Ecological site F004BX104CA
Redwood-Douglas-fir/Pacific rhododendron, ridge-tops, schist, red clay

Accessed: 04/26/2024

General information

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

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Classification relationships

No relationship has been established to other classifications.

Associated sites

F004BX101CA	**Redwood/Douglas-fir/Pacific rhododendron, mountain slopes, schist, clay loam** F004BX101CA is also located on summits of ridges like F004BX104CA.
F004BX105CA	**Douglas-fir/tanoak/California huckleberry, ridge-tops, schist, red clay** Both of the F004BX105CA and F004BX104CA are found on ridgetops within different geograhic areas in Redwood National Park. F004BX105 tends to be on drier, more inland sites than F004BX104CA.

Table 1. Dominant plant species

Tree	(1) *Sequoia sempervirens* (2) *Pseudotsuga menziesii*
Shrub	(1) *Rhododendron macrophyllum*
Herbaceous	Not specified

Physiographic features

This ecological site is found on ridge-tops and upper-mountain slopes west of Redwood Creek. It occurs on uniform, nearly-level to moderately steep summits and slightly convex shoulders of broad ridges and moderately steep to steep mountain slopes.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Mountain slope
Flooding frequency	None
Elevation	295–2,559 ft
Slope	0–50%
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

The climate is humid with cool, foggy summers and cool, moist winters. Coastal influence limits the diurnal range in temperatures. Summertime temperatures may range from 65 to 70 degrees F. The mean annual precipitation ranges from 70 to 100 inches and usually falls from October to May.

Table 3. Representative climatic features

Frost-free period (average)	290 days
Freeze-free period (average)	290 days
Precipitation total (average)	100 in

Influencing water features

There are no influencing water features on this site.

Soil features

These well-drained soils developed from residuum and colluvium derived primarily from schist. To a lesser extent, there are soils on the site developed from residuum and colluvium derived from sandstone and mudstone, or weakly consolidated fluvial and marine deposits. They are very strongly to strongly acidic at 40 inches with a dominantly clayey subsurface rock content ranging from non-gravelly to gravelly. These soils are dominantly very deep with small areas that are moderately deep to a paralithic contact.

This ecological site occurs on the following soil components and map units within Redwood National and State Parks:

Map Unit Soil Component

251 Surpur
290 Surpur
290 Mettah
558 Trailhead
559 Trailhead
560 Trailhead
562 Fortyfour

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silty clay loam (3) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	30–80 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–9 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.5–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The redwood's interior range is largely contained within the coastal fog belt. Coastal fog ameliorates the effects of solar radiation on conifer transpiration rates (Daniel, 1942). Research in the redwood region (Dawson, 1998) has indicated that fog drip and direct fog uptake by foliage may contribute significant amounts of moisture to the forest floor during summer months and over the course of the year.

Previous harvesting and the use of fire to treat logging slash have changed species composition on many formerly redwood-dominated sites (Noss et al, 2000). Within many areas of the park, aerial seeding of Douglas-fir has led to a 10:1 ratio of Douglas-fir to redwood (Noss, 2000).

The historical origins of fires within the northern redwood region remain unknown. Lightning-ignited fires are considered rare. However, Native American burning is thought to have played a major role by burning fires from the interior into the redwood zone (Veirs, 1996). Natural fire intervals ranged from 500 to 600 years on the coast, 150 to 200 years on intermediate sites, and 50 years on inland sites. The northern range of redwoods evolved within a low to moderate natural disturbance regime (Veirs, 1979).

Surface fires likely modified the tree species composition by favoring the thicker-barked redwood (*Sequoia sempervirens*) (Veirs, 1979). Western hemlock's (*Tsuga heterophylla*) shallow roots and thin bark make it susceptible to fire damage (Arno, 2002). Fires also expose the mineral-rich soil and reduce competition from other plants, thereby increasing the establishment of new western hemlock (Veirs, 1979, Williamson, 1976). Tanoak (Lithocarpus densiflorus) seedlings and sapling-sized stems are often top-killed by surface fire, though larger stems may survive with only basal wounding (Tappeiner, 1984).

Both redwood and tanoak have the ability to re-sprout following fire (Veirs, 1996). After fire, redwood may sprout from the root crown or from dormant buds located under the bark of the bole and branches (Noss, 2000). The sprouting ability of redwood is most vigorous in younger stands and decreases with age. Frequent fire reduces tanoak’s sprouting ability and also tends to keep understories open (Arno, 2002). Fire exclusion would allow for the gradual increase of tanoak in the understory (McMurray, 1989).

