Ecological site R022BI211CA
Spring Complex

Accessed: 05/04/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 022B–Southern Cascade Mountains

Site Concept:
Riparian Complex: Hydrologically connected by multiple springs and seeps
Landform: Glacial-valley walls and floors
Elevation (feet): 5,400 to 8,210
Slope (percent): 2 to 50 percent
Water Table Depth (inches): 0 to 49 (depending on soil component)
Flooding-Frequency: None
Ponding-Frequency: None
Aspect: No Influence on this site
Mean annual precipitation (inches): 51 to 113 inches (1,295 to 2,870 mm)
Primary Precipitation: Snow from November to April
Mean annual temperature: 38 to 43 degrees F (3.3 to 6.1 degrees C).
Restrictive Layer: Bedrock
Temperature Regime: Frigid and Cryic
Moisture Regime: Aquic
Parent Materials: Slope alluvium over colluvium and colluvium from volcanic rocks
Surface Texture: Very bouldery mucky ashy sandy loam and very bouldery ashy loamy sand
Surface Fragments <=3" (% Cover): 0-25

Surface Fragments > 3" (% Cover): 0-40
Soil Depth (inches): 10 to 80
Vegetation: Wet springs dominated by thinleaf alder (*Alnus incana* ssp. tenuifolia), with a diversity of associated species including blue wildrye (*Elymus glaucus*), fowl mannagrass (*Glyceria striata*), rough hedgenettle (*Stachys rigida* var. rigida), seep monkeyflower (*Mimulus guttatus*), mosses and California false hellebore (*Veratrum californicum* var. californicum).

Associated sites

F022BI110CA	**Frigid Humic Loamy Gentle Slopes** This white fir mixed conifer site is found surrounding the springs at the lower elevations.
F022BI115CA	**Frigid And Cryic Gravelly Slopes** This red fir forest site surrounds the springs at upper elevations.
F022BI120CA	**Frigid Gravelly Sandy Loam Outwash-Stream Terraces** This lodgepole pine- white fir forest is found adjacent to the springs on drier areas between springs.
R022BI218CA	**Thermal Seeps** This site is associated with the thermal springs and seeps near Drakesbad.

Similar sites

R022BI209CA	**Loamy Seeps** This site is located in the hydrothermally altered area, which is affected by active soil movement.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Alnus incana ssp. tenuifolia*
Herbaceous	(1) *Heracleum maximum* (2) *Elymus glaucus*

Physiographic features

This ecological site is found on glacial-valley walls and floors. It occurs between 5,400feet and 8,210 feet in elevation. Slopes range from 2 to 50 percent.

Table 2. Representative physiographic features

Landforms	(1) U-shaped valley (2) Valley side
Flooding frequency	None
Ponding frequency	None
Elevation	1,646–2,502 m
Slope	2–50%
Water table depth	0–124 cm
Aspect	Aspect is not a significant factor

Climatic features

This ecological site receives most of its annual precipitation during winter months in the form of snow. The mean annual precipitation ranges from 51 to 113 inches (1,295 to 2,870 mm) and the mean annual temperature ranges from 38 to 43 degrees F (3.3 to 6.1 degrees C). The frost free (>32F) season is 50 to 90 days. The freeze free (>28F) season is 65 to 200 days.

There are no representative climate stations for this site.

Table 3. Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	200 days
Precipitation total (average)	0 mm

Influencing water features

This site is a seep and spring ecological site. Seep and spring areas are formed when fractures or fault zones allow water from deeper aquifers to discharge at the surface. The presence of seeps and springs is largely dependent upon characteristics of the local and regional geology. In some cases, the emerging groundwater flows downhill through very small channels called rivulets or runnels that lack the banks, beds, and floodplains of larger streams. Many seeps and springs adjoin rivers, streams, lakes, and other kinds of wetlands. Because of the water source, seeps and springs provide relatively constant inflow and water temperature.

