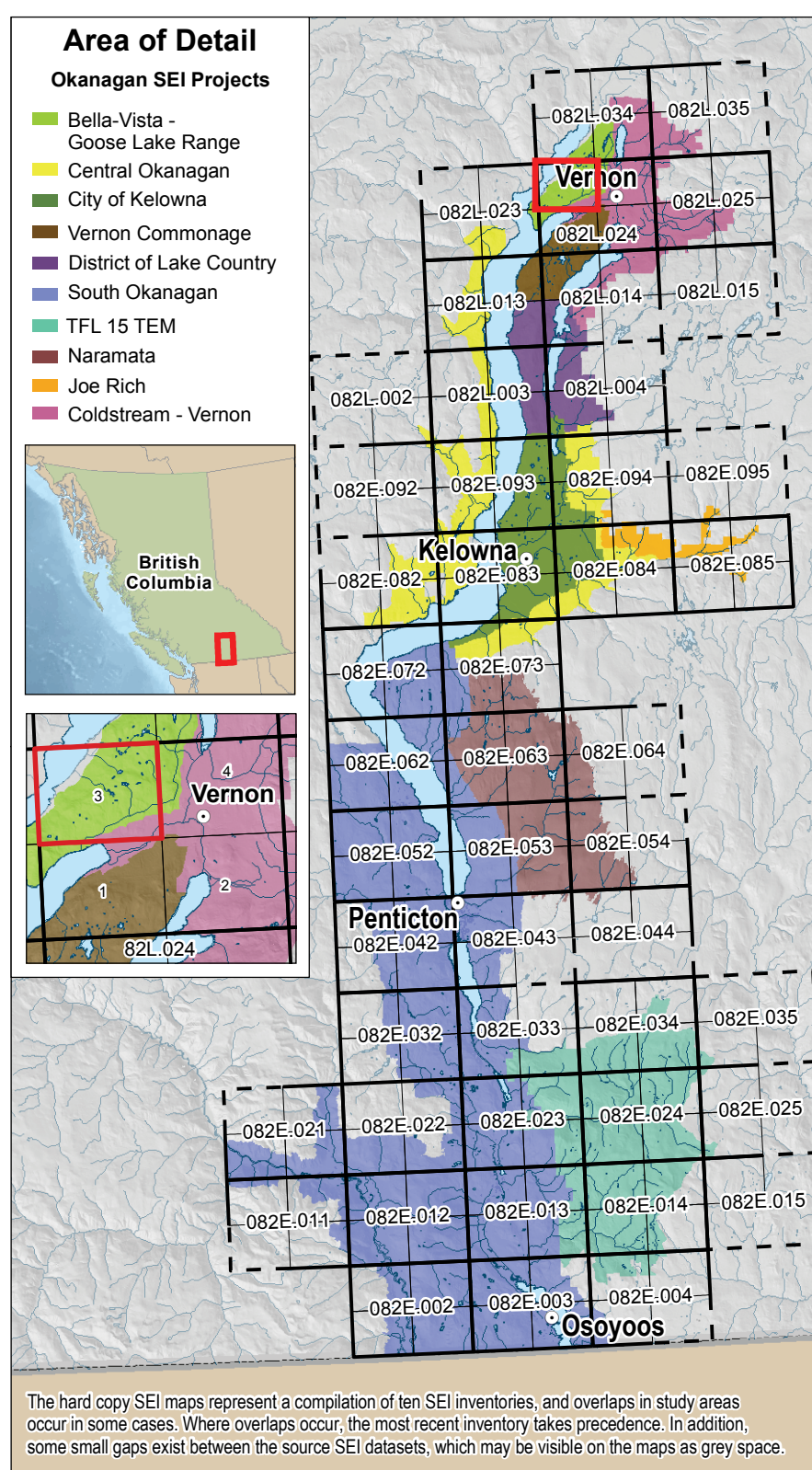


82L.024.3



Map Symbols

- Polygon Boundary
- Study Area Boundary
- Rivers
- Highways
- Roads
- Municipal Boundaries
- Outside the Okanagan Study Area

Sensitive Ecosystems (SE) Label

- Polygon Number
- 1st Component
- 2nd Component
- 3rd Component
- SE Class
- SE Subclass

The example label above indicates the SE attributes reported for polygon 13788. 82% of the polygon is 1021m - Coniferous Woodland, 20% is 1021m - Riparian Forest, and 20% of the polygon is 1021m - Old Forest.

