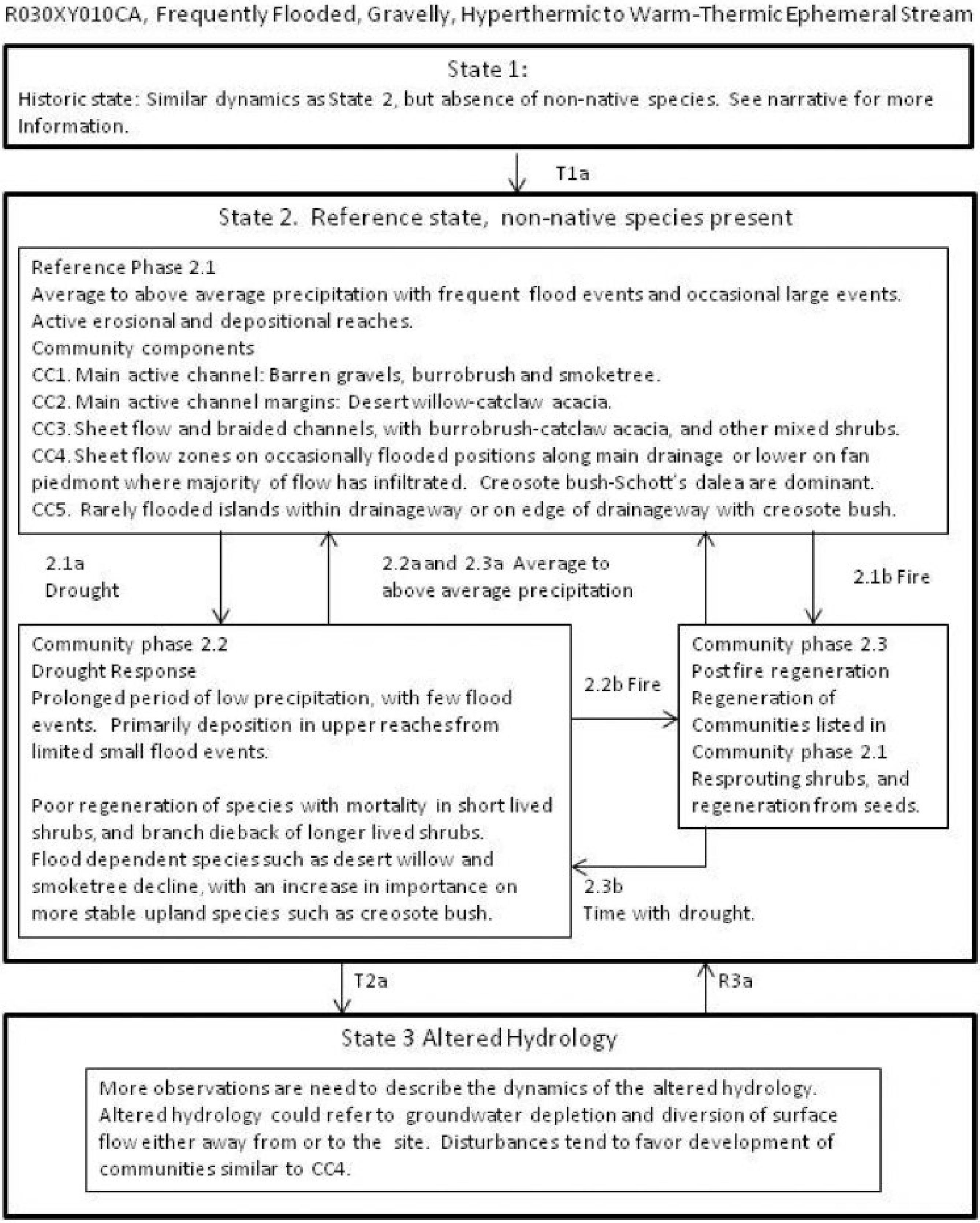

Figure 3. R030XY010CA Model

State 1
Historic State

State 1 represents the historic-natural condition for this ecological site. It is similar to State 2, but has only native species. If we were to include dynamics for this state it would be the same as displayed in State 2. The presence of non-native species is minimal in State 2, and has not altered the hydrology or fire frequency.

State 2
Reference State

This state represents the most common and most ecologically intact condition for this ecological site at the present time.

