USDA Natural Resources Conservation Service

Ecological site R022BI213CA
Frigid Sandy Flood Plains

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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 –
Riparian Complex: Hydrologically connected by a B type stream channel system.
Slopes: 0 to 8
Landform: Flood plains
Soils: Poorly drained, very deep, and formed in alluvium from redeposited debris flows or volcanic rock.
Temp regime: Frigid.
MAAT: 40 to 44 degrees F (4 to 7 degrees C).
MAP: 45 to 75 inches (1,143 to 1,905 mm).
Soil texture: Extremely gravelly ashy sand and ashy fine sand
Surface fragments: 0 to 80 percent gravel, 0-20 percent larger rock fragments.
Vegetation: Several montane riparian plant communities are present with a high cover of willow and mountain alder community types.

Associated sites

F022BI103CA	**Frigid Tephra Over Slopes And Flats** This is a white fir- Jeffrey pine forest, found on the hillslopes around the streams.

F022BI105CA	**Frigid Sandy Loam Debris Flow On Stream Terraces** This is a quaking aspen- Sierra lodgepole pine site found adjacent to this riparian site in some areas.
F022BI106CA	**Frigid Debris Flow Gentle Slopes** This developing forest site is associated with the Devastated Area, which this riparian site flows through in some areas.
F022BI115CA	**Frigid And Cryic Gravelly Slopes** This California red fir site is on the hillslopes surrounding this site at higher elevations.
F022BI117CA	**Frigid Coarse Glaciolacustrine Gentle Slopes** This California red fir-Sierra lodgepole pine site is found at higher elevations on glaciolucustrine deposits adjacent to this site.

Similar sites

R022BI210CA	**Frigid Loamy Flood Plains** This site is lower in elevation and is associated with a C type channel.
R022BI215CA	**Frigid Gravelly Flood Plains** This site is lower in elevation, a larger stream, and associated with a C/D type channel.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Alnus incana ssp. tenuifolia* (2) *Salix*
Herbaceous	(1) *Elymus glaucus* (2) *Anaphalis margaritacea*

Physiographic features

This ecological site is found on flood plains, between 5,860and 6,350 feet in elevation. Slopes range from 0 to 8 percent.

Table 2. Representative physiographic features

Landforms	(1) Flood plain
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	5,860–6,350 ft
Slope	0–8%
Water table depth	0–60 in
Aspect	Aspect is not a significant factor

Climatic features

This ecological site receives most of its annual precipitation during the winter months in the form of snow. The mean annual precipitation ranges from 45 to 75 inches (1,143 to 1,905 mm) and the mean annual temperature ranges from 40 to 44 degrees F (4 to 7 degrees C). The frost free (>32F) season is 60 to 85 days. The freeze free (>28F) season is 75 to 190 days.

There are no representative climate stations for this site.

Table 3. Representative climatic features

Frost-free period (average)	85 days

Freeze-free period (average)	190 days
Precipitation total (average)	44 in

Influencing water features

This ecological site encompasses a B type stream channel and the associated flood plains and terraces.

Soil features

Typic Endoaquents and Typic Psammaquents soil components are associated with this site. These soils formed in alluvium from volcanic rock or volcanic debris flows. They are very deep, poorly drained, and minimally developed. A thin layer of fresh organic material overlays coarsely textured C horizons. The surface textures are extremely gravelly ashy sand and ashy fine sand. The Typic Endoaquents have several C horizons with ashy sand textures containing very or extremely gravelly modifiers. The Typic Psammaquents have a thin buried A horizon from 4 to 5 inches. There are several stratified C horizons with alternating ashy coarse sand and ashy sand textures. The AWC is low to very low in the upper 60 inches of soil.

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

Map Unit/ Component /Component percent
111 Typic Endoaquents/ 5
132 Typic Endoaquents/ 2
133 Typic Endoaquents/ 30
138 Typic Endoaquents/ 10
139 Typic Endoaquents/ 1
154 Typic Endoaquents/ 2
161 Typic Psammaquents/ 95
163 Typic Endoaquents/ 1

Table 4. Representative soil features

Family particle size	(1) Sandy
Drainage class	Poorly drained
Permeability class	Rapid to very rapid
Soil depth	60 in
Surface fragment cover <=3"	0–80%
Surface fragment cover >3"	0–20%
Available water capacity (0-40in)	1.4–3 in
Soil reaction (1:1 water) (0-40in)	6.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–50%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

This ecological site is found in flood plains on recent stratified alluvium. This site covers a broad range of B type channels within a limited area, and may be defined as several ecological sites in the future. Intermittent sections of these streams have C type channels. "C" type channel are less entrenched, with greater channel sinuosity and generally have more developed floodplains. Please refer to ecological site R022BI210CA for more information on stream dynamics associated with C type channels.

