Ecological site F006XA002WA
Mesic Xeric Hill Slopes and Terraces (Ponderosa Pine Hot Dry Grass)

Last updated: 9/11/2023
Accessed: 10/12/2024

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): 006X–Cascade Mountains, Eastern Slope

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Stretching from northern Washington to southern Oregon, MLRA6 encompasses the mountain slopes, foothills, elevated plateaus and valleys on the eastern slopes of the Cascade mountains. This MLRA is a transitional area between the Cascade Mountains to the west and the lower lying Columbia Basalt Plateau to the east. Situated in the rain shadow of the Cascade Crest, this MLRA receives less precipitation than portions of the cascades further west and greater precipitation than the basalt plateaus to the east. Geologically, the majority of the MLRA is dominated by Miocene volcanic rocks, while the northern portion is dominated by Pre-Cretaceous metamorphic rocks and the southern portion is blanketed with a thick mantle of ash and pumice from Mount Mazama. The soils in the MLRA dominantly have a mesic, frigid, or cryic soil temperature regime, a xeric soil moisture regime, and mixed or glassy mineralogy. They generally are moderately deep to very deep, well drained, and loamy or ashy. Biologically, the MLRA is dominated by coniferous forest, large expanses of which are dominated by ponderosa pine, Douglas-fir or lodgepole pine. Areas experiencing cooler and moister conditions include grand fir, white fir, and western larch while the highest elevations include pacific silver fir, subalpine fir and whitebark pine. Economically, timber harvest and recreation are important land uses in these forests. Historically, many of these forests would have experienced relatively frequent, low and mixed severity fire favoring the development of mature forests dominated by ponderosa pine or Douglas-fir. In the southern pumice plateau forests, less frequent, higher severity fire was common and promoted the growth of large expanses of lodgepole pine forests.

LRU notes

Major Land Resource Area: 6 – Cascade Mountains, Eastern Slopes
Modal Land Resource Unit (LRU): Common Resource Area (CRA) 6.3 - Okanogan Pine / Fir Hills

This LRU occurs predominantly on slopes of hills and mountains, and glacial outwash terraces. The soils are dominantly in the Mollisols taxonomic order with minor areas of Alfisols and Entisols . Soil parent materials are dominantly colluvium and residuum from igneous, sedimentary, and metamorphic rock, glacial outwash, and glacial till, with a mixture of volcanic ash and loess in the upper part. Taxonomic soil climate is primarily a mesic temperature regime and xeric moisture regime with average annual precipitation of about 17 inches.

Other LRU'S where the site occurs:
CRA 6.4 - Chelan Tephra Hills
CRA 6.5 - Chiwaukum Hills and Lowlands

Classification relationships

Forest Service Plant Associations:
CPG141 (WEN) – Ponderosa pine/bluebunch wheatgrass (PIPO/PSSP)

CDG322 (WEN) – Douglas-fir/bluebunch wheatgrass (PSME/PSSP)
CD-G3-11 (OKAN) – Ponderosa pine-Douglas-fir/beardless bluebunch wheatgrass (PSME-PIPO/AGIN)
CDS637 – Douglas-fir/snowberry/bluebunch wheatgrass (PSME/SYAL/PSSP)
CDG134 – Douglas-fir/pinegrass-bluebunch wheatgrass (PSME/CARU-PSSP)

Associated sites

F006XA007WA	**Warm Frigid Xeric Mountain Slopes (Douglas-fir Warm Dry Shrub/Herb)** On cooler, moister sites.
F006XB004WA	**Mesic Xeric Foothills and Mountain Slopes (Ponderosa Pine Hot Dry Shrub Grass)** Associated in Okanogan and Chelan counties. Is a little cooler and moister.

Similar sites

F006XB004WA	**Mesic Xeric Foothills and Mountain Slopes (Ponderosa Pine Hot Dry Shrub Grass)** This site contains antelope bitterbrush in the understory.