Community 2.1
Reference Phase

Figure 4. CC1 main channel and CC2 channel margins

Figure 5. CC3

Figure 6. CC4

Figure 7. CC5

This community phase is dependent upon unimpaired hydrologic function and average to above average precipitation. Site specific historical data to determine flood size or frequency is difficult to find. However, historic precipitation data and runoff frequency calculated by measuring sediment deposits indicate greater than one inch precipitation events and runoff events occur in about 4.5 to 5 year intervals (Griffeths et al. 2006). Precipitation events of greater than one inch would flood the active channel, and extend to some portions of the higher relief sediment bars. It is difficult to determine the frequency of large flood events which would have enough volume to overflow onto the upper topographic positions. Precipitation of less than an inch occurs more often and creates surface flow in the active channel. This community phase includes the dynamics of the ephemeral stream from the upper fan to the distal fan, as well as flood dynamics and channel migrations across the drainageway. The core concept of this ephemeral stream is based on the large channel in the medial positions of the alluvial fan. This drainageway has several topographic positions, which experience different flooding frequencies and intensities. There are 5 community components (CC) described for this ecological site which include: CC1 the main channel; CC2 channel margins; CC3 adjacent zones and upper drainageway with occasional flooding and overflow; CC4 side channels or divergent channels and where the main channel loses velocity and has lost flow volume from infiltration; and CC5 stable islands within the drainageway. The relative spatial extent of these communities varies as the channel morphology fluctuates from flash flood events. Steeper reaches may be more incised with less chance of sheet flow over the banks. Data collected for this site was not always contained within one community component (plant community), as the transects were occasionally placed bisecting the drainageway, rather than along the drainageway. The data in the table below reflects combined plot data for this ecological site, rather than by individual community components. More specific data is described in the community component descriptions below. There are six dominant, predictable community components within this phase (although other permutations may exist). Community component 1 (CC1) This community exists in the main active channel, with frequent flood events and occasional larger flood events. It is distinguished by barren gravels and sand with scattered smoketree, burrobush (*Hymenoclea salsola*), sweetbush (*Bebbia juncea*) and an annual forb community that includes Bigelow's monkeyflower (*Mimulus bigelovii*), pygmy poppy (*Eschscholzia minutiflora*), bristly fiddleneck (*Amsinckia tessellata*), chia (*Salvia columbariae*), and suncup (Camissonia sp.). Smoketree is present in the main active channel because physical scarification by flood gravels improves seeds germination. The seeds may also have growth inhibitors, which are water soluble, and are removed by running water (Bainbridge 2007). Smoketree produces few leaves, and conducts most of its photosynthesis through the stem, which helps it withstand drought conditions by preventing water loss through the leaves (Nilsen et al. 1984). Community Component 2 (CC2) This community is found along the margins of the active channel. Phreatophyes such as desert willow, smoketree and catclaw acacia are present. Burrobrush and bladderpod spiderflower (*Cleome isomeris*) are common shrubs, and the forbs listed in CC1 and CC3 may be present. Desert willow has sporadic presence with about 3 percent cover in areas where it is present. It is a long-lived (>100 years) and winter deciduous. It reproduces sexually by wind-dispersed seed, as well as asexually by crown-sprouting following mechanical disturbance (Uchytil 1990). Seedlings establish in freshly deposited sediment, and require moisture for establishment (Uchytil 1990). Seeds are dispersed in the fall and winter and probably do not remain viable beyond the spring after dispersal (Magill 1974). Fruit production may be inhibited during drought (DePree and Ludwig 1978, Petersen et al. 1982). Desert willow may colonize freshly deposited sediment, and then act to trap further sediments, thereby creating islands within the active channel (Gardner 1951), and it also acts to stabilize stream banks (Uchytil 1990). Stands of desert willow are often absent from apparently suitable washes, indicating that this community can come and go (Sawyer et al. 2009). Catclaw acacia is not an obligate riparian species, but usually reaches dominance only where there is regular flooding, or where surface fragments channel water (Sawyer et al. 2009). Smoketree is present on the channel margins as well as in the channel. The larger shrubs and trees on this site are long-lived with shallow and deep roots. Their roots provide a strong deep anchor that stabilizes stream margins and captures sediments. In the event of a large flood