

Planning for Biodiversity

A GUIDE FOR BC FARMERS AND RANCHERS



Companion document to the

CANADA - BRITISH COLUMBIA ENVIRONMENTAL FARM PLAN PROGRAM



Planning for Biodiversity

A Guide for BC Farmers and Ranchers

COMPANION DOCUMENT TO THE

Canada - British Columbia Environmental Farm Plan (EFP)

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All photographs in the document that have not been credited are drawn from the BC Ministry of Agriculture image library.

PREFACE

The purpose of this supplemental Environmental Farm Plan (EFP) publication is to help farmers and ranchers increase their understanding of biodiversity and what it means to their operations. The guide provides a definition of biodiversity, highlights the importance of biodiversity locally and at landscape scales, lists the main principles of managing for biodiversity, and provides a template for developing a Biodiversity Management Plan for farms and ranches in British Columbia.

The idea for this publication emerged from a Biodiversity Workshop held in October 2005 in Kamloops, BC. EFP Planning Advisors and agency representatives who were interested in delivering the biodiversity component of the Agricultural Policy Framework to producers identified the need for this document.

The information in this guide applies primarily to privately owned farm and ranch lands in BC.

LIMITS OF LIABILITY

Unlike the other EFP program publications, this guide is not specifically a risk assessment tool. It is intended primarily as a source of information and a management planning tool for farmers, ranchers, and EFP Planning Advisors.

The biodiversity assessment, planning, implementation, and monitoring steps presented in this guide are designed to be used by farmers and ranchers with or without the assistance of an EFP Planning Advisor.

Beneficial management practices (BMPs) for retaining and/or enhancing biodiversity are presented in this guide. It is important to be aware that approvals may be required before the BMPs are implemented. It is the producer's responsibility to determine the need for such approvals.

Every effort has been made to ensure the accuracy and completeness of this guide, but it should not be considered the final word on the areas of practice that it covers. You should seek the advice of appropriate professionals and experts because the specifics of your situation may differ from those set out in this guide.

All information in this guide is provided entirely "as is", and no representations, warranties, or conditions, either expressed or implied, are made in connection with your use of, or reliance upon, this information. This information is provided to you, as the user, entirely at your risk.

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1 OVERVIEW

INTRODUCTION TO THIS GUIDE

Planning for Biodiversity: A Guide for BC Farmers and Ranchers (the guide) is designed for farmers and ranchers who wish to increase their understanding of biodiversity and what it means to their operations. It offers ideas on how agricultural producers can manage for biodiversity, and it provides some tools for doing so. The guide can be used in designing, implementing, and monitoring a Biodiversity Management Plan. The information is intended to apply primarily to privately owned farm and ranch lands in BC.

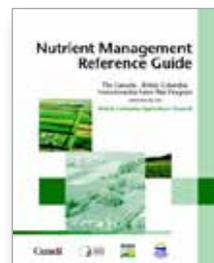
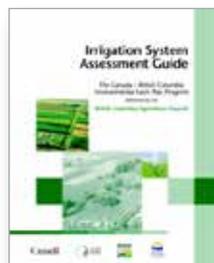
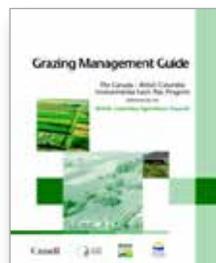
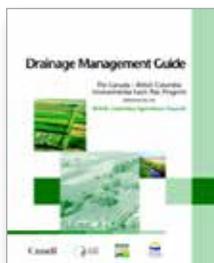
How Does This Guide Fit with My Environmental Farm Plan?

The Canada–BC Environmental Farm Plan (EFP) Program was designed to help producers identify environmental risks associated with their operations and opportunities to reduce those risks. *The EFP Reference Guide* provides information on various environmental regulations and makes suggestions for implementing environmentally sound practices. It is the main reference for completing the worksheets in the *EFP Planning Workbook*. Those worksheets ask some basic questions about biodiversity on agricultural lands.

This biodiversity planning guide is the next step beyond the EFP process. It is not intended to address regulatory issues specifically. The guide will be revised over time as science and on-farm experience provide additional information on biodiversity and related agricultural management practices.

This guide is intended to be used along with the other publications in the EFP series:

- ▶ Drainage Management Guide
- ▶ Grazing Management Guide
- ▶ Irrigation System Assessment Guide
- ▶ Nutrient Management Reference Guide
- ▶ Riparian Management Field Workbook



What if I Haven't Developed an Environmental Farm Plan Yet?

Although this guide can be used independently of the *EFP Reference Guide* and *Planning Workbook*, it is intended to complement those documents and complete the package of supplemental publications that are part of the EFP process. Producers are encouraged to complete an Environmental Farm Plan as part of enhancing their overall farm stewardship.

How Do I Use This Guide?

This guide provides a step-by-step approach to developing a Biodiversity Management Plan. By working through the guide, producers will enhance their understanding of biodiversity and the role they play in helping maintain it.

The guide includes six main sections:

- ▶ Overview
- ▶ Biodiversity Principles
- ▶ Developing a Biodiversity Management Plan
- ▶ Sample Biodiversity Management Plan
- ▶ Glossary
- ▶ Appendices

Overview: Producers are encouraged to read this section before starting work on their management plan. The section provides general background information on biodiversity. It begins by highlighting the importance of maintaining biodiversity at the local (farm and ranch) scale and ends with a discussion of the current challenges to, and efforts involved in, biodiversity conservation worldwide.

DID YOU KNOW?

Maintaining biodiversity can enhance agricultural productivity and stability.

This section:

- ▶ defines what biodiversity is,
- ▶ highlights the benefits it can provide to agricultural operations,
- ▶ outlines the role agricultural landscapes play in maintaining biodiversity,
- ▶ discusses the potential conflicts between agriculture and biodiversity,
- ▶ lists the global benefits of, and threats to maintaining biodiversity, and
- ▶ identifies current national and international efforts to conserve biodiversity.

By reading through the Overview, producers will gain a greater appreciation of their role in biodiversity conservation.

Biodiversity Principles: This section outlines eight basic principles involved in managing for biodiversity, and it gives examples of actions producers can take to address them. The principles focus on:

1. native areas,
2. semi-natural areas,
3. locations, patterns, and seasonal availability of habitats,
4. connections between native and semi-natural areas,
5. structurally diverse habitats,
6. healthy ecosystems,
7. species and genetic diversity, and
8. control over invasive alien species.

Reading through the Biodiversity Principles section will help producers formulate ideas about where they can most effectively focus their efforts when managing for biodiversity on their farm or ranch.

Developing a Biodiversity Management Plan: This section provides the actual “how tos” of developing a biodiversity management plan. They include:

- ▶ assessing opportunities to manage for biodiversity,
- ▶ creating an action plan by setting priorities for management, selecting related Beneficial Management Practices, and setting goals to achieve,
- ▶ implementing the selected Beneficial Management Practices, and
- ▶ monitoring and evaluating the effects of practices that are implemented.

The following materials have been provided to help producers develop their biodiversity management plan:

- ▶ worksheets for recording assessment opportunities,
- ▶ a list of Beneficial Management Practices that can be implemented to address those assessment opportunities, and
- ▶ worksheets to record the outcomes of the Beneficial Management Practices that are implemented.

Producers can use the worksheets to keep a written record of their management decisions and actions, and can use the work plan to generate ideas about how to manage for biodiversity on their land.

Sample Biodiversity Management Plans: This section provides examples of biodiversity management plans created by producers who worked through the process outlined in this guide.

Glossary: This section provides definitions for many of the terms used in this guide.

Producers can use this section to familiarize themselves with the terminology used in biodiversity conservation or to gain a greater understanding of those terms.

Appendices: This section provides:

- ▶ additional sources of Beneficial Management Practices and other related information,
- ▶ contact information for agencies involved in biodiversity management,
- ▶ examples of agriculture and biodiversity projects in BC,
- ▶ summaries of legislation related to biodiversity, and
- ▶ other sources of information related to biodiversity.

Producers can use the information in these appendices to support the development and implementation of their biodiversity management plan.



Sharpe Lake Ranch owners work with agencies to develop a new river crossing with fencing to keep cattle out of the watercourse.

PHOTO: KING CAMPBELL

Landowner Regulatory Responsibilities

All landowners have a responsibility to follow federal and provincial statutes that have been enacted to protect the environment. Appendix 3 of this guide provides summaries of the key Acts and Regulations that relate to protecting biodiversity on private agricultural lands. More details about this legislation can be obtained by accessing the links provided in the appendix or by referring to the Canada – BC Environmental Farm Plan Reference Guide.

Aquatic areas are particularly sensitive to any modification. If you are considering altering aquatic habitat on your farm or ranch, you will likely require approvals such as permits or other authorizations to undertake the work. You may also need to have your project reviewed by an appropriate environmental professional before beginning any work. Your regional Ministry of Environment and Climate Change and DFO Community Advisors can help by providing technical assistance and guidance on the legal requirements associated with working in and around water. Conservation organizations, such as Ducks Unlimited Canada, and industry associations may be able to help with project design and implementation.



You will find this “caution” symbol in the guide when evaluating a biodiversity opportunity that is likely to require a permit or approval.

WHAT IS BIODIVERSITY?

Biodiversity is defined as *the variety of all life forms plus the habitats and natural processes that support them*. It includes all forms of life from bacteria, viruses, and fungi to grasses, forbs, shrubs, trees, worms, insects, amphibians, reptiles, fish, birds, mammals, agricultural crops and livestock, and humans. Natural processes include pollination, predator-prey relationships, and natural disturbances such as floods and wildfires.

There are three basic levels of biodiversity: ecosystem, species, and genetic diversity.

Ecosystem diversity: refers to the variety of ecosystems in a given area and the different ways they function. Ecosystems are all the living (e.g., plants, animals) and non-living things (e.g., soil, water, air) in a given area, plus the interactions that occur among them. Ecosystems can be managed or unmanaged. Most agricultural landscapes are managed ecosystems.

It is important to note that ecosystems exist at different scales. You can find an ecosystem within a single tree, or it can extend across a field, an entire farm, or a large region like a major river basin. Interactions between living and non-living things occur at all these scales at the same time.

Ecosystems develop in response to local conditions, which are influenced by such things as climate patterns, soil types, and topography. Figure 1 shows some of the natural ecosystem diversity that exists in BC.

Species diversity: refers to the variety of species that occurs within an area or ecosystem. Different types of birds and different types of trees are examples of species diversity. Generally, the greater the number of species in an ecosystem, the more stable it is.

Genetic diversity: refers to the variety of genes within a species. Genes determine individual characteristics such as size, shape, and colour. The different characteristics that exist among breeds of chickens are an example of genetic diversity. It allows species to adapt to changes in their ecosystem or environment.

All these levels of diversity are intricately connected. Change in one part of the ecosystem can affect the functioning of other parts.



Ecosystem Diversity

PHOTO: THE LAND CONSERVANCY



Species Diversity



Genetic Diversity

PHOTO: AVIAN RESEARCH CENTRE AGASSIZ

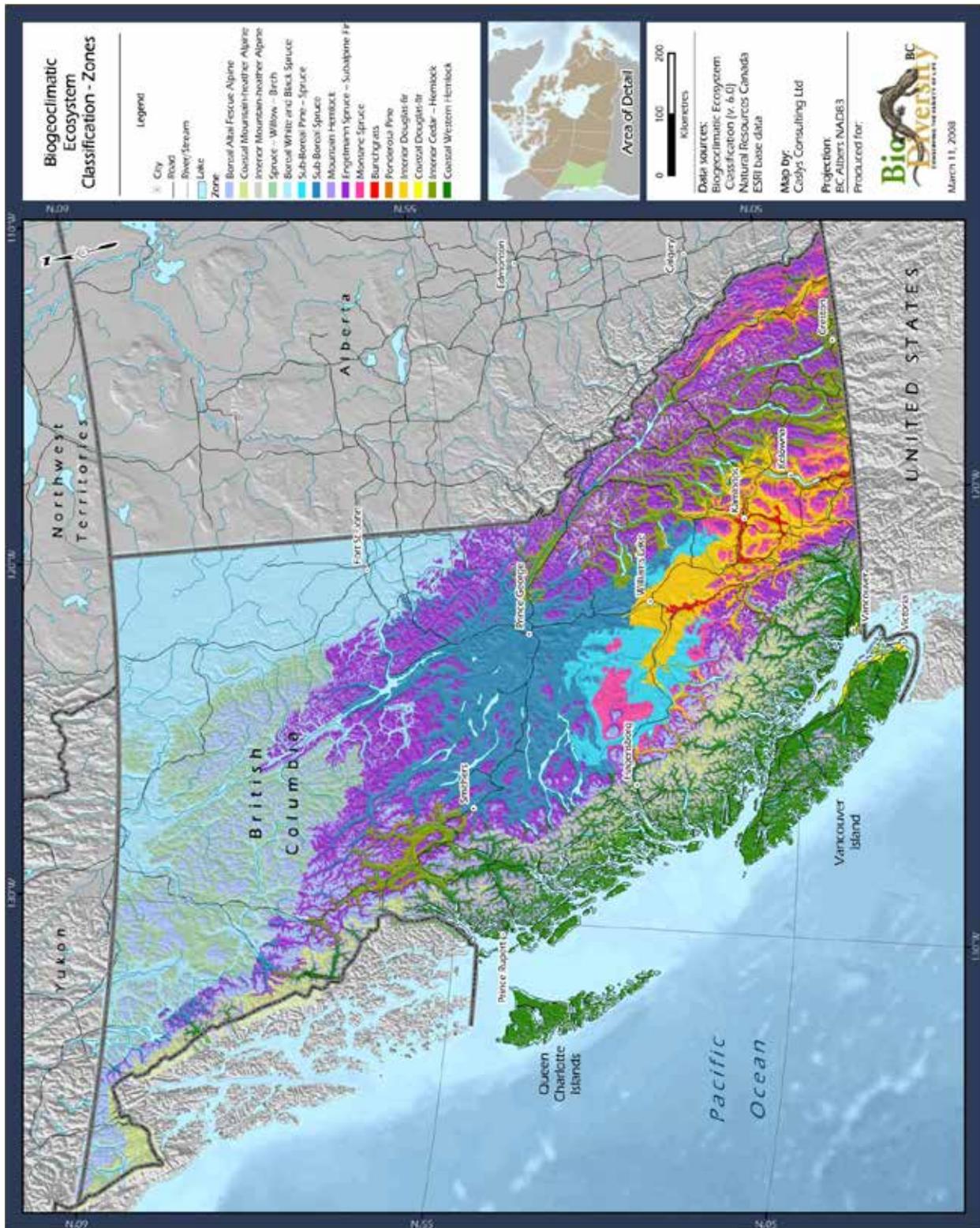


Figure 1 Biogeoclimatic Ecosystem Classification Zones in BC

Biodiversity in BC

BC is a biologically diverse region. It has:

- ▶ 468 species of fish;
- ▶ 22 species of amphibians;
- ▶ 18 species of reptiles and turtles;
- ▶ 142 species of mammals;
- ▶ 488 species of birds;
- ▶ 2,790 species of vascular plants, which includes trees, shrubs, grasses and ferns;
- ▶ 1,600 species of lichens;
- ▶ 10,000 species of fungi;
- ▶ 35,000 species of insects;
- ▶ 714 species of mosses.¹



Fall migration of Salmon

PHOTO: ISABELLE GROG

BC is one of the most biologically diverse provinces in Canada.² It is home to:

- ▶ 63% of Canada's insect species;
- ▶ 73% of Canada's mammal species;
- ▶ 78% of Canada's bird species;
- ▶ 77% of Canada's vascular plant species.³

BC has global responsibility for the conservation of many species and ecosystems.

For example:

- ▶ BC has more than 50% of the world's mountain goat population.²
- ▶ Most of the world's population of western sandpipers migrates along BC's coast every year.²
- ▶ More than 95% of the world's mountain caribou live in BC.²
- ▶ BC has 100% of the world's Vancouver Island marmots.²

¹ BC Conservation Data Centre. Species and Ecosystems Explorer. Available at: <http://a100.gov.bc.ca/pub/eswp/> (Accessed March 30, 2018) and Biodiversity BC <http://www.biodiversitybc.org/EN/main/20.html> (Accessed March 30, 2018).

² 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. Available at: www.biodiversitybc.org

³ Modified from Cannings, R.J., and S. Cannings. 2004. *British Columbia: A Natural History*. Douglas and McIntyre, Vancouver, BC.

WHY SHOULD I MANAGE FOR BIODIVERSITY ON MY FARM?

Benefits of Biodiversity to Agriculture

Biologically diverse ecosystems provide a number of critically important goods and services that benefit humans. While conserving and enhancing biodiversity may come at a cost to producers, there are immeasurable benefits to farmers and ranchers, including:

- ▶ soil formation and retention processes – maintain soil productivity and prevent soil loss due to wind and water erosion;
- ▶ nutrient breakdown, storage and cycling – makes nutrients available to domestic and native plants, prevents organic debris from accumulating, and helps maintain water quality;
- ▶ reduction of pest populations – helps reduce crop losses;
- ▶ pollination services – enhance yields for pollinator-dependent crops such as fruit trees.

These goods and services can reduce the need for inputs such as pesticides and fertilizers, increase the productive capacity of the land, and reduce production risks; therefore, they have the potential to maintain or even increase farm profitability. In addition, maintaining biodiversity on agricultural lands can increase land value and provide opportunities to develop agri-tourism and other niche marketing activities.

Managing for biodiversity ensures that agricultural lands can continue to receive the benefits provided by natural systems. Some of those benefits are discussed below.

DID YOU KNOW?

One of every three mouthfuls of food we eat comes from plants that were pollinated by insects.

Buchmann, S.L. and G.P. Nabhan. 1996. *The Forgotten Pollinators*. Island Press, Washington, DC.

Enhancing Production

Biologically diverse ecosystems tend to be healthy and productive. Diverse plant communities are generally more productive than communities with little diversity. In modern cropping systems, increased soil biodiversity has been associated with increased soil fertility. Soils with greater biodiversity tend to process and store nutrients and use water more efficiently, and are often less likely to leach nutrients beyond the root zone. Maintaining biologically diverse vegetation and soils can improve productivity by:

- ▶ improving soil fertility through enhanced nutrient cycling;
- ▶ improving water infiltration and water holding capacity of soils;
- ▶ reducing plant and soil pathogen populations;
- ▶ reducing levels of pollutants;
- ▶ reducing weed populations;
- ▶ increasing grazing capacity.

Agricultural productivity also benefits from the presence of diverse populations of wild pollinators, such as hummingbirds, moths, native bees, and other insects. Maintaining a diversity of pollinators increases the quantity, reliability, and duration of pollination services to crops. For example, there are several advantages to maintaining healthy populations of native bees in addition to honeybees:

- ▶ Native bees generally spend more hours during the day pollinating than honeybees.
- ▶ Native bees are usually more active in cold and wet weather than honeybees.
- ▶ Many native bees use “buzz” pollination, which allows them to pollinate crops that honeybees cannot.
- ▶ When native bees compete with honeybees for the same plant, honeybees can become more efficient pollinators.
- ▶ Native bees have greater species diversity than honeybees; therefore, they are less susceptible, as a group, to pests and disease.
- ▶ Native bees tend to be more efficient at distributing pollen than honeybees.¹

Agricultural landscapes that have a good mix of cropped and non-cropped, natural and semi-natural areas tend to have higher rates of pollination than less complex landscapes.



Productive forage land



Pollination



Barn Owl (blue-listed)

DID YOU KNOW?

An adult barn owl is an effective predator. It can eat more than 700 rodents per year.

Stability in Production

Managing for biodiversity creates the foundation for sustainable agriculture. Generally, the more diverse a production system is, the more stable it tends to be. For example:

- ▶ Diverse systems are more resistant to variations in climate, invasive alien species, outbreaks of diseases, and natural disturbances such as floods, wildfires, and windstorms.
- ▶ Increasing the genetic diversity of crop and/or livestock varieties can reduce the risk of production failures.
- ▶ Maintaining diverse bird and insect communities can help in controlling agricultural pests. Studies indicate that birds can suppress insect and rodent populations, at least at medium to low infestation levels. For example, in certain grassland environments, birds can effectively control grasshopper numbers. A greater diversity of beetles and spiders in a landscape has been shown to lower the incidence and magnitude of certain pest outbreaks.



Shelterbelt
PHOTO: NIELS HOLBEK

Flexibility in Production

Maintaining both native areas and a mix of crop varieties on the farm can maintain biodiversity while providing flexibility in production. For example, creating a shelterbelt that has a diversity of plants can provide:

- ▶ wood fibre;
- ▶ windbreaks;
- ▶ reduced risk of erosion,
- ▶ habitat for pollinators and desirable wildlife species;
- ▶ habitat connections across landscapes;
- ▶ favourable growing conditions for crops that require shelter or certain microclimates buffers against nuisances such as dust, noise, and odours.

Additionally, maintaining a diversity of crop and/or livestock varieties may provide flexibility in marketing opportunities for agricultural products. Similarly, using environmentally-friendly management practices may provide an opportunity to market specialty products to consumers who are concerned about the environment and how their food is produced.



Diverse mix of cropped and uncropped land

Agriculture, Biodiversity and Climate Change

Biodiversity provides resilience, which allows agriculture to adapt to climate change.

For example:

- ▶ Crops and livestock may need to adapt to changes in temperature, rainfall, pests, and diseases. Maintaining genetic diversity in both domesticated and wild varieties provides opportunities for adaptive breeding, and/or minimize crop losses as a result of extreme weather events.
- ▶ High levels of soil biodiversity are associated with increased soil fertility and nutrient and water retention. This can make soils more resilient to extreme conditions, such as droughts and floods.
- ▶ Managing for biodiversity by adding or maintaining different kinds of uncultivated areas such as shelterbelts, hedgerows, and uncultivated fencelines can improve microclimates by buffering winds, regulating water tables, and providing shade for crops and livestock.ⁱⁱ
- ▶ Maintaining natural hydrological processes, native vegetation, and genetic diversity within riparian ecosystems supports their natural resilience to disturbance. In turn, healthy riparian areas provide a strong link between aquatic and terrestrial ecosystems, increasing their resilience to climate change.ⁱⁱⁱ This can ensure that healthy water and forage sources are retained, which will add to stability in agricultural production.
- ▶ Maintaining connected habitats across landscapes is the most common recommendation for protecting biodiversity from climate change.^{iv} Corridors between habitats can also benefit agricultural operations by controlling erosion, retaining water, filtering runoff, and acting as windbreaks.



Flooding



Mountain Pine Beetle infestation

Agricultural Landscapes are Important to Biodiversity

Agricultural producers play a significant role in providing features that are essential for conserving biodiversity. These include:

- ▶ an adequate supply of habitat;
- ▶ structurally diverse habitats;
- ▶ connections between habitat patches;
- ▶ healthy, functional habitats;
- ▶ storehouses of genetic diversity.



Tree cavities provide important habitat for species such as the Northern Flicker

DID YOU KNOW?

In 2011, nearly one-third (30.2%) of agricultural land in Canada was wildlife habitat, which represented 19.6 million hectares.

- ▶ Three-quarters of wildlife habitat reported by Canadian farmers was natural land for pasture (75.0%), and the remainder was woodlands and wetlands (25.0%).
- ▶ Two in five farms (40.3%) reported natural land for pasture while one in two farms (49.9%) reported woodlands and wetlands in 2011.
- ▶ Agriculture and wildlife: A two-way relationship. 2012. Statistics Canada.
- ▶ <http://www.statcan.gc.ca/pub/16-002-x/2015002/article/14133-eng.htm>

Habitat

Habitats in agricultural landscapes provide the things that all species need to survive: water, food, shelter from predators and adverse weather conditions, and places to safely breed, and rear young.

Aquatic and Riparian Areas: All habitats within the agricultural landscape are important, but aquatic and riparian areas are especially significant to both biodiversity and agricultural production. Aquatic areas are considered to be some of the most productive ecosystems on Earth.^v Collectively, rivers, streams, lakes, and wetlands provide habitat for at least 25% of BC's vertebrate, invertebrate, and vascular plant species.^{vi}

Aquatic ecosystems interact closely with riparian zones—the areas of lush, green, moisture-loving vegetation that surround wetlands, lakes, streams, and rivers. Riparian areas form a transition zone between aquatic and dry, upland habitats. In their natural state, these areas typically have higher biodiversity than other habitats in agricultural landscapes because they provide shelter, food, breeding and rearing habitat, and safe access to water. The riparian areas along streams and rivers also provide travel corridors for a whole range of organisms that use aquatic and upland areas. In some intensively farmed areas of the province, retained aquatic and riparian areas provide the only opportunity for connecting habitats.



