USDA Natural Resources
Conservation Service

Ecological site R022BI214CA
Pyroclastic Flow

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General information

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

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 –
Slopes: 5 to 60 percent.
Landform: Pyroclastic flow in hanging valleys.
Soils: Very deep and excessively drained, soils formed in pyroclastic flows and fall deposits from the Chaos Crags. High percentage of subsurface gravels.
Temp regime: Cryic.
MAAT: 40 degrees F (4.4 degrees C).
MAP: 71 to 119 inches (1,803 to 3,023 mm).
Soil texture: Very gravelly ashy loamy coarse sand.
Surface fragments: 70 to 80 percent subangular fine and medium gravel and 0 to 18 percent cobbles and stones.
Vegetation: Low cover of prostrate alpine forbs such as marumleaf buckwheat (*Eriogonum marifolium*), dwarf alpinegold (*Hulsea nana*), Davidson's penstemon (*Penstemon davidsonii*), Nevada dustymaiden (*Chaenactis nevadensis*), cobwebby Indian paintbrush (*Castilleja arachnoidea*), and Mt. Hood pussypaws (*Cistanthe umbellata* var. umbellata).

Associated sites

F022BI124CA	**Upper Cryic Slopes** This is a mountain hemlock-whitebark pine forest site.
R022BI207CA	**Alpine Slopes** This rangeland site is sparsely vegetated with lupine and scattered mountain hemlocks.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Penstemon davidsonii* (2) *Hulsea nana*

Physiographic features

This ecological site is found between Lassen Peak and Chaos Crags on pyroclastic flow in a hanging valley. The elevation ranges from 6,710and 8,630 feet. Slopes range from 5 to 60.

Table 2. Representative physiographic features

Landforms	(1) Hanging valley (2) Mountain
Flooding frequency	None
Ponding frequency	None
Elevation	6,710–8,630 ft
Slope	5–60%
Aspect	N, E, W

Climatic features

This ecological site receives most of its annual precipitation in the winter months in the form of snow. The mean annual precipitation ranges from 71 to 119 inches (1,803 to 3,023 mm) and the mean annual temperature is 40 degrees F (4.4 degrees C). The frost free (>32 degrees F) season is 50 to 85 days. The freeze free (>28 degrees F) season is 65 to 185 days.

There are no representative climate stations for this site. The nearest one is Manzanita Lake, which receives substantially less precipitation than this area.

Table 3. Representative climatic features

Frost-free period (average)	85 days
Freeze-free period (average)	185 days
Precipitation total (average)	119 in

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

This ecological site is associated with hanging valleys which were buried with pumiceous pyroclastic flow and fall deposits from the Chaos Crags. The Vitrandic Cryorthents soil component is associated with this site. These soils are very deep and excessively drained. The A and AC horizons are from 0 to 4 and 4 to 9 inches respectively, and have very gravelly ashy loamy coarse sand textures with 1 percent clay and 45 to 50 percent gravels. The C

horizon has ashy course sand or ashy loamy coarse sand textures with 36 to 75 percent gravels. Below 30 inches there are 2 to 10 percent cobbles and 0 to 2 percent stones. This site has very low to low AWC.

This ecological site has been correlated with the following map units and components within the CA789 Soil Survey Area:

Map Unit Component, Percent
174 Vitrandic Cryorthents, 60

Table 4. Representative soil features

Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	60 in
Surface fragment cover <=3"	70–80%
Surface fragment cover >3"	0–18%
Available water capacity (0-40in)	0.58–3.28 in
Soil reaction (1:1 water) (0-40in)	6.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	35–85%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

This ecological site is very sparsely vegetated with about 12 percent cover of compact forbs and stunted trees. Western white pine (*Pinus monticola*) accounts for approximately 2 percent of the total cover.

The ecological dynamics of this site are strongly affected by the relatively undeveloped soil. The soil on this site is very coarse, has very low available water holding capacity (AWC) and contains very little organic matter. In addition to the soil having very low AWC the plants on this site must also contend with high winds and extreme temperatures. Plants in these alpine environments are small, close to the ground and widely spaced with large patches of bare soil and rock in between (Billings and Mooney 1968). The relative lack of vegetation on this site compounds the effects of microenvironments. Small differences in micro-topography can make large differences in soil temperature, depth of thaw, wind effects, snow drifting, and the resulting protection of buds and leaves (Billings and Mooney 1968). The trees growing here are stunted, twisted and shrubby. Adaptations that make life on such a harsh site possible.