event, catclaw acacia, desert willow, and smoketree can resprout from the root crown after being top-killed or injured by floods. Floods also initiate regeneration from seed. The seeds of catclaw acacia and smoketree are relatively large and are dependent on gravity, floods or animals for dispersal. Desert willow produces high volumes of wind dispersed seeds that will germinate in fresh, moist sediment deposits. Burrobrush is a shallow-rooted, short-lived shrub, which produces prolific wind or water dispersed seed. Community Component 3 (CC3) This community is present adjacent to the main channel where larger flood events overflow the main channel and create sheetflow across the drainageway and inset fans. It is also present in the main channel in the upper drainageway, and on side channels. The species composition is highly variable as the flood history and intensity is extremely variable in these areas. Burrobrush is typically dominant with 5 to 12 percent cover, and catclaw acacia (2-8 percent cover), bladderpod spiderflower (2 to 4 percent cover), and creosote bush (1 to 4) percent cover are common. Desert willow and smoke tree may be occasionally present along more active side channels. Other common shrubs are sweetbush, Wiggins' cholla (*Cylindropuntia echinocarpa*), branched pencil cholla (*Cylindropuntia ramosissima*), Mojave rabbitbrush (*Ericameria paniculata*), desert lavender (*Hyptis emoryi*), white ratany (*Krameria grayi*), peach thorn (*Lycium cooperi*), beavertail pricklypear (*Opuntia basilaris*), Mexican bladdersage (Salazaria Mexicana) and desertsenna (*Senna armata*), mesquite mistletoe (*Phoradendron californicum*), and Schott's dalea (*Psorothamnus schottii*). Perennial forbs include desert starvine (*Brandegea bigelovii*), desert dodder (*Cuscuta denticulata*), coyote gourd (*Cucurbita palmata*), hairy milkweed (*Funastrum hirtellum*), pepperweed (Lepidium sp.), wishbone-bush (*Mirabilis laevis* var. villosa), and birdcage evening primrose (*Oenothera deltoides*). Annual diversity and production is dependent upon the amount and timing of annual precipitation. The following annuals are generally present in years with normal precipitation: bristly fiddleneck, suncup (Camissonia spp.), (*Chaenactis fremontii*), cryptantha (Cryptantha sp), smooth desertdandelion (*Malacothrix glabrata*), and curvenut combseed (*Pectocarya recurvata*). Several other annuals are listed in the table below. The non-native forb, Asian mustard (*Brassica tournefortii*), is present in this site primarily within this community component. Apparently the occasional but not frequent soil disturbance allows this plant to establish, thus Asian mustard may pose a threat to this community. This species is already present at higher densities and biomass loads than native annual forbs in some areas, and may displace native annuals or shrub seedlings. Seed production is directly related to plant size in this plant, so large plants may especially overwhelm native seed banks. Other non-native species including common Mediterranean grass (*Schismus barbatus*), red brome (*Bromus rubens*), and redstem stork's bill (*Erodium cicutarium*) are present, but with low cover. Community Component 4 (CC4) This community is present along the distal alluvial fan, at the lower end of the ephemeral stream, or on side channels and divergent channels. This area is unconfined and subject to sheet flow from surface runoff on the adjacent alluvial fans, and stream flow from larger flood events. Burrobrush is still abundant with 1 to 6 percent cover. Schott’s dalea increases in importance in this component, with 1 to 6 percent cover, and creosote bush has 1 to 2 percent cover. The majority of the species listed in CC3 are present in this community as well, but have lower annual production and cover. Jojoba (*Simmondsia chinensis*) and Mojave yucca (*Yucca schidigera*) have less than 1 percent cover. Catclaw acacia may be sporadically present, but desert willow and smoketree are absent. Community Component 5 (CC5) This community is present on stable islands or along the edge of the wash, where flood waters rarely reach. Channels migrations and sediment deposits alter the direction of flow over time, and these areas may have been subject to more frequent floods. This community is dominated by large creosote bush (6 to 11 percent cover), and low shrub diversity. Nevada ephedra (*Ephedra nevadensis*) has 2 to 4 percent cover, and white ratany has less than 1 percent cover. Dominant annuals are pincushion flower, curvenut combseed, and woolly easterbonnets (*Antheropeas wallacei*). Other species listed in CC4 may occasionally be present, with less than 1 percent cover. The non-native annual, redstem stork's bill has high production (26 lbs/acre) and cover (4 percent) in this community component, indicating that it may be more productive in areas of more stability. Mediterranean grass (*Schismus barbatus*) and red brome (*Bromus rubens*) are present with less than 1 percent cover.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	11	56	448
Shrub/Vine	56	135	325
Forb	–	112	207
Grass/Grasslike	–	1	7
Total	**67**	**304**	**987**

