Ecological Site Description ID:	R236XY119AK—Boreal Herbaceous Loamy Flood Plains

Ecological Dynamics of the Site:

This boreal ecological site is located on lowland mid flood plains that are not in a channel. These areas are typically found at elevations between sea level and 220 feet with slopes of 0 to 2 percent. Slope aspect does not appear to influence the plant community dynamics of this site as it is found on all aspects.

This ecological site is correlated to soil component D36-Boreal grass loamy flood plains. Soil characteristics that are likely to influence plant community dynamics include a cryic soil temperature regime, an aquic moisture regime with slow soil permeability to a depth of 40 inches, and a moderately acidic to very strongly acidic (pH 5.9 to 4.8) first mineral horizon. These soils are poorly drained and have medium runoff potential. Organic material content is commonly 1 to 8 percent in the surface layer. Annual precipitation is between 24 and 35 inches, and the annual frost-free period ranges from 85 to 140 days. Parent material consists of grassy organic material over coarse-loamy alluvium over sandy and gravelly alluvium.

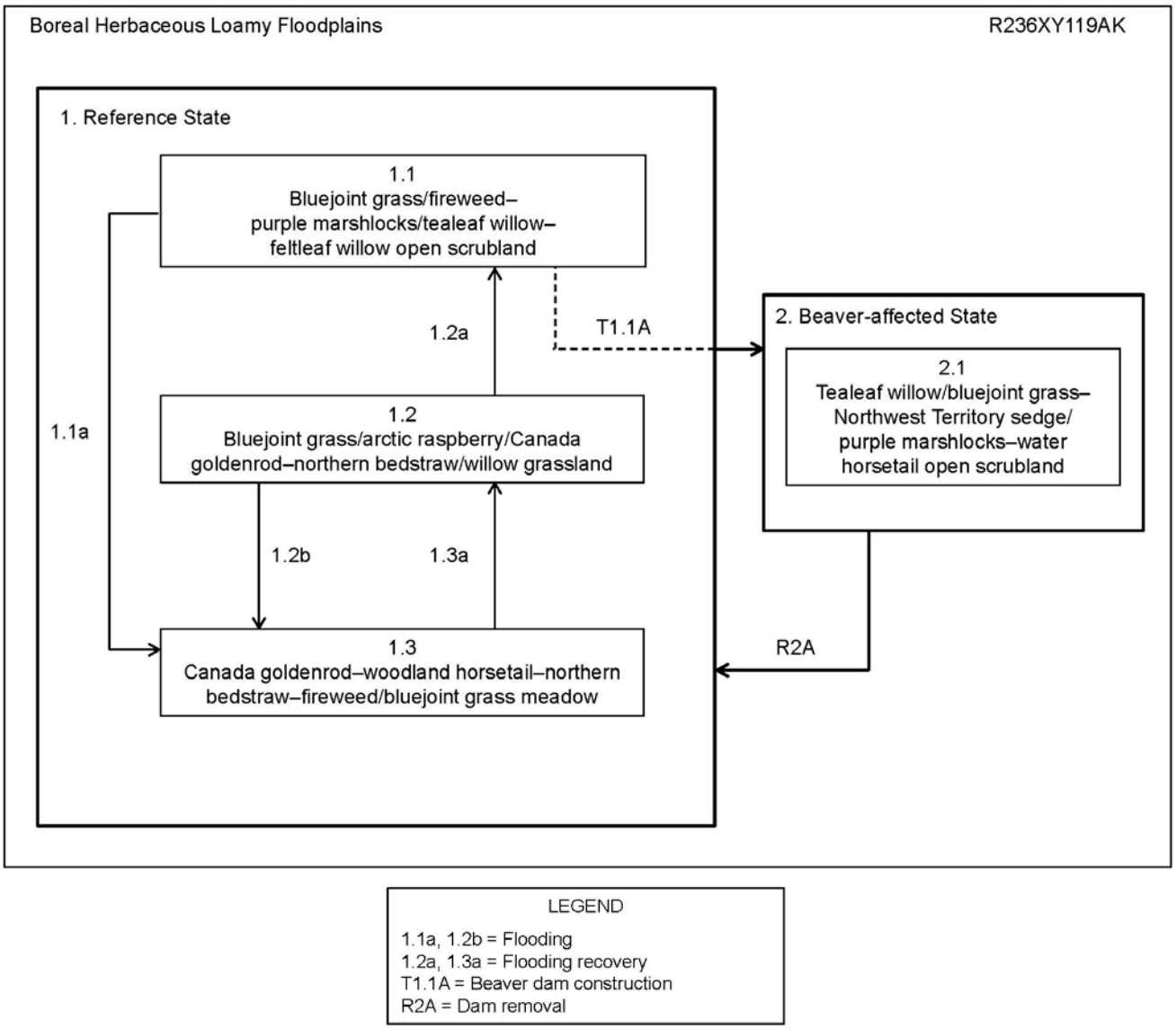
The reference community phase is typified by open willow scrubland with open areas of bluejoint grass (*Calamagrostis canadensis*) and diverse forbs. When compared to other ecological sites on lowland mid flood plains, this ecological site is unique in that it is exclusively in areas that are cut by a deep river channel that occasionally overflows. This creates a flooding disturbance regime and soil moisture gradient that is distinctly different from those of ecological sites R236XY120AK (Boreal Scrub Loamy Flood Plains, Open), R236XY121AK (Boreal Scrub Loamy Flood Plains), and R236XY158AK (Boreal Scrub Loamy Flood Plains, Moist). Differences in soil moisture (all other sites have an udic moisture regime) and disturbance regimes (including flooding frequency and duration) create distinct reference states and community phases, making the use of unique ecological sites necessary.

