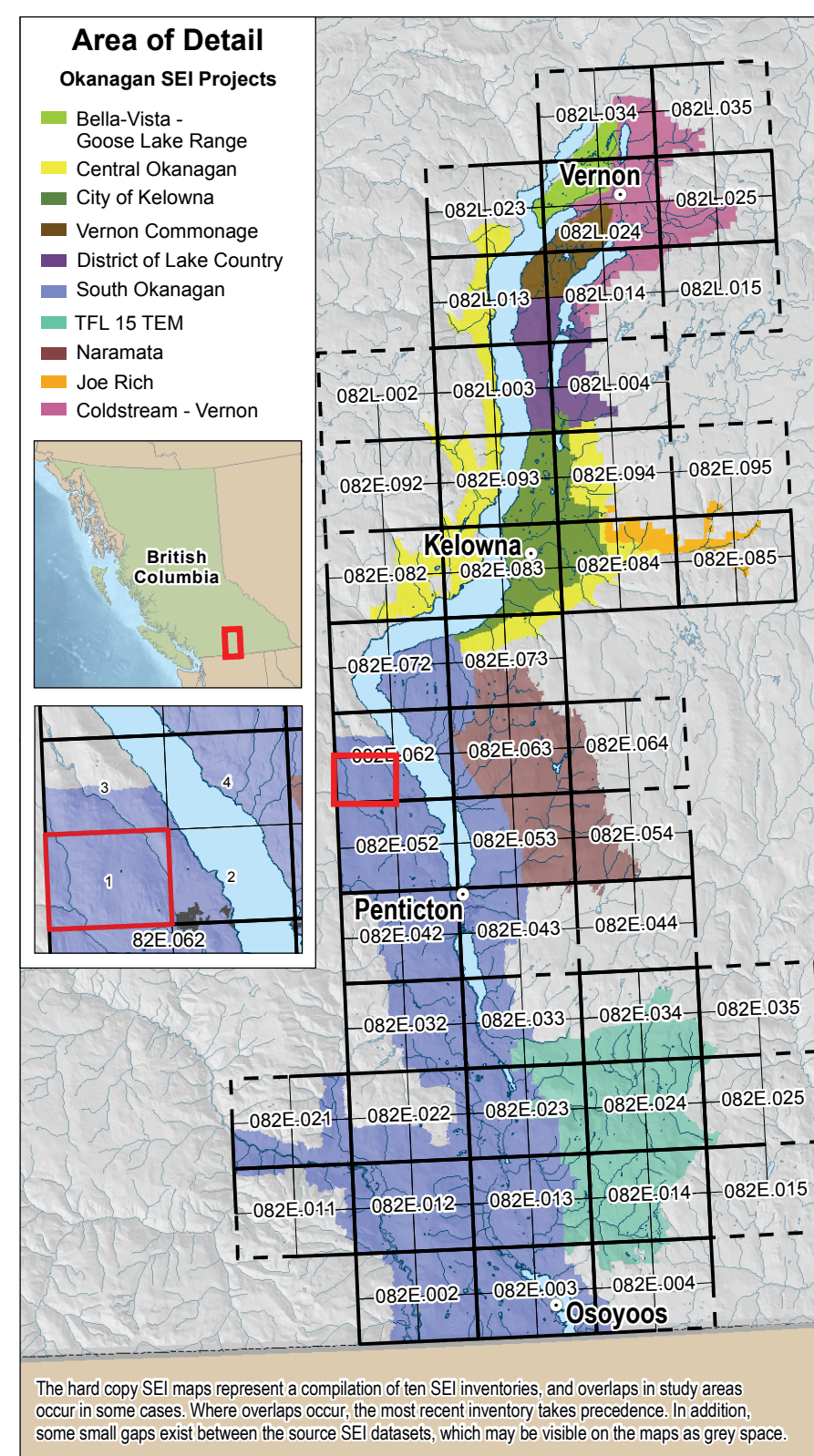




82E.062.1



Map Symbols

- Polygon Boundary
- Study Area Boundary
- Rivers
- Highways
- Roads
- Municipal Boundaries
- 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. 60% of the polygon is Old Forest (woodland), 20% is the Riverbank (open), and 20% is the Riverbank (open).

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

Ecosystem Components

- The base color represents the first ecosystem component.
- Coloured dots overlaid on 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 air photos but are displayed here at 1:100,000 scale. The map is intended to provide a general overview of the study area and is not intended to be used for detailed planning or design.

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

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.

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 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.

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 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 formations result from glacial lakes and the movement of materials by melting on during the retreat of the last glaciers. The complex landscape has created a mosaic of diverse and unique habitats, supporting diverse ecosystems and organisms. Open ponderosa pine forests, grasslands, old fields and lakes, 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.

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. 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 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 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 190 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), except in the Nanaimo project area where the SEI projects were mapped from air photos, using a bottom-up approach. TEM provided the foundation for the SEI thematic mapping, and the TEM units were analyzed for at-risk status and ecological sensitivity. Sensitive ecosystems were grouped using the Ecosystem-based Resource Mapping (EBRM) table. If the mapped TEM unit included within an at-risk ecological community as defined and listed by the CDC, or if it 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.

Treated species that have been included in Schedule 1 of the Species at Risk Act are protected protection 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 B.C. Conservation Foundation.

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, Weyerhaeuser Canada Ltd., District of Coquitlam, City of Kelowna, and B.C. Conservation Foundation.

Cartography: Lisa Zaitchik and Ann Blyth (Calyx Consulting Ltd.) for the City of Vernon, Environment Canada (Canadian Wildlife Service), Thanks to Alison Haney, Mike Sirek, Kristi Vernon, Carmen Castro, JoAnne Stacey, and Kim Cowell for their assistance in developing the map file.