Community 2.2
Drought Response

Figure 9. CC1 and CC2

This community phase develops after severe or prolonged drought, and absence of flood events. The plant community components remain the same, as described in Community Phase 2.1, but the proportion of each community type across the drainageway will shift in response to drier conditions, and overall growth and cover declines. With prolonged drought and absence of flood events the deep rooted phreatophytes along the channel margin will decline. They will initially suffer branch die-back, but if drought conditions persist or channel avulsion diverts flood waters from the previously active channel, they may suffer high mortality. Desert willow fruit production may be inhibited in response to drought (DePree and Ludwig 1978, Petersen et al. 1982). Further, moderate flooding in wet years is necessary for desert willow establishment (seeds dispersed in fall and winter establish in freshly deposited sediment), and establishment may be sporadic (Uchytil 1990, Sawyer et al. 2009). Desert willow seed has no dormancy, and seeds probably do not survive beyond the spring after dispersal occurs (Magill 1974). So although desert willow is long-lived (> 100 years), stands will not replace themselves in the absence of suitable recruitment conditions, and new stands of desert willow will not establish in suitable unoccupied locations. Since catclaw acacia produces a long-lived seed bank, and burrobush can take advantage of any moisture (i.e. not necessarily surface flow), these species may increase if the drought is not prolonged or severe. Smoketree will not regenerate without floods to scarify and leach the seeds, and to provide sufficient soil moisture. Severe drought can cause mortality in shorter lived shrubs such as burrobrush, bladderpod spiderflower, and Mojave rabbitbrush (*Ericameria paniculata*). Creosote bush may suffer branch die-back, but may persist in long term drought, and become dominant as other species die off. In the photo above, smoketree is dying in what was the active channel. The cause for this is unknown, but could be related to several factors. Smoketree may have established during the last big flood event (seed scarification and moisture), but since this location is far down the fan, perhaps floods have not reached this area in enough frequency or volume to continue to support smoketree. Another possibility is that channel avulsion has diverted the main flow to another channel, thus leaving the original channel dry or with lower flow. With an overall decrease in cover and the potential loss of root structure, this site is susceptible to erosion when floods return to the drainageway.

Community 2.3
Post fire regeneration

This community phase results from fire, which is historically rare in desert ephemeral drainageway communities. An increase in the abundance of invasive annual grasses and annual forb cover in associated upland communities has led to an increase in fire frequency (Brown and Minnich 1986, Brooks et al. 2004, Brooks and Matchett 2006, Rao et al. 2010, Steers and Allen) in upland communities as well as ephemeral drainageways. Smoketree, desert willow, and catclaw acacia can resprout after flood events and after fire. Catclaw acacia in particular may become more abundant several years post fire. The shorter lived shrubs, such as burrobrush, sweetbush and Mojave rabbitbrush will recolonize quickly from wind dispersed seed. Non-native annual grasses do not reach high cover in this site due to the frequent flood disturbance, so it is unlikely that this site will carry fire easily or convert to a grass-fire cycle after a burn. If extreme precipitation events follow fire, and especially if upslope hill communities also burned, then this community phase is vulnerable to channel entrenchment and transition to State 3, altered hydrology. This is because upslope and riparian vegetation act to reduce runoff and slow water flow, thus protecting soils from erosion and maintaining a system of braided channeling and sheetflow that supports the full range of vegetation communities in the riparian complex (Bull 1997).

Pathway 2.1a
Community 2.1 to 2.2

Reference Phase

Drought Response

This pathway occurs in response to greater than 5 years of drought, and an absence of flood events. The active, freshly scoured portion of the channel declines and a lack of freshly deposited sediment and moist conditions inhibits recruitment of desert willow, smoketree and catclaw acacia among other species.

Pathway 2.1b
Community 2.1 to 2.3

This pathway occurs in response to fire. Desert washes historically burn very infrequently (Uchytil 1990), but an increase in the abundance of invasive annual grasses and annual forb cover in general in associated upland communities (Brown and Minnich 1986, Brooks et al. 2004, Brooks and Matchett 2006, Rao et al. 2010, Steers and Allen 2011) has led to an increase in fire frequency in desert wash communities.

Pathway 2.2a
Community 2.2 to 2.1

Drought Response

Reference Phase

This pathway occurs with average to above average precipitation and associated flood events.

Pathway 2.2b
Community 2.2 to 2.3

This pathway occurs as a result of fire. Given low cover of annuals during drought, this pathway is unlikely except in periods immediately following heavy precipitation years.

