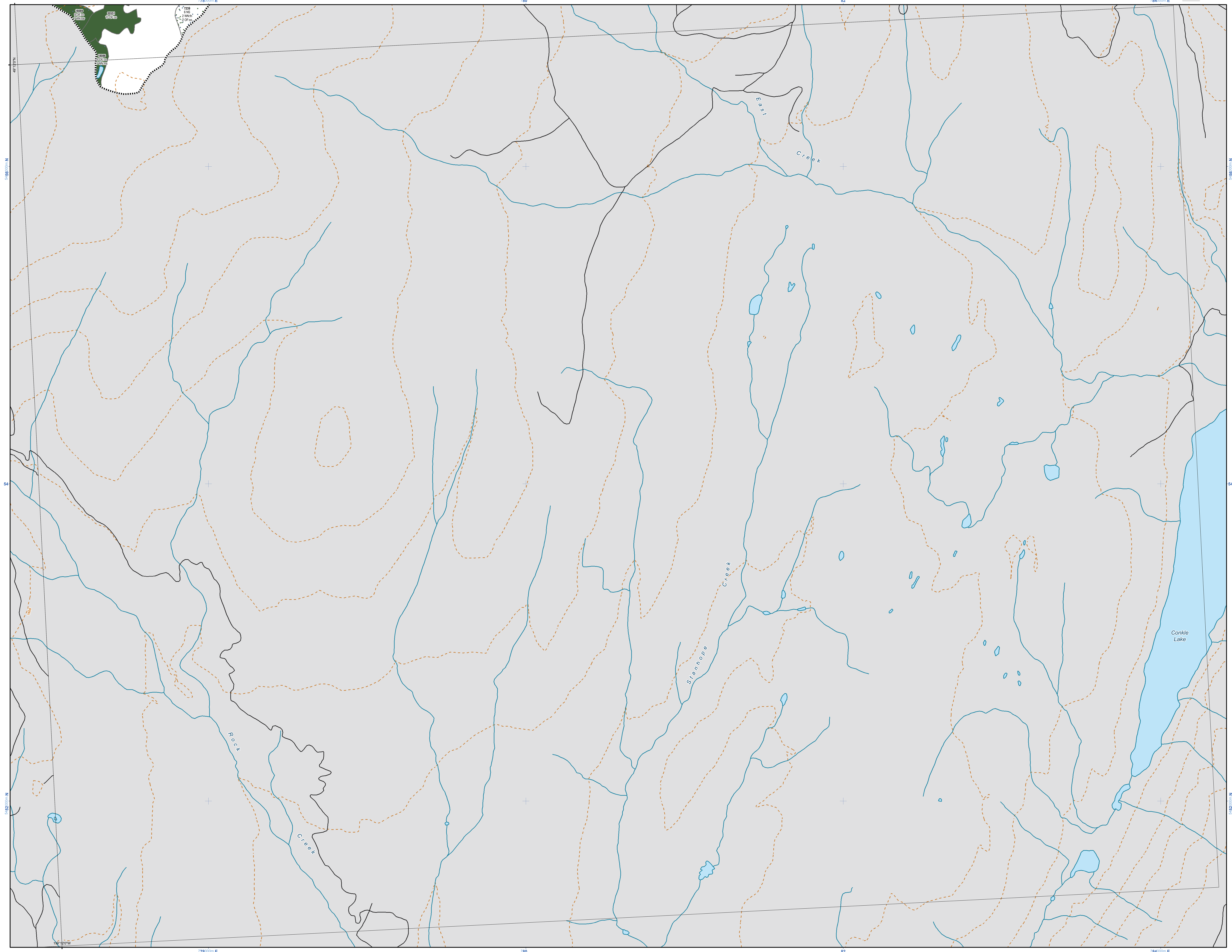
Sensitive Ecosystems Inventory of the Okanagan Valley: Vernon to Osoyoos



