Sensitive Ecosystems Inventory: Central Okanagan, 2000 – 2001

Volume 2: Terrestrial Ecosystem Mapping, Surface Erosion and Slope Stability, and Expanded Legend

September, 2004

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Acknowledgements

This project has been very much a team effort. We would like to thank and acknowledge the many people that have helped with this project. This project has also used the foundation built and experience shared by people that worked on the earlier Vancouver Island Sensitive Ecosystem Inventory.

The Regional District of the Central Okanagan and the Habitat Conservation Trust Fund provided funding for this project. The Ministry of Sustainable Resource Management donated many in-kind hours.

Project management was provided by *Steve Gormley* and *Todd Cashin*, Regional District of the Central Okanagan, *Carmen Cadrin*, Ministry of Sustainable Resource Management, and *Kristi Iverson*, Iverson & MacKenzie Biological Consulting Ltd.

Field work was completed by *Kristi Iverson*, and *Carmen Cadrin*, *Corey Erwin*, *Larry Lacelle*, *Ted Lea*, *Robert Maxwell*, *Sal Rasheed*, *Calvin Tolkamp*, *Deepa Spaeth Filatow* and *Debbie Webb*, (Ministry of Sustainable Resource Management), and *Mike Sarell* and *Alison Haney* (Ophiuchus Consulting), and *Christina Sinneman* (British Columbia Conservation Foundation). *Ken MacKenzie*, Iverson & MacKenzie Biological Consulting Ltd. volunteered several days of field assistance. Collected plant specimens and mosses were identified by *Terry McIntosh*, Biospherics Environmental Inc.

Ecosystem mapping and expanded legends were done by *Kristi Iverson* and *Corey Erwin*, and were reviewed by *Carmen Cadrin* and *Ted Lea*. Bioterrain mapping and interpretations were done by *Christina Sinneman*, *Larry Lacelle,* and *Deepa Spaeth Filatow* and reviewed by *Robert Maxwell*.

Tim Brierley, Ministry of Sustainable Resource Management, *Bruce Ganton* and *Iain Lawrence*, Regional District of the Central Okanagan, and *Bon Lee*, Baseline Geomatics Inc. completed digital, GIS and cartography work.

Terry Gunning and *Jo-Anne Stacey* (Ministry of Sustainable Resource Management), and *Lavyna Alexander* and *Edwin Hubert* provided technical assistance.

Helpful review comments on the draft report were provided by *Robert Maxwell*, *Les Gyug*, and *Richard Cannings*. Additional review comments were provided by *Leah Hartley*, *Steve Gormley*, *Todd Cashin*, and *Ken Arcuri* (Regional District of the Central Okangan).

We would like to thank the landowners that provided us with access to their lands for sampling. Without their support, this project would not have been possible.

Introduction

This report presents detailed information on ecosystems in the Central Okanagan. It is the second volume in a series of three volumes.

Volume 2, this report, provides detailed information on terrestrial ecosystem mapping (TEM) methods and gives descriptions of each of the ecosystems that occur within the sensitive ecosystems or other important ecosystems categories described in Volume 1. Appendix B of Volume 1 provides tables that can be used to cross-reference between sensitive and other important ecosystems units and ecosystem mapping units in this report.

This report describes the natural setting of the study area and details methods, results and recommendations for bioterrain mapping, ecosystem mapping, and slope stability and erosion potential mapping. It is intended for use by professionals that require more detailed ecological and terrain information. It is recommended for use by people interested in developing other interpretive map themes from the ecosystem or terrain mapping.

Volume 1[1] is intended for people and organizations that need information to help conserve and protect remaining sensitive and important ecosystems in the Central Okanagan and other similar areas. It is also intended to provide information and advice to landowners and developers on how to minimize and avoid possible degradation of sensitive ecosystems due to land use and development activities.

Volume 3[2] contains wildlife habitat mapping themes developed from the terrestrial ecosystem mapping (TEM) for ten species. Wildlife habitat mapping portrays the potential importance of each ecosystem to specific animal species through a species-habitat model. The model assigns ratings to different ecosystem units from the TEM based on the needs of the species for particular life requisites. These ratings are displayed on wildlife habitat maps. Volume 3 is intended for professionals who require more detailed information on wildlife habitat values in the study area than Volume 1 provides.

[1] Iverson and Cadrin 2003

[2] Sarell et al. 2003

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1 Study Area

The study area is located along the western edge of Lake Okanagan and on the eastern edge of the City of Kelowna (Figure 1). It lies wholly within the Regional District of the Central Okanagan. There are two biogeoclimatic subzones within the study area: the Okanagan Very Dry Hot Ponderosa Pine (PPxh1) and the Okanagan Very Dry Hot Interior Douglas-fir Variant (IDFxh1). These areas are the drier portions of the valley that face more threats and support more threatened and endangered ecosystems and species than the adjacent moister, higher elevation areas. The upper boundary of the IDFxh1 also forms part of the study area boundary.

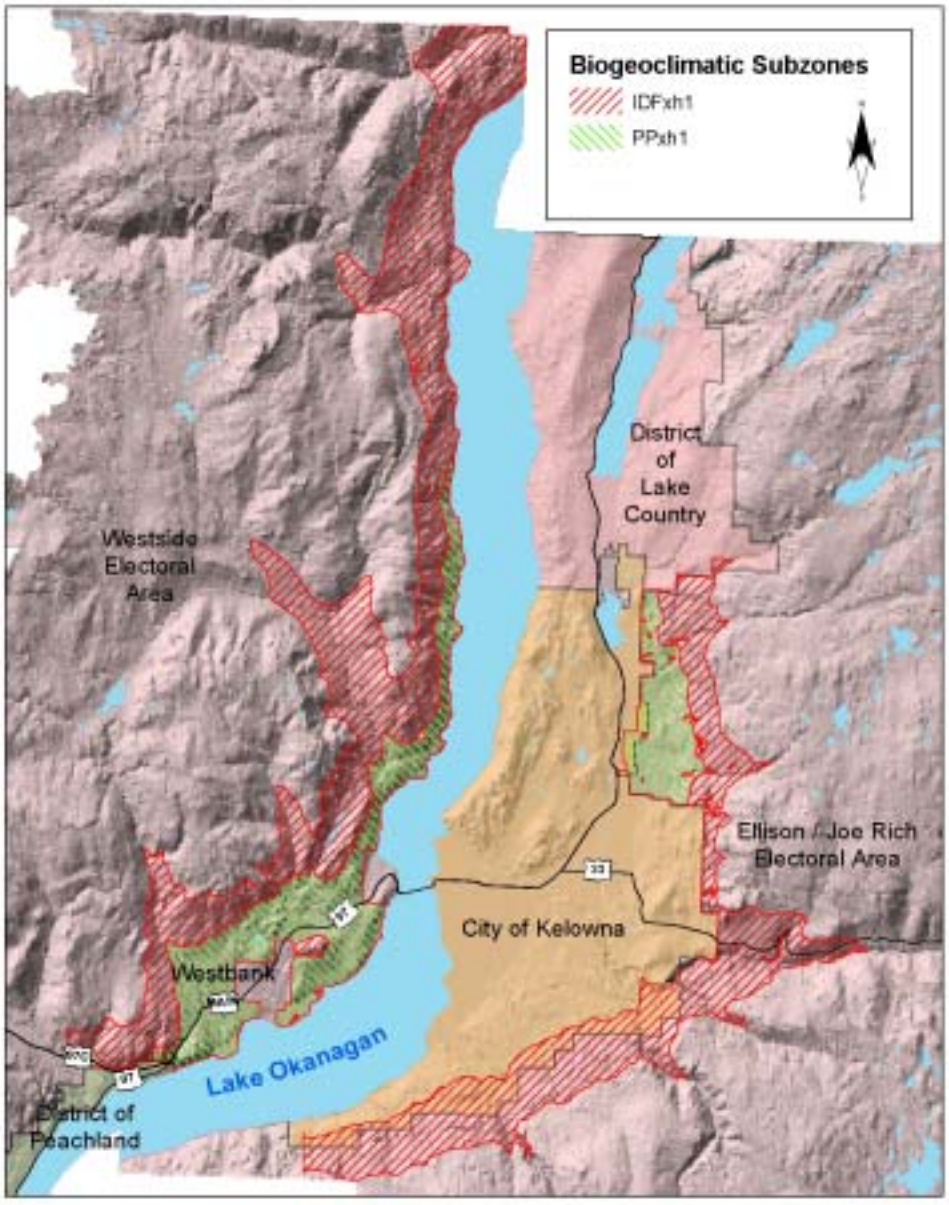

Figure 1. Central Okanagan study area shown in red (IDFxh1) and green (PPxh1) cross-hatching.

1.1 Landscape Setting

The Okanagan Valley is a major valley of the Interior Plateau. It is situated in the Thompson Plateau, a low relief upland area that represents a Late Tertiary erosion surface. Uplift, faulting and erosion created the major valleys in the Thompson Plateau, including the Okanagan Valley. Okanagan Lake occupies the main trench and Ellison, Kalamalka and Wood Lake occupy a parallel valley to the east. Okanagan Lake drains to the south into the Okanagan River through Osoyoos Lake and into the United States. The Okanagan drainage is a tributary of the Columbia River. The valley generally lies north-south in the study area.

1.1.1 Bedrock Geology

The slopes of the study area are underlain by a variety of bedrock types of various ages. Bedrock influences many ecological factors including slope morphology, nutrient regime and wildlife habitat.

The following paragraph describes the bedrock in the study area starting with the oldest rock types and ending with the youngest (sources are Little 1961 and The Map Place 2002).

The layered gneiss of the Monashee Group underlies the South Slopes area and the north and eastern most sections of the Ellison area. These are the oldest rocks in the study area and are paragneiss, gneiss that is formed by the severe metamorphosis of sedimentary rock. This group also includes zones of less metamorphosed sedimentary rock such as schist, amphibolite and quartzite. Field observations revealed that the Monashee Group rocks form ledges, overhangs, fissures and blocky talus that have important wildlife values.

The Glenrosa area and the lower slopes of Mount Boucherie are underlain by conglomerate, sandstone, shale and tuff. The Nelson Plutonic rocks occupy the area surrounding Wilson Landing as well as a small pocket in the Lambly Creek valley at 600 m elevation. The Nelson Pluton includes granitic rock types of varying composition (for example: granite, diotite, syenite, etc.). These are relatively resistant rocktypes that produce relatively coarse materials when they weather and fail and thus give rise to moderate to low nutrient regimes.

The rocks of the Cache Creek Group underlie the lower slopes adjacent to Okanagan Lake near the outflow of Lambly Creek. These are metamorphosed sedimentary rocks including greenstone, quartzite, argellite and limestone. These rocktypes are relatively nutrient rich.

The southern portion of the Ellison area, including Black Knight Mountain, consists of volcanic flows (basalt, trachyte and andesite), other volcanic derivatives (tuff, agglomerate and breccia), and sedimentary/meta-sedimentary rock (conglomerate, sandstone and shale). The most impressive exposure of these layered lava flows is displayed on the south face of Layercake Mountain. These volcanic and sedimentary rocks are also present at Boucherie Mountain, in the slopes west and north of Westbank, and in the Trepanier Creek Valley. These rock types give rise to moderate nutrient regimes. The nature of the bedrock derived from volcanic flows gives rise to cliffs, ledges and rubbly talus.

1.1.2 Glaciation and Post-Glacial Events

The large-scale morphology of the area including the Okanagan Valley, the surrounding plateau, and the bedrock types that underlay them, are landforms that predate glaciation.

During the Pleistocene Era (2,000,000 to 10,000 years ago) multiple glaciations scoured the landscape and deposited glacial drift. Each successive glacial period erased most of the evidence

of prior glaciations. The majority of the glacial sediments present in the landscape today are the result of the most recent, Fraser Glaciation. At the glacial maximum (15,000 years ago), the ice was over 2 km thick over the Okanagan Valley and the flow of the ice went south across the US border into the Columbia Valley.

On the Thompson Plateau, deglaciation (13,000 to 10,000 years ago) occurred mainly by downwasting (the melting or glacial ice in situ) resulting in the plateau areas becoming ice-free first. Remaining valley ice blocked tributary valleys and formed glacial lakes that extended up these side valleys. Such a lake deposited the silty (glaciolacustrine) materials that form terraces at the mouth of the Mission Creek valley. Melt-water, draining from side valleys along the edges of the valley ice, and into glacial lakes deposited sand and gravel in the form of terraces, deltas and fans. Valley ice melted further resulting in pockets of stagnant ice in the lower valley. A plug of stagnant ice blocked the Okanagan Valley to the south, at Okanagan Falls, creating a large glacial lake (Glacial Lake Penticton). At its maximum the lake extended as far north as Enderby. Glaciolacustrine deposits from Glacial Lake Penticton make up the silty planes and terraces below 500m elevation. Water dammed between stagnant valley ice and the west valley wall formed Glacial Lake Boucherie. This lake formed the silty deposits between 500-600m. With the further melting of the glacial ice and the lowering of lake levels, gravely fan deposits that accumulated where creeks flowed into the lake became raised or remnant fans. Raised fans are present along Kelowna Creek, Mission Creek, Trepanier Creek and McDougall Creek. (Naysmith 1962).

Post-glacially the forces of erosion and deposition have further shaped the landscape. Present day streams have deposited sediments, eroded valleys and carved terraces in glacial drift. Most of the major creeks in the study area have formed recent fluvial fans in the lower and toe slopes of the Okanagan Valley. These include Mission Creak, Powers Creek, Trepanier Creek, McDougall Creek, Lambly Creek, and Bellevue Creek. Following the retreat of the ice, vegetation took time to establish on the newly exposed soils. The action of wind was effective in eroding and depositing silt and sand sized particle. These deposits are common on the east slopes in the Ellison area in the form of veneers of fine sand and coarse silt overlaying terraces and gentles slopes in the midslope positions. Mass-movement processes such as debris flows, landslides and rockfall have eroded steep valley side walls and scarps. These processes have formed colluvial fans, slide deposits and talus slopes.

1.1.3 Soils

Soil forms the interface between surficial materials (parent materials) and the ecosystems they support. Ecosystems influence the formation of soils and soil affects what types of plants grow at a given site and the productivity of that site. Soil is defined as “naturally occurring, unconsolidated mineral or organic martial at least 10cm thick that occurs at the earth’s surface and is capable of supporting plant growth” (Soil Classification Working Group 1998). The factors affecting soil formation include: parent material, climate, biota, (including the vegetation, wildlife and organisms in the soil), topography, (for example: slope, aspect, and slope morphology), and time. The following descriptions are derived from Wittneben (1986). Further descriptions of soil horizons and soil taxonomy can be found in The Canadian System of Soils Classification (Soil Classification Working Group 1998). The following paragraphs give a description of the major soil groups present in the study area. Soil is not mapped in this project but has been included as part of the field data collected to describe the site and the ecosystems at ground inspection sites and detailed ecological plot locations (see section 2.1.3).

Chernozemic soils (Brown and Darkbrown Chernozems) have developed in the semi-arid lower valley grassland and open forest communities. These are characterized by the formation of an organic rich (Ah) upper mineral horizon. The Ah horizon forms from the accumulation of organic material from grasses and herbaceous plants and through the actions of earthworms.

Brunisolic soils exist throughout the study area. They are common under forested communities on moister and cooler aspects. These soils are present on moderately- to rapidly-drained surficial materials that are medium- to coarse-textured. These are soils that have poorly developed horizons. They have characteristics of other soils groups but have not developed sufficiently to meet the criteria to belong to other orders. They are often found in a complex with other soil types including chernozems, luvisols, and gleysols.

Luvisolic soils are present on moderately- to rapidly-drained clay-rich parent materials such as muddy glaciolacustrine deposits and finer textured tills. The movement of clay particles from the upper horizons to a lower horizon of accumulation (Bt) characterizes these soils. Luvisols underlie both forested and grassland communities in the Interior Douglas-fir and Ponderosa Pine Zones.

Organic soils develop under wet conditions where decomposition rates are relatively slow and a net accumulation of organic material (peat) occurs. Most organic soils are poor- to very poorly-drained and are saturated for prolonged periods of time. Organic soils occur under wetland communities in depressions, along lake margins and on floodplains.

Gleysolic soils develop under moist to wet conditions usually in depressions, toe slopes and on valley bottoms. They are mineral soils formed under periodic, or sustained, reducing conditions caused by saturation, and result in gleyed colours (grey, blue and green). Gleysolic soils are imperfectly to very poorly drained and occur under moist forests and wetland communities.

Regosolic soils are under developed soils that lack defined horizonation. Regosols are common on floodplains and talus slopes throughout study area. They develop on recent parent materials such as landslide and river deposits; recently exposed materials such as landslide scarps and eroded banks; or under conditions that suppress soil formation, for example, extremely dry conditions (very rapidly drained, coarse textured soils on southerly aspects). Regosols are often associated with non-vegetated or early successional plant communities.

Solonetzic soils occur on saline parent materials in semiarid to subhumid regions of the BC interior. No solonetzic soils were recorded during fieldwork; however, they likely occur in small non-vegetated or sparsely vegetated pockets in depressions and toe slope positions. These soils are often used as salt licks by wildlife and thus have high wildlife values. They occur in association with chernozemic soils and to a lesser degree with gleysolic and luvisolic soils.

1.1.4 Climate

The study area experiences some of the warmest and driest weather conditions in the province. It is located within the northern extension of a dry climatic system that spans the length of northern Mexico and the north-western United States (Demarchi 1996). Air masses moving east over the Coast and Cascade Mountains result in moisture falling before it reaches the southern interior. This rain shadow effect reduces precipitation in both winter and summer and brings clear skies, particularly in the summer. In summers, hot dry air moves in from the Great Basin, to the south, and very hot temperatures are common. The strong convection currents and high temperatures of the valley bottom draw moisture from the large valley bottom lakes, resulting in showers on the surrounding hills (Demarchi 1996). Consequently, grasslands dominate the lower areas of the valley and open forests occur over the mid-slopes of the valley.

Mean annual temperature is 7.4°C with summer temperatures hovering in the high twenties (°C) and winter temperatures slight below 0° C. Monthly highs average 27.6°C in July and monthly lows average –8.4°C in January. The recorded extreme high is 38.6°C in July and recorded extreme low is –3 1.7°C in January. Mean annual precipitation, in the form of rain or snow is 366.4 mm with maximum of 34.6 mm recorded for May and minimum of 21.9 mm recorded for the month of October. Growing degree days (when temperatures exceed 5° C) are equivalent to the city of Victoria but less than areas further south in the valley at Penticton and Osoyoos.

Climate is the most influencing factor in the distribution of ecosystems over the landscape at the macro scale. The amount of precipitation, mean daily temperatures, maximum highs and lows, and the available hours of sunshine and growing degree days all factor into the ability of plant species to grow in a given area. Within British Columbia, this region is considered to represent semi-arid steppe vegetation with distinctive geological and landscape features found nowhere else in the province. Consequently the area provides habitat for a provincially unique assemblage of plant and animal species.

1.1.5 Ecoregional and Biogeoclimatic Classification

Ecoregional Classification

The study area is located within the Southern Interior Ecoprovince, the northern extension of the Columbia Basin that extends south to Oregon[3]. Situated within the southernmost region of the Interior Plateau of British Columbia, the region lies west of the Columbia Mountains and east of the Coast and Cascade Mountains. Specifically, the study area occurs within the North Okanagan Basin Ecosection (NOB), a wide trench carved out by the movement of a huge glacier.

Biogeoclimatic Classification

The Ministry of Forests biogeoclimatic ecosystem classification (BEC) is a system of classifying vegetation based on climatic and topographic patterns[4]. Two biogeoclimatic variants are represented within the study area; the Okanagan Very Dry Hot Ponderosa Pine (PPxh1) and the Okanagan Very Dry Hot Interior Douglas-fir Variant (IDFxh1).

Okanagan Very Dry Hot Ponderosa Pine Variant (PPxh1)

The PPxh1 is the driest forested zone in British Columbia (Lloyd *et al.* 1990). Occurring only in the southern valleys of British Columbia, it is at the northern extent of a much larger range south through eastern Washington and Oregon. Cool winters with low snowfall and hot dry summers with growing-season moisture deficits result in a mosaic of open forests and grasslands.

Okanagan Very Dry Hot Interior Douglas-fir Variant (IDFxh1)

The IDFxh1 is the driest variant of the Interior Douglas-fir zone and is characterised by a long growing season with warm dry summers, but the region commonly experiences summer moisture

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[3] The ecoregional classification system was developed and adapted by the Ministry of Environment, Lands & Parks, Wildlife Branch, to provide a systematic view of the small scale ecological relationships within British Columbia. See Demarchi 1996 for further information.

[4] The Biogeoclimatic Ecosystem Classification system was developed by the Ministry of Forests to provide a basis for natural resource management, particularly forest management and range management. See Pojar et al. (1987) for further information.

deficits. It occurs above and north of the PPxh1. Winters are cool with low to moderate snowfall. The IDFxh1 is dominated by mixed open forests of Douglas-fir and Ponderosa pine.

1.2 Ecology and Disturbance Processes

The maintenance of biological diversity in managed landscapes is a challenging goal, given the number of species present in these ecosystems. Because we cannot know how human-induced changes to ecosystems affect all species, approximating historical conditions provides the most probable method of maintaining the viability of the most species, including those for which we have little awareness or understanding (Cissel *et al.* 1999; Landres *et al.* 1999; Swetnam *et al.*1999; Swanson *et al.*1994). Historical conditions include the structure of forests, distribution of different ecosystems and the ecological processes in those ecosystems (Morgan *et al.*1994). If our objective is to conserve biodiversity, a conservation strategy that emphasises ecosystems and landscapes is the only feasible approach. Additionally, because many species have conflicting needs, a management regime designed for one species is likely to have negative effects on other species.

Historically, fire was a key ecological process that maintained open ponderosa pine and Douglas-fir – ponderosa pine forests (Figure 2 shows a prescribed fire similar to historical fires). Frequent fire maintained understories dominated by bunchgrasses and shrubs and promoted nutrient cycling. Mean fire return intervals for ponderosa pine forests in the United States vary from 2 years to 15 years (Agee 1993); presumably B.C. ponderosa pine forests are similar. A range of mean fire intervals have been recorded for interior Douglas-fir forests in B.C. including: 22 years in the IDFdk3 (ranging from 5 to 49 years; Iverson *et al.* 2002); 13 years in the IDFdk1 (Gray and Riccius 1999); and, 6.2 to 17 years in the IDFww (Gray and Riccius 2000). The mean fire interval for the IDFxh1 is likely within these ranges. These estimates come from fire scars and are conservative as many fires do not leave scars (Agee 1993).

Figure 2. Understory fire similar to how most historical fires burned.

Fires were generally low severity, resulting in the survival of most overstory trees and death of most understory trees in a typical fire (Agee 1993). However, fire severity would have been somewhat variable depending on fire conditions (wind, slope, fuel moisture) and the time since the last fire, which would determine how much fuel there was on a given site and thus influence fire severity. Fires also contribute to nutrient cycling, releasing nutrients that are otherwise very slowly released through decay processes.

Moisture is very limiting in these dry forest ecosystems and available moisture is critical for the survival of ponderosa pine seedlings. However, ponderosa pine seedlings are better able to survive moisture depletion than Douglas-fir seedlings. Mature ponderosa pine have a massive taproot and widespread shallow lateral roots that occupy nearly all ground between trees, even when they are very open grown. Both ponderosa pine and Douglas-fir stands typically have a wide range of ages in them. Stand development is influenced by the shade-intolerance of ponderosa pine, shade-tolerance of Douglas-fir, episodes of above-average moisture allowing seedling establishment, and frequent fire. Typically, forests likely would have been open and park-like and dominated by bunchgrasses and shrubs in the understory (particularly in the PPxh1). Within the IDF, pinegrass, a sod forming grass, likely occurred on cooler, moister sites with bunchgrasses dominating warmer, drier sites. Additionally, cooler slopes and moister sites would be more productive with higher stand densities.

Succession within these dry forests was primarily cyclical in nature. Surface fires likely would have killed most regeneration and top-killed many shrubs, leaving behind overstory trees and a very grassy understory. During fire-free intervals, seedlings would have established, top-killed shrubs would have re-sprouted, and fire dependent seeds such as those of ceanothus would have germinated and grown. Thus, the forest cycled between these states and different stages of this cycle would be distributed across the landscape in varying proportions at any given time. In contrast, moist forested sites within the dry forest matrix would likely not have burned as frequently due to higher moisture fuels and would develop more quickly. These sites ('refugia'), including riparian areas and seepage slopes, likely would have developed multi-layered stands with gap dynamics.

The primary disturbances in grasslands were also frequent, low-intensity fires. Both lightning and First Nations peoples likely caused fires. First Nations people used fire to improve wildlife habitat, root crops (for example: bitterroot, mariposa lily, balsamroot) and likely to fireproof their villages (Turner 1994; Pokotylo and Froese 1983; Daubenmire 1968). Although lightning would infrequently have struck grassland areas, mid-slope lightning strikes would be carried into the valley bottom and grassland areas by night time down-slope winds and along the valley by valley winds. Most native grassland plants are well adapted to fire through buds just at or below the ground surface where fire temperatures typically are lower (Daubenmire, 1968). Often fire favours perennial forbs for at least a few years after a burn (Daubenmire 1968).

Historically, the principal grazing animals were likely deer and elk. They likely grazed in a similar pattern to their grazing patterns today, grazing forested areas in the summer and fall and grazing grasslands in spring and winter. Historical abundance of native ungulates is not known, but it is believed that it was not sufficient to cause overgrazing, except in localised areas, particularly during drought years. (Tisdale 1947)

The introduction of cattle grazing into grasslands and forests likely altered the fire regime of these sites. Cattle grazing removed the fine fuels that carry low severity fires and effectively excluded fire from many areas of grasslands and open forest (Moore *et al.*1999; Madany and West 1980). In many areas, there has been a shift from the more grazing-sensitive species such as bluebunch wheatgrass and rough fescue to more grazing resistant native grasses such as junegrass and Sandberg's bluegrass and forbs such as pussytoes (Dormaar *et al.*1989; McLean and Wikeem 1985; Daubenmire 1940). Unfortunately, other areas have been overtaken by knapweed and introduced annual brome grasses such as cheatgrass. Generally, our observations in the study area indicate that relatively undisturbed grasslands with very few weeds are infrequent and restricted to isolated, rocky areas.

The exclusion of most fires (dating back to the time of intensive grazing in the late 1800's) has lead to striking changes in these ecosystems. Some areas that were formerly grasslands have been encroached upon by trees and are now dominated by trees. Tree densities are now much higher in forests (Figure 3). Dense forests with accumulated fuels have lead to declines in grass and shrub productivity, increasing susceptibility to insect and disease outbreaks, and a shift from frequent low-severity fires to larger, more intense crown fires (Moore *et al.*1999; Fule *et al.*1997; Daigle 1996). It is unlikely that the wildfires that will occur can be suppressed on these sites forever (Daigle 1996). Very large, stand-replacing fires such as those that happened in the Salmon River Valley (1998), Penticton (mid-1990's) and Kelowna (2003) are likely to become more frequent in the next decades (Figure 4 shows an example of an area burned by a small stand-replacing fire at Shorts Creek).