Soil features

Aquepts and Typic Petraquepts, Bedrock soil components are associated with this site. The Aquepts soil component consists of deep and very deep, poorly drained soils that formed in slope alluvium over colluvium from volcanic rocks. Bedrock is encountered at 40 to 80 inches. There is a thin organic layer of leaves and twigs over a very bouldery mucky ashy sandy loam surface texture, with extremely bouldery ashy sandy loam, extremely cobbly ashy sandy loam, and extremely stony ashy sandy loam subsurface textures. Gleyed soil colors are present at the surface.

The Typic Petraquepts, Bedrock soil component is very shallow to moderately deep, poorly drained, and formed in colluvium from volcanic rocks. There is 2 to 7 inches of leaf litter over a very bouldery ashy loamy sand surface texture. Subsurface textures consist of extremely bouldery ashy coarse sandy loam and extremely bouldery ashy loamy coarse sand. Indurated bedrock occurs between 10 to 40 inches. Gleyed soil colors are present below the O horizons. The water table may be at or near the surface for prolonged periods during the growing season, but can drop to 49 inches in the Aquepts component later in the year and stays above 40 inches in the Typic Petraquepts, Bedrock component.

This ecological site has been correlated with the following map units and soil components:

Map Unit/ Component /Component percent
789126 Aquepts/ 2
789127 Aquepts/ 15
789129 Aquepts/ 2
789143 Aquepts/ 2
789144 Aquepts/ 3
789150 Aquepts/ 2
789151 Aquepts/ 1
789152 Aquepts/ 2
789154 Aquepts/ 3
789155 Aquepts/ 2
789156 Aquepts/ 5
789163 Aquepts/ 1
789166 Aquepts/ 2
789171 Aquepts/ 50
789171 Typic Petraquepts, Bedock / 35
789175 Aquepts/ 2
789176 Aquepts/ 1

Table 4. Representative soil features

Family particle size	(1) Sandy
Drainage class	Poorly drained
Permeability class	Moderately rapid
Soil depth	25–203 cm
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–40%
Available water capacity (0-101.6cm)	2.54–8.13 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–50%
Subsurface fragment volume >3" (Depth not specified)	0–80%

Ecological dynamics

This ecological site is associated with seeps and springs. Seep and spring areas are formed when fractures or fault zones allow water from deeper aquifers to discharge at the surface. The emerging groundwater flows downhill through very small channels called rivulets or runnels that lack the banks, beds, and floodplains of larger streams. These channels are usually less than a couple feet wide and may not be very distinct. The more distinct channels are confined in shallow gully-like channels. Because of the underground water source, seeps and springs provide relatively constant inflow and water temperature and can support unique species adapted to these conditions.

There is a high diversity of plant species within these wet springs and each spring is unique. This ecological site does not attempt to capture all variations of species composition, but will focus on the main concept. Dense thickets of thinleaf alder (*Alnus incana* ssp. tenuifolia) occur on the site and support a low cover of shade tolerant forbs in the understory. Understory diversity and production is higher in the canopy openings between the alders where a Native Herbaceous Community thrives. Common grass and herbaceous species in that community include blue wildrye (*Elymus glaucus*), California false hellebore (*Veratrum californicum* var. californicum), fowl mannagrass (*Glyceria striata*), rough hedgenettle (*Stachys rigida* var. rigida), and common cowparsnip (*Heracleum maximum*). In areas where water flows over exposed bedrock a unique Seep Monkeyflower Community occurs that is dominated by mosses and seep monkeyflower (*Mimulus guttatus*). Disturbances that alter the hydrology of the site generally have a drying effect and make the site more prone to invasive species invasion and encroachment from the adjacent Sierra lodgepole pine forest.

Soils on these sites developed in volcanic slope alluvium and colluvium and are poorly drained. The water table is at the surface for most of the year, but may drop in drier areas during October, November, and December. The soils may be shallow to very deep, but consistently have a high percentage of large rock fragments throughout the profile and a relatively thin surface organic layer.

