USDA Natural Resources Conservation Service

Ecological site R022AX104CA
Sphagnum Fen

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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): 022A–Sierra Nevada and Tehachapi Mountains

Major Land Resource Area 22A, Sierra Nevada Mountains, is located predominantly in California and a small section of western Nevada. The area lies completely within the Sierra Nevada Section of the Cascade-Sierra Mountains Province. The Sierra Nevada range has a gentle western slope, and a very abrupt eastern slope. The Sierra Nevada consists of hilly to steep mountains and occasional flatter mountain valleys. Elevation ranges between 1,500 and 9,000 ft throughout most of the range, but peaks often exceed 12,000 ft. The highest point in the continental US occurs in this MLRA (Mount Whitney, 14,494 ft). Most of the Sierra Nevada is dominated by granitic rock of the Mesozoic age, known as the Sierra Nevada Batholith. The northern half is flanked on the west by a metamorphic belt, which consists of highly metamorphosed sedimentary and volcanic rocks. Additionally, glacial activity of the Pleistocene has played a major role in shaping Sierra Nevada features, including cirques, arêtes, and glacial deposits and moraines. Average annual precipitation ranges from 20 to 80 inches in most of the area, with increases along elevational and south-north gradients. Soil temperature regime ranges from mesic, frigid, and cryic. Due to the extreme elevational range found within this MLRA, Land Resource Units (LRUs) were designated to group the MLRA into similar land units.

LRU “X” represents ecological sites driven by abiotic features that override the typical soils or climatic features that drive most of the other LRU zones. In the Sierra Nevada these sites are typically driven by water features associated with lotic or lentic riparian systems. Other features maybe shallow bedrock, or unique chemical development which affects the growth of typical vegetation.

Ecological site concept

This ecological site is a complex of vegetation communities associated with depressional peatland basins, or fens at elevations typically between 6,300 and 8,500 feet. Fens form when stable hydric soils with an aquic soil moisture regime allow a rate of organic matter production that is greater than the rate of decomposition, which over very long periods of time, leads to an accumulation of peat. Fens, with very deep histic soils composed of moss fibers, dominate this complex. Sphagnum moss (Sphagnum spp.) species dominate the fen community, with dwarf bilberry (Vaccinium caespitosum), bog laurel (Kalmia polifolia), and mountain willow (*Salix eastwoodiae*) important shrub species. Fen margins have soils with more mineral horizon development; margins support a community dominated by sedges (Carex spp.). A small pond of open water is typically present, and supports an aquatic plant community. Meadows associated with the fen system have drier soils with more mineral horizon development, and support a diverse tufted hairgrass (Deschampsia caespitosa) – forb community. Discharge slopes with very deep histic soils may be present, and support a forb community dominated by California false hellebore (*Veratrum californicum* var. californicum).

Associated sites

R022AX101CA	**Frigid Anastomosed System** This is a lacustrine fringe/ delta with Da to E channel types at lake inlets. Histic soils dominate, high beaver activity. The vegetation is a wet marsh, that is saturated most of year. Lemmon's and Geyer's willow, with mountain alder, Scirpus sp. and Northwest territory sedge.
R022AX102CA	**Frigid E-C Meadow System** This is a low gradient C to E type channels with broad gentle sloped floodplain. It consists of loamy, poorly drained soil complexes that are associated with a wet to dry meadow complex, with communities of Lemmon's and Geyer's willow, sedges, grasses and forbs.
R022AX103CA	**Cryic E Meadow System** This is a low gradient cryic E to C type channels with broad gentle sloped floodplain. It consists of loamy, poorly drained soil complexes that are associated with a wet cryic mountain willow-Sierra willow meadow.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Vaccinium uliginosum* (2) *Kalmia polifolia*
Herbaceous	(1) *Sphagnum squarrosum* (2) *Dodecatheon jeffreyi*

Physiographic features

This site occurs on closed basins where water is ponded for most of the year, allowing for the development of sphagnum fens. They are found in valley bottoms and relict glacial lakes. Slopes range from 0 to 2 percent, but are typically below 1 percent. Elevations range from 7,710 to 8,510 feet, but are typically above 6,300 feet.