Figure 3. Ingrown stand resulting from fire exclusion. In this stand, no remnant veteran trees are visible in the picture and the area was very open historically.

Figure 4. Fire at Shorts Creek. Fire severity was also much higher at this site than it would have been historically due to much higher stand densities.

1.3 Human History

The semi-arid climate of the Central Okanagan, with its hot summers and mild winters, has long attracted human habitation. Archaeological evidence indicates that humans have been present in the Okanagan valley for at least 6000 years. However, the population estimate for the Central Okanagan Regional District for the year 2003 is 158,562 and is projected to grow to 250,438 by the year 2026 (BC Stats 2003). This population growth will place continuing pressure on the remaining sensitive ecosystems in the Central Okanagan.

The low-elevations of the valley bottom provided many resources for the Okanagan's First Nations peoples including: accessible water, wildlife for hunting, fish, roots, berries, herbs and other foods and medicines (Cannings and Durance 1998; Thomson 2000); Figure 5 shows balsamroot, a common traditional use plant. Accidental and purposeful burning of grasslands and forests by First Nations peoples also influenced the landscape.

Figure 5. Balsamroot – a traditional use plant.

Following the discovery of gold in British Columbia, ranchers from western Oregon were attracted to the dry interior valleys of British Columbia and the Land Ordinance of 1860 encouraged land settlement by offering land at a low price (Mather 1996).

In the 1860's Indian reservations were introduced and then chosen by the Okanagan First Nations. The reserves were reduced in size in 1865 and again in the early 1900's (Thomson 2000).

In the 1870's the deterioration of the grasslands due to over-grazing was first recognised. The construction of the Canadian Pacific Railway in the early 1880's brought a new market for cattle and resulted in increased human settlement. Forage crops were cultivated for winter feed, and unfortunately, imports of seed for forage crops introduced seeds of invasive weeds (Mather 1996).

In the early 1900's most of the large ranches in the Okanagan were sold to development companies for conversion to orchards (Mather 1996). Irrigation needs led to the degradation or destruction of waterways through channelization (Cannings and Durance 1998).

Forestry during early settlement was localised but by the mid-1900's, forestry became industrial and more areas were accessed (Cannings and Durance 1998). Observations indicated that all accessible areas of the study area had been selectively harvested. The advent of industrial forestry also brought about active fire suppression.

Figure 6. Photo showing a recent cutblock in the study area.

2 Methods and Limitations

The methods used in this project are intended to provide a bridge between the inventory work done in the South Okanagan and the user-friendly methods used in the Sensitive Ecosystem Inventory project on Vancouver Island. We have used the Terrestrial Ecosystem Mapping (TEM) approach as a base map to be consistent with work done in the South Okanagan, thus enabling Okanagan-wide analysis and to aid in the development of an Okanagan-wide conservation strategy.

This project has used the provincially recognised TEM standard (RIC 1998) to map terrain and ecosystems in the study area. Ecosystems were then evaluated for Sensitive Ecosystem status and a Sensitive Ecosystem theme map was developed. We also developed wildlife habitat ratings for ten species for all ecosystems and developed a Slope Stability and Surface Erosion Potential theme maps for the south slopes portion of the study area. Details on the methods used are outlined below.

2.1 Terrestrial Ecosystem Mapping

The mapping was completed according to the methodology outlined in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998). Mapping was completed at a scale of 1:20,000 using Resource Inventory Committee (RIC) survey intensity level four.

In addition to the required map attributes, the following map attributes were also recorded for each polygon:

- stand composition modifiers (for example: coniferous, mixed, or broadleaf stand),
- percent canopy closure,
- percent shrub closure (for non-forested units), and
- quality and condition of the ecosystem.

2.1.1 Terrain Mapping

Terrain mapping is a classification system used to describe the surficial material (the loose materials on top of bedrock) and their textures, surface expressions (the three dimensional shape of the surficial materials), and geomorphological processes (the active mechanism that continue to shape the landscape) in a given area.

Bioterrain mapping is terrain mapping with an emphasis on those elements of the landscape that influence ecology, including, for example, aspect and drainage. Bioterrain mapping is an integral component of terrestrial ecosystem mapping.

Terrain units were delineated, prior to the beginning of fieldwork, onto 1:15,000 scale colour aerial photographs (1996 and 1994), following the standards outlined in the *Terrain Classification System for British Columbia* (Howes and Kenk 1988) and the *Guidelines and Standards for Terrain Mapping in British Columbia* (RIC 1996). Polygons were delineated based on a variety of ecological parameters including surficial geology, topography, soil drainage, aspect, and vegetation. Terrain symbols, geomorphic processes, and soil drainage classes were assigned to each polygon. Appendix I contains information regarding terrain mapping and the terrain symbols. In the South Slopes area, slope ranges, erosion potential classes and slope stability classes were also mapped for each polygon (see Section 2.2 and 2.3).

Following fieldwork, the pre-typed polygon lines, terrain symbols, and interpretive classes were revised based on data collected in the field. Each TEM polygon is linked to terrain information in the TEM database. Minimum data for each TEM polygon includes surficial material, surface expression and drainage.

2.1.2 Development of a Working Legend

A working legend is the document that describes the relationship between physical attributes (terrain, topographic position, soil depth) of a site to ecological units, thus forming the mapping model. This model results in improved mapping consistency and reliability of the final map product. The sampling plan is based on the working legend and ensures that all of the variability present in the study area is sampled. Using the bioterrain pre-typing as baseline information, ecosystem units expected to occur in the study area are correlated to the physical conditions most likely to support their development, and these assumptions are then verified or corrected during field sampling.

2.1.3 Field Sampling

A two-day field reconnaissance was conducted in September of 1999 to familiarize team members with the study area.

In the spring of 2000, a field-sampling plan was developed with the following objectives in mind:

- verify the presence of and quality and condition of sensitive ecosystems;
- identify other ecosystems;
- verify bioterrain labels and interpretation criteria;
- verify the ecosystems in at least 20% of the polygons;
- gather detailed data for unclassified ecosystems; and
- verify subzone boundaries.

Using forest cover maps, areas of potentially old forest were identified and accessible polygons were marked for field checking. Using the project aerial photographs, accessible potential sensitive ecosystems including grasslands, wetlands, ponds, riparian areas, rock outcrops and talus slopes were identified for field sampling. The bioterrain mappers also identified areas on the aerial photographs that they wished to check. Additionally, several Regional District staff members indicated areas that they felt were sensitive or that were of particular interest to planning activities.

Prior to initiating fieldwork, a letter was sent out to all landowners with larger properties in the electoral areas of the Regional District. This letter informed owners of the fieldwork for this SEI inventory and to provide an opportunity to notify the Regional District if they did not wish to have their property surveyed. For smaller properties or where no response was received, the field survey teams requested permission directly from the landowner prior to sampling on the property.

For the area sampled in 2000, fieldwork took place during one ten-day session during May of 2000 and one ten-day session during June of 2000. Two teams of three scientists (plant ecologist, terrain specialist and wildlife biologist) were present during each session. Additional experts accompanied the team members for several field days. Additional field verification took place during one day in September 2000.

For the South Slopes area we completed 8 days of fieldwork from June 29th to July 5th 2001.

Three types of sample plots were used to identify and assess ecosystems: detailed ecological plots (FS882), ground inspections, and visual inspections. Field sampling procedures for detailed ecological plots and ground inspections are outlined in *Field Manual for Describing Terrestrial Ecosystems* (B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests 1998). The *Standard for Terrestrial Ecosystem Mapping* in British Columbia (RIC 1998) provides guidelines for visual inspection data collection. Additionally, a site conservation evaluation form was filled out for all plots and this same form was used for visual inspections. One or more photos were taken at each detailed ecological plot and ground inspection plot. In the South Slopes area information pertaining to surface erosion and stability was also collected. Table 1 shows the number of plots sampled.

All plots were located and labelled on project aerial photographs. These site locations were digitally captured at the same time that the linework was digitised.

The plot types were sampled proportionally: approximately 6% of the plots were detailed ecological field plots, 26% were ground inspections, and 68% were visual inspections. Detailed ecological field plots were used to sample representative sensitive ecosystems, unclassified ecosystems, and representative examples of each ecosystem. Ground inspections were also used to sample sensitive ecosystems and representative examples of ecosystems. Visuals were primarily used to verify the ecosystem unit, structural stage, or terrain label; some visuals were done from a distance using binoculars.

Sampling sites were accessed by road, by hiking from roads and one day of helicopter access. We checked a total of 19% of the polygons (Survey Intensity IV).

Table 1. Sites visited

Full Plots	Ground Inspections	Visuals	TOTAL
42	192	505	739

Common plants were identified in the field and uncommon plants were identified later using provincial keys. Where identification was uncertain, specimens were pressed and sent for expert identification (T. McIntosh).

2.1.4 Expanded Legend Development

The expanded legend is a section of the TEM product that describes the terrain, soils, and vegetation of each ecosystem mapped in the study area (see Appendix II). Vegetation for each applicable structural stage is shown. The vegetation tables are based on study area data; data for many structural stages is extrapolated from this data, as it is rarely possible to sample all structural stages of all ecosystem units. Soils and terrain descriptions are also derived from plot data. The vegetation and terrain descriptions serve as a primary source for the wildlife biologists to develop wildlife habitat ratings for each map unit.

Forested ecosystems were identified using existing site series described in *A Field Guide for Site Identification and Interpretation for the Kamloops Forest Region* (Lloyd *et al.*1990). Non-forested units such as wetlands and rock outcrops were described based on the field data and units were developed in conjunction with the Ministry of Forest's Regional Ecologist in Kamloops, Dennis Lloyd.

The expanded legend also serves as a record of technical mapping information for each ecosystem unit: the map code, the ecosystem name, the site series number (if applicable), a listing of the assumed modifiers for each unit, and the modifier combinations that were mapped. The expanded legend also serves as a place for the ecosystem mappers to describe unusual or uncommon situations that they encountered.

2.1.5 Site Series and Site Unit Mapping

Ecosystem units were mapped according to the *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998). Site series are identified according to Lloyd *et al.* (1990). Each ecosystem is assigned an uppercase two-letter code that is equivalent to a recognised biogeoclimatic ecosystem classification (BEC) site series. Labelling for all forested ecosystems follows the updated site series coding master list available on the Ministry of Sustainable Resource Management Habitat Inventory & Analysis website (RIC 2000). Where an ecosystem was not recognised as an official site series (for example, wetlands), new ecosystem units were proposed and evaluated by the Ministry of Forests Regional Ecologist; and two letter codes applied to the units. Sparsely vegetated, non-vegetated and anthropogenic units follow the symbols outlined in Table 3.1 of the TEM standards (RIC 1998).

Site modifiers were used where applicable to more accurately describe the ecosystem (Table 2). Up to two site modifiers may be present (in lower case letters) with each ecosystem unit. Site modifiers represent different site conditions than those of the typical environmental condition for each site series. Each site series has a set of assumed site modifiers under the typical situation. Where a site series is mapped in its typical situation, assumed site modifiers are not included in the map label. The site series code or site modifier(s) are followed by a numerical structural stage designation, 1 through 7 (Table 3). A structural stage modifier (a single lower case letter) further subdivides the structural stage designation where appropriate. Stand composition modifiers (Table 10), a single uppercase letter indicating the dominant stand composition, and crown closure were also mapped for each ecosystem unit.

Up to three ecosystems units were noted for each polygon. The percentage of each ecosystem unit present is indicated by deciles ranging from 1 to 10 (1=10%; 10=100%). Note that 10 (100%) is not displayed in the map label, but does appear in the database (Figure 7).

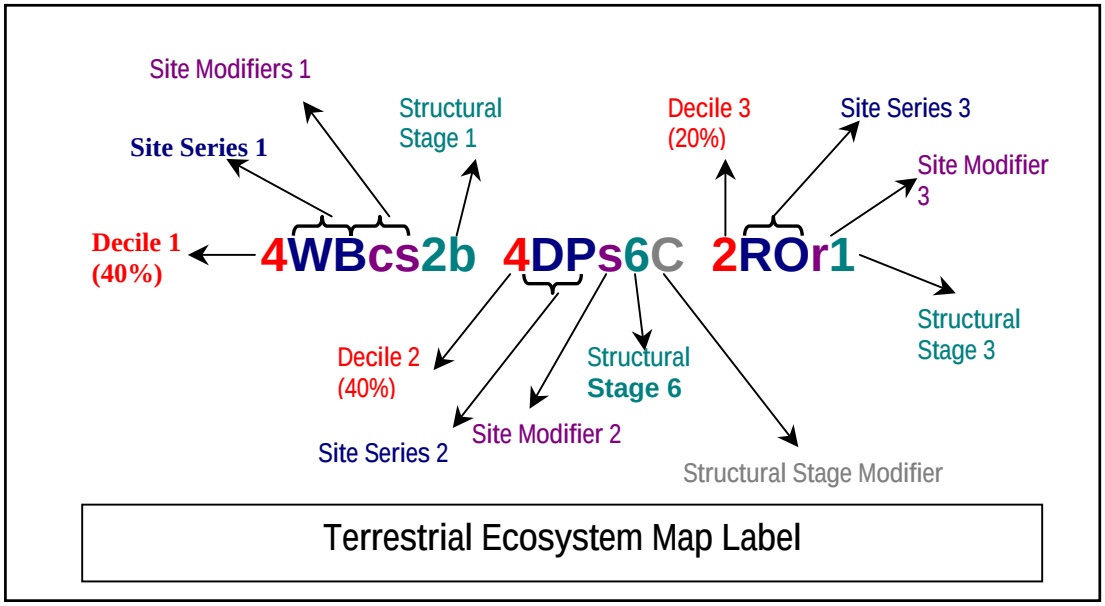

Figure 7. Example terrestrial ecosystem map label.

Site Modifiers

The following is a list of TEM codes for site modifiers applied to the study (*Standard for Terrestrial Ecosystem Mapping in British Columbia,* RIC 1998).

Table 2. Site modifiers for atypical conditions

Code	Criteria
a	active floodplain[1] – the site series occurs on an active fluvial floodplain (level or very gently sloping surface bordering a river that has been formed by river erosion and deposition), where evidence of active sedimentation and deposition is present.
c	coarse-textured soils[2] – the site series occurs on soils with a coarse texture, including sand and loamy sand; and also sandy loam, loam, and sandy clay loam with greater than 70% coarse fragment volume.
d	deep soil – the site series occurs on soils greater than 100 cm to bedrock.
f	fine-textured soils[2] – the site series occurs on soils with a fine texture including silt and silt loam with less than 20% coarse fragment volume; and clay, silty clay, silty clay loam, clay loam, sandy clay and heavy clay with less than 35% coarse fragment volume.
g	gullying[1] occurring – the site series occurs within a gully.
j	gentle slope – the site series occurs on gently sloping topography (less than 25% slope).
k	cool aspect – the site series occurs on cool, northerly or easterly aspects (285°–135°), on moderately steep slopes (25%–100% slope).
n	fan[1] – the site series occurs on a fluvial fan (most common), or on a colluvial fan or cone.
q	very steep cool aspect – the site series occurs on very steep slopes (greater than 100% slope) with cool, northerly or easterly aspects (285°–135°).
r	ridge[1] – the site series occurs throughout an area of ridged terrain, or on a ridge crest.
s	shallow soils – the site series occurs where soils are considered to be shallow to bedrock (20–100 cm).
t	terrace – the site occurs on a fluvial or glaciofluvial terrace.
v	very shallow soils – the site series occurs where soils are considered to be very shallow to bedrock (less than 20 cm).
w	warm aspect – the site series occurs on warm, southerly or westerly aspects (135°–285°), on moderately steep slopes (25%–100% slope).
z	Very steep warm aspect – the site series occurs on very steep slopes (greater than 100%) on warm, southerly or westerly aspects (135°–285°).

[1] Howes and Kenk 1988

[2] Soil textures have been grouped specifically for the purposes of ecosystem mapping.

Structural Stages

The following is a list of TEM codes for structural stages adopted from *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998). The definitions of structural stages have been modified to specifically reflect conditions in the study area. Structural stages are used to describe the dominant plant form(s) that occur on a particular site and the successional status of forested ecosystems.

Table 3. Structural stages and codes

Structural Stage	Description
1 Sparse/bryoid	Initial stages of primary and secondary succession; bryophytes and lichens often dominant, can be up to 100%; total shrub and herb cover less than 20%; total tree layer cover less than 10%.
2 Herb	Herbaceous communities maintained by environmental conditions or disturbance (for example: wetlands, grasslands); dominated by herbs (forbs, graminoids); some invading or residual shrubs and trees may be present; tree layer cover less than 10%, shrub layer cover less than or equal to 20% or less than 1/3 of total cover, herb-layer cover greater than 20%, or greater than or equal to 1/3 of total cover.
Substages	
2a Forb-dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by non-graminoid herbs, including ferns.
2b Graminoid-dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by grasses, sedges, reeds, and rushes.
3 Shrub/Herb	Early successional stage or shrub communities maintained by environmental conditions or disturbance (for example: wetlands, grasslands); dominated by shrubby vegetation; seedlings and advance regeneration may be abundant; tree layer cover less than 10%, shrub layer cover greater than 20% or greater than or equal to 1/3 of total cover.
Substages	
3a Low shrub	Communities dominated by shrub layer vegetation less than 2 m tall; this substage is only used for ecosystems that are permanent or nearly permanent shrub communities.
3b Tall shrub	Communities dominated by shrub layer vegetation that are 2–10 m tall; this substage is only used for ecosystems that are permanent or nearly permanent shrub communities.
4 Pole/Sapling	Trees greater than 10 m tall; typically densely stocked; most trees occur in one layer; primarily includes stands that have been selectively logged and have become densely ingrown due to fire exclusion; also includes young broadleaf stands that are closed and have not yet begun to self-thin, and stands that are regenerating after logging.
5 Young Forest	The forest canopy has some layers; a more open stand than in the pole/sapling stage; generally includes selectively logged forests with some mature trees; also includes young broadleaf stands that have started to self-thin and develop canopy layers.
6 Mature Forest	Trees dominating the site are mature (80 to 250 years old); understories are generally well-developed as the canopy is more open; generally includes selectively logged stands that may have retained some old trees or has a large component of mature trees. Many stands are denser now than they were historically due to fire exclusion.
7 Old Forest	Old, structurally complex stands composed an open canopy of old trees (>250 years). Historically, frequent fires maintained nearly all stands in this structural stage. Most sites had very open canopies and were generally not multi-layered. Snags and coarse woody debris were scattered but not abundant due to low stand densities and periodic consumption by fire.

Stand Composition Modifiers

The following is a list of the TEM codes for stand composition modifiers taken directly from *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998). Stand modifiers are applied to structural stages 4-7 for forested units. Stand composition modifiers are primarily used to provide further refinement of wildlife habitat ratings associated with each structural stage.

Table 4. Stand composition modifiers and codes

Modifier	2.1.5.1.1.1 Description
C coniferous	Greater than 3/4 of total tree layer cover is coniferous
B broadleaf	Greater than 3/4 of total tree layer cover is broadleaf
M mixed	Neither coniferous or broadleaf account for greater than 3/4 of total tree layer cover

2.1.6 Data Management

Successful inventory projects rely heavily on the quality of the databases, both spatial (the map representation) and non-spatial (the information) digital data. The non-spatial information is divided into field plot data and polygon attribute data. In order to achieve high quality standards, the provincially accepted *Standard for Terrestrial Ecosystem Mapping (TEM) - Digital Data Capture in British Columbia* (RIC 2000) was applied to the polygon data. The field plot data was captured and analysed using the provincially accepted VENUS software program.

Field Plot Data

Upon completion of the fieldwork, the appropriate soils, vegetation and wildlife personnel reviewed the field forms. Data from the field plots were recorded in digital format using RIC standard software (VENUS). Data from the ground and visual inspections were recorded into GRAVITI. Both manual and electronic quality assurance routines were run on the VENUS database. This database was used to sort the plots into groups with similar physical and vegetation attributes and then used to refine ecosystem classifications. The range of environmental conditions, terrain units, and vegetation communities over which site series were distributed is described in the expanded legend (Appendix II).

Non-spatial Digital Data

TEM requires the capture of a core set of polygon attributes (Table 5). Depending on the project objectives, various optional data fields can be collected and standard names, definitions, and codes are already designated for this type of data.

Table 6 lists the optional attributes applied in this project. In addition, a project may elect to apply “user-defined” polygon attributes. To accompany the Sensitive Ecosystem theme of this project, two user-defined attributes, Condition and Viability, were captured for all sensitive ecosystem units. Provincial Quality Assurance staff reviewed all mapping. Attribute databases undergo quality assurance through the application of detailed error checking routines.

Table 5. Core polygon attributes

Project- or Mapsheet-Specific Attributes - repeated for all polygons

Project name
Ecosystem mapper
Terrain mapper
Survey intensity level

Polygon-Specific Attributes - unique for each polygon

Record one of each of the following elements or classes per polygon:

Mapsheet number
Polygon number
Data source
Ecosection unit
Biogeoclimatic unit (zone and subzone; variant and phase required if present)
Geomorphological processes (when present)
Soil drainages

Record up to three ecosystem or terrain units per polygon:

Ecosystem attributes

- Decile
- Site series
- Site modifier(s)
- Structural stage

Terrain attributes

- Decile
- Terrain texture (optional but should be done where possible; record up to three for each component)
- Surficial material (record one for each component; could include a surficial subtype)
- Qualifiers (when present, record one for each component)
- Surface expression (record up to three for each component)

Table 6. List of Optional Attributes

Attribute
Structural stage modifiers
Stand appearance
Seral stage
Tree crown closure or shrub crown closure
Disturbance class and subclass

Spatial Digital Data

Ecosystems are represented visually on maps and the digital data required to produce this representation is maintained according to rigorous standards outlined in the TEM Digital Data Capture Standards (RIC 2000). The required mapping base is the Terrain Resource Information Management (TRIM) provincial standard. The digital spatial databases must adhere to the TEM Digital Capture Standards (files must be in Arc/Info format and projected in Albers). The linework mapped by the bioterrain and ecosystem specialists was captured through the process of Monorestitution. Monorestitution is the digital transfer of features by digitising directly from aerial photos using TRIM control points to georeference the data, and TRIM digital elevation models to correct for slope. The process allows for adjustments in polygon shape and size related to the third dimension. Again a series of standard routines are applied to determine the quality and accuracy of the mapping.

2.2 Surface Erosion Potential

2.2.1 Introduction

Surface Erosion Potential (SEP) ratings were mapped for the South Slopes[5] area only. SEP ratings indicate the susceptibility of bare soil to erosion. Ratings are based on the soil's erodablility when vegetation, humus, and other protective layers are removed, not on the polygon's current condition. For this study, erosion is defined as the particle-by-particle removal of soil by running water. Polygons are not rated for wind erosion as different factors contribute to surface erosion by wind.

Erosion occurs where an erodable soil is exposed to surface runoff. Areas where soil is commonly exposed and disturbed include: landslide scars, landscaping sites, road cuts, construction sites, excavation sites, areas subject to heavy traffic (for example: foot, bike, motorised vehicles, and heavy machinery), landings, trails, dirt roads, and severe burns. SEP ratings take into account surface material characteristics (including texture and compaction), surface expression (including material thickness and slope), and the amount of water passing through a polygon (this includes factors that contribute to surface runoff such as slope length, slope morphology [convex vs. concave, for example], and upslope catchment areas, etc.). Surface runoff occurs in natural and artificial streams, where water is diverted or concentrated, over relatively impermeable surfaces, in seepage areas, during snow melt, and as a result of storm events. Combinations of the above can intensify surface runoff. Water can be diverted, accelerated, or concentrated by topography, ditch

[5] The South Slopes area includes the portion of the study area south of Mission Creek and east of Okanagan Lake.

lines, storm sewer lines, irrigation, landscaping, gutters, drainage pipes, leaky structures, and artificial surfaces.

2.2.2 Objectives

The objective of the SEP theme was to provide a preliminary mapping tool, based on the bioterrain mapping, which identifies areas prone to surface erosion on a regional planning scale. This tool can be used to prevent or reduce soil erosion by identifying areas of very high erosion potential that should be avoided and by applying remedial and preventative measures in moderate to high-risk areas. The use of SEP maps does not preclude on-site field inspection.

2.2.3 Methods

SEP classes were mapped for the South Slopes portion of the study area only. Every TEM polygon in the South Slopes area has SEP ratings for each terrain component. This data is found in the user defined columns of the TEM data base. SEP is based on a five-class rating scheme (Table 7). Ratings are typically assigned through air photo interpretation. Conventional SEP mapping assigns one rating for the entire polygon and, where there is a complex of terrain types in one polygon, the polygon is rated according to the terrain with the highest class (that is, the most erodable terrain) . Bioterrain mapping indicates the percentage of the polygon represented by each terrain type in a complex polygon using the decile system. This made it possible to rate SEP for each terrain component in a complex polygon. A single polygon can have one to three SEP ratings, which relate to each of the terrain components. If a single value is desired for each polygon the highest value must be used (average value is not appropriate).

Table 8 lists examples of the criteria used to assign SEP ratings. Additional factors not included in the table were also used to assign ratings. In complex polygons the interpreter used past experience and professional judgment to weigh multiple factors in order to assign ratings (Filatow 1999, for example). The following criteria are based on studies conducted in the Okanagan and in the Boundary Forest District (Maynard 2001, Kenna and Spaeth 1998, Kenna and Spaeth 1997), and the field work for the South Slopes. Both the criteria table and the individual polygon ratings were revised based on field observations.

Table 7. Surface Erosion Potential rating scheme

Class	Rating	Definition and Implications
VL	Very low	• No erosion or very minor erosion. • No significant erosion problems expected.
L	Low	• Minor erosion.
M	Moderate	• Erosion problems should be anticipated. • Expect moderate erosion where exposed soils are subject to surface runoff.
H	High	• Major erosion problems should be anticipated. • Expect significant erosion where exposed soils are subject to surface runoff. • Disturbed soils are a potential source of sediment.
VH	Very high	• Severe surface erosion problems should be anticipated. • Surface erosion is active in these areas and they are existing sources of sediment. • Severe surface and gully erosion problems can occur if water is channelled into these areas. • Runoff from these areas can carry significant amounts of sediment into streams.