The riparian ecological site concept is a relatively new concept for ecological sites. Although this ecological site is not associated with a stream channel, it has several plant communities that are dependent upon water from the spring and seeps. The springs override other parameters that normally define ecological sites, such as soil or climatic variables. The state and transition diagram below illustrates the change in plant community component composition as a result of disturbance, rather than focusing on the succession of one plant community. Although there is considerable qualitative experience supporting the pathways and transitions within the State and Transition Model (STM), there is no quantitative information to specifically identify threshold parameters that distinguish between natural equilibrium and altered states in this ecological site. For information on STMs, see the following citations: Bestelmeyer el al. 2003, Bestelmeyer et al. 2009, and Stringham and Shaver 2003.

State and transition model

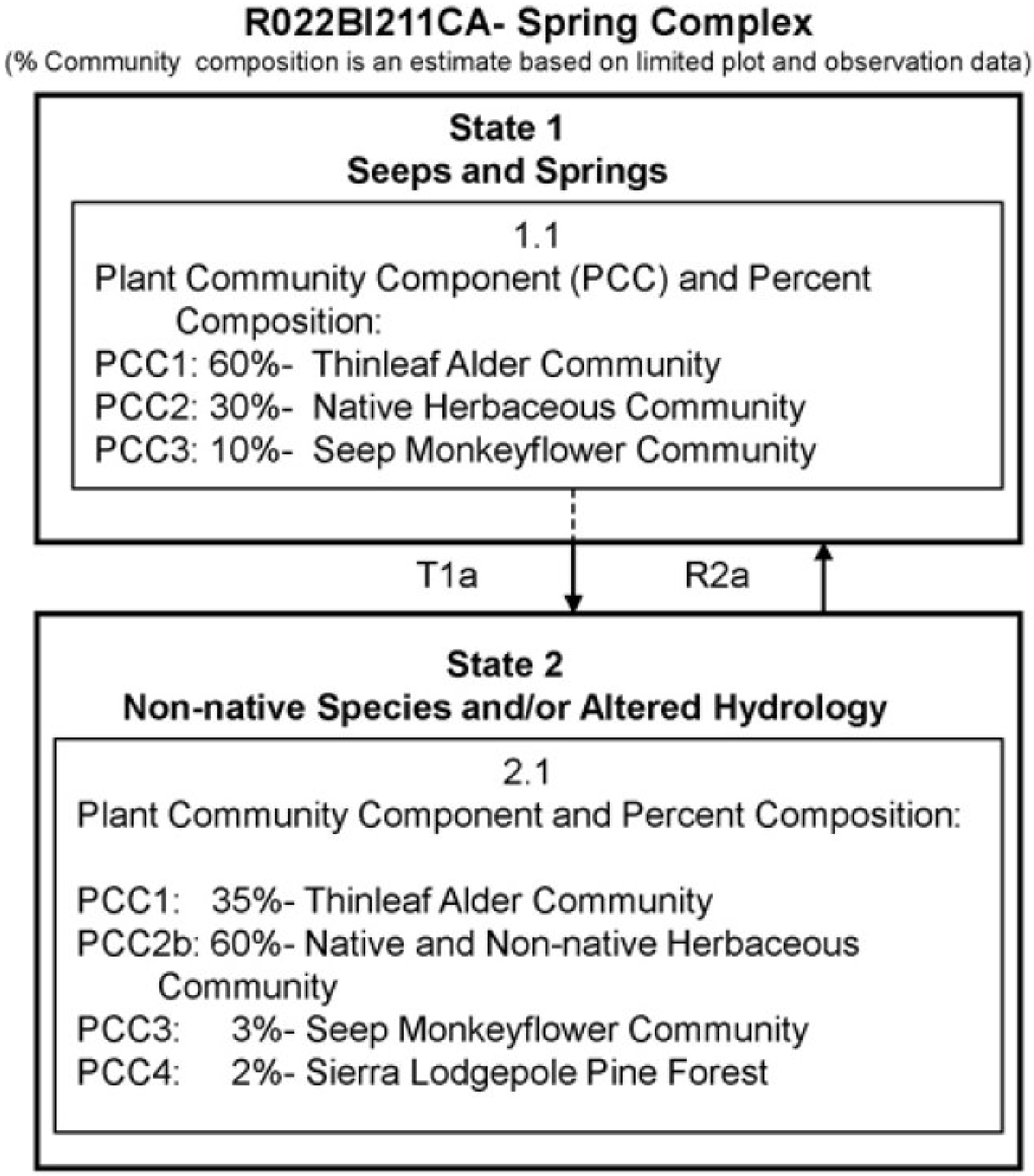

Figure 3. Spring Complex Model

State 1
Springs and Seeps

This is a fairly stable site. Because of the underground water source, seeps and springs are relatively constant environments that are minimally affected by the temperature variations, scouring, and droughts that often affect riparian vegetation. However, springs are replenished by precipitation that percolates into the aquifer, so prolonged drought can alter the hydrology. Springs are classified as gravity springs or artesian (DOI 2001). Gravity springs are created when water moves along an elevational gradient emerging at the surface. Aquifer springs are created when the water level of the ground water flow system is above the land surface and the water flows out at the surface under pressure from an aquifer outcrop or faults and fractures. The two main types of artesian springs are and fault springs. This ecological site incorporates a fault spring.

Community 1.1
Springs and Seeps

Figure 4. Seep Monkeyflower Community

Figure 5. Thinleaf Alder and Herbaceous Community

This state has one community phase with three main plant community components. The composition of the community components remains relatively static across the hillslopes that receive flow from the springs. Other plant communities are associated with microclimates within these springs, such as saturated small basins or dry hummocks. However, variability is high and consistency is low, so they are not described as community components for this site. The Thinleaf Alder Community is the most widespread and it can be found on shallow to deep soils with varying degrees of wetness. There is very little understory directly under the alders but a Native Herbaceous Community is found in canopy openings among the alders and adjacent to