Table 1. Dominant plant species

Tree	(1) *Pinus ponderosa*
Shrub	Not specified
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

This ecological site occurs mainly on plateaus, and back slopes, shoulders and foot slopes of hills and mountains, and glacial outwash terraces. It is found between 1,100 feet and 6,500 feet in elevation on all aspects. Slope gradients generally range from 8 to 65 percent but can be found on slopes up to 90 percent.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Terrace (2) Mountains > Mountain slope (3) Foothills > Hillslope
Flooding frequency	None
Ponding frequency	None
Elevation	1,800–3,800 ft
Slope	8–65%
Water table depth	30–80 in
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	1,100–6,500 ft
Slope	0–90%
Water table depth	Not specified

Climatic features

Mean Annual precipitation

Total Range: 11 - 40 inches
Central tendency: 13 - 20 inches

Mean Annual Air Temperature
Total Range: 4 - 11 C (39 - 52 F)
Central tendency: 6 - 9 C (43 - 48 F)

Frost-free period (days)
Total range: 80 - 155

Table 4. Representative climatic features

Frost-free period (characteristic range)	110-145 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	13-20 in
Frost-free period (actual range)	80-155 days
Freeze-free period (actual range)	
Precipitation total (actual range)	11-40 in

Influencing water features

Soil features

This ecological site is associated with several soil mapunit components. The components are dominantly Haploxerolls in the Mollisols taxonomic order, with minor areas of Argixerolls. Soils range from shallow to very deep and have average available water capacity of about 4.2 inches (10.7 cm) in the 0 to 40-inches (0-100 cm) depth range. Soil parent material is dominantly colluvium and residuum from granitic, volcanic, metamorphic, and sedimentary rock, glacial outwash, and glacial till, with minor amounts of volcanic ash and loess.

Dominant Soil Series: Donavan, Peka, Swakane, Vanbrunt, Winthrop

Parent Materials:
Kind – colluvium, residuum, glacial outwash, glacial till, minor amounts of volcanic ash and loess
Origin – granitic, volcanic, metamorphic, and sedimentary rock

Water Table Depth: Total range: 30 to greater than 80 inches
Central tendency: greater than 80 inches

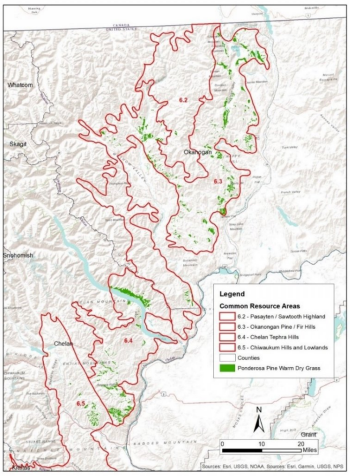


Figure 1. Map of soil mapunits with a major component linked to the Ponderosa Pine Warm Dry Grass Ecological Site

Table 5. Representative soil features

Surface texture	(1) Ashy loam (2) Ashy sandy loam
Family particle size	(1) Coarse-loamy (2) Loamy-skeletal (3) Sandy-skeletal
Drainage class	Well drained
Depth to restrictive layer	10–60 in
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–15%
Available water capacity (0-40in)	0.8–8.9 in
Calcium carbonate equivalent (Depth not specified)	0–8%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (0-10in)	5.3–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–45%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Table 6. Representative soil features (actual values)