Riparian area

Terrestrial Areas: In agricultural landscapes, terrestrial habitat consists of both native areas, such as forests and grasslands, and semi-natural areas, such as farm woodlots, pastures, hedgerows, and cultivated fields. While native areas within and around farms provide the best opportunity for conserving biodiversity, land that is used for agricultural production is also important.

A report by Statistics Canada (2012) noted that the majority of wildlife habitat reported by Canadian farmers was natural land for pasture, which represented 22.7% of all agricultural land, and the remainder was woodlands and wetlands, which accounted for 7.6% of all agricultural land.

Natural land for pasture is largely found in Alberta (6.4 million hectares), followed by Saskatchewan (4.8 million hectares), Manitoba (1.5 million hectares) and British Columbia (1.4 million hectares). British Columbia reported the largest area of natural land for pasture as a proportion of total agricultural land (53%).

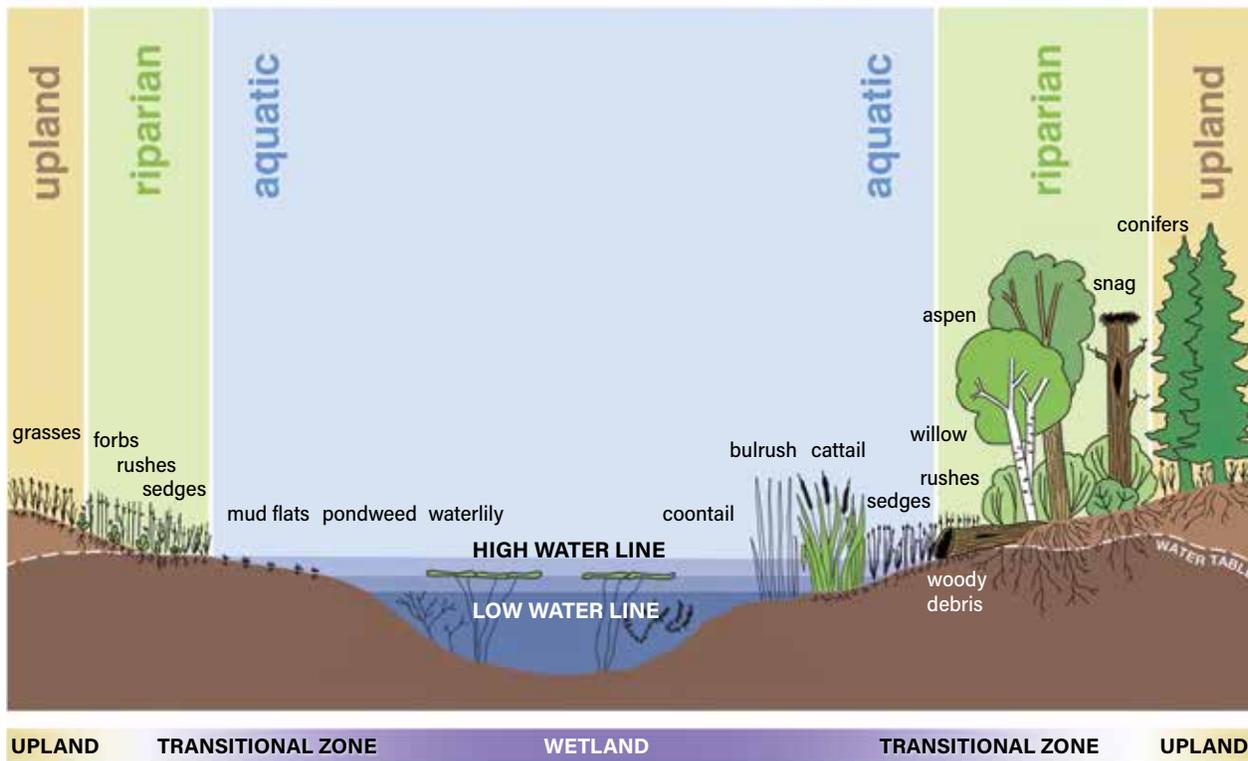


Figure 2: Relationship among aquatic, riparian, and terrestrial habitats
 IMAGE: DUCKS UNLIMITED CANADA

Structurally Diverse Habitats

Structurally diverse habitats have a mix of vegetation types with different heights and forms. This variation in structure provides different types of important habitats for a variety of native species. Farms and ranches that have a mix of cultivated and uncultivated fields, woodlands, hedgerows, fencerows, shelterbelts, and aquatic and riparian areas provide greater structural diversity than operations that have only cultivated fields or native pastures. As a result, they are able to support greater biological diversity.



Structurally diverse riparian habitat

Connections between Habitat Patches

Corridors that connect patches of native and semi-natural areas provide safe, sheltered travel routes for animals when they are migrating or searching for food and mates, and they provide routes for pollen and seeds to disperse. These corridors also help maintain ecosystem services by controlling erosion, filtering contaminated runoff, acting as windbreaks, and providing opportunities for economic diversification. Grasslands, shelterbelts, hedgerows, woodlands, fencerows, uncultivated areas, gullies, intact riparian areas, and rock outcroppings can be used effectively to provide connections between habitat patches both within an individual farm and between neighbouring properties. Corridors can include different kinds of habitats and can be used to connect different habitat types.



Corridors between native and semi-natural areas

Healthy, Functional Habitats

Habitats that are healthy and functioning properly support higher levels of biodiversity than habitats that have been compromised. For example, if lakes and streams are to support viable populations of native fish species, they must be free of excess nutrients, sediments, and other pollutants, and they must have an adequate supply of cool, clean water. Agricultural management practices such as conservation tillage, off-stream watering, and nutrient management can help maintain the health of both native and semi-natural habitats on the farm.



Off-stream watering helps to maintain healthy ecosystems

Storehouses of Genetic Diversity

Agricultural operations can act as sources of genetic diversity both by conserving native species and by managing a variety of crops and livestock species. Agricultural practices such as crop rotation, use of winter cover crops and perennial cover, intercropping, and agroforestry contribute to increased levels of biodiversity. Additionally, areas left in native pasture can support a greater diversity of soils microorganisms, native plants, and pollinators than tame pastures.

Crop and Livestock Diversity: Planting a diversity of flowering crops that bloom at different times can provide food and rest areas for native insects such as wild bees, which are important crop pollinators.

Adding livestock to a crop-based agricultural production system can also provide many benefits. Manure can be used as a soil amendment. Livestock can be used to control weeds and promote desired plant species and structural diversity in pastures when their levels of grazing, trampling, and rooting are properly controlled. For example, pigs can be used to root weeds from cultivated lands, and sheep can be used to graze herbaceous plants that compete with newly planted trees in tree plantations.

Adding different kinds of livestock to a production system can also increase the effective use of pastures. For example, cattle and sheep have different plant preferences and tend to crop plants to different heights, thereby extending the useable amount of forage in a pasture.



Using livestock to manage competing vegetation

PHOTO: LISA ZABEK



Multiple species grazing



Crop rotation

Crop Rotation: Crop rotation provides crop diversity over time. Rotational cropping helps retain normal ecosystem functioning by curbing erosion, improving soil structure, conserving soil moisture, and disrupting insect, disease, and weed cycles. Rotations that include three or more crops usually have fewer problems with pests and require fewer crop inputs. Rotational cropping can also contribute soil nutrients. For example, legumes like alfalfa or sweet clover are an economical source of nitrogen.



Cover crop

Cover Cropping: Using cover crops during crop rotation supports beneficial organisms above and below ground. These organisms help build soils by decomposing organic matter and contributing to nutrient cycling. Additionally, organic matter is often lost from fallow fields that lack vegetation cover because the soil is exposed to wind and water erosion. Using cover crops, such as a fall rye, instead of letting fields remain fallow, can improve water infiltration, storage, and flow, and add to soil nitrogen content. Delayed seeding and the use of winter cover crops can also be beneficial to a number of species, particularly some species of waterfowl, shorebirds and grassland birds.

Perennial Cover: Perennial cover can make a larger contribution to biodiversity than annual crops can because there is generally less disturbance from farm activities such as tillage, seeding, and spraying. This allows plants and animals to follow their life cycles without disruption. Perennial cover can also provide a greater diversity of vegetation structure, which in turn supports more species. Perennial cover can include crops such as hay (tame or native vegetation) or berry bushes. It can also include native and semi-natural areas that have been left for beneficial insects and other wildlife.



Perennial cover

PHOTO: MINISTRY OF FOREST AND RANGE

Intercropping: Intercropping provides crop diversity and can increase vegetation structural diversity. It can also provide habitat for beneficial insects. For example, sunflowers planted within one metre of vegetable crops can increase the number of beneficial insects found in crops.^{vii}



Intercropping – grass in a harvested corn stand

Agroforestry: Agroforestry intentionally combines the production of trees with other crops and/or livestock. By integrating a diversity of crop and other plant species, agroforestry can contribute significantly to the structural diversity of habitats.



Agroforestry – alley cropping

The Diminishing Diversity of Our Food Supply^{viii}

Since the 1900s, some 75% of plant genetic diversity has been lost as farmers worldwide have left their multiple local varieties and landraces for genetically uniform, high-yielding varieties.

Today, 75% of the world's food is generated from only 12 plants and five animal species.

Of the 4% of the 250 000 to 300 000 known edible plant species, only 150 to 200 are used by humans. Only three - rice, maize and wheat - contribute nearly 60% of calories and proteins obtained by humans from plants.

Animals provide some 30% of human requirements for food and agriculture and 12% of the world's population live almost entirely on products from ruminants.

Source:

FAO. 1999. Women: users, preservers and managers of agrobiodiversity
<http://www.fao.org/docrep/x0171e/x0171e03.htm>

Interactions between Agriculture and Biodiversity

Every time humans interact with their habitat they interact with biodiversity. This is especially evident in any type of resource use, including agriculture. Therefore, it is important to understand the types of interactions that can occur between agriculture and biodiversity and the impacts they may have.

Impacts of Agriculture on Biodiversity

Habitat Loss and Fragmentation: Regions that support agricultural production are among the most altered ecosystems on the planet. For example:

- ▶ Agriculture and urban development continue to impact the grasslands of Southern Okanagan. ^{ix}
- ▶ More than 75% of the wetlands in the Okanagan Valley and Fraser River delta have been converted by agricultural, urban, and commercial development. ^x
- ▶ Since 1800, 63% of the black cottonwood/water birch riparian shrub forest in the Okanagan has been lost due to flooding, and rural, recreational, and agricultural development. ^{xi}
- ▶ More than 30% of BC's Species at Risk depend on grasslands for their survival. ^{xii}



Endangered grassland ecosystem

Loss of habitat to agricultural development is associated with a disproportionately high number of species at risk in agricultural areas. Agricultural land makes up approximately 7.3% of Canada's land base^{xiii}, yet more than half of the terrestrial species at risk are found in agricultural areas.^{xiv} Accordingly, agricultural producers, who play an important role in land management, are increasingly being asked to consider practices that help conserve biodiversity.

Agricultural activities can also affect biodiversity by altering the size, density, connectivity, and shape of habitats and the distances between them. Large areas of connected native vegetation tend to support the highest levels of native biodiversity. However, smaller patches of native and semi-natural vegetation can also support many species and populations. This is particularly true where patches are close to one another or are connected by corridors of perennial cover that allow wildlife to move safely between them.



Soil Conservation- no till drill

Tillage Impacts: Tillage tends to degrade the diversity of soil micro-organisms found throughout the soil profile. This reduces the efficiency of nutrient cycling, the breakdown of toxins, and the maintenance of soil structure, which are all needed to sustain the productivity of agricultural soils.

Mycorrhiza fungi play an important role in maintaining above- and below-ground biodiversity and soil productivity. These fungi form associations with approximately 80% of the terrestrial plant species in the world, including legumes, flax, sunflowers, corn, and fruit trees.

DID YOU KNOW?

Networks of mycorrhiza fungi are disrupted by tillage and must be re-established after every major tillage operation.

Generally, the fungi make nutrients (i.e., phosphorus, nitrogen, potassium, magnesium, and some micronutrients) available for plant growth. Undisturbed, mycorrhiza fungi grow into long, intricate networks in the soil. They transport nutrients through these networks to the plants' roots in exchange for carbon.

Irrigation Impacts: Many aquatic species, such as fish and amphibians, rely on the maintenance of certain water regimes throughout the year. Changes in water levels, due to control structures and/or irrigation withdrawals, may negatively impact habitat and water quality. In addition, over-irrigating not only depletes surface water and groundwater, it can drown plant roots. It can also reduce nutrient uptake, cool soils, reduce crop quality, and increase erosion as well as nutrient and chemical runoff into watercourses.^{xv} These impacts affect both aquatic and terrestrial ecosystems and can be detrimental to biodiversity.



Drip irrigation

Input Impacts: Production inputs include fertilizers and pesticides. Depending on the timing and intensity of their use, production inputs can have significant effects on biodiversity. Repeated additions of nutrients in excess of what crops use can destabilize soil conditions, reduce soil organism diversity, and impair soil processes. Improper use of production inputs can also cause water and air pollution. Nutrients, such as nitrogen and phosphorus, can reduce surface water quality by causing overgrowth of aquatic plants and algae.^{xvi} When these plants decompose, the resulting loss of oxygen can be lethal to fish and other aquatic organisms. Overgrowth of some types of blue-green algae can result in the release of toxins that are harmful to a variety of species.



Fertilizing corn

DID YOU KNOW?

Leaf-cutting bees can be harmed by insecticide residue on the leaves they use to line their nests.

The use of pesticides (particularly insecticides) can have toxic effects on soil organisms, which can impair soil biological processes. Some pesticides can also have adverse effects on beneficial insects, including pollinators such as bees. Most pollinating insects are especially vulnerable to insecticide applications in the cool of the early morning and when their forage plants are flowering. They can also be affected by chemical drift into non-cropped areas where they nest.

Grazing Impacts: When the intensity and timing of grazing and browsing are not properly managed, biodiversity can be negatively affected. When grazing is too intense or too frequent, individual plants become less vigorous. Over time, plant diversity decreases, and grazing-resistant or less preferred species increase in abundance. These impacts can lead to a loss of food and habitat for beneficial insects, amphibians, reptiles, birds, and mammals.

Different species require different types of vegetation structure. Historically, vegetation structural diversity across the landscape was created by fire and a variety of wild herbivores (see description of “structural diversity” on p 17 and in the Glossary). In agricultural systems, structural diversity can be achieved by managing grazing intensity to maintain mosaics of lightly grazed, moderately grazed, and more heavily grazed areas. This can support greater biodiversity than areas that are grazed uniformly or left ungrazed.

Grazing that is too intense or that occurs at the wrong time of year can affect soils and site productivity by impacting soil organisms, reducing infiltration of water and associated minerals and nutrients, and affecting the exchange of oxygen, carbon dioxide, and other gases in the root zone. Unmanaged grazing can also create areas of bare soil, which can be prime sites for invasive plants to establish, and soil compaction, which can lead to an increased risk of erosion and reduced water quality for fish and aquatic insects.

The timing of grazing activities must also take into consideration the fact that plants and animals can be especially sensitive to disturbance at certain periods during their life cycle. Some animal species may also be vulnerable during certain times of the day.



Heavily grazed landscape

DID YOU KNOW?

A genetically modified bent grass pollinated other plants of the same species that were located 21 km downwind of where it had been planted.

IUCN. 2007. Current Knowledge of the Impacts of Genetically Modified Organisms on Biodiversity and Human Health: An Information Paper.

https://pdfs.semanticscholar.org/3498/f30c6f61f79d15285a772aadaf2a9972161e.pdf?_ga=2.226081881.253763449.1583357755-1818849551.1583357755



Spray tower reduces pesticide drift
NIELS HOLBEK PHOTO

Impacts of Genetically Modified Organisms: Genetically modified organisms (GMOs) are plants, animals, bacteria, or viruses whose genetic makeup has been deliberately altered in a way that does not occur naturally through mating or natural gene recombination.^{xvii} Modification is often designed to improve yield and production by making the organism resistant to disease, insects, and/or pesticides, but it can also be used to enhance or reduce certain traits such as fat content or fibre quality.

The growing of monoculture crops reduces biodiversity because many plant species are replaced by a single species. The growing of GMOs further reduces biodiversity because all the plants within a single species come from a genetically modified source plant, so they are all genetically identical.^{xviii} Unintentional cross breeding of GMO species with non-GMO species has the potential to reduce genetic diversity or introduce undesirable traits. On the other hand, GMOs may enhance yields, reduce pesticide use, and improve the nutritional value of crops. The overall effects that GMOs have on biodiversity are not fully understood, and they can differ among crops, environments, and the types of modifications made to the organism.^{xix}

Impacts on Wildlife: Agricultural activities can have negative effects on native wildlife species aside from causing habitat loss. For example:

- ▶ wild sheep and goats that come into contact with domestic sheep, llamas, or alpacas can be exposed to diseases that do not naturally occur in wild populations;
- ▶ agriculture activities can disturb wildlife and cause them to move or be displaced, or can upset their normal life cycle;
- ▶ livestock can trample bird nests;
- ▶ equipment used for haying, cultivating, tree harvesting, etc., can injure or kill wildlife;
- ▶ fencing can cut off wildlife access to travel corridors, winter/spring ranges, feeding areas, and water. Animals can also be injured or killed when trying to jump over or go under fences; birds can be harmed by accidentally flying into fences;
- ▶ runoff polluted with manure or fertilizer can harm fish and amphibians;
- ▶ pesticide sprays can injure or kill native pollinators.



Potential wildlife conflict

Impacts of Wildlife on Agriculture

While there are many benefits of managing for biodiversity, it is important to recognize that not all species have a positive effect on agricultural production. There a number of animal species, both native and introduced, that can cause significant impacts on agricultural operations, including damage to infrastructure, loss of growing or stored crops, transmission of diseases, and harassment, injury, or death of livestock. The type of impact often varies by species.

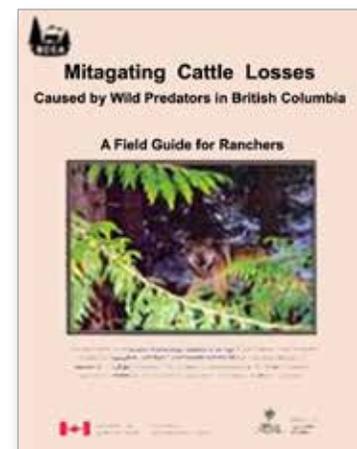
For example:

- ▶ deer and rabbits can damage fruit trees;
- ▶ coyotes can damage drip irrigation lines and emitters;
- ▶ birds can raid fruit crops;
- ▶ deer and elk can consume standing crops and stored forage;
- ▶ elk and other large mammals can damage fencing;
- ▶ bears can damage apiaries;
- ▶ predators can attack livestock;
- ▶ waterfowl can consume standing crops and compact soils of cropped fields, particularly during fall migration;
- ▶ waterfowl can also transmit infectious disease;
- ▶ bats, starlings, rodents, skunks, and raccoons can damage buildings by roosting and nesting in attics, digging and denning under foundations, or sheltering within walls.



Fencing damaged by elk.

When viewed on a provincial scale, most wildlife do not negatively affect agricultural production, but when they do, the impacts to individual producers can be significant. It is important to note that producers can manage for biodiversity without necessarily increasing the risk of wildlife-related conflicts. The key is to find an acceptable balance between the benefits and potential costs of managing for biodiversity.



Species at Risk and Agriculture

A species at risk is defined by the federal *Species at Risk Act* (SARA) as an extirpated, endangered or threatened species or those species that may become threatened or endangered due to a combination of their biological characteristics and identified threats. SARA protects species at risk by providing legal protection to listed species under the Act and their residences. Listed aquatic species (e.g., fish and marine plants) and migratory birds are protected on all lands and water in Canada. However, individuals of other listed species are only protected on federal land, including indigenous reserves and national parks, unless an order is made under the Act. Orders typically occur in cases where provincial action is deemed insufficient to protect listed species; provisions of the federal *Species at Risk Act* (known as the 'safety net') could then be invoked at the provincial level on crown and private land.

There are several species listed as either endangered or threatened in BC through SARA. A significant number of these occur in areas that could be impacted by agriculture. See the *Species at Risk Public Registry* and *Aquatic Species at Risk* resources for more information.

There is no stand-alone legislation for protection of species and ecosystems at risk in British Columbia. Management of SAR in BC is coordinated through the *Canada-BC Agreement on Species at Risk*. Provincially threatened and endangered species are listed in Schedule D and E of the *BC Wildlife Act: Designation and Exemption Regulation*. The province's *Conservation Data Centre (CDC)* provides information on BC's wildlife, plants, and ecosystems, including their conservation status using terms such as "red-listed", "blue-listed", and "yellow-listed". Other provincial laws applicable to SAR include the *Forest and Range Practices Act*, the *Oil and Gas Activities Act*, the *Water Sustainability Act*, and the *Land Act*.

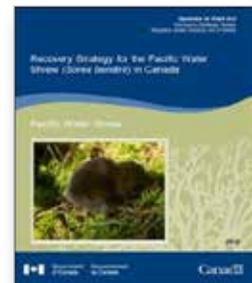
The *Riparian Areas Protection Act* and *Riparian Areas Regulation* were enacted to protect riparian areas from development to better support fish and fish habitat. The regulation applies to those developments under Local Government authority (e.g., construction of a residential dwelling) in certain geographic regions, and most normal farm practices are exempt.

The provincial and federal governments work together on recovery planning to ensure species do not become extinct due to human activity. Recovery means stopping or reversing declines in a species' population and removing threats to a species' recovery so it can persist in its natural environment.

The recovery process for BC is fully described in the *British Columbia Guide to Recovery Planning for Species and Ecosystems at Risk*.

The federal recovery process is described in the *Species at Risk Public Registry – Recovery Strategies*.

Recovery Plans identify survival and recovery habitat for threatened or endangered species, and list specific threats and mitigation strategies. They can be complemented with Action Plans that guide implementation of the recovery strategy. Management Plans describe specific conservation measures and land use activities to ensure species of special concern do not become endangered or threatened.



It can be challenging to manage species at risk since we don't always know exactly where they exist within the landscape. Under SARA, the Committee of the Status of Endangered Wildlife in Canada (COSEWIC) assesses SAR and then lists them. After listing, the recovery planning can begin. In BC, the Conservation Data Centre conducts a status assessment, after which the SAR is legally listed and recovery planning begins at the provincial level. Critical habitat is also assessed during the recovery planning process. SARA defines critical habitat as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or action plan for the species". Critical habitat can be designated on both public and private land (e.g. farmland, grazing areas, range lands and pastures). For example, the *Recovery Strategy for the Oregon Spotted Frog*^{xx}, includes critical habitat that has been described as:

- ▶ Areas of wetland, streams, or ponds where any life stage (e.g. tadpoles or adults) of Oregon Spotted Frog occurs or has been known to occur.
- ▶ Other suitable habitat connected by streams to known habitat (within 3 km), or other ponds and streams not connected, but close to known habitat (within 400 m).
- ▶ Other habitat, close by which is needed to maintain the necessary attributes of its habitat (extending out 45 m from the high water mark in agricultural land).