bedrock outcrops. The Seep Monkeyflower Community is found where springs flow over broad benches of exposed bedrock. That unique assemblage of species is fairly open as the alders rarely establish on the bedrock. To capture the main concept, data was collected across the entire hillslope and the cover and production data in the table below is a combination of all three community components. Species are listed under the community component where they most commonly occur. An estimate of plant community component composition: PCC1: 60%- Thinleaf Alder Community Thinleaf alder grows dense in this community with a low cover of shade tolerant forbs in the understory such as small enchanter's nightshade (*Circaea alpina* ssp. pacifica), redstem springbeauty (*Claytonia rubra*), brittle bladderfern (*Cystopteris fragilis*), Pacific bleeding heart (Dicentra Formosa), bugle hedgenettle (*Stachys ajugoides*), and violets (Viola spp.). PCC2: 30%- Native Herbaceous Community This community is found in patches within the alder where there are canopy opening for sufficient sunlight. It can also be continuous across open slopes. Associated plants are common yarrow (*Achillea millefolium*), western columbine (Aquilegia Formosa), Douglas' thistle (*Cirsium douglasii*), brittle bladderfern (*Cystopteris fragilis*), willowherb (Epilobium), stickywilly (*Galium aparine*), common cowparsnip (*Heracleum maximum*), streambank bird's-foot trefoil (*Lotus oblongifolius*), seep monkeyflower (*Mimulus guttatus*), western sweetroot (*Osmorhiza occidentalis*), hairy brackenfern (*Pteridium aquilinum* var. pubescens), arrowleaf ragwort (*Senecio triangularis*), woollyhead parsnip (*Sphenosciadium capitellatum*), and California false hellebore (*Veratrum californicum* var. californicum). Common grasses and grasslikes are bentgrass (Agrostis sp.), sedges (Carex spp.), tufted hairgrass (*Deschampsia cespitosa*), blue wildrye, (*Elymus glaucus*), and fowl mannagrass (*Glyceria striata*). PCC3: 10%- Seep Monkeyflower Community This community is dominated by seep monkeyflower (*Mimulus guttatus*) and mosses. It is a distinct assemblage of species, but it shares many species with the adjacent Native Herbaceous Communtiy. Associated species are common yarrow (*Achillea millefolium*), western columbine (Aquilegia Formosa), Douglas' thistle (*Cirsium douglasii*), brittle bladderfern (*Cystopteris fragilis*), willowherb (Epilobium), rushes (Juncus spp.), California grass of Parnassus (*Parnassia californica*), Parish's yampah (*Perideridia parishii*), streambank bird's-foot trefoil (*Lotus oblongifolius*), arrowleaf ragwort (*Senecio triangularis*), and woollyhead parsnip (*Sphenosciadium capitellatum*).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	695	1525	2914
Forb	112	919	1260
Grass/Grasslike	45	224	497
Total	**852**	**2668**	**4671**