Species growing here are adapted to stressful environments. Plants like buckwheat (Eriogonum spp.) are slow growers because poor nutrient availability. This is a common characteristic of stress-tolerant plants. Plants are less susceptible to fluctuations in nutrient level when adapted to lower nutrient levels (Chapin and Bliss 1989).

This site has a simple 1 box state and transition model since it is not dependent upon disturbance for regeneration, and will take centuries or more to develop a significant tree canopy.

State and transition model

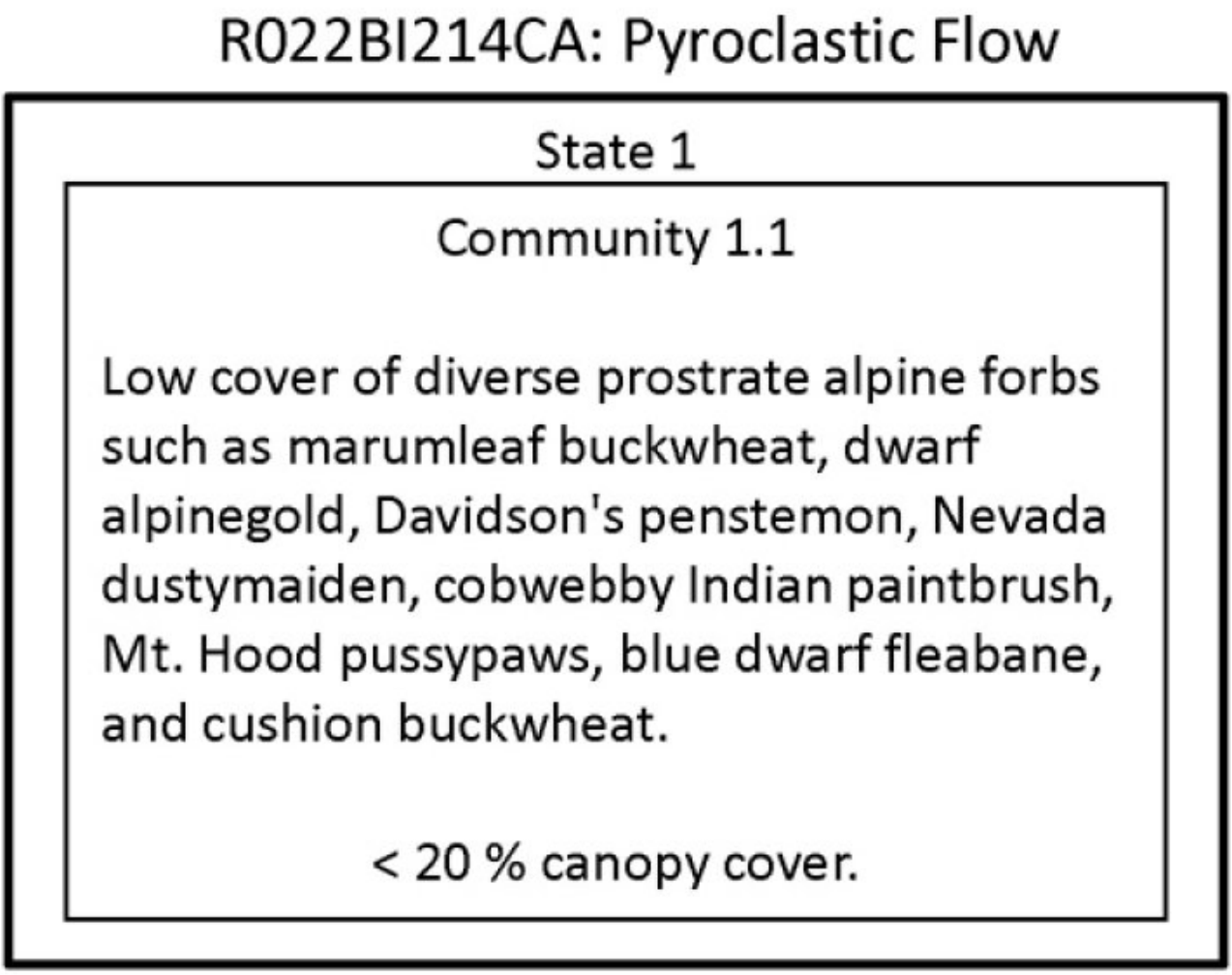

Figure 2. Pyroclastic Flow Model

State 1
Natural State

This is the natural state for this ecological site.