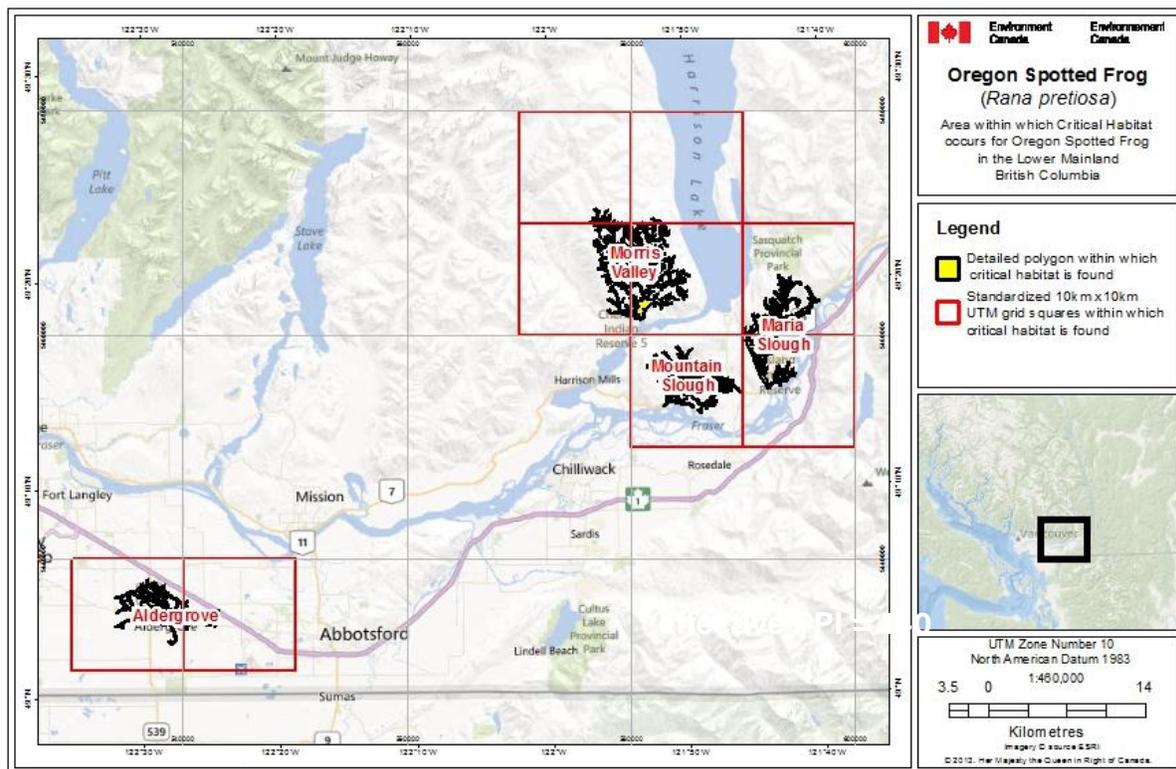


Figure 3: Area of critical habitat for Oregon Spotted Frog in B.C. (Source: Recovery Strategy for the Oregon Spotted Frog in Canada, 2015. Government of Canada).

Habitat required by many SAR often covers a large area. Meeting this need means that cooperation between both public and private landowners is essential to protect SAR and their habitat. Voluntary cooperation of landowners through land stewardship is a key component of recovery strategies; even stewardship activities at the small scale can make a difference. The Stewardship Centre of British Columbia provides voluntary stewardship guides for species at risk management, some of which are specific to agriculture. Examples of beneficial management practices include:

- ▶ Protecting sensitive habitat by establishing covenants and conservation agreements;
- ▶ Timing activities to reduce potential disturbance during sensitive times of a species' life cycle, (e.g., breeding season);
- ▶ Restoring and enhancing sensitive habitat;
- ▶ Applying and storing manure responsibly;
- ▶ Using manual equipment rather than heavy equipment where appropriate to minimize habitat disturbance and damage; and
- ▶ Partnering with organizations that manage SAR.

If a landowner should discover a Species at Risk on their property, they are encouraged to notify the Canadian Wildlife Service, as new information on a listed SAR is highly valuable to recovery teams; however, this action is also voluntary.

More information on Acts and Regulations pertaining to Species at Risk in BC can be found here:

[Species At Risk legislation in BC - website](#)



Oregon Spotted Frog. (Mid-Columbia River Refuges) (Red-listed by the BC Conservation Data Centre and designated as endangered by COSEWIC, and legally designated as an Endangered species under the federal Species At Risk Act (SARA)).



Nuttall's Cottontail. (Justin Wilde) (Blue-listed by the BC Conservation Data Centre and designated as a species of special concern by COSEWIC).



Burrowing Owl (Red-listed by the BC Conservation Data Centre and legally designated as an Endangered species under the BC Wildlife Act).

Thinking Regionally

While it is important to manage for biodiversity on the farm, it is equally important to consider how an individual farm can contribute to biodiversity at the regional scale. Areas with different climate regimes, elevations, landforms, and soils (Figure 1) tend to support different plant and animal communities. Because of this, some parts of the province naturally contain greater concentrations of native plant and animal species than others. The number of species present in a given area is often referred to as species richness (Figure 4).

Much of BC's farmland is located within the Agricultural Land Reserve (Figure 5), which tends to overlap areas of higher species richness. Many species of plants and animals prefer valley bottoms because they have favourable climates, fertile soils, and easily accessible water sources. However, these same features make these areas some of the most suitable land for agricultural and urban development in the province. As a result, the needs of agriculture often compete with those of native biodiversity. In areas of the province that have high species richness, such as the lower Fraser Valley, southeast Vancouver Island, the Gulf Islands, and the Okanagan Valley, there is an increasing need to find ways to ensure that farmland remains productive while providing habitat for biodiversity. Agricultural lands in areas of the province that have lower species richness are also critical to ensuring the survival of native plants and animals, and they help connect areas of higher species richness.



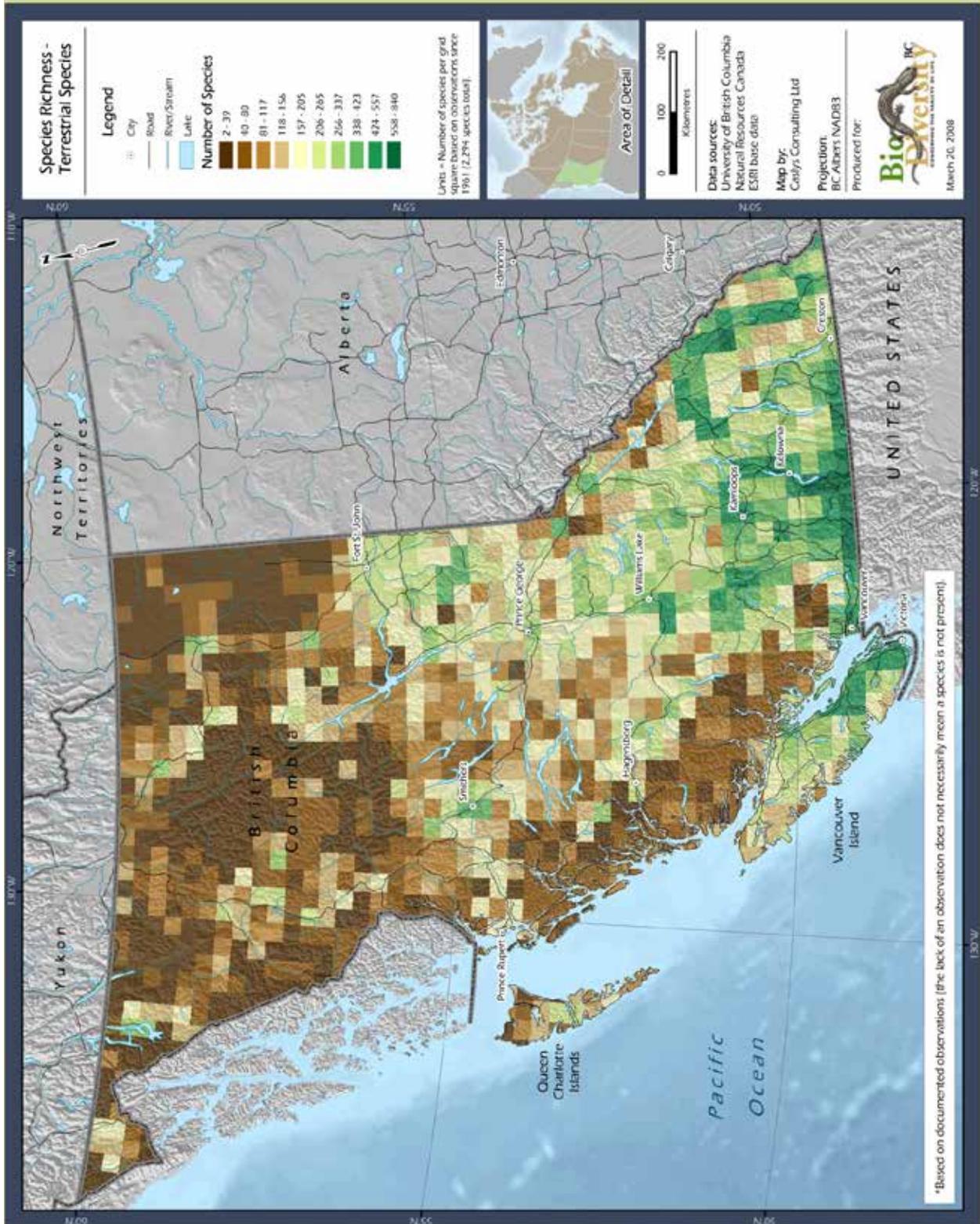


Figure 4: Species Richness – Terrestrial Species in BC

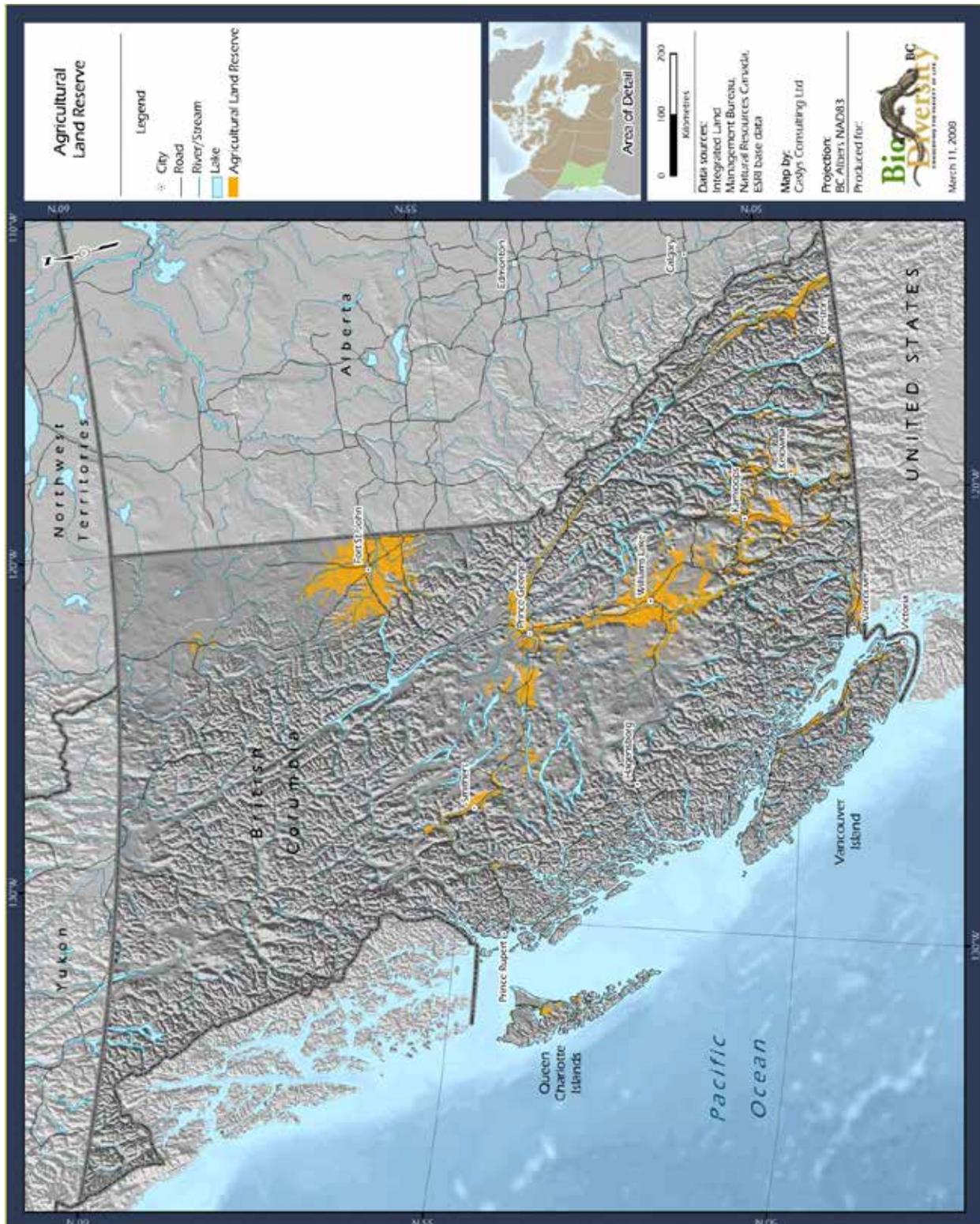


Figure 5: Agricultural Land Reserve

Building Connections across Landscapes

Considering the farm in a regional context is important because pollen, plant seeds, and animals often move over large areas that extend well beyond the farm boundary. For example, millions of migratory birds may travel thousands of kilometres along the Pacific flyway between their breeding and wintering habitats, and may rely on farmland along the way as important stopover points for resting and feeding. One migrating species is the Tundra Swan, which breeds in Alaska and winters on the Pacific coast, in BC and California, migrating 6,000 km between these areas. Other species with large home ranges may use farmland as a corridor to travel between isolated patches of native habitat as they search for food, shelter, or mates. Species also move across landscapes in response to disturbances such as drought, fire, or disease. Meeting the needs of wide-ranging species requires management strategies that operate at the landscape scale. These strategies can also benefit us, as many of these species provide important services to agriculture, including pollination, pest control, and nutrient cycling.

Agricultural land use activities can have impacts on connectivity, making it less suitable for wildlife (including species at risk). Tree clearing, vegetation maintenance, and drainage projects, for example, can affect connectivity by creating smaller, fragmented habitat patches. These small patches may not be big enough to support many species and can isolate populations, leading to a reduction in genetic diversity and population health. Habitat fragmentation has led to significant declines in populations of birds, mammals, fish, amphibians, reptiles, and insects and the benefits that these species can provide.

Maintaining or restoring habitat connectivity in fragmented landscapes is a beneficial management practice for wildlife. Connected habitat helps wildlife move across the landscape to meet their different life needs (e.g., find food, shelter, mates, and raise young). Corridors help bridge the gap between fragmented patches and larger natural areas, and increase effective habitat area and quality by making the whole greater than the sum of its parts. If establishing linear corridors is not possible, maintaining small patches in close proximity to one another can be of benefit, as they can act as natural stepping stones to improve connectivity. Management practices that improve connectivity are particularly important for migratory species, genetically isolated populations, species with large home ranges, and/or those species that are more reluctant to travel across disturbed or open areas.

Maximizing the value of farmland to biodiversity depends on understanding how actions at the farm scale contribute to larger scale processes. While it is understandable that farm operators and ranchers may want to maximize land availability for livestock or crop production, well-planned corridors can help meet the needs of both the farmer and wildlife. Corridors can be established along fencerows, roadsides, narrow fields, hillsides, wetlands, streams, or other existing natural features to connect existing habitat and help maximize land productivity. Although wider corridors are typically better and will get more use, even narrow vegetated strips can improve habitat connectivity and be of benefit to many species. For instance, riparian and grassland corridors in agricultural areas have been shown to increase the abundance and diversity of birds, mammals, reptiles and amphibians. Different species will have specific requirements or preferences for corridors (e.g. width, vegetation composition, etc.). In cases where a particular species is being managed for, the corridor's characteristics will need to reflect those specific needs. Farm operators may wish to consult with local wildlife agencies to help design effective corridors to meet individual species needs.



Treed corridor

AGRICULTURE AND AGRI-FOOD CANADA



Tundra swan. A blue-listed species in BC.

(OREGON DEPARTMENT OF FISH & WILDLIFE)



A hedgerow connecting two forest patches.

PHOTO: HUGH VENABLES

The responsibility for conserving biodiversity is shared across the landscape. BC's network of parks and protected areas plays a key role in maintaining habitat for a variety of species, as do conservation practices used on Crown lands. Individual farms and ranches play an important role in retaining and enhancing biodiversity, but the power to make a difference increases by working collaboratively with other producers, community members, and organizations. There are numerous coordinated efforts underway in BC to conserve habitat and protect biodiversity. Some are driven by government; others are driven by stewardship groups in which agricultural producers have key roles. The following are examples of regional and landscape-scale biodiversity conservation initiatives that rely, in part on the agriculture community to achieve their goals:

- ▶ The Biodiversity Conservation Strategy for Metro Vancouver was developed for an area that encompasses both the largest population base in the province and some of the most productive agricultural land in BC. The strategy addresses a number of biodiversity conservation needs including habitat mapping and making recommendations for linking agricultural lands to forested areas, aquatic habitats and parks.
- ▶ The Pacific Coast Joint Venture and the Canadian Intermountain Joint Venture are regional-scale efforts that focus on conserving habitat and sustaining species and populations of waterfowl and other birds that migrate across North America. Established as part of the North American Waterfowl Management Plan, these cooperative ventures between governments, stewardship organizations and private landowners work to establish and achieve targets for bird conservation, often by securing important wetlands and adjacent upland habitat. The agriculture sector plays an important role in these Joint Ventures.
- ▶ The Delta Farmland and Wildlife Trust works to conserve wildlife habitat in the Fraser Delta, an area that contains both internationally significant wildlife habitat and highly productive farmland. The delta is recognized as one of Canada's Important Bird Areas due to the large numbers of migratory and resident birds that congregate in the delta at various times throughout the year. It is estimated that at least 1.5 million birds from 20 countries travel through the delta on an annual basis. At the same time, the combination of rich soils and optimal climate make the region one of BC's most productive agricultural areas; it produces a wide variety of vegetables, berries and dairy products. The Trust includes members of the agriculture community, stewardship groups, government agencies and universities. Among other activities, the Trust provides funding for set-asides, winter cover crops and management of field margins to enhance habitat values.



Stream banks and fish passage protected

PHOTO: NIELS HOLBEK



Snow Geese

PHOTO: ROB BUTLER



Delta Farmland and Wildlife Trust

PHOTO: DAVID SHACKELTON



Examples of other regional projects are provided under [Where Can I Learn More about Biodiversity?](#), p 29-40.

Thinking Globally

What Are the Global Benefits of Maintaining Biodiversity?

Biodiversity not only benefits agricultural operations, it provides a range of goods and services that are of value to society as a whole.

Ecosystem Services (ES) are any beneficial natural process arising from healthy ecosystems, such as purification of water and air, pollination of plants and decomposition of waste. They are services that are not traded on the markets but have great value to us all. Ecosystem Services also include the preservation of biodiversity necessary to maintain a specific environment.

DID YOU KNOW?

The global value of ecosystem services was estimated to average \$33 trillion/yr in 1995 \$US (\$46 trillion/yr in 2007 \$US). The estimate for the total global ecosystem services in 2011 was \$125-\$145 trillion/yr in 2007 \$US

Costanza, R., et al. 2014. Changes in the global value of ecosystem services. *Global Environmental Change* 26: 152-158

ES includes:

- ▶ fresh water;
- ▶ food, fibre, and fuel;
- ▶ biochemicals;
- ▶ genetic resources^{xxi};
- ▶ water purification and flow regulation - maintains drinking water supplies;
- ▶ food and raw material production - maintains food and commodity supplies;
- ▶ flood regulation through wetlands and floodplains;
- ▶ carbon storage and oxygen production - maintains air quality and reduces impacts of greenhouse gas emissions;
- ▶ protection from natural hazards - provides flood control and recovery from drought and forest fires;
- ▶ cultural services - provide educational, aesthetic, recreational and spiritual values.^{xxii}



Southwestern British Columbia

PHOTO: NASA

Conserving biodiversity is an efficient and effective means of maintaining these types of services. Replacing ecological goods and services with technology is frequently very expensive, rarely practical, and often not possible.

Maintaining biodiversity can be seen as an insurance policy for guarding against undesirable changes in ecosystem functioning on a global scale.

What Are the Broader Threats to Biodiversity?

The diversity of ecosystems, species, and genetic resources around the world is faced with significant threats associated with human activity. Over the last 100 years, humans have changed global ecosystems more rapidly and extensively than in any other period in human history. Oil and gas extraction and refining, deforestation, mining, urban sprawl, and the conversion of forests to agricultural land and pasture threatens native forests. Urban development, resource extraction, and livestock grazing also place grasslands, wetlands, and other ecosystems under pressure.

In BC, more than half of the ecological communities identified in the province are classified as either “red-” or “blue-listed” by the BC Conservation Data Centre^{xxiii}, meaning they are extirpated, endangered, or threatened (red-listed), or are of special concern (blue-listed).

In terms of species and genetic diversity, a number of studies have shown that the population size and geographic range of most of the world’s native species are declining.^{xxiv} Over the past few hundred years, species extinction rates due to human-related impacts increased by as much as 1000 times compared to the rates that occurred throughout Earth’s history.^{xxv} In BC, approximately 1,600 of the more than 4000 plant and animals species recorded in the province have been either red or blue-listed by the BC Conservation Data Centre in 2018. This includes 431 animal species and 1196 plant species. Of these species, more than 200 are recognized by the federal Committee on the Status of Endangered Wildlife in Canada as being either endangered, threatened, of special concern, or extirpated.^{xxvi} The continued existence of some of these species in BC is uncertain, especially where their population numbers have dropped to very low levels. For example, the entire population of the Yellow-breasted Chat in BC was estimated at 170 breeding pairs in 2014 owing in part to development, roadside vegetation removal, and livestock grazing.^{xxvii} While some native species may be uncommon, threatened, or endangered, they can be key components of healthy ecosystems. They are called “keystone” or indicator species. A keystone species has a disproportionate effect on its environment relative to its abundance.

Threats to biodiversity, both globally and in BC, can be grouped into five categories.^{xxviii}

- ▶ habitat loss and fragmentation;
- ▶ introductions of invasive alien species;
- ▶ overharvesting and accidental mortality;
- ▶ nutrient loading and other pollution;
- ▶ climate change.

Most species will be exposed to more than one of these threats, and may be exposed to all of them, over the course of their life.



Deforestation

PHOTO: DUCKS UNLIMITED CANADA



*Yellow-breasted Chat
(red-listed)*

PHOTO: DOUG BACKLUND

DID YOU KNOW?

Despite covering less than 1% of the province, grasslands are associated with more than 30% of BC’s species at risk.

Source: Grasslands of the Southern Interior. 2004.
BC Ministry of Sustainable Resource Management.

www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/species-ecosystems-at-risk/brochures/grasslands_southern_interior.pdf

HABITAT LOSS AND FRAGMENTATION

Habitat loss and fragmentation is a major factor in the decline of ecosystem, species, and genetic diversity worldwide. In a study designed to identify the threats facing 488 species at risk in Canada, habitat loss was found to be a significant threat in 84% of the cases.^{xxix} Habitat loss can take many forms but is typically a result of the reduction or degradation of native habitat due to any of the following activities: urban development (including residential, commercial, and industrial land uses or pollution and runoff associated with this development), agriculture (crop production and livestock grazing and associated nutrient and chemical inputs and runoff), human disturbance (recreation, tourism, transportation), resource extraction (logging, mining, fishing, oil and gas exploitation), and infrastructure development (power lines, dams, diversions, pipelines, utilities).

In general terms, the larger, more diverse, and less fragmented native habitat there is available, the greater the diversity of species present. Some species of plants and wildlife do very well on the edges of habitat patches (e.g., a forest bordering an area of cropland). However, as patches of habitat become smaller, populations that depend on undisturbed habitat either become very small or vanish all together. A decrease in the amount of available habitat is then compounded by fragmentation of the remaining habitat into isolated patches due to the construction of roads, utility corridors, or conversion of habitat to other land uses. Fragmentation of habitat makes it increasingly difficult for species to move safely across the landscape in search of shelter, food, or mates.

Habitat loss and fragmentation is not restricted to terrestrial areas. Because riparian areas tend to be relatively small, they are particularly vulnerable to alteration. For example, the removal of streamside vegetation or the disturbance of stream banks can reduce the availability and quality of riparian habitat, and it can disrupt the ability of species to move freely along streamside corridors. Physical disturbances of stream beds and wetland bottoms, and straightening (channelization), damming, and dyking of watercourses can also impact both terrestrial and aquatic biodiversity.



Habitat fragmentation



Streamside degradation

INTRODUCTIONS OF INVASIVE AND NOXIOUS SPECIES

The introduction and spread of invasive and noxious species poses a significant threat to ecosystems around the world. These species are sometimes also called “exotic,” “introduced,” “non-native,” “non-indigenous,” or “invasive” species. Invasiveness refers to the ability of a plant or animal species to spread beyond its introduction site and become established in new locations. Invasive species compete with native species for available resources, and in some cases, contribute to the decline or loss of native species. Invasive plant species, such as spotted knapweed, are well known for their ability to spread rapidly in disturbed and inappropriately grazed areas. They also compete with native plants for moisture and soil nutrients but often do not provide suitable forage for wildlife or livestock. Invasive plant species reduce native biodiversity and can be extremely difficult and costly to control once established.



Oxeye Daisy

The Committee on the Status of Endangered Wildlife in Canada estimates that 25% of endangered species, 31% of threatened species, and 16% of species of special concern in Canada are negatively affected by invasive alien species.^{xxx}

Invasive species are a big risk to SAR, second only to human disturbance.

