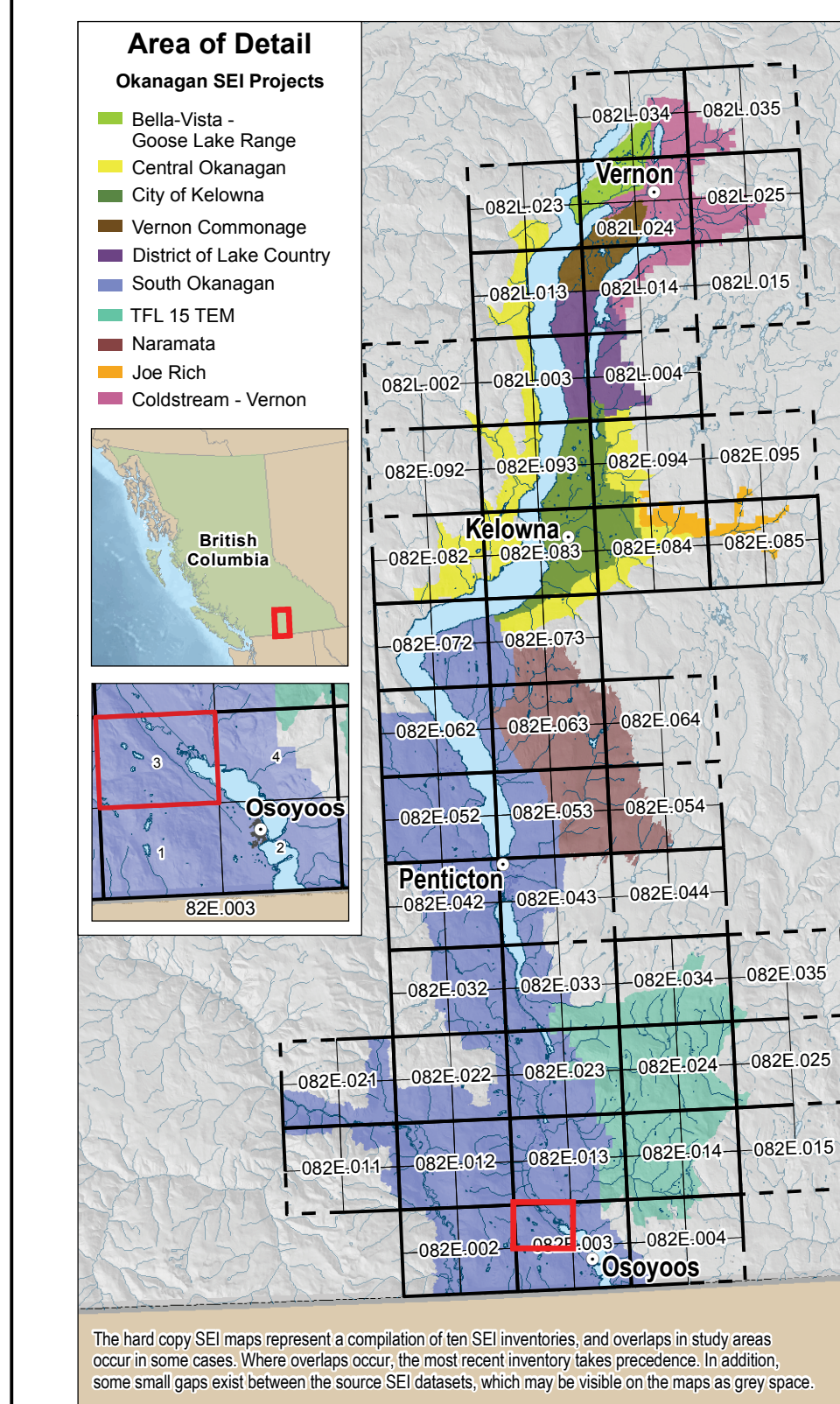


## 82E.003.3



## Map Symbols

- Polygon Boundary
- Study Area Boundary
- Rivers
- Lake/Major River
- Roads
- Highways
- Municipal Boundaries
- Rail Line
- 100m contours
- Areas 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 SEI attributes reported for polygon 13788. 82% of the polygon is 1022m Coniferous Woodland. 20% of the polygon is 1022m Coniferous Woodland. 20% of the polygon is 1022m Coniferous Woodland.

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

The base color represents the primary 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 10 NAD83  
100m Contours  
February 15, 2010

The SEI data are based on 1:10,000 scale air photos but are displayed here at a 1:10,000 scale. The map is not a replacement for detailed on-site assessments. The map is not a replacement for detailed on-site assessments.