Pathway 2.2a
Community 2.3 to 2.1

This pathway occurs with average to above average precipitation and associated flood events.

Pathway 2.3a
Community 2.3 to 2.1

This pathway occurs in response to the passing of time with average to above average precipitation and associated flood events.

Pathway 2.3b
Community 2.3 to 2.2

This pathway occurs in response to the passing of time with drought conditions and absence of flooding.

State 3
Hydrologically Altered

State 3 represents altered hydrological conditions. Data is needed to develop a successional diagram for this state, and it is unknown to what extent hydrologic modifications have affected this ecological site.

Community 3.1
Hydrologically Altered

Surface flow alterations, increase in impervious surfaces, and ground water depletion can hydrologically alter this system. Surface flow alterations from roads and ditches can divert flow away from or to a new area. If water is diverted away from the original channel, the flood dependent species will die out and be replaced with more upland species such as creosote bush and burrobush. Channel entrenchment can develop due to a range of interacting factors (Bull 1997), including the creation of drainage ditches in urban areas (NRCS staff observations) which cause increased runoff and infiltration in downstream reaches due to an increase in impervious surfaces (Nishikawa et al. 2004). Incised arroyos may form due to extreme climatic events, especially if they follow a period of drought or a fire that also burns upslope hill communities (Bull 1997). Research in other arid lands ephemeral stream systems has shown that channel entrenchment can lead to mortality in xeroriparian communities in a time span of only decades (Bull 1997 and references therein). Several of the associated communities in the reference state of the ecological site are lost, and only a productive creosote bush community may be left. In an in-depth study addressing management of groundwater resources in the Joshua Tree-Twentynine Palms area, Nishikwawa et al. (2004) found that significant draw-down of upper and middle aquifers is occurring due to household wells, and that natural regeneration of aquifers is very limited. Desert willow is a phreatophyte that relies on groundwater to survive adverse droughty conditions (de Soyza et al. 2004). With severe ground-water depletion, existing desert willow trees will no longer be able to access water and will die. Data on the timeframe within which this might occur is not available. CC2 would die out, leaving CC3 through CC6. Catclaw acacia does not depend on groundwater for survival, although it does need regular flooding (or run-on on stony slopes).

Restoration pathway R3a
State 3 to 2

Restoration from State 3 back to State 2 would be an intensive task. Individual site assessments would be required to determine proper restoration methods. Some hydrological modifications are not feasible restored, such as ground water depletion. However, impervious pavement, road diversions, and channel armoring can be redesigned to allow proper infiltration and channel flow. Entrenched channels can be built up with check dams, stones, or woody debris to increase the frequency of overflow on to the alluvial fan. Seeds or plants of appropriate species may need to be reintroduced to the restored channels, and associated sheet-flow areas.

Additional community tables

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
1	**Trees**			0–448	
	desert willow	CHLI2	*Chilopsis linearis*	0–336	0–3