Table 2. Representative physiographic features

Landforms	(1) Fen
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to none
Ponding duration	Very long (more than 30 days)
Ponding frequency	Frequent
Elevation	7,710–8,510 ft
Slope	0–2%
Ponding depth	0–6 in

Water table depth	0–10 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation ranges from 45 to 47 inches. Most of this precipitation is received in the form of snow in the winter. The average annual air temperature ranges from 37 to 40 degrees Fahrenheit. The frost-free (>32F) season is 25 to 75 days. The freeze- free (>28F) season is 35 to 95 days.

(1) 048762, Tahoe Valley FFA AP, California. Period of record 1968-2008

Table 3. Representative climatic features

Frost-free period (average)	50 days
Freeze-free period (average)	65 days
Precipitation total (average)	39 in

Influencing water features

The wetland class is palustrine moss-lichen. This is sphagnum dominated fen. Other associated wetland classes are PEM1 and PAQ3/4.

Soil features

There are several soils associated with this ecological site. They are associated with different fluvial surfaces and plant community components, and vary in organic matter accumulation and mineral soil development. The soil temperature regime is frigid, and the soil moisture regime is aquic.

Soils by fluvial surface:

Fen, discharge slope:
The dominant soils associated with this ecological site are the Hellhole soils (Euic, frigid Typic Sphagnofibrists). These soils occur in fens and discharge slopes, and are entirely composed of slightly decomposed moss fibers, with peat or mucky peat textures. The depth of the fibers is almost 10 feet deep, with very little mineral soil. The moss fibers float like a mat over and in water, and are saturated all year round. Available water capacity is very high, ranging from 21.7 to 25.6. AWC values are not entered in the table below because the maximum value allowed in ESIS is 15.99 Community components 2 and 5 (CC2 and CC5) are associated with the Hellhole soils. Community component 2 occurs on floating or stable fens, and CC5 occurs on discharge slopes.

Fen margin:
The Watah (coarse-loamy, mixed, superactive, acid, frigid Histic Humaquepts) soils are associated with fen margins. The Watah soils have 20 to 40 cm of peat or mucky peat, developed primarily from decomposed sedge roots. Below the organic horizons the soil is sandier with gravelly mucky coarse sandy loam and gravelly loamy coarse sand textures. Gleyed soil colors occur below 73 cm. Community component 3 (CC3) is associated with the Watah soils.

Meadow:
The Tahoe (coarse-loamy, mixed, superactive, acid, frigid Cumulic Humaquepts) soils occur on meadows associated with fens. The surface texture is mucky silt loam and subsurface textures are mucky silt loam and gravelly coarse sand. Community component 4 (CC4) is associated with this soil component.

This ecological site has been correlated with the following mapunits and soil components in the Tahoe Basin soil survey area (CA693):

Musym ; MUname ; Compname ; Local_phase ; Comp_pct

7021 ; Hellhole peat, 0 to 2 percent slopes ; Hellhole ; ; 80; Watah ; ; 5
9001 ; Bidart complex, 0 to 2 percent slopes ; Hellhole ; ; 2
7071 ; Watah peat, 0 to 2 percent slopes ; Hellhole ; ; 1

Table 4. Representative soil features

Surface texture	(1) Peat
Family particle size	(1) Loamy
Drainage class	Very poorly drained
Permeability class	Rapid
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Soil reaction (1:1 water) (0-40in)	5.1–6
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Abiotic factors
This ecological site is a complex of vegetation communities associated with depressional basin peatlands and mound peatlands. Peatlands, or fens, form when stable hydric soils with an aquic soil moisture regime allow a rate of organic matter production that is greater than the rate of decomposition, which over very long periods of time, leads to an accumulation of peat (Patterson and Cooper 2007, Weixelman and Cooper 2009). Peat accumulates very slowly, taking thousands of years to develop (Patterson and Cooper 2007). Basin fens develop in topographic depressions with a groundwater source, or that receive surface runoff from basin edges (Weixelman and Cooper 2009). Mound fens are raised areas where peat accumulates due to a source of upwelling of water (Weixelman and Cooper 2009).