Flooding is the major documented disturbance regime for this ecological site, and it is considered to be a natural event that is typically unmanaged. It results in three distinct vegetative phases within the reference state. The generally low elevation, minimal slope, and presence of a bisecting deep river channel make this ecological site susceptible to flooding. Very brief, occasional periods of flooding occur from April through October. The available background information suggests that the intensity of flooding and time elapsed since the last flood have a critical effect on the distribution and abundance of vegetation in Alaskan riverine systems (Wohl, 2007). Flooding can lead to plant succession by creating barren, moist colonization spots, burying organic layers, adding nutrients to the soil, and depositing seed banks (Rood *et al.,* 2007; Yarie *et al.,* 1998). Occasional, brief periods of ponding can occur from April through October as well, and a seasonal water table commonly is present in May and June. Ponding during the growing season may affect the composition of the plant community, as the hypoxic or anoxic conditions caused by ponding are a major abiotic stress that helps to determine the presence or absence of vascular plants (Vartapetian and Jackson, 1996). Ponding associated with snowmelt, precipitation, and flooding may play a role in determining the types of plants in this ecological site and the time and frequency of transitions between community phases.

Slight to severe browsing in summer by moose on willows and forbs has been recorded in the reference phase community, which may contribute to keeping the willow stands patchy rather than ubiquitous. This browsing, however, does not significantly affect the structure and function of the community or ecological site.

Some areas of this ecological site are affected by beavers. Hydrophilic forbs, graminoids, and willows typically surround the ponded areas upstream from beaver dams. Following blowout of a dam, either by man or natural causes, the area is expected to return to the reference state, though *in situ* observation of this has not been documented.

State and Transition Diagram:



