

Ecological site R022BI202CA
Frigid Alluvial Flat

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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.

MLRA notes

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

Site Concept – Riparian Complex: Hydrologically connected by multiple springs, flows, and seasonal snow melt. Slopes: Generally 1 to 3 percent but can have up to 5 percent slopes. Landform: stream terrace. Soils: Very deep alluvium, with varying depths of organic horizons. Temp regime: Frigid. MAAT: 5.5 to 6.1 degrees C. (42 to 43 degrees F.). MAP: 1,295 to 1,753 mm (51 to 69 inches). Soil texture: muck to gravelly ashy fine sandy loam. Surface fragments: 0 to 10 percent gravel Commonly Associated with: R022BI211CA Spring Complex and R022BI210CA Frigid Loamy Flood Plain Floodplain Vegetation: several montane meadow plant communities dominated by graminoid species with some willow and mountain alder.

Associated sites

F022BI120CA	Frigid Gravelly Sandy Loam Outwash-Stream Terraces This white fir- Sierra lodgepole pine forest surrounds the meadow.
R022BI211CA	Spring Complex This site is a spring complex which provides water to the meadow.

Similar sites

R022BI210CA	Frigid Loamy Flood Plains This riparian site is associated with Hot Springs Creek.
R022BI217CA	Frigid Lacustrine Flat This meadow site is associated with relic glacial lakes and alluvial terraces, without major spring influences.
R022BI206CA	Cryic Lacustrine Flat This meadow site is found at higher elevations, and is associated with small meandering streams.

Table 1. Dominant plant species

Tree	Not specified
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Shrub	(1) <i>Salix lemmonii</i> (2) <i>Alnus incana</i> ssp. <i>tenuifolia</i>
Herbaceous	(1) <i>Carex nebrascensis</i> (2) <i>Carex simulata</i>

Physiographic features

This ecological site is presently mapped between 5,440 and 5,790 feet in elevation, but the elevation range may be extended if found outside the park. This site is on stream terraces. Slopes are generally 1 to 3 percent but may be up to 5 percent.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace
Flooding duration	Extremely brief (0.1 to 4 hours) to long (7 to 30 days)
Flooding frequency	Rare to frequent
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Occasional to frequent
Elevation	1,660 – 1,770 m
Slope	0 – 10 %
Water table depth	0 – 150 cm
Aspect	Aspect is not a significant factor

Climatic features

This ecological site receives most of its annual precipitation in the form of snow from November to April. The mean annual precipitation ranges from 51 to 69 inches (1,295 to 1,753 mm). The mean annual temperature ranges from 42 to 43 degrees F (5.5 to 6.1 degrees C). The frost free (>32 degrees F) season is 70 to 90 days. The freeze free (> 28 degrees F) season is approximately 80 to 200 days.

Table 3 Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	200 days
Precipitation total (average)	1,750 mm

Influencing water features

This site has wetland and non-wetland features; further delineation would be needed to locate the wetland boundaries. The drier portions of this meadow complex are seasonally saturated for short durations after the spring snowmelt. The wettest areas are saturated to the surface throughout the entire year, due to continual input of water from springs that emerge just upslope from the meadow.

Soil features

The soil components associated with this meadow ecological site are Terric Haplohemists, Histic Humaquepts, Aquandic Humaquepts, and Aquandic Endoaquepts. These are all very deep, very poorly to somewhat poorly drained soils that formed in alluvium.

The wettest part of this meadow fits the criteria for a fen because it has at least 40 cm of organic soil within the upper 80 cm of soil, supports hydrophytic vegetation, and its soil is saturated to the surface for a least one month each year (Cooper and Evan, 2006). Incised ditches and the removal of Lemmon's willow (*Salix lemmonii*) and other shrubs have altered the vegetation, threatening the characteristics of the fen. The soil in this part of the meadow are Terric Haplohemists, which has 20 inches of organic muck over a 10 inch ashy silty clay loam textured horizon. The lower horizons have ashy silty loam and ashy silty clay loam textures. The water table fluctuates from 0 to 24 inches during the dry season. The vegetation is dominated by analogue sedge (*Carex simulata*), Northwest Territory sedge (*Carex utriculata*), and Nebraska sedge (*Carex nebrascensis*), along with other hydrophytic vegetation (PCC1b).