Ecological/Disturbance factors
The fen system supports a complex of soils and vegetation communities. In the center is open water supporting aquatic vegetation including yellow pond lily (*Nuphar lutea*) and pondweeds (Potamogeton ssp.). At the water's edge is a floating or stable sphagnum mat. This mat is dominated by sphagnum moss species. The fen vegetation changes in relation to depth and stability of the peat layer. In some cases this can be seen in concentric rings extending from the remaining open water. More stable surfaces support dwarf bilberry, bog laurel, mountain willow, and sedges and forbs. This mat may support unusual plant species such as the carniverous round leaf sundew (*Drosera rotundifolia*) and the mud sedge (*Carex limosa*). Fen margins, which are seasonally inundated and have soils with more mineral horizon development, support emergent plants dominated by sedges (Carex ssp.). Trees such as Sierra lodgepole pine (*Pinus contorta* var. murrayana) may invade and retreat from the fen and fen margins (Bartolome et al. 1990). Meadows associated with the fen system have drier soils with more mineral horizon development, and support a diverse tufted hairgrass (Deschampsia caespitosa) – forb community. Discharge slopes with very deep histic soils may be present, and support a forb community dominated by California false hellebore (*Veratrum californicum* var. californicum).

Fens in the Sierra Nevada are highly important for the biological diversity they support, and they are also important carbon sinks (Weixelman and Cooper 2009). Fens are naturally highly stable systems although fluctuations in size, location, and plant community composition may occur over time (e.g. Erman 1976, Bartolome et al. 1990). However, fens are highly vulnerable to anthropogenic disturbances including hydrological diversions, grazing, and off-road vehicle use (Patterson and Cooper 2007, Weixelman and Cooper 2009). Hydrological alterations such as ditches, dams and roads that reduce water supply to the fen creates aerobic conditions that stop the accumulation of peat and allow non wetland species to establish (Cooper et al. 1998, Patterson and Cooper 2007, Austin 2008). Removing the diversion and re-establishing water flow can re-establish anaerobic conditions and restore the fen

(Cooper et al. 1998, Patterson and Cooper 2007). Grazing and off-road vehicle use can compact peat, expose bare ground, and lead to erosion and gullying that depletes fen water supply and allows for the establishment of non wetland species as above (Weixelman and Cooper 2009).

Historical land management has impacted fens in the Lake Tahoe Basin. For example, Osgood Swamp was drained in the 1960s, but after acquisition by the U.S. Forest Service the water table was restored (Holst 2000). The water table then dropped in response to drought in the 1990s, allowing Sierra lodgepole pine (*Pinus contorta* var. murrayana) to invade, but beaver activity assisted by management again restored the water table and the meadow (Holst 2000). All fens were likely impacted by historic grazing, as all meadows in the Lake Tahoe Basin were grazed in the past by cattle and sheep. Over 13 dairy farms were active in the basin, and most meadows were fenced for cattle grazing. Sheep roamed the mountains, and denuded much of the forbs and grasses (Elliot-Fisk et al. 1996). The impacts on the basin fens have been described as minimal however (Holst 2000).

The peatlands in the Lake Tahoe basin area have developed by gradually filling in relict glacial lakes. Grass Lake by Luther Pass in one example of this process. Slowly over time sphagnum has grown from the edge of the meadow towards the center. As it grows, it inhibits water flow creating an anoxic environment. Low oxygen and nutrient availability create an environment suitable for the growth of sphagnum mosses. As the mosses continue to grow, they create a thick floating mat of fiber called peat. If you walk on this layer it shakes and rolls like walking on a waterbed. When this peat layer becomes thick enough, or reaches the bottom of the lake, Sierra lodgepole pine and mountain willow (*Salix eastwoodiae*) can establish. The vegetation changes in relation to depth and stability of the peat layer.

