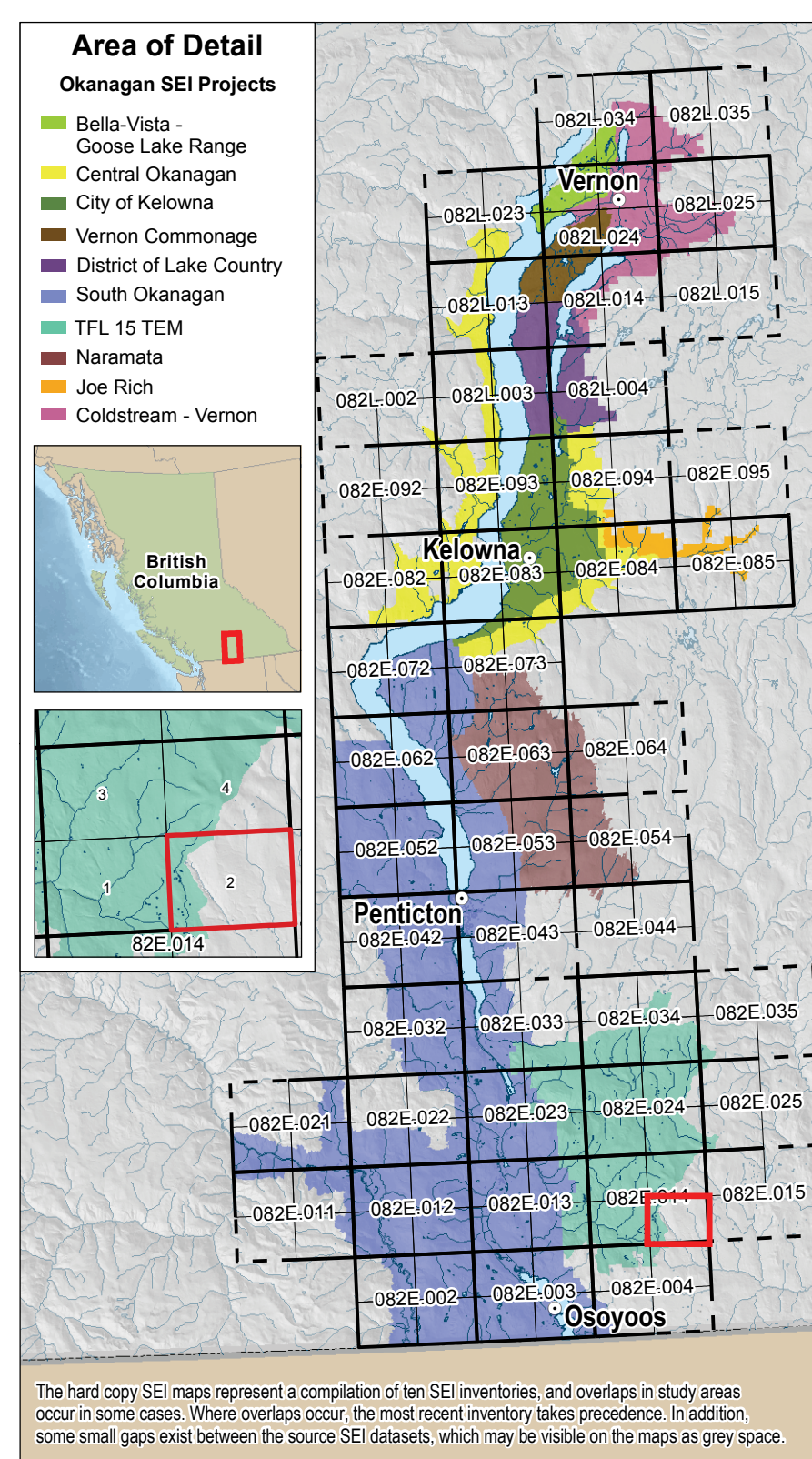


82E.014.2



Map Symbols

- Polygon Boundary
- Study Area Boundary
- Rivers
- Lake/Major River
- Buildings
- Roads
- Municipal Boundaries
- Rail Line
- Areas Outside the Okanagan Study Area
- 100m contours

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 1023m Confined Woodland. 20% of the polygon is 07m Old Forest. 20% of the polygon is 07m Old Forest. 20% of the polygon is 07m Old Forest.

NS are modified (non-sensitive) landscapes. Please refer to the legend for more information about how areas are modified. Note that the area can be correlated to a SE class and subclass. Polygon labels on the map do not include the SE class.

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.

The SEI data are based on 1:10,000 scale maps and are displayed here at a 1:10,000 scale. The use of a 1:10,000 scale is appropriate for the purpose of the SEI. The use of a 1:10,000 scale is appropriate for the purpose of the SEI. The use of a 1:10,000 scale is appropriate for the purpose of the SEI.

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

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

Healthy, functional ecosystems play an important role in adapting to and mitigating the impacts of climate change. Climate change adaptations such as reducing stressors, improving ecosystem 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 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 SEI project is comprised of a number of individual SEI projects: Bella Vista - Goose Lake Range, Central Okanagan City of Kelowna, Vernon Community, District of Lake Country, Joe Rich, TFL 15, Nanaimo, Coldstream - Vernon, and the South Okanagan. For more information about these projects and the methods used, study results, descriptions of the deliverables include 100 SEI maps at a 1:10,000 scale on a Terrain Resource 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) on this map.