Table 8. Surface Erosion Potential criteria

Class	Texture	Materials	Slope %	Example Landforms	Drainage
			VERY LOW		
VL	Medium to course	M, C, FG, F	< 10	Depressions, terraces, planes	All
VL	Organic	O	< 10	Planes, depressions	All
VL	Very coarse (rubble, blocks & boulders)	C ,M , FG	< 27	Land slide deposits, undulating ablation till	All
VL	Bedrock	R	All	Cliffs, bluffs, undulating outcrops	All
			LOW		
L	Fine	LG, L, szFG	< 10	Depressions, terraces, planes	All
L	Medium	M, C, F	10-27	Gentle slopes, undulating deposits	w, r, x
L	all	F, C	10-27	Fans	All
L	Medium	M, C	10-40	Thin mantles over irregular bedrock surfaces	w, r, x
L	Coarse to medium	FG	10-27	Gentle slopes, undulating deposits	All
L	Coarse	C, D	27-70	Talus slopes and cones derived from rockfall, thin veneers of bedrock derived materials	w, r, x
L	Coarse	FG	<10	Depressions, planes terraces	i, p, v
L	Very coarse	C	>27		All
			MODERATE		
M	Fine	LG, szFG	10-27	Gentle slopes	w, r, x
M	Fine	LG	<10	Gently sloping to flat receiving sites.	i, p, v
M	Medium	M	27-50	Long moderately steep slopes	
M			27-60	Short moderately steep slopes	
			HIGH		
H	Fine	LG, szFG	27-40	Moderate slopes	w, r, x
H	Fine	LG, szFG	10-27	Gentle slopes	i, p, v
H	Medium	M	<30	Gullied	All
H	Medium	M	>30	Moderate to steep slopes and scarps	i, p, v
H	All	M, U, LG	>40	Scarp slopes in thick drift with no signs of active erosion.	w, r, x
			VERY HIGH		
VH	All	All	All	Gullied and failing slopes	All
VH	Fine	LG	>40	Slopes with any evidence of active erosion	m, i, p, v
VH	Medium to fine	M, U, LG		Scarp slopes in thick drift with no signs of active erosion.	m, i, p, v

2.3 Slope Stability

2.3.1 Introduction

Slope stability classes were mapped for the South Slopes[6] area only. Slope stability mapping identifies relative stability using a polygon based five class rating system. Slope stability classes indicate a polygons susceptibility to the initiation of mass movement (gravity induced) processes including landslides, debris flows, rotational slumps, earthflows, and rock slides. Slope stability maps are used to plan development including forestry, roads, and urban development.

2.3.2 Objectives

The objective of the slope stability theme is to provide a map, based on the bioterrain information, which will identify areas prone to instability on a regional planning scale. This map will aid in locating building development, roads, green space and other land uses while reducing slope failures caused by human development and the impact of naturally occurring slope failure on development. The use of terrain stability maps does not preclude on-site field inspection.

2.3.3 Methods

Slope stability is evaluated by air photo interpretation. Each terrain component was evaluated using the 5 class rating system (I, stable, to V, unstable). Conventional terrain stability mapping assigns one rating for the entire polygon and, where there is a complex of terrain types in one polygon, the polygon is rated according to the terrain with the highest class (i.e., most unstable) . Bioterrain mapping indicates the percentage of the polygon represented by each terrain type in a complex polygon using the decile system. This made it possible to rate slope stability for each terrain component in a complex polygon. A single polygon can have one to three stability ratings, which relate to each of the terrain components. If a single value is desired for each polygon the highest value must be used (average value is not appropriate).

Table 9 outlines the criteria used as a guideline for evaluating slope stability. The mapper takes into account slope morphology, steepness (slope), surficial material, material texture, material thickness, evidence of existing instability (for example: tension cracks and landslide scars), and drainage. The mapper also considers local knowledge, field data, reports and mapping from this study area and in relevant adjacent studies.

[6] The South Slopes area includes the portion of the study area south of Mission Creek and east of Okanagan Lake.

Table 9. Slope Stability criteria

Class	Dominant slope %	Texture	Example materials and landforms	Processes[7]
I	<10	all	LGt	None
I	<20	medium to coarse	Mvw, FGu, Mu, FGp, FGt, Op, FAp, Mb, Ru	None
II	10-25	fine	LGv	None
II	10-30	medium to coarse	Mj, Mb, FGj, Ff, Cf	None
II	10-50	course	FGh	None
III	30-50	all	Mb, Cv, FGa, Ua	None
III	30-60	medium to coarse	Cvx, Mvw, FGh, FGr, Rak	None
III	30-70	coarse to very coarse	Ck-Rb, Ca, Cc, Ca-Rds	–R may be present
IV	>40	fine to medium	Ua, Uk, Mk	-V may be present
IV	>40	fine	LGk	-V may be present
IV	>40	medium to coarse	Mb-V, Uk-V	-V
IV	>60	medium to coarse	Rks-R"b, 8Cxv 2Rs, Mv, Uk, FGks	-R"b and –V may be present
V	all	all	Uks-R"s, LGks-R"sV, 5Cvx 5Rs-R"bs	-R" and –F"

The above criteria are a guideline only. In order to fine-tune assessments to local conditions, each terrain polygon was rated individually with regard to additional factors. These include, but were not limited to:

- Slope smoothness/irregularity: The "bumps" on irregular slopes are usually formed by near-surface bedrock which acts to pin surficial materials in place. Thus, the potential for instability on an irregular slope is lower than that on a slope of similar overall steepness but with a smoother profile.
- Moisture: In general, wet slopes are more erodible and more prone to failures than dry ones. High pore water pressure, such as that which develops when the water table rises into weathered till, leads to a reduction in normal stress and slope failure. Overland flow, which develops more readily in wet than dry areas, leads to surface erosion.
- Slope curvature: Concave slopes can concentrate moisture, which can increase erosion and cause instability. Convexities across the slope can represent drier and more resilient areas that are more stable. While steepening downslope (convex down) represent an unstable configuration, as materials are not supported from below.
- Slope position: In general, lower slopes and concavities are relatively wet because they receive moisture from a large area upslope and the watertable tends to be at a relatively shallow depth; thus, they tend to be potentially unstable if steep, and potentially erodible if moderately sloping.

[7] Mass movement and erosional processes.

2.4 Mapping Limitations

2.4.1 SEI and TEM Mapping Limitations

The SEI and TEM information is intended for use in alerting local and regional decision-makers of the presence of important ecosystems and ecological features. The SEI and TEM do not replace the need for on-site assessments of areas where land use changes are proposed or contemplated.

The accuracy of polygon boundaries is limited by the scale (1:15,000) and date (1994 and 1996) of the aerial photographs on which the sites are delineated. *It is recommended that data should not be enlarged beyond the scale of the photos as this may result in unacceptable distortion and faulty registration with other data sets.*

Given the continuing land-uses within the Central Okanagan including human settlement and logging, some polygons may have changed since the data of the aerial photographs or fieldwork. Wherever possible, polygons were updated to reflect changes noted at the time of fieldwork.

One of the primary limitations of aerial photograph interpretations is the limited ability to see disturbances such as grazing and invasion of noxious weeds. The mapper must apply the information based on extrapolation from adjacent areas or current land use. Additionally, disturbance levels may have changed in some areas after fieldwork was completed. It is possible that some grasslands may be incorrectly assigned to either 'grasslands' or 'disturbed grasslands'.

Another common limitation is the limited ability to delineate polygons around small sensitive features or ecosystems. In most cases, these ecosystems are captured as a small component of a larger polygon dominated by another ecosystem. Many polygons are a complex of ecosystems and sensitive ecosystems may only occupy a portion of that polygon. The proportion of sensitive ecosystems is shown through colour coding and dot density theming (the dots do not reflect the locations of ecosystems within the polygon).

In many cases, field verification was limited by access. Not all private land owners granted permission to sample on their property or were available at the time of the site visit to that area. In addition, many areas have limited physical access – some of these areas were accessed by hiking or by helicopter overview. Ecosystem types that occur on sites physically difficult to access have the least amount of field sampling (for example, cliffs).

Finally, many important wildlife habitat features are difficult to capture in ecosystem maps unless they correlate well with certain ecosystems. It is likely that important habitat features such as snags, tree cavities, and large woody debris are present but are not included in SEI polygons.

2.4.2 Terrain Mapping Limitations

There are several factors that influence the reliability of terrain mapping and the interpretations that are based on the mapped information. These include the factors listed in Table 10 below.

Table 10. The factors affecting the reliability of terrain mapping

Factors	Notes on this study
Skill and experience of the mapper	South slopes mapped by Deepa Spaeth Filatow, Ellison area mapped by Larry Lacelle, and the West Side mapped by Christina Sinneman.
Number of mappers	Three mappers were involved in various stages of the project.
Continuity	Multiple reviewers and mappers. No one person worked though to the end of the project.
Quality control	Multiple reviewers.
Vegetation cover	Varied from area to area.
Complexity of the landscape	Variable. The rock controlled portion of the landscape is predictable and fairly straight forward. The thick valley fill in the lower Okanagan is more complex.
Quality and scale of the airphotos	Good quality. Colour photos. Appropriate photo scale for the scale of the final mapping.
Terrain Survey Intensity Level (TSIL)	TSIL D[8] is normal for TEM but is low for Surface Erosion Potential (SEP) and Slope Stability themes.
Interpretative criteria for Surface Erosion Potential and Slope Stability	Inadequate field data from this study but good data was available from comparable studies done in adjacent areas.
Amount of time spent finalising the mapping on the airphotos	Appropriate for TSIL and for TEM and SEI.
Quality of the topographic base	Good.
Transfer of linework into digital format	Good. Checked during data entry.
Transfer of terrain symbols into digital format	The database is free of terrain coding errors. As every polygon was not checked against the original mapping on the airphotos, it is possible that data entry errors occurred. Spot-checking indicated that errors were not common.
Edit of final maps	No stand-alone bioterrain map was created so no final edit was done. The SEP and Slope Stability maps were checked against the original mapping on photos.

The information and analyses contained in this report are based on observations of land-surface conditions and the current understanding of terrain and erosion. The following factors have not been taken into account by this study: subsurface conditions not detectable by airphoto interpretations or surface observations (subsurface hydrologic conditions, for example), events

[8] TSIL D is defined as 1-20% of polygons inspected; 19% of polygons were inspected in this project.

whose time of occurrence and severity cannot be predicted (storm events, for example), management practices, and land-use.

2.4.3 Limitations of Surface Erosion Potential and Slope Stability Mapping

In addition to the limitations to terrain mapping the Surface Erosion Potential (SEP) and Slope Stability ratings for the South Slopes area have the following limitations:

1. SEP and Stability ratings are based on a methodology developed primarily for forestry applications. In an urban setting, artificial surfaces make runoff and delivery of sediments into waterways more prevalent. Caution should be exercised even in areas with low erosion potential ratings. Areas rated moderate to very high should be treated as sensitive. Stability classes III through V should be considered sensitive and caution should still be taken with drainage in class I and II polygons.
2. SEP and Stability classes are assigned to the terrain components at the polygon level and may not apply to areas within the polygon that are not represented by the polygon symbol. These inclusions are components of the polygon that are too small for the scale of mapping and are typically less than 10% of the polygon. For example, a short steep slope within a gently sloping polygon will have higher erosion potential than the indicated SEP rating for the polygon. In another example, some surficial materials may contain inclusions of finer textured material that are more erodable. For example, coarse textured, inter-bedded sands and gravels may contain beds of very fine sand and silt, which are more erodable.
3. This study has been conducted at TSIL D (most studies that incorporate SEP and Slope Stability are TSIL C-A[9]). The field survey did not focus on M-VH and III-V rated polygons, as is the norm, and did not collect SEP field data (apart from drainage and texture). However, several studies done in the area (Maynard 2001; Kenna and Spaeth 1998; Kenna and Spaeth 1997; field work for the South Slopes) have mapped SEP following the accepted methodology. Information from those studies was used to establish the criteria for this study.
4. In order to meet the project objectives the mapper incorporated criteria for bioterrain, slope stability and surface erosion potential into the mapping. This has resulted in a high level of detail (small average polygon size) and utility. Incorporating multiple interpretations, however, may take away from the quality of each individual inventory.
5. Slope stability mapping identifies initiation zones and does not identify runout zones; for example, areas down slope of unstable areas that are in the zone historically impacted by runout of landslide deposits. This information is, however, in the terrain portion of the database.

[9] TSIL A is defined as 75-100% of polygons field inspected, TSIL B is defined as 50-75% of polygons field inspected, TSIL C is defined as 20-50% of polygons field inspected, and TSIL D is defined as 0-20% of polygons field inspected; 19% of polygons were inspected in this project.

3 Results and Discussion

3.1 TEM Results and Discussion

The study area is located within two subzones: the PPxh1 (8093 hectares) and the IDFxh1 (22 815 ha). Table 11 lists the ecosystems units that we mapped in the IDFxh1 and the total area and percentage of the study area for each unit. Table 12 lists the ecosystems units that we mapped in the PPxh1 and the total area and percentage of the study area for each unit.

Descriptions of each ecosystem unit for the IDFxh1 and PPxh1 are provided in the expanded legends at the end of this report. The IDFxh1 units are listed first and are followed by the PPxh1 units. Ecosystem units are ordered alphabetically, according to the two-letter mapping codes. Each unit is described on two pages: the first page has a photograph (where available) with a description of the typical conditions, mapped units, and site and terrain features. The second page shows the dominant and indicator vegetation species expected for each structural stage of the ecosystem unit. The '*' symbol indicates the general abundance expected for each species; classes are defined at the bottom of each vegetation table. Vegetation tables are based on data where available and are extrapolated from known species responses to ecological conditions, disturbance, and succession where no data is available. For grassland units, vegetation is shown for each seral stage.

Within the IDFxh1, the /05 and the /06 site series were not mapped as we did not feel that we could distinguish these sites in mapping. It appeared that the abundance of different forbs that distinguishes these units may be more related to site history (ingrowth, logging, grazing) rather than being related to different site conditions.

Table 11. Ecosystem Units mapped in the IDFxh1, their area, their percent of the subzone, and their percent of the study area

IDFxh1				
Ecosystem Unit Code/ Number	Ecosystem Unit Name	Area (hectares)	% of IDFxh1	% of study area
AM /00	At – Common snowberry – Mountain sweet-cicely	30	0.1	0.1
AO /00	At – Mock orange – Choke cherry Riparian	12	0.05	0.04
AS /98	At – Snowberry – Kentucky bluegrass	59	0.3	0.2
BM /00	Bulrush Marsh	3	0.01	0.01
BN /96	Kentucky bluegrass – Stiff needlegrass	69	0.3	0.2
BR /00	Baltic Rush Marsh-Meadow	3	0.01	0.01
CB /00	Cutbank	1	0.003	0.002
CD /00	ActFd –Common Snowberry – Red-osier Dogwood Riparian	174	0.8	0.6
CF /00	Cultivated Field	443	2	1
CL /00	Cliff	58	0.3	0.2
CO /00	Cultivated Orchard	3	0.01	0.01
CS /00	Common Spikerush Marsh	2	0.01	0.01
CT /00	Cattail Marsh	1	0.005	0.003
CW /00	Choke cherry – Bluebunch wheatgrass rocky bluff	37	0.2	0.1
DP /01	FdPy – Pinegrass	8308	36	27
DS /07	FdPy – Snowberry – Spirea	1848	8	6
DW /03	FdPy – Bluebunch wheatgrass – Pinegrass	3091	8	6
ES /00	Exposed Soil	67	0.3	0.2
FC/00	Rough fescue - Cladina	55	0.2	0.2
FO /00	FdPy –Saskatoon – Mock orange	89	0.4	0.3
FW /91	Idaho fescue – Bluebunch wheatgrass	693	3	2
GB /00	Gravel Bar	1	0.004	0.003
GP /00	Gravel Pit	25	0.1	0.08
OW /00	Shallow Open Water	11	0.05	0.03
PB /02	FdPy – Bluebunch wheatgrass – Balsamroot	1935	8	6
PD /00	Pond	11	0.04	0.03
RE /00	Reservoir	62	0.3	0.2
RF /97	Prairie Rose – Idaho fescue	147	0.6	0.5
RI /00	River	32	0.1	0.1
RO /00	Rock Outcrop	235	1	0.8
RS /00	CwFd – False Solomon's Seal	184	0.8	0.6
RW /00	Rural	393	2	1
RZ /00	Road Surface	236	1	1
SA/00	Antelope brush – Selaginella	22	0.1	0.07
SB /00	Selaginella – Bluebunch wheatgrass rock outcrop	204	0.9	0.6
SD /08	SxwFd – Douglas maple – Dogwood	352	2	1
SM /00	Sedge Marsh	0.2	0.0007	0.0005
SO /00	Saskatoon – Mock orange Talus	223	1	0.7
SP /04	FdPy – Snowbrush – Pinegrass	2972	13	10
SS /00	Saskatoon – Common snowberry	10	0.04	0.03
TA /00	Talus	130	0.6	0.4
UR /00	Urban/Suburban	90	0.4	0.3
WA/92	Big sage – Bluebunch wheatgrass – Balsamroot	18	0.08	0.06
WB /93	Bluebunch wheatgrass – Balsamroot	467	2	2
WS /09	Willow – Sedge Wetland	5	0.02	0.02
TOTAL		22 815	100	74

Table 12. Ecosystem Units mapped in the PPxh1, their area, their percent of the subzone, and their percent of the study area

PPxh1				
Ecosystem Unit Code/ Number	Ecosystem Unit Name	Area (hectares)	% of IDFxh1	% of study area
AS /00	At – Snowberry – Kentucky bluegrass	5	0.06	0.02
BE /00	Beach	3	0.04	0.01
CB /00	Cutbank	19	0.2	0.06
CF /00	Cultivated Field	948	12	3
CL /00	Cliff	7	0.08	0.02
CN /00	Canal	2	0.03	0.007
CO /00	Cultivated Orchard	666	8	2
CT /00	Cattail Marsh	6	0.07	0.02
CV /00	Cultivated Vineyard	247	3	0.8
DM /08	Fd – Water birch - Douglas maple	174	2	0.6
DS /07	FdPy – Snowberry – Spirea	115	1	0.4
ES /00	Exposed Soil	64	1	0.2
FB /00	Rough fescue – Bluebunch wheatgrass	255	3	0.8
GC /00	Golf Course	154	2	0.5
GP /00	Gravel Pit	84	1	0.3
GW /00	Giant Wildrye grassland	1	0.01	0.003
LA /00	Lake	15	0.2	0.05
OW /00	Shallow Open Water	6	0.07	0.02
PA /00	PyAct – Snowberry Riparian	63	1	0.2
PC /04	Py – Bluebunch wheatgrass – Cheatgrass	749	9	2
PD /00	Pond	1	0.008	0.002
PF /05	Py – Bluebunch wheatgrass – Rough fescue	612	8	2
PT /02	Py – Red three-awn	419	5	1
PW /01	Py – Bluebunch wheatgrass – Idaho fescue	618	8	2
RE /00	Reservoir	11	0.1	0.04
RO /00	Rock Outcrop	73	1	0.2
RW /00	Rural	353	4	1
RZ /00	Road Surface	104	1	0.3
SB /00	Selaginella – Bluebunch wheatgrass rock outcrop	85	1	0.3
SO /00	Saskatoon – Mock orange Talus	43	1	0.1
SP /06	FdPy – Snowberry – Pinegrass	614	8	2
SR /00	Snowberry – Rose – Kentucky Bluegrass	34	0.4	0.1
TA /00	Talus	23	0.3	0.1
UR /00	Urban/Suburban	1366	17	4
WB /00	Bluebunch wheatgrass – Balsamroot	158	2	0.5
TOTAL		8093	100	26

The distribution of structural stages mapped in the study area is shown in Table 13. Young forests form the most abundant structural stage (41%), followed by mature forests (15%) and herb structural stages (13%). Old forests are extremely rare in the study area (1%) although historically they would have dominated in forested areas.

Table 13. Distribution of structural stages in the study area

Structural Stage	Area (hectares)	Percent of study area
Not applicable	2692	9
Sparsely Vegetated	790	3
Herb	3542	11
Shrub/Herb	2871	9
Pole sapling	2663	9
Young Forest	13 350	43
Mature forest	4734	15
Old forest	265	1

3.2 Terrain Results

Terrain results are summarized in Appendix I, which defines and summarizes the nature and distribution of materials surface expressions, geomorphological processes and drainage for the entire study area. Appendix I also includes a summary of the SEP and Slope Stability results for the South Slopes area.

3.3 Terrain Recommendations

The bioterrain and interpretive themes coupled with TEM, SEI, and wildlife information have the potential for creating additional interdisciplinary themes. Below are some examples of how the terrain and ecological information are relevant to each other, and some possible uses of interdisciplinary themes.

Vegetative cover reduces erosion and could be used to enhance the SEP theme. Different ecosystem types will have an effect on the actual rate of erosion on a slope (as described in Section 2.2, SEP is based on exposed soil). For example, in a forest the tree canopy will intercept precipitation, reducing surface runoff; while grasslands may be more susceptible to erosion. Sediment from highly erodible polygons could have a negative affect on down-slope sensitive ecosystems such as wetlands and riparian ecosystems. Polygons rated high to very high for erosion potential that drain into SEI polygons may require special attention.

Bioterrain information should be upgraded to produce SEP and Slope Stability maps for the Ellison and Westside Areas. This would involve adding slope classes, SEP ratings and Slope Stability classes to each polygon by air-photo interpretation, upgrading some of the line-work and symbols, and conducting field work to confirm and upgrade the rating criteria. Fieldwork should collect information on texture and sorting and should further classify the sand fraction (for example: very fine, fine, medium, coarse and very coarse).

Map users should explore the value of adding Slope Stability, SEP, sediment delivery to streams, and landslide induced sedimentation interpretations.

3.3.1 Surface Erosion Potential Recommendations

In polygons rated moderate (M), high (H), or very high (VH), it is recommended that a qualified team of professionals, including both geotechnical and hydrological expertise, prepare a Drainage Plan and a Sediment Control Plan. Best Management Practices as outlined in the document *Best Management Practices for Erosion and Sediment Control-Upland Works* (City of Kelowna 1998b) should be followed. In and adjacent to riparian zones, it is particularly critical to avoid disturbances of erodable soils. Best Management Practices as outlined in *Best Management Practices for Erosion and Sediment Control-Instream Works* (City of Kelowna 1998a) should be followed as well as all legal requirements outlined in the *Fisheries Act* and the provincial *Water Act*.

Table 14. Management recommendations for different SEP classes

Class	Management Recommendations
VL	• Follow BMP particularly in and adjacent riparian zones.
L	• Follow BMP particularly in and adjacent riparian zones. • Use the recommendations outlined for M and H SEP in areas where slopes are greater than indicated for the polygon (see below); for example, road cuts.
M H	• Minimise soil disturbance on these sites. • Site inspection by a qualified terrain or soils specialist is recommended. • Use preventative and remedial measures (BMP) in disturbed areas to reduce erosion; avoid causing sedimentation in waterways. • Avoid upslope land-use that may diverting, concentrate, and/or increase surface runoff.
VH	• Avoid disturbing these sites. • Site inspection by a qualified terrain or soils specialist is recommended. • Use preventative and remedial measures (BMP) in disturbed areas to reduce erosion; avoid causing sedimentation into waterways. • Avoid upslope land-use that may divert, concentrate, and/or increase surface runoff into these areas.

3.3.2 Slope Stability Recommendations

The stability rating of the polygon in which development is proposed should be considered as well as the stability class of upslope polygons that could affect the development. This is particularly critical for new development on fans, where the entire upslope catchment area should be considered. Qualified professionals should evaluate the risk of a debris flow/torrent impacting development on the fan.

Activities proposed for potentially unstable slopes adjacent to major creeks should consider potential impacts to existing development along the creek and on the creek's fan.

Areas down slope of unstable glaciolacustrine scarps are also areas that could be impacted by landslide runout. Terraced landforms such as glaciolacustrine terraces and glaciofluvial terraces are typically rated I on the flat terrace surface and IV or V on the scarp face. Land use and disturbance on the stable terrace surface can affect the stability of the scarp below. Precautions should be taken with drainage. Over-irrigation of lawns and gardens should be avoided; sewer and waterlines should be properly maintained and inspected to avoid leaks or breakages; and drainage should be carefully planned. Adding weight too close to the scarp edge should be avoided (i.e.,

buildings, pools, trees, fill etc.). The force of the wind on tall trees and buildings can increase the forces that contribute to rotational slumps in thick glaciolacustrine materials.

Glaciolacustrine materials are also susceptible to piping and collapse. It is recommended that qualified professionals investigate ground conditions in areas of thick glaciolacustrine material even in class I and II terrain.

Table 15. Management recommendations for slope stability classes

Class	Management Recommendations
I	• Check for instability in polygons upslope that may impact this polygon. • Use the recommendations outlined for II in areas where slopes are greater than indicated for the polygon (see below)
II	• Follow BMP. • Check for instability in polygons upslope that may impact this polygon. Particularly on fans where sediment can travel from a long distance up stream. • Use the recommendations outlined for III and IV in areas where slopes are greater than indicated for the polygon (see below); for example, cutslopes.
III & IV	• Minimise disturbance on these sites. • Site inspection by a qualified professional is recommended. • Use preventative and remedial measures (BMP) in disturbed areas to reduce sedimentation and instability. • Avoid upslope land-use that may divert, concentrate, or increase drainage into these areas. • Evaluate risk on fans down valley from polygons adjacent streams.
V	• Avoid development on these sites. • Site inspection by a qualified terrain or soils specialist is recommended. • Use preventative and remedial measures to avoid down slope impacts. • Avoid upslope land-use that may divert, concentrate, or increase drainage into these areas. • Avoid development down slope that may be impacted by slope failure in these areas. • Evaluate risk on fans down valley from unstable areas adjacent streams.

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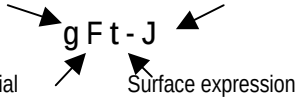
Appendix I Terrain Legend

The terrain legend is usually attached to a published terrain map that includes all mapped symbols. This map was not produced for the Central Okanagan project. All the spatial (digital linework) and associated databases are available to do this in a GIS system. The legend is presented to facilitate someone who wishes to make a terrain map and to provide the reader with a quick reference for the many terms and symbols used in this report. It is recommended that a terrain specialist be consulted if terrain maps are to be published. Terrain map production must follow the standards outlined in Standards and Guidelines for Terrain Mapping in B.C. (1996) and Terrain symbols must adhere to Howes and Kenk (1988).

Simple Terrain Unit

Example: Texture Process



Note: Two or three letters may be used to describe any characteristic except surficial material. Letters may be omitted if information is lacking.

Composite Units

Used when two or three terrain types are present in one polygon. Deciles are used to indicate relative proportions.

Example:

^{8}Mb ^{2}gFt

Indicates that roughly 80% of the polygon is Mb and 20% is gFt. Terrain that constitutes less than 10% is normally not included in the terrain symbol.

Stratigraphic Units

Used when one surficial materials overlie a different material or bedrock.

Example 1: Example 2:

$\frac{Cv}{Mb}$ $\frac{/Cv}{Rk}$

Example 1 indicates that Cv (colluvium) overlies Mb (till). In example 2 the '/' indicates that the colluvium is partially covering the underlying rock and some rock is exposed at the surface.

Surficial Material		Surface Expression	
Symbol	Name	Symbol	Name
A	Anthropogenic	a	moderate slope
C	Colluvium	b	blanket
D	Weathered rock	c	cone
E	Eolian	d	depression
F	Fluvial	f	fan
FG	Glaciofluvial	h	hummocky
L	Lacustrine	j	gentle slope
LG	Glaciolacustrine	k	moderately steep
M	Morainal	m	rolling
N	Not Classified	p	plain
O	Organic	r	ridge(s)
R	Rock	s	steep
U	Undifferentiated	t	terraced
		u	undulating
		v	veneer
		w	mantle of variable thickness
		x	thin veneer

Geomorphological Process

Symbol	Name
E	Glacial meltwater channels
F	Slow mass movement (SMM)
F"	SMM: Initiation zone *
Fu	SMM: Slump in surficial material*
H	Kettled
I	Irregularly sinuous channel
P	Piping
R	Rapid mass movement (RMM)
R"	RMM: Initiation Zone*
Rb	RMM: Rock fall*
Ru	RMM: Slump in surficial material*
Rs	Debris slide*
U	Inundated
V	Gullying

Drainage Class

Symbol	Name
x	very rapidly drained
r	rapidly drained
w	well drained
m	moderately well drained
i	imperfectly drained
p	poorly drained
v	very poorly drained

Where two drainage classes are shown:

if the symbols are separated by a comma, for example: w,i then no intermediate classes are present;

if the symbols are separated by a dash, for example: w-i then all intermediate classes are present.