Although every peatland is different within this survey area, they tend to follow a similar pattern. In the center is open water with yellow pond lily (*Nuphar lutea*) and pondweeds (Potamogeton spp.). At the water's edge is the floating sphagnum mat. On this mat several unusual plant species survive, such as the carniverous round leaf sundew (*Drosera rotundifolia*) and the mud sedge (*Carex limosa*). Emergent plants, such as Northwest Territory Sedge (*Carex utriculata*) are found bordering the mat in the shallow water. Beyond the Northwest Territory sedges is a wet grassland plant community dominated by tufted hairgrass (Deschampsia caespitosa).

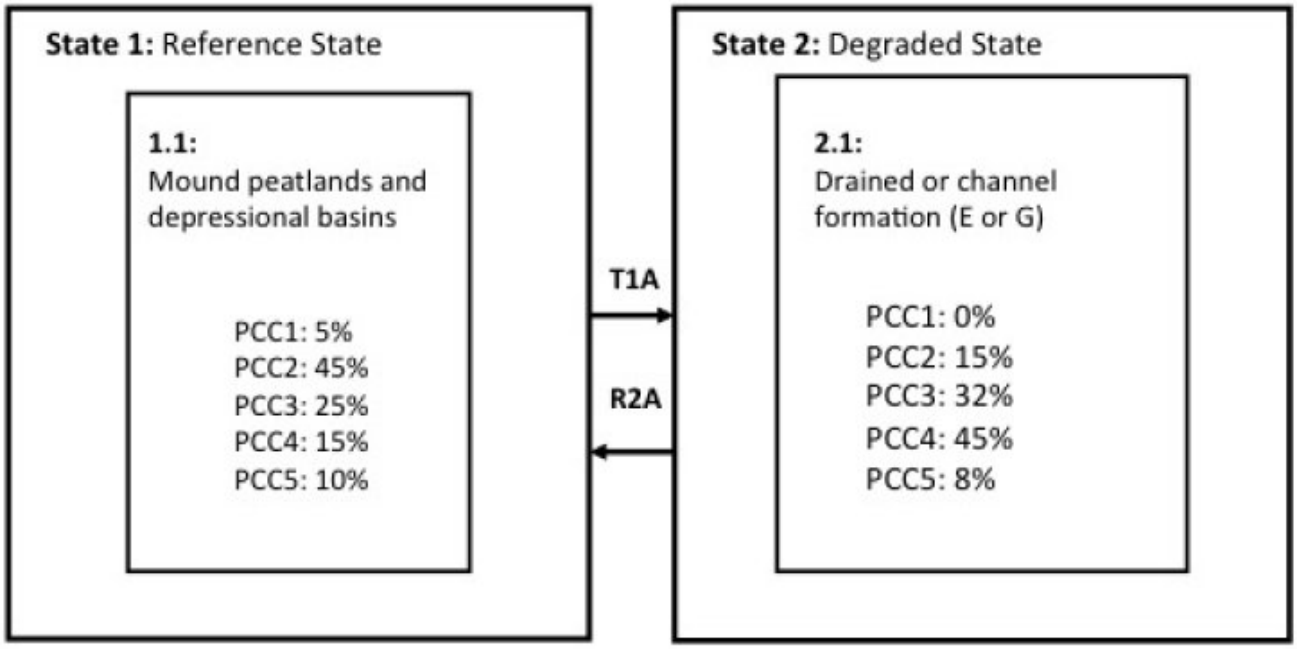
The reference state is typically the pre-settlement, most successionally advanced and hydrologically stable community phase (numbered 1.1), and the community phases that result from natural and human disturbances. Community phase 1.1 is deemed the phase representative of the most successionally advanced pre-European plant/animal community including beaver activity and hydrologic conditions that influence its composition and production. Because this phase is partly determined from reconstruction and/or historic literature, some speculation is necessarily involved in describing it.