\* Written scales are based on a 30 x 48 inch paper size.

Map by CASLVS

## WHAT IS A SENSITIVE ECOSYSTEM?

For the purpose of the 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.

## 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 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 a tool that uses scientific information and mapping to help decision makers make land use decisions that 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. 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.

The Okanagan Valley project was developed by first understanding Terrestrial Ecosystem Mapping (TEM) and then applying the methodology to the SEI. The project was developed by first understanding Terrestrial Ecosystem Mapping (TEM) and then applying the methodology to the SEI.

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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 landscape is characterized by a variety of soil types, climate, species diverse ecosystems and organisms. Open ponderosa pine forests, grasslands, shrubs 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 relatively 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 (1800s 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 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 SEIs 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.

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) of all projects except the City of Kelowna which was based on 1:10,000 digital aerial photography and date 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 information. 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.

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 (regional and basin-wide). The project deliverables include 100 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.

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## Inventory Results

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) of all projects except the City of Kelowna which was based on 1:10,000 digital aerial photography and date 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 information. 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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Threatened species have been included in Schedule 1 of the Species at Risk Act and are protected on federal lands, and the new B.C. Wildlife Amendment Act will protect their populations and habitats on provincial lands. Protection of Species at Risk and their important habitats on private lands is primarily achieved through careful land use planning and municipal bylaws.

**Acknowledgements**

**Project partners include:** B.C. Ministry of Environment, 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, Weyerhaeuser Canada Ltd., District of Coquitlam, City of Kelowna, and the Regional District of Okanagan Similkameen.

**Financial or in-kind support for the project 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, Weyerhaeuser Canada Ltd., District of Coquitlam, City of Kelowna, and the Regional District of Okanagan Similkameen.

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**References**

Information and access to full reports and map products for the Okanagan Valley SEI projects are available at [www.gov.bc.ca/ecosyst/Type/SEI/SEI\\_Okanagan\\_Vale/01.htm](http://www.gov.bc.ca/ecosyst/Type/SEI/SEI_Okanagan_Vale/01.htm) or the project area name as a keyword).

**SEI Report:** Iverson, K. E., D. Curran, T. Fleming, and A. L. Iverson. 2008. *Sensitive Ecosystems Inventory - Okanagan Valley, Vernon to Osoyoos, 2009 - 2007*. Methods, Ecological Descriptions, Results and Conservation Tools. Technical Report Series No. 495. Canadian Wildlife Service, Pacific and Yukon Region, British Columbia.

**Map can be cited as:** Environment Canada. *Sensitive Ecosystems Inventory - Okanagan Valley: Vernon to Osoyoos, 2002-2007*. 1:20,000. Vancouver, BC: Canadian Wildlife Service, Pacific and Yukon Region, 2009.

**Namata:** Dalziel, Rod. 2006. *Namata Sensitive Ecosystems Inventory*. 1:20,000 map.

**Central Okanagan (including south slopes):** Haney, A. and K. Iverson. 2009. *Conservation analysis and updated ecosystem mapping for the Central Okanagan valley, Central Okanagan, South Slopes, Kelowna, Eftson and Juv-Rich project areas*. Unpub. report prepared for the Okanagan Collaborative Conservation Program.

**Vernon, K. and C. Erwin.** 2001 and 2002. *Ecosystem Mapping of Portions of the PPHN and DPHN in the Central Okanagan*. Prepared for the Regional District of Central Okanagan and the Ministry of Sustainable Resource Management. 1:20,000 map.

**Within 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 reviewed by the Committee on the Status of Endangered Wildlife in Canada (CSEWC) as Endangered, Threatened, or of Special Concern. Endangered species have imminent extinction or reduction. 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**

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**Lake Country:** Iverson, K. and P. Ulinia. 2008. *Sensitive Ecosystems Inventory: Lake Country, 2005*. 1:20,000 maps.

**TF 15:** Bruhl, D. and S. Robertson. 1999. *Ecosystem Mapping of Weyerhaeuser Canada Ltd. Tree Farm License 15*. Prepared for Weyerhaeuser Canada Ltd., Okanagan Falls, in partnership with FRBC and Ministry of Forests, Kamloops, BC. 1:20,000 maps.

**Vernon - Coldstream:** Iverson, K. and P. Ulinia. 2008. *Sensitive Ecosystems Inventory: Vernon Coldstream, 2005*. 1:20,000 maps.

**Kelowna:** Iverson, K. and P. Ulinia. 2008. *Sensitive Ecosystems Inventory: City of Kelowna, 2005*. 1:20,000 maps.

**South Okanagan:** Iverson, K. and A. Haney. 2009. *Refined and updated ecosystem mapping for the South Okanagan and lower Similkameen Valley*. Unpub. report prepared for the Regional District of Okanagan Similkameen.