State ID Number:	1	State Name:	Reference State
State Narrative:	The reference state supports three community phases, grouped by the structure and dominance of the vegetation (e.g., graminoids, shrubs, and forbs) and their ecological function and stability. The presence of these three communities is temporally dictated by the occasional periods of flooding associated with the landform. The reference community phase is represented by open scrubland with graminoids and forbs throughout. A transition to an alternate state is caused by the damming of a nearby waterway by beavers (*Castor canadensis*). This report provides baseline vegetation inventory data for this ecological site. Future data collection is needed to provide further information about existing plant communities and the disturbance regimes that would result in transitions from one community to another.		
Phase 1.1			
Community Phase Number:	1.1	Community Phase Name:	Bluejoint grass/fireweed-purple marshlocks/tealeaf willow-feltleaf willow scrubland
Community Phase Narrative:			
The reference community phase is characterized by open willow scrubland with areas of grass and diverse forbs throughout. Annual production is visually estimated to be highest among shrubs followed by graminoids and forbs, though this could vary depending on the location within the community. Typically, this community contains patchy medium and tall tealeaf willow (*Salix pulchra*) and feltleaf willow (*Salix alaxensis*) with open areas of bluejoint grass (*Calamagrostis canadensis*), arctic raspberry (*Rubus arcticus*), and various forbs, including fireweed (*Chamerion angustifolium*), purple marshlocks (*Comarum palustre*), and northern bedstraw (*Galium boreale*). Other species may include tall Jacob's-ladder (*Polemonium acutiflorum*), kneeling angelica (*Angelica genuflexa*), Canada goldenrod (*Solidago canadensis*), fewflower meadow-rue (*Thalictrum sparsiflorum*), horsetails (*Equisetum spp.*), and others. Individual medium and/or regenerative trees, including balsam poplar (*Populus balsamifera*), paper birch (*Betula papyrifera*), and white spruce (*Picea glauca*) may also be present. Mosses commonly are present (total mean cover ~ 28 percent). Other ground cover generally includes herbaceous litter (~79 percent) and woody litter (~4 percent).			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
S	Tealeaf willow	*Salix pulchra*	SAPU15	75.0	18.1
S	Feltleaf willow	*Salix alaxensis*	SAAL	56.3	23.7
S	Arctic raspberry	*Rubus arcticus*	RUAR	87.5	10.6
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100.0	62.8
F	Fireweed	*Chamerion angustifolium*	CHAN9	87.5	4.9
F	Northern bedstraw	*Galium boreale*	GABO2	87.5	6.2
F	Purple marshlocks	*Comarum palustre*	COPA28	75.0	11.1
F	Canada goldenrod	*Solidago canadensis*	SOCA6	75.0	10.8
F	Kneeling angelica	*Angelica genuflexa*	ANGE2	56.3	8.1
F	Horsetails	*Equisetum spp.*	EQUIS	37.5, 25.0, 31.3^	4.5, 12.5, 27.0

^ Horsetails (*Equisetum spp.*) are represented by three species: *E. arvense, E. pratense,* and *E. sylvaticum,* respectively.

Community Pathways

Pathway Number	Pathway Name & Description
1.1a	Flooding. Flooding can inundate these mid flood plain areas, commonly eroding the soil and scouring the vegetation. Free from space and light constraints, fast-growing, hydrophilic pioneer forbs and graminoids may colonize. Seeds of these species commonly are dispersed by wind or water. The time needed for plants to colonize is unknown, but it is hypothesized to begin shortly after flooding has subsided.

Phase 1.2			
Community Phase Number:	1.2	Community Phase Name:	Bluejoint grass/arctic raspberry/Canada goldenrod-northern bedstraw/willow grassland
Community Phase Narrative:			
This is the late flooding community phase. It is characterized by grassland with various forbs throughout. Annual plant production is visually estimated to be highest among graminoids with less production in the forb and shrub groups. Overall production is hypothesized to be less in this community than in the reference community phase due to the lower abundance of shrubs, though dense graminoids may partially or fully negate the loss of shrub production. Typically, this community consists of dense bluejoint grass (*Calamagrostis canadensis*) with arctic raspberry (*Rubus arcticus*) and scattered forbs throughout. The forbs may include any or all of the following—northern bedstraw (*Galium boreale*), tall Jacob's-ladder (*Polemonium acutiflorum*), Canada goldenrod (*Solidago canadensis*), marsh pea (*Lathyrus palustris*), horsetails (*Equisetum spp.*), and other generally less common or abundant species. Mosses are generally in the ground cover (total mean cover ~23 percent). The ground cover also commonly includes herbaceous litter (~90 percent) and woody litter (~2 percent). About 13 percent is bare soil.			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
S	Arctic raspberry	*Rubus arcticus*	RUAR	100.0	14.2
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100.0	79.0
F	Canada goldenrod	*Solidago canadensis*	SOCA6	80.0	13.3
F	Northern bedstraw	*Galium boreale*	GABO2	100.0	5.4
F	Tall Jacob's-ladder	*Polemonium acutiflorum*	POAC	100.0	2.9
F	Marsh pea	*Lathyrus palustris*	LAPA4	80.0	Trace
F	Horsetails	*Equisetum spp.*	EQUIS	20.0, 40.0, 40.0^	5.0, 15.0, 47.5

^ Horsetails (*Equisetum spp.*) are represented by three species—*E. arvense, E. pratense,* and *E. sylvaticum,* respectively.