All tabular data listed for a specific community component within this ecological site description represent a summary of one or more field data collection plots taken in modal communities within the community component. Although such data are valuable in understanding the community component (kinds and amounts of ground and surface materials, canopy characteristics, community phase overstory and understory species, production and composition, and growth), they do not represent the absolute range of characteristics or an exhaustive listing of all species that may occur in that phase over the geographic range of the ecological site.

State and transition model

R022AX104CA, Sphagnum Fen Complex

Vaccinium uliginosum-Kalmia polifolia/Sphagnum squarrosum-Dodecatheon jeffreyi
bog blueberry-bog laurel/Sphagnum-Sierra shooting star



Notes (not all possible states and phases of all reaches are shown. Refer to narratives for descriptions):

T1A. *This transition occurs with alterations in hydrology that reduce water supply to the fen.*

R2A. This restoration pathway occurs with removal of hydrological diversion and re-establishment of the water supply to the fen.

I.D.	Plant Association	Fluvial Surface/Landform
1	Aquatic community	Pond
2	Sphagnum moss - bog blueberry - forbs	Fen
3	Sedge dominated community	Fen margins
4	Tufted hairgrass and forbs	Meadow
5	California false hellebore and forbs	Discharge slopes

Figure 6. R022AX104CA

State 1
Reference

The representative state of this ecological site occurs on sphagnum fens occurring as depressional basins or mound peatlands.

Community 1.1
Mound peatlands and depressional basins

Figure 7. CC2 Fens

Figure 8. CC1 Ponds

Figure 9. CC3 Fen margins

Figure 10. CC4 Meadows

This community phase is composed of five community components: Community Component 1 (CC1), Ponds This community develops in open water ponds at the center of the fen, and typically represents 5 percent of the vegetation community components. It is composed of an aquatic plant community, with species such as yellow pond-lily (*Nuphar lutea*), pondweeds (Potamogeton ssp.) and bur-reeds (Sparganium ssp.). Data is not available to describe the community composition. Community Component 2 (CC2), Fens This is the dominant community component of the representative state, at 45 percent. It occurs on fens, and is dominated by sphagnum moss and sedges (Carex ssp.), with other moss and wetland grasslike species, wetland forbs, dwarf bilberry, mountain willow, and bog laurel. Blister sedge (*Carex vesicaria*) and mud sedge are common sedge species. Spikerush (Eleocharis ssp.) are frequently present, as are hairgrass (Deschampsia ssp.) and muhly (Muhlengbergia ssp.). Common forbs occurring in more stable areas include tundra aster (*Oreostemma alpigenum*), Sierra shooting star (*Dodecatheon jeffreyi*), alpine shooting star (*D. alpinum*), buckbean (*Menyanthes trifoliata*), elephantshead (*Pedicularis attollens*), and American bistort (*Polygonum bistortoides*). Community Component 3 (CC3), Fen margins This community occurs on fen margins, where soils are less saturated and where mineral soil horizons are well developed; this is the second most abundant component, at 25 percent. It is strongly dominated by sedges, and does not have