The site typically supports a "B" type channel according to the Rosgen classification scheme. A "B" type channel is a moderately entrenched, riffle dominated channel with infrequently spaced scour pools. The channel has moderate sinuosity, a moderate gradient with less than 4% slope, and a width to depth ratio greater than 12. A “B” type channel is a sediment-limited system and while bedrock and boulder channels are relatively stable, the channel on this site supports unstable gravel-bottom (B4) and sand bottom (B5) reaches that have high erosion potential. The sensitivity to disturbance is high for both B4 and B5 types (Rosgen, 1994).

Portions of this ecological site exhibit an altered state due to recent burial by volcanic deposits from Lassen Peak. A succession of eruptions in 1915 of Lassen Peak created an area referred to as the Devastated Area as debris flows blanketed the area with 6 to 30 feet of material. Most of the area now supports upland vegetation in various stages of recovery, but some stream corridors have developed. This site occurs where stream flows have cut new channels through the sediments. Vegetative recovery on these volcanic deposits is slow, because of the low nutrient availability and high porosity of the undeveloped soils. However, along water courses and in areas of shallower debris deposits, vegetation reestablishes sooner. Please refer to the Jeffrey pine-Mixed Fir Ecological Site Description (F022BI106CA) for more information regarding forest dynamics and succession within the upland community.

Another area where this site is correlated is upstream from a small lake. The stream channel transitions in a short distance from a constrained B channel into to a less entrenched C type channel as the stream crosses the old lake terrace. This area is also affected by a small dam. The higher lake levels, due to the dam, submerge the stream channel near the lake and reduce stream velocity for a short distance upstream. This allows finer sediments to accumulate and changes the form of the stream channel. The channel in this area is broader, shallower, and less entrenched than a B type channel. It has several C type channel characteristics, but sections also braid with multiple channels that resemble a D type channel. This area is dominated by shining willow (*Salix lucida*). Because of limited extent and variable channel characteristics this area is included with this ecological site.

Vegetation exerts a moderate controlling influence on the stream dynamics of B channels. The plant communities along this channel occur in distinct zones related to variable water table depth and disturbance events. A thinleaf alder (*Alnus incana* ssp. tenuifola)/willow (Salix spp.) community occurs along the streambank, a pioneer forb community is on point bars and fresh deposits and a Sierra lodgepole pine (*Pinus contorta* var. murrayana) forest is present just above the banks, on rarely used floodplains. The most common willows along the stream channels are Lemmon's willow (*Salix lemmonii*) and shining willow (*Salix lucida*). The understory is dominated by graminoids and various forbs including western needlegrass (*Achnatherum occidentale*), Idaho bentgrass (*Agrostis idahoensis*), California brome (*Bromus carinatus*), carex (Carex spp.), slender hairgrass (*Deschampsia elongata*), squirreltail (*Elymus elymoides*), blue wildrye (*Elymus glaucus*), meadow barley (*Hordeum brachyantherum*), mountain rush (*Juncus arcticus* ssp. littoralis), meadow fescue (*Schedonorus pratensis*), pearly everlasting (*Anaphalis margaritacea*), and cinquefoil (Potentilla sp.).