Examples of invasive species in BC include:

- ▶ yellow perch, bass, black crappie, and carp, which threaten native fish stocks;
- ▶ introduced bullfrogs, which present a serious threat to native amphibians; and
- ▶ European Starlings, which often compete with native bird species for nest sites
- ▶ Common burdock (*Arctium minus*) is a tall, invasive biennial herb known for clinging burs. The burs get tangled in manes and tails of horses, cows and other livestock, and can also damage or de-value the wool of sheep.
- ▶ Tansy ragwort (*Senecio jacobaea*) is a biennial to short-lived perennial. Tansy ragwort grows in grazed pastures, hay fields, and vacant non-crop lands.

Additional information on the threats posed by invasive alien species can be found in Appendix 4.

OVERHARVESTING AND ACCIDENTAL MORTALITY

Overharvesting through fishing, hunting, trapping, or direct harvesting for food, cultural, or medicinal purposes has been implicated in the decline of many native species. Fish are especially vulnerable to overharvesting, but terrestrial species, particularly certain top predator species, are also affected. Some of these species, such as wolves and bears, may also be killed as a result of conflicts with agricultural operations and urban populations. Accidental mortality resulting from vehicles further threatens many native species, such as badgers and rattlesnakes.



Subsurface manure injection

NUTRIENT LOADING AND OTHER POLLUTION

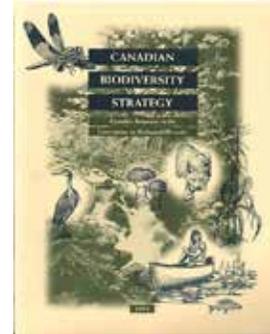
The availability of commercial synthetic fertilizers has allowed significant increases in agricultural production to be made worldwide, but it has also resulted in the accumulation of excessive levels of nitrogen and phosphorus in soils and water bodies. Excess nutrients in aquatic habitats can threaten biodiversity by reducing oxygen levels, causing toxic algal blooms, or altering ecosystems so that nutrient-tolerant species are favoured. Other agricultural and industrial contaminants, including pesticides, solvents, oils, and fuels can contribute to water and air pollution, which degrades habitat quality and threatens biodiversity. Amphibian species, in particular, are especially vulnerable to pollution. Their populations are known to be declining worldwide.^{xxxi}



Silage leachate

CLIMATE CHANGE

The Earth's climate is changing as human activities and natural forces increase the amount of greenhouse gases in the atmosphere. Climate change is predicted to have significant impacts on the Canadian climate, whether it causes earlier snowmelt, increased summer temperatures, longer growing seasons, or reduced precipitation levels.^{xxxii} These impacts, in turn, are expected to influence water availability, which will affect both aquatic and terrestrial biodiversity. It is also expected that in drier areas, climate change will lead to salinization, desertification, and increased rates of soil erosion and degradation, which can affect soil biodiversity and function.^{xxxiii} The frequency and severity of natural disturbances, such as fire and disease, is forecasted to change, which could expose ecosystems and species to increased mortality rates. Changes in climate patterns could also affect the natural distribution patterns of native species.



What Are the Broader Commitments to Conserving Biodiversity?

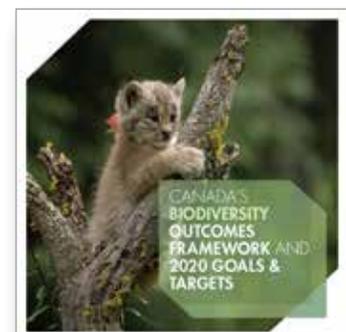
Actions to support biodiversity conservation at the farm scale are supported by strong national and international commitments to preserving ecosystem, species, and genetic diversity. At the 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for sustainable development, which included the Convention on Biological Diversity (CBD). Canada was the first industrialized country to sign and ratify the Convention, which officially came into force in 1993. The Convention establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources. There are presently 196 Parties (member states) to the Convention worldwide, 168 of which are Signatories. The Strategic Plan for Biodiversity was revised and updated in 2010, with new targets. Target 7 states that by 2020, areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.



*Red-legged Frog
(blue-listed)*

Another example of this strong international commitment is CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, whose aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES came into effect in 1975, and currently includes 172 Parties around the world. Although agreements like the CBD and CITES are legally binding on the Parties, they do not take the place of national laws. Rather, they provide a framework upon which each country can design its own legislation to ensure that its international obligations are met at the national level.

In Canada, the adoption of biodiversity conservation measures within agricultural landscapes has been guided by the Canadian Biodiversity Strategy (1995) and the Agriculture and Agri-Food Canada (AAFC) Biodiversity in Agriculture Action Plan (1997), and subsequent departmental sustainable development strategies. The Canadian Biodiversity Strategy is essentially a blueprint for the conservation and sustainable use of Canada's living resources. It recognizes existing constitutional and legislative responsibilities in Canada while promoting cooperation among different levels of government to advance biodiversity conservation goals. AAFC's 1997 plan outlined the department's specific commitments to biodiversity conservation as a component of achieving sustainable agriculture. Provincial governments in Canada have also adopted various programs and policies in support of the goals of the Canadian Biodiversity Strategy.



In 2010, a Strategic Plan for Biodiversity was adopted at the Conference of the Parties for the United Nations Convention on Biological Diversity. This plan includes 20 global biodiversity targets, known as Aichi Targets, which each party to the Convention has agreed to contribute to achieving by the year 2020. In 2015, Canada adopted a suite of national targets known as the “2020 Biodiversity Goals and Targets for Canada”. These 19 targets cover issues ranging from species at risk to sustainable forestry to connecting Canadians to nature. Target 7 aims for agricultural working landscapes to provide a stable or improved level of biodiversity and habitat capacity by 2020.

The national and international commitments described above are supported by a legislative and regulatory framework in Canada, with the federal *Species at Risk Act* as the most obvious example [see Species At Risk and Agriculture – p1-19]. The Act came into force in Canada in 2003. Its primary aim is to protect species and their habitats from extinction. The Act also established the Committee on the Status of Endangered Wildlife in Canada as an advisory body charged with producing, updating and maintaining an official list of species at risk of extinction in Canada. Additional information on the *Species at Risk Act* and other relevant legislation and regulations is provided in Appendix 3. Additional background information on national and international obligations to conserve biodiversity is available from the following organizations. Their contact information is provided in Appendix 4:

- ▶ Convention on Biological Diversity
- ▶ Canadian Biodiversity Information Network
- ▶ *Species at Risk Act* Public Registry

WHERE CAN I LEARN MORE ABOUT BIODIVERSITY?

The process of developing a Biodiversity Management Plan begins on the farm, but it can lead to increased awareness about the role the farm plays in the larger landscape. You can learn more about biodiversity from the internet and the following resources. Their contact information is provided in Appendices 2 and 4.

Government Agencies

- ▶ Agriculture and Agri-Food Canada
- ▶ BC Conservation Data Centre
- ▶ BC Ministry of Agriculture
- ▶ BC Ministry of Environment
- ▶ BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
- ▶ Environment and Climate Change Canada
- ▶ Fisheries and Oceans Canada
- ▶ Provincial Agricultural Land Commission

Specialists

- ▶ EFP Planning Advisors
- ▶ Registered Professional Agrologists
- ▶ Registered Professional Biologists
- ▶ Registered Professional Foresters
- ▶ Industry Specialists



Wetland ecosystem
DUCKS UNLIMITED CANADA



Sage Thrasher (red-listed)

Conservation Initiatives and Non-governmental Agencies

- ▶ Biodiversity Conservation Strategy for the Metro Vancouver
- ▶ Burrowing Owl Recovery Program
- ▶ Canadian Intermountain Joint Venture
- ▶ Delta Farmland and Wildlife Trust
- ▶ Ducks Unlimited Canada
- ▶ Grasslands Conservation Council of BC
- ▶ Invasive Plant Council of BC
- ▶ Pacific Coast Joint Venture
- ▶ Partners in Flight
- ▶ Salmon River Watershed Roundtable
- ▶ South Okanagan-Similkameen Conservation Program
- ▶ South Okanagan-Similkameen Stewardship Program
- ▶ Yellowstone to Yukon Conservation Initiative



Farmland and semi-natural areas within a natural landscape

DUCKS UNLIMITED CANADA

Regional Projects

- ▶ **The South Okanagan-Similkameen Stewardship Program** (SOS Stewardship Program) works to protect and enhance species at risk, plant communities, and habitats in the South Okanagan-Similkameen, an area that is one of the four most endangered ecosystems in Canada. Private landowners, including farmers and ranchers, play a vital role in protecting biodiversity in this area. The SOS Stewardship Program helps them find information on native plants and wildlife



- ▶ prepare conservation plans, habitat assessments, and management plans
- ▶ provide information on potential wildlife interactions
- ▶ complete habitat restoration projects
- ▶ protect habitat through the use of stewardship agreements and conservation covenants

- ▶ **The Salmon River Watershed Roundtable** was formed out of concern over the deterioration of the Salmon River, located in the North Okanagan/ Shuswap, and its salmon population. Two key factors were impacting water quality and salmon: urban development and agriculture. In 2007-2008, the Roundtable delivered an Equivalent Agri-Environmental Plan on a watershed basis under the Canada - BC Environmental Farm Plan Program. The objective was to work with individual farms and ranches to complete EFPs and adopt specific Beneficial Management Practices (BMPs) to mitigate agricultural impacts on the river. The BMPs selected for the watershed included using fencing to exclude cattle from the river and providing off-stream watering systems.



Snake barrier fencing project

THE LAND CONSERVANCY



Salmon River stream bank restoration

SALMON RIVER ROUNDTABLE

► **The Burrowing Owl Recovery Program** began in 1990 with a goal of re-establishing self-sustaining populations of Burrowing Owls within their historic range in BC's southern interior. The program includes the captive-breeding and release of owls, construction of artificial burrows in release habitats, and field monitoring of released owls, their offspring, and migrant returns. The success of the program relies heavily on the support of private landowners, including farmers and ranchers. In addition to providing access to their properties for recovery activities, contributing landowners have modified their grazing regimes and are using management practices that support a healthy grassland ecosystem. The program has also raised public awareness about the difficulties of trying to reverse environmental change and the need to ensure effective conservation measures are developed for grassland species and habitats.^{xxxii}



*Burrowing Owl
(red-listed)*

PHOTO: JARED HOBBS

► **The Species at Risk Partnerships on Agricultural Lands (SARPAL)** is an Environment and Climate Change Canada initiative that is focused on working with farmers to support the recovery of species at risk on agricultural land. The BC Cattlemen's Association has received funding through SARPAL to deliver a pilot program that will enable cattle producers to implement Best Management Practices (BMP's) and projects that will protect habitat for the Yellow Breasted Chat and the Lewis's Woodpecker. The Yellow Breasted Chat can be found in valley bottom riparian areas in the southern Okanagan and Similkameen valleys, in dense riparian thickets. Wild rose bushes are considered a preferred nesting site for the Yellow Breasted Chat. The Lewis's Woodpecker prefers open forests, riparian woodlands and grasslands with scattered trees. Mature or old riparian cottonwood stands typically adjacent to grasslands, agricultural fields, shrub steppe or open woodlands are favoured by Lewis's Woodpeckers.



Lewis's Woodpecker

► **The Farmland Advantage Project:** This project is focused on developing a long-term program that pays farmers and ranchers to enhance ecosystems to produce benefits like clean drinking water and healthy wildlife populations. Farmland Advantage works with farmers to enhance the natural values on their land. These natural values are often referred to as "ecosystem services" — services of a natural environment that benefit humans that can include areas like wetlands that filter and purify water, and forests that clean the air and provide habitat for healthy wildlife populations. The project helps farmers identify the natural values that can be protected and enhanced, and develops recommendations and plans to preserve them. These plans can include actions such as water or stream setbacks, strategic fencing, reforestation, or rangeland enhancement. Farmers then carry out the recommendations and Farmland Advantage helps to provide compensation based on successful implementation. This phase of the project is focused on three targeted regions of BC: the Lower Mainland, Okanagan, and Kootenays. The Columbia Valley Farmland Advantage Stewardship Project, which received funding from the Columbia Valley Local Conservation Fund in 2017, is geared toward farmers who own much of the valley's critical habitat, and rewards those who demonstrate exceptional care for any land bordering wetlands, streams and rivers (riparian habitats). To date, the Columbia Valley project has resulted in 11 farm sites under contract with 252 acres of prime riparian habitat and 7,987 metres of shoreline conserved and enhanced.

► **The Langley Ecological Services Initiative:** This is the first program of its kind on B.C.'s west coast to reward farmers for maintaining eco-friendly areas on their lands. Such practices can be costly and the Ecological Services Initiative (ESI) was created to help farmers bear the cost of keeping waterways, forests, and other ecologically sensitive areas clean and healthy for current and future generations.

The ESI is a farmer-led program that supports financial incentives for agricultural producers who contribute to a healthy ecosystem. Maintaining areas to include practices such as a clean water supply, erosion control, pest management, and habitat preservation creates sustainable food production that benefits everyone.

The farmers currently participating in Langley ESI are maintaining a second growth forest along the creekside, removing invasive species, then planting native species.

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2 BIODIVERSITY PRINCIPLES

MANAGING FOR BIODIVERSITY

EIGHT AGRICULTURAL BIODIVERSITY PRINCIPLES

Managing for agricultural biodiversity is about conserving the variety and number of all living things, including both native and domestic species, and the relationships and interactions among them. The principles on the following pages reflect the key relationships and interactions that need to be considered when managing for biodiversity on farms and ranches.

- 1 Go Native**
Native areas (wetlands, aquatic areas, riparian areas, forest woodlands, and grasslands) provide the most important contribution to biodiversity.
- 2 Semi-natural is Valuable**
Semi-natural areas such as shelterbelts, hedgerows, fencerows, buffers, road margins, pastures, and haylands also contribute to the conservation of biodiversity.
- 3 Location, Location, Location**
The location, pattern, and seasonal availability of habitat influences the type and amount of biodiversity present.
- 4 You Gotta Have Connections**
Connection between native and semi-natural areas on your land, and neighbouring landscapes, is important to biodiversity.
- 5 Achieving New Heights**
Structural diversity – the variation in physical structure of both native vegetation and crops – on your land provides an important contribution to biodiversity.
- 6 Healthy Ecosystem Wanted**
The health of the soil and water influences the type and amount of biodiversity present.
- 7 Nature Loves Variety**
The number and mix of species present, including crops and livestock, influences the type and amount of biodiversity present.
- 8 Watch Out for Aliens**
Invasive alien species are generally detrimental to the conservation of biodiversity.

EIGHT AGRICULTURAL BIODIVERSITY PRINCIPLES

Managing for agricultural biodiversity is about conserving the variety and number of all living things, including both native and domestic species, and the relationships and interactions among them.

PRINCIPLE 1

Go Native

Native areas (wetlands, aquatic areas, riparian areas, forest woodlands, and grasslands) provide the most important contribution to biodiversity.

PRINCIPLE 2

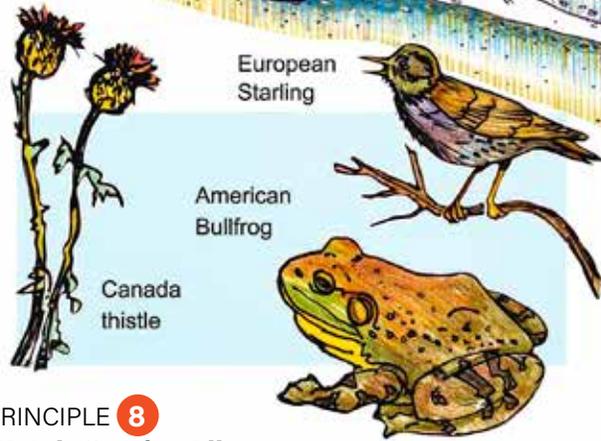
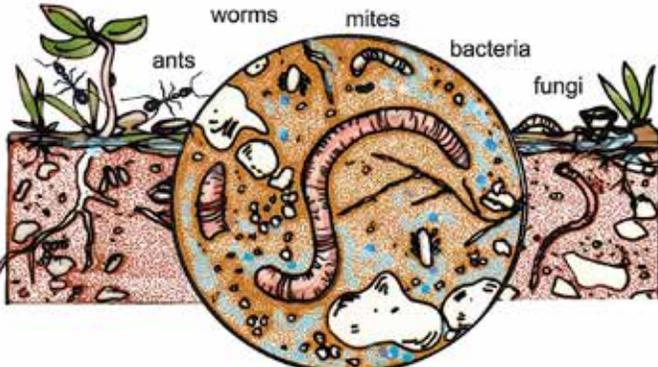
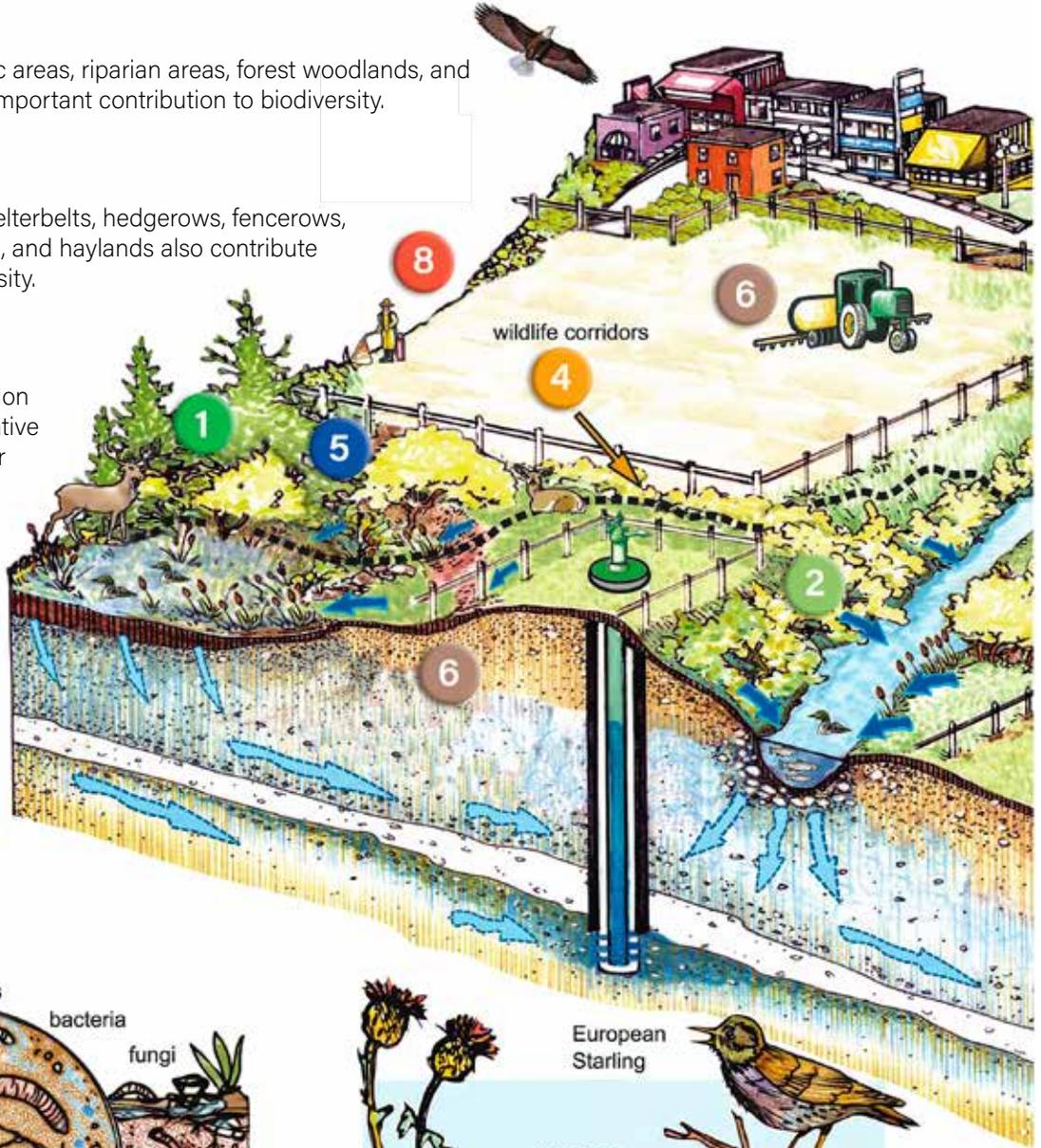
Semi-natural is Valuable

Semi-natural areas such as shelterbelts, hedgerows, fencerows, buffers, road margins, pastures, and haylands also contribute to the conservation of biodiversity.

PRINCIPLE 5

Achieving New Heights

Structural diversity – the variation in physical structure of both native vegetation and crops – on your land provides an important contribution to biodiversity.



PRINCIPLE 6

Healthy Ecosystem Wanted

The health of the soil and water influences the type and amount of biodiversity present.

PRINCIPLE 8

Watch Out for Aliens

Invasive alien species are generally detrimental to the conservation of biodiversity.

PRINCIPLE 3

Location, Location, Location

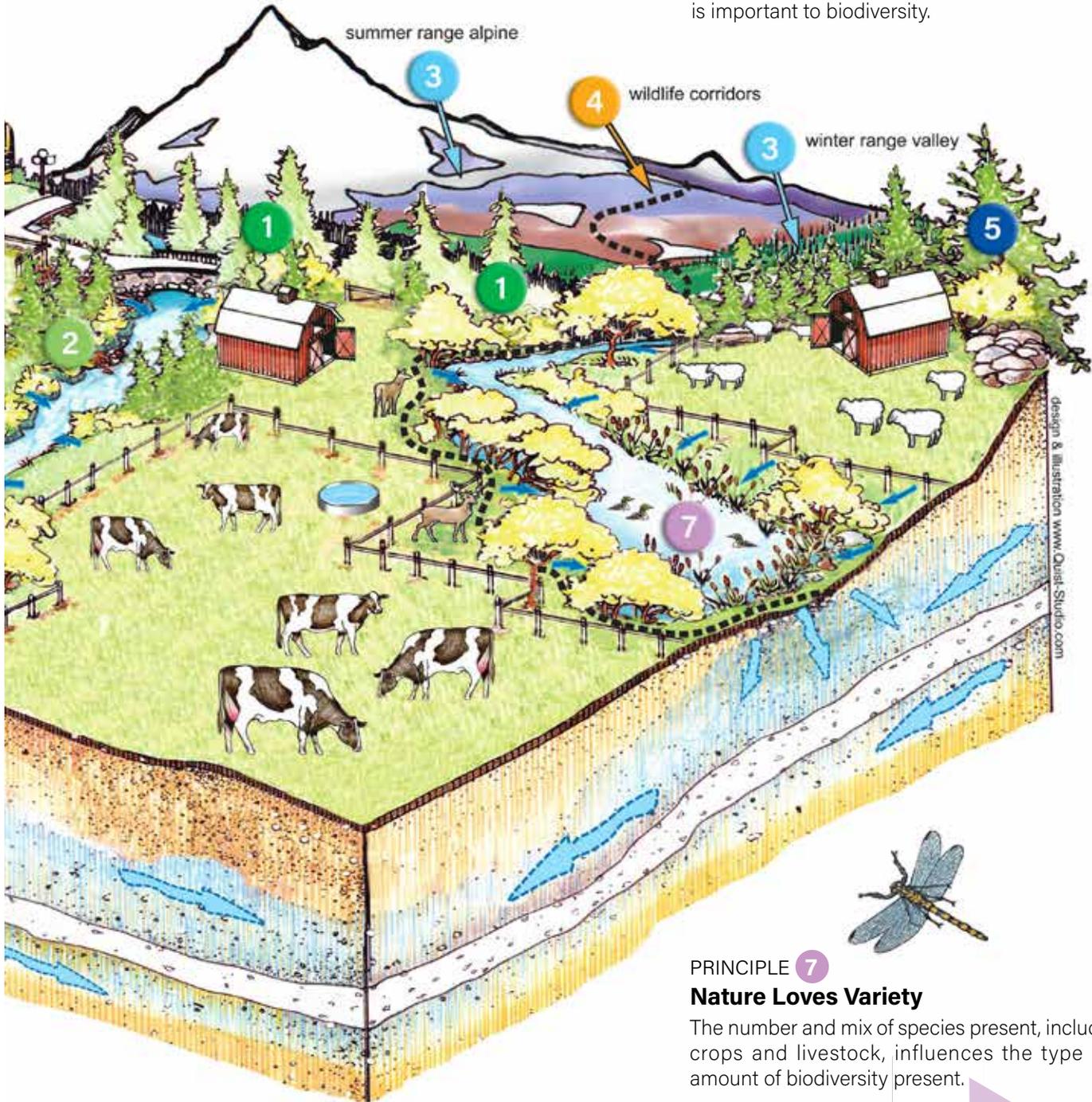
The location, pattern, and seasonal availability of habitat influences the type and amount of biodiversity present.