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	8-15%
Grass/grasslike basal cover	0-2%
Forb basal cover	0-15%
Non-vascular plants	0-1%
Biological crusts	0%
Litter	55-95%
Surface fragments >0.25" and <=3"	0-25%
Surface fragments >3"	0-40%
Bedrock	0-1%
Water	0-12%
Bare ground	1-5%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0-1%	0-6%
>0.15 <= 0.3	–	–	0-8%	0-35%
>0.3 <= 0.6	–	–	2-22%	0-50%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	30-77%	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 2
Non-native Species and/or Altered Hydrology

Springs are vital water resources in the arid western United States. In many cases they have been developed to enhance water availability for livestock, big game, or human use. Livestock trampling, diversion, channelization, impoundment, and the encroachment of non-native plants and animals have altered the physical and biological characteristics of a majority of springs and they now bear little resemblance to their historic, unaltered conditions.

The level of manipulation and disturbance at this site varies. This state is characterized by altered hydrology and/or the presence of non-native plant species. In general, altered hydrology in a seep and spring wetland will facilitate the establishment of non-native species by reducing water flow and drying the soil. Less soil moisture reduces the competitive advantage of the obligate wetland species that are adapted to the wet spring conditions and enables non-native grasses and forbs to encroach.

Community 2.1
Altered Hydrology

This community phase results from a disturbance that alters the site hydrology which generally reduces water flow. A reduction in water flow at this site causes the thinleaf alder and monkeyflower seep communities to decline and the herbaceous community doubles in extent to comprise 60% of the total vegetation. Under drier conditions, the herbaceous community becomes more dominated by grasses and non native species and the adjacent Sierra lodgepole pine forest encroaches on a limited basis. Estimate of plant community component composition: PCC1: 35%- Thinleaf Alder Community Thinleaf alder grows dense in this community with a low cover of shade tolerant forbs in the understory such as small enchanter's nightshade (*Circaea alpina* ssp. pacifica), redstem springbeauty (*Claytonia rubra*), brittle bladderfern (*Cystopteris fragilis*), Pacific bleeding heart (Dicentra Formosa), bugle hedgenettle (*Stachys ajugoides*), and violet (Viola sp.). PCC2b: 60%- Native and Non-native Herbaceous Community This community is similar to PCC2 in State 1, Community Phase 1.1, but some non-native species have established and grasses have increased in cover. Non-native species include Kentucky bluegrass (*Poa pratensis*), timothy (Phleum pretense), bull thistle (*Cirsium vulgare*), and common dandelion (*Taraxacum officinale*). PCC3: 3%- Seep Monkeyflower Community This community is dominated by seep monkeyflower (*Mimulus guttatus*) and mosses. It is a distinct assemblage of species, but it shares many species with the adjacent Native Herbaceous Community. Associated species are common yarrow (*Achillea millefolium*), western columbine (Aquilegia Formosa), Douglas' thistle (*Cirsium douglasii*), brittle bladderfern (*Cystopteris fragilis*), willowherbs (Epilobium spp.), rushes (Juncus spp.), California grass of Parnassus (*Parnassia californica*), Parish's yampah (*Perideridia parishii*), streambank bird's-foot trefoil (*Lotus oblongifolius*), arrowleaf ragwort (*Senecio triangularis*), and woollyhead parsnip (*Sphenosciadium capitellatum*). PCC4: 2%- Sierra Lodgepole Pine Forest Sierra lodgepole pine (*Pinus contorta* ssp. murrayana) is the dominant tree, with white fir (*Abies concolor*), and Jeffrey pine (*Pinus jeffreyi*) occasionally present in small amounts. Understory plants include blue wildrye (*Elymus glaucus*), white hawkweed (*Hieracium albiflorum*), western sweetroot (Osmorhiza chilensis), naked buckwheat (*Eriogonum nudum*), stickywilly (*Galium aparine*), common yarrow (*Achillea millefolium*), American vetch (Vicia Americana), Pacific bleeding heart (Dicentra Formosa), California false hellebore (*Veratrum californicum* var. californicum), whitestem gooseberry (*Ribes inerme*), Gray's licorice-root (*Ligusticum grayi*), starry false lily of the valley (*Maianthemum stellatum*), California stickseed (*Hackelia californica*), and California brome (*Bromus carinatus*).