Community Pathways

Pathway Number	Pathway Name & Description
1.2a	Natural succession: Normal time and growth without disruptive flooding. It is probable that as time passes, willows (*Salix spp.*) will colonize and outcompete bluejoint grass (*Calamagrostis canadensis*) for light and space. The time needed for this transition to occur is currently unknown; however, it is likely to depend at least partially on factors such as the distance to the nearest seed source and the availability of suitable seeding habitat.
1.2b	Flooding. The flooding regime for this ecological site is occasional (5 to 50 flooding events per 100 years). The specific frequency and duration required to initiate a community transition is currently unknown. If a flooding occurs during the late flooding community phase, it is expected that community phase 1.2 will transition to the early flooding community phase, as described by pathway 1.1a.

Phase 1.3			
Community Phase Number:	1.3	Community Phase Name:	Canada goldenrod-woodland horsetail-northern bedstraw-fireweed/bluejoint grass meadow
Community Phase Narrative:			
This is the early flooding community phase. It is characterized by a forb meadow with interspersed graminoids. Annual plant production is visually estimated to occur dominantly in the forb group. With fewer graminoid and shrub species, overall production is hypothesized to be less than that of the late flooding and reference community phases. Typically, this community consists of various forbs, including Canada goldenrod (*Solidago canadensis*), northern bedstraw (*Galium boreale*), woodland horsetail (*Equisetum sylvaticum*), and fireweed (*Chamerion angustifolium*) with bluejoint grass (*Calamagrostis canadensis*) throughout. Rough bentgrass (*Agrostis scabra*), arctic raspberry (*Rubus arcticus*), larkspurleaf monkshood (*Aconitum delphiniifolium*), fewflower meadow-rue (*Thalictrum sparsiflorum*), and tall bluebells (*Mertensia paniculata*) may also be included. Mosses generally are present (total mean cover ~66 percent). The ground cover also commonly includes herbaceous litter (~63 percent) and a trace amount of woody litter. Areas of bare soil are also included. Individual medium and regenerative trees may be in this community, particularly in areas where it is adjacent to forested or woodland ecological sites that are not affected by flooding.			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100.0	16.4
F	Canada goldenrod	*Solidago canadensis*	SOCA6	100.0	44.0
F	Larkspurleaf monkshood	*Aconitum delphiniifolium*	ACDE2	100.0	Trace
F	Northern bedstraw	*Galium boreale*	GABO2	100.0	6.6
F	Woodland horsetail	*Equisetum sylvaticum*	EQSY	80.0	51.3
F	Fireweed	*Chamerion angustifolium*	CHAN9	80.0	10.0
F	Fewflower meadow-rue	*Thalictrum sparsiflorum*	THSP	80.0	Trace
F	Tall bluebells	*Mertensia paniculata*	MEPA	60.0	2.3

Community Pathways	
Pathway Number	Pathway Name & Description
1.3a	Natural succession: Normal time and growth without disruptive flooding. It is likely that as time passes without further flooding, the existing population of graminoids will likely increase. Many extant forbs that are unable to thrive under competition for space and sunlight may decrease in abundance. The time required for this to occur is unknown, but it is hypothesized to be short as seed production among graminoids such as bluejoint grass can be exceptionally high.