A moderate fire could lead towards more of a mosaic in regeneration patterns. Patches of trees would be killed leaving others slightly damaged or unharmed. Douglas-fir (*Pseudotsuga menziesii*) regeneration would be favored in the large gaps that are created following a moderate fire, potentially leading to a larger proportion of Douglas-fir to redwood for several centuries (Agee, 1993). Without these gaps caused by fire, Douglas-fir regeneration is unsuccessful, and with continued lack of disturbance it may slowly be replaced by redwood as the dominant canopy species (Veirs, 1979, 1996).

Fires will also alter the composition of shrubs and forbs in the understory community. California huckleberry (*Vaccinium ovatum*) is a common species in both moist and dry redwood environments. It is normally a fire-dependent shrub species, but little is known concerning it's adaptation to fire under low to moderate fire return intervals (Tirmenstein, 1990). Following a fire, California huckleberry will often re-sprout and recover rapidly. Pacific rhododendron (*Rhododendron macrophyllum*) is considered sensitive to fire. Following a surface fire, it may reestablish seedlings by sprouting from the rootcrown or stembase (Crane, 1990). After a disturbance such as fire, a decrease in plant cover is common, and will be followed by a gradual increase in cover over time.

Other potential disturbances in the redwood zone include winter storms that can cause top breakage. This breakage may kill individual or groups of trees and create small openings from windfall (Noss, 2000). This would likely favor the establishment of redwood and other shade tolerant conifers. On alluvial sites with periodic flooding, redwood and other colonizing hardwoods would dominate (Veirs, 1996). Where existing redwoods are inundated, new roots would develop in newly deposited silt (Veirs, 1996).