Transition 1A
State 1 to 2

This transition occurs when natural events or human intervention cause a change in spring flow and alters the hydrology of the site. Most often the disturbance will reduce water flow and cause the site to dry. The most likely disturbance at this site is diversion of flow through road construction. Road construction that did not take the site hydrology into consideration could intercept and divert flow. Water diversion is one of the most common disturbances of springs in the western US and has been shown to decrease biological diversity by reducing aquatic habitat and reducing soil moisture (DOI 2001). Grazing is another disturbance that could cause some drying of the site through vegetation removal, trampling, and soil compaction, but this particular area does not appear to be subject to grazing at the present time. Prolonged drought could naturally reduce some water flow at the site by reducing recharge to the aquifer. However, this type of seep and spring generally provides a relatively constant environment that is minimally affected by short term drought because of the underground water source.

Restoration pathway 2A
State 2 to 1

The primary restoration objective is to restore the natural hydrology of the site. This may require reconstruction of roads and trails, so water flow is able to cross in alignment with the natural drainage. Non-native species should be removed.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			695–2914	
	thinleaf alder	ALINT	*Alnus incana ssp. tenuifolia*	695–2914	25–77
Grass/Grasslike					
1	**Grass- Grasslike**			45–497	
	blue wildrye	ELGL	*Elymus glaucus*	45–448	2–20
	bentgrass	AGROS2	*Agrostis*	0–17	0–4
	tufted hairgrass	DECE	*Deschampsia cespitosa*	0–17	0–3
	fowl mannagrass	GLST	*Glyceria striata*	0–11	0–2
	sedge	CAREX	*Carex*	0–3	0–1
Forb					
1	**Forbs**			112–1260	
	California false hellebore	VECAC2	*Veratrum californicum var. californicum*	0–420	0–15
	woollyhead parsnip	SPCA5	*Sphenosciadium capitellatum*	0–375	0–15
	arrowleaf ragwort	SETR	*Senecio triangularis*	0–168	0–15
	Douglas' thistle	CIDO2	*Cirsium douglasii*	0–95	0–8
	common cowparsnip	HEMA80	*Heracleum maximum*	0–90	0–7
	brittle bladderfern	CYFR2	*Cystopteris fragilis*	0–28	0–5
	seep monkeyflower	MIGU	*Mimulus guttatus*	0–17	0–3
	streambank bird's-foot trefoil	LOOB2	*Lotus oblongifolius*	0–11	0–5
	common yarrow	ACMI2	*Achillea millefolium*	0–11	0–3
	western columbine	AQFO	*Aquilegia formosa*	0–9	0–2
	Pacific bleeding heart	DIFO	*Dicentra formosa*	0–9	0–2
	western sweetroot	OSOC	*Osmorhiza occidentalis*	0–9	0–2
	hairy brackenfern	PTAQP2	*Pteridium aquilinum var. pubescens*	0–4	0–1
	bugle hedgenettle	STAJ	*Stachys ajugoides*	0–4	0–1
	violet	VIOLA	*Viola*	0–1	0–1
	California grass of Parnassus	PACA18	*Parnassia californica*	0–1	0–1
	Parish's yampah	PEPA21	*Perideridia parishii*	0–1	0–1
	willowherb	EPILO	*Epilobium*	0–1	0–1
	stickywilly	GAAP2	*Galium aparine*	0–1	0–1
	small enchanter's nightshade	CIALP2	*Circaea alpina ssp. pacifica*	0–1	0–1
	redstem springbeauty	CLRU2	*Claytonia rubra*	0–1	0–1

Animal community

Spring wetlands provide habitat for aquatic plants and animals and a water source for terrestrial animals. Such wetlands provide a source of food and cover for birds, reptiles, amphibians, and mammals and they may be occupied by endemic vertebrates or macroinvertebrates.