PRINCIPLE 4

You Gotta Have Connections

Connection between native and semi-natural areas on your land, and neighbouring landscapes, is important to biodiversity.



PRINCIPLE 7

Nature Loves Variety

The number and mix of species present, including crops and livestock, influences the type and amount of biodiversity present.

The loss of diversity puts the world's food and fiber supply at risk

90% of all plants and animals used for food were domesticated and/or cross bred originally from **wild stocks**

50% of the world's food consumed is from just **3** plant crops

96% of commercial vegetable varieties available in 1903 are **now extinct**

BIODIVERSITY PRINCIPLE 1: GO NATIVE

Native areas (wetlands, aquatic areas, riparian areas, forests/woodlands, and grasslands) provide the most important contribution to biodiversity on your land.

Native plants and animals have evolved over time in response to the physical and biological conditions of the areas in which they occur. As a result, they are uniquely adapted to local conditions. For example, native grasslands can be more drought resistant than tame pastures, and in low-input agriculture systems, locally adapted grasses often produce higher yields and are more resistant to pests than varieties that have been bred for high performance under optimal conditions. Native areas are also home to many unique plant and animal species which depend on these areas for food, shelter, reproduction, rest stops during migration, and refuge from predators.

Many producers have native areas on their farms or ranches and are often faced with the challenge of determining how much of their land to put into production and how much to leave as native land. In general, large areas of native habitat support more and/or different species than smaller areas. Once native areas are converted to the production of tame species or other land uses, it can be very difficult, time consuming, and costly to restore them to their native state.

What Can You Do?

- ▶ Maintain native areas, including riparian areas, wetlands and aquatic areas, forests, woodlands, and grasslands.
- ▶ Where possible, restore riparian areas, wetlands, forests, woodlands, and grasslands to their natural state by planting or encouraging the establishment of native species.
- ▶ Manage all native areas so that sensitive and rare plant and animal species continue to live there.
- ▶ Where possible, expand native areas.

DID YOU KNOW?

Grasslands cover less than 1% of BC's land base, but they provide habitat for more than 30% of the province's threatened or endangered species.

Grasslands Conservation Council of BC.
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[http://www.bcgrasslands.org/
thompsonportfolio.htm](http://www.bcgrasslands.org/thompsonportfolio.htm)



Aquatic and Riparian Habitat

BIODIVERSITY PRINCIPLE 2: SEMI-NATURAL IS VALUABLE

Semi-natural areas (e.g., shelterbelts, hedgerows, fencerows, pastures and haylands, buffers, road margins) also contribute to the conservation of biodiversity.

In general, the least altered areas of your farm and ranch have the highest potential for conserving biodiversity. However, other areas that contain non-native perennial vegetation or a mix of native and non-native plants can also be important to biodiversity. Uncropped areas can become naturalized and contribute to ecosystem functioning, especially where there is little available native habitat. For example, plantings of hybrid poplar trees in field margins or around farmsteads, and old tame pastures that have grown wild can provide food and shelter for native wildlife. They can also contribute to the ecosystem services that agriculture depends on by providing habitat for pollinating insects and species that help control pests.

Infrequently tilled cropland can also support large, diverse assemblages of soil organisms, which contribute to site productivity by cycling nutrients and maintaining soil structure and moisture. In addition, when legumes are part of the plant mix in a tame pasture, external nutrient inputs can be reduced, which saves money and reduces the risk of contamination. A mix of plants also increases a pasture's ability to meet livestock nutritional needs, and its ability to withstand diseases or pests.

Tame pastures can also be included in grazing rotations so that overall biodiversity benefits. They can provide an alternative forage source when native pastures are particularly sensitive or when they need to be rested to allow native plants to complete their reproductive cycles.

What Can You Do?

- ▶ Maintain or establish semi-natural shelterbelts, hedgerows, fencerows, pastures and haylands, buffers, and road margins.
- ▶ Where possible, restore areas by planting native species.
- ▶ Wherever possible, use native and locally adapted plant species that thrive under local conditions.
- ▶ Manage semi-natural areas so that sensitive and rare plant and animal species continue to live there.

DID YOU KNOW?

Ten percent of the soil-dwelling organisms found on a farm in southern England occurred only in the grassy margins surrounding cultivated fields.

Grassy Field Margins Enhance Soil Biodiversity. 2009.



Semi-natural Landscape

BIODIVERSITY PRINCIPLE 3: LOCATION, LOCATION, LOCATION

The location, pattern, and seasonal availability of habitat influences the type and amount of biodiversity present.

Location of Habitat

Location affects the physical and biological characteristics of a habitat, which in turn determines which species it can support. A single animal may need different types of habitat in different locations for finding food, water, shelter, and mates.

Some habitats support more species than others because of their location. For instance, riparian habitats, which are located next to water, generally support more species than habitats in dry areas. Valley bottoms tend to support more and different types of species than alpine areas, which can provide habitat for very specialized and often rare species. Habitats near urban areas generally support fewer species than agricultural lands or habitats in more remote, undeveloped areas.

In BC, agricultural regions have some of the highest levels of species richness in the province (see page 28). While areas of high species richness are important, farms and ranches located in areas of lower species richness can also play an important role in managing for biodiversity.



Big Bend, Vancouver

Patterns of Habitat

Pattern refers to the arrangement of habitats across the landscape. These patterns may occur at a fine scale, such as a cluster of small wetlands, or at a broad landscape scale, such as connected areas of forest that extend well beyond the farm.

Historically, native grassland, forest, wetland, and riparian habitats in BC covered large areas and were interconnected. However, urban and agricultural development, plus a variety of other factors have altered this natural pattern by reducing, fragmenting, and isolating many habitat types. This has changed the amount of available habitat for some native species and has affected their ability to move safely between areas. Taking action on the farm to protect and restore historical patterns of habitats can enhance biodiversity at both the farm and landscape scales. This will also help rebuild ecosystem functions.



Black Bear den
SALMON RIVER ROUNDTABLE

Seasonal Availability of Habitat

A particular habitat's importance to a species can vary throughout the year due to seasonal changes in the availability of food, water, and shelter. As a result, many species move between habitats at different times of the year to take advantage of locally abundant resources. For example, in autumn, salmon migrate from the ocean to rivers and streams to spawn. Because they congregate in these areas, they can become an abundant food source for other animals. As a result, bears, eagles, gulls, and other animals often move into these areas in the fall to feed.



Grizzly Bear (blue-listed)
TONY STEVENS PHOTO

Some habitats, such as small ponds used by amphibians for breeding, can disappear at certain times of the year and then reappear as the season changes. Retaining these types of seasonally available habitats is extremely important for maintaining biodiversity.

What Can You Do?

- ▶ Be aware of how habitats located on your property contribute to biodiversity.
- ▶ Consider the historical pattern of habitat when determining opportunities to protect and restore habitat on your farm.
- ▶ Protect and restore seasonally available habitat that is important to maintaining biodiversity.
- ▶ Plan the location of farm developments and cropping to account for biodiversity.



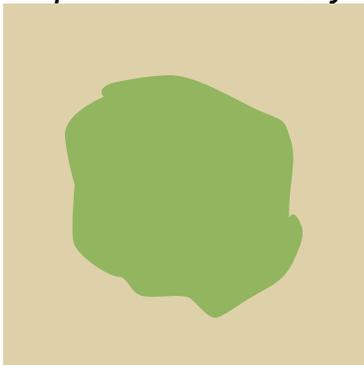
Bald Eagle
DAVE FRASER PHOTO



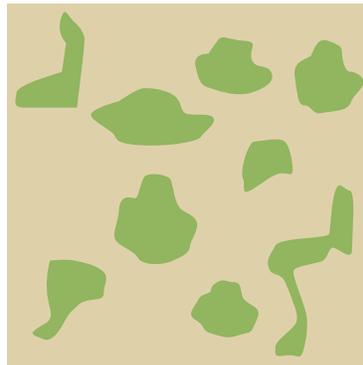
Salmon are an abundant food source for many animals
M. NAGA PHOTO

BIODIVERSITY PRINCIPLE 4: YOU GOTTA HAVE CONNECTIONS

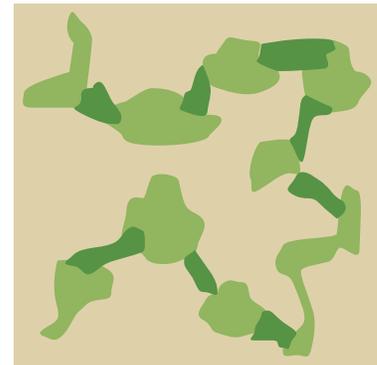
Connecting native and semi-natural areas on your land and with neighbouring landscapes is important to biodiversity.



Intact Habitat Patch



Scattered Habitat Patches



Connected Habitat Patches

Connecting individual patches of native and semi-natural land can improve habitat quality for plants and animals. A single, large block of grassland or forest generally supports more species than a similar area of small, isolated habitat patches. However, the value of those isolated patches can be greatly improved if they are connected by habitat corridors.

Uncultivated areas that connect patches of terrestrial habitat can be used as travel corridors by animals during migration, when searching for food and mates, and when young are dispersing. They also provide routes for pollen and seeds to spread. The most effective terrestrial corridors:

- ▶ are vegetated year round,
- ▶ do not present barriers to wildlife movement,
- ▶ are generally left undisturbed during times when wildlife use them,
- ▶ contain a diversity of plants of different heights and types, and
- ▶ are an appropriate width to provide shelter and escape routes from predators.



Connected forested habitat

Aquatic habitats that have become isolated by dams or other structures that impede water flow can be reconnected by:

- ▶ improving or constructing side-channels,
- ▶ deepening or lengthening groundwater-fed channels,
- ▶ removing pipes and culverts or installing a bridge, or
- ▶ restoring natural water flow in the channel.

Connecting native and semi-natural areas over landscapes much larger than an individual farm or ranch is especially important if the survival needs of certain native species are to be met. For example, wild ungulates, such as deer and elk, often migrate to different elevations during different seasons to find food, raise their young, and escape harsh weather conditions. This is particularly true in the large river valleys where much of BC's agricultural land is located. These valleys are among the most disrupted landscapes in Canada. As a result, connecting every piece of native habitat in these areas is critically important to native biodiversity.



Connected riparian habitat

MIKE WALLIS PHOTO

What Can You Do?

- ▶ Leave uncultivated land between habitat patches so natural infilling occurs.
- ▶ Join habitat patches by leaving or creating shelterbelts or hedgerows between them.
- ▶ Connect habitat patches by planting native vegetation between them.
- ▶ Work with your neighbours to join habitat patches across the landscape.

BIODIVERSITY PRINCIPLE 5: ACHIEVING NEW HEIGHTS

Structural diversity—the variation in physical structure of both native vegetation and crops—on your land provides an important contribution to biodiversity.

Maintaining a mix of vegetation layers, such as forbs, grasses, shrubs, and trees provides a diversity of habitats for birds, animals, and beneficial insects. Structural diversity is obvious where there is a mix of uncultivated areas, such as hedgerows, woodlands, and riparian areas. It is less obvious in native pastures, but it can be achieved by maintaining different heights of grasses, forbs, and woody vegetation, which can provide cover and breeding sites for native species.

What Can You Do?

- ▶ Establish and/or maintain a mix of forbs, grasses, shrubs, and trees on your land.
- ▶ Establish and/or maintain a mix of plant heights and age classes.



Grasses, shrubs, and trees provide structural diversity

BC MINISTRY OF FORESTS AND RANGE

BIODIVERSITY PRINCIPLE 6: HEALTHY ECOSYSTEMS WANTED

The health of native and semi-natural areas, all other farmland, and soil and water influences the type and amount of biodiversity present.

Healthy Ecosystems

Healthy ecosystems are the foundation of biodiversity. When ecosystems are healthy, they function effectively and efficiently in terms of building soils, storing and filtering water, storing and cycling nutrients, and regulating climate and the impacts of disturbances such as droughts and floods. All life forms in an ecosystem, and farms depend on one or more of these functions. For example, if a landscape does not provide sufficient water or appropriate soil quality to support the trees in which warblers nest, the birds are unlikely to occur in the area. As a result, they cannot help control local insect populations. The easiest way to conserve biodiversity is to create conditions in which the greatest variety of life can thrive – that is, create healthy landscapes.

In general, healthy ecosystems occur where there is:

- ▶ a diversity of plant and animal species;
- ▶ representatives of all land types and native plant communities that occur in the area;
- ▶ large areas of native vegetation;
- ▶ few areas of bare soil;
- ▶ minimal erosion;
- ▶ corridors and large areas of perennial cover;
- ▶ few weeds;
- ▶ productive plant communities;
- ▶ appropriate types and levels of disturbance, such as fire, flooding, and drought, which maintain natural landscape processes; and
- ▶ functioning riparian areas adjacent to waterbodies.

The intensity and timing of farming and ranching activities can have significant impacts on the health of ecosystems. Generally, when intensive agriculture is practiced and when the timing of activities does not take biodiversity into consideration, negative impacts on ecosystem health can be anticipated.

Healthy Soils

Soils store water, provide a substrate for plants, and support a variety of organisms. In fact, soil is a world teeming with life—plant roots, viruses, bacteria, fungi, algae, protozoa, mites, nematodes, worms, ants and other insects and their larvae (grubs), and larger animals. The number of living organisms below ground is often far greater than above ground. Soil organisms break down organic matter and release nutrients back into the soil, which plants then use. These and other natural processes help stabilize soils and improve soil structure, tilth, and productivity.



Healthy wetland ecosystem



Healthy woodland ecosystem

JARED HOBBS PHOTO



Soil profile

Soils can be particularly sensitive to the timing of equipment operations, forest harvesting, livestock grazing, and controlled burning. If these activities occur when soil moisture content is high, soil compaction can occur. This can lead to decreased soil aeration and moisture capacity, which affects the natural community of soil organisms and site productivity. It can also increase the risk of erosion. Generally, in both cultivated and grazed systems, maintaining a relatively stable upper soil layer, including thatch/residue, is critical to maintaining diverse and functioning soil communities. It also contributes to improved crop yields.

Clean Water

Clean water is free of excess nutrients, sediments, and other pollutants. It is needed to maintain viable populations of all life forms from the smallest organisms to fish, birds, large mammals, and human populations. Clean water is also critical for agricultural irrigation and for maintaining healthy soils, crops, and livestock.

What Can You Do?

- ▶ Minimize soil disturbances by appropriately managing tillage, grazing, and the development of roads, trails, and landings. Avoid grazing and harvesting when the ground is saturated (especially in riparian areas) or at times that may be stressful to tree seedlings and shrubs.
- ▶ Plant cover and relay crops to avoid soil erosion.
- ▶ Use production inputs appropriately to avoid disrupting soil biota and the natural functioning of soil and aquatic ecosystems. Use biological and physical methods to control pests, wherever possible.
- ▶ Manage your farm or ranch as a part of a functioning watershed or landscape by maintaining key ecological functions such as pollination, soil building, water filtration and storage, nutrient storing and cycling, erosion control, and organic matter decomposition.



Soil organisms



Clean water

TONY BROWN PHOTO

DID YOU KNOW

Beef cattle need 22–75 litres of clean water per head per day.

R.T. France and R.B. Haywood-Farmer. 1998. *Livestock Behaviour and Management*. Pages 92–107 in C.W. Campbell and A.H. Bawtree, eds. *Rangeland Handbook for B.C.* British Columbia Cattleman's Association, Kamloops, BC.

BIODIVERSITY PRINCIPLE 7: NATURE LOVES VARIETY

The number and mix of species present, including crops and livestock, influences the type and amount of biodiversity present.

Biodiversity not only includes the mix of species but also the genetic variety within species. Genetic variety has allowed for the selection of traits that are very important to agricultural production and products. It also contributes the adaptability of a species.

Biodiversity is a little like money in the bank. Higher levels of biodiversity are associated with proper landscape functioning, which generally leads to higher productivity and year-to-year stability in production. Higher levels of biodiversity can also provide more ecosystem services, such as pollination, soil fertility, water quality, pest control, and disease resistance.

Biodiversity on agricultural land includes all crops and livestock. Maintaining diverse varieties of livestock as well as annual and perennial crops helps ensure that agriculture remains sustainable under changing climatic, social, and economic conditions.



Crop variety

What Can You Do?

- ▶ Maintain a variety of plant species of different ages and heights in the native and semi-natural areas on your farm or ranch.
- ▶ Grow a variety of crops.
- ▶ Consider using agroforestry practices on your farm or ranch.
- ▶ Consider raising different varieties of livestock.
- ▶ Where possible and with great care, disturbance techniques (e.g., fire, grazing, flooding) that mimic natural disturbances may be used to rejuvenate soil and vegetation.

BIODIVERSITY PRINCIPLE 8: WATCH OUT FOR ALIENS

Invasive alien species are generally detrimental to the conservation of biodiversity.

Next to habitat loss, invasive alien species pose one of the greatest threats to biodiversity in BC and many other parts of the world. Invasive species include plants, animals, insects, and micro-organisms that are not native to a region but were introduced either accidentally or intentionally. They often out-compete native species for available resources and can reproduce prolifically. Because they usually arrive unaccompanied by their natural predators or competitors, they can be difficult to control. Left unchecked, many invasive species can transform ecosystems. Examples of invasive alien species in BC include Canada thistle, purple loosestrife, Japanese knotweed, quackgrass, yellow bush lupine, knapweed, yellow perch, the European Starling, and the American bullfrog.

Agricultural areas frequently provide opportunities for invasive species to establish. Alien weed species often invade disturbed sites, which occur during crop management or with heavy grazing. Once established, these species can be hard to control and can have profound impacts on production. Regional responses to invasive alien species are common in many agricultural areas. Controlling and eradicating invasive species is frequently a large challenge involving concerted effort among many people.

When managing for biodiversity, it is important to remember that not all species are considered equal. For example, the introduction of invasive fish species into local waterbodies can have severe impacts on native fish species such as trout and salmon. Also, starlings thrive in disturbed and fragmented landscapes, but they often out-compete native birds for nest sites. Management practices that support increased starling populations will not contribute to the general health of the overall landscape.

What Can You Do?

- ▶ Identify, control, and where possible and appropriate, eradicate invasive species. This can include maintaining healthy perennial cover and diverse native vegetation, minimizing the edge between disturbed areas (e.g., cultivated fields, roads and trails) and native habitats, or using domestic grazing animals to control weeds.
- ▶ Do not allow invasive fish species to gain access to waterbodies.
- ▶ Get assistance in developing management practices that foster desirable species and discourage undesirable ones.



*Field with
Oxeye Daisies and
Orange Hawkweed*



Toadflax

*Spotted
Knapweed*



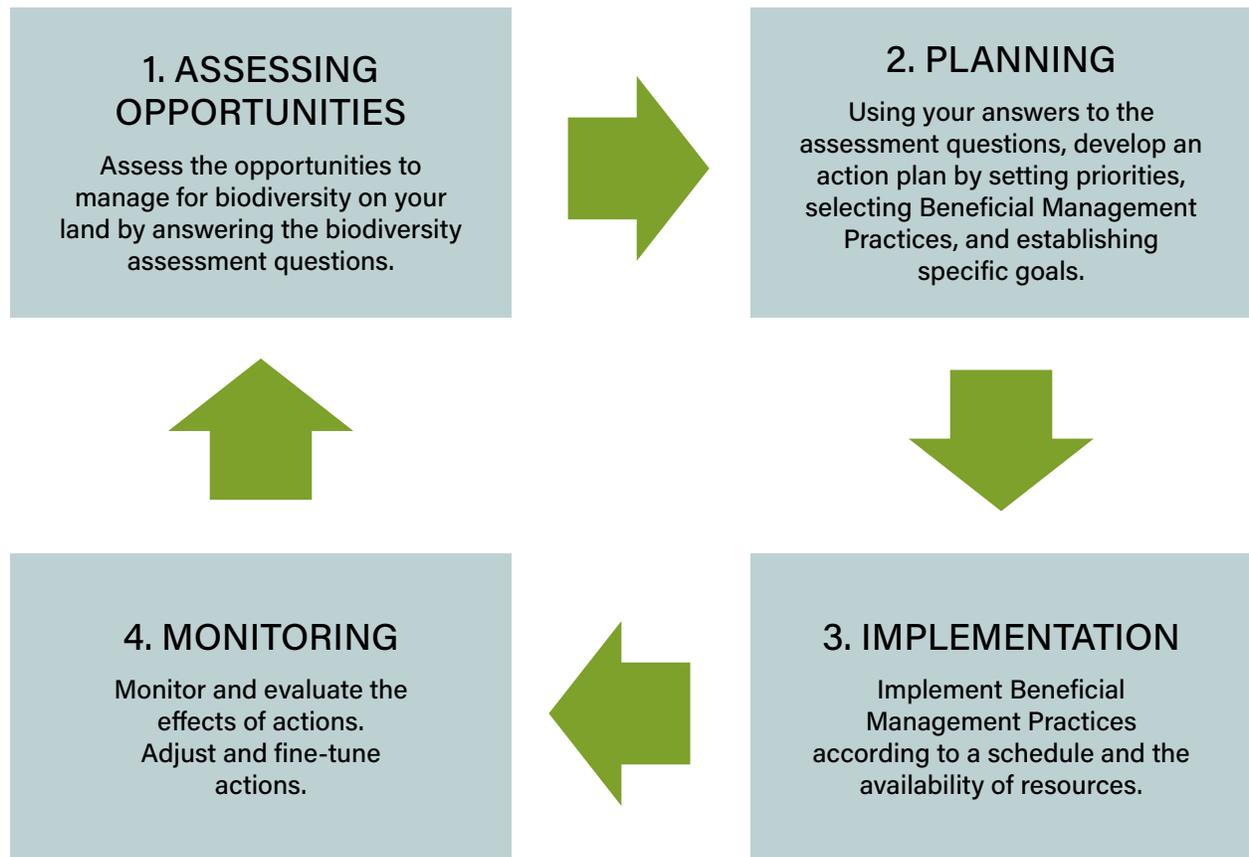
W.S. PRICE PHOTO

*American Bullfrog –
invasive alien species*

3 DEVELOPING A BIODIVERSITY MANAGEMENT PLAN

A FOUR-STEP ADAPTIVE MANAGEMENT PROCESS FOR DEVELOPING A PLAN

This section presents an adaptive management process that producers can use to develop a biodiversity plan for their farm or ranch. The process involves the following four steps, and can be completed by individuals or in collaboration with neighbours, local community organizations, or watershed groups.



Step 1: Assessing Opportunities

This step of the planning process includes 17 questions about ecosystems and other features on the farm, and 2 additional questions about areas beyond the farm. The answers to these questions will guide you in selecting appropriate Beneficial Management Practices (BMPs) to implement on your property. Because this guide is a general tool, not all the assessment questions will apply to all farming and ranching operations.

Step 2: Planning

Planning involves determining what your priorities are in terms of managing for biodiversity, selecting the BMPs that are most applicable to your operation, and then setting goals for what you wish to achieve by implementing the BMPs. The goals need to be specific and have measurable outcomes—for example, reduce the percentage of pastures that are infested with invasive plant species.

Step 3: Implementation

Prior to implementing the BMPs, determine if any special approvals or permits are required and if there are programs that can help you defray the costs of implementation. A schedule for implementing the BMPs also needs to be developed, and the results of your plan need to be documented.



Regulatory approvals
may be required.

Step 4: Monitoring

Monitoring involves collecting, recording, analyzing, and interpreting data on the state of your farm before any work is done and after your BMPs have been implemented. Taking photographs is a good way to record the implementation of your BMPs. Use a marker (steel post, marked fence post, or marked tree) so you can take photos from the same spot at about the same time every year. Record the date, location, and photo direction.

Monitoring will help you determine if your biodiversity goals are being met, or if they or your Biodiversity Management Plan needs to be modified. To be effective, monitoring must be repeated at regular intervals, under similar conditions, and at the same time each year. This provides data and images that are consistent and comparable among years, which will give you a sense of the trends and outcomes of your management activities over time.

These steps are collectively referred to as an adaptive management process because they allow you to continually improve your management practices. This is achieved by reviewing the monitoring results of the BMPs you implemented, assessing the effectiveness of your action plan in achieving your stated goals, re-assessing your opportunities for achieving any unmet goals, and refining your management activities accordingly. The process is repeated as long as improvements in your management system are needed or desired.