This ecological site is a complex of riparian plant communities that 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 type 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

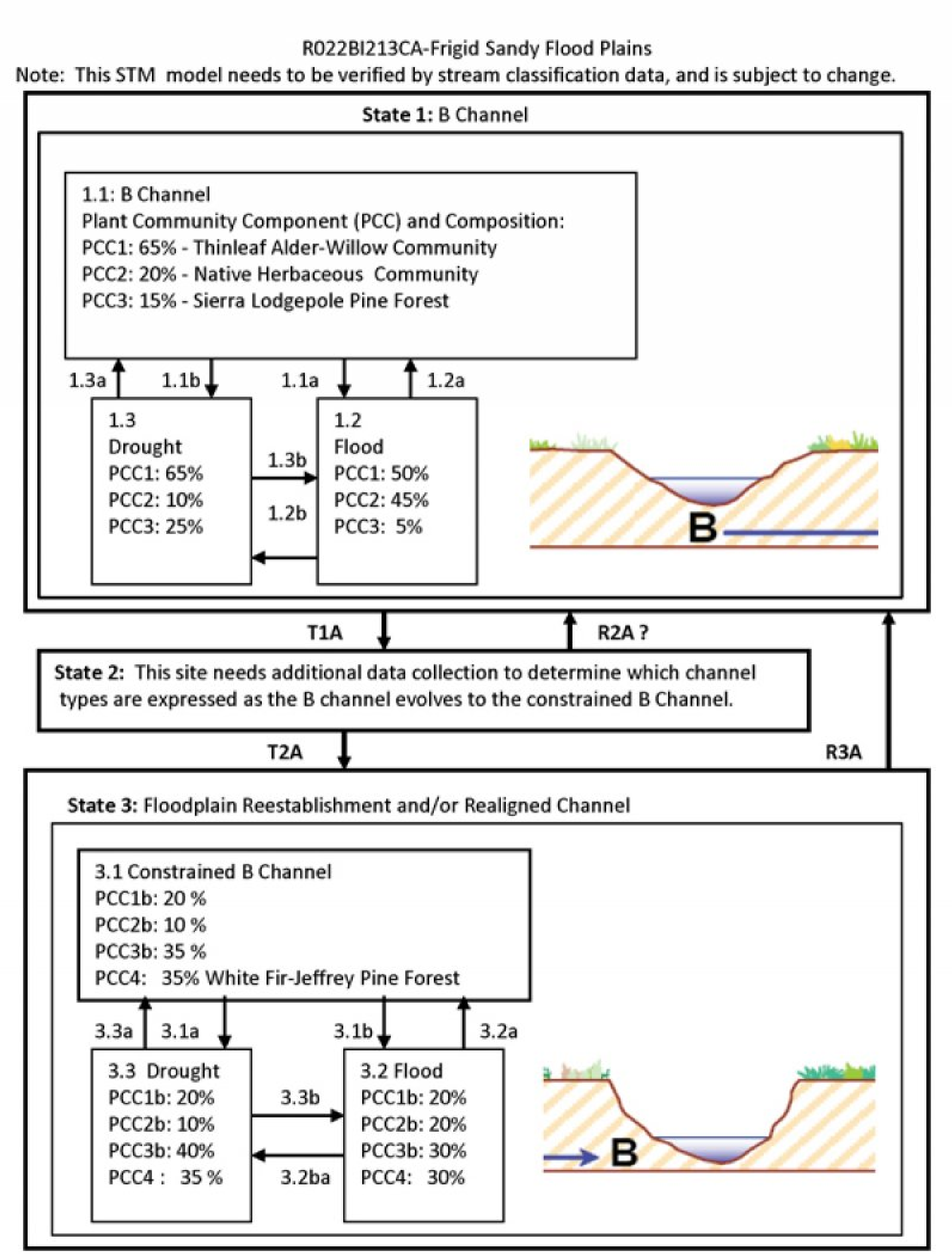

Figure 2. Frigid Sandy Flood Plains Model

State 1

B Channel

This state is a single thread B type channel found on the deep, coarse volcanic deposits erupted from Lassen Peak or in alluvium. B channels are considered moderately entrenched and have a moderate to high width to depth ratio. Sinuosity is moderate, resulting in a riffle-dominated channel with infrequently spaced scour pools. B type channels are sediment-limited systems but this site supports unstable gravel-bottom (B4) and sand bottom (B5) reaches that have high erosion potential. The sensitivity to disturbance is high for both B4 and B5 types and vegetation exerts a moderate controlling influence on stream dynamics. Obligate wetland species dominate the site in the undisturbed community phase. A shrub community of thinleaf alder/ willow is found on the stream banks of the active channel and the floodplain. A pioneer plant community of native herbs is found on recently exposed substrate, generally along the stream channel, but may also be found on upper side channels. The adjacent upland habitat is coniferous forest of Sierra lodgepole pine.