significant sphagnum moss. Mud sedge, Northwest Territory sedge (*Carex utriculata*), needleleaf sedge (*Carex duriuscula*), blister sedge, and Nebraska sedge (*Carex nebrascensis*), and other sedge species may all be abundant. Spikerush, tufted hairgrass (Deschampsia caespitosa), and mat muhly (Muhlenbergia richarsonensis) are typically present in this community. Mountain willow and dwarf bilberry and common shrubs. American bistort and buckbean may be abundant, and alpine shooting star, hooded lady's tresses (*Spiranthes romanzoffiana*) and primrose monkeyflower (*Mimulus primuloides*) are among the frequently encountered forb species present. Community Component 4 (CC4), Meadows This community component represents 15 percent of the vegetation typically present, and occurs on meadows associated with the fen systems, where soils are driest and have the least organic horizon development. This community is dominated by tufted hairgrass, with a high diversity of other grasslike and grass species and forbs. Mountain rush (*Juncus arcticus* ssp. littoralis) and straightleaf rush (*J. orthophyllus*), spikerush, mat muhly, and pullup muhly (*Muhlenbergia filiformis*) are common secondary grasses and grasslike species. Alpine shooting star, alpine gentian (*Gentiana newberryi*), elephantshead, Rydeberg's penstemon (*Penstemon rydbergii*), slender cinquefoil (*Potentilla gracilis* var. fastigiata), creeping sibbaldia (*Sibbaldia procumbens*), and California false hellebore (*Veratrum californicum* var. californicum) are common forb species, although many additional species may be found in this diverse community. This community may be invaded by pines such as Sierra lodgepole pine (*Pinus contorta* var. murrayana). Community component 5 (CC5), discharge slopes This community occurs on discharge slopes, and typically represents 10% of the vegetation present. It is dominated by California false hellebore, with sedges and a high diversity of other forbs. Sierra larkspur (*Delphinium glaucum*) may be abundant. Western mountain aster (*Symphyotrichum spathulatum*), wavyleaf Indian paintbrush (*Castilleja applegatei*), tiny trumpet (*Collomia linearis*), Oregon willowherb (*Epilobium oregonense*), large mountain fleabane (*Erigeron coulteri*), common cow parsnip (Heracleum lanatum), tall fringed bluebells (Mertensia ciliatus), seep monkeyflower (*Mimulus guttatus*), Parish's yampah (*Perideridia parishii*), arrowleaf ragwort (*Senecio triangularis*), elkweed (*Frasera speciosa*) and Fendler's meadow-rue (Thalactricum fendleri) are among the forb species commonly encountered. Capitate sedge (*Carex capitata*), squirreltail (*Elymus elymoides*) and meadow barley (*Hordeum brachyantherum*) are common grasses and grasslike species.

Table 5. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-1%
Grass/grasslike foliar cover	0-1%
Forb foliar cover	0-1%
Non-vascular plants	85-100%
Biological crusts	0%
Litter	0-1%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0-25%
Bare ground	0%

Table 6. Canopy structure (% cover)

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

State 2
Degraded

This state is characterized by a loss of peat-formation function due to a declining water table. A Rosgen E or G type channel may have developed. The composition of the vegetation community components is altered in this state with a decline in wetter community components (CC1, CC2, and CC5) and an increase in marginal and meadow community components (CC3 and CC4). The degree to which the wetland community types are lost is dependent on the severity of the hydrological disturbance, and the percentages shown in the STM are one example. In this case the aquatic community (CC1) has been lost, while the fen community (CC2) has significantly declined. The discharge slope community (CC5) declines near the lower edge. The fen margin community (CC3) and meadow community (CC4) both increase, with the meadow community now dominant. More severe alterations could result in a loss of the fen and fen margin communities altogether.

Transition T1A
State 1 to 2

This transition occurs with alterations in hydrology that reduce water supply to the fen, inhibiting the accumulation of peat and allowing for expansion of drier vegetation community types.

Restoration pathway R2A
State 2 to 1

This restoration pathway occurs with removal of hydrological diversion and re-establishment of the water supply to the fen.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
2	**CC2 Fens**			15–80	
	bog blueberry	VAUL	*Vaccinium uliginosum*	5–30	8–30
	mountain willow	SAEA	*Salix eastwoodiae*	5–30	5–25
	bog laurel	KAPO	*Kalmia polifolia*	5–20	5–15
3	**CC3 Fen Margins**			0–120	
	mountain willow	SAEA	*Salix eastwoodiae*	0–100	0–30
	bog blueberry	VAUL	*Vaccinium uliginosum*	0–15	0–5
Grass/Grasslike					