How Does the Process Link to the Biodiversity Principles?

You are encouraged to use your own knowledge along with the Biodiversity Principles to develop a plan that works for you. These principles cover most of the concepts that need to be considered when managing for biodiversity.

Where Can I Use This Process?

This process can be used on most agricultural operations in British Columbia.

STEP 1 - ASSESSING OPPORTUNITIES

This step allows you to assess the opportunities to manage for biodiversity on your farm or ranch.

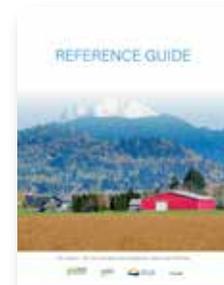
Preparation

The following materials will help you complete your assessment:

- ▶ a previously developed Environmental Farm Plan map
- ▶ a map of your property, which may include topographical, survey, or hand drawn maps; air photos, or orthophotos
- ▶ coloured pencils for marking the map
- ▶ a transparent grid overlay (optional)
- ▶ a blank Assessment Worksheet

Other resources you can draw upon include:

- ▶ your EFP Planning Advisor
- ▶ Ministry of Agriculture Agrologists
- ▶ local government websites or hard copy mapping services
- ▶ FrontCounter BC
- ▶ GeoGratis internet map site
- ▶ GoogleEarth
- ▶ Appendix C of *Develop With Care*
- ▶ habitat type maps, including online sensitive habitat (species at risk) mapping provided by the BC Conservation Data Centre
- ▶ regional habitat atlas resources as published online by the Community Mapping Network
- ▶ landscape features maps
- ▶ soils mapping
- ▶ cadastral maps
- ▶ topographic maps
- ▶ aerial photos
- ▶ historic photos and records
- ▶ regional mapping showing habitat connections or potential connections
- ▶ Fish Wizard mapping
- ▶ Hectares BC



Implemented EFP

BASIC PLAN STRUCTURE

The Biodiversity Plan consists of the following:

1. Background

Include a brief written account or mapping of:

- ▶ the location of your operation (including linkages from your farm/ranch to surrounding landscape features);
- ▶ your production systems;
- ▶ your management practices.

2. Habitat and Land Use Types

As applicable, identify the following features on your map:

- i. roads, driveways, buildings, equipment storage areas, corrals, feedlots, lawns, gardens, rock outcroppings
- ii. greenhouses and/or polyhouses
- iii. annual crops
- iv. cultivated (tame) perennial forage crops
- v. orchards, vineyards, tree farms
- vi. forest
- vii. native grasslands
- viii. aquatic features such as wetlands, ponds, ditches, streams, and lakes
- ix. riparian areas such as the margins of wetlands, ponds, ditches, streams, rivers, and lakes
- x. linear habitats such as windbreaks, hedgerows, uncultivated fencelines, ravines, gullies, and other corridors of native or semi-natural vegetation
- xi. any special features such as dens, burrows, nest sites, wildlife trees that you know of that may exist on your farm

Note: Fallow land should be mapped in the category that reflects its anticipated future use. On your map, estimate the portion of your farm represented by each of these categories (refer to Figure 6 as an example).

3. Ecological Information

- ▶ biogeoclimatic zones (general and detailed information, including a map)
- ▶ species at risk
- ▶ species richness/biodiversity index
- ▶ adjacent habitat types that provide or might provide biodiversity connections or corridors

Find the general location of your farm on Figure 4,
and note the species richness of your area on your map.

To learn if species at risk, threatened and endangered species (red-listed species), or species of conservation concern (blue-listed) occur on your property, contact your local Ministry of Environment office and/or go to the BC Conservation Data Centre iMap website:

<https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/known-locations-of-species-and-ecosystems-at-risk/cdc-imap-theme>

This mapping site allows you to find records of species at risk in your area.

The B.C. Conservation Data Centre database is dynamic and is based on best-known information. The addition and upkeep of records is an ongoing process with edits taking place on a daily basis. The BC Conservation Data Centre collects data from many sources. Not all the data are the result of comprehensive or site-specific field surveys and many areas in BC have never been thoroughly surveyed. The absence of occurrences does not necessarily mean that there are no species or ecosystems at risk present; only that there are none currently recorded in our database. A detailed assessment of the property conducted during the appropriate season is the only way to confirm presence or absence of species or ecosystems at risk.

4. Assessment Worksheet

5. Action Plan Worksheet

6. Monitoring plan and schedule

Content Considerations:

- ▶ Ensure all maps have a legend, a north arrow, and, as applicable, a geographical reference such as a road or watercourse.
- ▶ If possible, provide a scale on each map.
- ▶ Locate your farm on all maps, if possible.
- ▶ Include photos of your farm. They can highlight key biodiversity issues and can be used as photo points for tracking changes over time.
- ▶ Identify and include the species richness of your farm or ranch.
- ▶ Identify species at risk that may be present on your farm.
- ▶ Note any identified fish species and fish presence in watercourses.
- ▶ Include information on invasive species that are present, and available information on any invasive species that you think may become a problem on your farm in the future.

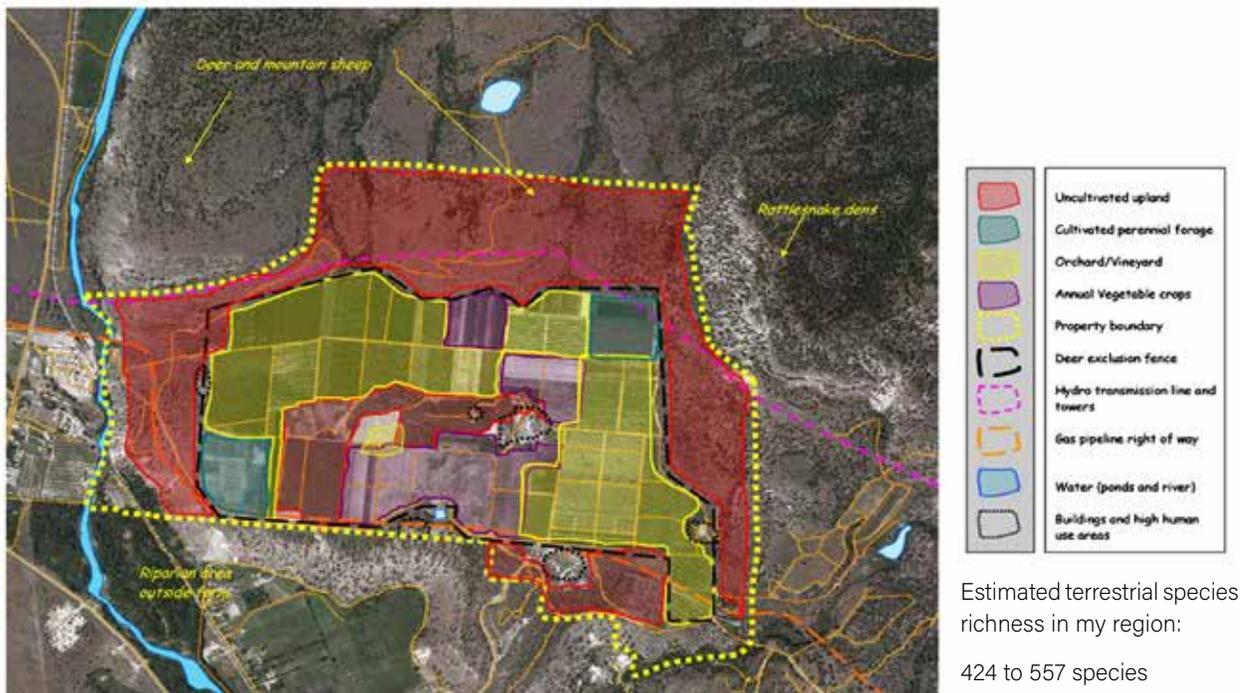


Figure 6 Example of a Completed Biodiversity Map

Sample Biodiversity Management Plans are included in the next section of the guide. A review of these plans can help you get a feel for what your plan will contain.

KEY CONSIDERATIONS WHEN ADDRESSING THE ASSESSMENT QUESTIONS

- Remember—retaining both natural and semi-natural habitat is likely the easiest and most effective way to maintain biodiversity on your farm. If you have maintained areas of either natural or semi-natural habitat on your farm, you have likely already achieved many biodiversity objectives.
- Many of the assessment questions refer to the opportunities to enhance areas of your farm. Enhancing includes all actions and management activities on the farm that *improve* existing habitat, *restore* lost habitat, or *create* new habitat where none existed previously.
- Enhancing habitat must be done with care and a good understanding of the objectives and risks involved. It is important to consult with technical authorities to ensure that the enhancement undertaken achieves the desired objectives and does not unexpectedly endanger existing biodiversity.
- Where an assessment question does not apply to your farm simply note it as not applicable in the notes column.

TABLE 1: ASSESSMENT QUESTIONS FOR DEVELOPING THE BIODIVERSITY PLAN

ASSESSMENT QUESTIONS ON THE FARM	
	RIPARIAN HABITAT
1	What are the opportunities to enhance the riparian habitat on your farm?
2	What are the opportunities to increase the connectedness of riparian habitat within your farm?
	AQUATIC AREAS, INCLUDING WETLANDS
3	What are the opportunities to enhance aquatic habitat on your farm?
4	What are the opportunities to increase the connectedness of aquatic habitat within your farm?
	FOREST AND WOODLANDS
5	What are the opportunities to enhance forest or woodland habitat on your farm?
6	What are the opportunities to increase the connectedness of forest or woodland habitat within your farm?
7	What are the opportunities to modify your forest management practices, including their intensity and/or timing, to benefit biodiversity?
	GRASSLANDS, SHRUBLANDS, AND NATIVE PASTURES
8	What are the opportunities to enhance grassland, shrubland, and native pasture habitats on your farm?
9	What are the opportunities to increase the connectedness of grassland, shrubland, and native pasture habitats within your farm?
10	What are the opportunities to modify your native pasture management practices, including their intensity and/or timing, to benefit biodiversity?
	WILDLIFE, INCLUDING KEYSTONE SPECIES AND SPECIES AT RISK
11	What are the opportunities to enhance habitat for wildlife, keystone species, and species at risk that may occur on your farm?
	INVASIVE AND NOXIOUS SPECIES
12	What are the opportunities to control invasive or noxious species on your farm?
	CROPS AND LIVESTOCK
13	What are the opportunities to enhance perennial crop areas on your farm to benefit biodiversity?
14	What are the opportunities to modify your farm management practices, including their intensity and/or timing, to benefit biodiversity?
15	What are the opportunities to increase the mix of crop and/or livestock species on your farm?
16	What are the opportunities to manage for soil biodiversity on your farm?
	CONFLICTS WITH WILDLIFE
17	What are the opportunities to minimize conflicts between agriculture and wildlife?
ASSESSMENT QUESTIONS BEYOND THE FARM	
18	What are the opportunities to increase the connectedness of habitat across neighbouring landscapes?
19	What are the opportunities for your farm to contribute to a regional biodiversity conservation initiative?

Assessment Opportunities

Four categories are used for answering the assessment questions:

Achieved

A review of your farming operation determines there is nothing more related to this question that can reasonably be done to manage for biodiversity. For example, the riparian area on your farm has been fenced to control livestock access, it supports a desirable mix of vegetation, and it has stable stream banks.

Some Opportunity

There are opportunities to enhance biodiversity on your farm either because of the activities you have already initiated or because of the features on your farm. For example, the riparian area on your farm has been fenced to control livestock access, but there is little riparian vegetation, and some stream bank erosion is still occurring.

Considerable Opportunity

There are some very important things you can do in response to this question that will help you manage for biodiversity. For example, the riparian area on your farm has not been fenced to control livestock access, there is no riparian vegetation present, and stream bank erosion is occurring.

Not Applicable

There are neither relevant features on your farm nor regional opportunities related to the question. For example, there are no riparian areas on your farm.

GENERAL PRINCIPLES FOR MANAGING HABITAT PATCHES:

- ▶ one large patch is better than many small patches;
- ▶ several patches close together are better than several patches far apart;
- ▶ a cluster of patches is better than a line of patches;
- ▶ a patch linked to another patch by a corridor of habitat generally is better than two isolated patches;
- ▶ a compact (circular) patch with a low ratio of edge to area is better than an elongated patch with a high ratio of edge to area.

N.F. Payne and F.C. Bryant. 1994 *Techniques for Wildlife Habitat Management of Uplands*. McGraw-Hill, New York.

First review the overall applicability of the question. If it is not applicable, check the "Not Applicable" box and move on to the next question. If the question is applicable, review each opportunity and tick the answer that corresponds most closely to your current situation. If the individual opportunity within the question is not applicable, make that comment in the notes column. It is important to note that the list of examples provided for each category is not exhaustive; it is only meant to help you identify the opportunities you have for managing for biodiversity. Check only one box for each biodiversity assessment opportunity in the tables below.

A sample plan has been included as a separate section in the guide to assist you in completing your plan.

“On the Farm” Assessment

The 17 questions for the “On the Farm” portion of the assessment provide an overview of your whole operation in relation to biodiversity. Use your map and background information to help answer the assessment questions.

The most important contribution you can make to biodiversity on your farm or ranch is to retain native and semi-natural areas, and the connections between them (*Biodiversity Principles 1–4*). On your map, Habitat and Land Use Type categories (i) to (xii) (Pages 58 and 59) cover all the native and semi-natural areas on your farm, including small and large patches and linear habitats (e.g., fencelines). The greater the size of these areas, the more connection there is between them, and how close they are to one another, all lead to a higher potential to retain biodiversity.

The next most important contribution you can make to biodiversity is to retain the natural ecosystem functions of the native and semi-natural areas on your property (*Biodiversity Principle 6*) and provide diversity, both in habitat structure and species of native and domestic plants and animals (*Biodiversity Principles 5, 7, and 8*).

“Beyond the Farm” Assessment

While it is important to manage for biodiversity on your farm, it is equally, if not more, important to consider how an individual farm can contribute to biodiversity on a larger regional scale. This is necessary because during their life cycle, many animals and plant seeds and pollen often move over large areas that extend well beyond the farm boundary. Facilitating the movement of species may also help them respond or adapt to stresses such as drought, fire, or disease. Meeting the needs of wide-ranging species requires management strategies that operate at the landscape scale. The 2 questions for the “Beyond the Farm” are part of an overview assessment that is intended to help you determine how your farming or ranching operation can contribute to managing for biodiversity on this larger scale.

RIPARIAN HABITAT



QUESTION 1

What are the opportunities to enhance the riparian habitat on your farm?

- ▶ Typically, riparian habitats are among the most productive and biologically diverse areas on any farm or ranch.

Regulatory approvals may be required.

Look for the following opportunities to enhance the riparian habitats on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no riparian habitats on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Riparian habitat is vegetated by a variety of healthy native plant species of differing structures and/or heights.	<input type="checkbox"/> Riparian habitat is vegetated but with a limited number of native plants species, and those present exhibit few differences in structure and/or height.	<input type="checkbox"/> Riparian habitat has few, if any, native plant species present, and those present exhibit minimal differences in structure and/or height.	
<input type="checkbox"/> No weed or invasive or noxious plant species are present in the riparian area.	<input type="checkbox"/> Weed species are present but there are no invasive or noxious plant species in the riparian area.	<input type="checkbox"/> There are significant populations of weed species and/or invasive and/or noxious plant species present in the riparian area.	
<input type="checkbox"/> There are no livestock in the riparian area, or livestock are managed in a way that protects the riparian area from damage.	<input type="checkbox"/> Livestock have some access to the riparian area and are damaging vegetation and/or bank stability.	<input type="checkbox"/> Livestock have uncontrolled access to the riparian area and are causing significant damage to native plants and bank stability.	
<input type="checkbox"/> Numerous wildlife species are present in the riparian area.	<input type="checkbox"/> Some wildlife species are present in the riparian area.	<input type="checkbox"/> Wildlife species are rarely seen in the riparian area.	
<input type="checkbox"/> Machinery is not used in the riparian area.	<input type="checkbox"/> Machinery is sometimes used in the riparian area.	<input type="checkbox"/> Machinery is frequently used in the riparian area.	
<input type="checkbox"/> Roads and/or crops are located well away from riparian areas.	<input type="checkbox"/> Roads and/or perennial crops are set back a moderate distance from riparian areas.	<input type="checkbox"/> Roads and annual crops are located very near riparian areas.	

QUESTION 2

What are the opportunities to increase the connectedness of riparian habitat within your farm?

- ▶ Connecting riparian areas may be the best way to increase habitat connections on your farm.

Regulatory approvals may be required.

Look for opportunities to increase the connectedness of riparian habitat on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no opportunities to increase the connectedness of riparian habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> There are riparian areas on your land that are already connected to other habitat, and they provide a travel corridor for wildlife.	<input type="checkbox"/> There is one riparian area on your farm, but there are patches of other native or semi-natural areas that could be connected to it.	<input type="checkbox"/> There are several unconnected riparian areas on your land that are close together and could be connected.	



AQUATIC AREAS, INCLUDING WETLANDS



QUESTION 3

What are the opportunities to enhance aquatic habitat on your farm?

- ▶ Enhancing aquatic habitat can make significant contributions to biodiversity.

Regulatory approvals may be required.

Look for opportunities to enhance aquatic habitat on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There is no aquatic habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Aquatic habitat on your farm has been maintained, enhanced, and/or created, and is healthy.	<input type="checkbox"/> Some aquatic habitat can be enhanced by improving water storage, restoring previously drained wetlands, and/or improving water management.	<input type="checkbox"/> Large areas of aquatic habitat can be readily enhanced by improving water storage, restoring previously drained wetlands, and/or improving water management.	
<input type="checkbox"/> Banks of watercourses, including wetlands, are intact and not slumping, compacted, or eroded.	<input type="checkbox"/> There are some slumping, compacted, or eroded watercourse banks.	<input type="checkbox"/> Banks of watercourses show significant slumping, compaction, and/or erosion.	
<input type="checkbox"/> Watercourses have a mature canopy of vegetation cover, which moderates water temperatures.	<input type="checkbox"/> Watercourses have some vegetation cover.	<input type="checkbox"/> Watercourses have no vegetation cover.	
<input type="checkbox"/> There are no livestock present or livestock access to aquatic habitat is controlled, and buffers have been established.	<input type="checkbox"/> Livestock access to aquatic habitat can be controlled, and buffers can be enhanced.	<input type="checkbox"/> There is significant livestock access to aquatic habitat that is causing damage, and the use of buffers is limited.	
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Where possible, aquatic habitat has been enhanced by developing off-channel habitat within the floodplain.	<input type="checkbox"/> There are some opportunities to enhance aquatic habitat by developing off-channel habitat within the floodplain.	<input type="checkbox"/> There are significant opportunities to enhance aquatic habitat by developing off-channel habitat within the floodplain.	
<input type="checkbox"/> Watercourses are able to overflow their banks during high water and access the historic floodplain.	<input type="checkbox"/> Watercourses are able to overflow some of their banks during high water but can not access all of the historic floodplain.	<input type="checkbox"/> Watercourses are not able to overflow their banks during high water or access the historic floodplain.	
<input type="checkbox"/> Aquatic habitats are protected from farming impacts.	<input type="checkbox"/> Some areas of aquatic habitat could benefit from improved farm management practices.	<input type="checkbox"/> Several or large areas of aquatic habitat could benefit from improved farm management practices.	
<input type="checkbox"/> Aquatic habitats are not receiving pollutants and sedimentation from your farm.	<input type="checkbox"/> Aquatic habitats show some evidence of sedimentation and pollutants coming from your farm.	<input type="checkbox"/> Aquatic habitats show extensive evidence of sedimentation and/or pollutants coming from your farm.	

QUESTION 4

What are the opportunities to increase the connectedness of aquatic habitat within your farm?



Regulatory approvals may be required.

- ▶ Connecting aquatic habitats, particularly to larger systems, can significantly increase habitat value.
- ▶ Connecting aquatic habitats can also bring incompatible aquatic species into contact with one another. It is very important to get advice from technical experts and agencies on your proposed plans before you begin any work of this nature.

Look for opportunities to increase the connectedness of aquatic habitat on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no opportunities to increase the connectedness of aquatic habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Connections between aquatic habitats exist or have been restored.	<input type="checkbox"/> There are few natural or modified aquatic areas (a short drainage ditch or section of channelized stream) that can be relocated and/or restructured to become connected to a more natural functioning area.	<input type="checkbox"/> There are several natural or modified aquatic areas (a long drainage ditch or channelized stream) that can be relocated and/or restructured to become connected to more natural functioning areas.	
<input type="checkbox"/> There is a network of habitats, such as riparian areas, woodlands, hedgerows, fencerows, or uncultivated areas that connect the aquatic areas on your farm.	<input type="checkbox"/> There is an aquatic area on your farm, and there are patches of other native or semi-natural areas that could be connected to it.	<input type="checkbox"/> There are several unconnected aquatic areas on your land that are close together and could be connected.	
<input type="checkbox"/> There are no existing structures such as a dykes, dams, or closed culverts on your property that impair fish passage.	<input type="checkbox"/> There is an existing structure such as a dyke, dam, or closed culvert on your property.	<input type="checkbox"/> There are existing structures such as a dykes, dams, or closed culverts on your property.	

FOREST AND WOODLANDS

QUESTION 5

What are the opportunities to enhance forested or woodland habitat on your farm?

- ▶ Sizeable patches of forest provide interior core habitat that supports a wide range of biodiversity values. In large patches, the interior core is buffered from edge effects associated with differences in microclimates and with agricultural activities, such as cultivation and crop management. Enhancing existing forest and woodland areas by increasing their size can enhance the size and integrity of the interior core and protect it from edge effects.

Look for the opportunities to enhance the forested or woodland habitat on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There is no opportunity to enhance forested or woodland habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Forests and woodlands are either in a natural state or are managed sustainably.	<input type="checkbox"/> Forests and woodlands could be managed in a more sustainable manner.	<input type="checkbox"/> Forests and woodlands are not managed for sustainability.	
<input type="checkbox"/> Forests and woodlands on your land have a diverse and healthy understory (grasses, forbs, and shrubs) with good structural diversity.	<input type="checkbox"/> Forests and woodlands on your land have some understory (grasses, forbs, and shrubs), but it is not well established or has limited structural diversity.	<input type="checkbox"/> Forests and woodlands on your farm have little or no understory (grasses, forbs, shrubs) due to grazing or forest management activities.	
<input type="checkbox"/> Livestock do not graze in the forest or the grazing is managed to minimize impacts on biodiversity.	<input type="checkbox"/> Livestock do graze in the forest and grazing has some impacts on biodiversity.	<input type="checkbox"/> Livestock do graze in the forest and grazing is unmanaged.	
<input type="checkbox"/> Forests and woodlands have a diversity of native plant species.	<input type="checkbox"/> Forest and woodland plant diversity could be enhanced by planting native species.	<input type="checkbox"/> Forest and woodland plant diversity could be enhanced considerably through natural regeneration or by planting a variety of native species.	
<input type="checkbox"/> There are few weeds and/or invasive plant species in your forest, and they are controlled.	<input type="checkbox"/> Weeds and/or invasive plant species are present in your forest and may be competing with forest species.	<input type="checkbox"/> Weeds and/or invasive plant species are common in your forest but can be controlled.	
<input type="checkbox"/> Many wildlife trees/snags and coarse woody debris are present and are protected during harvesting.	<input type="checkbox"/> Some wildlife trees/snags and coarse woody debris are present and are protected during harvesting activities.	<input type="checkbox"/> No wildlife trees/snags or coarse woody debris are present or are not protected during harvesting.	
<input type="checkbox"/> Numerous wildlife species are present in the forested areas on your farm.	<input type="checkbox"/> Some wildlife species are present in the forested areas on your farm.	<input type="checkbox"/> Wildlife is rarely seen in the forested areas on your farm.	
<input type="checkbox"/> Your forests and woodlands include many non-timber forest products which provide species diversity.	<input type="checkbox"/> Your forests and woodlands include some non-timber forest products.	<input type="checkbox"/> Your forests and woodlands include few if any non-timber forest products.	

QUESTION 6

What are the opportunities to increase the connectedness of forest and woodland habitat within your farm?

- ▶ Patches of habitat that are connected by perennial vegetation provide much higher quality habitat for plants and animals than isolated patches.