Community 1.1
B Channel

Figure 3. Sandy Flood Plains 2

Figure 4. Sandy Flood plains

The plant community along the B channel occurs in distinct zones related to variable water table depth and disturbance events. Approximately 65% of the total vegetation is a thinleaf alder/willow community that forms a continuous stringer immediately adjacent to the stream where the water table stays relatively high year round. Both thinleaf alder and Lemmon’s willow are flood and shade tolerant and act as an important stabilizing component of the streambank. These shrubs produce copious amounts of seeds in the fall and winter and seeds germinate immediately after dispersal when conditions are favorable. Germination and seedling establishment is optimal on exposed mineral substrate. Thinleaf alder may also reproduce vegetatively through spreading underground rhizomes or suckers, but Lemmon’s willow does not have this capacity. Both species can re-sprout vigorous following a top cut or fire. Streambanks anchored by these shrubs are stable and can withstand relatively severe spring runoff and flooding. As alder and willow thickets develop after floods finer fluvial deposits are trapped within the extensive root networks, facilitating soil development. In addition, thinleaf alder improves soil fertility through the addition of nitrogen to the soil from nitrogen-fixing root nodules and a nitrogen-rich leaf litter. The improved soil texture and fertility enables establishment and retention of an understory dominated by sedges. The extensive root mats formed by the sedge component further stabilizes the streambank. Drought and flood are the primary forces that drive transitions between the alternate community phases. A lower water table from prolonged drought facilitates encroachment of the upland community on the floodplain and an associated reduction in the thinleaf alder/ willow community. Conversely, a flood destroys sections of the riparian shrub community within the active channel and favors establishment of the pioneering native herb community that colonizes recently exposed substrate and provides valuable forage and habitat for wildlife. Plant Community Component (PCC) and Composition: PCC1: (65%)- Thinleaf Alder-Willow Community This is the plant community along the banks. Thinleaf alder (*Alnus incana* ssp. tenuifola) is the most common shrub but Lemmon’s willow (*Salix lemmonii*) and shining willow (*Salix lucida*) are occasionally present. Sedge (Carex spp.), willowherb (Epilobium spp.), fowl mannagrass (*Glyceria striata*), and field horsetail (*Equisetum arvense*) are present as well as scattered forbs listed in PCC2. PCC2: (20%)-Native Herbaceous Community This Plant community is found on point bars and floodplains. Common species are common yarrow (*Achillea millefolium*), Idaho bentgrass (*Agrostis idahoensis*), pearly everlasting (*Anaphalis margaritacea*), rosy pussytoes (*Antennaria rosea*), aster (Aster sp.), sedge (Carex sp.), cryptantha (Cryptantha sp.), slender hairgrass (Deschampsia elongate), squirreltail (*Elymus elymoides*), blue wildrye(*Elymus glaucus*), field horse tail (*Equisetum arvense*), meadow barley (*Hordeum brachyantherum*), rush (Juncus sp.), mountain rush (Juncus articus ssp. littoralis), dwarf mountain ragwort (*Senecio fremontii*), and cinquefoil (Potentilla spp.). PCC 3: (15%)- Sierra Lodgepole Pine Forest This moist lodgepole pine forest is present on rarely flooded floodplain. Sierra lodgepole pine (*Pinus contorta* ssp. murrayana) is dominant and provides 15-45 percent cover over a grassy understory. Some of the species listed in PCC2 are also in the understory. Common plants are western needlegrass (*Achnatherum occidentale*), California brome (*Bromus carinatus*), squirreltail (*Elymus elymoides*), blue wildrye (*Elymus glaucus*), (*Eriogonum pyrolifolium*), groundsmoke (Gayophytum sp.), meadow barley (*Hordeum brachyantherum*), (mountain rush (Juncus articus ssp. littoralis), Pacific lupine (*Lupinus lepidus*), bearded melicgrass (*Melica aristata*), and gooseberry (Ribes sp.).