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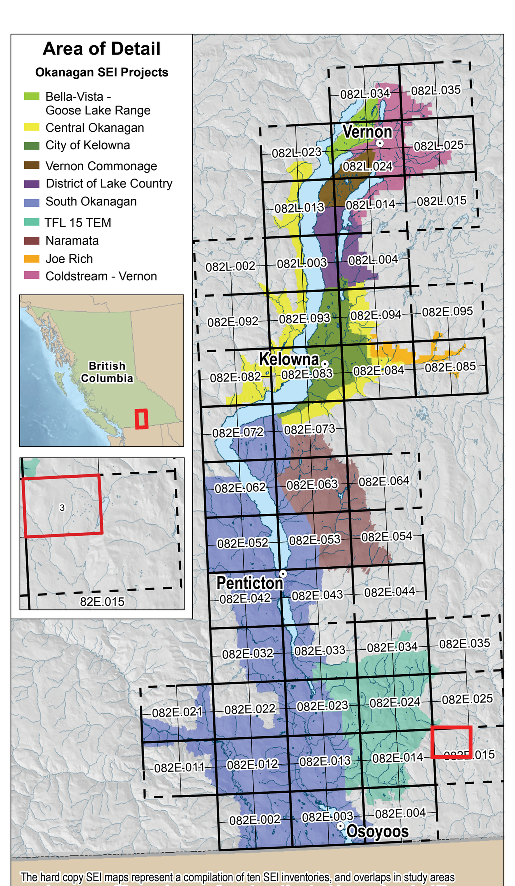


The hard copy SEI maps represent a compilation of ten SEI inventories, and overlaps in study areas occur in some cases. Where overlaps occur, the most recent inventory takes precedence. In addition, some small gaps exist between the source SEI datasets, which may be visible on the maps as grey space.

Map Symbols

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

Sensitive Ecosystems (SE) Label

Polygon Number — 13768 — 1st Component
% of polygon (as decile) — 6 WD:co
2 RI:be — 2nd Component
2 WN:co — 3rd Component
SE Class — SE subclass

The example label above indicates the SEI attributes mapped for polygon 13768.
60% of the polygon is WD:co - Coniferous Woodland.
20% is RI:be - Riparian: beach
20% of the polygon is OF:co - Old Forest: coniferous

NS are modified (non-sensitive) landscapes. Please refer to the legend for more information about these areas. More than one site unit can be correlated to a SE class and subclass. Polygon labels on the map do not include the site units.

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.

0 100 200 300 400 500
Metres
UTM Projection Zone 10 NAD83
100m Contour Interval
February 15, 2010

The SEI data are based on 1:15,000 scale air photos but are displayed here at 1:10,000* for ease of viewing, especially in areas with many small polygons. The maps are intended as a flagging tool, and are not a replacement for detailed on-site assessments that are needed before land use decisions are made.

* Written scales are based on a 36 x 48 inch paper size.

Map by: CASLYS 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 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 ice during the retreat of the last glaciers. The complex terrain, combined with a moderated semi-arid climate, supports diverse ecosystems and organisms. Open ponderosa pine forests, grasslands, cliffs 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 nearly unparalleled 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 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.

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 Commonage; District of Lake Country; Joe Rich; TFL 15; Naramata; Coldstream – Vernon; and the South Okanagan. For more information about these projects and the methods used, please refer to the 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 land use planning and to encourage landscape-level conservation planning at multiple scales, including regional and basin-wide. The project deliverables include 150 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).

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 Naramata project area where the SEI polygons were mapped from air photos using a bioterrain 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 (ERM) table tool. This tool 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 CDC, 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.

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, 47.9% was mapped as Sensitive Ecosystems (SE) and 7.9% fell into the Other Important Ecosystems category (see Legend). The inventory results indicated that wetlands, broadleaf woodlands, antelope-brush steppe, sagebrush steppe and old forest ecosystems were extremely rare - covering less than 5% of the study area. Although areas of grasslands, coniferous woodlands, and mature forests remain, many have been altered significantly and therefore few high quality sites remain. The study found many SEs that have been degraded by fragmentation, human use, livestock grazing, and alien species.

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

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 (1:15,000 for all projects except the City of Kelowna which was based on 1:10,000 digital aerial photographs) 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 see specific disturbances (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.

Species at Risk

The large variety of ecosystems in the Okanagan Valley provide for diverse habitat needs of many wildlife and plant species, including a remarkable number of at-risk plant and animal species. Many of these species have very restricted ranges, and some occur nowhere else in B.C. or Canada. A high proportion of these species considered at-risk, either provincially or federally, rely on the habitat values found only in the at-risk and sensitive ecosystems of the valley.