State and transition model

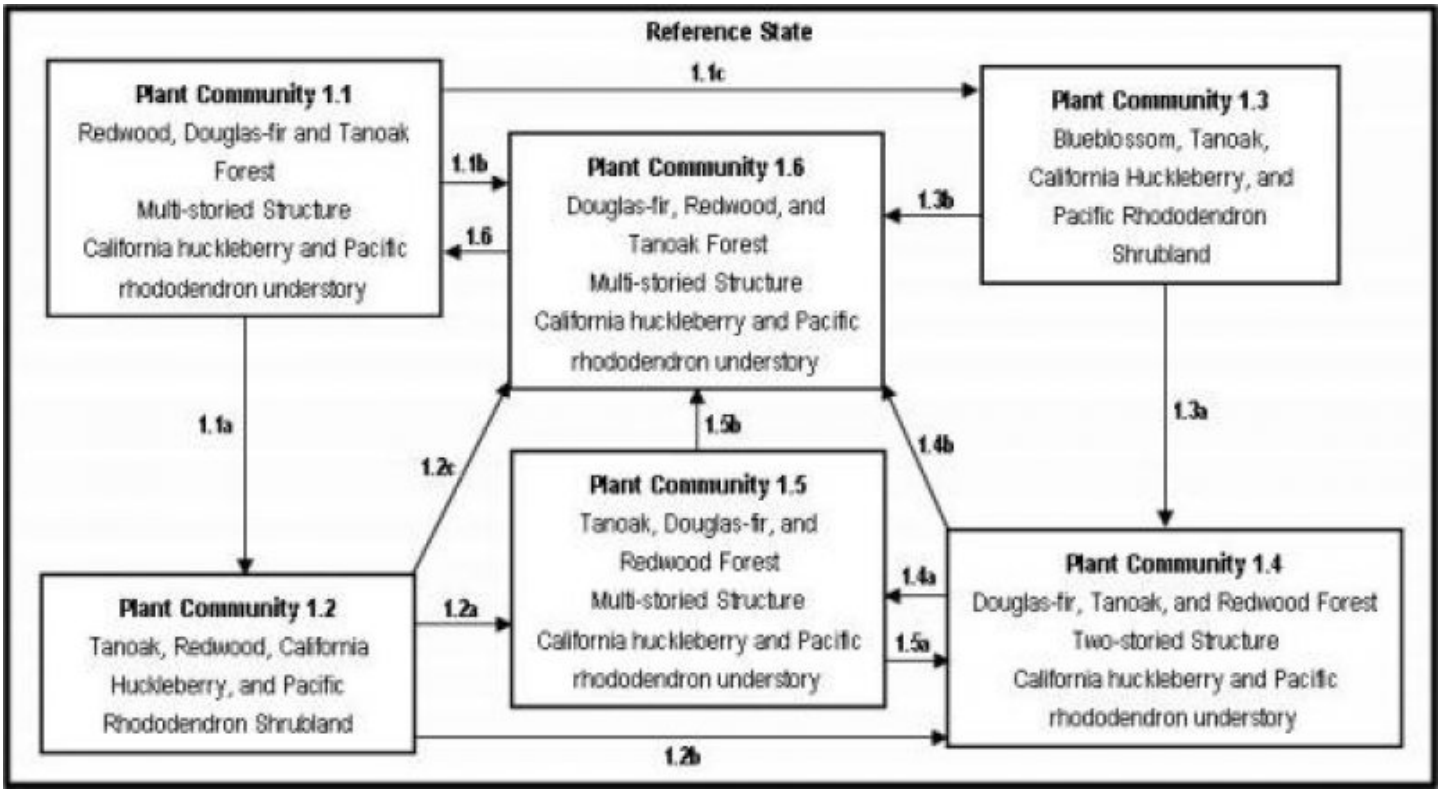

Figure 4. State and Transition Model

State 1
Reference State - Plant Community 1.1: Redwood and Douglas-fir Forest

Community 1.1
Reference State - Plant Community 1.1: Redwood and Douglas-fir Forest

The reference community for this site is a redwood and Douglas-fir forest. Redwood (*Sequoia sempervirens*) dominates in the overstory, with Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (Tsuga heterophyllia) found as associates. Tanoak (Lithocarpus densiflorus) is often seen in the sub-canopy. The understory is shrub-

dominated with California huckleberry (*Vaccinium ovatum*), Pacific rhododendron (*Rhododendron macrophyllum*), and salal (*Gaultheria shallon*). Occasionally western swordfern (*Polystichum munitum*) may be found in the understory layer, but forb cover is generally low. The estimated age for this community is 200 years or more. Community Pathway 1.1a: Following a block harvest or a block harvest followed by burning, shrubs and hardwoods will sprout and transition this community to PC 1.2. Community Pathway 1.1b: If partial cutting or moderate fire occurs then this community will transition to PC 1.6. Improved seedbed conditions could favor infill of Douglas-fir. Shrubs such as California huckleberry and Pacific rhododendron may increase in cover. Community Pathway 1.1c: Blueblossom may dominate the site following block harvesting if a post-harvest burn also occurs, and if a seed source is present. This will lead to PC 1.3.

Forest overstory. The main overstory is dominated by redwood and Douglas-fir. Western hemlock is found occasionally on some sites.

Tanoak often forms a moderate sub-canopy layer beneath the primary overstory.

Main canopy Sub-canopy

Redwood 40-60% Tanoak 20-40%
Douglas-fir 20-50%

Forest understory. The understory is dominated by California huckleberry, Pacific rhododendron, and salal. The shrub form of tanoak is present in the understory in varying amounts.

Average Percent Canopy Cover

California huckleberry 15-35%
Pacific rhododendron 15-25%
Tanoak 15-25%
Salal 5-15%

Table 5. Ground cover

Tree foliar cover	70-100%
Shrub/vine/liana foliar cover	40-60%
Grass/grasslike foliar cover	0%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	80-100%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 6. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	–
>1 <= 2	–	–	–	0-5%
>2 <= 4.5	–	30-60%	–	–
>4.5 <= 13	–	0-20%	–	–
>13 <= 40	15-20%	–	–	–
>40 <= 80	0-5%	–	–	–
>80 <= 120	0-15%	–	–	–
>120	75-80%	–	–	–