Community 1.2
Flood

This community phase develops after a major flood event. The plant community components remain the same, as described in Community phase 1.1, but the proportion of each community type shifts after flooding scours sections of the active channel, exposing mineral substrate in some locations and depositing large quantities of sediment in other areas. The destruction of sections of the thinleaf alder/willow community in the channel is accompanied by a 25% increase in the herbaceous pioneer community as early seral grasses like squirreltail and herbs quickly colonize the recently exposed substrate. Some of the adjacent Sierra lodgepole pine community may also be destroyed by the flood and decline to only 5%. Estimate of plant community component composition in this phase: PCC1: 50% PCC2: 45% PCC3: 5%

Community 1.3
Drought

This community phase results from prolonged drought. Drought reduces the water flow in the stream and lowers the seasonal water table. A lower water table facilitates encroachment of the upland Sierra lodgepole pine forest on the floodplain and an associated reduction in the Native Herbaceous Community. Estimate of plant community component composition in this phase: PCC1: 65% PCC2: 10% PCC3: 25%

Pathway 1.1a
Community 1.1 to 1.2

This pathway is created when a flood scours the channel of existing vegetation, depositing a layer of sediment and initiating regeneration.

Pathway 1.1b
Community 1.1 to 1.3

This pathway is created by natural processes that cause the site to become drier, usually several years of drought.

Pathway 1.2a

Community 1.2 to 1.1

This pathway is created with time and allows for the recovery of the plant communities after the flood event.

Pathway 1.2b
Community 1.2 to 1.3

This pathway is created with prolonged periods of drought.

Pathway 1.3a
Community 1.3 to 1.1

This pathway is created when the site becomes wetter for natural reasons, such as the end of a drought cycle.

Pathway 1.3b
Community 1.3 to 1.2

This pathway is created when a flood causes bank erosion and sediment deposition.

State 2
Stream Channel Succession

B type channels can become unstable due to disturbances which impact the stream bank vegetation, change the flow regime, or alter the channel morphology. Overgrazing and excessive trampling by livestock can seriously reduce streambank stability. Additional stream classification data is required to determine which channel types are expressed as the B channel evolves in response to disturbance. Continued disturbance can entrench the stream. The Rosgen Stream Succession Scenario #6 diagram is displayed below. In this possible succession scenario, the “B” type channel in State 1 down-cuts into an entrenched low gradient “G” type channel that naturally begins to widen over time into an entrenched “Fb” type channel. The plant community components associated with these possible successional channel types is not known. However, deeply incised “G” and “Fb” channels generally lose the wetland obligate species and become dominated by upland grass, shrub and/or forest plant communities. As the water table lowers at the site, the adjacent conifer community of Sierra lodgepole pine and white fir would encroach and reduce the thinleaf alder and mixed willow riparian community. Upland grass species like blue wildrye and western neeedlegrass would begin to dominate the native herbaceous community. Eventually, a new entrenched “B” type channel may form that resembles the original “B” type channel. The entrenched channel still supports some wetland plant communities but it is constrained by terraces which have a upland plant communities.

Community 2.1
Stream Succession

Figure 5. Rosgen Stream Succession Scenario #6

Figure 6. Transitional Stream Channel

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State 3
Constrained B Channel

The constrained B Channel on this ecological site has further downcut through the deep, coarse volcanic deposits erupted from Lassen Peak. As sediment deposition in the broadly entrenched “F” type channel continued, the vegetation increases channel stability and eventually channel sinuosity returns and a new meandering channel will develop that has similar morphological features of the original B channel but is constrained by the old floodplain, which is now a hydrologically disconnected dry terrace. The obligate wetland species that dominate the site in the undisturbed community phase, have been reduced under the drier conditions, so that the riparian shrub community of thinleaf alder/ willow along the stream banks of the active channel now occupies only 20% of the total vegetation. The pioneer plant community of native herbs persists on recently exposed substrate, but may have more non-natives and a greater proportion of upland grasses than sedges. The adjacent upland Sierra lodgepole pine and mixed conifer forest is now the dominate vegetation.