The Nebraska sedge (*Carex nebrascensis*) community (PCC2b) is found in slightly drier locations surrounding the fen and is associated with the Histic Humaquepts soil component. These soils have 9 inches of organic material over 19 inches of ashy loam textured A and B horizons. The C horizons have extremely cobbly ashy sandy clay loam and very cobbly ashy coarse sandy loam textures. The water table is at the surface in early summer then fluctuates from 10 to 60 inches during the dry season.

A mixed sedge and grassland community (PCC3b) is found throughout the meadow and is associated with the Aquandic Humaquepts soil component. These soils have 4 inches of ashy mucky peat over an ashy very fine sandy loam textured horizon. The subsurface textures are very gravelly, extremely gravelly, and gravelly ashy sandy loams. The water table is near the surface in early summer and fluctuates from 10 to 60 inches in the dry season. Common plants include widefruit sedge (*Carex angustata*), tufted hairgrass (*Deschampsia cespitosa*), Kentucky bluegrass (*Poa pratensis*), and timothy (*Phleum pretense*).

The driest part of the meadow is associated with the Aquandic Endoaquepts soil component. These soils formed in bar deposits. They do not have an organic horizon, due to the aerobic conditions created by these soils as water flows through them. This creates oxygenated conditions for most of the year that allow organic matter to decompose rather than form peat. The surface texture is a gravelly ashy fine sandy loam surface texture. Subsurface textures include ashy very fine sandy loams, ashy loamy fine sand, and ashy loam coarse sand, and gravelly ashy loam coarse sand. This soil has a high percentage of surface gravels and bare ground, compared to the rest of the meadow. Sedges (*Carex* spp.) and mountain rush (*Juncus arcticus* ssp. *littoralis*) provide about 70 percent cover of the vegetation cover (PCC4b).

This ecological site has been correlated with the following map units and soil components in the Lassen Volcanic National Park Soil Survey (CA789):

- Map Unit Component /Component percent
- 165 Aquandic Humaquepts / 35
- 165 Histic Humaquepts / 25
- 165 Aquandic Endoaquepts / 20
- 165 Terric Haplohemists / 15

Table 4. Representative soil features

Family particle size	(1) Loamy
Drainage class	Very poorly drained to somewhat poorly drained
Permeability class	Moderately slow to moderate
Soil depth	150 cm

Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	9.65 – 23.88 cm
Soil reaction (1:1 water) (0-101.6cm)	5.6 – 7.3
Subsurface fragment volume <=3" (Depth not specified)	0 – 80 %
Subsurface fragment volume >3" (Depth not specified)	0 – 40 %

Ecological dynamics

This ecological site is a montane meadow-fen complex. One representative location of this ecological site is the Drakesbad Meadow in Lassen Volcanic National Park. The following description is based on data and research from Drakesbad Meadow, however this site may be found and mapped elsewhere within the MLRA.

This ecological site complex has an assemblage of plant communities and soil types dependent upon dependent upon stream deposit characteristic, micro-topography, hydrologic characteristics, and human-influenced alterations. An extensive study of the hydrology of the lower part of Drakesbad Meadow, by Lindsay Patterson, determined that 99 percent of the hydrologic input during the summer months comes from the associated spring complex ecological site, R022BI211CA located almost 200 feet above the meadow. These spring complexes can be created by groundwater seeping out at a contact between an older andesite flow and a more recent dacite flow, which is the case in Lassen Volcanic National Park. These springs are from a regional aquifer that is recharged by a high winter snowfall. The spring flow reaches the meadow by surface flow and creates a flow- through system in the meadow (Patterson, 2005). There is also a small tributary to Little Hot Springs Creek bisects Drakesbad Meadow. It effectively intercepts the spring flow before it reaches the upper portion of the meadow, where fen characteristics have not developed. The riparian ecological site: Frigid Loamy Flood plains R022BI210CA, is often associated with this ecological site. An example of this site in Lassen Volcanic National Park would be Hot Springs Creek, which is on the lower, south side of this valley. This site may or may not be supplying hydrologic support to this ecological site, and in Lassen Volcanic National Park. Hot Springs Creek stays mainly in its channel and does not regularly overflow into the meadow, and is thus of secondary hydrologic importance.

There is little known about the use of these meadows by the Native Americans. The Mountain or Northeastern Maidu were seasonal inhabitants in the Warner Valley prior to European settlers and it is likely they harvested plant materials for consumption and for weaving material. They hunted game, although their impact was probably minimal.