State 2
Plant Community 1.2: Tanoak Shrubland

Community 2.1
Plant Community 1.2: Tanoak Shrubland

Shortly after block harvesting, Tanoak's rapid growth will cause it to become the dominant species in the overstory. Sprouting will also occur from the redwood stumps in the area. The site is quickly covered by rapidly growing shrubs and hardwoods that may dominate the site for a short period of time. A dense shrub layer of California huckleberry, Pacific rhododendron, and salal will persist in the understory. Douglas-fir seedlings are likely to be present, depending on an available seed source and the degree of ground disturbance, but conifer growth is initially suppressed by brush and hardwood competition. The estimated age for this community ranges from 20 to 200 years. Community Pathway 1.2a: Without management this community will transition to PC 1.5 as Douglas-fir and redwood gradually infill and grow. This growth is slowed by the competition from tanoak. Community Pathway 1.2b: If an adjacent seed source is present, the infill of Douglas-fir and the sprouting of redwoods would transition this community to PC 1.4. The establishment and growth of Douglas-fir and redwood could be accelerated by brush and hardwood management or chemical treatment which would act to reduce hardwood competition. Tanoak will remain as part of the plant community, leading to a stand of Douglas-fir, tanoak and redwood. Some remnant shrubs of California huckleberry, Pacific rhododendron and salal would remain part of the understory. Douglas-fir may remain as the dominant conifer for a long period of time, with redwoods eventually regenerating in the understory. Community Pathway 1.2c: Brush management, chemical control and tree planting may transition this community to PC 1.6 by reducing brush competition and the time period of shrub dominance. Douglas-fir infill from adjacent seed sources could lead to a larger proportion of Douglas-fir to redwood. Overtime, an older multi-story stand of Douglas-fir, redwood and tanoak will develop. Because of tanoak's shade tolerance and persistent behavior to infill, it will remain a stand component indefinitely.

State 3
Plant Community 1.5: Tanoak and Douglas-fir Forest

Community 3.1
Plant Community 1.5: Tanoak and Douglas-fir Forest

Tanoak has rapidly grown in height and is able to dominate large portions of the overstory canopy in this plant community (McMurray, 1989, Adams, 1992). Both redwood and Douglas-fir are established, but growth is inhibited by the competition from tanoak. A modest shrub layer of California huckleberry, Pacific rhododendron and occasionally, salal will remain established in the understory. The estimated age for this community ranges from 20 to more than 200 years. Community Pathway 1.5a: Eventually, Douglas-fir and redwood height will exceed that of tanoak, transitioning this plant community to PC 1.4. With time, a multistoried Douglas-fir and redwood plant community with a tanoak sub-canopy would develop. A shrub layer of California huckleberry, Pacific rhododendron and salal remains in the understory. Community Pathway 1.5b: The growth of Douglas-fir and redwood could be accelerated by a combination of partial cutting, tree planting and chemical control of tanoak in conjunction with the

planting of Douglas-fir and redwood. Redwood sprouts would also be released from hardwood competition. This management would transition the plant community to PC 1.6.

State 4
Plant Community 1.4: Douglas-fir and Tanoak Forest

Community 4.1
Plant Community 1.4: Douglas-fir and Tanoak Forest

During the transition from PC 1.2 or PC 1.3, tanoak's rapid growth causes it to be the dominate species for a short period of time before Douglas-fir and redwood overgrow it. After Douglas-fir and redwood surpasses tanoak in height, an overstory of Douglas-fir and redwood forms with a sub-canopy of tanoak. California huckleberry, Pacific rhododendron, and salal form the understory shrub layer. The estimated age for this site ranges from 20 to more than 200 years. Community Pathway 1.4a: In the early stages of stand development a moderate fire could kill young conifers causing sprouting tanoak to become more abundant for a period of time. This will transition the community to PC 1.5. Community Pathway 1.4b: Partial cutting or chemical control of tanoak may release the conifers from competition and could reduce the amount of time needed to develop into the community seen in PC 1.6.

State 5
Plant Community 1.6: Douglas-fir and Redwood Forest

Community 5.1
Plant Community 1.6: Douglas-fir and Redwood Forest

Douglas-fir and redwood dominate the overstory with tanoak in the sub-canopy. Additional Douglas-fir infill from adjacent seed sources could lead to a larger proportion of Douglas-fir to redwood. After an extended period of time, an older multi-storied stand of Douglas-fir, redwood and tanoak will develop. Because of tanoak's shade tolerance and persistent behavior to infill, it will remain a stand component indefinitely. California huckleberry and Pacific rhododendron are present in the shrub layer and may become more prominent in openings. The estimated age of this plant community ranges from 20 to 400 years, depending on management efforts. Community Pathway 1.6: Fire exclusion or lack of harvesting will severely inhibit Douglas-fir's ability to successfully regenerate. Redwood continues to establish in the understory and eventually becomes dominant over Douglas-fir, transitioning this community back to PC 1.1.