Community 3.1
Constrained B channel

Figure 7. Constrained B Channel

The constrained B channel has similar morphological features of the original B channel, but the floodplain is now a hydrologically disconnected dry terrace. The water table is much lower and the adjacent upland Sierra lodgepole pine and mixed conifer forest is now the dominate vegetation. This community phase has the three plant community components of Community Phase 1.1, but the species composition has changed to include non-native species such as Kentucky bluegrass (*Poa pratensis*), common dandelion (Taraxicum officinale), common mullein (*Verbascum thapsus*), and rat-tail fescue (*Vulpia myuros*). The proportion of these community components has also shifted as the stream channel incised through the debris flow or glacial deposits, creating a dry terrace that supports much more upland forest (PCC4). The riparian communities are now confined to a smaller area within the new floodplain so that the thinleaf alder community/willow (PCC1b) now occupies only 20% of the total vegetation and the herbaceous community (PCC2b) comprises only 10%. The sedges along the channel have been replaced by grasses because of lower water tables. The Sierra lodgepole pine forest (PCC3b) occupies more area on the dry terrace and the adjacent White Fir-Jeffrey Pine Forest (PCC4) has encroached so that upland vegetation may eventually occupy 70% of the formerly riparian vegetation. PCC1b: (20%) - Thinleaf Alder-Willow Community This plant community along exist along the active stream banks. Thinleaf alder (*Alnus incana* ssp. tenuifola) is the most common shrub but Lemmon's willow (*Salix lemmonii*) and shining willow (*Salix lucida*) are occasionally present. Sedge (Carex spp.), willowherb (Epilobium spp.), fowl mannagrass (*Glyceria striata*), and field horsetail (*Equisetum arvense*) are present as well as scattered forbs listed in PCC2b. PCC2b: (10%) - Herbaceous Community This plant community is found on point bars and floodplains. Common species are common yarrow (*Achillea millefolium*), Idaho bentgrass (*Agrostis idahoensis*), pearly everlasting (*Anaphalis margaritacea*), rosy pussytoes (*Antennaria rosea*), aster (Aster sp.), sedge (Carex sp.), cryptantha (Cryptantha sp.), slender hairgrass (*Deschampsia elongata*), squirreltail (*Elymus elymoides*), blue wildrye (*Elymus glaucus*), field horse tail (*Equisetum arvense*), meadow barley (*Hordeum brachyantherum*), rush (Juncus sp.), mountain rush (Juncus articus ssp. littoralis), dwarf mountain ragwort (*Senecio fremontii*), and cinquefoils (Potentilla spp.). PCC3b: (35%) - Sierra Lodgepole Pine Forest This moist lodgepole pine forest is present on upper floodplains or low terraces. Sierra lodgepole pine (*Pinus contorta* ssp. murrayana) is dominant and provides 15-45 percent cover over a grassy understory. Some of the species listed in PCC2b are also in the understory. Common plants are western needlegrass (*Achnatherum occidentale*), California brome (*Bromus carinatus*), squirreltail (*Elymus elymoides*), blue wildrye (*Elymus glaucus*), (*Eriogonum pyrolifolium*), groundsmoke (Gayophytum sp.), meadow barley (*Hordeum brachyantherum*), mountain rush (Juncus articus ssp. littoralis), Pacific lupine (*Lupinus lepidus*), bearded melicgrass (*Melica aristata*), and gooseberry (Ribes sp.) PCC4: (35%) - White fir-Jeffrey Pine Forest This forest community is present on upper terraces. It is dominated by white fir (*Abies concolor*) and Jeffrey pine (*Pinus jeffreyi*), with some Sierra lodgepole pine (*Pinus contorta* ssp. murrayana). The understory has moderate cover of grasses and forbs. Common plants are western needlegrass (*Achnatherum occidentale*), California brome (*Bromus carinatus*), squirreltail (*Elymus elymoides*), groundsmoke (Gayophytum sp.), and Kentucky bluegrass (*Poa pratensis*). Once this community has established on the terraces, it is less involved with the riparian stream dynamics and more influenced by forest dynamics which involve forest pathogens and fire. Please refer to the White Fir-Jeffrey Pine Ecological Site Description (F022BI103CA) or the Jeffrey pine- Fir Forest Ecological Site Description (F022BI106CA) for more information regarding forest dynamics and succession. At higher elevations California red fir replaces white fir on this landscape position (F022BI115CA). A Quaking aspen (*Populus tremuloides*)- Sierra lodgepole pine (*Pinus contorta* ssp. murrayana) ecological site (F022BI105CA) is adjacent to the riparian corridor at lower elevations on broad valleys. The production data in the table below is a compilation of all the community types. ESIS does not currently support multiple tables for several community types in one phase. To identify species by plant community component refer to the narrative above rather than the table.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	960	2800	6413
Grass/Grasslike	6	115	239
Forb	0	30	49
Total	**966**	**2945**	**6701**