The recent history of Drakesbad Meadow in particular has been well documented in several papers, with nice photo pairs showing the changes over time. Edward Drake arrived in Warner Valley around 1875 and was the first documented settler in the area. In 1894 he finally purchased or had a government patent for the upper Warner Valley, including Drakesbad Meadow. By this time he had improved the dirt road from Chester, built a house and a barn, and fenced and planted his pasture with timothy grass. As many as 100 horses may have been passing through Drakesbad Meadow at one time (Hoke, et al., 2005; Bozeman). The Sifford family bought the ranch from Edward Drake in 1900. The Siffords began a campground and guest house for tourists visiting the nearby hot springs. They spent many long and arduous days removing willows and alders from the meadow west of the lodge. They also dug ditches to drain the wettest areas there, and tried to divert the water to drier areas (Hoke, et al. 2005). Between 1942 and 1951, the Siffords ran about 100 head of cattle as many as 30 horses passing through Drakesbad Meadow at any one time. During the cattle ranching period, fencing was expanded and timothy seed was spread in the pastures. Drakesbad Meadow and the surrounding areas became part of Lassen National Volcanic Park in 1958 and cattle grazing ceased, although horses are still corralled near the meadow.

The hydrology, soil development and history of this site and Drakesbad Meadow in particular, play important roles in the distribution and composition of the plant communities present. The constant flow of water and the subsequent prolonged saturated soil conditions has allowed peat to develop from sedge roots by creating anaerobic conditions that inhibit organic matter decomposition. Peat accumulation is a slow process with accumulation rates of approximately 20 cm per thousand years, as cited in Patterson's report (Patterson 2005, and Chimner and Cooper, 2003). Peat from the southeast portion of Drakesbad Meadow has been dated from 4200 years BP (White, et. al 2001). Once peat dries out it can decompose quickly. Presently only the wettest areas of the meadow have deep organic soils. The drier areas of the meadow have mineral soils and support a larger composition of upland plant species.

This ecological site is a complex of plant communities which are interrelated by hydrology. This is a relatively new concept for ecological sites. The state and transition diagram below illustrates the change in plant community component composition as a result of disturbance or change in the water table, rather than focusing on the succession of one plant community.

Fire is not included in the successional dynamics for this ecological site. Under natural conditions this meadow would be too wet to burn. The drier upper meadow could burn, but the native perennial grasses would resprout and recover quickly.

There is a potential serious threat from fire in State 2, if the peat dries out. It could burn and restoration of the fen would be nearly impossible.

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 et al. 2003, Bestelmeyer et al. 2009, and Stringham and Shaver 2003.

State and transition model

Figure 3. Frigid alluvial flats

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
1	shrubs			0-112	
	thinleaf alder	ALINT	<i>Alnus incana ssp. tenuifolia</i>	0-84	0-1
	Lemmon's willow	SALE	<i>Salix lemmonii</i>	0-56	0-1
	alpine laurel	KAMI	<i>Kalmia microphylla</i>	0-22	0-2
Grass/Grasslike					
1	grass/grasslike			1569-3133	
	Northwest Territory sedge	CAUT	<i>Carex utriculata</i>	605-897	20-30
	Nebraska sedge	CANE2	<i>Carex nebrascensis</i>	319-785	15-25
	analogue sedge	CASI2	<i>Carex simulata</i>	280-560	10-20
	spikerush	ELEOC	<i>Eleocharis</i>	235-353	10-15
	panicled bulrush	SCMI2	<i>Scirpus microcarpus</i>	179-280	8-12
	Bolander's bluegrass	POBO	<i>Poa bolanderi</i>	40-101	2-5
	bentgrass	AGROS2	<i>Agrostis</i>	39-78	1-2
	California brome	BRCA5	<i>Bromus carinatus</i>	39-78	1-2
2	grass/grasslike			1704-2937	
	Nebraska sedge	CANE2	<i>Carex nebrascensis</i>	1681-2802	80-95
	mountain rush	JUARL	<i>Juncus arcticus ssp. littoralis</i>	22-112	5-28
	tufted hairgrass	DECE	<i>Deschampsia cespitosa</i>	0-11	0-1
	meadow barley	HOBR2	<i>Hordeum brachyantherum</i>	0-11	0-1