Look for opportunities to increase the connectedness of forested or woodland habitat on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no patches of forest/woodland on your farm, or there is only one patch with no opportunity to connect it to native habitat.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> All forested areas are connected by uncultivated land, shelterbelts, hedgerows, wooded fencerows, and/or riparian corridors.	<input type="checkbox"/> There are a few patches of forested areas that are far apart but they could be connected.	<input type="checkbox"/> There are multiple patches of forested areas close together that could be connected.	

QUESTION 7

What are the opportunities to modify your forest management practices, including their intensity and/or timing, to benefit biodiversity?

- Forestry practices modify habitat structure and composition. The intensity and timing of these changes may have positive or negative effects on biodiversity from the stand to the landscape scale.

Look for the following opportunities to modify your forest management practices on your farm, including their intensity or timing, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no forest lands present on your farm, forest lands have been left in a native state, or there are no activities that need to be modified.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Forestry operations maintain native plant species.	<input type="checkbox"/> Forestry operations maintain some native plant species.	<input type="checkbox"/> Forestry operations do not maintain native plant species.	
<input type="checkbox"/> Forestry operations maintain structural diversity.	<input type="checkbox"/> Forestry operations maintain some structural diversity.	<input type="checkbox"/> Forestry operations do not maintain native structural diversity.	
<input type="checkbox"/> Forest regeneration includes a variety of locally adapted tree species.	<input type="checkbox"/> Forest regeneration includes a few locally adapted tree species.	<input type="checkbox"/> Forest regeneration does not include locally adapted tree species.	
<input type="checkbox"/> Forestry activities that use heavy equipment occur in winter or at other times when soil impacts can be minimized.	<input type="checkbox"/> Forestry activities that use heavy equipment are limited during periods when soils are wet.	<input type="checkbox"/> Soil conditions are not taken into account when heavy equipment is used in the forest.	
<input type="checkbox"/> The timing and intensity of harvesting trees and/or non-timber forest products is managed to allow desired plants to successfully set seed or reproduce vegetatively.	<input type="checkbox"/> The timing and intensity of harvesting trees and/or non-timber forest products is sometimes managed to allow desired plants to successfully set seed or reproduce vegetatively.	<input type="checkbox"/> The timing and intensity of harvesting trees and non-timber forest products is not timed to allow desired plants to successfully set seed or reproduce vegetatively.	
<input type="checkbox"/> Livestock grazing is scheduled to allow desired plants to successfully set seed or reproduce vegetatively.	<input type="checkbox"/> Livestock grazing could be better managed to allow desired plants to successfully set seed or reproduce vegetatively.	<input type="checkbox"/> Livestock grazing can be managed to allow grass, forb, and shrub layers to regenerate and new tree seedlings to reach a size where they cannot be damaged or killed by browsing.	
<input type="checkbox"/> All forest and grazing management activities are timed to avoid sensitive periods in the life cycles of native wildlife species, such as breeding, nesting, and denning.	<input type="checkbox"/> Some forest and grazing management activities are timed to avoid sensitive periods in the life cycles of native wildlife species.	<input type="checkbox"/> Life cycles of local wildlife are not known, and management activities are not timed to avoid sensitive periods in the life cycles of native wildlife species.	

Achieved	Some Opportunity	Considerable Opportunity	Notes
<p>❑ Livestock do not graze in forested areas, or grazing and browsing is managed such that structural layers, species composition, health, and vigour of the understory vegetation is well maintained.</p>	<p>❑ Livestock graze in forested areas, and grazing and browsing has caused some changes to structural layers, species composition, health, and vigour of the understory vegetation.</p>	<p>❑ Livestock graze in forested areas, and grazing and browsing has caused extensive changes to structural layers, species composition, health, and vigour of the understory vegetation.</p>	
<p>❑ Both large and small woody debris is maintained on the forest floor.</p>	<p>❑ No large woody debris is maintained on the forest floor.</p>	<p>❑ No woody debris is maintained on the forest floor.</p>	
<p>❑ Forest roads are developed and maintained in a way that minimizes impacts to biodiversity.</p>	<p>❑ Forest roads are developed and maintained in a way that does not fully minimize impacts to biodiversity.</p>	<p>❑ The placement and maintenance of forest roads does not take into consideration impacts to biodiversity.</p>	

GRASSLANDS, SHRUBLANDS, AND NATIVE PASTURE

QUESTION 8

What are the opportunities to enhance grassland, shrubland, and native pasture habitats on your farm?

- ▶ Healthy and biologically diverse native grasslands, shrublands, and pastures are resistant to drought, pests, and invasion by invasive or noxious species. With proper management, these areas can preserve biodiversity while providing high-quality forage with minimal external inputs.

Look for opportunities to enhance grassland, shrubland, and native pasture habitats on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no grasslands, shrublands, or native pastures on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Grazing is managed to optimize production and maintain biodiversity.	<input type="checkbox"/> Grazing is managed but production and the maintenance of biodiversity is not optimized.	<input type="checkbox"/> Grazing is not managed.	
<input type="checkbox"/> There are many varieties of native plants species, including shrubs, in your native pasture.	<input type="checkbox"/> There are few native plants species, including shrubs, in your native pasture.	<input type="checkbox"/> There are no native plants species, including shrubs, in your native pasture.	
<input type="checkbox"/> Native pastures on your land have a diversity of vegetation structure with different heights of grasses, forbs, and shrubs.	<input type="checkbox"/> Native pastures on your land have some diversity of vegetation structure.	<input type="checkbox"/> Native pastures on your land have little diversity of vegetation structure.	
<input type="checkbox"/> There are no bare, trampled, or eroded areas in your native pastures.	<input type="checkbox"/> There are a few bare, trampled, or eroded areas in your native pastures.	<input type="checkbox"/> There are extensive bare, trampled, or eroded areas in your native pastures.	
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> There are few weeds and/or invasive plant species, and they are controlled.	<input type="checkbox"/> Weeds and/or invasive plant species are present and may be out-competing native plants.	<input type="checkbox"/> Weeds and/or invasive plant species are common but can be controlled.	
<input type="checkbox"/> Plant litter is present.	<input type="checkbox"/> Plant litter is minimal.	<input type="checkbox"/> Plant litter is lacking.	
<input type="checkbox"/> All marginal and erodable lands are in perennial cover.	<input type="checkbox"/> Most marginal and erodable lands are in perennial cover.	<input type="checkbox"/> Marginal and erodable lands are in annual crop production.	
<input type="checkbox"/> There is limited ingrowth of trees on your native pastures.	<input type="checkbox"/> Ingrowth of trees on native pastures is affecting the variety of species present.	<input type="checkbox"/> Ingrowth of trees is significantly limiting the variety of species present.	

QUESTION 9

What are the opportunities to increase the connectedness of grassland, shrubland, and native pasture habitats within your farm?

- ▶ The biodiversity value of grasslands, shrublands, and native pastures increases significantly when they are connected to other native or semi-natural areas.

Look for opportunities to increase the connectedness of the grassland, shrubland, and native pasture habitats on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no native grasslands, shrublands, or native pastures on your farm, or there is only one patch of such habitat and no opportunity to connect it to other native or semi-natural habitat.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> There are two or more patches of grassland/shrubland/native pasture, and they are joined.	<input type="checkbox"/> There is only one patch of grassland/shrubland/native pasture present but there are patches of other native or semi-natural areas (e.g., forest or riparian areas) that could be connected to it.	<input type="checkbox"/> There are two or more patches of grassland/shrubland/native pasture close together, and they could be joined.	

QUESTION 10

What are the opportunities to modify your native pasture management practices, including their intensity and/or timing, to benefit biodiversity?

- ▶ Managed grazing maintains healthier and more productive plants.
- ▶ Managing grazing frequency and intensity helps increase soil stability and moisture retention, and limits the occurrence and numbers of invasive plant species.

Look for opportunities to modify native pasture management practices on your farm, including timing and intensity, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There is no native pasture on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> The intensity and timing of livestock grazing is managed so that plants have sufficient resources and time to respond to grazing and can sustain themselves in the plant community.	<input type="checkbox"/> Intensity and timing of livestock grazing is based on a calendar schedule rather than on observing how much plants have grown/regrown or how much leaf material has been consumed.	<input type="checkbox"/> Grazing intensity and timing is not managed.	
<input type="checkbox"/> Livestock are moved among pastures in a different pattern and order each year.	<input type="checkbox"/> Livestock are moved among pastures but in the same pattern and order each year.	<input type="checkbox"/> Livestock are not moved among pastures.	
<input type="checkbox"/> Grazing occurs when invasive plant species are most susceptible so that their seed dispersal is minimized.	<input type="checkbox"/> Grazing occurs when invasive plant species are somewhat susceptible so that their seed dispersal is significant.	<input type="checkbox"/> The timing of grazing does not take invasive plant species management into account.	
<input type="checkbox"/> Timing of grazing takes soil moisture condition into account.	<input type="checkbox"/> Timing of grazing sometimes takes soil moisture condition in account.	<input type="checkbox"/> Timing of grazing does not take soil moisture conditions into consideration, but it could be.	
<input type="checkbox"/> Grazing of native pastures occurs when plants (including their leaves and roots) have fully recovered from previous grazing events.	<input type="checkbox"/> Sometimes grazing of native pastures includes periods of effective rest.	<input type="checkbox"/> Grazing of native pastures does not provide effective rest periods for plants (including their leaves and roots) to fully recover from previous grazing events.	

Achieved	Some Opportunity	Considerable Opportunity	Notes
<ul style="list-style-type: none"> <input type="checkbox"/> Livestock distribution within pastures is well managed and maximizes success of desirable plant species, applies pressure on invasive plant species, and promotes vegetation conditions that are preferred by local wildlife. 	<ul style="list-style-type: none"> <input type="checkbox"/> Livestock distribution within pastures is managed but could be improved. 	<ul style="list-style-type: none"> <input type="checkbox"/> Livestock distribution within pastures is not managed. 	
<ul style="list-style-type: none"> <input type="checkbox"/> Intensity and timing of livestock browsing of woody species is monitored, and heavy or repeated browsing is avoided. 	<ul style="list-style-type: none"> <input type="checkbox"/> Livestock are moved based on forage consumption, but the focus has been on grasses and forbs; more attention could be paid to woody species. 	<ul style="list-style-type: none"> <input type="checkbox"/> Browsing occurs but there is no specific management to prevent repeated heavy use of woody species. 	
<ul style="list-style-type: none"> <input type="checkbox"/> Haying and mowing are avoided in the evening when wildlife are bedded down. 	<ul style="list-style-type: none"> <input type="checkbox"/> Haying and mowing are sometimes undertaken at night. 	<ul style="list-style-type: none"> <input type="checkbox"/> Haying and mowing are undertaken at night with no consideration given to minimizing impacts on wildlife. 	
<ul style="list-style-type: none"> <input type="checkbox"/> Seeding is timed to reduce wildlife disturbance during the breeding season. 	<ul style="list-style-type: none"> <input type="checkbox"/> Seeding is sometimes timed to reduce wildlife disturbance during the breeding season. 	<ul style="list-style-type: none"> <input type="checkbox"/> Seeding is rarely timed to reduce wildlife disturbance. 	
<ul style="list-style-type: none"> <input type="checkbox"/> Grazing management activities are timed to avoid sensitive periods in the life cycles of local native wildlife species, such as breeding, nesting, and denning. 	<ul style="list-style-type: none"> <input type="checkbox"/> Some grazing management activities are timed to avoid sensitive periods in the life cycles of native wildlife species. 	<ul style="list-style-type: none"> <input type="checkbox"/> Life cycles of local wildlife are not known; therefore, grazing management activities may not be timed to avoid sensitive periods in the life cycles of native wildlife species. 	

WILDLIFE, INCLUDING KEYSTONE SPECIES AND SPECIES AT RISK

QUESTION 11

What are the opportunities to manage habitat for wildlife, particularly keystone species, and species at risk (SAR) habitat that may occur on your farm?

- ▶ If you have a keystone species or a species at risk on your property, it is likely that there is also habitat supporting other species on your farm. It is worth noting, however, that the mere presence of these species does not necessarily mean that the habitat overall is being optimally managed, as it may be part of a wider network of critical habitat. Opportunities to improve habitat management may still exist.
- ▶ If you suspect, but are unsure, that you have keystone species or SAR (or habitat for these species) on your property, the opportunities provided in this assessment question may also apply to you.
- ▶ You may not actually observe SAR on your farm because some species are very small, secretive, cryptically coloured, or active mainly at night; however, your property may contain specialized habitat features that these species use. These could include wildlife trees/snags, riparian areas, snake dens, creeks, or cliffs. Such features are important to protect because they may be quite rare in the surrounding landscape.

Look for opportunities to retain or enhance habitat for wildlife. Keystone species and species at risk are of particular value for biodiversity management. Determine if these species may be present on your farm, and then determine the appropriate practices to manage and enhance their habitat.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no records of species at risk for your area. Wildlife species, including keystone species and species at risk, are well represented on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Species at risk are seen regularly on your property, and your farm has specific habitats or habitat features that support these species.	<input type="checkbox"/> There are historical records or there have been occasional sightings of species at risk in your area or on your property, but further habitat enhancement is needed to recover the species' habitat or habitat features.	<input type="checkbox"/> Species at risk have been observed in your area or on your property in the past and are known to use specific habitats or habitat features, which you can retain and/or enhance.	
<input type="checkbox"/> Keystone species occur on your property, and their habitat is protected and/or maintained.	<input type="checkbox"/> It is suspected that there may be keystone species on your property as there are others that occur in surrounding habitats similar to those found on your farm.	<input type="checkbox"/> There are no keystone species on your property but they occur in surrounding habitats similar to those found on your farm.	
<input type="checkbox"/> Opportunities to enhance wildlife habitat, diversity, and population levels have been identified and implemented.	<input type="checkbox"/> There are some opportunities to enhance wildlife habitat, diversity, and population levels generally on the farm.	<input type="checkbox"/> There are numerous opportunities to enhance wildlife habitat, diversity, and population levels on the farm.	

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Opportunities to set aside (protect and maintain) natural and semi-natural habitat for wildlife have been identified and implemented.	<input type="checkbox"/> Some areas, including connectivity corridors, of natural and semi-natural habitat exist on the farm which can be set aside (protected and maintained) for wildlife, without overly compromising agricultural activities.	<input type="checkbox"/> Many areas, including connectivity corridors, of natural and semi-natural habitat exist on the farm, which can be set aside (protected and maintained) for wildlife, without overly compromising agricultural activities.	
<input type="checkbox"/> Several farm practices have been implemented to support biodiversity, including agriculturally-beneficial species (e.g. pollinators), without overly compromising agricultural activities.	<input type="checkbox"/> Some farm practices have been implemented to support biodiversity, including agriculturally beneficial species.	<input type="checkbox"/> No farm practices have been implemented to support biodiversity, including agriculturally beneficial species.	
<input type="checkbox"/> Farming activities are planned and conducted in a manner that attempts to avoid wildlife disturbance, injury, or death by conducting such activities during times of day, or times of the year, that minimize disturbances to these species.	<input type="checkbox"/> Farming activities are sometimes, but not always, planned or conducted in a manner that attempts to avoid wildlife disturbance, injury, or death.	<input type="checkbox"/> Disturbance, injury, or death of wildlife is not considered when planning or undertaking farming activities.	

INVASIVE AND NOXIOUS SPECIES

QUESTION 12

What are the opportunities to control invasive and noxious species on your farm?

- ▶ Non-native plants, animals, and micro-organisms can spread and cause serious and often irreversible damage to Canada's ecosystems, economy, and society.

Look for opportunities to control both terrestrial and aquatic invasive and noxious species on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no invasive and noxious species on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> There are few invasive and noxious species on your farm, and they are controlled with the objective of eradicating them.	<input type="checkbox"/> You can minimize the occurrence of invasive and noxious species on your farm, but eliminating them is a major challenge.	<input type="checkbox"/> You may be able to significantly reduce or eliminate invasive and noxious species on your farm.	

CROPS AND LIVESTOCK

QUESTION 13

What are the opportunities to enhance perennial crop areas on your farm to benefit biodiversity?

- ▶ Perennial crop areas include tame pastures, vineyards, orchards, and other long-term crops. These areas are not the equivalent of native areas, but they contribute to biodiversity.
- ▶ Conversion of annual cropped areas to perennial crop areas can increase biodiversity by improving soil condition and creating more diverse habitats.
- ▶ Consideration of the life cycle of wildlife species within perennial crop areas, and timing of farm activities, such as mowing, spraying, pruning, application of fertilizers and manure, so that they have the least impact to wildlife species can make an important contribution to biodiversity.

Look for opportunities to enhance perennial crop areas on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no perennial cropping opportunities on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Perennial crop areas are a significant component of your farm.	<input type="checkbox"/> Some perennial crop areas occur on your farm, but there is opportunity to convert additional areas from annual crops to perennial.	<input type="checkbox"/> There are limited areas of perennial crops and annual crops provide the only cover on your farm.	
<input type="checkbox"/> Perennial crop areas are maintained in a healthy state, which minimizes the need for rejuvenation.	<input type="checkbox"/> Perennial crop areas are not well maintained and require rejuvenation.	<input type="checkbox"/> Perennial crop areas are not well maintained and require frequent rejuvenation.	
<input type="checkbox"/> Alternate pastures are used to reduce pressure on native pastures at critical times.	<input type="checkbox"/> Alternate pastures could be used to reduce pressure on native pastures at critical times.	<input type="checkbox"/> It is possible to access additional grazing lands and reduce pressure on native pastures at critical times.	

QUESTION 14

What are the opportunities to modify your farm management practices, including their intensity and/or timing, to benefit biodiversity?

- ▶ Minimizing pollution is essential to supporting biodiversity in terrestrial and aquatic habitats.
- ▶ Intensive agriculture tends to be associated with increased environmental disturbance, which disrupts the composition, structure, and function of ecosystems, including the productivity of agricultural soils.

Look for opportunities to modify the intensity of crop and/or livestock management practices on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no opportunities to modify the intensity of crop and/or livestock management practices on your farm			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Integrated pest management is used to determine the best approach to controlling pests.	<input type="checkbox"/> Integrated pest management is sometimes used to determine the best approach to controlling pests.	<input type="checkbox"/> Integrated pest management is not considered when determining the best approach to controlling pests.	
<input type="checkbox"/> Pesticides, including insecticides, herbicides, fungicides, or rodenticides are stored appropriately in secure facilities that are located away from aquatic areas.	<input type="checkbox"/> Pesticides are stored in one facility but in a manner that does not fully meet current standards. They may also be located close to aquatic areas.	<input type="checkbox"/> Pesticides are stored in various locations around the farm. They are neither stored in secure facilities nor in a manner that meets current standards. They may also be located close to aquatic areas.	
<input type="checkbox"/> Pesticides are applied only in accordance with label specifications, and an appropriate buffer is maintained to protect waterways from spray drift and runoff.	<input type="checkbox"/> Pesticides are not applied in full accordance with label specifications, and an appropriate buffer is not maintained to protect waterways from spray drift and runoff.	<input type="checkbox"/> Pesticides are not applied in accordance with label specifications, and appropriate buffers are not maintained to protect waterways from spray drift and runoff.	
<input type="checkbox"/> The selection of insecticides and timing of application is managed to minimize impacts on pollinating and other beneficial insects.	<input type="checkbox"/> The selection of insecticides and timing of application is sometimes managed to minimize impacts on pollinating and other beneficial insects.	<input type="checkbox"/> The selection of insecticides and timing of application does not consider the impacts on pollinating and other beneficial insects.	
<input type="checkbox"/> Where possible, pesticides are applied using non-broadcast applications.	<input type="checkbox"/> There some are opportunities to apply pesticides using non-broadcast applications.	<input type="checkbox"/> There are frequent opportunities to apply pesticides using non-broadcast applications.	
<input type="checkbox"/> Nutrient inputs are applied at rates based on the requirements of last year's crop.	<input type="checkbox"/> Nutrient inputs are applied at rates based soil testing results.	<input type="checkbox"/> Nutrient inputs are applied at rates using estimated nutrient requirements.	
<input type="checkbox"/> Manure is stored and applied in such a way that minimizes pollution.	<input type="checkbox"/> Manure is either not stored or not applied in a manner that minimizes pollution.	<input type="checkbox"/> Manure is neither stored nor applied in a manner that minimizes pollution.	

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Fertilizers are stored in such a way that they minimize pollution.	<input type="checkbox"/> Fertilizers are not always stored in a manner that minimizes pollution.	<input type="checkbox"/> Fertilizers are not stored in a manner that minimizes pollution.	
<input type="checkbox"/> Fuel and other petroleum products are stored and dispensed in a manner that minimizes pollution.	<input type="checkbox"/> Fuel and other petroleum products are either not stored or not dispensed in a manner that minimizes pollution.	<input type="checkbox"/> Fuel and other petroleum products are neither stored nor dispensed in a manner that minimizes pollution.	
<input type="checkbox"/> Multiple pastures are rotationally grazed, and the order of grazing is changed each year.	<input type="checkbox"/> Pastures are rotationally grazed but are used in the same order each year.	<input type="checkbox"/> Pasture rotation is infrequent, and pastures are used in the same order each year.	
<input type="checkbox"/> Pastures are given adequate rest during the growing season.	<input type="checkbox"/> Pastures are given some rest during the growing season.	<input type="checkbox"/> Pastures are grazed continuously and season-long.	
<input type="checkbox"/> Grazing of areas with thin soils and steep slopes is avoided when soils are wet.	<input type="checkbox"/> Grazing of areas with thin soils and steep slopes sometimes occurs when soils are wet.	<input type="checkbox"/> Grazing of areas with thin soils and steep slopes often occurs when soils are wet.	
<input type="checkbox"/> Mowing is done in a way that maintains strips of blooming, native flowering plants for pollinating insects.	<input type="checkbox"/> Mowing is sometimes done in a way that maintains strips of blooming, native flowering plants for pollinating insects.	<input type="checkbox"/> Mowing often coincides with peak native flower blooming periods; native flowering plants are not maintained for pollinating insects.	
<input type="checkbox"/> Irrigation is managed to conserve water.	<input type="checkbox"/> Some irrigation practices that conserve water have been implemented.	<input type="checkbox"/> Flood and sprinkler irrigation could be modified to conserve water.	
<input type="checkbox"/> Drainage is managed in a way that takes biodiversity and best practices into consideration.	<input type="checkbox"/> Most drainage is managed in a way that takes biodiversity and best practices into consideration.	<input type="checkbox"/> Drainage is not managed in a way that takes biodiversity and best practices into consideration.	

QUESTION 15

What are the opportunities to increase the mix of crop and/or livestock species on your farm?

- ▶ Increasing the mix of crop and livestock species contributes to both species and genetic diversity on the farm, and may also increase the overall productivity of your farm.

Look for opportunities to increase the mix of crop and/or livestock species on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no opportunities to increase the mix of crop and/or livestock species on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Your operation includes a wide diversity of crop species.	<input type="checkbox"/> Your operation includes some diversity of crop species.	<input type="checkbox"/> Your operation includes only a very limited diversity of crop species.	
<input type="checkbox"/> Your operation includes a diversity of livestock species.	<input type="checkbox"/> Some additional livestock species could be included in your operation.	<input type="checkbox"/> There is an opportunity to include a significant diversity of livestock species in your operation.	
<input type="checkbox"/> The diversity of crops in your operation creates a variety of habitats for desirable wildlife species, including pollinators and the natural enemies of pests.	<input type="checkbox"/> There is some diversity of crops in your operation, and they create some habitat for desirable wildlife species, including pollinators and the natural enemies of pests.	<input type="checkbox"/> There is a limited diversity of crops in your operation, which creates little habitat for desirable wildlife species, including pollinators and the natural enemies of pests.	

QUESTION 16

What are the opportunities to manage for soil biodiversity on your farm?

- ▶ Maintaining a diverse biological community in soils creates a healthy environment for plants.
- ▶ Maintaining soil biodiversity can also help with pest and disease control.
- ▶ The benefits of diversified crop rotations, together with reduced tillage and especially no tillage, can dramatically increase soil productivity while reducing costs.
- ▶ Generally, mixed- and inter-cropping systems increase above-ground diversity. Because below-ground diversity often mirrors above-ground diversity, these systems tend to have more diverse soil biotic communities.