Community 3.2 Flood

This community phase develops after flooding scours sections of the active channel, exposing mineral substrate in some locations and depositing sediment in other areas. Since the channel is constrained, the old flood plain is now a hydrologically disconnected terrace with a much lower water table. Flooding destroys large sections of the thinleaf alder/willow community in the channel but the herbaceous pioneer community reestablishes and expands on the newly exposed substrates. Some of the upland Sierra lodgepole pine and mixed conifer forest community is destroyed on the dry terrace, but upland vegetation still dominates the formerly riparian vegetation. Estimate of plant community component composition in this phase: PCC1b: 20% PCC2b: 20% PCC3b: 30% PCC4: 30%

Community 3.3
Drought

This community phase results from prolonged drought. Drought reduces the water flow in the stream and lowers the seasonal water table. A lower water table facilitates further encroachment of the upland Sierra lodgepole pine and adjacent mixed conifer forest on the floodplain, so that upland vegetation may eventually occupy 75% of the formerly riparian vegetation. The thinleaf alder/willow community is able to persist as does the herbaceous community, but the species composition likely shifts to favor grasses over sedges and some non-natives. Estimate of plant community component composition in this phase: PCC1b: 20% PCC2b: 10% PCC3b: 40% PCC4 : 35%

Pathway 3.1b
Community 3.1 to 3.2

This pathway is created when a flood creates erosion and deposition, leaving barren soil for early successional species to establish.

Pathway 3.1a
Community 3.1 to 3.3

This pathway is created by natural processes that cause the meadow to become drier. Several years of drought may cause this.

Pathway 3.2a
Community 3.2 to 3.1

This pathway is created with time and allows for the recovery of the plant communities after a flood event.

Pathway 3.2b
Community 3.2 to 3.3

This pathway is created when the site becomes drier due to drought or other causes.

Pathway 3.3a
Community 3.3 to 3.1

This pathway is created when the site becomes wetter for natural reasons, such as the end of a drought cycle.

Pathway 3.3b
Community 3.3 to 3.2

This pathway is created when a flood leaves barren soil from erosion or deposition, allowing the pioneer plant community to increase in area.

Transition T1A
State 1 to 2

This transition can occur naturally as the “B” type channel in State 1 down-cuts through the deep coarse volcanic deposits erupted from Lassen Peak. The channel on this site supports gravel-bottom (B4), and sand bottom (B5) reaches which have high erosion potentials. Bank erosion is a natural river adjustment process and can as the result of mass wasting, liquification, freeze-thaw, fluvial entrainment, and ice scour. The coarse colluvial and alluvial deposits in the valley bottom are gradually eroded through these processes. This transition can be initiated by a disturbance that alters the hydrology of the site including channel realignment and/or confinement, culvert installations, and road construction. Such alterations straightened the channel, eliminating its ability to meander. This increases the shear stress along the stream bank, which accelerates stream bank erosion, thereby increasing sediment supply and decreasing sediment transport capacity. As the channel straightens it has a shorter course down the valley, creating a steeper gradient. The stream may adjust by headcutting into the base level of the channel until it establishes a new gradient through the meadow. As the stream bed is lowered, so is the water table in the meadow. The new larger and steeper channel can contain more flow, reducing the frequency of flooding and the extent of the floodplain, creating terraces. Disturbances such as cattle grazing and/or the seeding of non-native grass for forage that impacts the vegetation along the stream bank can cause a similar entrenchment of the channel but through a different mechanism. When cattle reduce vegetation and trample the exposed stream banks, the resulting erosion also leads to eventual straightening and headcutting of the channel. Likewise, when non-native grasses displace the native riparian sedges and rushes, the stabilizing root mats that help prevent erosion are also removed.

Restoration pathway R2A
State 2 to 1

Additional stream classification data is required to determine which channel types are expressed in State 2 as the B channel evolves in response to disturbance. Without this data it is not possible to identify the restoration pathway for the intermediate phase of the stream succession scenario.

Transition T2A
State 2 to 3

This transition occurs when continued sediment deposition in the broadly entrenched “Fb” type channel allows riparian vegetation to reestablish on the new floodplain. The vegetation increases channel stability and eventually channel sinuosity returns creating a new “B” type channel that is more entrenched and constrained than the original “B” channel.