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 extirpated, endangered, or threatened; blue-listed species are of special concern due to low or declining populations and are sensitive to human activities or natural events. Nationally at-risk species are ranked by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered, Threatened, or of Special Concern. Endangered species face imminent extirpation or extinction; 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 Threatened species that have been included in Schedule 1 of the Species at Risk Act are afforded 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, and the Regional District of North Okanagan.

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), Real Estate Foundation of B.C., Habitat Conservation Trust Fund, the Habitat Stewardship Program, Greater Vernon Services Commission, Regional District of Central Okanagan, Regional District of the North Okanagan, Regional District of the Okanagan Similkameen, Allan Brooks Nature Centre, City of Vernon, District of Lake Country, Weyerhaeuser Canada Ltd, District of Coldstream, City of Kelowna, and B.C. Conservation Foundation.

Cartography: Lisa Zetterberg and Ann Blyth (Caslys Consulting Ltd.) for Jan Kirkby, Environment Canada (Canadian Wildlife Service). Thanks to Allison Haney, Mike Sarell, Kristi Iverson, Carmen Cadrin, Jo-Anne Stacey, and Kim Everett for their assistance in developing the map text.

References

Information and access to full reports and map products for the Okanagan Valley SEI projects are available at EcoCat; www.env.gov.bc.ca/ecocat (type in SEI Okanagan Valley or the project area name as a keyword).

SEI Report:
Iverson, K. E., D.L. Curran, T.L. Fleming, and A.L. Haney, 2008. **Sensitive Ecosystems Inventory - Okanagan Valley: Vernon to Osoyoos, 2000 – 2007. Methods, Ecological Descriptions, Results and Conservation Tools.** Technical Report Series No. 495, Canadian Wildlife Service, Pacific and Yukon Region, British Columbia.

This map can be cited as:
Environment Canada. *Sensitive Ecosystems Inventory - Okanagan Valley: Vernon to Osoyoos, 2000–2007.* 1:20,000. Vancouver, BC: Canadian Wildlife Service, Pacific and Yukon Region. 2009.

Naramata: Dalzeil, Rod. 2006. *Naramata Sensitive Ecosystems Inventory.* 1:20,000 maps

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, Ellison and Joe Rich project areas.* Unpub. report prepared for the Okanagan Collaborative Conservation Program

Iverson, K. and C. Erwin. 2001 and 2002. *Ecosystem Mapping of Portions of the PPxh1 and IDFxh1 in the Central Okanagan.* Prepared for the Regional District of the Central Okanagan and the Ministry of Sustainable Resource Management. 1:20,000 maps.

Lake Country: Iverson, K. and P. Uunila. 2006. *Sensitive Ecosystems Inventory: Lake Country, 2005.* 1:20,000 maps.

TFL 15: Bruhjell, 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 – Commonage: Iverson, Kristi. 2005. *Sensitive Ecosystems Inventory: Vernon Commonage 2005.* 1:20,000 maps.

Bella Vista – Goose Lake Range: Iverson, K. and J. Shypitka. *2002. Terrestrial Ecosystem Mapping Of the Bella Vista – Goose Lake Range.* 1:20,000 maps.

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

Kelowna: Iverson, K. and P. Uunila. 2008. *Sensitive Ecosystems Inventory: City of Kelowna.* 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 the Okanagan - Similkameen.

K. Iverson. 2005. *Terrestrial Ecosystem Mapping South Okanagan.* (This is an update to Lea, E. and R. Maxwell. 1995. Biophysical Habitat Units of the South Okanagan). 1:20,000 maps.

Joe Rich: Iverson, K. and P. Uunila. 2006. Sensitive Ecosystems Inventory: Central Okanagan Joe Rich. 1:20,000 maps.

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

Related Publications and Links

Green Bylaws Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure: www.greenbylaws.ca
The Toolkit contains practical examples of bylaw 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.J and R.H. Hebda. *Mitigating and Adapting to Climate Change through the Conservation of Nature.* Available at www.landtrustalliance.bc.ca/research.html

Develop with Care: *Environmental Guidelines for Urban and Rural Land Development in British Columbia.* BC Ministry of Environment www.env.gov.bc.ca/wld/documents/bmp/devwithcare2006/develop_with_care_intro.html

Taking Nature's Pulse: The Status of Biodiversity in British Columbia
Austin, M.A., D.A. Buffett, D.J. Nicolson, G.G.E. Scudder 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

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.