Project Information

Study Area	Central Okanagan
Mapped For	Central Okanagan Regional District
Terrain Mappers	Christina Sinneman, Larry Lacelle, and Deepa Spaeth Filatow
Scale	1:20 000
TSIL	D
Report	Central Okanagan Sensitive Ecosystem Inventory, 2004.
Field work	May and June 2000, July 2001
	Christina Sinneman, Larry Lacelle, Bob Maxell, and Deepa Spaeth Filatow
Cartography	Bruce Ganton and Iain Lawrence
Base map	Portions of map sheets: 082E083, 082E084, 082E093, 082E094, 082E095, 082L003, 082L004, 082L013, and 082L023

* Geomorphological process with subclass. Up to 3 subclasses can be used in combination

Based on the Terrain Classification System for British Columbia, Howes and Kenk 1988.

Expanded Terrain Legend

The following terrain legend provides definitions and explanations to aid in the use of: 1) the terrain information in the TEM database and 2) the terminology used throughout this report. The 'in the study area' column of each table describes and summarizes the terrain attributes found in the study area. Further supporting information and descriptions can be found at http://srmwww.gov.bc.ca/rib/wis/terrain/inventory/manuals.htm. Howes and Kenk (1988) describes the terrain system of classification and is a guide to how terrain labels are constructed. The Terrain Database Manual: Standards for Digital Terrain Capture in BC (RIC 1998) has descriptions of each field in Section 2.2.

Simple Terrain Unit Symbol

One or more groups of letters are used to describe each terrain unit. The relative position of a letter within its group indicates the characteristic that it represents.

EXAMPLE

spF^{A}pf-BA
In this symbol '**s**' and '**p**' represent texture; '**F**' superscript '**A**' represents an active fluvial surficial material; '**p**' and '**f**' represent surface expression; and '**B**' and '**A**' represent geomorphological processes.

Composite Terrain Unit Symbol

Terrain units that include two or three different kinds of terrain are indicated by two or three groups of letters always arranged in decreasing order of importance. A number that indicates the percentile representing approximate proportions separates the components.

EXAMPLE

^{8} Mb ^{2} gFt	means that there is roughly 80% '**Mb**' and 20% '**gFt**'
Terrain that constitutes less than 10% of a terrain unit is normally not included in the terrain unit symbol.	

Stratigraphic Information

Where two or more kinds of surficial material are superimposed, or where the surface expression of buried bedrock is shown, a stratigraphic symbol is used.

EXAMPLE

rCw / Mb	means that '**rCw**' (Colluvial) material overlies '**Mb**' (morainal) material

Terrain interpretations

These can be printed on the same terrain map (below the terrain symbol) or on a separate map.

EXAMPLE

Terrain	^{8} Mb ^{2} gFt	
Drainage	w-m	Applies to the polygon
Slope	0-5, 20-30	Applies to the polygon
Erosion potential classes	M, VL	Applies to each terrain decile
Stability Classes	II, I	Applies to each terrain decile

Texture of Surficial Material

Texture refers to the size, shape and sorting of particles for all materials except organic sediments for which the texture describes the degree of decomposition. Textural terms are used only where there is sufficient information. Omission of texture from a symbol implies that the material texture lies within the range of textures defined in the legend under surficial material. Up to three textural terms can be used to describe a surficial material. Textural terms are listed in reverse order of importance. Thus, the dominant texture is closest to the surficial material symbol, for example, zdsMw (silty, stony, sandy till mantle of variable thickness). Textures that represent less than 20% of the material by volume need not be listed.

Symbol	Name	Description	In the Study Area:
a	blocks	angular particles <256 mm	Blocks are common in colluvial deposits that are derived from rockfall.
b	boulders	rounded and subrounded particles >256 mm	Not used in the study area.
k	cobbles	rounded and subrounded particles 64-256 mm	Not used in the study area.
p	pebbles	rounded and subrounded particles 2-64 mm	Used to describe fluvial and glaciofluvial deposits and lacustrine beach deposits. Often mixed with sand.
d	mixed fragments	A mixture of rounded to angular particles >2mm	Mainly used for till or colluvium derived from till. Occasionally used to describe glaciofluvial deposits.
g	gravels	rounded particles, greater than 2mm in size, a mixture of pebbles and cobbles	Gravels are a major component of the glaciofluvial deposits, which are abundant in the study area.
s	sand	particles 2-.062 mm	Sands are very common in the study area, they are also one of the dominant clast sizes 'mixed' in the matrix of tills and glaciofluvial sediments.
z	silt	particles ..062-.002 mm	Silts are a common sized soil particle and are found mainly in the tills and in glaciolacustrine materials. They are a major nutrient and moisture holding component of the soil.
c	clay	particles <.002 mm	
r	rubble	angular particles 2 - 256 mm	Rubble is common mainly in colluvial deposits along the base of slopes in the hilly areas and in association with the near surface bedrock.
m	mud	mix of clay and silt particles <.062	Mud is used to describe Lacustrine and Glaciolacustrine materials and as a component of till.
e	fibric	Least decomposed of the organic materials. Von Post 1-4 *	Not used in the study area.
u	mesic	Intermediate stage of decomposition between fibric and humic.	Not used in the study area.
h	humic	Most advanced and compact of the decomposed organic material. Von post 8-10*	Not used in the study area.

Von post scale is available on page 29 of Field Manual for Describing Terrestrial Ecosystems (B.C. Ministry of Environment, Lands, and Parks and B.C. Ministry of Forests 1998).

Surficial (Genetic) Materials

Surficial materials are classified according to their mode of deposition; this influences material characteristics such as texture, structure, cohesion, and compactness. These characteristics influence ecology as well as the engineering properties of materials including erodibility, bearing strength, and stability. Only one surficial material term can be used for each component of the terrain symbol. Up to three materials can be described in a complex polygon with the use of deciles, for example, ^{6}Mbv ^{3}Cv ^{1}Rs. Note the term glacial drift refers to surficial materials associated with glaciation (M, FG, LG, and U).

Symbol	Name	Definition	In the study area
A	Anthropogenic	Man-made or man-modified material.	These materials are found where there is a substantial amount of fill. Examples of anthropogenic materials are found in roads, mine tailings, dams and borrow pits. Texture can vary greatly and is related to the origin of the material and the mechanism of deposition.
C	Colluvium	Materials deposited as a result of down slope movements due to gravity.	The characteristics of this material can vary greatly depending on its source. Bedrock derived colluvium is coarse textured and unconsolidated and particle size and shape are influenced by the bedrock geology. These materials are loose and well drained and are common on steeper slide-slopes in the upper elevations of the study area. These materials are thin and discontinuous on steep slopes and on hill crests. Thick (talus-like) deposits (rCk) are found along the base of cliffs and have dominantly rubbly or blocky textures. Colluvium derived from the failure of other surficial material reflects the textures of those materials but are often looser and more porous.
E	Eolian	Materials transported and deposited by wind.	Eolian deposits form discontinuous veneers over other surficial materials on the gentle midslopes of the study area. They are loose, well sorted fine-sands and coarse -silts. These materials are common on the east facing slopes and benches on the east side of the Okanagan Valley. In polygon 25 the aeolian deposits have created dunes.
F	Fluvial	Materials (recently) deposited by streams.	Fluvial deposits in this area are mainly contained to the valley floors and are usually associated with stream courses. The textures are generally gravely sands but pockets of sands and silts can be expected along the small floodplains and the lower wet terraces. Steeper gradient streams often show gravels mixed with cobbles and boulders.
FG	Glaciofluvial	Materials deposited by glacial meltwater streams in front of, or in contact with glacial ice.	These materials are common in the Okanagan Valley. They form thick stratified deposits of gravels and sands often in the form of terraces and are well drained. Some thinner FG deposits are found over till in the higher elevations of the study area. Moister FG planes are common on the floor of meltwater channels.
L	Lacustrine	Lake deposited sediments	Well-sorted fine sands, silt and clay found in depressions and seasonal lakes, and coarser beach deposits.
LG	Glaciolacustrine	Sediments deposited in ice-dammed lakes.	Layered deposits of well-sorted sand, silt and clay forming terraces and planes. These are deposits from Glacial Lake Penticton and Glacial Lake Boucherie. These also include beach deposits.
M	Morainal	Materials deposited by glaciers.	Morainal deposits, or till, are widespread on gentle to moderately sloping terrain mostly in the mid to upper elevations of the area. Till textures range from coarse gravely sands to silty stony sands to stony mud rich tills. Most till in the area contain a mixture of fine matrix and stones of various sizes, shapes and rocktypes.
O	Organic	Material resulting from the accumulation and decay of vegetative matter.	In the study area most wetlands are classified as 'organics'. These deposits are found in drainage routes that have 'hollows' that became natural impoundments. The textures are generally fibric in the surface tier and strata of humic and mesic in the middle and bottom tiers. Water tables are at the surface and the drainage is classed as very poor and poor.
R	Rock	Bedrock outcrops covered by <2 cm of material	This is not a true surficial material. Bedrock outcrops are found as bluffs, cliffs, and undulating surfaces. See the bedrock geology Section 1.1.1 for a description of rock types in the study area.
U	Undifferentiated	Layered sequence	Used to describe layers of several types of surficial materials outcropping on a steep erosional slope (scarp)

Surface Expression

Surface expression is the topography or shape of the land surface. The terms listed below provide information that augments those provided by the contours of the topographic base map.

Symbol	Name	Description	In the study area
a	moderate slope	unidirectional surface; 16 to 26° (26 to 50%)	Moderately sloping thick deposits of surficial material such as talus and till. Can be depositional or erosional.
b	blanket	a mantle of unconsolidated materials; >1 m thick	Used to describe moderately thick till and colluvium deposits draped over bedrock and/or other surficial materials.
c	cone	a cone with a smooth surface and relatively straight slopes (>26%)	Usually formed by mass movement processes and made up of colluvium.
d	depression	a circular or irregular hollow delimited by an abrupt break of slope.	Common in till and glaciofluvial materials deposited in conjunction with stagnant ice. Also used to describe bedrock controlled depressions. Depressions are often poorly drained and may have some organic deposits.
f	fan	a fan with a smooth surface and relatively straight slopes (,26%)	Depositional landform associated with fluvial and colluvial materials.
h	hummocky	hillocks and hollows with multidirectional 15 to 35° (26 to 70%)	A depositional landform used with glaciofluvial and till deposits associated with down-wasting. Also used to describe irregular bedrock surfaces.
j	gentle slope	unidirectional surface; 4 to 15° (5 to 26%)	A depositional landform used with a variety of materials including river deposits and thick deposits of glacial drift in the lower valley.
k	moderately steep	unidirectional surface; 27 to 35° (50 to 70%)	Commonly used to describe talus slopes (depositional colluvial slopes). Also used to describe erosional scarp slopes in thick glacial drift and moderately steep bedrock surfaces.
m	rolling	elongate hillocks with slopes 3 to 15o (5 to 26%)	Used to describe rolling bedrock surfaces. Can also be used to describe thick rolling deposits of glacial drift. In the study are there are some rolling glaciofluvial deposits.
p	plain	unidirectional surface; 0 to 3° (3 to 5%)	A depositional landform usually describing thick infillings of fluvial, glaciofluvial, organic, lacustrine, glaciolacustrine, and morainal materials.
r	ridge(s)	steeper elongated hillocks 15 to 35° (26 to 70%)	Used to indicate eskers (linear glaciofluvial ridges) and rock ridgeline.
s	steep	steep slopes; >35° (>70%)	Most commonly describes erosional scarp slopes in thick surficial materials and steep rock faces.
t	terraced	step-like topography	A complex of erosional and depositional surfaces. In the study area terraces are most commonly underlain by glaciofluvial materials. Glaciolacustrine, fluvial, till and anthropogenic deposits alto form terraces.
u	undulating	Gently sloping hillocks and hollows with multidirectional slopes (<26%)	Used for irregular bedrock surfaces, undulating glacial drift and landslide deposits.
v	veneer	Mantle of unconsolidated material; 10 cm to 1 m thick	Widely used to describe thin deposits of a variety of materials draped over bedrock and/or other surficial materials.
w	mantle of variable thickness	A layer or discontinuous layer of variable thickness (typically 0-3m) that fill depressions in an irregular substrate. It is usually too thin to mask irregularities in the underlying material.	Widely used to describe deposits of a variable thickness draped over an irregular underlying surface of bedrock or surficial materials. This is commonly used with materials that fill in hollows including till.
x	thin veneer	Similar to veneer (2-20 cm thick)	Used to describe very thin veneers of materials. Most often used to describe a thin layer of colluvium over bedrock.

Geomorphological Processes

Geomorphological processes are naturally occurring mechanisms that modify the landscape. They include weathering, erosional and depositional processes that are either active at the present time or former processes that may be reactivated by disturbance of the environment. Many of these processes constitute potential hazards or constraints to land use.

Symbol	Name	Description	In the study area
E	Glacial meltwater channels	Areas crossed by meltwater channels (MWC) that are too small or too numerous to map individually.	MWC are common in till and thick glaciofluvial deposits. They can also be cut into bedrock. MWC sidewalls are often steep and may be unstable and erodable. Sidewalls may be cut through layers of surficial material and/or bedrock. MWC floors are flat to gently sloping and can be imperfectly to well drained.
F	Slow mass movement (SMM)	Slope affected by slow mass movement, such as sliding or slumping.	Common in glaciolacustrine deposits and along scarp slopes cut into thick drift. Bedrock failures are also present in the study area.
F"	SMM: Initiation zone *	Polygons that include zones or sites of instability such as slump headscarps. The active scarp or source area for slow mass movement feature(s).	Common in glaciolacustrine deposits and along scarp slopes cut into thick drift.
Fu	SMM: Slump in surficial material*	Slow down slope movement of an internally cohesive mass of material along a planar or curved slip plane.	Most common in glaciolacustrine materials. These slumps are retrogressive and rotational.
H	Kettled	Area includes numerous small depressions and/or lakes where buried blocks of ice melted.	Found in thick till and glaciofluvial deposits. These depressions are commonly moist and may have infillings of organics and/or slope wash.
I	Irregularly sinuous channel	Channel displays irregular turns and bends.	Used to describe the floodplain of Bear Creek.
P	Piping	Subsurface erosion of silty sediments by flowing water resulting in the formation of underground conduits.	Can occur in thick Glaciolacustrine deposits as a result of ground water movement. Only mapped on one polygon #2558.
R	Rapid mass movement (RMM)	Slope affected by processes such as debris flows, debris slides, and rockfall.	Found along steep slopes and scarps throughout the study area.
R"	RMM: Initiation Zone*	Polygons that include zones or sites of instability such as landslide headscarps. The active scarp or source area for rapid mass movement feature(s).	Common on steep scarp slopes in thick drift, over-steepened slopes, mantles of material over steep to moderately steep rock, and on steep rocky slopes.
Rb	RMM: Rock fall*	Decent of a mass of surficial material by falling, bouncing and rolling.	Initiation is common on steep rocky bluffs and cliffs. Rockfall also affects runout zones on talus slopes.
Ru	RMM: Slump in surficial material*	Rapid down slope movement of an internally cohesive mass of surficial material along a planar or curved slip plane.	Used in polygon #54. This failure is in a scarp slope cut into a thick sequence of glacial drift.
Rs	RRM: Debris slide*	Sliding of a disintegrating mass of surficial material.	Used with till and colluvial veneers on steep to moderately steep slopes and on steep to moderately steep scarps cut into thick drift.
U	Inundated	Areas submerged in standing water from a seasonally high water table.	Used in polygon #178 and #2468 which are both depressions. #178 is kettled till and #2468 is a depression with lacustrine infillings.
V	Gullying	Slope affected by gully erosion.	Common throughout the study area. Gullying is a sign of active erosion in the landscape. Gullying is common in till, glaciolacustrine and glaciofluvial slopes. Gullies can also form in rock slopes. Gully sidewalls can be cut into drift and/or bedrock. Bedrock gullies may have a veneer of colluvium.

* Geomorphological process with subclass. Up to 3 subclasses can be used in combination

Description of Soil Drainage Classes

Drainage classes indicate the average moisture conditions in a polygon and reflect how quickly water is removed in relation to the supply. Drainage classes apply to the whole polygon.

Symbol	Name	Description
x	very rapidly drained	Water is removed from the soil very rapidly in relation to supply. Water source is precipitation and available water storage capacity following precipitation is essentially nil. Soils are typically fragmental skeletal, or both.
r	rapidly drained	Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Water source is precipitation. Soils are generally coarse textured.
w	well drained	Water is remover from the soil readily, but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Water source is precipitation. On slopes, subsurface flow may occur for short duration, but additions are equalled by losses. Soils are generally intermediate in texture and lack restricting layers.
m	moderately well drained	Water is removed from the soil somewhat slowly in relation to supply because of imperviousness or lack of gradient. Precipitation is the dominant water source in medium-to fine-textured soils; precipitation and significant additions by subsurface flow are necessary in coarse textured soils.
i	imperfectly drained	Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is the major source. If subsurface water or groundwater (or both) is the main source the flow rate will vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface or groundwater flow (or both) increases as available water storage capacity decreases. Soils generally have a wide range of texture, and some mottling is common.
p	poorly drained	Water is removed so slowly in relation to supply that the soil remains wet for much of the time that it is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface or groundwater flow (or both), in addition to precipitation, are the main water sources. A perched water table may be present. Soils are generally mottled and/or gleyed.
v	very poorly drained	Water is removed from the soil so slowly that the water table remains at or near the surface for most of the time the soil is not frozen. Groundwater flow and subsurface flow are the major sources. Precipitation is less important, except where there is a perched water table with precipitation exceeding evapotranspiration. Typically associated with wetlands.

Slope Range

Slope range is indicated in percent slope (rise divided by the run)

Distinct slope ranges are separated by a comma

Example: 0-5, 50-60

Description of Surface Erosion Potential Classes

Surface erosion potential (SEP) ratings indicate the susceptibility of bare soil to erosion. SEP is rated for each terrain decile. The highest value must be taken to apply one rating for a polygon.

Symbol	Name	In the study area
VL	Very low	Scattered throughout the study area where materials are resistant to surface erosion and where deposition is dominant, such as: undulating bedrock outcrops (for example, polygon # 4532); wetlands (for example, polygon # 4532); gravely flood planes (for example, polygon # 5010); resistant bedrock outcrops (for example, polygon # 5004); and dry course textured terraces (for example, polygon # 4647).
L	Low	Relatively common in the study area. Gentle and undulating slopes, course textures and low moisture make many areas less prone to surface erosion, such as: very thin material over undulating bedrock (for example, polygon # 4038); well drained, low angle till slopes (for example, polygon # 4 168); fans (for example, polygon # 4360); and undulating deposits of sand and gravel (for example, polygon # 4199).
M	Moderate	Very common on the South Slopes due to the wide spread, moderately to well drained, medium textured till common to the moderately sloping, mid to lower slopes such as polygons # 4511 and 4727. Undulating rock with discontinuous or thin material cover also have moderate ratings mixed with low or very low SEP.
H	High	Relatively common in the study area on slopes that are prone to erosion, mostly scarp slopes and slopes with signs of past gullying such as: moderately steep, well drained scarp slopes cut into thick surficial materials (for example, polygon # 4671); slopes with evidence of relic or inactive gullying (for example, polygon # 4499); relatively dry terrace scarps (for example, polygon # 4461); imperfectly drained scarp slopes (for example, polygon # 4806); meltwater-channel side slopes (for example, polygon # 4762); and moist gully sidewalls (for example, polygon # 4771).
VH	Very high	Less then 30 polygons have ratings of very high. They are mostly found along the steep slopes adjacent the major creaks where steep scarps have been cut into thick surficial materials such as polygon # 4758 and along terrace scarps with signs of active erosion such as polygon # 4311.

See Table 7 for descriptions of the classes and Table 8 for example landforms in the study area.

Description of Slope Stability Classes

Slope Stability classes indicate relative stability and indicate a slope's susceptibility to mass movement processes (see the above section on geomorphological processes). Slope Stability classes have been assigned for each terrain decile. The highest value must be taken to obtain one slope stability class for a polygon.

Symbol	Name	In the study area
I	Stable	These are level terraces (for example, polygon # 5006), plains (for example, polygon # 4827), and gently undulating polygons (for example, polygon # 4786) that are found scattered throughout the study area.
II	n/a	This is the most common rating, by area, due to the dominance of large gently undulating and gently sloping till in the study area (for example, polygon # 4730) and thin materials over undulating bedrock (for example, polygon # 4723).
III	n/a	This rating is fairly common on the mid to upper slopes in the study area. Some examples include long continuous till slopes such as polygon # 4727, rocky hill tops such as polygon # 4505, eskers such as polygon # 5011, and thick hummocky deposits like polygon # 4450.
IV	Potentially unstable	Class IV slopes are scattered throughout the study area. and are generally found along the steeper slopes cut into both bedrock and thick glacial drift along the major creaks in the area. They are: moderately steep to steep gully and creak sidewalls such as polygon # 4614; narrow, east-west trending, steeper bedrock controlled slopes such as polygon # 4309; and moderately steep to steep slopes with a thin veneer of material that may be prone to sliding off of rock surfaces such as polygon # 4087.
V	Unstable	Fifteen polygons in the south slopes are rated unstable. Most have active mass movement processes evident on the air photos or identified during field work. The majority of these polygons are moderately steep to steep scarp slopes cut into thick glacial drift. Polygon # 4329 appears to be an old rock slide. It has been labelled 'inactive' but has been rated V as it warrants further investigation. Any disturbance of this polygon could reinitiate movement.

See table 9 for example polygon description.

Appendix II Expanded Legend

CENTRAL OKANAGAN EXPANDED LEGEND – IDFxh1

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AM	At – Common snowberry – Mountain sweet-cicely	IDFxh1	00

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with rich, gently sloping sites that are receiving seepage. They occur as small to medium-sized patches usually in a coniferous forest matrix. This unit is quite uncommon in the study area. Forests are dominated by trembling aspen and are moderately closed. The shrubby understory is rich and is dominated by snowberry, Douglas maple, saskatoon and other shrubs and forbs. Due to the build-up of deciduous litter, mosses are uncommon on these sites. Trembling aspen has very thin bark and is very easily killed by fire. Historically, many of these sites may have had aspen as a shrub stage for long periods of time.

List of mapped units:

AMg	fine-textured soils
AMk	cool-aspect; slope >25%

SITE INFORMATION

Common Terrain Types:

- gentle morainal slopes

Slope position:	middle
Slope (%):	
Aspect:	all
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AM	At – Common snowberry – Mountain sweet-cicely	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus tremuloides*	***	****	****	****	****	trembling aspen
Shrubs	*Prunus virginiana*	****	***	***	***	***	choke cherry
	Symphoricarpos albus	***	***	***	***	***	common snowberry
	Rosa sp.	***	**	**	**	**	rose
	Acer glabrum var. *douglasii*	***	**	**	**	**	Douglas maple
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
Grasses	*Elymus glaucus*	***	*	*	*	*	blue wildrye
	Maianthemum stellata	***	**	**	**	**	star-flowered false Solomon's-seal
	Galium triflorum	**	*	*	*	*	northern bedstraw
	Osmorhiza berteroi	**	*	*	*	*	mountain sweet-cicely
	Aralia nudicaulis	**	*	*	*	*	sarsaparilla
PLOTS		COV44		COG22 COG45 COG71 COG86	COG26		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites

***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AO	At – Mock orange – Choke cherry Riparian	IDFxh1	00

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with moist streamside riparian sites in grassland areas. The overstory is composed of trembling aspen and the understory is rich, shrubby and diverse. This unit is rare in the study area and was only noted in the Ellison area. The moss layer is sparse but scattered moisture-indicating mosses such as leafy mosses do occur.

List of mapped units:

AOa	active floodplain
AOg	occurs in a gully
AOt	occurs on a fluvial terrace

SITE INFORMATION

Common Terrain Types:

- gentle and level fluvial sites

Slope position:	level, lower and toe
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhygric - hygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AO	At – Mock orange – Choke cherry Riparian	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus tremuloides*	***	****	****	****	****	trembling aspen
Shrubs	*Symphoricarpos albus*	****	***	***	***	***	common snowberry
	Philadelphus lewisii	****	***	***	***	***	mock-orange
	Acer glabrum var. *douglasii*	***	***	***	***	***	Douglas maple
	Rosa nutkana	***	**	**	**	**	Nootka rose
	Cornus stolonifera	**	**	**	**	**	red-osier dogwood
	Amelanchier alnifolia	**	*	*	*	*	saskatoon
	Salix bebbianna	**	*	*	*	*	Bebb's willow
	Betula occidentalis	*	*	*	*	*	water birch
Grasses	*Elymus glaucus*	*	*	*	*	*	blue wildrye
	Poa pratensis	*	*	*	*	*	Kentucky bluegrass
Herbs	*Viola canadensis*	**	**	**	**	**	Canada violet
	Urtica dioica	**	*	*	*	*	stinging nettle
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
	Thalictrum occidentalis	*	*	*	*	*	western meadowrue
	Cynoglossum officinale	*	*	*	*	*	hound's tongue
	Arctium minus	*	*	*	*	*	burdock
Mosses	*Mnium* sp.	*	*	*	*	*	leafy moss
PLOTS		COV134		COG41	COG42 COG61 COG54		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: the presence of stinging nettle is a good indicator for high nitrogen on these sites.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	At – Snowberry – Kentucky bluegrass	IDFxh1	98

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This forest ecosystem commonly occurs in large, broad depressions in grassland areas. This unit is rare in the study area and was only noted in the grasslands of the Ellison area. These sites collect moisture from surrounding grassland areas. They have an overstory of trembling aspen and a shrubby understory dominated by snowberry and roses. This site unit was observed on the east side of the study area (Ellison) but no data was collected for it.

List of mapped units:

ASk	cool-aspect; slope >25%	ASw	warm-aspect; slope >25%

SITE INFORMATION

Common Terrain Types:

- aeolian veneer over thick morainal or glaciofluvial materials

Slope position:	lower, toe, depression
Slope (%):	0-35
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	At – Snowberry – Kentucky bluegrass	IDFxh1	98

	Structural Stage	3	4	5	6	7	
Trees	*Populus tremuloides*	***	****	****	****	****	trembling aspen
Shrubs	*Amelanchier alnifolia*	**	*	*	*	*	saskatoon
	Symphoricarpos albus	*****	****	****	****	****	common snowberry
	Rosa nutkana	***	**	**	**	**	Nootka rose
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
	Poa pratensis	**	*	*	*	*	Kentucky bluegrass
Herbs	*Cynoglossum officinale*	*	*	*	*	*	hound's tongue
	Arctium minus	*	*	*	*	*	burdock
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
	Thalictrum occidentalis	**	*	*	*	*	western meadowrue
Mosses	*Brachythecium* sp.	*	*	*	*	*	ragged moss
PLOTS							

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BM	Bulrush Marsh	IDFxh1	00

Typic unit occurs on level sites with deep, fine-textured soils (assumed modifiers are d, f, and j)

This unit is equivalent to the *Great bulrush marsh* association in the provincial classification (MacKenzie and Shaw 2000)

This marsh wetland ecosystem commonly occurs on small ponds adjacent to shallow open water as a fringe along the shoreline. This unit is very uncommon in the study area. It sometimes occurs as a complex with cattail marshes (CT) and shallow open water (OW). Typically a narrow mixed-forest riparian fringe (CD) in an upland coniferous forest matrix surrounds these ecosystems. Bulrush marshes in larger ponds may have a willow fringe (WS) and a forest riparian fringe (CD). Water depths are usually up to 1.5 m but water levels draw down significantly in the summer. These sites are most commonly dominated by soft-stemmed bulrush, with some floating aquatic plants (duckweed, bladderwort and water smartweed) and occasionally with a minor component of cattail. Vegetation species diversity is typically low on these sites. Soils are typically mineral, sometimes with a thin organic veneer.

