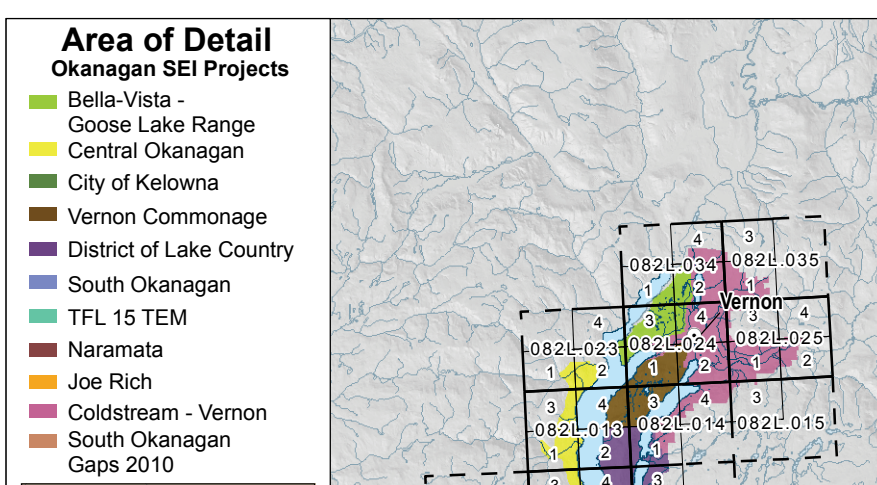


82E.032.3



Map Symbols

Polygon Boundary
Study Area Boundary
Roads
Highways
Rail Line
100m contours
City of Kelowna
Vernon Community
District of Lake Country
South Okanagan
TFL 15 TEM
Naramata
Joe Rich
Coldstream - Vernon
South Okanagan
Gage 2010

Sensitive Ecosystems (SE) Label

Polygon Number
% of polygon
SE Class
SE Subclass
1st Component
2nd Component
3rd Component

The example label above indicates the SE attributes reported for polygon 13788. 60% of the polygon is 1020m Contour Forested. 20% of the polygon is 1020m Contour Forested. 20% of the polygon is 1020m Contour Forested. The map is not modified (non-sensitive) landscape. Please refer to the legend for more information about these areas. Note that the SE label can be combined to a SE class and subclass. Polygon labels on the map do not include the SE label.

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.

UTM Projection Zone 18 NAD83
100m Contour
October 15, 2010

The SEI data are based on 1:10,000 scale photos but are displayed here at 1:10,000. To avoid any misinterpretation of the data, the map is not intended to be used for any purpose other than the original purpose of the SEI. The map is intended to be used for the purpose of the SEI only.

* Written notes are based on a 30 x 40 inch paper size.

Map by CASYS CONSULTING

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 natural resources. The project is intended to identify the remaining sensitive ecosystems in the Okanagan Valley. The SEI is intended to provide a tool that uses scientific information and mapping to encourage local governments, landowners, developers, and other citizens to become involved in protecting, conserving, and restoring sensitive ecosystems.

Conservation of these ecosystems is increasingly important as rapid population growth in the Okanagan continues to cause fragmentation, degradation, and loss of sensitive ecosystems. The project is intended to provide a tool that uses scientific information and mapping to encourage local governments, landowners, developers, and other citizens to become involved in protecting, conserving, and restoring sensitive ecosystems.

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. Criteria for ecological sensitivity include the presence of shadow 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 formations result from glacial lakes and the movement of materials by melting on during the retreat of the last glaciers. The complex terrain, combined with its moderate semi-arid climate, supports diverse ecosystems and organisms. Open ponderosa pine forests, grasslands, dunes 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 largely unimpacted 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 ecological condition, 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 factors 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.

Data Limitations
The SEI information is intended to alert local and regional decision-makers to the presence of sensitive and other important ecosystems and ecological features. The SEI mapping does not replace the need for on-site assessments in areas where land use changes are proposed. The accuracy of polygon boundaries is limited by the scale (1:10,000) for all projects except the City of Kelowna which was based on 1:10,000 digital aerial photography and the aerial photographs on which the sites are delineated (i.e., changes may have taken place since the photos were taken). It is recommended that digital data not be enlarged significantly beyond the scale of the photos, as this may result in unacceptable distortion and faulty registration with other datasets. The ability to use specific distances (e.g., invasive plants) is limited when interpreting air photos, and field sampling is needed to supplement the interpretation. It can also be difficult to delineate small sensitive ecosystems. In many cases these ecosystems are captured as a small component of a larger polygon that is dominated by another ecosystem. It is important to remember that a polygon may contain a complex, or mosaic, of ecosystems, and sensitive ecosystems may only occupy a portion of that polygon.

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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 SEI 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.

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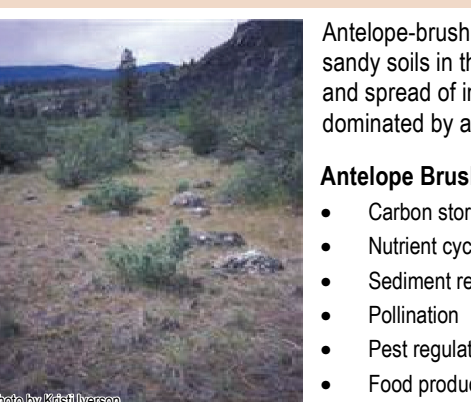
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Sensitive Ecosystems Legend

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 many of the species listed in this map can be found in other sensitive ecosystems found throughout the Okanagan Valley. 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-as) and disturbed antelope-brush steppe dominated by antelope-brush and invasive alien plants (SS-as).