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):

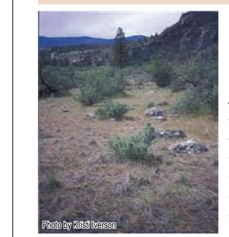
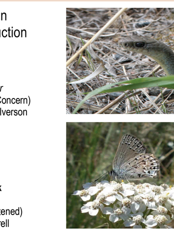


Photo by Kristi Iverson

Antelope-brush communities are dryland ecosystems characterized by abundant shrub cover 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 (AS:ds).

Antelope Brush Steppe Ecosystems provide the following services:
- Carbon storage
- Nutrient cycling and maintenance of productive soils
- Sediment retention
- Pollination
- Pest regulation
- Food production
- Erosion control

Some species associated with Antelope-brush Steppe Ecosystems are:
- Western Harvest Mouse
- Night Snake
- Behr's Hairstreak
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Great Basin Spadefoot
- Tiger Salamander
- Great Basin Gophersnake
- Racer
- Common Nighthawk



Racer *Coluber constrictor* (Reptile, Special Concern) Photo by Larry Halverson

Behr's Hairstreak *Satyrium behrii* (Arthropod, Threatened) Photo by Mike Sarell

Sagebrush Steppe (SS):

Photo by Leah Ramsay

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 gently sloping ecosystems dominated by big sagebrush and bunchgrasses (SS:ss), **steep slope** sagebrush steppe (SS:st), **steep, shallow** soil sagebrush steppe (SS:sh), and **disturbed** sagebrush steppe dominated by big sagebrush and invasive alien plants (SS:ds).

Sagebrush Steppe Ecosystems provide the following services:
- Carbon storage
- Erosion control
- Sediment retention
- Nutrient cycling and maintenance of productive soils
- Pollination
- Pest regulation

Some species associated with Sagebrush Steppe Ecosystems are:
- Night Snake
- Western Rattlesnake
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Half-moon Hairstreak
- Great Basin Spadefoot
- Western Skink
- Common Nighthawk
- Sage Thrasher
- Nugget Moss
- American Badger

Nuttall's Cottontail *Sylvilagus nuttallii* (Mammal, Special Concern) Photo by Royal Alberta Museum

Sage Thrasher *Oreoscoptes montanus* (Bird, Endangered) Photo by Peter LaTourrette

Grasslands (GR):

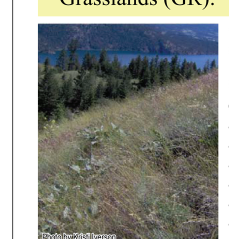


Photo by Kristi Iverson

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), **steep, shallow** grasslands (GR:ss), and **disturbed** grasslands dominated by invasive alien plants (GR:dg or DG:dg). 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 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:
- Night Snake
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Tiger Salamander
- Columbian Carpet Moss
- Burrowing Owl
- Showy Phlox
- Great Basin Gophersnake
- Western Skink
- Ferruginous Hawk
- Long-billed Curlew

Showy Phlox *Phlox speciosa occidentalis* (Vascular Plant, Threatened) Photo by Orville Dyer

Long-billed Curlew *Numenius americanus* (Bird, Special Concern) Photo by Fred Lang

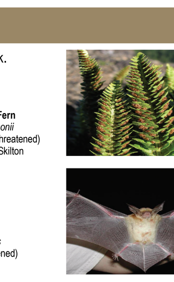
Sparsely Vegetated (SV):

Photo by Kristi Iverson

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:
- Night Snake
- Western Rattlesnake
- Pallid Bat
- Peregrine Falcon
- Nuttall's Cottontail
- Rubber Boa
- Great Basin Gopher Snake
- Western Skink
- Racer
- Spotted Bat
- Lemmon's Holly Fern



Lemmons Holly Fern *Polystichum lemmonii* (Vascular Plant, Threatened) Photo by Virginia Skilton