NS are modified (non-sensitive) landscapes. Please refer to the legend for more information about these areas. Note that the NS are not considered to be SEs and are not included in the SE map. The NS are not included in the SE map.

Ecosystem Components
This cartographic product uses Dot Density to indicate where more than one ecosystem class is mapped in a polygon. The number of dots indicates the proportion of the polygon represented by the 2nd and 3rd ecosystem. The colour of the dots indicates the 2nd and 3rd ecosystem class.

The base colour represents the first ecosystem component.
Coloured dots overlaid upon the base colour indicate a second ecosystem component.
Two colours of dots indicate a second and third ecosystem.

Note: The actual placement of the dots has no significance; they are randomly placed within each polygon.
Written labels are based on a 30 x 48 inch paper size.

UTM Projection Zone 10 NAD83
100m Contours
February 15, 2010

The SEI data are based on a 1:10,000 scale and are displayed here at a 1:10,000 scale. The SEI data are not intended to be used for any other purpose. The SEI data are not intended to be used for any other purpose.

WHAT IS A SENSITIVE ECOSYSTEM?

For the purpose of this study, an ecosystem is considered to be a portion of the landscape with relatively uniform dominant vegetation.

Sensitive Ecosystems are ecosystems that are ecologically sensitive and/or at risk in the landscape.

Rationale

The Okanagan Valley region covers one of the most rapidly growing population centres of British Columbia, and development pressure is escalating. The area is under intense pressure due to urban and rural human settlement as well as extensive agricultural conversion, and has experienced significant changes to its ecosystem structure and function through the spread of invasive alien species and fire exclusion. Very high ecological values, combined with the development pressure on the landscape, underscore the need for careful, conservation-based land use decision making throughout the Okanagan Valley.

Regional and municipal governments of the Okanagan Valley and conservation organizations, assisted by Environment Canada's Canadian Wildlife Service and the B.C. Ministry of Environment, have completed regional and local Sensitive Ecosystems Inventory mapping projects as a means to identify the remaining sensitive ecosystems in the Okanagan Valley. The SEI is intended to provide information that will be used to guide land use planning and development decisions that will protect and enhance the remaining sensitive ecosystems in the Okanagan Valley.

An ecosystem, for the purpose of this inventory, is a portion of the landscape with relatively uniform vegetation and soils. Sensitive ecosystems are those that are ecologically fragile and/or at risk. Factors for ecological sensitivity include the presence of shallow soils, susceptibility to soil erosion, vulnerability to hydrological changes, sensitivity to the introduction and spread of invasive plants, and sensitivity to recreational activity and other human disturbances. Within the province, at-risk status for species and ecological communities is determined by the B.C. Conservation Data Centre (CDC), a member program of the International NatureServe network. The CDC list of Ecological Communities can help to determine if a particular ecosystem is representative of an at-risk ecological community.

Ecological Significance
The Okanagan Valley is characterized by a complex landscape of rugged steep, rocky terrain and gently sloping terraces. These terraces result from glacial lakes and the movement of materials by melting on during the retreat of the last glaciers. The complex terrain, combined with a moderate semi-arid climate, supports diverse ecosystems and organisms. Open ponderosa pine forests, grasslands, old fields and talus slopes, and a diversity of riparian and wetland ecosystems often occur in close proximity to one another. The wetland and riparian ecosystems are a focal point in the landscape for many species.

The Valley is a region of highly unreplicated ecological and biological diversity within British Columbia and the rest of Canada. It is home to many at-risk

species and ecological communities, including some ecosystems unique to Canada. Broadleaf woodlands, antelope-brush steppe, sagebrush steppe, wetlands and old forest ecosystems, once well-represented in the Okanagan Valley, have become rare. Historical ecosystem mapping (1980s) to present shows losses of greater than 90% of some ecosystem types in the Okanagan Valley.