2	**CC2 Fens**			20–70	
	sedge	CAREX	*Carex*	20–50	30–50
	blister sedge	CAVE6	*Carex vesicaria*	1–10	1–8
	spikerush	ELEOC	*Eleocharis*	0–3	0–3
	hairgrass	DESCH	*Deschampsia*	0–3	0–2
	mud sedge	CALI7	*Carex limosa*	0–3	0–2
	muhly	MUHLE	*Muhlenbergia*	0–1	0–1
3	**CC3 Fen Margins**			1300–3000	
	sedge	CAREX	*Carex*	500–1800	20–80
	Northwest Territory sedge	CAUT	*Carex utriculata*	1–1300	1–60
	mud sedge	CALI7	*Carex limosa*	1–1300	1–60
	Nebraska sedge	CANE2	*Carex nebrascensis*	1–1300	1–60
	blister sedge	CAVE6	*Carex vesicaria*	0–500	0–40
	needleleaf sedge	CADU6	*Carex duriuscula*	5–50	5–130
	spikerush	ELEOC	*Eleocharis*	1–25	1–15
	tufted hairgrass	DECE	*Deschampsia cespitosa*	1–20	1–5
	slimstem muhly	MUFI	*Muhlenbergia filiculmis*	0–1	0–1
4	**CC4 Meadows**			600–3500	
	tufted hairgrass	DECE	*Deschampsia cespitosa*	550–1700	20–50
	rush	JUNCU	*Juncus*	0–500	0–40
	Nebraska sedge	CANE2	*Carex nebrascensis*	20–450	1–15
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	10–250	1–15
	spikerush	ELEOC	*Eleocharis*	1–35	1–5
	straightleaf rush	JUOR	*Juncus orthophyllus*	1–30	1–5
	slimstem muhly	MUFI	*Muhlenbergia filiculmis*	1–15	1–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–10	0–130
	mat muhly	MURI	*Muhlenbergia richardsonis*	1–5	0–2
5	**CC5 Discharge Slopes**			10–30	
	capitate sedge	CACA13	*Carex capitata*	0–15	0–5
	sedge	CAREX	*Carex*	0–15	0–5
	squirreltail	ELEL5	*Elymus elymoides*	0–1	0–1
	meadow barley	HOBR2	*Hordeum brachyantherum*	0–1	0–1
	rush	JUNCU	*Juncus*	0–1	0–1
Forb					
2	**CC2 Fens**			5–20	
	tundra aster	ORALA2	*Oreostemma alpigenum var. alpigenum*	1–5	3–8
	American bistort	POBI6	*Polygonum bistortoides*	0–3	0–2
	alpine shootingstar	DOAL	*Dodecatheon alpinum*	0–3	0–2
	Sierra shootingstar	DOJE	*Dodecatheon jeffreyi*	0–3	0–2
	willowherb	EPILO	*Epilobium*	0–1	0–1
	bedstraw	GALIU	*Galium*	0–1	0–1
	buckbean	METR3	*Menyanthes trifoliata*	0–1	0–1
	little elephantshead	PEAT	*Pedicularis attollens*	0–1	0–1