Pallid Bat *Antrozous pallidus* (Mammal, Threatened) Photo by USGS

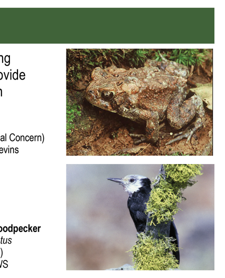
Old Forest (OF):

Photo by Kristi Iverson

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 fire 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**. Old riparian 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
- Flood control
- Pollution control
- Pest regulation
- Pollination
- Food production

Some species associated with Old Forest Ecosystems are:
- Williamson's Sapsucker
- Western Toad
- Wolverine
- Lewis's Woodpecker
- Flammulated Owl
- Common Nighthawk
- White-headed Woodpecker
- Olive-sided Flycatcher
- Western rattlesnake
- American Badger
- Lyall's Mariposa Lily
- Showy Phlox



Western Toad *Bufo boreas* (Amphibian, Special Concern) Photo by David Blevins

White-headed Woodpecker *Picoides albolarvatus* (Bird, Endangered) Photo by USF & WS

Broadleaf Woodlands (BW):

Photo by Kristi Iverson

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 seepage** (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:
- Drainage and natural irrigation
- 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 Boa

Rubber Boa *Charina bottae* (Reptile, Special Concern) Photo by Kristiina Ovaska

Lewis's Woodpecker *Melanerpes lewis* (Bird, Special Concern) Photo by USF & WS

Coniferous Woodlands (WD):

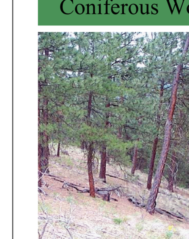
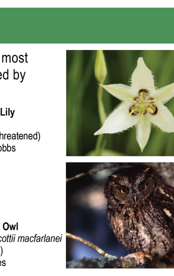


Photo by Kristi Iverson

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 fire exclusion, weed invasion, and other human disturbances.

Coniferous Woodland Ecosystems provide the following services:
- Climate regulation
- Air quality
- Erosion control
- Sediment retention
- Carbon storage
- Pest regulation
- Nutrient cycling and maintenance of productive soils
- Pollination
- Pollution control
- Flood control
- Food production

Some species associated with Coniferous Woodland Ecosystems are:
- Western Rattlesnake
- Rubber Boa
- Lewis's Woodpecker
- Flammulated Owl
- Great Basin Gophersnake
- Common Nighthawk
- Racer
- White-headed Woodpecker
- Lyall's Mariposa Lily
- Showy Phlox
- Western Screech Owl



Lyall's Mariposa Lily *Calochortus lyallii* (Vascular Plant, Threatened) Photo by Jared Hobbs

Western Screech Owl *Megascops kennicottii macfarlanei* (Bird, Endangered) Photo by Rod Innes

Riparian (RI):

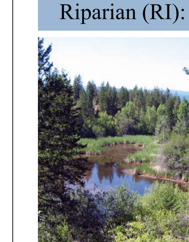


Photo by Susan Latimer

Riparian ecosystems are streamside and lakeside ecosystems or sites with significant seepage; includes ecosystems on floodplains and benches along creeks and rivers (**bench**, RI:fp), shrub-dominated floodplains and lakeshores (**shrub**, RI:sh), ecosystems in gullies, often with creeks (**gully**, RI:gu); fringe ecosystems associated with pond and lake shorelines or sites with significant seepage (**fringe**, RI:ff), the river bed of large systems (**river**, RI:ri), 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, diversions, channelization, draining, and pollution have seriously affected many riparian ecosystems.

Riparian Ecosystems provide the following services:
- Fresh water
- Flood control
- Drought recovery
- Storm protection
- Drainage 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
- Giant Helleborine
- Purple Spikerush
- Toothcup Meadow-foam
- Small Flowered Lipocarpha
- Western Rattlesnake
- Western Painted Turtle
- Columbia Mottled Sculpin
- Umatilla Dace
- Scarlet Ammania

Giant Helleborine *Epipactis gigantean* (Vascular Plant, Special Concern) Photo by Virginia Skilton

Yellow Breasted Chat *Icteria virens auricollis* (Bird, Endangered) Photo by Arthur Morris

Wetlands (WN):