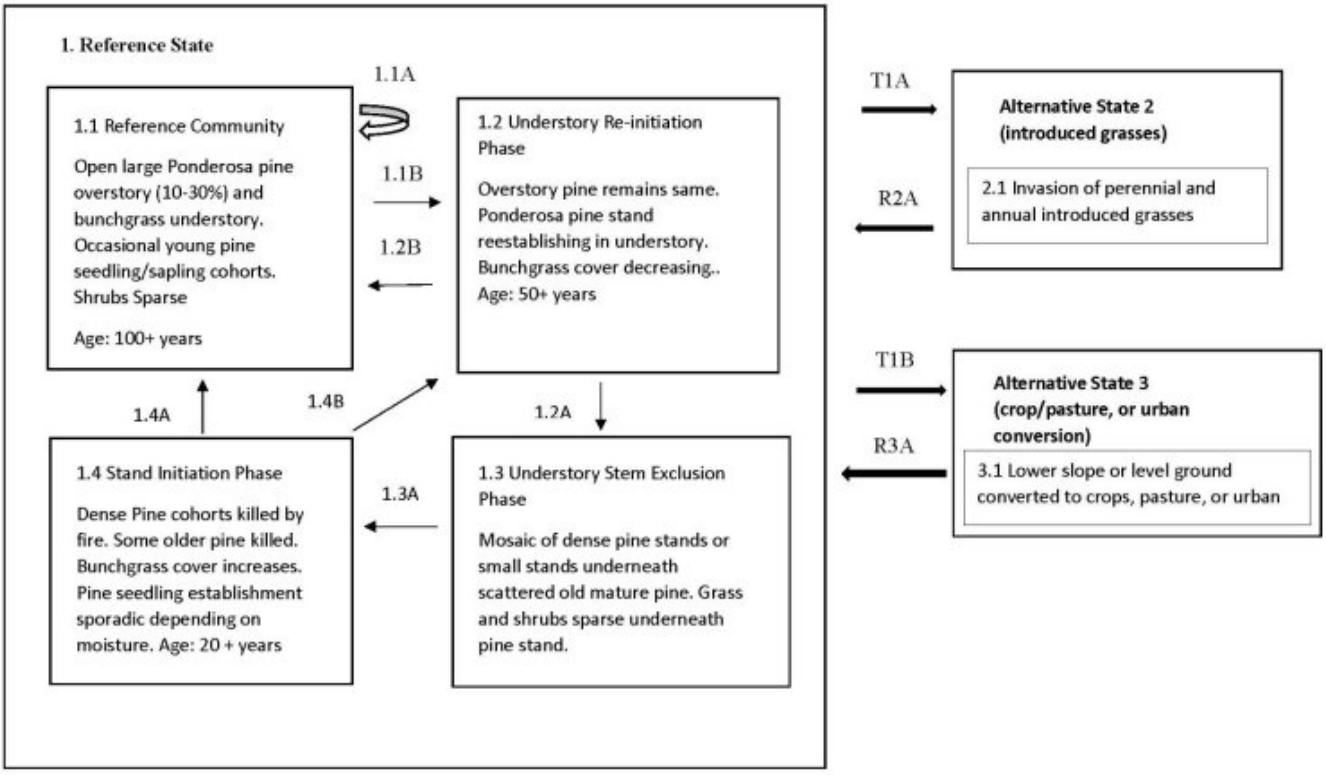
Drainage class	Moderately well drained to somewhat excessively drained
Depth to restrictive layer	10–60 in
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–15%
Available water capacity (0-40in)	0.8–8.9 in
Calcium carbonate equivalent (Depth not specified)	0–8%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (0-10in)	5.3–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–45%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

This reference site is located on very warm dry slopes with Ponderosa pine the only tree species with an understory of mainly bluebunch wheatgrass, Idaho Fescue, and some needle and thread grass. Average elevation range is

1800 – 3800 feet. Average precipitation range is 15 - 40 inches. Tree stocking is low with large open grown Ponderosa pine and small amounts of sapling/pole size pine in understory. Frequent ground fires every 10-15 years kept pine regeneration low and perpetuated this condition with a dominant grass understory. With fire exclusion a mosaic of pine cohorts underneath the large pine survive, but rarely form a closed canopy. In addition, some woodland shrubs may establish, and an occasional Douglas-fir is restricted to microsites. Soils are mainly sandy loams or loamy sands. The main/modal plant association in this ecological site is Ponderosa pine/bluebunch wheatgrass. Other plant associations this ecological site includes are PSME/PSSP, PIPO-PSME/AGIN, PSME/SYAL/PSSP, and PSME/CARU-PSSP. Douglas-fir will be more prominent at higher elevations and woodland shrubs can be present in the understory. On most sites Douglas-fir will be subdominant to pine.

State and transition model



State 1
Reference State

This state is dependent on the occurrence of frequent low intensity ground fires keeping an open grown pine stand with a dominant ground cover of bunchgrass. When fire intervals are infrequent pine regeneration can survive and a patchy pine woodland develops underneath the large old pine. With drought stress the large old pine can be subject to beetle kill and the understory pine stands subject to dwarf mistletoe infestation. It is also possible to have a stand replacement fire when stand density is increased and ladder fuels can reach the larger pine crowns. Major insects that cause mortality in ponderosa pine are the western pine beetle, mountain pine beetle, and pine engraver beetle. The western and mountain pine beetles can kill mature to old growth pine. The pine engraver beetles attack and kill young pole size stands. Drought and tree to tree competition cause stress which increases bark beetle mortality. Other insect concerns in pine include the following defoliators: Pandora moth, pine butterfly, sawflies, and needle miners. Major diseases include Annosum and Armillaria root rot, commandra rust, and elytroderma needle disease,