Lower right section of the photo shows a bulrush marsh (darker green; brighter green on the left is a sedge marsh).

SITE INFORMATION	
Common Terrain Types: • lacustrine plains	
Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhydric - hydric
Soil Nutrient Regime:	rich – very rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BM	Bulrush Marsh	IDFxh1	00

	Structural Stage	2b	
Rushes	*Scirpus validus*	***	soft-stemmed bulrush
	Schoenoplectus pungens	**	American bulrush
Herbs	*Utricularia macrorhiza*	**	greater bladderwort
	Polygonom amphibium	**	water smartweed
	Lemna sp.	**	duckweed
	Typha latifolia	*	common cattail
Liverworts	*Ricciocarpos natans*	**	
PLOTS		9802126 9901741 COV93	

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: sites are usually only dominated by one bulrush species; soft-stemmed bulrush was more common in the study area

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BN	Kentucky bluegrass – Stiff needlegrass	IDFxh1	96

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This ecosystem commonly occurs in moisture-collecting swales and depressions in grasslands and grassland openings. This unit is uncommon in the study area. These sites are generally quite small and are dominated by grasses with scattered forbs. All sites observed were disturbed and dominated by Kentucky bluegrass. This ecosystem is likely dominated by needlegrasses at climax.

List of mapped units:

BNf	fine-textured soils	BNs	occurs on shallow soils (generally 50-100cm deep)
BNg	occurs in a gully	BNw	warm-aspect; slope >25%

SITE INFORMATION

Common Terrain Types:

- aeolian veneer over thick morainal or glaciofluvial materials

Slope position:	toe, depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	medium – rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BN	Kentucky bluegrass – Stiff needlegrass	IDFxh1	96

	Structural Stage	2b	
Grasses	*Poa pratensis*	****	Kentucky bluegrass
	Achnatherum occidentale	**	stiff needlegrass
Herbs	*Taraxacum officinale*	**	dandelion
	Potentilla gracilis	**	graceful cinquefoil
	Achillea millefolium	**	yarrow
	Dodecatheon pulchellum	**	few-flowered shooting star
	Ranunculus glaberrimus	*	sagebrush buttercup
PLOTS		COG75 COV80 COV81 COV29	

Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BR	Baltic Rush Marsh-Meadow	IDFxh1	00

Typic unit occurs on level sites with deep, fine-textured soils (assumed modifiers are d, f, and j)
This unit is equivalent to the *Baltic rush – Field sedge marsh* association in the provincial classification (MacKenzie and Shaw 2000)
This marsh-meadow wetland ecosystem occurs in areas where water draws down below the soil surface most summers (seasonal flooding). This unit is rare in the study area. These sites are dominated by baltic rushes or other rushes. Field sedge may also occur in slightly drier situations. Soils are typically mineral. Within the study area, this marsh was observed in grassland areas.

SITE INFORMATION	
Common Terrain Types: • lacustrine veneer over thick morainal or glaciofluvial materials	
Slope position:	toe, depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	hygric – subhydric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BR	Baltic Rush Marsh-Meadow	IDFxh1	00

	Structural Stage	2b	
Rushes	*Juncus articulatus*	***	jointed rush
	Juncus balticus	***	baltic rush
Herbs	*Hippuris vulgaris*	**	common mare's tail
	Lemna minor	**	common duckweed
	Ranunculus sceleratus	**	celery-leaved buttercup
PLOTS		COG74	

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: We observed one jointed rush marsh but baltic rush is likely the more typical species in these marshes. Field sedge is also common in slightly drier situations.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CB	Cutbank	IDFxh1	N/A
Edge of a road cut that is upslope or down slope of a road and was created by the excavation of a hillside.			
List of mapped units:			
CBw	warm-aspect; slope >25%		

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	Black cottonwood / Douglas-fir –Common Snowberry – Red-osier Dogwood Riparian	IDFxh1	00

Typic unit occurs on level or very gently sloping sites with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with active floodplains and fluvial terraces with subsurface water (CDa, CDac, CDct, CDt). This unit is uncommon in the study area. This unit is also found as a narrow riparian fringe around ponds (CD) and along the Okanagan Lake foreshore (CDc, CD). Forests are often mixed black cottonwood with Douglas-fir, and mature and older forests are usually multi-layered. The understory is typically rich and shrubby, often dominated by Douglas maple, snowberry and red-osier dogwood. Forbs (star-flowered false Solomon's seal), grasses (blue wildrye) and ragged mosses are uncommon and scattered.

List of mapped units:

CDa	active floodplain	CDct	coarse-textured soil, fluvial terrace
CDac	active floodplain, coarse-textured soils	CDg	occurs in a gully
CDc	coarse-textured soils (commonly mapped on Okanagan Lake foreshore)	CDs	occurs on shallow soils (unusual situations where bedrock is within 1m of the surface in riparian areas)
CDcn	fluvial fan, coarse-textured soils		

SITE INFORMATION

Common Terrain Types:

- gently sloping & level fluvial sites & active floodplains

Slope position:	level, lower and toe
Slope (%):	0-5
Aspect:	none
Soil Moisture Regime:	subhygric – hygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	Black cottonwood / Douglas-fir –Common Snowberry – Red-osier Dogwood Riparian	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus balsamifera* ssp. *trichocarpa*	**	***	***	***	***	black cottonwood
	Betula papyrifera		**	**	**	**	paper birch
	Pseudotsuga menziesii var. *glauca*			*	**	**	Douglas-fir
Shrubs	*Symphoricarpos albus*	*****	****	****	****	****	common snowberry
	Acer glabrum var. *douglasii*	****	***	***	***	***	Douglas maple
	Amelanchier alnifolia	***	**	**	**	**	saskatoon
	Mahonia aquifolium	***	**	**	**	**	tall oregon-grape
	Rosa nutkana	***	**	**	**	**	Nootka rose
	Cornus stolonifera	***	**	**	**	**	red-osier dogwood
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
	Poa pratensis	**	*	*	*	*	Kentucky bluegrass
Herbs	*Equisetum hyemale*	**	*	*	*	*	scouring rush
	Maianthemum stellata			*	*	*	star-flowered false Solomon's-seal
	Maianthemum racemosa			*	*	*	false Solomon's seal
	Prosartes trachycaulum			*	*	*	rough-fruited fairybells
Mosses	*Brachythecium* sp.				*	*	ragged moss
PLOTS					9802070 9802103 9802114 9901738 COG101 COG115 COG146 COG90 COV275 COV479	COG167 COG190	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: some sites along the Okanagan Lake foreshore have low tree cover. Some pond fringes have higher Douglas-fir cover and may have tea-leaved willow and water birch as well on these sites.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CF	Cultivated Field	IDFxh1	N/A
These are agricultural fields with tilled soils and planted crops or ground cover.			
List of mapped units:			
CFt	terrace (fluvial or glaciofluvial)	CFw	warm aspect; slope >25%

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CL	Cliff	IDFxh1	N/A
These are steep, vertical or overhanging rock faces. Typically there are scattered plants such as saskatoon cliff ferns occurring in rock fractures.			
List of mapped units:			
CLq	very steep cool aspect	CLz	very steep warm aspect

Plots: COG170

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CO	Cultivated Orchard	IDFxh1	N/A
Agricultural areas for growing fruit trees.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CS	Common Spikerush Marsh	IDFxh1	00

Typic unit occurs on level sites with deep, fine textured soils (assumed modifiers are d, f, and j)

This unit is equivalent to the *Common spike-rush marsh* association in the provincial classification (MacKenzie and Shaw 2000)

These marsh wetland ecosystems occur in standing water as a fringe around ponds, shallow open water and other marshes. This unit is rare in the study area. The water table often drops to the soil surface in late summer. These sites usually have shallower water than Bulrush marshes or Cattail marshes. They have a variable mixture of common spikerush, reed canary grass (probably due to disturbance) and some floating aquatic species. Soils are typically mineral, but may have a thin organic veneer on top. This wetland unit was observed in both grassland areas and in forested areas with a narrow riparian fringe (CD).

SITE INFORMATION	
Common Terrain Types: • lacustrine	
Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhydric
Soil Nutrient Regime:	rich – very rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CS	Common Spikerush Marsh	IDFxh1	00

	Structural Stage	2b	
Rushes *Grasses* *Sedges*	*Eleocharis palustris*	***	common spike-rush
	Juncus balticus	**	baltic rush
	Phalaris arundinacea	**	reed canarygrass
	Alopecurus aequalis	**	little meadow-foxtail
	Carex spp.	**	sedges
Herbs	*Polygonom amphibium*	**	water smartweed
	Lemna minor	**	common duckweed
	Ranunculus sceleratus	**	celery-leaved buttercup
PLOTS		9802112 9901742 COG159	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: reed canarygrass probably only occurs in disturbed marshes

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CT	Cattail Marsh	IDFxh1	00

Typic unit occurs on level sites with deep, medium-textured soils (assumed modifiers are d, j, m)

This unit is equivalent to the *Cattail marsh* association in the provincial classification (MacKenzie and Shaw 2000)

This marsh wetland ecosystem commonly occurs as a fringe on pond edges or in depressions, often adjacent to shallow open water (OW). This unit is very uncommon in the study area. Water depths are typically up to 1 m in spring but draw down to the soil surface by late summer; soils remain saturated for most of the season. Some wetlands convert to cattail marshes when they are subject to nutrient loading. These sites are dominated by cattails with few other species. Soils are typically mineral, but may have a thin organic veneer on top. All cattail marshes observed in the study area occurred in a forested matrix with a narrow forested riparian fringe (CD).

Photo shows cattail marsh and shallow open water.

List of mapped units:

CTp peaty materials, 40+cm of organic material overlaying mineral deposits

SITE INFORMATION

Common Terrain Types:

- lacustrine veneer over morainal or glaciofluvial blanket

Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	hygric - subhydric
Soil Nutrient Regime:	rich – very rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CT	Cattail Marsh	IDFxh1	00

	Structural Stage	2a	
Herbs	*Typha latifolia*	****	common cattail
	Spirodela polyrhiza	**	great duckmeat
	Lemna minor	**	common duckweed
PLOTS		9901740 COG178 COV93	

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CW	Choke cherry – Bluebunch wheatgrass rocky bluff	IDFxh1	00

Typic unit occurs on gentle slopes with very shallow soils (assumed modifiers are j and v)

This ecosystem commonly occurs on bedrock bluffs where the bedrock is quite fractured. This unit is rare in the study area. Exposed bedrock usually occupies 30-50% of the area. Shrubs are common, typically occurring in cracks in the rocks. Grasses, forbs, lichens and mosses occur in small soil pockets scattered in amongst the bedrock. These sites tend to occur more commonly in grassland areas. Historically, the lack of fuels on these sites meant that they would not have burned and would have been refugia for dry, fire-intolerant species such as Rocky Mountain juniper.

List of mapped units:			
CWk	cool aspect; slope >25%	CWw	warm aspect; slope >25%
CWq	cool aspect; slope very steep (>100%)	CWz	warm aspect; slope very steep (>100%)
CWr	occurs on a ridge		

SITE INFORMATION	
Common Terrain Types: • rock and very thin colluvial and morainal and glaciofluvial veneers	
Slope position:	crest, upper
Slope (%):	0-100
Aspect:	all
Soil Moisture Regime:	very xeric
Soil Nutrient Regime:	poor, medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CW	Choke cherry – Bluebunch wheatgrass rocky bluff	IDFxh1	00

	Structural Stage	3	
Trees	*Pinus ponderosa*	*	ponderosa pine
Shrubs	*Philadelphus lewisii*	***	mock-orange
	Amelanchier alnifolia	**	saskatoon
	Symphoricarpos albus	**	common snowberry
	Prunus virginiana	**	choke cherry
	Juniperus scopulorum	*	Rocky Mountain juniper
	Ribes cereum	*	squaw currant
Grasses and Sedges	*Pseudoroegneria spicata*	**	bluebunch wheatgrass
	Bromus japonicus or *tectorum*	*	Japanese brome or cheatgrass
	Carex rossii	*	Ross' sedge
Herbs	*Selaginella densa* or *Selaginella wallacei*	**	compact selaginella Wallace's selaginella
	Woodsia scopulina	*	mountain cliff fern
	Balsamorhiza sagittata	*	arrowleaf balsamroot
Mosses and Lichens	*Cladonia* spp.	**	clad lichens
	Tortula ruralis	**	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*	felt pelt felt pelt
PLOTS		9802113 COG79 COV148 COV172	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DP	Douglas-fir / Ponderosa pine – Pinegrass	IDFxh1	01

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with gently sloping sites that are neither receiving nor losing moisture (circumesic). This is the most common unit in the study area. Forests are moderately closed with mixed Douglas-fir and ponderosa pine overstories, although historically they would have been quite open. The understory is generally dominated by abundant pinegrass, often with rough fescue and scattered shrubs, forbs, mosses and lichens. Forbs are more abundant on more open sites that have been less subject to ingrowth (or have been thinned). This unit is also common on cool aspects (DPk) where there is usually more of a moss layer and often occurs on shallow soils on cool aspects (DPks). This ecosystem also occurs on gentle glaciofluvial slopes (DP, DPc) or terraces (DPt, DPct) where Ponderosa pine is often more abundant than Douglas-fir but understories are very similar. Mature (structural stage 6) and old (structural stage 7) forests are uncommon because most of the large trees historically present on these sites have been logged. Because of fire exclusion, most sites have become ingrown with higher densities of smaller stems. Rough fescue is quite common and Idaho fescue is quite uncommon on DP sites in this study area relative to those in the South Okanagan.

List of mapped units:

DPc	coarse-textured soils	DPks	cool aspect (usually NW to E), shallow soils (generally 50-100cm)
DPck	coarse-textured soils, cool aspect (usually north to north-east)	DPn	occurs on a fan
DPct	coarse-textured soils; terrace (usually glaciofluvial)	DPs	shallow soils (generally 50-100cm)
DPcw	coarse-textured soils; warm aspect (usually SE or WNW; these sites likely have some compensating moisture or occur at upper edge of subzone)	DPsw	shallow soils (generally 50-100cm); warm aspect (usually NW or SE at upper edge of subzone or with some compensating moisture)
DPf	fine-textured soils	DPt	occurs on a terrace (usually a glaciofluvial terrace)
DPfk	fine-textured soils, cool aspect (usually north to north-east)	DPv	very shallow soils; occurs only at upper elevations in the deeper pockets associated with shallow soil sites where there is compensating moisture
DPg	site occurs in a gully	DPw	warm aspect (usually SE or NW these sites have some compensating moisture or occurs at the upper edge of the subzone
DPk	cool aspect (usually NW or E)		

SITE INFORMATION

Common Terrain Types:

- deep morainal and glaciofluvial materials on gentle slopes
- moderate to steep cool aspect morainal and glaciofluvial slopes (deep or shallow)
- glaciofluvial terraces

Slope position:	mostly level and middle
Slope (%):	0-30; up to 70% on cool aspects
Aspect:	all
Soil Moisture Regime:	mesic – submesic
Soil Nutrient Regime:	medium (poor, rich)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DP	Douglas-fir / Ponderosa pine – Pinegrass	IDFxh1	01

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	****	****	***	***	Douglas-fir
	Pinus ponderosa	**	***	***	***	***	ponderosa pine
	Populus tremuloides	*	*	*			
Shrubs	*Paxistima myrsinites*	***	**	**	**	**	falsebox
	Symphoricarpos albus	****	**	**	**	**	common snowberry
	Spirea betulifolia	**	*	**	**	**	birch-leaved spirea
	Amelanchier alnifolia	**	*	*	*	*	saskatoon
	Mahonia aquifolium	**	*	*	*	*	tall oregon-grape
	Ceanothus sanguineus	****	*	*			redstem ceanothus
	Rosa spp.	**	*	**			roses
	Rubus idaeus	***					red raspberry
	Holodiscus discolor	**					ocean spray
Grasses and Sedges	*Calamagrostis rubescens*	****	**	***	***	****	pinegrass
	Festuca campestris	**	**	**	***	***	rough fescue
	Carex concinnoides	**	*	*	*	*	northwestern sedge
Herbs	*Balsamorhiza sagittata*	****	**	***	***	***	arrowleaf balsamroot
	Arnica cordifolia	***	**	**	**	**	heart-leaved arnica
	Antennaria neglecta	**	*	*	*	*	field pussytoes
	Fragaria virginiana	***	*	*	*	*	wild strawberry
	Epilobium angustifolium	***					fireweed
Mosses	*Tortula ruralis*	***	**	**	**	*	sidewalk moss
	Peltigera canina	*	*	*	*	*	dog pelt
	Dicranum sp.	*	*	*	*	*	
	Polytrichum juniperinum	*	*	*	*	*	juniper haircap moss
	Brachythecium sp.	*	*	*	*	*	ragged moss
PLOTS		COG106, COG111, COG131, COG134, COG135, COV169	9802076, COG49, COV143, COG95	COG03, COG04, COG06, COG103, COG114, COG121, COG133, COG150, COG21, COG34, COG40, COG55, COG59, COG88, COG183, COG196, COG185, COV109, COV124, COV184, COV211, COV36, COG145, COV168	COG01, COG05, COG107, COG125, COG31, COG52, COG68, COG69, COG85, COG187, COV35, COV16	9802099, COG78	

Highlighted species – indicate important forage plants for ungulates

* incidental cover (less than 1% cover); used as indicator species

** 1-5% cover; occurs in 60% or more of sites

*** 6-25% cover; occurs in 60% or more of sites

**** 26-50% cover; occurs in 60% or more of sites

***** >50% cover; occurs in 60% or more of sites

Comments: Fireweed seems to be common only after burning (as opposed to logging)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	Douglas-fir / Ponderosa pine – Snowberry – Spirea	IDFxh1	07

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with gently sloping sites that are receiving some moisture. This is a common unit in the study area. It is also found on higher floodplain benches along creeks and rivers where there is some sub-surface moisture. These forests typically have moderately closed Douglas-fir overstories with very shrubby understories dominated by snowberry with some Oregon-grape, Douglas maple, and saskatoon. Often there is scattered pinegrass and/or Kentucky bluegrass with some heart-leaved arnica and other scattered forbs. There is a minimal moss layer with scattered patches of ragged mosses. Because these sites are moist, they may have had a longer fire-return interval than adjacent mesic and drier forests. These sites also tend to recover more quickly after disturbance (such as logging) because they are moister and more productive.

Although these sites are productive and vegetation recovers relatively quickly following disturbances such as logging, the moist soils on these sites are sensitive to disturbance and are difficult to find places for septic fields. Alterations in subsurface water flow present considerable risks to soil stability.

List of mapped units:

DSa	occurs on an active floodplain (higher benches)	DSk	cool aspects (most commonly N or NE)
DSc	coarse-textured soils	DSks	occurs on cool aspects (usually N or NE) with shallow soils
DScg	site occurs in a gully with coarse-textured soils	DSn	occurs on a fan
DSck	coarse-textured soils, cool aspect (most commonly N or NE)	DSs	occurs on shallow soils (generally 50-100cm; usually at upper edges of subzone, receiving sites)
DScw	coarse-textured soils, warm aspect (places where seepage emerges on steep glaciofluvial slopes)	DSt	occurs on a terrace (usually fluvial)
DSfg	site occurs in a gully with fine-textured soils	DSw	warm aspect (usually SE or NW, usually only at higher elevations or sites with some compensating moisture)
DSg	site occurs in a gully		

SITE INFORMATION

Common Terrain Types:

- gentle morainal and glaciofluvial slopes

Slope position:	level, lower, toe, middle, depression
Slope (%):	0-15% (sometimes steeper on cool or warm aspects)
Aspect:	none, cool
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	medium – rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	Douglas-fir / Ponderosa pine – Snowberry – Spirea	IDFxh1	07

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	*****	****	****	***	Douglas-fir
	Populus tremuloides	**	**	**	**	*	trembling aspen
	Betula paperifera	**	**	**	**	**	paper birch
Shrubs	*Symphoricarpos albus*	*****	***	****	****	****	common snowberry
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Paxistima myrsinites	**	**	**	**	**	falsebox
	Acer glabrum	***	**	**	**	***	Douglas maple
	Spirea betulifolia	***	**	**	**	**	birch-leaved spirea
	Rosa nutkana	***	**	**	**	**	Nootka rose
	Ceanothus sanguineus	****	*				redstem ceanothus
Grasses	*Calamagrostis rubescens*	***	**	**	**	**	pinegrass
	Elymus glaucus	**	*	*	*	*	blue wildrye
	Poa pratensis	**	**	**	**	**	Kentucky bluegrass
Herbs	*Arnica cordifolia*	***	*	**	**	**	heart-leaved arnica
Mosses	*Brachythecium* sp.	**	*	**	**	**	ragged moss
PLOTS		COG58 COG144 COG189 COV176		9802121 9802127 COG93 COG112 COG148 COG155 COG162 COG182 COV83 COG110	9802049 COG24 COG89 COG119 COG120 COG164 COG174		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: Douglas maple is more common on slightly moister sites; mixed and deciduous sites usually have a more diverse shrub layer; star-flowered false Solomon's seal, mountain sweet-cicely, and western meadowrue are often present on these mixed/pure deciduous sites as well

	Site Unit Name	BGC	Site Series Number
DW	Douglas-fir / Ponderosa pine – Bluebunch wheatgrass - Pinegrass	IDFxh1	03

Typic unit occurs on moderate to steep warm aspects with deep, medium textured soils (d, m and w are assumed modifiers).

This forest ecosystem is common on moderate to steep warm aspects (excluding southeast and west aspects which are usually /04 sites). This is a moderately common unit in the study area. Sometimes occurs on cooler aspects were soils are shallower. Also occurs on ridges and crests where soils are not shallow enough to be the IDFxh1 /02 (PB). Mixed ponderosa pine – Douglas-fir forests are open and dominated by bunchgrasses, particularly bluebunch wheatgrass with scattered forbs (mostly balsamroot). Rough fescue commonly occurs, in contrast with the Idaho fescue that more commonly occurs on these sites further south. Mosses and lichens are scattered and uncommon. Because these sites are drier, ingrowth is less predominant than on other sites, although it is still present.

List of mapped units:

DWc	coarse-textured soils (usually glaciofluvial)	DWks	cool aspect (generally NW or ESE), shallow soils (20-100cm)
DWck	coarse-textured soils (usually glaciofluvial), cool aspect (generally NW or ESE; usually only at lower elevations)	DWkv	cool aspect (generally NW or ESE), very shallow soils (<20cm); exposed bedrock (typically 10-20% cover) is present
DWcr	coarse-textured soils; occurs on a ridge	DWr	ridge
DWcs	coarse-textured soils; shallow soils (20-100cm)	DWrs	ridge, shallow soils (20-100cm)
DWf	fine-textured soils (usually glaciolacustrine banks)	DWrv	ridge, very shallow soils (<20cm)
DWj	gentle slope (dry upper slopes)	DWs	shallow soils (20-100cm)
DWjv	gentle slope with very shallow soils (<20cm)	DWv	very shallow soils (<20cm; usually only at upper elevations); exposed bedrock (typically 10-20% cover) is present
DWk	cool aspect (generally NW or ESE; upper slopes; usually low elevations)	DWz	very steep warm aspect (>100% slope)

SITE INFORMATION

Common Terrain Types:

- steep warm aspect colluvial and morainal slopes
- thin colluvial and morainal slopes (Cv, Mv)
- moderate glaciofluvial slopes (FGk) on warm aspects

Slope position:	middle and upper
Slope (%):	(30) 40 – 75%
Aspect:	south, southwest, west (also southeast on glaciofluvial slopes and shallow soils)
Soil Moisture Regime:	subxeric (xeric)
Soil Nutrient Regime:	poor – medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DW	Douglas-fir / Ponderosa pine – Bluebunch wheatgrass - Pinegrass	IDFxh1	03

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	***	***	***	***	Douglas-fir
	Pinus ponderosa	**	****	***	***	***	ponderosa pine
Shrubs	*Amelanchier alnifolia*	**	*	**	**	**	saskatoon
	Spirea betulifolia	***	**	**	**	**	birch-leaved spirea
	Mahonia aquifolium	**					tall oregon-grape
Grasses	*Pseudoroegneria spicata*	***	**	***	***	***	bluebunch wheatgrass
	Festuca campestris	***	*	**	**	***	rough fescue
	Koeleria macrantha	***	*	**	**	**	junegrass
	Poa fendleriana	***	*	**	**	**	Fendler's bluegrass
	Bromus tectorum	**	**	**	**	**	cheatgrass
Herbs	*Balsamorhiza sagittata*	***	*	**	**	**	arrowleaf balsamroot
	Achillea millefolium	**	*	**	**	**	yarrow
	Antennaria microphylla or *Antennaria parviflora* or *Antennaria umbrinella*	**	*	*	*	*	white pussytoes Nuttall's pussytoes umber pussytoes
Mosses and Lichens	*Cladonia* spp.	**	**	**	**	**	clad lichens
	Tortula ruralis	**	*	*	*	*	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*	*	*	*	*	felt pelt felt pelt
	Brachythecium sp.	*	*	*	*	*	
PLOTS		COG141		COG108 COG138 COG163 COG188 COG198	9901743 9901744 COG09 COG104 COG109 COG117 COG126 COG130 COG166 COV14 COV27		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
ES	Exposed Soil	IDFxh1	N/A
These are areas of exposed soils and typically include recent disturbances such as soil erosion.			
List of mapped units:			
ESk cool aspect		ESw warm aspect	

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FC	Rough fescue - Cladina	IDFxh1	00

Typic unit occurs on cool aspects with very shallow soils (assumed modifiers are k, v)

This grassland ecosystem occurs on cool aspects of smooth, gentle to moderate cool aspects of gneiss formations. This unit is common in the South Slopes area but was not seen elsewhere. It was apparently restricted to the South Slopes area because of the distinctive nature of the gneiss rock outcrops in that area. The abundant light-yellow coloured reindeer lichen with rough fescue and some low-relief, unfractured bedrock outcrops make these sites distinctive. Many sites are relatively undisturbed. These sites usually occur as small openings in amongst forests areas on deeper soils and with cliffs or SA sites on the rugged, warm aspect slopes of gneiss rock outcrops.