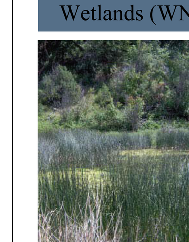
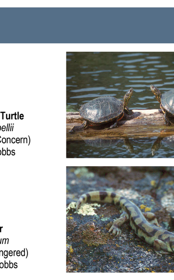


Photo by Susan Latimer

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:ms), **swamps** (WN:sp), **wet meadows** (WN:wm or WN:md), **fens** (WN:fn), and **shallow open water** (WN:sw) ecosystems. They are extremely important because of their natural rarity in this 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
- Storm protection
- Drainage and natural irrigation
- Fresh water
- Filtration and pollution control
- Nutrient cycling and maintenance of productive soils
- Silt storage
- Climate regulation
- Pollination
- Pest regulation
- Food production

Some species associated with Wetland Ecosystems are:
- Western Toad
- Tiger Salamander
- Western Painted Turtle
- Great Basin Spadefoot
- Mexican Mosquito-fern
- Giant Helleborine
- Northern Leopard Frog
- Western Rattlesnake



Western Painted Turtle *Chrysemys picta bellii* (Reptile, Special Concern) Photo by Jared Hobbs

Tiger Salamander *Ambystoma tigrinum* (Amphibian, Endangered) Photo by Jared Hobbs

Alpine (AP):

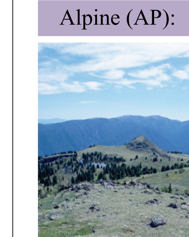


Photo by Will Mackenzie

Alpine ecosystems are high-elevation alpine and parkland ecosystems including **herbaceous** ecosystems dominated by forbs or graminoid vegetation (AP:hp), **parkland forests** where trees occur in distinct clumps (AP:pf), 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
- Wolverine

American Badger *Taxidea taxus jeffersonii* (Mammal, Endangered) Photo by Parks Canada/ W. Lynch

Wolverine *Gulo gulo luscus* (Mammal, Special Concern) Photo by Parks Canada/ W. Lynch

Other Important Ecosystems

Seasonally Flooded Agricultural Fields (FS):

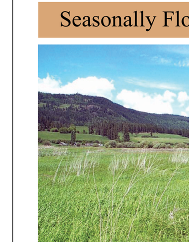


Photo by Susan Latimer

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 predators. 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
- Drought recovery
- Storm protection
- Drainage and natural irrigation
- Fresh water
- Carbon storage
- Maintenance of productive soils
- Pollination
- Pest regulation
- Food production

Some species associated with Seasonally Flooded Agricultural Fields are:
- Great Basin Spadefoot
- Long-billed Curlew
- Peregrine Falcon
- American Badger
- Great Basin Gophersnake
- Western Rattlesnake

Great Basin Spadefoot *Spea intermontana* (Amphibian, Threatened) Photo by Gary Nafis – CaliforniaHerps.com

Peregrine Falcon *Falco peregrinus anatum* (Bird, Special Concern) Photo by Fred Lang

Mature Forest (MF):

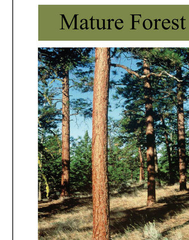


Photo by Susan Latimer

Mature Forest ecosystems are dominated by mature trees; including **broadleaf** (MF:bd) forests, **coniferous** (MF:co) forests, and **mixed** (MF:mx) 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
- Flood control
- Pest regulation
- Pollination
- Pollution control
- Food production

Some species associated with Mature Forest Ecosystems are:
- Lyall's Mariposa Lily
- Wolverine
- Williamson's Sapsucker
- Olive-sided Flycatcher
- Showy Phlox
- Western Rattlesnake
- Western Screech Owl
- Flammulated Owl

Flammulated Owl *Otus flammeolus* (Bird, Special Concern) Photo by Parks Canada/ W. Lynch

Williamson's Sapsucker *Sphyrapicus thyroideus* (Bird, Endangered) Photo by Jared Hobbs

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 range, farmland and native vegetation, or cultivated crops. Young forests are conifer-dominated stands with an age range between 0 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 too small to map individually. These modified areas are depicted as NS (non-sensitive) on the map.