Dwarf mistletoe is a major concern infecting over 25% of ponderosa pine acreage. It is more serious in the drier ponderosa pine sites. It also can spread more readily in dense stands lacking frequent fire cycles. Douglas-fir mistletoe can also be a concern when Douglas-fir occurs. Forest productivity is measured using site index (SI) and culmination of annual increment (CMAI). Ponderosa pine is the key tree species and site indexes ranges greatly depending on local site characteristics. NRCS forest site index plots taken throughout MLRA B6 shows this variability. Site index ranges from 60 – 84 using Meyers 100-year total age table. CMAI range is 14 – 46. Low CMAI values depict low tree stocking (density) due to droughty sites. Forage production estimates from NRCS Range 5 Plots in Okanogan County in Ponderosa pine /bluebunch wheatgrass and PP/Idaho fescue sites are as follows based on overstory tree canopy. Forage production figures are in pounds/acre for all vegetation below 4.5 feet (grass, sedges, forbs, shrubs, tree regeneration): In addition, these Ppine/grass sites are adjacent to 12 – 15 inch loamy-sandy loam range sites composed of bluebunch wheatgrass and fescue in association with sagebrush and/or bitterbrush. Comparisons are made below in forage production. Overstory tree canopy – Forage production 0 – 20% - 600 to 1100 lbs/ac 60+% < 400 lbs/ac No tree canopy – 12 -15 inch range site 800 to 1200 lbs/ac The bulk of the grass production was bluebunch wheatgrass and Idaho fescue. Other grass species included needle and thread grass, prairie junegrass, rough fescue, pine grass and sandberg bluegrass. The most prominent forbs were lupine, basalmroot, pussytoes, hawkweed, and yarrow. The most prominent shrub was bitterbrush. Other shrubs included currant, snowbrush ceanothus, big sagebrush, rabbitbrush, and buckwheat. Tree regeneration included mostly ponderosa pine with an occasional Douglas-fir.

Dominant plant species

- ponderosa pine (*Pinus ponderosa*), tree
- antelope bitterbrush (*Purshia tridentata*), shrub
- currant (*Ribes*), shrub
- snowbrush ceanothus (*Ceanothus velutinus*), shrub
- big sagebrush (*Artemisia tridentata*), shrub
- rabbitbrush (*Chrysothamnus*), shrub
- buckwheat (*Eriogonum*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), other herbaceous
- Idaho fescue (*Festuca idahoensis*), other herbaceous
- needle and thread (*Hesperostipa comata*), other herbaceous
- pinegrass (*Calamagrostis rubescens*), other herbaceous
- prairie Junegrass (*Koeleria macrantha*), other herbaceous
- Sandberg bluegrass (*Poa secunda*), other herbaceous
- lupine (*Lupinus*), other herbaceous
- arrowleaf balsamroot (*Balsamorhiza sagittata*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous
- white hawkweed (*Hieracium albiflorum*), other herbaceous
- pussytoes (*Antennaria*), other herbaceous

Community 1.1
Reference Plant Community

Figure 2. Ponderosa pine/bluebunch wheatgrass site on south slope. Open grown pine stand.

Large open grown pine with bunchgrass understory. Pine canopy coverage may range from 10 – 30%. Understory dominated by bluebunch wheat grass on the drier sites. Other key understory species include arrowleaf basalmroot, western yarrow, buckwheat, and needle and thread grass.

Resilience management. 1.1A – Historic fire regime. Frequent ground fires burn out regeneration and maintain open pine/bunchgrass.

Community 1.2
Stand Re-initiation Phase

Figure 3. Understory pine become established. Occasional Douglas-fir and shrubs may be present.

Large overstory Ponderosa pines remain at a 10%-30% cover. A prolonged fire interval allows understory pine start to establish. Bunchgrass cover reduced. Woodland shrubs and fir may establish at higher elevations.

Community 1.3
Understory Stem Exclusion Phase

As understory pines cohorts grow, they become ladder fuel to the crowns of the large overstory. Understory pine stands start to decline through competition. Snags and woody debris develop. Beetle kill possible. Stand susceptible to stand replacing fire with possible large old pine killed. Mixed severity fire will thin out understory pine stand, woodland shrubs and kill fir regeneration. Bunchgrass cover will increase.

Community 1.4
Stand Initiation Phase

Figure 4. Ponderosa pine / Idaho fescue site with stand replacing fire. Pine seedlings established in clumps after 10 years.

Understory pine stand killed by fire, some larger overstory pine killed. Overstory crown cover may be reduced to

10% or less. Bunchgrass cover increased. Sporadic pine regeneration dependent on moisture, topographic, and good seed crop years.