List of mapped units:

FCj gentle slopes (cool aspects, but less than 25% slope)

SITE INFORMATION	
Common Terrain Types: • very thin and thin colluvial and morainal veneers	
Slope position:	middle to upper
Slope (%):	20-50%
Aspect:	all
Soil Moisture Regime:	subxeric
Soil Nutrient Regime:	poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FC	Rough fescue - Cladina	IDFxh1	00

	Structural Stage	2b FW	
Grasses	*Festuca campestris*	***	rough fescue
	Agrostis scabra	**	hair bentgrass
	Koeleria macrantha	**	junegrass
	Pseudoroegneria spicata	**	bluebunch wheatgrass
Herbs	*Heuchera cylindrica*	*	round-leaved alumroot
	Selaginella densa	*	compact selaginella
	Lomatium spp.	*	desert-parsley
	Fritillaria affinis	*	chocolate lily
	Galium aparine	*	cleavers
	Sedum stenopetalum	*	worm-leaved stonecrop
	Epilobium brachycarpum	*	tall annual willowherb
Mosses	*Cladina mitis*	***	lesser green reindeer
Lichens	*Dicranum sp.*	**	
PLOTS		9802096 COG181	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FO	Douglas-fir / Ponderosa pine –Saskatoon – Mock orange	IDFxh1	00

Typic unit occurs on steep slopes with deep, coarse-textured (rocky) soils (c, and d are assumed modifiers).

This forest ecosystem is commonly associated with steep colluvial sites with rocky soils. This is an uncommon unit in the study area. It occurs on both cool (FOk) and warm (FOw) aspects. The soil matrix is a mixture of both angular rocks and sandy, silty material. The overstory is generally open and dominated by Douglas-fir with scattered ponderosa pine. Understories are often quite shrubby with snowberry, saskatoon and mock orange. There is usually scattered bluebunch wheatgrass. Small rocks dominate a large portion of the soil surface.

List of mapped units:

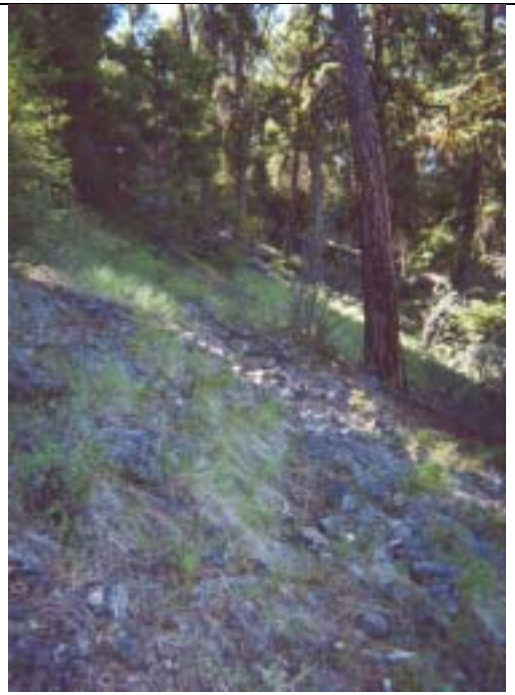
FOk	cool aspect	FOw	warm aspect (slope >25%)
FOsw	shallow soils (50-100cm); warm aspect (slope >25%)		

SITE INFORMATION

Common Terrain Types:

- moderate and steep colluvial slopes

Slope position:	lower to upper
Slope (%):	50-75%
Aspect:	all
Soil Moisture Regime:	submesic – subxeric
Soil Nutrient Regime:	medium, poor



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FO	Douglas-fir / Ponderosa pine –Saskatoon – Mock orange	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	***	***	***	***	Douglas-fir
	Pinus ponderosa		**	**	**	**	ponderosa pine
Shrubs	*Symphoricarpos albus*	*****	***	***	****	****	common snowberry
	Spirea betulifolia	****	**	**	***	***	birch-leaved spirea
	Amelanchier alnifolia	***	**	**	***	***	saskatoon
	Paxistima myrsinites	**	*	*	*	**	falsebox
	Acer glabrum	**	*	*	*	*	Douglas maple
Grasses	*Pseudoroegneria spicata*	***	**	**	***	***	bluebunch wheatgrass
	Calamagrostis rubescens	***	**	**	***	***	pinegrass
Herbs	*Apocynum androsaemifolium*	***	**	**	**	**	spreading dogbane
	Penstemon fruticosa	*	*	*	*	*	shrubby penstemon
PLOTS				COG127	9802100 COG124 COG165 COV257		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FW	Idaho fescue – Bluebunch wheatgrass	IDFxh1	91

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, m)

This grassland ecosystem occurs on gentle warm aspects, levels sites, and cool aspects. This unit is common in the Ellison area but uncommon elsewhere. Historically, these sites were likely maintained as grasslands by fire and many may have been lost to forest encroachment. A mixture of rough fescue and bluebunch wheatgrass with balsamroot and other herbs dominates late seral sites. In contrast to sites further south, Idaho fescue was not observed on this site unit within the study area. Many sites have significant pocket gopher digging in them. Soils are typically black chernozems and often have a fine-sand, stone-free aeolian cap overtop of either glaciofluvial or morainal materials. Unfortunately, most of these sites are highly disturbed and have a significant component of weeds. Sites with more than 10% weed cover are mapped as seral associations. These are described below.

FW:nb ***$Columbian needlegrass – Balsamroot seral association***

This seral association was only observed in the grasslands at the west end of Lambly (Bear Creek). It is a mid- to late-seral site.

FW:wk ***$Bluebunch wheatgrass – Knapweed seral association***

This is a mid- to late-seral seral association. On these sites there is still a reasonable component of bluebunch wheatgrass with either knapweed, and/or cheatgrass.

FW:kc ***$Knapweed - Cheatgrass seral association***

These are early and very early seral sites. There is little or no bluebunch wheatgrass remaining on these sites. Non-native plants including knapweed, cheatgrass and sulphur cinquefoil dominate these sites.

List of mapped units:

FWc	coarse-textured soils (usually glaciofluvial)	FWk	cool aspect
FWcs	coarse-textured soils, shallow soils (50-100cm)	FWks	cool aspect, shallow soils (20-100cm)
FWct	coarse-textured soils, terrace (glaciofluvial)	FWs	shallow soils (50-100cm)
FWf	fine-textured soils	FWt	terrace (glaciofluvial)
FWfk	fine-textured soils, cool aspect	FWw	warm aspect; typically 25-35% slopes on SE or WNW aspects

SITE INFORMATION

Common Terrain Types:

- aeolian veneers overlying morainal or glaciofluvial blankets

Slope position:	middle to upper
Slope (%):	0-35%
Aspect:	all
Soil Moisture Regime:	submesic – mesic
Soil Nutrient Regime:	medium – rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FW	Idaho fescue – Bluebunch wheatgrass	IDFxh1	91

	Structural Stage Seral Association	2b FW	2b FW:nb	2b FW:wk	2b FW:kc	
Grasses	*Pseudoroegneria spicata*	****		***	*	bluebunch wheatgrass
	Festuca campestris	***				rough fescue
	Koeleria macrantha	**	**	**		junegrass
	Achnatherum nelsonii		***			Columbian needlegrass
	Poa secunda		***			Sandberg's bluegrass
	Bromus tectorum or *Bromus japonicus*	*	**	***	****	cheatgrass or Japanese brome
Herbs	*Balsamorhiza sagittata*	***	***	**		arrowleaf balsamroot
	Lupinus sericeus	**	*	**		silky lupine
	Artemisia frigida	*	*	*		pasture sage
	Erigeron spp.	*	*	*		fleabanes and daisies
	Eriogonum heracleoides	*	*	*		parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	*		lemonweed
	Centaurea diffusa			***	****	diffuse knapweed
	Potentilla recta			***	****	sulphur cinquefoil
Mosses and Lichens	*Cladonia* spp.	**	**	*		clad lichens
	Tortula ruralis	**	**	*		sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*	*			felt pelt felt pelt
PLOTS		9802105 9802115 9802098 COV90 COV174 9802124	COG158	COV113 COV22	COV34 COV119 COV122 COV123	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GB	Gravel Bar	IDFxh1	N/A
Areas of gravel and cobbles in rivers formed by waves and currents. These sites have less than 10% vegetation cover.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GP	Gravel Pit	IDFxh1	N/A
An area of exposed soil formed through the removal of sand and gravel			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
OW	Shallow Open Water	IDFxh1	N/A
These are areas of permanent open water that are less than 2m deep. There is less than 10% emergent vegetation but floating aquatics such as bladderwort may be present. Shallow open water commonly occurs in association with marsh ecosystems. The photo shows open water at the bottom surrounded by bulrush marsh (BM).			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PB	Douglas-fir / Ponderosa pine – Bluebunch wheatgrass – Balsamroot	IDFxh1	02

Typic unit occurs on warm aspects with medium-textured shallow soils (m, s and w are assumed modifiers).

This forest ecosystem is commonly associated with shallow or very shallow soils and bedrock outcrops (PB, PBrv, PBv). This unit is uncommon and scattered throughout the study area. Forests are very open with scattered large trees, often growing in bedrock fractures. The understory is variable depending on soil depth with more vegetation occurring on deeper soil pockets. Scattered shrubs and bunchgrasses (bluebunch wheatgrass and rough fescue) dominate the understory. A lichen and moss crust may be present on undisturbed sites. This ecosystem also occurs on steep glaciofluvial slopes with ravelling, sandy (and sometimes gravely) surface soils (PBcd). Trees and other vegetation are usually widely spaced and scattered on these slopes.

List of mapped units:

PBc	coarse-textured soils (usually steep, sandy glaciofluvial slopes, surface soils are often actively ravelling)	PBqv	very steep cool aspect (>100% slope); very shallow soils (<20cm)
PBcd	deep, coarse-textured soils (occurs on steep, sandy glaciofluvial slopes, deep surface soils are often actively raveling)	PBr	ridge
PBcq	coarse-textured soils; very steep cool aspect (>100% slope)	PBrv	ridge, very shallow soils, exposed pockets of bedrock are usually present on-site (10-30% cover of bedrock)
PBcv	coarse-textured soils; very shallow soils (<20cm)	PBv	very shallow soils (<20cm), exposed pockets of bedrock are usually present on-site (10-30%)
PBjv	gentle slope (<25%), very shallow soils (<20cm), exposed pockets of bedrock are usually present on-site	PBvz	very shallow soils (<20cm), exposed bedrock usually present, very steep warm aspect (>100% slope)
PBkv	cool aspect (usually SE or NW), very shallow soils (<20cm), exposed pockets of bedrock are usually present on-site (10-30%)	PBz	very steep warm aspect (>100% slope)
PBq	very steep cool aspect (>100% slope, usually NW or E aspects)		

SITE INFORMATION

Common Terrain Types:

- Thin and very thin colluvial, morainal and glaciofluvial materials with rock
- Steep warm, glaciofluvial slopes

Slope position:	upper and crest (& middle slopes on steep glaciofluvial sites)
Slope (%):	0-70% (50-75% only for PBcd)
Aspect:	none, south, southwest
Soil Moisture Regime:	xeric to subxeric
Soil Nutrient Regime:	poor (very poor, medium)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PB	Douglas-fir / Ponderosa pine – Bluebunch wheatgrass – Balsamroot	IDFxh1	02

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*	**	***	***	***	***	ponderosa pine
	Pseudotsuga menziesii var. *glauca*	**	**	**	**	**	Douglas-fir
Shrubs	*Amelanchier alnifolia*	**	*	**	**	**	saskatoon
	Spirea betulifolia	**	*	**	**	**	birch-leaved spirea
	Symphoricarpos albus	**	*	**	**	**	common snowberry
	Mahonia aquifolium	*	*	*	*	*	tall oregon-grape
Grasses and Sedges	*Pseudoroegneria spicata*	***	**	***	***	***	bluebunch wheatgrass
	Festuca campestris	**	**	**	**	**	rough fescue
	Bromus japonicus or *tectorum*	*	*	*	*	*	Japanese brome or cheatgrass
Herbs	*Balsamorhiza sagittata*	**	**	**	**	**	arrowleaf balsamroot
	Selaginella densa or *Selaginella wallacei*	*	*	*	*	*	compact selaginella Wallace's selaginella
	Woodsia scopulina	*	*	*	*	*	mountain cliff fern
	Penstemon fruiticosa	*	*	*	*	*	shrubby penstemon
	Heuchera cylindrica	*	*	*	*	*	round-leaved alumroot
	Lomatium spp.	*	*	*	*	*	parsleys
Mosses and Lichens	*Cladonia* spp.	**	**	**	**	**	clad lichens
	Tortula ruralis	**	**	**	**	**	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*	*	*	*	*	felt pelt felt pelt
PLOTS		COG149 COG157 COV45		COG186	9802102 9802110 COG116 COG136 COG70 COG81 COG92 COG177		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: cover of Japanese brome or cheatgrass will usually increase with disturbance, spreading dogbane is often present on steep glaciofluvial sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PD	Pond	IDFxh1	N/A
These are small bodies of permanent water greater than 2m deep but less than 50ha in size.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RE	Reservoir	IDFxh1	N/A
A man-made body of water created by impounding water behind a dam, berm, dyke, or wall. Older reservoirs may have marshes associated with them.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RF	Prairie Rose – Idaho fescue	IDFxh1	97

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This shrubland ecosystem commonly occurs in moisture collecting depressions and swales in grassland areas. This unit is rare in the study area and only occurs in the Ellison area. These sites are usually larger and moister than IDFxh1 /96 BN sites, but are still small in nature. They are dominated by shrubs, primarily snowberry and roses. Forbs and grasses are scattered in openings between shrubs. These sites are often less disturbed than the surrounding grasslands because they provide less forage for cattle. White-tailed deer were commonly observed using these sites.

List of mapped units:

RFc	coarse-textured soils	RFk	cool aspect
RFf	fine-textured soils	RFw	warm aspect
RFg	occurs in a gully		

SITE INFORMATION

Common Terrain Types:

- aeolian veneer over morainal or glaciofluvial blanket

Slope position:	lower, toe, depression
Slope (%):	0-15
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	medium – rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RF	Prairie Rose – Idaho fescue	IDFxh1	97

	Structural stage	3a	3b	
Shrubs	*Symphoricarpos albus*	*****	****	common snowberry
	Rosa woodsii	***	***	prairie rose
	Rosa nutkana	***	***	Nootka rose
	Prunus virginiana		**	choke cherry
	Amelanchier alnifolia		**	saskatoon
Grasses	*Poa pratensis*	**	**	Kentucky bluegrass
Herbs	*Taraxacum officinale*	**		dandelion
	Cynoglossum officinale	*		hound's tongue
	Senecio integerrimus	*		western groundsel
PLOTS		9802111 COG160 COG43 COV33		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RI	River	IDFxh1	N/A
A permanent watercourse that flows within continuous permanent banks.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RO	Rock Outcrop	IDFxh1	N/A

These are areas of exposed bedrock with less than 10% vegetation cover. On sites with fractured bedrock, some plants may be growing out of rock cracks. Generally rock outcrops on the east side of the study area had more fractures than those on the west side of the study area.

List of mapped units:

ROk	cool aspect	ROw	warm aspect
ROq	very steep (>100%) cool aspect	ROz	very steep (>100%) warm aspect
ROr	ridge		

Plots: COG195

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RS	Western redcedar / Douglas-fir – False Solomon's Seal	IDFxh1	00

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with fluvial sites (terraces, slopes) and gullies which are influenced by cold air drainage. This is an uncommon unit in the study area. The overstory of these closed forests includes a mixture of western red cedar, Douglas-fir and paper birch. A diverse mixture of shrubs and forbs generally dominates the understory although the understory can be very sparse on sites with very closed canopies.

List of mapped units:

RSa	active floodplain	RSg	occurs in a gully
RSac	active floodplain; coarse-textured soils		

SITE INFORMATION

Common Terrain Types:

- fluvial plains and terraces

Slope position:	level, lower and toe
Slope (%):	
Aspect:	none
Soil Moisture Regime:	subhygric – hygric
Soil Nutrient Regime:	medium, rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RS	Western redcedar / Douglas-fir – False Solomon's Seal	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Thuja plicata*	***	****	****	****	****	western red cedar
	Pseudotsuga menziesii var. *glauca*	**	**	***	***	***	Douglas-fir
	Populus balsamifera ssp. *trichocarpa*	***	*	**	**	*	black cottonwood
	Betula paperifera	**	*	*	**	**	paper birch
Shrubs	*Acer glabrum* var. *douglasii*	***	**	**	**	**	Douglas maple
	Paxistima myrsinites	***	**	**	**	**	falsebox
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Symphoricarpos albus	**	*	*	**	**	common snowberry
	Rosa nutkana	**	*	*	*	*	Nootka rose
	Ribes lacustre	**	*	*	*	*	black gooseberry
	Cornus stolonifera	**	*	*	*	*	red-osier dogwood
	Clematis occidentalis	*	*	*	*	*	Columbia bower
Grasses	*Elymus glaucus*	***	*	*	*	*	blue wildrye
Sedges	*Carex* spp.	**	*				sedges
Herbs	*Maianthemum racemosa*	***	*	*	*	*	false Solomon's-seal
	Equisetum arvense	***	*	*	*	*	common horsetail
	Aralia nudicaulis	**	**	**	**	**	sarsaparilla
	Osmorhiza berteroi	**	*	*	*	*	mountain sweet-cicely
	Viola canadensis	*	*	*	*	*	Canada violet
	Brachythecium sp.	*	*	*	*	*	ragged moss
Mosses	*Mnium* sp.	*	**	**	**	**	leafy moss
PLOTS				9802069 COG94 COG102 COG175 COG179	COG02 COG128 COG51 COG173 COV15		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RW	Rural	IDFxh1	N/A
Rural areas of human settlement with scattered houses intermingled with native vegetation or cultivated areas.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RZ	Road Surface	IDFxh1	N/A
A gravel or paved road used for vehicular travel. Most small gravel roads are mapped as deciles in larger polygons.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SA	Antelope Brush - Selaginella	IDFxh1	00

Typic unit occurs on gentle slopes with shallow soils (assumed modifiers are j, m and s).

However, in the study area, this unit more commonly occurs on steep south facing slopes on gneiss rock outcrops with small ledges and pockets of soil (modifiers v and w). The bedrock is layered and fractured. This is an uncommon unit in the study area and is restricted in distribution to the South Slopes area. In contrast with areas further south, there is no antelope brush on these sites. Scattered ponderosa pine trees, oregon grape shrubs and saskatoon bushes occur in rock fractures. Soil pockets on ledges are dominated by bluebunch wheatgrass with junegrass, selaginella, and a well developed microbiotic crust.

List of mapped units:

SAqv	very steep cool aspect (>100% slope), very shallow soils	SAvz	very shallow soils, very steep warm aspect (>100% slope)
SAvw	very shallow soils, warm aspect	SAw	warm aspect

SITE INFORMATION

Common Terrain Types:

- rock, very thin morainal, glaciofluvial and colluvial veneers

Slope position:	crest, upper, mid
Slope (%):	40-100
Aspect:	160-270
Soil Moisture Regime:	very xeric
Soil Nutrient Regime:	very poor, poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SA	Antelope Brush – Selaginella	IDFxh1	00

	Structural Stage	2b	3	
Trees	*Pinus ponderosa*	**	**	ponderosa pine
Shrubs	*Amelanchier alnifolia*	*	**	saskatoon
Grasses	*Pseudoroegneria spicata*	***	**	bluebunch wheatgrass
	Koeleria macrantha	**	*	junegrass
Herbs	*Selaginella densa or Selaginella wallacei*	**	**	compact selaginella Wallace's selaginella
	Balsamorhiza sagittata	**	**	arrowleaf balsamroot
Mosses and Lichens	*Cladonia* spp.	**	**	clad lichens
	Polytrichum piliferum	**	**	awned haircap moss
	Collema sp.	*	*	tarpaper lichens
PLOTS		9802097 9901736 9901739		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	Selaginella – Bluebunch wheatgrass rock outcrop	IDFxh1	00

Typic unit occurs on gentle slopes with very shallow soils (assumed modifiers are j and v)

This grassland ecosystem commonly occurs on bedrock outcrops. The bedrock is generally low relief and unfractured. This is a very uncommon unit in the study area. Selaginella and rusty steppe moss with some grasses and forbs dominate these sites. Shrubs are quite uncommon. This unit is commonly scattered as small sites in a forested matrix. Some sites are very disturbed and dominated by weeds. This seral association is described below.

SB:cg ***Cheatgrass seral association***
This seral association is dominated by cheatgrass with selaginella and rusty steppe moss.

List of mapped units:

SBk	cool aspect	SBr	ridge
SBks	cool aspect (generally SE or NW), shallow soils (generally 20-50cm)	SBw	warm aspect

SITE INFORMATION

Common Terrain Types:
- rock, very thin morainal, glaciofluvial and colluvial veneers

Slope position:	crest, upper
Slope (%):	0-100
Aspect:	all
Soil Moisture Regime:	very xeric
Soil Nutrient Regime:	poor, medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	Selaginella – Bluebunch wheatgrass rock outcrop	IDFxh1	00

	Structural Stage Seral stage	2a SB	2a SB:cg	
Trees	*Pinus ponderosa*	*	*	ponderosa pine
Shrubs	*Amelanchier alnifolia*	*	*	saskatoon
Grasses and Sedges	*Pseudoroegneria spicata*	**	*	bluebunch wheatgrass
	Festuca campestris	**		rough fescue
	Bromus japonicus or tectorum	*	***	Japanese brome or cheatgrass
	Poa secunda	*	*	Sandberg's bluegrass
Herbs	*Selaginella densa or* *Selaginella wallacei*	***	***	compact selaginella Wallace's selaginella
	Eriogonum heracleoides	*	*	parsnip-flowered buckwheat
	Achillea millefolium	*	*	yarrow
	Erigeron spp.	*	*	daisies or fleabanes
	Geum triflorum	*	*	old man's whiskers
	Sedum stenopetalum	*	*	worm-leaved stonecrop
	Balsamorhiza sagittata	*		arrowleaf balsamroot
Mosses and Lichens	*Cladonia* spp.	**	*	clad lichens
	Tortula ruralis	**	*	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*		felt pelt felt pelt
PLOTS		COG96 COG151 COG122 COV73 COV94 COV100 COV136 COV137 COV297 COV150	COV204	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
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*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SD	Hybrid white spruce / Douglas-fir – Douglas maple – Dogwood	IDFxh1	08

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with gullies with intermittent or permanent streams or subsurface water flow. This is an uncommon unit in the study area. These are diverse, rich sites with mixed coniferous (Douglas-fir) and deciduous (paper birch, aspen, black cottonwood) overstories. The understories are dominated by diverse mixture of shrubs. Forb species are diverse but not abundant and mosses are scattered on these sites. These sites are similar to RS sites, but are apparently warmer, as western red cedar is relatively uncommon on these sites. These moist sites likely had a longer fire return interval than adjacent upland areas.

Although these sites are productive and vegetation recovers relatively quickly following disturbances such as logging, the moist soils on these sites are sensitive to disturbance and septic fields would be difficult to locate on these sites. Alterations in subsurface water flow present considerable risks to soil stability.

List of mapped units:

SDa	active floodplains	SDgw	occurs in gullies on warm aspects
SDac	active floodplains, coarse-textured soils	SDk	occurs on cool aspects (with seepage)
SDc	coarse-textured soils	SDkn	occurs on cool aspect fluvial fan
SDcg	coarse-textured soils; occurs in a gully	SDn	occurs on a fluvial fan
SDf	fine-textured soils (glaciolacustrine)	SDt	occurs on fluvial terraces
SDg	gullies, usually associated with permanent or intermittent creeks		

SITE INFORMATION

Common Terrain Types:

- gentle fluvial and morainal sites
- occasionally found on moist glaciolacustrine sites

Slope position:	lower, toe (depression)
Slope (%):	0-15%
Aspect:	none
Soil Moisture Regime:	subhygric, hygric
Soil Nutrient Regime:	(medium) rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SD	Hybrid white spruce / Douglas-fir – Douglas maple – Dogwood	IDFxh1	08

	Structural Stage	3	4	5	6	7	
Trees	*Betula paperifera*	****	***	***	***	**	paper birch
	Pseudotsuga menziesii var. *glauca*	*	****	***	***	***	Douglas-fir
	Populus tremuloides	**	**	***	***	*	trembling aspen
	Populus balsamifera ssp. *trichocarpa*	**	*	*	*	**	black cottonwood
Shrubs	*Symphoricarpos albus*	****	***	***	***	***	common snowberry
	Acer glabrum var. *douglasii*	****	**	***	***	***	Douglas maple
	Rosa nutkana	**	**	**	**	**	Nootka rose
	Cornus stolonifera	***	***	**	**	***	red-osier dogwood
	Betula occidentalis	***	**	**	**	**	water birch
	Rubus parviflorus	***	**	**	**	**	thimbleberry
	Ribes lacustre	**	*	*	*	*	black gooseberry
	Salix bebbianna	**	*				Bebb's willow
Grasses	*Carex* spp.	***					sedges
	Poa pratensis	**	**	**	**	**	Kentucky bluegrass
Herbs	*Aralia nudicaulis*	**	**	**	**	**	sarsaparilla
	Rubus pubescens	***	**	**	**	**	trailing raspberry
	Equisetum arvense	***	*	*	*	*	common horsetail
	Osmorhiza berteroi	**	*	*	*	*	mountain sweet-cicely
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
	Viola canadensis	*	*	*	*	*	Canada violet
	Urtica dioica	*	*	*	*	*	stinging nettle
Mosses	*Mnium* sp.	*	*	*	*	*	leafy moss
PLOTS		COG132 COG152	COG197	COG32 COG171 COV200 COV99	COG56 COG176 COV18 COV30 COV38 COV54 COV86 COV227 COV258 COV491	COG193	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SM	Sedge Marsh	IDFxh1	00

Typic unit occurs on level sites with deep, fine-textured soils (assumed modifiers are d, f, and j)

This unit is equivalent to the *Woolly sedge marsh* and *Water sedge – Beaked sedge fen* units in the provincial classification (MacKenzie and Shaw 2000)

This ecosystem commonly occurs on the edges of larger wetlands (fens) or in depressions with water tables above or near the soil surface. This is a very rare ecosystem in the study area and was only noted in the Ellison area. These may be dominated by a variety of sedge species (often woolly sedge, beaked sedge or water sedge) depending on the site and disturbance. Our one sample was dominated by woolly sedge. Soils are typically mineral, but may sometimes have a thin organic veneer on top.

SITE INFORMATION	
Common Terrain Types: • lacustrine materials	
Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	hygric - subhydric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SM	Sedge Marsh	IDFxh1	00

	Structural Stage	2b	
Sedges	*Carex lanuginosa*	****	woolly sedge
Rushes	*Juncus balticus*	**	baltic rush
	Carex spp.	**	sedges
PLOTS		COG44	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
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**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: Beaked sedge and water sedge probably also commonly occur

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	Saskatoon – Mock orange Talus	IDFxh1	00

Typic unit occurs on both warm and cool steep slopes with deep, coarse textured soils (blocky) (c, and d are assumed modifiers).

This ecosystem is commonly associated with steep, blocky talus slopes with minimal soil in pockets between blocks. This is an uncommon unit in the study area. Scattered trees (Douglas-fir, ponderosa pine and/or aspen) and scattered shrubs (mock orange, snowberry, ocean spray) grow in soil pockets between blocks. Often cliff ferns (a very characteristic species) and scattered grasses are found growing in soil pockets. Vegetation cover is generally higher on sites with smaller blocks and more soil. Cool aspects more commonly have trees on them. Sites that are dominated by shrubs will not necessarily succeed into a forested structural stage. Historically, these sites would not have had enough fuel to burn. Thus they may have been a seed source for some dry refugia species that are fire intolerant such as Rocky Mountain juniper.