Healthy, functioning natural ecosystems play an important role in adapting to and mitigating the impacts of climate change. Climate change adaptations such as reducing stressors, improving ecosystem resilience, and landscape connectivity contribute to ecosystem resilience and adaptive capacity in the future. The ecosystems mapped in this project are ecologically significant because of their rarity and fragility and also for the important ecosystem services they provide, such as climate regulation, water filtration, productive soil, carbon sequestration, nutrient cycling, pollination, wildlife habitat and more. Sensitive ecosystems must be considered in the context of the overall landscape, which includes other ecosystems that also contribute to ecosystem services.

The services and benefits SEs provide and the wildlife species they support are critically important to the quality of life in the Okanagan. With so few at-risk and fragile ecosystems remaining, it is essential that each site be carefully considered and all land use options be fully evaluated prior to initiating any changes in these areas.

Study Area

The Okanagan Valley project is comprised of a number of individual SEI projects. The Valley SEI project is a component of the Okanagan Valley Sensitive Ecosystems Inventory (SEI) project, which is a component of the Okanagan Valley Sensitive Ecosystems Inventory (SEI) project.

The purpose of the SEI Okanagan Valley project is to combine all of the various SEI projects that have been completed in the Okanagan Valley from Vernon to Osoyoos, and to consider and present them as a whole in mapped form to aid use planning and to encourage landscape-level conservation planning at multiple scales, including regional and basin-wide. The project deliverables include 101 SEI maps at a 1:10,000 scale on a Terrain Raster Information Management (TRIM) base, and a series of reports. The individual project reports detail the methods used, study results, descriptions of the ecosystems, and conservation tools for management (see References section).

Sensitive Ecosystems Inventory Methods
Sensitive Ecosystems Inventory was developed as a conservation tool. It is flexible and can be completed in a short time with limited funding when necessary, or expanded to incorporate more information for advanced conservation planning and sustainable development.

Most Okanagan SEI projects were developed by first undertaking Terrestrial Ecosystem Mapping (TEM) work in the Okanagan project area where the SEI polygons were mapped. From air photos, using a bottom-up approach, TEM provided the foundation for the SEI thematic mapping, and the TEM units were assigned for at-risk status and ecological sensitivity. Sensitive ecosystems were grouped using the Ecosystem-based Resource Mapping (ERMA) table.

The last three SEI classes and subclasses to be assigned to each TEM unit. If the mapped TEM unit is included within an at-risk ecological community as defined and listed by the CDC, or if it is ecologically sensitive, the unit was assigned to one of the applicable ecosystem classes and subclasses. It cases where a given ecosystem falls into more than one class, it is always assigned to the more sensitive class.

In the province, species are assessed by the B.C. Conservation Data Centre. Species at risk are identified on the B.C. Red and Blue lists. Red-listed species are endangered, endangered, or threatened. Blue-listed species are of special concern due to low declining populations and are sensitive to human activities or natural events. Nationally at-risk species are listed on the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered, Threatened, or of Special Concern. Endangered species face imminent extinction or extirpation. Threatened species may become endangered if limiting factors are not reversed. Species of Special Concern are particularly sensitive to human activities or natural events. Endangered or

Inventory Results

Many of the sites identified by the SEI are at high risk of conversion to other land uses or further degradation. Within the study area, 47.5% was mapped as Sensitive Ecosystems (SE) and 7.9% fell into the Other Important Ecosystems category (see Legend). The inventory results indicated that wetlands, broadleaf woodlands, antelope-brush steppe, sagebrush steppe and old forest ecosystems were extremely rare - covering less than 5% of the study area. Although areas of grasslands, coniferous woodlands, and mature forests remain, many have been altered significantly and therefore few high quality sites remain. The study found many SEs that have been degraded by fragmentation, human use, livestock grazing, and alien species.

The services and benefits SEs provide and the wildlife species they support are critically important to the quality of life in the Okanagan. With so few at-risk and fragile ecosystems remaining, it is essential that each site be carefully considered and all land use options be fully evaluated prior to initiating any changes in these areas.

Financial or in-kind support for the projects was provided by: The B.C. Ministry of Environment (B.C. Conservation Data Centre), Environment Canada (Canadian Wildlife Service), the Allan Brooks Nature Centre, Regional District of Okanagan Similkameen, Regional District of Central Okanagan, City of Kelowna, City of Vernon, District of Lake Country, Weyhehauer Canada Ltd., District of Coquitlam, City of Kelowna, and B.C. Conservation Foundation.