	desert willow	CHLI2	*Chilopsis linearis*	[illegible]	[illegible]
	smoketree	PSSP3	*Psorothamnus spinosus*	0–112	0–9
Shrub/Vine					
2	**Shubs**			56–325	
	catclaw acacia	ACGR	*Acacia greggii*	6–202	0–8
	bladderpod spiderflower	CLIS	*Cleome isomeris*	1–135	1–4
	creosote bush	LATR2	*Larrea tridentata*	0–105	0–6
	Schott's dalea	PSSC5	*Psorothamnus schottii*	0–84	0–6
	burrobrush	HYSA	*Hymenoclea salsola*	11–69	1–13
	sweetbush	BEJU	*Bebbia juncea*	0–45	0–11
	Mojave rabbitbrush	ERPA29	*Ericameria paniculata*	0–37	0–6
	desertsenna	SEAR8	*Senna armata*	0–34	0–2
	jojoba	SICH	*Simmondsia chinensis*	0–22	0–2
	Eastern Mojave buckwheat	ERFA2	*Eriogonum fasciculatum*	0–18	0–4
	branched pencil cholla	CYRA9	*Cylindropuntia ramosissima*	0–16	0–1
	Mexican bladdersage	SAME	*Salazaria mexicana*	0–15	0–3
	peach thorn	LYCO2	*Lycium cooperi*	0–11	0–1
	white ratany	KRGR	*Krameria grayi*	0–10	0–1
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0–3	0–1
	Mojave yucca	YUSC2	*Yucca schidigera*	0–3	0–1
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	0–1	0–1
	desert lavender	HYEM	*Hyptis emoryi*	0–1	0–1
	burrobush	AMDU2	*Ambrosia dumosa*	0–1	0–1
Forb					
3	**Forb perennial**			0–34	
	hairy milkweed	FUHI	*Funastrum hirtellum*	0–18	0–4
	desert starvine	BRBI	*Brandegea bigelovii*	0–17	0–1
	desert dodder	CUDE2	*Cuscuta denticulata*	0–17	0–1
	coyote gourd	CUPA	*Cucurbita palmata*	0–7	0–1
	wishbone-bush	MILAV	*Mirabilis laevis var. villosa*	0–3	0–1
	mesquite mistletoe	PHCA8	*Phoradendron californicum*	0–2	0–1
	birdcage evening primrose	OEDE2	*Oenothera deltoides*	0–1	0–1
	pepperweed	LEPID	*Lepidium*	0–1	0–1
4	**Forb annual**			0–146	
	curvenut combseed	PERE	*Pectocarya recurvata*	0–90	0–6
	smooth desertdandelion	MAGL3	*Malacothrix glabrata*	0–45	0–16
	western tansymustard	DEPI	*Descurainia pinnata*	0–45	0–1
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–34	0–2
	pincushion flower	CHFR	*Chaenactis fremontii*	0–13	0–5
	distant phacelia	PHDI	*Phacelia distans*	0–6	0–2
	cryptantha	CRYPT	*Cryptantha*	0–4	0–4
	sowthistle desertdandelion	MASO	*Malacothrix sonchoides*	0–3	0–2
	brittle spineflower	CHBR	*Chorizanthe brevicornu*	0–3	0–1
	buckwheat	ERIOG	*Eriogonum*	0–1	0–9

	buckwheat	ERIOG	*Eriogonum*	0–1	[illegible]
	Western Mojave buckwheat	ERMO3	*Eriogonum mohavense*	0–1	0–2
	suncup	CAMIS	*Camissonia*	0–1	0–2
	desert thorn-apple	DADI2	*Datura discolor*	0–1	0–1
	pygmy poppy	ESMI	*Eschscholzia minutiflora*	0–1	0–1
	Schott's calico	LOSC6	*Loeseliastrum schottii*	0–1	0–1
	lupine	LUPIN	*Lupinus*	0–1	0–1
	blazingstar	MENTZ	*Mentzelia*	0–1	0–1
	purplemat	NADE	*Nama demissum*	0–1	0–1
	chia	SACO6	*Salvia columbariae*	0–1	0–1
	small wirelettuce	STEX	*Stephanomeria exigua*	0–1	0–1
	phacelia	PHACE	*Phacelia*	0–1	0–1
5	**Forb non-native**			0–168	
	Asian mustard	BRTO	*Brassica tournefortii*	0–168	0–1
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–29	0–4
Grass/Grasslike					
6	**non-native grasses**			0–7	
	common Mediterranean grass	SCBA	*Schismus barbatus*	0–7	0–7
	Mediterranean grass	SCHIS	*Schismus*	0–2	0–1
	red brome	BRRU2	*Bromus rubens*	0–1	0–1

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 shrubs and trees, such as desert willow, catclaw acacia, and smoketree, 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

This site is well suited for many types of recreation. Bird watching would be excellent here, since the desert trees attract many resident and migrant birds. Since this site is the drainage for much of the surrounding area, even in drought years some plants in the wash flower, providing opportunities for photography. Naturalists would find the wash fascinating for its diversity of shrubs and abundant wildflowers in wet years, and especially for its desert trees.

Other products

Native Americans used desert willow wood to make bows and baskets (Gucker 2005).

Catclaw acacia wood is strong, durable and has unique coloration. It has been used to make cabinets, souvenirs, and fencing (Uchytil 1990).

Inventory data references

The following NRCS vegetation plots were used to describe this ecological site:

CC1 and CC2
POWA88
DD-32 type location

CC3
PIMO08
217-172-2
PIMO07b
1249704001
1249704016
WAWA04 (poor data)

CC4
DD-33
PIMO07A
Y-34

CC5
POWA92

Type locality

Location 1: San Bernardino County, CA	
UTM zone	N
UTM northing	3746832
UTM easting	616153
General legal description	The type location is in Pintobasin, about a half mile east of Old Dale Road, and about 7 miles north of the Old Dale and Black Eagle Mine Road in Joshua Tree National Park.

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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	

Approved by	
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:**