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 100 SEI maps at a 1:10,000 scale on a Terrain Resource 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) on this map.

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 understanding Terrestrial Ecosystem Mapping (TEM) except in the Nanaimo project area where the SEI project was mapped from air photos using a bottom-up approach. TEM provided the foundation for the SEI thematic mapping, and the TEM units were tailored for at-risk status and ecological sensitivity. Sensitive ecosystems were grouped using the Ecosystem-based Resource Mapping (EBRM) table. The table allows 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 COC, or if it is ecologically sensitive, the unit was assigned to one of the applicable ecosystem classes and subclasses. In cases where a given ecosystem falls into more than one class, it is always assigned to the more sensitive class.

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 a 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 rarely unaltered ecological and biological diversity within British Columbia and the rest of Canada. It is home to many at-risk

Inventory Results

Many of the sites identified by the SEI are at high risk of conversion to other land uses. The SEI maps show that 47.5% of the study area is at high risk of conversion to other land uses. The SEI maps show that 47.5% of the study area is at high risk of conversion to other land uses. The SEI maps show that 47.5% of the study area is at high risk of conversion to other land uses.

Healthy, functional ecosystems play an important role in adapting to and mitigating the impacts of climate change. Climate change adaptations such as reducing stressors, improving ecosystem 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 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.

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 use of 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.

References
Information and access to full reports and map products for the Okanagan Valley SEI projects are available at: www.gov.bc.ca/ecoecol/tye.htm

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K. Hewson. 2005. Terrestrial Ecosystem Mapping South Okanagan. (This is an update to L. E. and R. Maxwell. 1999. Biophysical Habitat Units of the South Okanagan). 1:20,000 maps.

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

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.

Climate Change: Wilson, S. and R.H. Hedden. *Mitigating and Adapting to Climate Change through the Conservation of Nature*. Available at: www.landforjustice.ca/casesearch.htm

Developed with: Environmental Guidelines for Urban and Rural Land Development in British Columbia. BC Ministry of Environment.

Taking Nature's Pulse: The Status of Biodiversity in British Columbia Austin, M.A., D.A. Butler, D.A. Nielsen, G.E. Souder and V. Stevens (eds.). 2008. 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 many 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.

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 and disturbed antelope-brush steppe dominated by antelope-brush and invasive alien plants (AS-05).

Antelope Brush Steppe Ecosystems provide the following services:

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

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-01), steep, shallow soil antelope-brush steppe (SS-02), and disturbed sagebrush steppe dominated by big sagebrush and invasive alien plants (SS-03).

Sagebrush Steppe Ecosystems provide the following services:

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

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-02 or GR-03). 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

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:

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

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 old Coniferous Woodlands (OF-co) and old Broadleaf Woodlands (OF-bl). Old forests are included in the Riparian category.

Old Forest Ecosystems provide the following services:

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

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 a dry landscape 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

Coniferous Woodlands (WD):

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

Coniferous Woodland Ecosystems provide the following services:

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

Riparian (RI):

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

Riparian Ecosystems provide the following services:

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

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) and fens (WN-f), and shallow open water (WN-wa) systems. 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
- Storm protection
- Fresh water
- Filtration and pollution control
- Nutrient cycling and maintenance of productive soils

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 (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.

Alpine Ecosystems provide the following services:

- Erosion control
- Climate regulation
- Nutrient cycling and maintenance of productive soils
- Pollination
- Food production
- Soil formation

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, waterfowl and other bird species, small mammals, and many types of producers. They are located along low-lying areas or former floodplains that have been isolated 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
- Carbon storage
- Damage and natural irrigation
- Storm protection
- Drainage and natural irrigation
- Fresh water

Mature Forest (MF):

Mature Forest ecosystems are dominated by mature trees, including broadleaf (MF-bl) forests, coniferous (MF-co) forests, and mixed (MF-m) deciduous and coniferous forests; however it excludes mature riparian forests, and mature coniferous and broadleaf woodlands. Mature Forests are an important buffer to sensitive ecosystems. They provide some of the same values associated with Old Forest ecosystems and can also be important recruitment sites for Old Forests. Mature Forest ecosystems have many important structural attributes, including some remaining large, old trees.

Mature Forest Ecosystems provide the following services:

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

Non-sensitive Landscapes (NS): (Areas not mapped as sensitive or other important ecosystems are depicted in white)

Non-sensitive Landscapes are modified areas not occupied by sensitive ecosystems, and include urban areas, disturbed rural landscapes, and young forests. Urban areas have human-influenced features or disturbances that are dominant across the landscape. Disturbed rural areas can be interspersed with agricultural and natural vegetation. Young forests are conifer-dominated stands with an age range between 1 and 80 years. Non-sensitive Landscapes are shown in white in the areas that are not designated by a sensitive ecosystem. In addition, many sensitive ecosystem polygons close to urban or disturbed areas may have a modified landscape interspersed with the sensitive ecosystem(s), in which the sensitive ecosystems are also used to map individually. These modified areas are depicted as NS (non-sensitive) on the map.