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/Type in SEI Okanagan Valley or the project area name as a keyword

SEI Report: Iversen, K., D. Curran, T.L. Fleming, and A.L. Haney. 2009. *Sensitive Ecosystems Inventory - Okanagan Valley*. Vernon: Osoyoos, 2009. 2007. *Methods, Ecological Descriptions, Results and Conservation Tools*. Technical Report Series No. 695. Canadian Wildlife Service, Pacific and Yukon Region.

Nanaimo: Dalziel, Rod. 2006. *Nanaimo Sensitive Ecosystems Inventory*. 1:20,000 maps.

Central Okanagan (including south slopes): Haney, A. and K. Iversen. 2009. *Conservation analysis and updated ecosystem mapping for the Central Okanagan Valley*. Central Okanagan, South Slopes, Kelowna, Eklon and Juvik 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 PPH and DPH in the Central Okanagan*. Prepared for the Regional District of the Central Okanagan and the Ministry of Sustainable Resource Management. 1:20,000 maps.

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 species distribution maps 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 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-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
- Great Basin Gophersnake
- Roadrunner
- Common Nighthawk
- 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 seed 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-st), 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
- Food production

Some species associated with Sagebrush Steppe Ecosystems are:

- Great Basin Spadefoot
- Western Rattlesnake
- Pacific Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Half-moon Hawk
- Great Basin Spadefoot
- 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-st), 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 wild or 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
- Sediment retention

Some species associated with Grassland Ecosystems are:

- Great Basin Spadefoot
- Shorebird
- Great Basin Gophersnake
- Western Skink
- Tiger Salamander
- Ferngrouse Hawk
- Long-billed Curlew
- Columbian Capemoss

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 sparse 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 Gopher Snake
- Western Rattlesnake
- Pacific Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Rubber Boe

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, growth 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 riparian forests are included in the Riparian category.

Old Forest Ecosystems provide the following services:

- Climate regulation
- Carbon storage
- Carbon sequestration
- Air quality
- Soil formation
- 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 Toad
- Western Skink
- Western Screech Owl
- American Badger
- Spotted Bat
- Yell's Mariposa Lily
- Shorebird

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 that 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:

- 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-breasted Chat
- Western Rattlesnake
- Western Screech Owl
- Great Basin Spadefoot
- Lewis's Woodpecker
- Rubber Boe

Coniferous Woodlands (WD):

Coniferous Woodlands are open stands of Douglas-fir or ponderosa pine (WD-co) 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 removal of trees associated with fire exclusion, weed encroachment, and human disturbances.

Coniferous Woodland Ecosystems provide the following services:

- Climate regulation
- Air quality
- Carbon storage
- Carbon sequestration
- Pest regulation
- Nutrient cycling and maintenance of productive soils
- Pollination
- Pollution control
- Food production

Some species associated with Coniferous Woodland Ecosystems are:

- Roadrunner
- White-headed Woodpecker
- Yell's Mariposa Lily
- Shorebird
- Great Basin Spadefoot
- Lewis's Woodpecker
- Rubber Boe

Riparian (RI):

Riparian ecosystems are streamside and lakeside ecosystems or sites with significant seepage, including 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 significant seepage (seepage, RI-se), and ecosystems associated with riparian (riparian, RI-ri). The river bed of large systems (river, RI-r), and beaches on lakes (beach, RI-be). These sites frequently form natural corridors through the landscape, connecting other ecosystems and providing passageways for animals. Damming, dewatering, channeling, 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
- Climate regulation
- Soil and nutrient deposition
- Pollination
- Pest regulation
- Food production

Some species associated with Riparian Ecosystems are:

- Yellow-breasted Chat
- Western Screech Owl
- Great Helebreton
- Purple Spinefin
- Tongue Meadow-lark
- Small Flowered Lycopodium
- 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-m), fens (WN-f), and shallow open water (WN-a) ecosystems. They are extremely important because of their natural rarity in this area and the 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
- Damage and natural irrigation
- Fresh water
- Filtration and pollution control
- Nutrient cycling and maintenance of productive soils
- Soil storage
- Climate regulation
- Pollination
- Pest regulation
- Food production

Some species associated with Wetland Ecosystems are:

- Western Toad
- Northern Leopard Frog
- Western Rattlesnake
- Tiger Salamander
- Western Painted Turtle
- Great Helebreton
- Purple Spinefin
- Tongue Meadow-lark
- Small Flowered Lycopodium
- Great Helebreton

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
- Fresh water
- Climate regulation
- Nutrient cycling and maintenance of productive soils
- Pollination
- Food production
- Soil formation

Some species associated with Alpine Ecosystems are:

- American Badger
- Peregrine Falcon
- Western Skink
- Yell's Mariposa Lily

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 rodents. 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
- Carbon storage
- Carbon sequestration
- Storm protection
- Damage and natural irrigation
- Fresh water

Some species associated with Seasonally Flooded Agricultural Fields are:

- Great Basin Spadefoot
- Western Skink
- Peregrine Falcon
- American Badger
- Common Nighthawk
- Western Rattlesnake

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 for 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
- Pest regulation
- Pollination
- Pollution control
- Food production

Some species associated with Mature Forest Ecosystems are:

- Yell's Mariposa Lily
- Williamson's Sapsucker
- White-headed Woodpecker
- Shorebird
- Western Rattlesnake

Non-sensitive Landscapes (NS):

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 forest, farmland and native vegetation, or cultivated crops. Young forests are conifer-ecosystem polygons close to urban or disturbed areas that may have a modified landscape interspersed with the sensitive ecosystem(s), in which the sensitive ecosystems are too small to map individually. These modified areas are depicted as NS (non-sensitive) on the map.

82E.062.1

82E.062.1

82E.062.1