Forested structural stages may include sites with less than 10% tree cover (6-9%). These sites are included as forested structural stages because the tree cover is significant for wildlife interpretations.

List of mapped units:

SOk	cool aspect	SOsw	shallow soils (20-100cm), warm aspect
SOks	cool aspect, shallow soils (20-100cm)	SOw	warm aspect

SITE INFORMATION

Common Terrain Types:

- rubbly colluvial slopes

Slope position:	lower to upper
Slope (%):	50-75%
Aspect:	all
Soil Moisture Regime:	subxeric to very xeric
Soil Nutrient Regime:	poor to medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	Saskatoon – Mock orange Talus	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	**	**	**	***	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
	Populus tremuloides		**	**	**		trembling aspen
Shrubs	*Philadelphus lewisii*	***	**	**	**	**	mock-orange
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Acer glabrum var. *douglasii*	**	**	**	**	**	Douglas maple
	Symphoricarpos albus	**	**	**	**	**	common snowberry
	Ceanothus sanguineus	*	*	*	*	*	redstem ceanothus
	Mahonia aquifolium	*	*	*	*	*	tall oregon-grape
	Spirea betulifolia	*	*	*	*	*	birch-leaved spirea
	Juniperus scopulorum	*	*	*	*	*	Rocky mountain juniper
	Prunus virginiana	*	*	*	*	*	choke cherry
Grasses	*Calamagrostis rubescens*	*	*	*	*	*	pinegrass
	Pseudoroegneria spicata	*	*	*	*	*	bluebunch wheatgrass
Herbs	*Woodsia* sp.	*	*	*	*	*	cliff fern
	Balsamorhiza sagittata	*	*	*	*	*	arrowleaf balsamroot
	Penstemon fruticosa	*	*	*	*	*	shrubby penstemon
PLOTS		9802117 COG83 COG105 COV206 COV483		COG50 COG87	COG84 COV284		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	Douglas-fir / Ponderosa pine – Snowbrush – Pinegrass	IDFxh1	04

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with moderate to steep slopes on slightly cool aspects (SPk; northwest and east-southeast). This is a common unit in the study area. It is also found on gently sloping sites with shallow soils (SPs). Occasionally it is found on warm aspects, but generally these are moderately sloping (25-35%) and/or on 'barely' warm aspects (west-northwest, southeast). It also may occur on gentle to steep cool slopes with very shallow soils (SPkv, SPv); these sites have some exposed bedrock and open forests. The overstory is moderately closed, although historically frequent surface fires would have kept these stands very open and ceanothus and bunchgrasses likely were more abundant. Understories are usually a mixture of pinegrass and bunchgrasses (bluebunch wheatgrass and rough fescue) with scattered shrubs, forbs and mosses. In contrast with sites in the South Okanagan, yellow-stem ceanothus is uncommon here (red-stem is more common, but only on disturbed sites) and rough fescue is more common here than Idaho fescue.

List of mapped units:

SPc	coarse-textured soils	SPkv	cool aspect, very shallow soils
SPck	coarse-textured soils, cool aspect (usually ESE and NW)	SPr	ridge
SPcr	coarse-textured soils, ridge	SPrs	ridge, shallow soils (generally 50-100cm)
SPct	coarse-textured soils, terrace (glaciofluvial)	SPs	shallow soils
SPcw	coarse-textured soils, warm aspect (usually SE or WNW or occurs at higher elevations)	SPsw	shallow soils, warm aspect (usually SE or WNW or at higher elevations)
SPk	cool aspect (usually ESE and NW aspects	SPvw	very shallow soils (<20cm); warm aspect (usually SE or WNW)
SPks	cool aspect (usually SE or WNW), shallow soils	SPw	warm aspect (usually SE or WNW or at higher elevations)

SITE INFORMATION

Common Terrain Types:

- colluvial and morainal slopes
- thin colluvial and morainal slopes, mostly on cool aspects

Slope position:	middle and upper
Slope (%):	30 – 75%
Aspect:	east-southeast, west-northwest
Soil Moisture Regime:	submesic
Soil Nutrient Regime:	poor – medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	Douglas-fir / Ponderosa pine – Snowbrush – Pinegrass	IDFxh1	04

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	***	***	***	***	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	*ponderosa pine*
Shrubs	*Spirea betulifolia*	***	**	**	**	**	birch-leaved spirea
	Symphoricarpos albus	***	**	**	**	**	common snowberry
	Amelanchier alnifolia	***	*	**	**	**	saskatoon
	Ceanothus sanguineus	***					redstem ceanothus
	Rubus idaeus	**					red raspberry
Grasses	*Calamagrostis rubescens*	****	**	***	***	***	pinegrass
	Pseudoroegneria spicata	***	*	**	**	**	bluebunch wheatgrass
	Festuca campestris	***	*	**	**	***	rough fescue
Herbs	*Balsamorhiza sagittata*	**	*	**	**	**	arrowleaf balsamroot
	Heuchera cylindrica	**		*	*	**	round-leaved alumroot
Mosses	*Cladonia* spp.	**	*	*	*	*	clad lichens
Lichens	*Brachythecium* sp.	*	*	*	*	*	ragged moss
PLOTS		COG46	COG123 COV242	9802116 COG33 COG118 COG191 COV107 COV240 COV151 COV42	9901737 COG113 COG129 COG137 COG153 COG156 COG169 COG172 COG180 COG194 COV286 COV300	COV298	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SS	Saskatoon – Common snowberry	IDFxh1	00

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This shrubland ecosystem commonly occurs in large, broad depressions in grassland areas (although these sites are still quite small). This is a very rare unit in the study area and was only noted in the grasslands in the Black Night Mountain area. These sites are moister than /97 sites and likely receive some ground-water in addition to collecting run off moisture.

List of mapped units:

SSf	fine-textured soils

SITE INFORMATION

Common Terrain Types:

- aeolian veneers over thick glaciofluvial or morainal materials

Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SS	Saskatoon – Common snowberry	IDFxh1	00

	Structural stage	3b	
Shrubs	*Betula occidentalis*	****	water birch
	Symphoricarpos albus	****	common snowberry
	Cornus stolonifera	***	red-osier dogwood
	Salix bebbiana	**	Bebb's willow
	Rosa woodsii	**	prairie rose
	Rosa nutkana	**	Nootka rose
	Prunus virginiana	**	choke cherry
	Amelanchier alnifolia	**	saskatoon
Grasses	*Poa pratensis*	**	Kentucky bluegrass
Herbs	*Osmorhiza berteroi*	**	mountain sweet-cicely
	Viola canadensis	**	western groundsel
	Viola adunca	**	early blue violet
	Maianthemum stellata	**	star-flowered false Solomon's seal
	Taraxacum officinale	**	dandelion
PLOTS		COG72	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
TA	Talus	IDFxh1	N/A
Steep colluvial deposits of angular rock fragments that result from rockfall. These sites have less than 10% vegetation cover.			
List of mapped units:			
TAk cool aspect		TAw warm aspect	

Plots: COG184

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
UR	Urban/Suburban	IDFxh1	N/A
Residential areas with concentrated houses and buildings that almost continuously cover the area. Urban areas are shown in the lower portion of the photo.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WA	Big sage – Bluebunch wheatgrass – Balsamroot	IDFxh1	92

Typic unit occurs on warm aspects with deep, medium-textured soils (assumed modifiers are d, m, and w)

This shrub steppe ecosystem occurs on warm aspects on glaciolacustrine slopes. It was very rare in the study area and was observed only on small, isolated sites. Both big sage and rabbit-brush were common on these sites. The photo shows a degraded site infested by knapweed and affected by mountain biking.

List of mapped units:

WAf fine-textured soils

SITE INFORMATION

Common Terrain Types:

- lacustrine slopes

Slope position:	upper, crest
Slope (%):	40-60%
Aspect:	south, southwest, west
Soil Moisture Regime:	xeric
Soil Nutrient Regime:	poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WA	Big sagebrush – Bluebunch wheatgrass – Balsamroot	IDFxh1	92

	Structural Stage	3a	
Shrubs	*Artemisia tridentata*	***	big sagebrush
	Ericameria nauseosus	**	*common rabbit-brush*
Grasses	*Pseudoroegneria spicata*	***	bluebunch wheatgrass
	Sporobolus cryptandrus	**	sand dropseed
	Hesperostipa comata	**	needle-and-thread grass
	Bromus tectorum	**	cheatgrass
	Aristida longiseta	*	red three-awn
Herbs	*Balsamorhiza sagittata*	*	arrowleaf balsamroot
	Erigeron spp.	*	fleabanes and daisies
	Lupinus sericeus	*	silky lupine
	Eriogonum heracleoides	*	parsnip-flowered buckwheat
	Lithospermum ruderale	*	lemonweed
Mosses	*Cladonia* spp.	*	clad lichens
Lichens	*Tortula ruralis*	*	sidewalk moss
PLOTS		COV509	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
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*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	Bluebunch wheatgrass – Balsamroot	IDFxh1	93

Typic unit occurs on warm aspects with deep, medium-textured soils (assumed modifiers are d, m, and w)

This grassland ecosystem commonly occurs on moderately steep to steep warm slopes. This unit is uncommon, occurring in the Ellison area and uncommonly scattered elsewhere. Often surface soils are actively raveling. Bluebunch wheatgrass and balsamroot dominate these sites. Bunchgrasses are more widely spaced than on gentler slopes. Many of these sites have been disturbed be grazing and have been invaded by noxious weeds. Sites with more than 10% noxious weeds are mapped as seral associations that are described below.

WB:wk ***$Bluebunch wheatgrass – Knapweed seral association***

This is a mid- to late-seral seral association. On these sites there is still a reasonable component of bluebunch wheatgrass with either knapweed, and/or cheatgrass.

WB:kc ***$Knapweed - Cheatgrass seral association***

These are early and very early seral sites. There is little or no bluebunch wheatgrass remaining on these sites. They are dominated by non-native plants including knapweed, cheatgrass and sulphur cinquefoil. These are mid to late seral sites.

WB:nc ***$Needle-and-thread grass – Cheatgrass seral association***

This is an early seral association that is dominated by native species such as needle-and-thread grass with some weeds. This is an uncommon seral association.

List of mapped units:

WBc	coarse-textured soils	WBs	shallow soils (20-100cm)
WBcs	coarse-textured, shallow (20-100cm) soils	WBv	very shallow soils (<20cm; no exposed bedrock present)
WBrs	ridge, shallow (20-100cm) soils		

SITE INFORMATION

Common Terrain Types:

- morainal and glaciofluvial blankets, often with an aeolian veneer on top on moderate slopes

Slope position:	middle, upper
Slope (%):	35-65%
Aspect:	south, southwest, west
Soil Moisture Regime:	subxeric
Soil Nutrient Regime:	medium – poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	Bluebunch wheatgrass – Balsamroot	IDFxh1	93

	Structural Stage Seral Association	2b WB	2b WB:wk	2b WB:kc	2b WB:nc	
Grasses	*Pseudoroegneria spicata*	****	***	*	**	bluebunch wheatgrass
	Koeleria macrantha	*	*			junegrass
	Poa secunda	*	**		*	Sandberg's bluegrass
	Hesperostipa comata				***	needle-and-thread grass
	Bromus tectorum or *Bromus japonicus*	*	***	***	****	cheatgrass or Japanese brome
Herbs	*Artemisia frigida*	*	*		*	pasture sage
	Balsamorhiza sagittata	***	**		**	arrowleaf balsamroot
	Lupinus sericeus	**	**	*	**	silky lupine
	Eriogonum heracleoides	*	*	*	*	parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	*		lemonweed
	Centaurea diffusa	*	**	***	*	diffuse knapweed
	Potentilla recta		**	***	*	sulphur cinquefoil
Mosses	*Cladonia* spp.	*	*		*	clad lichens
Lichens	*Tortula ruralis*	**	*		*	sidewalk moss
PLOTS		COG53 COV171 COV77	COG100 COG154 COG161 COG23 COG73	COG147 COG82 COV117 COV121 COV295	COG91	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: Rabbitbrush is sometimes present on glaciolacustrine materials

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	Willow – Sedge Wetland	IDFxh1	09

Typic unit occurs in depressions with deep, medium-textured soils (assumed modifiers are d, j, and m)

This unit is equivalent to several swamp associations in the provincial classification (MacKenzie and Shaw 2000). Presently there is not enough data for correlation to provincial units.

This swamp wetland ecosystem commonly occurs at the edges of ponds and wetlands, forming a shrubby fringe on mineral soils. This is a very rare unit in the study area. It is dominated by willows (mostly tea-leaved willow in the study area), usually with sedges where it occurs at the edge of a wetland. Our sites all occurred adjacent to ponds and did not have sedges as a significant component of the vegetation. One site was dominated by northern blackcurrant, an atypical species for these sites.

SITE INFORMATION	
Common Terrain Types: • lacustrine veneer over morainal or glaciofluvial blanket	
Slope position:	level, depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhygric – hygric
Soil Nutrient Regime:	medium, rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	Willow – Sedge Wetland	IDFxh1	09

	Structural Stage	3	
Shrubs	*Salix planifolia*	*****	tea-leaved willow
	Cornus stolonifera	***	red-osier dogwood
	Ribes husonianum	**	northern blackcurrant
Sedges	*Carex* spp.	**	sedges
PLOTS		9802125	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: sedges are probably more abundant on wetter sites

CENTRAL OKANAGAN EXPANDED LEGEND – PPxh1

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	Trembling aspen – Snowberry – Kentucky bluegrass	PPxh1	00

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This ecosystem commonly occurs in large, broad depressions in grassland areas. These sites collect moisture from surrounding grassland areas. They have an overstory of trembling aspen and a shrubby understory dominated by snowberry and roses. This site unit was observed on the east side of the study area (Ellison).

SITE INFORMATION	
Common Terrain Types: • aeolian veneer over morainal or glaciofluvial blankets	
Slope position:	lower, toe, depression
Slope (%):	0-15
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	Trembling aspen – Snowberry – Kentucky bluegrass	PPxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus tremuloides*	***	****	****	****	****	trembling aspen
Shrubs	*Symphoricarpos albus*	*****	****	****	****	****	common snowberry
	Rosa nutkana	***	**	**	**	**	Nootka rose
	Prunus virginiana	***	**	**	**	**	choke cherry
	Amelanchier alnifolia	**	*	*	*	*	saskatoon
	Mahonia aquifolium	**	*	*	*	*	tall Oregon-grape
Grasses	*Elymus glaucus*	*	*	*	*	*	blue wildrye
	Poa pratensis	*	*	*	*	*	Kentucky bluegrass
Herbs	*Cynoglossum officinale*	*	*	*	*	*	hound's tongue
	Arctium minus	*	*	*	*	*	burdock
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
Mosses	*Brachythecium* sp.	*	*	*	*	*	ragged moss
PLOTS		COV106					

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BE	Beach	PPxh1	N/A
Sorted sediments formed by wave action at the edge of a water body; Okanagan Lake beaches			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CB	Cutbank	PPxh1	N/A
Edge of a road cut that is upslope or down slope of a road and was created by the excavation of a hillside.			

List of mapped units:			
CBk	cool aspect	CBw	warm aspect

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CF	Cultivated Field	PPxh1	N/A
These are agricultural fields with tilled soils and planted crops or ground cover.			

List of mapped units:	
CFk	cool aspect

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CL	Cliff	PPxh1	N/A
These are steep, vertical or overhanging rock faces. Typically there are scattered plants such as cliff ferns occurring in pockets.			

List of mapped units:			
CLq	very steep (>100%) cool aspect	CLz	very steep (>100%) warm aspect

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CN	Canal	PPxh1	N/A
An artificial watercourse created for transport, drainage, and/or irrigation purposes.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CO	Cultivated Orchard	PPxh1	N/A
Agricultural areas for growing fruit trees.			
List of mapped units:			
COk	cool aspect		

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CT	Cattail Marsh	PPxh1	00

Typic unit occurs on level sites with deep, medium-textured soils (assumed modifiers are d, j, m)

This unit is equivalent to the *Cattail marsh* association in the provincial classification (MacKenzie and Shaw 2000)

This ecosystem commonly occurs as a fringe on ponds or in depressions, often adjacent to open water. Water depths are typically up to 1 m in spring but draw down to the soil surface by late summer; soils remain saturated for most of the season. Some wetlands convert to cattail marshes when they are subject to nutrient loading. These sites are dominated by cattails with few other species. All cattail marshes observed in the study area occurred in a forested matrix with a narrow forested riparian fringe (PA).

The photo below shows a cattail marsh in the spring before the new cattail leaves have grown above dead leaves from previous years' growth.

SITE INFORMATION	
Common Terrain Types: • lacustrine veneer over morainal or glaciofluvial blanket	
Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	hygric - subhydric
Soil Nutrient Regime:	rich – very rich

	Structural Stage	2a	
Herbs	*Typha latifolia*	****	common cattail
	Lemna minor	**	common duckweed
PLOTS		COG67	

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CV	Cultivated Vineyard	PPxh1	N/A
Agricultural areas for growing grape vines.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DM	Douglas-fir – Water birch - Douglas maple	PPxh1	08

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with gullies with intermittent or permanent streams or subsurface water flow. These are diverse, rich sites with mixed coniferous (Douglas-fir) and deciduous (paper birch, aspen, black cottonwood) overstories. The understories are dominated by diverse mixture of shrubs. Forbs are diverse but not abundant and mosses are scattered on these sites. These moist sites likely had a longer fire return interval than adjacent upland areas.

Although these sites are productive and vegetation recovers relatively quickly following disturbances such as logging, the moist soils on these sites are sensitive to disturbance and are difficult to find places for septic fields. Alterations in subsurface water flow present a considerable risk.

List of mapped units:

DMa	active floodplains	DMg	gullies, usually associated with permanent or intermittent creeks
DMct	coarse-textured soils, fluvial terrace	DMt	fluvial terraces

SITE INFORMATION

Common Terrain Types:

- gentle fluvial and morainal sites
- occasionally found on moist glaciolacustrine sites

Slope position:	lower, toe (depression)
Slope (%):	0-15%
Aspect:	none
Soil Moisture Regime:	subhygric, hygric
Soil Nutrient Regime:	(medium) rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DM	Douglas-fir – Water birch - Douglas maple	PPxh1	08

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	**	**	**	**	Douglas-fir
	Populus tremuloides	**	***	***	***	*	trembling aspen
	Betula paperifera	****	***	***	***	**	paper birch
Shrubs	*Symphoricarpos albus*	***	***	***	***	***	common snowberry
	Acer glabrum var. *douglasii*	****	***	***	***	***	Douglas maple
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Philadelphus lewisii	**	**	**	**	**	mock-orange
	Salix bebbiana	***	*	*	*	*	Bebb's willow
	Rosa nutkana	**	*	*	*	*	Nootka rose
	Cornus stolonifera	**	*	*	*	*	red-osier dogwood
	Betula occidentalis	**	*	*	*	*	water birch
Sedges	*Carex* spp.	***					sedges
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
Herbs	*Osmorhiza berteroi*	*	*	*	*	*	mountain sweet-cicely
	Galium triflorum	*	*	*	*	*	sweet-scented bedstraw
	Viola canadensis	*	*	*	*	*	Canada violet
	Equisetum spp.	***					horsetails
Mosses	*Brachythecium* sp.	*	*	*	*	*	ragged moss
	Mnium sp.	*	*	*	*	*	leafy moss
PLOTS		COG36 COG62 COG67 COV47 COV163		COG11 COV230 COV61	9802104 COG16 COV49 COV325 COV320 COV195		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	Douglas-fir / Ponderosa pine – Snowberry – Spirea	PPxh1	07

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with gently sloping sites that are receiving some moisture. It is also found on higher floodplain benches along creeks and rivers where there is some sub-surface moisture. These forests are typically have moderately closed Douglas-fir overstories with very shrubby understories dominated by snowberry with some Oregon-grape, birch-leaved spirea, and saskatoon. Often there is scattered pinegrass and/or Kentucky bluegrass with some heart-leaved arnica and other scattered forbs. There is a minimal moss layer with scattered patches of ragged mosses. Because these sites are moist, they likely had a longer fire-return interval than adjacent mesic and drier forests. These sites also tend to recover more quickly after disturbance (such as logging) because they are moister and more productive.

List of mapped units:

DSc	coarse-textured soils	DSk	cool aspects (most commonly north or north-east)
DSf	fine textured soils (usually glaciolacustrine)	DSw	warm aspects
DSg	gullied (usually associated with intermittent streams)		

SITE INFORMATION

Common Terrain Types:

- gentle morainal and glaciofluvial slopes

Slope position:	level, lower, toe, middle
Slope (%):	0-15% (sometimes steeper on cool aspects)
Aspect:	None
Soil Moisture Regime:	Subhygric
Soil Nutrient Regime:	Medium – rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	Douglas-fir / Ponderosa pine – Snowberry – Spirea	PPxh1	07

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	**	***	****	***	Douglas-fir
	Populus tremuloides	**	***	***	**		trembling aspen
Shrubs	*Symphoricarpos albus*	****	***	***	***	***	common snowberry
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Spirea betulifolia	***	**	**	**	**	birch-leaved spirea
	Ribes lacustre	**	*	*	*	*	black gooseberry
	Acer glabrum	**	*				Douglas maple
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
	Carex spp.	**					sedges
Herbs	*Maianthemum racemosa*	*	*	*	*	*	false Solomon's-seal
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
	Osmorhiza berteroi	*	*	*	*	*	mountain sweet-cicely
	Viola canadensis	*	*	*	*	*	Canada violet
	Equisetum spp.	**					horsetails
Mosses	*Mnium* sp.	*	*	*	*	*	leafy moss
PLOTS				COV313 COV340	COG66		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites

Comments: Douglas maple is more common on slightly moister sites; mixed and deciduous sites usually have a more diverse shrub layer; star-flowered false Solomon's seal, mountain sweet-cicely, and western meadowrue are often present on these mixed/pure deciduous sites as well

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
ES	Exposed Soil	PPxh1	N/A
These are areas of exposed soils and typically include recent disturbances such as soil erosion.			
List of mapped units:			
ESk	cool aspect	ESw	warm aspect

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FB	Rough fescue – Bluebunch wheatgrass	PPxh1	00

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, m)

This ecosystem commonly occurs on gentle warm aspects, level sites, and cool aspects (when they are non-forested). A mixture of rough fescue and bluebunch wheatgrass with balsamroot and other herbs dominate late seral sites. In contrast to sites further south, Idaho fescue was not observed on this site unit within the study area. Many sites have significant pocket gopher digging in them. Unfortunately, most of these sites are highly disturbed and have a significant component of weeds. Sites with more than 10% weeds are mapped as seral associations. Only one early seral association has been mapped in the PPxh1, it is described below. Other late seral associations were mapped and described in the IDFxh1.

FB:kc ***$Knapweed – Cheatgrass seral association***

This is an early seral unit. There is little or no bluebunch wheatgrass remaining on these sites. Non-native plants including knapweed, cheatgrass, and sulphur cinquefoil dominate these sites. This seral stage is shown in the photo below.

List of mapped units:

FBcw	coarse-textured soils, warm aspects	FBs	shallow soils
FBk	cool aspects, typically 25-35% slopes	FBw	warm aspects; typically 25-35% slopes (NW or SE aspects)
FBks	cool aspects, shallow soils		

SITE INFORMATION

Common Terrain Types:

- aeolian veneers overlying morainal or glaciofluvial blankets

Slope position:	Middle to upper
Slope (%):	0-35%
Aspect:	All
Soil Moisture Regime:	Submesic – mesic
Soil Nutrient Regime:	Medium – rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FB	Rough fescue – Bluebunch wheatgrass	PPxh1	00

	Structural Stage Seral Association	2b FB	2b FB:kc	
Grasses	*Pseudoroegneria spicata*	****	*	bluebunch wheatgrass
	Bromus tectorum or *Bromus japonicus*	*	****	cheatgrass or Japanese brome
	Festuca campestris	***		rough fescue
	Koeleria macrantha	**		junegrass
	Poa secunda	*	*	Sandberg's bluegrass
Herbs	*Artemisia frigida*	*	*	pasture sage
	Balsamorhiza sagittata	***		arrowleaf balsamroot
	Centaurea diffusa		****	diffuse knapweed
	Lupinus sericeus	**	*	silky lupine
	Erigeron spp.	*		fleabanes and daisies
	Eriogonum heracleoides	*		parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	lemonweed
	Potentilla recta		**	sulphur cinquefoil
Mosses and Lichens	*Cladonia* spp.	**	*	clad lichens
	Tortula ruralis	**	*	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*		felt pelt felt pelt
PLOTS			COG28 COV01 COV10 COV20 COV31 COV32	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GC	Golf Course	PPxh1	N/A
Areas set aside for playing golf including grass-covered areas, and patches of trees or shrubs.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GP	Gravel Pit	PPxh1	N/A
An area of exposed soil formed through the removal of sand and gravel			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GW	Giant Wildrye grassland	PPxh1	00

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This ecosystem commonly occurs on slopes with seepage that are likely alkaline. These sites are generally quite small and are dominated by large clumps of giant wildrye with scattered forbs and rabbit brush. This is ecosystem was only observed once in the study area.

List of mapped units:

GWw	Warm aspects, typically 25-35% slopes

SITE INFORMATION

Common Terrain Types:

- aeolian veneer over morainal or glaciofluvial blanket

Slope position:	Lower, level, toe slopes
Slope (%):	0
Aspect:	None
Soil Moisture Regime:	Subhygric
Soil Nutrient Regime:	Rich (high alkalinity)

	Stuctural Stage	2b	
Shrubs	*Ericameria nauseosus*	***	common rabbit-brush
Grasses	*Leymus cinereus*	***	giant wildrye
	Poa sp.	**	
	Bromus tectorum	**	cheatgrass
Herbs	*Comandra umbellata*	**	pale comandra
	Achillea millefolium	**	yarrow
PLOTS		9802075	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
LA	Lake	PPxh1	N/A
A naturally occurring water body that is greater than 2m deep and is greater than 50ha in size.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
OW	Shallow Open Water	PPxh1	N/A
These are areas of permanent open water that are less than 2m deep. There is less than 10% emergent vegetation but floating aquatics such as bladderwort may be present.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PA	Ponderosa pine / Black cottonwood – Snowberry Riparian	PPxh1	00

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with active floodplains and fluvial terraces with subsurface water (PAa, PAac, PAt). This unit is also found as a fringe around ponds (PA) and along the Okanagan Lake foreshore (PAc, PA). Forests are often multi-layered with a mixture of black cottonwood, Douglas-fir, and Ponderosa pine. The understory is typically rich and shrubby, often dominated by snowberry and Douglas maple. Forbs (star-flowered false Solomon's seal), grasses (blue wildrye) and ragged mosses are uncommon and scattered.