Pathway 1.1B
Community 1.1 to 1.2

Reference Plant Community

Stand Re-initiation Phase

Time, prolong fire return interval allows pine regeneration to establish.

Pathway 1.2B
Community 1.2 to 1.1

Stand Re-initiation Phase

Reference Plant Community

Ground fires reoccur before regeneration becomes ladder fuel to overstory crowns, returning site to open pine/grass site.

Pathway 1.2A
Community 1.2 to 1.3

Time, a continued lack of fire allowing pine cohorts to form dense patchy, clumps of large saplings and pole sized trees.

Pathway 1.3A
Community 1.3 to 1.4

Stand replacing fire, dense understory pine stands killed, some large overstory pine survive.

Pathway 1.4A
Community 1.4 to 1.1

Stand Initiation Phase

Reference Plant Community

Historic fire interval resumes, maintaining open pine stand with abundant bunchgrass.

Pathway 1.4B
Community 1.4 to 1.2

Stand Initiation Phase

Stand Re-initiation Phase

Prolonged fire interval causing increase in pine establishment.

State 2
Alternative State 2 Introduced Grasses

Community 2.1
Introduced Grasses

Invasion of introduced perennial and annual cool season grasses from adjacent pastures, homesteads, and abandoned areas. One particular annual grass of concern from past overgrazing is the invasion of cheat grass. Once it gets established in the understory it will prevent native bunchgrasses from reestablishing and restoring site.

State 3
Alternative State 3

Community 3.1
Conversion to Crops, Pasture, Urban

Lower level terrain converted to crops, pasture or urban development. Much of the ponderosa pine ESDs are adjacent to local towns and cities. They have been converted to housing developments, shopping malls, or urban recreation areas. In the more rural areas, these sites have been converted to pastures and dry or irrigated cropland.

Transition T1A
State 1 to 2

Invasion of introduced perennial and annual grasses outcompete native bunchgrasses.

Transition T1B
State 1 to 3

Land converted to crop, pasture, or urban development.

Restoration pathway R2A
State 2 to 1

Site preparation, native grass reseeding, weed control, grazing protection followed by prescribed burning after establishment to maintain site in reference plant community.

Restoration pathway R3A
State 3 to 1

Afforestation. Site preparation, tree planting, maintenance. Possible planting of native shrubs and grasses. Highly unlikely in urban developed lands unless for parks or conservation lands. Agricultural lands more likely converted if land is retired from crop/pasture or sold to owners desiring trees.

Additional community tables

Inventory data references

Relationship to Other Established Classifications:

United States National Vegetation Classification (2008) – A3447 Ponderosa Pine / Herbaceous Understory Central Rocky Mt. Forest & Woodland Alliance

Washington Natural Heritage Program. Ecosystems of Washington State, A Guide to Identification, Rocchio and Crawford, 2015 – Northern Rocky Mountain Ponderosa Pine Woodland and Savanna

Level III and IV Ecoregions of WA, US EPA, June 2010 – 77e Okanogan Pine/Fir Hills, 77f Chelan Tephra Hills

USDA NRCS WA Common Resource Areas. CRA 6.3 Okanogan Pine/Fir Hills. CRA 6.4 Chelan Tephra Hills

This ecological site includes the following USDA Forest Service Plant Associations: PIPO/PSSP, and PIPO-PSME/PSSP.

Other references

Forest Vegetation of Eastern Washington and Northern Idaho. Washington State University, College of Agriculture, Tech. Bulletin 60, R. Daubenmire and J. Daubenmire, 1968
Fire Ecology of the Forest Habitat Types of Northern Idaho. USFS Intermountain Research Station, GT Report INT – GTR – 363,
Smith and Fischer, 1997.
NRCS Nat. Forestry Manual, 1998
Forest Plant Associations of the Okanogan Nat. Forest. R6-Ecol-132b-1983. Williams, Lillybridge. Sept. 1983
Forested Plant Associations of the Wenatchee Nat. Forest. PNW-GTR-359, Lillybridge et. al. October 1995
NRCS Soil and Site Index data for MLRA B6 in form of excel spreadsheets.
NRCS Range 5 forage production summary plots, 1992 Chiliwist CRM, 1993 Riverside CRM

Contributors

Gary Kuhn
Frank Gariglio
Carri Gaines
Steve Campbell

Approval

Kirt Walstad, 9/11/2023

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	10/12/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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:**