Acknowledgements
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References
Information and access to full reports and map products for the Okanagan Valley SEI projects are available at: www.env.gov.bc.ca/ecosyst/tem/ (SEI Okanagan Valley or the project area name as a keyword).

Related Publications and Links
Green Bytes Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure: www.greenbytes.ca/
The Toolkit contains practical examples of bylaws provisions currently in use in B.C., including model provisions for Regional Growth Strategies, Official Community Plans, Development Permit Areas, Zoning, Tax Exemptions, Environmental Assessment, Stormwater Management and other regulatory tools. It includes several examples and case studies of successful green infrastructure projects and bylaws.

Developed with: Environmental Guidelines for Urban and Rural Land Development in British Columbia. BC Ministry of Environment. www.env.gov.bc.ca/edl/documents/bcenvruraldev2006devtool_dev_tool_rls.htm

Taking Nature's Pulse: The Status of Biodiversity in British Columbia Audette, M.A., D.A. Butler, D.A. Neidhart, G.E. Scudder and V. Stevens (eds.) 2005. Taking Nature's Pulse. The Status of Biodiversity in British Columbia. Biodiversity BC, Victoria, BC. 268 pp. Available at: www.biodiversitybc.org

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British Columbia Conservation Data Centre (CDC), Ecosystems Branch. BC Ministry of Environment. www.env.gov.bc.ca/cdc/

Green Bytes Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure: www.greenbytes.ca/

Taking Nature's Pulse: The Status of Biodiversity in British Columbia Audette, M.A., D.A. Butler, D.A. Neidhart, G.E. Scudder and V. Stevens (eds.) 2005. Taking Nature's Pulse. The Status of Biodiversity in British Columbia. Biodiversity BC, Victoria, BC. 268 pp. Available at: www.biodiversitybc.org

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Sensitive Ecosystems Legend

Sensitive ecosystems are fragile and/or rare, or are ecologically important because of the diversity of species they support and the ecosystem services they provide. Some at-risk wildlife and plant species are associated with Sensitive Ecosystems, and are listed below. Species at Risk are those species which are considered Endangered, Threatened or of Special Concern. Please note that the map of the species listed in this map can be found in other sensitive ecosystems as well as non-sensitive ecosystems found throughout the Okanagan Valley.

Note: Information on Species at Risk is included in the map legend to highlight the species habitat values of the sensitive ecosystems. This map series does not include the actual mapping of species locations. For information on species location mapping see the B.C. Conservation Data Centre reference below.

Antelope-brush Steppe (AS):

Antelope-brush communities are dryland ecosystems characterized by abundant shrub dominated by antelope-brush. These communities occur in the southern portion of the Okanagan Valley, on sandy soils in the warm, dry valley bottoms. They commonly occur on sites that are very amenable to development - primarily for vineyards and housing. Overuse by domestic livestock and the introduction and spread of invasive plants threaten this ecosystem. Antelope-brush ecosystems are recognized as one of the four most endangered ecosystems in Canada. Antelope-brush Steppe ecosystems are dominated by antelope-brush and bunchgrasses. AS-aj and disturbed antelope-brush steppe dominated by antelope-brush and invasive alien plants (AS-ib).

Antelope Brush Steppe Ecosystems provide the following services:

- Carbon storage
- Nutrient cycling and maintenance of productive soils
- Sediment retention
- Pollination
- Pest regulation
- Food production

Some species associated with Antelope-brush Steppe Ecosystems are:

- Great Basin Sapsucker
- Night Snake
- Belted Gopher Snake
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail

Sagebrush Steppe (SS):

Sagebrush Steppe ecosystems are dryland ecosystems characterized by abundant big sagebrush. These communities occur on similar sites to grassland ecosystems, where conditions are too warm and dry for trees to establish. This ecosystem is mostly found in the southern reaches of the study area, where they are dominated by bunchgrasses with scattered forbs and a soil crust dominated by mosses and lichens. These ecosystems commonly occur on sites that are amenable to urban or agricultural development, where livestock trampling and invasive plants threaten remaining Sagebrush Steppe ecosystems. Sagebrush Steppe are generally steppe ecosystems dominated by big sagebrush and bunchgrasses (SS-aj), steep, shallow soil sagebrush steppe (SS-sh), and disturbed sagebrush steppe dominated by big sagebrush and invasive alien plants (SS-ib).