Community 1.1
Compact forbs and stunted trees

Figure 3. Pyroclastic Flow Ecological Site

Unique assemblages of prostrate alpine forbs are found across this site. Common species include marumleaf

buckwheat (*Eriogonum marifolium*), dwarf alpinegold (*Hulsea nana*), Davidson's penstemon (*Penstemon davidsonii*), Nevada dustymaiden (*Chaenactis nevadensis*), cobwebby Indian paintbrush (*Castilleja arachnoidea*), Mt. Hood pussypaws (*Cistanthe umbellata* var. umbellata), squirreltail (*Elymus elymoides*), blue dwarf fleabane (*Erigeron elegantulus*), cushion buckwheat (*Eriogonum ovalifolium*), rockcress (Arabis sp.), silverleaf phacelia (*Phacelia hastata*), Pringle's bluegrass (*Poa pringlei*), Shasta knotweed (*Polygonum shastense*), and Suksdorf's silene (*Silene suksdorfii*). This site produces very little biomass due to the relatively short growing season and harsh conditions. Reproduction of the species growing on this ecological site is also slow, which in turn makes the successional process very slow. Early successional species generally have long term seed viability, so a large number of individuals can germinate when conditions are favorable (Bazzaz 1979). Species have different life strategies that allow for survival on site with relatively undeveloped soil and limited resources. The buckwheat species have a large amount of fine root biomass which increases its ability to take up nutrients and water in a limiting environment (Chapin and Bliss 1989). Knotweed species invest very little in a fine root system and have a large taproot. This means there is less surface area for nutrient and water uptake, but the taproot provides a reserve on nutrients for stressful years (Chaplin and Bliss 1989). The other co-dominate species dwarf alpine gold utilize rhizomes, horizontal underground stems, to assists new cohorts (Wilken 1975). These thickened secondary roots also allow for nutrient storage, similar to the strategy employed by knotweed species.

Forest overstory. There may be up to 2 percent cover of overstory western white pine.

Forest understory. The production and canopy cover data in the tables above are based on ocular estimates.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Forb	5	34	61
Tree	0	2	4
Total	**5**	**36**	**65**

Table 6. Soil surface cover

Tree basal cover	0-1%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	1-10%
Surface fragments >0.25" and <=3"	70-80%
Surface fragments >3"	10-35%
Bedrock	15-25%
Water	0%
Bare ground	1-10%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	0-24%
>0.5 <= 1	–	–	–	–
>1 <= 2	–	–	–	–
>2 <= 4.5	0-1%	–	–	–
>4.5 <= 13	0-1%	–	–	–
>13 <= 40	0-2%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
1	**Tree**			0–4	
	western white pine	PIMO3	*Pinus monticola*	0–4	0–2
Forb					
1	**Forbs**			0–61	
	marumleaf buckwheat	ERMA4	*Eriogonum marifolium*	0–25	0–6
	dwarf alpinegold	HUNA	*Hulsea nana*	0–9	0–5
	cobwebby Indian paintbrush	CAAR11	*Castilleja arachnoidea*	0–6	0–3
	Nevada dustymaiden	CHNE	*Chaenactis nevadensis*	0–4	0–2
	Mt. Hood pussypaws	CIUMU	*Cistanthe umbellata var. umbellata*	0–4	0–2
	silverleaf phacelia	PHHA	*Phacelia hastata*	0–4	0–2
	Shasta knotweed	POSH	*Polygonum shastense*	0–4	0–2

Animal community

This ecological site provides habitat for species like the gray-crowned rosy finch, pika and golden mantled ground squirrel.

Recreational uses

This ecological site provides scenic vistas.

Wood products

none

Inventory data references

The following NRCS vegetation plot was used to describe this ecological site:

789388- type location

Type locality

Location 1: Shasta County, CA	
Township/Range/Section	T31 N R4 E S27
UTM zone	N
UTM northing	4485809
UTM easting	626567
General legal description	The type location is about 2.13 miles west of the Emigrant Pass/Devastated Area parking lot in Lassen Volcanic National Park.

Other references

Bazzaz, F.A. “The Physiological Ecology of Plant Succession.” Annual Review of Ecology and Systematics 10 (1979): 351-371.

Billings, W. D. and H.A. Mooney. “The Ecology of Artic and Alpine Plants.” Biol. Rev. 43 (1968): 481-529.

Chapin, David M. and L. C. Bliss. “Seedling growth, Physiology, and Survivorship in a Subalpine, Volcanic Environment.” Ecology 70 (1989):1325-1334.

Wilken, Dieter H. “A Systemation Study of the Genus Hulsea (Asteraceae).” Brittonia 27 (1975): 228-244.

Contributors

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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:**

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2. **Presence of water flow patterns:**

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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):**

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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:**