3	**CC3 Fen Margins**			10–50	
	American bistort	POBI6	*Polygonum bistortoides*	0–30	0–20
	buckbean	METR3	*Menyanthes trifoliata*	1–10	10–20
	tundra aster	ORALA2	*Oreostemma alpigenum var. alpigenum*	0–3	0–5
	alpine shootingstar	DOAL	*Dodecatheon alpinum*	0–3	0–2
	willowherb	EPILO	*Epilobium*	0–1	0–1
	primrose monkeyflower	MIPR	*Mimulus primuloides*	0–1	0–1
	moving polemonium	POCA3	*Polemonium californicum*	0–1	0–1
4	**CC4 Meadows**			50–100	
	Rocky Mountain pussytoes	ANME2	*Antennaria media*	0–50	0–5
	Rydberg's penstemon	PERY	*Penstemon rydbergii*	0–15	0–3
	creeping sibbaldia	SIPR	*Sibbaldia procumbens*	1–5	1–3
	California false hellebore	VECAC2	*Veratrum californicum var. californicum*	1–5	1–3
	slender cinquefoil	POGR9	*Potentilla gracilis*	0–5	0–1
	little elephantshead	PEAT	*Pedicularis attollens*	0–5	0–1
	alpine shootingstar	DOAL	*Dodecatheon alpinum*	0–1	0–1
	alpine gentian	GENE	*Gentiana newberryi*	0–1	0–1
5	**CC5 Discharge Slopes**			130–200	
	California false hellebore	VECAC2	*Veratrum californicum var. californicum*	20–50	15–30
	Sierra larkspur	DEGL3	*Delphinium glaucum*	15–50	5–30
	common cowparsnip	HEMA80	*Heracleum maximum*	1–30	1–5
	arrowleaf ragwort	SETR	*Senecio triangularis*	1–15	1–3
	tall fringed bluebells	MECI3	*Mertensia ciliata*	1–10	1–3
	wavyleaf Indian paintbrush	CAAP4	*Castilleja applegatei*	0–5	0–3
	western mountain aster	SYSPS	*Symphyotrichum spathulatum var. spathulatum*	0–5	0–2
	Parish's yampah	PEPA21	*Perideridia parishii*	1–3	1–2
	seep monkeyflower	MIGU	*Mimulus guttatus*	0–2	0–1
	tiny trumpet	COLI2	*Collomia linearis*	0–1	0–1
	moving polemonium	POCA3	*Polemonium californicum*	0–1	0–1
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	0–1	0–1
	Oregon willowherb	EPOR2	*Epilobium oregonense*	0–1	0–1
	large mountain fleabane	ERCO6	*Erigeron coulteri*	0–1	0–1
	elkweed	FRSP	*Frasera speciosa*	0–1	0–1
	common yarrow	ACMI2	*Achillea millefolium*	0–1	0–1
Moss					
2	**CC2 Fens**			100–500	
	sphagnum	SPSQ70	*Sphagnum squarrosum*	100–500	60–80
	sphagnum	SPHAG2	*Sphagnum*	50–200	10–30
Tree					
4	**CC4 Meadows**			0–2	

	Sierra lodgepole pine	PICOM	*Pinus contorta var. murrayana*	0–2	0–1

Animal community

Many small mammals and birds eat the leaves and berries of mountain blueberry (Vaccinium uligonosum). Bears eat large amounts of the berries in fall.

Several aquatic insects are found in the bogs and open water.

Hydrological functions

Sphagnum bogs are permanently saturated, and receive most of their precipitation form snow in the winter months. Some ground water and hillslope runoff is also caught in the basins. These sites hold water, in closed basins, or have a slow outlet.

Recreational uses

These areas are very sensitive to impact, and should be protected from disturbances. If a trail is desired, it should border the meadow and bog community.

Wood products

None

Other products

Due to the rarity of this habitat peat cannot be harvested in this area.

Other information

Sphagnum can be used as a sponge, and it is antibacterial.

It was used for surgical dressings during world War I.

Inventory data references

The following NRCS TEUI plots were used to describe this ecological site.

HiS04005
HiS04006
HiS04007
HiS04008
HiS04009
histosol1
histosol2- site location
histosol3
HLO
Lo02H35A
lo03071

Type locality

Location 1: El Dorado County, CA	
Township/Range/Section	T11N R18E S1
UTM zone	N

UTM northing	4301280
UTM easting	244367
General legal description	The site location in the Hellhole fen, south of Lake Tahoe towards Freel Peak.

Other references

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Elliot-Fisk, D. L., R. Harris, R. A. Rowntree, T. C. Cahill, R. Kattelmann, P. Rucks, O. K. Davis, R. Lacey, D. A. Sharkey, L. Duan, D. Leisz, S. L. Stephens, C. R. Goldman, S. Lindstrom, D. S. Ziegler, G. E. Gruell, and D. Machida. 1996. Lake Tahoe Case Study. Pages 217-276 Sierra Nevada Ecosystem Project. University of California, Centers for Water and Wildland Resources, Davis, CA.

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Holst, E. M. 2000. Accounts of focal aquatic ecosystems and ecologically significant areas. Page Appendix C in D. D. Murphy and C. M. Knopp, editors. Lake Tahoe Watershed Assessment. USDA U.S. Forest Service Pacific Southwest Research Station, Albany, CA.

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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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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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:**