Sagebrush Steppe Ecosystems provide the following services:

- Carbon storage
- Erosion control
- Sediment retention
- Nutrient cycling and maintenance of productive soils
- Pollination
- Pest regulation

Some species associated with Sagebrush Steppe Ecosystems are:

- Great Basin Sapsucker
- Western Rattlesnake
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Half-moon Haresnake

Grasslands (GR):

Grassland ecosystems occupy areas that are generally too hot and dry for forests to establish, and are dominated by bunchgrasses (grassland, GR-gr), steep slope grasslands (GR-sl), step, shallow grasslands (GR-sh), and disturbed grasslands dominated by invasive alien plants (GR-ib). Large areas of grasslands have been lost to agricultural and urban development and degraded by invasive alien plants. Most of the remaining grasslands have become wild and are considered to be Disturbed Grasslands through partial invasion by noxious weeds. Given the very limited extent of remaining grasslands, these are important sites for grassland restoration, soil conservation, and maintenance of many other grassland values, including habitat for many at-risk and endangered species.

Grassland Ecosystems provide the following services:

- Carbon storage
- Erosion control
- Nutrient cycling and maintenance of productive soils
- Pollination
- Pest regulation
- Food production

Some species associated with Grassland Ecosystems are:

- Night Snake
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Long-billed Curlew

Sparsely Vegetated (SV):

Sparsely vegetated ecosystems are sites where rock or talus (angular rock fragments) limits vegetation establishment; vegetation cover is discontinuous and interspersed with bedrock or blocks of rock. Sparsely vegetated ecosystems are subdivided into four sub-categories: shrub, talus, cliff, and rock outcrop ecosystems. Cliff (SV-cl), grassy or un-vegetated Rock Outcrop (SV-ro), Shrubby Rock Outcrop (SV-sh), and Talus Slope (SV-ta). Many of these ecosystems are at risk, and their coarse or shallow soils make them sensitive to disturbance and soil erosion.

Sparsely Vegetated Ecosystems provide the following services:

- Erosion control
- Nutrient cycling and maintenance of productive soils
- Pollination
- Soil formation

Some species associated with Sparsely Vegetated Ecosystems are:

- Great Basin Sapsucker
- Western Rattlesnake
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Rubber Bo

Old Forest (OF):

Old Forest Ecosystems are dominated by large, old trees, usually greater than 150 years of age. Most of these forests have been lost to selective logging of larger trees, ingrowth of dense trees resulting from the exclusion, and development. Only small remnants of these forests remain today. These old forests contribute to climate regulation, soil stability, moisture retention and the old trees in them provide important habitat for many species including many woodpeckers, owls, and male deer. Old Forest ecosystems include Coniferous Woodlands (OF-co) and Old Broadleaf Woodlands (OF-bo). Old forest forests are included in the Riparian category.

Old Forest Ecosystems provide the following services:

- Climate regulation
- Carbon storage
- Air quality
- Sediment retention
- Nutrient cycling and maintenance of productive soils

Some species associated with Old Forest Ecosystems are:

- Williamson's Sapsucker
- Western Toad
- Wolverine
- American Badger
- Flammulated Owl
- Common Nighthawk

Broadleaf Woodlands (BW):

Broadleaf Woodland ecosystems are often dominated by trembling aspen which occur in depressions and moist areas (Aspen Copse, BW-ac) in grassland areas, and aspen steppe (BW-as) slopes, however it includes old forest. Broadleaf Woodlands are susceptible to changes in the water table. They are unusual in a dry landscape and their moist soils are sensitive to disturbance. Old Broadleaf Woodlands are included in the Old Forest category.

Broadleaf Woodlands provide the following services:

- Climate regulation
- Drought recovery
- Fresh water
- Flood control
- Storm protection
- Nutrient cycling and maintenance of productive soils

Some species associated with Broadleaf Woodland Ecosystems are:

- Yellow-breasted Chat
- Western Rattlesnake
- Western Screech Owl
- Great Basin Sapsucker
- Lewis's Woodpecker
- Rubber Bo

Coniferous Woodlands (WD):

Coniferous Woodlands are open stands of Douglas-fir or ponderosa pine (WD-co), often on shallow soils, with grassy understories; old Coniferous Woodlands are part of the Old Forest category. They most commonly occur in the drier climates of the Okanagan Valley, on sites with limited moisture, on rocky knolls and on warm south-facing slopes. Numerous sites have been lost to development and altered by ingrowth of trees associated with forest human disturbances.