State ID Number:	2	State Name:	Beaver-affected Areas
State Narrative:	This alternative state results from beaver ponding. Beavers (*Castor canadensis*) directly kill trees and large shrubs for use as food and in dam construction, and they also indirectly killing these species and other plant species by causing a rise in the water table (FS-R10-FHP, 2013). The ponding associated with this area generally creates a plant community different from that normally found on these flood plains. This plant community commonly includes resilient individuals and species extant in the reference community phase as well as pioneer hydrophilic species. The permanent ponding associated with areas upstream of beaver dams can negate the influence of flooding on the soils and vegetation. The plant community is likely to remain relatively stable until the dam is removed. When the dam is removed, by natural dam blowing, beaver abandonment, or human intervention, it is thought that the plant community will revert back to the reference state, though further research is needed to quantify the *in situ* outcome of this process. Browsing of willow by moose can be severe in these areas. This browsing may prevent willows from becoming dominant in the community, thereby maintaining the open scrubland.		

Phase 2.1			
Community Phase Number:	2.1	Community Phase Name:	Tealeaf willow/bluejoint grass-Northwest Territory sedge/purple marshlocks-water horsetail open scrubland
Community Phase Narrative:			
This community phase is associated with areas surrounding beaver ponds. It is characterized by open scrubland with facultative to obligate graminoids and forbs throughout. Annual plant production is visually estimated to be relatively equal among the shrub, graminoid, and forb groups, though local high production is expected in areas where a plant group is densest. Overall production is hypothesized to be less than that of the reference community phase due to a lower abundance of shrubs and a poorer growing habitat. Typically, this community phase consists of patchy tealeaf willow (*Salix pulchra*) with ubiquitous bluejoint grass (*Calamagrostis canadensis*), Northwest Territory sedge (*Carex utriculata*), purple marshlocks (*Comarum palustre*), and water horsetail (*Equisetum fluviatile*). Other species include silvery and Lyngbye's sedges (*Carex canescens* and *C. lyngbyei*), cottongrasses (*Eriophorum spp.*), arctic raspberry (*Rubus arcticus*), and Mackenzie's water hemlock (*Cicuta virosa*). The ground cover commonly consists of mosses, herbaceous litter, and woody litter. Areas of open water and bare soil are also included.			

Community Phase Canopy Cover

(Vegetation data in the table are provided as constancy (percent) and average canopy cover (percent) of the most dominant and ecologically relevant species for this community phase.)

Plant group	Common name	Scientific name	USDA plant code	Constancy (percent)	Average canopy cover (percent)
S	Tealeaf willow	*Salix pulchra*	SAPU15	100.0	25.0
S	Arctic raspberry	*Rubus arcticus*	RUAR	100.0	5.0
G	Bluejoint grass	*Calamagrostis canadensis*	CACA4	100.0	45.0
G	Northwest Territory sedge	*Carex utriculata*	CAUT	100.0	5.0
F	Purple marshlocks	*Comarum palustre*	COPA28	100.0	35.0
F	Water horsetail	*Equisetum fluviatile*	EQFL	100.0	6.0

Note: The vegetation and soils for this plant community phase were sampled at one location. Due to the limited data available for this community phase, personal field observations were used to aid in describing this plant community.

State Transitions and Restoration Pathways

State Transition Pathways			
Transition Number	From	To	Transition Narrative
T1.1A	1	2	This transition is caused by the damming of a water source by beavers. Areas surrounding beaver ponds typically support plant assemblages distinctly different from those typically on these mid flood plains. The vegetative community consists of species that are water tolerant and can reproduce in wet soils. These areas are susceptible to flooding and ponding after rainfall and snowmelt, thereby preventing the vegetative community from supporting nonhydrophilic pioneer species, which may keep the composition relatively stable. The time required for this transition to occur depends on the presence and activity of beavers.

State Restoration Pathways			
Restoration Pathway Number	From	To	Restoration Pathway Narrative
R2A	2	1	The restorative pathway to the reference state occurs when a beaver dam bursts as a result of flood damage, beaver inactivity, or anthropogenic means. Once a dam is removed, it is thought that the community will transition to the reference state. This is contingent on various factors such as the existing seed bank, propagule recruitment, return of the natural flooding regime, and the length of time a dam was in place. Further research and *in situ* documentation is needed to fully describe this transition.

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This report is interim and subject to change.