List of mapped units:

PAa	active floodplain	PAt	fluvial terrace
PAac	active floodplain, coarse-textured soils		

SITE INFORMATION

Common Terrain Types:

- gentle and level fluvial sites and active floodplains

Slope position:	level, lower and toe
Slope (%):	0-15%
Aspect:	None
Soil Moisture Regime:	Subhygric – hygric
Soil Nutrient Regime:	Rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PA	Ponderosa pine / Black cottonwood – Snowberry Riparian	PPxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus balsamifera* ssp. *trichocarpa*	**	****	***	***	***	black cottonwood
	Betula papyrifera	*	**	**	**	**	paper birch
	Pinus ponderosa			*	**	**	ponderosa pine
	Pseudotsuga menziesii var. *glauca*			*	*	*	Douglas-fir
Shrubs	*Symphoricarpos albus*	*****	****	****	****	****	common snowberry
	Acer glabrum var. *douglasii*	****	***	***	***	***	Douglas maple
	Amelanchier alnifolia	***	**	**	**	**	saskatoon
	Mahonia aquifolium	***	**	**	**	**	tall oregon-grape
	Prunus virginiana	***	**	**	**	**	choke cherry
	Rosa nutkana	***	**	**	**	**	Nootka rose
	Cornus stolonifera	**	*	*	*	*	red-osier dogwood
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
Herbs	*Equisetum hyemale*	**	*	*	*	*	scouring rush
	Prosartes trachycaulum			**	**	**	rough-fruited fairybells
	Maianthemum stellata			*	*	*	star-flowered false Solomon's-seal
	Maianthemum racemosa			*	*	*	false Solomon's seal
Mosses	*Brachythecium* sp.			*	*	*	ragged moss
PLOTS				COV158 COV159	9802109 COG27 COG64 COV07		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: some sites along the Okanagan Lake foreshore have low tree cover. Some pond fringes have higher Douglas-fir cover and may have tea-leaved willow and water birch as well on these sites.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PC	Ponderosa pine – Bluebunch wheatgrass – Cheatgrass	PPxh1	04

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j, and m are assumed modifiers).

This forest type is most common on moderate to steep warm aspects. It sometimes occurs on cooler aspects where soils are shallow and/or coarse textured. Occasionally found on ridges and crests where soils are not shallow enough to be the PPxh1 /02 (PT). Forests are open and dominated by bunchgrasses, particularly bluebunch wheatgrass with scattered forbs. Rough fescue commonly occurs, in contrast with the Idaho fescue that more commonly occurs on these sites further south. Mosses and lichens are scattered and uncommon.

List of mapped units:

PCc	coarse-textured soils	PCkv	cool aspect, very shallow soils (<20cm), pockets of exposed bedrock common (10-20%)
PCck	coarse-textured soils, cool aspect (35-60% slopes, typically southeast)	PCr	ridge, crest
PCct	coarse-textured soils, terrace (typically glaciofluvial)	PCs	shallow soils
PCcw	coarse-textured soils, warm aspect (25-50% slopes)	PCsw	shallow soils, warm aspect (25-50% slopes)
PCk	cool aspect (35-60% slopes, typically southeast)	PCw	warm aspect (25-50% slopes)
PCks	cool aspect (35-60% slopes, typically southeast), shallow soils		

SITE INFORMATION

Common Terrain Types:

- colluvial and morainal blankets and veneers
- moderate to steep glaciofluvial slopes

Slope position:	middle and upper
Slope (%):	(30) 40 – 60%
Aspect:	south, southwest, west (also southeast on glaciofluvial slopes and shallow soils)
Soil Moisture Regime:	Subxeric – submesic
Soil Nutrient Regime:	Medium - rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PC	Ponderosa pine – Bluebunch wheatgrass - Cheatgrass	PPxh1	04

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*	**	****	***	***	***	ponderosa pine
Shrubs	*Amelanchier alnifolia*	***	**	**	**	**	saskatoon
Grasses	*Pseudoroegneria spicata*	****	***	***	***	****	bluebunch wheatgrass
	Festuca campestris	***	**	**	**	**	rough fescue
Herbs	*Balsamorhiza sagittata*	***	**	**	**	**	arrowleaf balsamroot
	Antennaria dimorpha	**	*	*	*	*	Low pussytoes
	Achillea millefolium	**	*	*	*	*	yarrow
Mosses and Lichens	*Cladonia* spp.	**	**	**	**	**	clad lichens
	Tortula ruralis	**	**	**	**	**	sidewalk moss
	Brachythecium sp.	*	*	*	*	*	ragged moss
PLOTS			COV357	9802122 9802123 COV70 COV155 COV306 COV314 COV315 COV356	COV105		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PD	Pond	PPxh1	N/A
These are small bodies of permanent water greater than 2m deep but less than 50ha in size. Ponds observed in the study area occur in forested areas, typically with a riparian fringe (PA) and often with a marsh ecosystem.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PF	Ponderosa pine – Bluebunch wheatgrass – Rough fescue	PPxh1	05

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with moderate to steep slopes on cool aspects (north, northeast, and east; PFck, PFk, PFks). It is also found on gently sloping sites with shallow soils (PFs). Occasionally it is found on warm aspects, but generally these are moderately sloping (25-35%) and/or on 'neutral' aspects (northwest, southeast; PFcw, PFw). The overstory is moderately closed, although historically frequent surface fires would have kept these stands very open. Understories are usually a mixture of bluebunch wheatgrass, rough fescue, and pinegrass with scattered shrubs, forbs and mosses. In contrast with sites further south, rough fescue is more common here than Idaho fescue.

List of mapped units:

PFc	coarse-textured soils	PFk	cool aspect (30-70% slopes, usually only includes north, northeast and east aspects)
PFck	coarse-textured soils, cool aspect (30-70% slopes, usually only includes north, northeast and east aspects)	PFks	cool aspect (30-70% slopes, usually only includes north, northeast, and east aspects), shallow soils
PFct	coarse-textured soils, terrace (usually glaciofluvial)	PFs	shallow soils
PFcw	coarse-textured soils, warm aspect (25-35%, usually mid-lower slopes on northwest and southeast aspects)	PFw	warm aspect (25-35%, usually mid-lower slopes on northwest and southeast aspects)

SITE INFORMATION

Common Terrain Types:

- colluvial and morainal blankets and veneers
- moderate to steep glaciofluvial slopes

Slope position:	middle and upper
Slope (%):	30 – 75%
Aspect:	(northwest) north, northwest, east
Soil Moisture Regime:	Mesic
Soil Nutrient Regime:	medium (poor, rich)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PF	Ponderosa pine – Bluebunch wheatgrass – Rough fescue	PPxh1	05

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	***	***	***	***	Douglas-fir
	Pinus ponderosa	**	***	***	***	***	ponderosa pine
Shrubs	*Amelanchier alnifolia*	***	**	**	**	**	saskatoon
	Spirea betulifolia	***	**	**	**	**	birch-leaved spirea
	Symphoricarpos albus	***	**	**	**	**	common snowberry
	Mahonia aquilfolium	*	*	*	*	*	tall oregon grape
Grasses	*Pseudoroegneria spicata*	***	***	***	***	***	bluebunch wheatgrass
	Festuca campestris	***	**	**	**	**	rough fescue
	Calamagrostis rubescens	***	**	**	**	**	pinegrass
	Koeleria macrantha	*	*	*	*	*	junegrass
Herbs	*Balsamorhiza sagittata*	**	*	**	**	**	arrowleaf balsamroot
	Achillea millefolium	**	*	*	*	*	yarrow
	Antennaria spp.	**	*	*	*	*	pussytoes
	Lithophragma parviflorum	*	*	*	*	*	small-flowered woodland star
Mosses and Lichens	*Cladonia* spp.	**	*	*	*	*	clad lichens
	Tortula ruralis	*	*	*	*	*	rusty steppe moss
	Polytrichum juniperinum	*	*	*	*	*	juniper haircap moss
PLOTS				9802106 9802108 COG48 COV71 COV72 COV355 COV131 COV133 COV68	COG35 COG39 COG168 COV322		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PT	Ponderosa pine – Red three-awn	PPxh1	02

Typic unit occurs on warm aspects with deep, coarse-textured soils (c, d, and w are assumed modifiers).

This forest type most commonly occurs on moderate to steep warm aspects, with shallow or very shallow soils (PTs, PTv). It is also commonly found on moderate to steep cool aspects (mostly NW and ESE) and ridge crests where the soils are extremely shallow (PTkv, PTrv, PTrs). Forests are very open with scattered large trees, often growing in bedrock fractures. The understory is variable depending on soil depth with more vegetation occurring on deeper soil pockets. Scattered shrubs and bunchgrasses (bluebunch wheatgrass and rough fescue) dominate the understory. A lichen and moss crust may be present on undisturbed sites. This ecosystem also occurs on steep glaciofluvial slopes with raveling, sandy surface soils (PT). Trees and other vegetation is usually widely spaced and scattered on these slopes.

List of mapped units:

PTjv	gentle slopes, very shallow soils, exposed bedrock usually present on-site (10-20%)	PTrv	ridge, very shallow soils, exposed pockets of bedrock are usually present on-site (this is the most common situation; 10-20% bedrock)
PTk	cool aspect	PTs	shallow soils
PTkv	cool aspect (35-70% slope), very shallow soils, exposed pockets of bedrock are usually present on-site (10-20%)	PTv	very shallow soils, exposed pockets of bedrock are usually present on-site (10-20% bedrock)
PTrs	ridge, shallow soils		

SITE INFORMATION

Common Terrain Types:

- Thin and very thin colluvial, morainal and glaciofluvial veneers over bedrock
- Steep glaciofluvial slopes

Slope position:	upper and crest (and middle slopes on steep glaciofluvial sites)
Slope (%):	0-70%
Aspect:	None (crest), south, southwest
Soil Moisture Regime:	Very xeric to subxeric
Soil Nutrient Regime:	poor (very poor, medium)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PT	Ponderosa pine – Red three-awn	PPxh1	02

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*	**	***	***	***	***	ponderosa pine
	Pseudotsuga menziesii var. *glauca*			*	**	**	Douglas-fir
Shrubs	*Amelanchier alnifolia*	**	**	**	**	**	saskatoon
	Symphoricarpos albus	**	*	*	*	*	common snowberry
Grasses and Sedges	*Pseudoroegneria spicata*	***	***	***	***	***	bluebunch wheatgrass
	Bromus japonicus or tectorum	*	*	*	*	*	Japanese brome or cheatgrass
	Festuca campestris	*	*	*	*	*	rough fescue
Herbs	*Selaginella densa* or *Selaginella wallacei*	***	**	**	**	**	compact selaginella Wallace's selaginella
	Balsamorhiza sagittata	**	**	**	**	**	arrowleaf balsamroot
	Penstemon fruiticosa	**	**	**	**	**	shrubby penstemon
	Achillea millefolium	*	*	*	*	*	yarrow
	Lomatium spp.	*	*	*	*	*	parsleys
Mosses Lichens	*Cladonia* spp.	**	**	**	**	**	clad lichens
	Tortula ruralis	**	**	**	**	**	sidewalk moss
PLOTS		COG98		COG18 COG97 COV48 COV69 COV225 COV237 COV235 COV226	COG47 COV103		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: cover of Japanese brome or cheatgrass will usually increase with disturbance, spreading dogbane is often present on steep glaciofluvial sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PW	Ponderosa pine – Bluebunch wheatgrass – Idaho fescue	PPxh1	01

Typic unit occurs on gentle slopes with deep, medium-textured soils (d, j, and m are assumed modifiers).

This forest type is commonly associated with gently sloping glaciofluvial and morainal deposits, quite often coarse-textured (PWc, PWct). Occasionally found on shallow soils and both warm and cool aspects (PWw, PWk, PWs). The overstory is generally open and dominated by ponderosa pine. Historically these sites would have been kept extremely open by frequent low-severity surface fires. Saskatoon, bluebunch wheatgrass, rough fescue and arrow-leaved balsamroot are most common in the understory. This ecosystem type has a very limited distribution within the study area, as it has been heavily impacted through urban growth and development.

List of mapped units:

PWc	coarse-textured soils (typically glaciofluvial materials)	PWks	cool aspect (25-35% slopes, usually mid-upper slopes), shallow soils (generally 50-100cm deep)
PWck	coarse-textured soils, cool aspect (25-35% slopes, usually mid-upper slopes)	PWs	shallow soils (generally 50-100cm deep)
PWct	coarse-textured soils, terrace (usually glaciofluvial materials)	PWsw	shallow soils, warm aspect (25-35% slopes, most often mid-lower slopes)
PWcw	coarse-textured soils, warm aspect (25-35% slopes, most often mid-lower slopes)	PWw	warm aspect (25-35% slopes)
PWk	cool aspect (25-35% slopes, usually mid-upper slopes)		

SITE INFORMATION

Common Terrain Types:

- Gently sloping glaciofluvial and morainal slopes and terraces

Slope position:	Level, mid to upper
Slope (%):	0-15 (25)%
Aspect:	None
Soil Moisture Regime:	Submesic – mesic
Soil Nutrient Regime:	Poor – medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PW	Ponderosa pine – Bluebunch wheatgrass – Idaho fescue	PPxh1	01

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*		**	***	**	**	ponderosa pine
Shrubs	*Amelanchier alnifolia*	**	**	*	*	*	saskatoon
	Rosa acicularis	**	*	*	*	*	prickly rose
	Ceanothus sanguineus	***	**				redstem ceanothus
Grasses	*Festuca campestris*	***	***	***	***	***	Rough fescue
	Pseudoroegneria spicata	**	**	**	**	**	bluebunch wheatgrass
	Bromus tectorum	*	*	*	*	*	cheatgrass
Herbs	*Balsamorhiza sagittata*	***	**	**	**	**	arrow-leaved balsamroot
	Antennaria spp.	**	**	**	**	**	pussytoes
	Achillea millefolium	*	*	*	*	*	yarrow
	Collinsia parviflora	*	*	*	*	*	small-flowered blue-eyed Mary
	Erigeron filifolius	*	*	*	*	*	thread-leaved fleabane
Mosses	*Brachythecium* sp.	*	*	*	*	*	ragged moss
	Tortula ruralis	*	*	*	*	*	sidewalk moss
PLOTS			COV324 COV179 COV180	COV341 COV62			

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RE	Reservoir	PPxh1	N/A
A man-made body of water created by impounding water behind a dam, berm, dyke, or wall.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RO	Rock Outcrop	PPxh1	N/A
These are areas of exposed bedrock with less than 10% vegetation cover. On sites with fractured bedrock, some plants may be growing out of rock cracks. Generally rock outcrops on the east side of the study area had more fractures than those on the west side of the study area.			

List of mapped units:			
ROk	cool aspect	ROw	warm aspect
ROq	very steep (>100%) cool aspect	ROz	very steep (>100%) warm aspect
ROr	ridge		

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RW	Rural	PPxh1	N/A
Rural areas of human settlement with scattered houses intermingled with native vegetation or cultivated areas.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RZ	Road Surface	PPxh1	N/A
A gravel or paved road used for vehicular travel.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	Selaginella – Bluebunch wheatgrass rock outcrop	PPxh1	00

Typic unit occurs on gentle slopes with very shallow soils (assumed modifiers are j and v)

This ecosystem commonly occurs on bedrock outcrops with low relief, generally unfractured bedrock. Selaginella and rusty steppe moss with some grasses and forbs dominate these sites. Shrubs are sometimes present but are quite uncommon due to the lack of fractures in the bedrock. This unit is quite commonly scattered as small sites in a forested matrix. Some sites are very disturbed and dominated by weeds (SB:cg). This seral association is described below.

SB:cg ***Cheatgrass seral association***
This seral association is dominated by cheatgrass.

List of mapped units:

SBk cool aspect (25-70% slope)

SBw warm aspect (25-70% slope)

SITE INFORMATION

Common Terrain Types:

- Rock
- Very thin morainal, glaciofluvial and colluvial veneers

Slope position:	crest, upper
Slope (%):	0-100
Aspect:	All
Soil Moisture Regime:	very xeric
Soil Nutrient Regime:	poor, medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	Selaginella – Bluebunch wheatgrass rock outcrop	PPxh1	00

	Structural Stage Seral stage	2a SB	2a SB:cg	
Trees	*Pinus ponderosa*	*	*	ponderosa pine
Shrubs	*Amelanchier alnifolia*	*	*	saskatoon
Grasses	*Pseudoroegneria spicata*	**	*	bluebunch wheatgrass
	Bromus japonicus or tectorum	*	***	Japanese brome or cheatgrass
	Poa secunda	*	*	Sandberg's bluegrass
Herbs	*Selaginella densa or Selaginella wallacei*	***	***	compact selaginella Wallace's selaginella
	Eriogonum heracleoides	**	*	parsnip-flowered buckwheat
	Achillea millefolium	*	*	yarrow
	Erigeron sp.	*	*	daisy or fleabane
	Opuntia fragilis	*	*	brittle prickly-pear cactus
	Sedum stenopetalum	*	*	worm-leaved stonecrop
Mosses and Lichens	*Cladonia* spp.	**	*	clad lichens
	Tortula ruralis	**	*	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*		felt pelt
PLOTS		COG139 COV236		

Highlighted species – indicate important forage plants for ungulates

Species – non-native species

* incidental cover (less than 1% cover); used as indicator species

** 1-5% cover; occurs in 60% or more of sites

*** 6-25% cover; occurs in 60% or more of sites

**** 26-50% cover; occurs in 60% or more of sites

***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	Saskatoon – Mock orange Talus	PPxh1	00

Typic unit occurs on both warm and cool steep slopes with deep, coarse textured soils (blocky soils; c, and d are assumed modifiers).

This forest type is commonly associated with steep, blocky talus slopes with minimal soil in pockets between blocks. Scattered trees (Douglas-fir, ponderosa pine and/or aspen) and scattered shrubs (mock orange, snowberry, ocean spray) grow in soil pockets between blocks. Often cliff ferns (a very characteristic species) and scattered grasses are found growing in soil pockets. Vegetation cover is generally higher on sites with smaller blocks and more soil development, typically a mixture of both angular rocks and sandy, silty material. Cool aspects more commonly have trees on them. Sites that are dominated by shrubs will not necessarily succeed into a forested structural stage. Historically, these sites would not have enough fuel to burn. Thus they would be have been a seed source for some dry refugia species that are fire intolerant such as Rocky Mountain juniper.

Forested structural stages may include sites with less than 10% tree cover (6-9%). These sites are included as forested structural stages because the tree cover is significant for wildlife interpretations.

List of mapped units:			
SOk	cool aspect	SOw	warm aspect

SITE INFORMATION	
Common Terrain Types: • rubbly colluvium	
Slope position:	Lower to upper
Slope (%):	50-75%
Aspect:	All
Soil Moisture Regime:	Subxeric to very xeric
Soil Nutrient Regime:	poor to medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	Saskatoon – Mock orange Talus	PPxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	**	**	**	**	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
	Populus tremuloides		**	**	**		trembling aspen
Shrubs	*Philadelphus lewisii*	***	**	**	**	**	mock-orange
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Acer glabrum var. *douglasii*	**	**	**	**	**	Douglas maple
	Symphoricarpos albus	**	**	**	**	**	common snowberry
	Holodiscus discolor	**	*	*	*	*	ocean-spray
	Mahonia aquifolium	*	*	*	*	*	tall oregon-grape
	Juniperus scopulorum	*	*	*	*	*	Rocky mountain juniper
Grasses	*Pseudoroegneria spicata*	*	*	*	*	*	bluebunch wheatgrass
Herbs	*Woodsia* sp.	*	*	*	*	*	cliff fern
PLOTS		COV67					

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	Douglas-fir / Ponderosa pine – Snowberry - Pinegrass	PPxh1	06

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with gentle lower slopes and moderate to steep cool aspects (SP, SPk) that are receiving some subsurface moisture. Common on the lower slopes of gullies (SPg), adjacent to the wetter /08 (DM) unit mapped along the creeks and streams. Forests are moderately closed with mixed Douglas-fir and ponderosa pine overstories, although historically they would have been quite open, as fire would have been a frequent disturbance. The understory is dominated by snowberry and pinegrass. Mosses are prominent in the moss and lichen layer, especially on the cool aspects. Forbs are more abundant on the open sites that have been less subject to ingrowth (or have been thinned). This ecosystem also occurs on gentle glaciofluvial slopes (SP, SPc) or terraces (SPt, SPct) where ponderosa pine is often more abundant than Douglas-fir but understories are very similar. Mature (structural stage 6) and old (structural stage 7) forests are uncommon because most of the large trees historically present on these sites have been logged. Because of fire exclusion, most sites have become ingrown with higher densities of smaller stems. Rough fescue is quite common and Idaho fescue is quite uncommon on these sites relative to those further south.

List of mapped units:

SPc	coarse-textured soils	SPg	gullied (usually along side slopes adjacent to intermittent creeks and streams)
SPck	coarse-textured soils, cool aspect (usually north to north-east)	SPk	cool aspect (usually north to north-east)
SPct	coarse-textured soils; terrace (usually glaciofluvial)	SPks	cool aspect (usually north to northeast), shallow soils
SPcw	coarse-textured soils, warm aspect (lower slopes, often south, southeast)	SPs	shallow soils
SPf	fine-textured soils	SPw	warm aspect (lower slopes, often south, southeast)

SITE INFORMATION

Common Terrain Types:

- gentle morainal and glaciofluvial slopes
- moderate to steep morainal and glaciofluvial slopes
- glaciofluvial terraces

Slope position:	Middle to lower
Slope (%):	0-30%; up to 70% on cool aspects
Aspect:	All
Soil Moisture Regime:	Mesic – subhygric
Soil Nutrient Regime:	Medium-rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	Douglas-fir / Ponderosa pine – Snowberry - Pinegrass	PPxh1	06

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	****	***	***	***	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
Shrubs	*Symphoricarpos albus*	***	***	***	***	***	common snowberry
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Spirea betulifolia	**	**	**	**	**	birch-leaved spirea
	Rosa spp.	**	**	**	*	*	roses
	Amelanchier alnifolia	**	*	*	*	*	saskatoon
	Ceanothus sanguineus	****	*	*			redstem ceanothus
Grasses	*Calamagrostis rubescens*	***	***	****	****	****	pinegrass
	Festuca campestris	***	**	**	**	**	rough fescue
	Elymus glaucus	**	*	*	*	*	blue wildrye
Herbs	*Arnica cordifolia*	***	**	**	**	**	heart-leaved arnica
	Aster conspicuus	**	*	*	*	*	showy aster
Mosses	*Tortula ruralis*	**	*	*	*	*	sidewalk moss
	Dicranum sp.		*	**	**	**	
	Pleurozium schreberi		*	*	*	*	red-stemmed feathermoss
	Rhytidiadelphus triquetris		*	*	*	*	electrified cat's tail moss
PLOTS		COG37 COV164	COG99, COV228, COV152	9802107, COG13, COG17, COG38, COG57, COG63, COG142, COV316	COG143, COV344		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: Fireweed seems to be common only after burning (as opposed to logging)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SR	Snowberry – Rose – Kentucky Bluegrass	PPxh1	00

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

Typically moist shrub dominated depressions in grassland mosaics (equivalent to the IDFxh1 RF /97 unit). Sites are dominated by snowberry and Nootka rose, with some Kentucky bluegrass in openings between the shrubs. These depressions are typically much smaller than those sites with trembling aspen. This unit is uncommon due to the relative lack of natural grassland areas remaining within the PPxh1.

List of mapped units:

SRc	coarse-textured soils	SRw	warm aspect (typically warm aspect lower slopes, often south, southeast)
SRg	gullied (usually along side slopes adjacent to intermittent creeks and streams)		

SITE INFORMATION

Common Terrain Types:

- gentle and level fluvial sites

Slope position:	level, lower and toe
Slope (%):	0-15%
Aspect:	None
Soil Moisture Regime:	Subhygric - hygric
Soil Nutrient Regime:	Rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SR	Snowberry – Rose - Kentucky bluegrass	PPxh1	00

	Structural Stage	3	
Shrubs	*Symphoricarpos albus*	*****	common snowberry
	Amelanchier alnifolia	**	saskatoon
	Rosa nutkana	****	Nootka rose
	Prunus virginiana	**	choke cherry
	Rosa acicularis	**	prickly rose
Grasses	*Poa pratensis*	**	Kentucky bluegrass
	Elymus glaucus	*	blue wildrye
PLOTS		COG29 COV09 COV156 COV60	

Highlighted species – indicate important forage plants for ungulates

Species – non-native species

* incidental cover (less than 1% cover); used as indicator species

** 1-5% cover; occurs in 60% or more of sites

*** 6-25% cover; occurs in 60% or more of sites

**** 26-50% cover; occurs in 60% or more of sites

***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
TA	Talus	PPxh1	N/A
Steep colluvial deposits of angular rock fragments that result from rockfall. These sites have less than 10% vegetation cover.			
List of mapped units:			
TAk cool aspect		TAw warm aspect	

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
UR	Urban/Suburban	PPxh1	N/A
Residential areas with concentrated houses and buildings that almost continuously cover the area.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	Bluebunch wheatgrass – Balsamroot	PPxh1	00

Typic unit occurs on warm aspects with deep, medium-textured soils (assumed modifiers are d, w, and m)

This ecosystem commonly occurs on moderately steep to steep warm slopes. Often surface soils are actively raveling. Bluebunch wheatgrass and balsamroot dominate these sites. Bunchgrasses are more widely spaced than on more gentle slopes. Many of these sites have been disturbed by grazing and have been invaded by weeds. Sites with more than 10% weeds are mapped as seral associations. Only one early seral association has been mapped in the PPxh1, it is described below. Other seral associations were mapped and described in the IDFxh1.

WB:kw ***$Knapweed – Cheatgrass – Bluebunch wheatgrass seral association***
This is an early to mid seral unit. There is some bluebunch wheatgrass remaining on these sites, however most sites are dominated by non-native plants including knapweed, cheatgrass, and sulphur cinquefoil.

List of mapped units:

WBc	coarse-textured soils	WBks	cool aspect, shallow soils
WBcs	coarse-textured, shallow soils	WBs	shallow soils
WBk	cool aspect	WBv	very shallow soils

SITE INFORMATION

Common Terrain Types:
- morainal and glaciofluvial blankets and veneers

Slope position:	middle, upper
Slope (%):	30-65%
Aspect:	South, southwest, west
Soil Moisture Regime:	subxeric
Soil Nutrient Regime:	medium – poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	Bluebunch wheatgrass – Balsamroot	PPxh1	93

	Structural Stage Seral Association	2b WB	2b WB:kw	
Grasses and Sedges	*Pseudoroegneria spicata*	****	**	bluebunch wheatgrass
	Bromus tectorum or *Bromus japonicus*	*	***	cheatgrass or Japanese brome
	Koeleria macrantha	*	*	junegrass
	Poa secunda	*	**	Sandberg's bluegrass
Herbs	*Balsamorhiza sagittata*	**	*	arrowleaf balsamroot
	Lupinus sericeus	**	*	silky lupine
	Artemisia frigida	*	*	pasture sage
	Eriogonum niveum	*	*	snow buckwheat
	Eriogonum heracleoides	*	*	parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	lemonweed
	Centaurea diffusa	*	***	diffuse knapweed
	Vulpia octoflora		**	six-weeks fescue
	Potentilla recta		***	sulphur cinquefoil
Mosses Lichens	*Cladonia* spp.	**		clad lichens
	Tortula ruralis	**	*	sidewalk moss
PLOTS		COG07 COV154 COV157	COG10	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
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*** 6-25% cover; occurs in 60% or more of sites
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