**K. Iverson.** 2005. *Terrestrial Ecosystem Mapping South Okanagan*. (This is an update to Lab. E. and R. Maxwell. 1998. *Biophysical Habitat Units of the South Okanagan*). 1:20,000 maps.

**Joe Rich:** Iverson, K. and P. Ulinia. 2008. *Sensitive Ecosystems Inventory: Central Okanagan Joe Rich*. 1:20,000 map.

**British Columbia Conservation Data Centre (CDC), Ecosystems Branch.** B.C. Ministry of Environment. [www.env.gov.bc.ca/cdc/](http://www.env.gov.bc.ca/cdc/)

**Related Publications and Links**

**Green Bytes Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure:** [www.greenbytes.ca](http://www.greenbytes.ca)

The Toolkit contains practical examples of bylaws provisions currently in use in B.C., including model provisions for regional governments, 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. Hobbs. *Mitigating and Adapting to Climate Change through the Conservation of Nature*. Available at [www.landinterface.ca/casesearch.htm](http://www.landinterface.ca/casesearch.htm)

**Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia**. B.C. Ministry of Environment.

**Taking Nature's Pulse: The Status of Biodiversity in British Columbia**. Austin, M.A., D.A. Butler, D.A. Johnston, G.S. Bouvier 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.ca](http://www.biodiversitybc.ca)

## 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 arable to agriculture and housing. Overuse by domestic livestock, primarily for overgrazing and housing, and spread of invasive plants threaten this ecosystem. Antelope-brush steppe communities are recognized as one of the four most endangered ecosystems in Canada. Antelope-brush Steppe ecosystems are dominated by antelope-brush and bunchgrasses (AS-ab) and disturbed antelope-brush steppe dominated by antelope-brush and invasive alien plants (AS-di).

**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
- Pacific Bat
- Peregrine Falcon
- Common Nighthawk
- Nuttall's Cottontail

**Beaver Henshaw** (Endangered, Special Concern) Photo by J. L. Savelle

## 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 primarily steppe ecosystems dominated by big sagebrush and bunchgrasses (SS-ab), steep, shallow soil sagebrush steppe (SS-sh), and disturbed sagebrush steppe dominated by big sagebrush and invasive alien plants (SS-di).

**Sagebrush Steppe Ecosystems provide the following services:**

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

**Some species associated with Sagebrush Steppe Ecosystems are:**

- Great Basin Spadefoot
- Western Skink
- Sage Thrasher
- Common Nighthawk
- Nuttall's Cottontail
- Nugget Moss
- American Badger

**Nuttall's Cottontail** (Endangered, Special Concern) Photo by J. L. Savelle

## 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-di or GR-di). 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 what are considered to be Disturbed Grasslands through partial invasion by rowcrops. 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:**

- Burrowing Owl
- Shorebird
- Peregrine Falcon
- Nuttall's Cottontail
- Peregrine Falcon
- Long-billed Curlew
- Columbian Ground Squirrel

**Shorebird** (Endangered, Special Concern) Photo by J. L. Savelle

## 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 Spadefoot
- Western Skink
- Pacific Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Rubber Bo

**Western Skink** (Endangered, Special Concern) Photo by J. L. Savelle

## 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 old Coniferous Woodlands (OF-co) and old Broadleaf Woodlands (OF-bl). Old forested areas 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
- Flood control
- Pollution control
- Pest regulation
- Food production

**Some species associated with Old Forest Ecosystems are:**

- Williamson's Sapsucker
- White-headed Woodpecker
- Western Tanager
- Western Screech Owl
- Western Woodpecker
- Yellow-bellied Sapsucker
- Yellow-bellied Sapsucker
- Yellow-bellied Sapsucker

**Williamson's Sapsucker** (Endangered, Special Concern) Photo by J. L. Savelle

## 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 sedge (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 Woodland Ecosystems provide the following services:**

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

**Some species associated with Broadleaf Woodland Ecosystems are:**

- Yellow-bellied Sapsucker
- Western Tanager
- Western Screech Owl
- Western Woodpecker
- Yellow-bellied Sapsucker
- Yellow-bellied Sapsucker
- Yellow-bellied Sapsucker

**Yellow-bellied Sapsucker** (Endangered, Special Concern) Photo by J. L. Savelle

## 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 the exclusion, water extraction, and human disturbances.

**Coniferous Woodland Ecosystems provide the following services:**

- Climate regulation
- Air quality
- Erosion control
- Sediment retention
- Carbon storage
- Pest