3	grass/grasslike			1961-3486	
	widefruit sedge	CAAN15	<i>Carex angustata</i>	1345-2466	50-70
	mountain rush	JUARL	<i>Juncus arcticus ssp. littoralis</i>	560-785	65-75
	tufted hairgrass	DECE	<i>Deschampsia cespitosa</i>	56-224	5-15
	meadow barley	HOBR2	<i>Hordeum brachyantherum</i>	0-11	0-1
4	grass/grasslike			1195-1810	
	sedge	CAREX	<i>Carex</i>	673-897	30-40
	mountain rush	JUARL	<i>Juncus arcticus ssp. littoralis</i>	448-673	50-70
	Bolander's bluegrass	POBO	<i>Poa bolanderi</i>	40-140	2-7
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	34-101	1-3
20	non-native grasses CT3			261-504	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	260-392	8-12
	timothy	PHPR3	<i>Phleum pratense</i>	1-112	1-10
Forb					
1	native forbs			67-291	
	longstalk clover	TRLO	<i>Trifolium longipes</i>	11-112	1-5
	Scouler's St. Johnswort	HYSCS2	<i>Hypericum scouleri ssp. scouleri</i>	34-90	2-4
	longstalk starwort	STLO2	<i>Stellaria longipes</i>	11-56	1-3
	Douglas' thistle	CIDO2	<i>Cirsium douglasii</i>	11-34	0-1
2	native forbs			0-29	
	Rydberg's penstemon	PERY	<i>Penstemon rydbergii</i>	0-13	0-1
	slender phlox	MIGRG4	<i>Microsteris gracilis var. gracilis</i>	0-11	0-1
	knotweed	POLYG4	<i>Polygonum</i>	0-1	0-1
	longstalk clover	TRLO	<i>Trifolium longipes</i>	0-1	0-1
	violet	VIOLA	<i>Viola</i>	0-1	0-1
	rose thistle	CIAN	<i>Cirsium andersonii</i>	0-1	0-1
3	native forbs			337-854	
	Chamisso arnica	ARCH3	<i>Arnica chamissonis</i>	336-740	25-55
	Rydberg's penstemon	PERY	<i>Penstemon rydbergii</i>	1-67	0-5
	California false hellebore	VECAC2	<i>Veratrum californicum var. californicum</i>	0-22	0-1
	threepetal bedstraw	GATR2	<i>Galium trifidum</i>	0-11	0-5
	cinquefoil	POTEN	<i>Potentilla</i>	0-11	0-3
	longleaf starwort	STLO	<i>Stellaria longifolia</i>	0-1	0-1
	fringed willowherb	EPCI	<i>Epilobium ciliatum</i>	0-1	0-1
4	native forbs			2-62	
	spreading groundsmoke	GADI2	<i>Gayophytum diffusum</i>	1-34	1-5
	aster	ASTER	<i>Aster</i>	1-11	0-2
	longstalk clover	TRLO	<i>Trifolium longipes</i>	0-11	0-2
	slender cinquefoil	POGR9	<i>Potentilla gracilis</i>	0-6	0-1
30	non-native forbs CT1			0-67	
	bull thistle	CIVU	<i>Cirsium vulgare</i>	0-34	0-1
	common dandelion	TAOF	<i>Taraxacum officinale</i>	0-34	0-1

Table 7. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

This site provides valuable wildlife resources, such as water, forage, and cover. The leaves, stems, and seeds of Nebraska sedge, tufted hairgrass, and other grasses and sedges provide forage for wildlife and livestock. The sedges and bunchgrasses provide nesting habitat for waterfowl and cover for small mammals. Songbird mist-netting studies have been conducted in Drakesbad for the last 10 years. The results indicate above average songbird productivity. A complete list of netted songbirds can be viewed on their report (Lassen Volcanic National Park, 2006).

Hydrological functions

The hydrologic function of this meadow is to provide a catchment for water, sediments, and nutrients. The meadow allows sediments from spring snow melt to settle out and traps nutrients in surface and subsurface flows. The meadow provides water storage that slowly releases down the drainage throughout the year. This meadow also provides a broad abandoned flood plain which may take on overflow from Hot Springs Creek in the event of a very large flood event. Access to this flood plain would reduce erosion downstream and allow for sediment deposition.

Recreational uses

This meadow provides open space for wildlife viewing, photographic opportunities, historical features, access to hot springs, and easy level nature trails. Trails should be constructed in appropriate areas to avoid water diversion or soil compaction.

Other products

Mountain rush was and may still be used for basketry and food by native Americans.

Inventory data references

The following NRCS vegetation plots were used to describe this ecological site: 789168- Aquandic Humaquepts (CT3) 789204- Histic Humaquepts (CT2) 789286- Aquandic Endoaquepts (CT4) 789348- Terric Haplohemist (CT1)

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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:

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:
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17. Perennial plant reproductive capability:
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