State 6
Plant Community 1.3: Blueblossom Shrubland

Community 6.1
Plant Community 1.3: Blueblossom Shrubland

Block harvesting followed by a moderate post-harvest fire, may lead to an abundance of blueblossom (*Ceanothus thyrsiflorus*). Blueblossom is a prolific seeder, and the regeneration of seeds stored in the soil tends to be favored following fire. It also readily sprouts when cut (Adams, et al, 1992).Tanoak, California huckleberry and Pacific rhododendron will also sprout and remain part of the plant community. Repeated light to moderate fires would maintain this shrub community. The estimated age for this community ranges from 5 to 15 years. Community Pathway 1.3a: Without management, blueblossom could dominate an area for an extended period of time. However, gradual infill of conifers will occur as holes are created from dying brush. Initial conifer growth will be slowed by extreme brush competition, but this community will eventually transition to PC 1.4. Community Pathway 1.3b: Brush management and chemical control, in conjunction with conifer tree planting or infill, could transition this shrubland to PC 1.6.

Additional community tables

Animal community

The Redwood forest provides habitat for many species of mammals and native birds. Predators include black bear, fisher and marten, mountain lion, fox and bobcat. Ungulates included deer and elk, which use the forested areas for

foraging and cover.

Many bird species use the redwood forest on a seasonal basis. Bird species include warblers, tanagers, sparrows, blackbirds, the Marbeled Murrelet, the Northern spotted owl and the Bald Eagle.

Common reptiles found in forested areas would include the alligator lizard and garter snake.

Amphibians are mostly associated with riparian and wetland areas. The northwest salamander and two newt species spend much of their lives in upland habitat.

Hydrological functions

These soils have a slow to moderate infiltration rate when thoroughly wet. They are moderately fine-textured, moderately deep to very deep and well-drained. These soils have a moderate rate of water transmission through the soil profile.

The site is subject to erosion where adequate vegetative cover is not maintained. Road building, timber harvest, and site preparation for planting may increase surface erosion and potential for mass wasting.

Hydrologic Groups

Supur-290--C
Mettah-290--D
Trailhead-558--C
Trailhead-559--C
Trailhead-560--C
Fortyfour-562--D

Recreational uses

Limitations to recreational uses and development may occur due to slope considerations, soil texture and the amount of rock fragments.

Wood products

Redwood is a highly valued lumber because of its resistance to decay. Uses of redwood include house siding, paneling, trim and cabinetry, decks, hot tubs, fences, garden structures, and retaining walls. Other uses include fascia, molding and industrial storage and processing tanks.

Douglas-fir is employed in residential structures and light commercial timber-frame construction. It is also used for solid timber heavy duty construction such as pilings, wharfs, bridge components and warehouse construction.

Other products

Redwood burls are used for tabletops, veneers, bowls and other turned products. Redwood bark is widely used as garden mulch.

Douglas-fir is a very desirable Christmas tree; branches and cones are also used as materials for Christmas wreaths.

California huckleberries are made into wine, as well as processed into pie fillings for home and commercial use. Foliage of the California huckleberry is used by florists in floral arrangements and to make Christmas decorations.

Other information

Pacific rhododendron is sometimes used for erosion protection on steep slopes.

California Huckleberry leaves may be eaten by deer, and its berries are utilized by many bird and mammal species including bear, fox, squirrel, and skunk.

NOTE-Forest Site Productivity: SI for PSME is using 50 yr base age (KING); SI for Redwood is using 100 year base age (L&P).

Table 7. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
redwood	*SESE3*	151	160	218	240	–	–	–	
Douglas-fir	*PSME*	130	165	129	176	–	–	–	

Inventory data references

Data was collected utilizing both transects and vegetation data at the location of soil pits, unless otherwise noted. Plot numbers are given by year and soil pit number.

Surpur-251
08-21
08-48
09-67

Mettah-290
92-34
92-37
03-38
92-36
04-02

Surpur-290
03-34
03-37

Trailhead-558
04-46

Trailhead-559
02-44
01-07
01-09
6005 (Note)

Trailhead-560
01-03
02-41

Fortyfour-562
6015 (Note)

Type locality

Location 1: Humboldt County, CA	
UTM zone	N

UTM northing	4562447
UTM easting	414809
General legal description	Trailhead - Redwood National Park, Humboldt County; California; Bald Hills Quadrangle

Other references

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Contributors

Judy Welles

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:

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:**