Restoration pathway R3A
State 3 to 1

The processes that have altered this stream system may be natural or human-influenced. If the primary reason for channel adjustment is a result of natural erosion through the debris or glacial deposits, the channel should be fairly well readjusted and left alone. However, if human caused disturbance has caused the erosion, then restoration procedures should be considered. The goal of restoration is to return the channel to its full potential, which is defined as the best channel condition, based on quantifiable morphological characteristics of that stream type. For a constrained B channel the goal is to raise the water table, increase the channel sinuosity, and re-establish riparian vegetation on the stream banks to reduce bank erosion. Each segment of the stream channel should be surveyed to determine the evolutionary stages of channel adjustment and evaluate the potential for natural recovery. If natural recovery does not seem likely, a thorough stream departure analysis can determine the feasibility of restoration, anticipate response to future changes in management, and develop appropriate restoration designs.

Additional community tables

Table 6. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			960–6413	
	shining willow	SALU	*Salix lucida*	0–2913	0–40
	thinleaf alder	ALINT	*Alnus incana ssp. tenuifolia*	900–2600	10–27
	Lemmon's willow	SALE	*Salix lemmonii*	60–900	1–12
Grass/Grasslike					
1	**Grass/ grasslike**			6–239	
	sedge	CAREX	*Carex*	0–65	0–20
	western needlegrass	ACOC3	*Achnatherum occidentale*	0–34	0–18
	squirreltail	ELEL5	*Elymus elymoides*	3–34	1–18
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	3–30	1–10
	fowl mannagrass	GLST	*Glyceria striata*	0–20	0–6
	blue wildrye	ELGL	*Elymus glaucus*	3–20	1–5
	meadow barley	HOBR2	*Hordeum brachyantherum*	0–18	0–6
	Idaho bentgrass	AGID	*Agrostis idahoensis*	0–6	0–3
	California brome	BRCA5	*Bromus carinatus*	0–6	0–3
	slender hairgrass	DEEL	*Deschampsia elongata*	0–6	0–2
Forb					
1	**Forbs**			0–49	
	common yarrow	ACMI2	*Achillea millefolium*	0–15	0–3
	field horsetail	EQAR	*Equisetum arvense*	0–7	0–2
	western pearly everlasting	ANMA	*Anaphalis margaritacea*	0–6	0–2
	dwarf mountain ragwort	SEFR3	*Senecio fremontii*	0–6	0–2
	aster	ASTER	*Aster*	0–5	0–1
	Pacific lupine	LULE2	*Lupinus lepidus*	0–3	0–1
	cinquefoil	POTEN	*Potentilla*	0–2	0–2
	cryptantha	CRYPT	*Cryptantha*	0–2	0–2
	willowherb	EPILO	*Epilobium*	0–1	0–1
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–1	0–1
	groundsmoke	GAYOP	*Gayophytum*	0–1	0–1

Animal community

This site provides valuable wildlife resources such as water and cover. Thinleaf alder and willow communities often serve as travel corridors for big game animals such as deer and many bird species utilize these riparian corridors for nesting and brood rearing. Overhanging alder and willow branches provide shade and cover for salmonids. In addition, wildlife and livestock depend on the leaves, stems, and seeds of Nebraska sedge, tufted hairgrass, and other various grasses and sedges as forage. The sedges and bunchgrasses provide nesting habitat for waterfowl and cover and forage for small mammals.

Hydrological functions

The hydrological function of the flood plain is to provide a catchment for water, sediments, and nutrients. Floodplains may also provide water storage, which is slowly released down the drainage throughout the year.

Recreational uses

These streams provide scenic hiking corridors with wildlife viewing, fishing and photographic opportunities.

Inventory data references

The following NRCS vegetation plots have been used to describe this ecological site:

789139- Type location
789259

Type locality

Location 1: Shasta County, CA	
Township/Range/Section	T31 N R4 E S14
UTM zone	N
UTM northing	4487581
UTM easting	627919
General legal description	The type location is about 0.36 miles south-southeast of Hot Rock, in Lassen Volcanic National Park.

Other references

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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:**

17. **Perennial plant reproductive capability:**