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 Spadefoot
- Tiger Salamander
- Belt's Henshaw
- Road
- Peregrine Falcon
- Common Nighthawk
- Nuttall's Cottontail

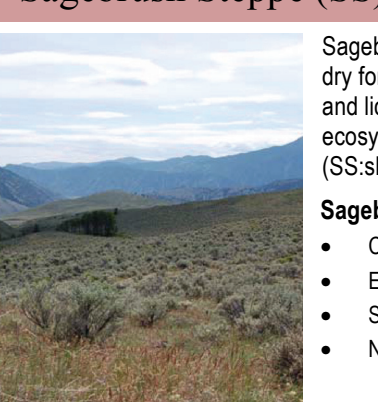
Other species associated with Antelope-brush Steppe Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Other species associated with Antelope-brush Steppe Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

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 ecologically important because of big sagebrush and bunchgrasses (SS-as), steep, shallow soil antelope steppe (SS-as), and disturbed sagebrush steppe dominated by big sagebrush and invasive alien plants (SS-as).

Sagebrush Steppe Ecosystems provide the following services:

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

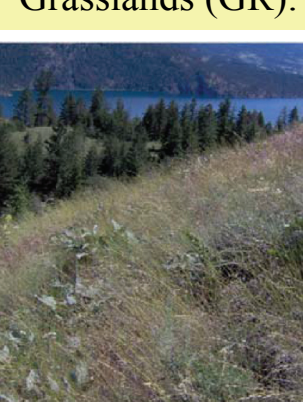
Some species associated with Sagebrush Steppe Ecosystems are:

- Great Basin Spadefoot
- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Other species associated with Sagebrush Steppe Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

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-sl), and disturbed grasslands dominated by invasive alien plants (GR-sl or GR-sl). 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:

- Great Basin Spadefoot
- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Other species associated with Grassland Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

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-ts). 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 Spadefoot
- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Other species associated with Sparsely Vegetated Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

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 mule deer. Old Forest ecosystems include Coniferous Woodlands (OF-co) and Old Broadleaf Woodlands. Old forest forests are included in the Riparian category.

Old Forest Ecosystems provide the following services:

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

Some species associated with Old Forest Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Other species associated with Old Forest Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

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 excludes old forests. Broadleaf Woodlands are susceptible to changes in the water table. They are unusual in an antelope and their moist soils are sensitive to disturbance. Old Broadleaf Woodlands are included in the Old Forest category.

Broadleaf Ecosystems provide the following services:

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

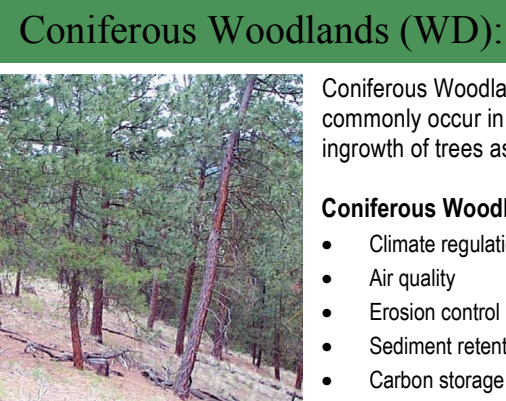
Some species associated with Broadleaf Woodland Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Other species associated with Broadleaf Woodland Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Coniferous Woodlands (WD):



Coniferous Woodlands are open stands of Douglas-fir or ponderosa pine (WD-co), often on shallow soils, with grassy understoreys; 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 the exclusion, weed invasion, and other human disturbances.

Coniferous Woodland Ecosystems provide the following services:

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

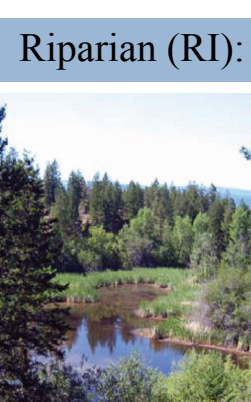
Some species associated with Coniferous Woodland Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
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Other species associated with Coniferous Woodland Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Riparian (RI):



Riparian ecosystems are streamside and lakeside ecosystems or sites with significant vegetation, includes ecosystems on floodplains and benches along creeks and rivers (bench, RI-b), shrub-dominated floodplains and lakeshore (bench, RI-b), ecosystems on gulches, often with aspen (gully, RI-g), Alpine ecosystems are found at higher elevations in the South Okanagan (TFL 15) 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.

Riparian Ecosystems provide the following services:

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

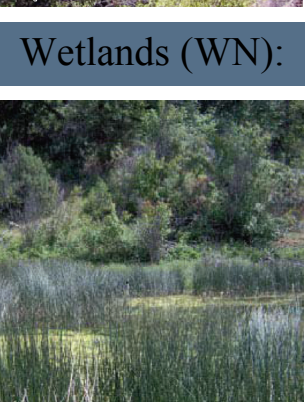
Some species associated with Riparian Ecosystems are:

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- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Other species associated with Riparian Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

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-wd), fens (WN-f), and shallow open water (WN-wa) ecosystems. They are extremely important because of their natural rarity in the area and the critically 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
- Flood control
- Drought recovery
- Storm protection
- Damage and natural irrigation
- Nutrient cycling and maintenance of productive soils

Some species associated with Wetland Ecosystems are:

- Western Rattlesnake
- Western Skink
- Common Nighthawk
- Sage Thrasher