Hydrological functions

This site is a source of ground water and aquifer discharge, which has high water quality.

Recreational uses

This area provides wildlife viewing opportunities, but the lush vegetation makes cross country travel difficult. Trails should be constructed carefully, so water flow is not diverted.

Inventory data references

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

789212
789288
789350- Type location
789350b

Type locality

Location 1: Plumas County, CA	
Township/Range/Section	T30 N R5 E S22
UTM zone	N
UTM northing	4478371
UTM easting	634761
General legal description	The type location is about 0.38 miles west of Drakesbad Guest Ranch in Lassen Volcanic National Park.

Other references

Bestelmeyer, Brandon T.; Brown, Joel R.; Havstad, Kris M.; Alexander, Robert; Chavez, George; and Herrick Jeffrey E.; 2003. Development and Use of State-and-Transition Models for Rangelands. Journal of Range Management, Vol. 56, No. 2 (Mar., 2003), pp. 114-126. Allen Press and Society for Range Management. Stable URL: http://www.jstor.org/stable/4003894

Bestelmeyer, Brandon T.; Tugel, Arlene J.; Peacock, George L. Jr.; Robinett, Daniel G.; Shaver, Pat L.; Brown, Joel R.; Herrick, Jeffrey E.; Sanchez, Homer; and Havstad, Kris M.; 2009. State-and-Transition Models for Heterogeneous Landscapes: A Strategy for Development and Application. Rangeland Ecology and Management 62:1–15; January 2009.

Briske, D. D., Fuhlendorf, S. D; and Smeins, F. E., 2006. A Unified Framework for Assessment and Application of Ecological Thresholds. Rangeland Ecology and Management 59:225–236.

Briske, D. D; Bestelmeyer B. T; Stringham, T. K., and Shaver, P. L., 2008. Recommendations for Development of Resilience-Based State-And-Transition Models. Rangeland Ecology and Management 61:359–367.Bestelmeyer el al. 2003,

Bozeman, Tandy. A History in Photographs, Drakesbad Guest Ranch, Lassen Volcanic National Park. http://www.drakesbad.com/DB%20Web%20Pictorial/DB.htm

Briske, D. D.; Fuhlendorf, S. D.; and Smeins, F. E.; 2009. State-and-Transition Models, Thresholds, and Rangeland Health: A Synthesis of Ecological Concepts and Perspectives. Rangeland Ecology & Management, Vol. 58, No. 1 (Jan., 2005), pp. 1-10. Allen Press and Society for Range Management. Stable URL:

http://www.jstor.org/stable/3899791

Rosgen, D.L., 1994. A Stream Classification System. Catena, 22 169199. Elsevier Science, Amsterdam.

Rosgen, D.L., 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, Colorado, and Ft. Collins, CO.

Stringham, T.K., W.C. Krueger, and P.L. Shaver. 2003. State and Transition Modeling: An Ecological Process Approach. J. Range Manage 56: 106-113.

USDA, NRCS. 2007. The PLANTS Database. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. Available online at: http://plants.usda.gov

USDA, NRCS. 2003. National Range and Pasture Handbook. Available online at: http://www.glti.nrcs.usda.gov/technical/publications/nrph.html

US Department of the Interior. 2001. Riparian area management: A guide to managing, restoring, and conserving springs in the Western United States. Technical Reference1737-17. Bureau of Land Management. Denver, CO. 70 pp.

Weixelman, Dave; Weis, Sue; Linton, Fletcher; and Swartz, Heather; 2007. DRAFT: Condition Checklist for Fens in the Montane and Subalpine Zones of the Sierra Nevada and Southern Cascade Ranges, CA.

Contributors

Marchel M. Munnecke

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:**