Coniferous Woodland Ecosystems provide the following services:

- Climate regulation
- Air quality
- Carbon storage
- Pest regulation
- Nutrient cycling and maintenance of productive soils

Some species associated with Coniferous Woodland Ecosystems are:

- Williamson's Sapsucker
- Rubber Bo
- Lewis's Woodpecker
- Flammulated Owl
- Great Basin Sapsucker
- Common Nighthawk

Riparian (RI):

Riparian ecosystems are streamside and lakeside ecosystems or sites with significant vegetation, including ecosystems on floodplains and benches along creeks and rivers (bench, RI-b), shrub-dominated and lakebedside (RI-b), ecosystems in gulches, often with wetlands (RI-g), Alpine ecosystems are found at higher elevations in the South Okanagan (RI-sh), the river bed of large systems (river, RI-r), and beaches on lakes (beach, RI-l). These sites frequently form natural corridors through the landscape, connecting other ecosystems and providing pathways for animals. Damming, diversions, channelization, draining, and pollution have seriously affected many riparian ecosystems.

Riparian Ecosystems provide the following services:

- Fresh water
- Flood control
- Drought recovery
- Storm protection
- Damage and natural irrigation
- Nutrient cycling and maintenance of productive soils

Some species associated with Riparian Ecosystems are:

- Yellow-breasted Chat
- Western Screech Owl
- Great Horned Owl
- Purple Spinehawk
- Towhees Meadow-lark
- Small Flowered Lizard
- Western Rattlesnake

Wetlands (WN):

Wetland ecosystems occur on sites where the water table is at, near, or above the soil surface for a sufficient period of time to influence soil and vegetation development; includes marshes (WN-m), swamps (WN-s), wet meadows (WN-wm or WN-md), fens (WN-f), and shallow open water (WN-w) ecosystems. They are extremely important because of their natural rarity in this area and the important ecosystem services they provide. Many Wetlands have been lost to development. It is estimated that 85% of the original wetland habitat in the Southern Okanagan has disappeared.

Wetland Ecosystems provide the following services:

- Drought recovery
- Flood control
- Storm protection
- Damage and natural irrigation
- Fresh water
- Filtration and pollution control
- Nutrient cycling and maintenance of productive soils

Some species associated with Wetland Ecosystems are:

- Western Toad
- Western Painted Turtle
- Great Horned Owl
- Purple Spinehawk
- Scarlet Anna
- Towhees Meadow-lark
- Small Flowered Lizard
- Western Rattlesnake

Alpine (AP):

Alpine ecosystems are high-elevation alpine and parkland ecosystems including herbaceous ecosystems dominated by forbs or graminoid vegetation (AP-g), parkland forests where trees occur in distinct clumps (AP-f), and shrub ecosystems dominated by dwarf shrubs such as heather (AP-sh). Alpine ecosystems are found at higher elevations in the South Okanagan (RI-sh), where there is significant snow cover for large parts of the year. Alpine ecosystems are sensitive to disturbance, as the shallow soils and cold temperatures slow vegetation recovery.

Alpine Ecosystems provide the following services:

- Erosion control
- Carbon storage
- Climate regulation
- Nutrient cycling and maintenance of productive soils

Some species associated with Alpine Ecosystems are:

- American Badger
- Peregrine Falcon
- Wolverine

Seasonally Flooded Agricultural Fields (FS):

Seasonally Flooded Agricultural Fields ecosystems are cultivated fields that flood annually, providing important migration and wintering habitat for birds. They provide important habitat for amphibians, wetlands and other bird species, small mammals, and many other products. They are located along low-lying areas or former floodplains that have been created by channelization of creeks and rivers. In some cases, these areas could be restored to Wetland or Riparian ecosystems if natural flood regimes and vegetation are re-established.

Seasonally Flooded Agricultural Fields Ecosystems provide the following services:

- Flood control
- Fresh water
- Storm protection
- Damage and natural irrigation
- Fresh water