Look for opportunities to manage for soil biodiversity on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no soil-bound crops on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Zero tillage is practiced.	<input type="checkbox"/> Zero tillage is sometimes practiced.	<input type="checkbox"/> Tillage is commonly used to control weeds and prepare the soil for seeding.	
<input type="checkbox"/> Nutrient inputs are mainly organic (animal manure and/or green manure).	<input type="checkbox"/> Nutrient inputs are a mix of organic (animal manure and/or green manure) and commercial fertilizers.	<input type="checkbox"/> Nutrient inputs are almost exclusively derived from commercial fertilizers.	
<input type="checkbox"/> Nutrient inputs are applied at rates based on the requirements of last year's crop.	<input type="checkbox"/> Nutrient inputs are applied at rates based on soil testing results.	<input type="checkbox"/> Nutrient inputs are applied at rates based only on experience from previous years or on estimated requirements.	
<input type="checkbox"/> Cover crops are used regularly to create green manures and contribute to structural diversity.	<input type="checkbox"/> Cover crops are sometimes used to create green manures and contribute to structural diversity.	<input type="checkbox"/> Cover crops are not used.	
<input type="checkbox"/> Crop rotations are regular and include both legumes and grasses, which are selected based on their contribution to soil health.	<input type="checkbox"/> Crop rotations, when practiced, do not include legumes.	<input type="checkbox"/> Crop rotation is not practiced.	
<input type="checkbox"/> Field activities are managed so that wet soil conditions and soil compaction are avoided.	<input type="checkbox"/> Field activities are sometimes managed to avoid wet soil conditions and soil compaction.	<input type="checkbox"/> Field activities are not managed to avoid wet soil conditions and soil compaction.	
<input type="checkbox"/> Fall-sown crops are frequently used to protect soil through the winter and early spring.	<input type="checkbox"/> Fall-sown crops are sometimes used to protect soil through the winter and early spring.	<input type="checkbox"/> Fall-sown cover crops are not used.	

CONFLICTS WITH WILDLIFE



QUESTION 17

What are the opportunities to minimize conflicts between agriculture and wildlife?

Regulatory approvals may be required.

- Conflicts generally occur when wildlife have access to agriculturally produced food sources. This can result in unnaturally high concentrations of wildlife.

Look for opportunities to minimize conflicts between agriculture and wildlife on your farm, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no conflicts between agriculture and wildlife on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Opportunities to reduce conflicts with wildlife have been identified and implemented.	<input type="checkbox"/> The risk of conflict exists due to the availability of some unsecured food sources and the presence of large wildlife populations, and there are some limited opportunities to mitigate this risk.	<input type="checkbox"/> The risk of conflict is high due to the availability of unsecured food sources, and there are opportunities to mitigate this risk.	



Regulatory approvals may be required.

QUESTION 18

What are the opportunities to increase the connectedness of habitats across neighbouring landscapes?

- ▶ Large cultivated areas, roadways, and fencelines can fragment habitats and disrupt plant and animal movements across the landscape. This can lead to loss of important habitat, increased mortality risks, and reduced genetic mixing within species. Maintaining habitat connections across the landscape is a key component of managing for biodiversity.
- ▶ Connectedness can be achieved by maintaining native or semi-natural corridors or habitat patches along property lines. Landscape connectedness can be accomplished by working with neighbours to strategically link patches.

Look for opportunities to increase the connectedness of habitats across neighbouring landscapes, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no uncropped areas or aquatic habitat on your land, or there is only one patch of uncropped area on your land with no opportunity to connect it to habitat in adjacent lands.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> All uncropped areas of the same type are connected to similar areas in the neighbouring landscape. They are connected by perennially vegetated corridors that are barrier-free and are managed to retain a high diversity of native plant species.	<input type="checkbox"/> There are at least two isolated uncropped areas on your land that could be connected to similar areas in the neighbouring landscape.	<input type="checkbox"/> There are several isolated uncropped areas on your land, and they could be readily connected to similar areas in the neighbouring landscape.	
<input type="checkbox"/> Corridors from your farm to the neighbouring landscape are managed to minimize disturbance of wildlife that use them and to maintain healthy and diverse plant communities.	<input type="checkbox"/> There is a corridor on your land that could be connected to a neighbouring landscape and could be managed to improve its use by specific species or groups of species. This could be done without adversely affecting your operation.	<input type="checkbox"/> There are several habitat corridors on your land that could be connected to a neighbouring landscape and could be managed to improve their use by specific species or groups of species. This could be done without adversely affecting your operation.	
<input type="checkbox"/> All watercourses are barrier-free, or include a safe passage for native fish, amphibians, and other aquatic wildlife around or through the barrier. Natural water flows occur in all watercourses.	<input type="checkbox"/> Some barriers are present in watercourses, and water flow is occasionally impeded.	<input type="checkbox"/> Water flow in surface watercourses is impeded, and watercourse segments have become isolated or dead-end streams.	

QUESTION 19

What are the opportunities for your farm to contribute to a regional biodiversity conservation initiative?

- ▶ Several regional biodiversity initiatives around the province are contributing to biodiversity conservation and enhancement. Participation in these initiatives by landowners is often a key part of achieving success.

Look for opportunities to contribute to a regional biodiversity initiative, and then determine the appropriate practices to achieve them.

Assessment of Opportunities			
<input type="checkbox"/> Does not apply. There are no active stewardship initiatives in your region.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Management of important habitat, such as riparian areas, forests, streams, wetlands, and grasslands on your farm is coordinated with a local or regional biodiversity initiative.	<input type="checkbox"/> Management of important habitat, such as riparian areas, forests, streams, wetlands, and grasslands on your farm could be coordinated with a local or regional biodiversity initiative.	<input type="checkbox"/> Management of important wildlife habitat, such as riparian areas, forests, streams, wetlands, and grasslands, at the landscape level has been not been considered in your community but could be initiated.	

STEP 2 - PLANNING

MOVING FROM ASSESSMENT TO PLANNING – COMPLETING THE ACTION PLAN WORKSHEET

Setting Priorities

From the assessment questions you rated as *Considerable Opportunity* or *Some Opportunity*, select the ones that you want to take action on and record them on the Action Plan Worksheet on page 87. List the *Considerable Opportunities* first.

FARM: <i>TLN Ranch/ Low Bench</i>		Developed By: <i>Smith</i>	DATE DEVELOPED: <i>April 2020</i>	Page <i>1</i> of <i>1</i>	
Questions to Be Acted Upon	Proposed BMP or BMP Practice Code	Specific Goal(s) Related to BMP(s)	Proposed Monitoring		Date Completed, Approvals or Permits Required, and Other Comments
			What	When	
Question #1 <i>Enhance riparian habitat</i>	<i>BMP 1.4: Retain a wide variety of native plants that are adapted to living in riparian areas</i>	<i>Allow shrub layer to regenerate</i>	<i>Increase in native plants and wildlife populations. New growth on shrubs</i>	<i>Spring and when moving livestock</i>	
Question #6 <i>Increase connectedness of forest habitat within farm</i>	<i>BMP 6.7: Connect forested areas along riparian corridors</i>	<i>Allow wildlife to travel through my farm</i>	<i>Watch for wildlife in the connected habitat</i>	<i>Spring</i>	

Selecting Beneficial Management Practices

The Beneficial Management Practices (BMPs) in this guide (page 90) provide a starting point for managing biodiversity on your land. Using the Biodiversity BMP list, select BMPs that are relevant to your selected assessment questions. From that list, select the BMPs that you want to implement on your land. Once you have selected your BMPs, enter them into the Action Plan Worksheet.

Note: Because this guide is a general tool, not all the assessment questions will apply to all farming and ranching operations. You are encouraged to use your own knowledge along with the Biodiversity Principles to develop a plan that works for you. You may need to search for other solutions that are best suited to your operation and to biodiversity in your area. Your EFP Planning Advisor can provide advice, if needed. Additional sources of information on BMPs related to agriculture and biodiversity are provided in Appendix 1, *Biodiversity Resources for Farms and Ranches*. You may also wish to consult the other guides in Canada-BC Environmental Farm Plan program series:

- ▶ Drainage Management Guide
- ▶ Grazing Management Guide
- ▶ Irrigation System Assessment Guide
- ▶ Nutrient Management Reference Guide
- ▶ Riparian Management Field Workbook for Streams and Small Rivers

Setting Goals

After selecting the BMPs, you will need to set goals that are specific to them and what you want to achieve on your farm or ranch. This will help you determine if your investment in a BMP has been successful. The goals should be specific, measurable, and related to your activities. Write down your goals and then review them to determine if there are any opportunities to integrate goals or activities. For example, by controlling livestock access to riparian areas you may eliminate the need for revegetation, which may happen naturally with reduced grazing pressure.

Once you have finalized your goals, enter them into your Action Plan Worksheet. Some example goals are provided here:

Priority: Improve riparian areas.

Goal: Re-vegetate shrubs and trees in grazed riparian area in west pasture.

Priority: Increase crop diversity.

Goal: Plant two new varieties of potatoes and establish a Saskatoon berry patch for local sales.

Priority: Retain native habitat on land.

Goal: Remove from production two small parcels of land in the east quarter that are currently not economical to farm, and seed them down with perennial or native plants.

STEP 3 - IMPLEMENTATION

Implementing the BMPs you selected will involve the following steps:

Getting Agency Approvals

Determine if agency approvals are needed to implement the various parts of your plan. If so, be sure to get the necessary approvals such as permits or other authorizations before beginning any project. For more complex projects, you may wish to seek the advice of an environmental professional.

Securing Funding

Some BMPs will be easier than others to implement, either logistically or financially. Outside funding sources and community organizations may be able to provide the additional financial resources you need. Identify and apply to any programs that may help defray the costs of materials, labour, or consultative services needed to implement the BMPs you selected.

Determining Timing

Determine the timing needed to most effectively implement the BMPs you selected, and work according to that schedule.

Accessing Technical References

Contact your EFP Planning Advisor, check the references identified in this guide, and search the Internet for any technical references you may need to implement your plan.

Seeking Professional Advice

Ask your EFP Planning Advisor and farm organization for contact information for other respected professionals who may be able to help you implement your plan. Contact agency resources in your community or region (Appendix 2).

Securing Equipment, Materials, and Other Resources

When implementing a BMP, ensure you have the right equipment and materials on hand when you need them. Consider the on-farm resources that you have access to.

Maintaining BMPs

Try to ensure that any maintenance required to successfully achieve the BMP is undertaken in a timely manner.

Documenting the Project

Document the existing conditions on your property before implementing the BMPs—for example, 25% of the pasture land base is infested with knapweed. Then record which BMPs were implemented and when. This will help you monitor your efforts.

Linking to the Environmental Farm Plan and Other Planning Processes

If you have implemented an Environmental Farm Plan, many of the actions you are taking may already be benefiting biodiversity on your property. This guide provides you with an opportunity to expand your EFP to include biodiversity more specifically in your management actions. Determine if you can participate in any regional biodiversity initiatives.

TABLE 3 ACTION PLAN WORKSHEET

List the assessment questions that you scored as Considerable Opportunity or Some Opportunity and which you want to take action on. Using the BMP list, select the BMPs that you want to implement on your land. Set goals that are specific to the BMPs and what you want to achieve in your operation. Determine what you will monitor and when to check if your goals are being met. See the Sample Biodiversity Management Plan section of the guide for an example.

Farm: Questions Number	BMP	Developed By: Specific Goal(s) Related to BMP(s)	Date Developed:		Proposed Monitoring When	Date Completed, Approvals or Permits Required, and Other Comments	Page ____ of ____
			What				

Farm:		Developed By:	Date Developed:		Page ____ of ____	
Questions Number	BMP	Specific Goal(s) Related to BMP(s)	What	When	Date Completed, Approvals or Permits Required, and Other Comments	

TABLE 4 BIODIVERSITY BENEFICIAL MANAGEMENT PRACTICES

Note: This is a list of biodiversity BMPs that could apply to your operation. It should not be considered a comprehensive list because BMPs are frequently site-specific and change with new knowledge. Also, some BMPs may be relevant to more than one question. Remember regulatory approvals may be required (See the relevant question).

BENEFICIAL MANAGEMENT PRACTICES		
ON THE FARM		RIPARIAN HABITAT
Question 1	BMP	What are the opportunities to enhance the riparian habitat on your farm?
	1.1	Develop a Riparian Management Plan using the EFP <i>Riparian Management Field Workbook</i> and the assistance of your EFP advisor and learn about the specific characteristics of your riparian areas.
	1.2	Develop off-channel watering and/or construct fencing that controls livestock access to riparian areas and watercourses.
	1.3	Manage the timing and extent of grazing in riparian areas to protect native species, leave ample residue/litter, and avoid creating wet trampled spots (e.g., avoid overgrazing forbs and shrubs).
	1.4	Retain a wide variety of native plants that are adapted to living in riparian areas.
	1.5	Construct or relocate facilities and roads away from riparian areas.
	1.6	Retain natural riparian areas.
	1.7	Improve bank stability through riparian plantings.
	1.8	Where appropriate, use thorny shrubs (e.g., hawthorn) or dense plantings of conifers to deter livestock from using riparian restoration areas.
	1.9	Avoid or minimize the impact of farm machinery use in or around riparian areas.
Question 2	BMP	What are the opportunities to increase the connectedness of riparian habitat within your farm?
	2.1	Connect or reconnect riparian habitats by leaving an uncultivated corridor between them.
	2.2	Join riparian habitats by maintaining uncultivated areas, planting native vegetation, a shelterbelt, or a hedgerow between them.

ON THE FARM		AQUATIC AREAS, INCLUDING WETLANDS
Question 3	BMP	What are the opportunities to enhance aquatic habitat on your farm?
	3.1	Follow the EFP <i>Drainage Management Guide</i> .
	3.2	Keep existing wetlands intact.
	3.3	Keep equipment above the high water mark of wetlands.
	3.4	Where possible, allow natural cycles and events to take place (e.g., periodic flooding; fallen trees left in stream to provide habitat).
	3.5	Enhance aquatic habitat by maintaining features that provide habitat complexity, such as large woody debris.
	3.6	Avoid obstructing water flows with harvesting debris.
	3.7	Allow selected areas to flood to provide habitat for migratory waterfowl.
	3.8	Re-establish drained wetlands by restoring their original drainage pattern.
	3.9	Limit storm water movement into natural watercourses.
	3.10	Install sediment traps where necessary, especially to avoid transporting sediments into watercourses.
	3.11	Improve stream crossings by using clear span bridges or open bottom culverts to enhance fish passage where fish are present.
	3.12	Construct artificial wetlands to improve water quality and enhance aquatic habitat.
	3.13	Leave stream meanders and channels.
	3.14	Enhance canopy development over watercourses to reduce water temperatures.
	3.15	Control livestock access to waterways.
	3.16	Develop livestock watering systems away from aquatic areas.
Question 4	BMP	What are the opportunities to increase the connectedness of aquatic habitat within your farm?
	4.1	Connect or reconnect aquatic habitat on your farm by removing barriers or other isolating factors but only when aquatic invasive species are not present.
	4.2	Minimize the risk of trapping fish in seasonally wetted connections to aquatic habitat.
	4.3	Appropriately size and place culverts so that fish passage is not impeded.
	4.4	Incorporate natural substrates such as gravel in open bottom culverts when constructing fish passage.
	4.5	Connect aquatic habitats by leaving an uncultivated corridor between them.
	4.6	Join aquatic habitats by planting native vegetation, a shelterbelt, or a hedgerow between them.
	4.7	Provide safe passage for fish, amphibians, and other aquatic wildlife where it is not incorporated into existing dykes, dams, or closed culverts.

ON THE FARM		FOREST AND WOODLANDS
Question 5	BMP	What are the opportunities to enhance forest or woodland habitat on your farm?
	5.1	Develop a forest management plan.
	5.2	When planting, use locally adapted species, favouring native species.
	5.3	Manage the timing and intensity of livestock use of forested pastures and tree/shrub stands in native pastures to avoid heavy browsing and maintain healthy shrub/tree populations.
	5.4	Identify existing or potential old-growth stands for protection from cutting and deadwood removal; protect as much old-growth as possible.
	5.5	Protect rare woodland communities. Talk to your local conservation organizations to learn more about woodland communities in your region and their significance in the region, province, and country.
	5.6	Where appropriate, reforest or regenerate clearings or fields within forested areas to benefit biodiversity.
	5.7	Where appropriate, reduce the number of forest edges and increase forest size by planting or regenerating trees around forested edges.
	5.8	Minimize the number and total length of forest access roads.
	5.9	Protect stick nests (nests built by large birds, such as raptors and herons) by establishing vegetation buffers and minimizing activities near the nests; consult the appropriate agency for specifics regarding individual species.
	5.10	Use large woody debris, brush piles, temporary fencing, seedling shelters, and some weed control practices to protect seedlings until they become established.
	5.11	Establish or maintain non-timber forest products such as berries, nuts, mushrooms, vines, specialty trees, and shrubs.
	5.12	Leave large rotting or hollow logs for habitat.
	5.13	Create habitat and improve nutrient cycling by leaving branches, tree tops, cull logs, and log portions at felling sites rather than at landings.
	5.14	Leave windrows, brush piles, chip piles, and fallen or cut off branches.
	5.15	Try to retain a few large trees that protrude above the forest canopy so they can be used by raptors.
	5.16	Where safe to do so, retain dead and standing trees for wildlife habitat.
	5.17	Try to retain six or more cavity trees per hectare for birds.

Question 6	BMP	What are the opportunities to increase the connectedness of forest or woodland habitat within your farm?
	6.1	Replant or allow natural regeneration to (re)connect wooded areas on you farm.
	6.2	Connect wooded areas by maintaining wooded fencerows and riparian areas.
	6.3	Where appropriate to your region, plant shelterbelts or hedgerows with multiple native species, including forbs, shrubs, and trees.
	6.4	Manage for, or restore, diverse buffers of native trees, shrubs, grasses, and forbs to support wildlife.
	6.5	Integrate management of trees and livestock pasture (silvopasture).
	6.6	Retain uncultivated land between forested areas.
	6.7	Connect forested areas along riparian corridors.
Question 7	BMP	What are the opportunities to modify your forest management practices, including their intensity and/or timing, to benefit biodiversity?
	7.1	Conserve wildlife trees, rock piles, and other wildlife habitat features such as snake hibernacula.
	7.2	Undertake forest operations when soils are dry or frozen to minimize soil and root disturbance.
	7.3	Do not schedule forest harvesting during breeding seasons of known wildlife species.
ON THE FARM		GRASSLANDS, SHRUBLANDS, AND NATIVE PASTURES
Question 8	BMP	What are the opportunities to enhance grassland, shrubland, and native pasture habitats on your farm?
	8.1	Develop and implement a Grazing Management Plan. Refer to the EFP <i>Grazing Management Guide</i> for details. Consider implementing a monitoring plan to assess grazing practices. As necessary, modify your Grazing Management Plan.
	8.2	Use a variety of livestock distribution tools, including fencing (permanent and electric), herding, off-site watering, and strategically located salt, minerals, and supplemental feed in order to manage grazing on native areas and to create a diverse plant community (types, sizes, ages).
	8.3	Control timing and intensity of grazing to retain native plant communities and encourage a range of plant heights.
	8.4	Familiarize yourself with the growth cycle of key forage plants in order to better manage grazing. Allow plants an effective rest period in order to establish good vegetative growth prior to grazing.
	8.5	Balance forage demand with supply so that sufficient plant material, including litter, remains. This will help maintain forage and range health, conserve moisture, and protect soil from erosion and organic matter loss.

Question 8	GRASSLANDS, SHRUBLANDS, AND NATIVE PASTURES continued	
	8.6	Where appropriate, use more than one livestock type to enhance grazing management options.
	8.7	Restore or establish local native species of forages, shrubs, and trees.
	8.8	Restore or rejuvenate pastures to optimize production and biodiversity.
	8.9	Increase the perennial crop area of your farm.
	8.10	To reduce tree ingrowth, implement juvenile or pre-commercial thinning activities using manual, chemical, and/or mechanized techniques.
	8.11	Manage ingrowth by developing Christmas tree production.
	8.12	Control grazing to allow deep rooted perennial native plants to regenerate and structural diversity to increase.
	8.13	Control browsing by livestock so that shrubs remain healthy and vigorous.
Question 9	BMP	What are the opportunities to increase the connectedness of grassland, shrubland, and native pasture habitats within your farm?
	9.1	Connect grasslands, shrublands, and native pastures by planting local native species of forages, shrubs, and trees between them.
	9.2	Connect grasslands, shrublands, and native pastures by leaving an uncultivated corridor or tame pasture between them so natural infilling occurs.
	9.3	Connect grasslands, shrublands, and native pastures by leaving a shelterbelt or hedgerow between them.
	9.4	Connect grasslands, shrublands, and native pastures by maintaining a well vegetated riparian corridor.
Question 10	BMP	What are the opportunities to modify your native pasture management practices, including their intensity and/or timing, to benefit biodiversity?
	10.1	Balance pasture forage consumption with supply so that sufficient plant material, including litter, remains.
	10.2	Manage grazing timing and intensity so enough native plant species are able to set seed and maintain viable populations.
	10.3	Delay grazing of native grasses that are adapted to late season use, and graze tame pastures or annual forages early in the season.
	10.4	Use rotational grazing practices rather than season-long grazing to achieve rest and recovery of native plants.
	10.5	Defer grazing in some areas that are used by ground-nesting birds until late in the nesting season.
	10.6	Use timed grazing to help control weeds. For example, to control the spread of Canada thistle, graze just before budding to weaken the plants and prevent them from going to seed.

ON THE FARM		WILDLIFE, KEYSTONE SPECIES, AND SPECIES AT RISK
Question 11	BMP	What are the opportunities to enhance habitat for wildlife, keystone species, and species at risk that may occur on your farm?
	11.1	Learn to identify important native, pest, and keystone species on your land. Work with local experts on how you can foster desirable species and discourage undesirable ones.
	11.2	Install bird and/or bat boxes to increase available habitat.
	11.3	Restrict livestock and equipment from sensitive nesting areas.
	11.4	Avoid disturbing stick nests (nests built by large birds, such as raptors and herons).
	11.5	Avoid forestry operations within 1 km of a heronry during nesting season.
	11.6	Conserve wildlife trees, rock piles, and other wildlife habitat features, such as snake hibernacula.
	11.7	Manage areas around stick nests (nests built by large birds, such as raptors and herons) by establishing vegetation buffers and minimizing activities near the nests; consult the appropriate agency for specifics regarding individual species.
	11.8	Provide nesting and perch sites to attract raptors that prey on rodents.
	11.9	Try to retain a few large trees that protrude above the forest canopy so they can be used by raptors.
	11.10	Try to retain six or more cavity trees per hectare for birds.
	11.11	Do not schedule forest harvesting during breeding seasons of known wildlife species.
	11.12	Manage for, or restore, diverse buffers of native trees, shrubs, grasses, and forbs to support wildlife.
	11.13	Buffer sensitive wildlife habitats from agricultural activities by using hedgerows and buffer strips.
	11.14	Plan crop rotations so some fields provide food and cover for wildlife.
	11.15	Consider using non-lethal predator control.
	11.16	Keep disruptive agricultural activities away from known wildlife corridors to reduce wildlife conflicts.
	11.17	Intercrop vegetables or other crops with suitable plants that are likely to attract beneficial insects, improve soil fertility, and/or support wild pollinators.
	11.18	Establish hedgerows, shelterbelts, and/or uncultivated strips with clusters of sequentially flowering native trees, shrubs, and forbs in unused areas that are prone to weeds—e.g., around telephone poles, in odd shaped pieces of land, unirrigated field corners, and along fencelines.
	11.19	Time haying and mowing to avoid causing wildlife disturbance, injury, or death.
	11.20	Use a flushing bar and/or mow fields either from one edge to another, or from the centre to the edge to give wildlife an escape route.
	11.21	Encourage the growth of native vegetation, including flowering plants, to provide habitat and food for beneficial predators.

ON THE FARM		INVASIVE AND NOXIOUS SPECIES
Question 12	What are the opportunities to control invasive noxious species on your farm?	
	12.1	Prevent invasive plant and animal species, including fish species, from establishing by managing access or by early eradication.
	12.2	Learn to identify invasive and noxious species. For example, learning to identify weeds and invasive plants, particularly at the seedling stage, using the <i>Guide to Weeds in BC</i> and/or the <i>Field Guide to Noxious and other Selected Weeds of British Columbia</i> facilitates early control.
	12.3	Develop a comprehensive management strategy to deal with invasive species; use farm management practices, such as using certified seed, to reduce the risk of noxious invasive plant species from becoming established.
	12.4	Restore native plants to areas where weeds have been removed and/or to patches of bare ground where weeds may appear.
	12.5	Use an integrated management approach to invasive species (cultural, mechanical, chemical, and biological).
	12.6	Prevent noxious weeds from going to seed by using mowing or other control practices; control weeds along farm roads and trails to prevent weeds from spreading.
	12.7	Prevent movement of weeds to new locations such as when livestock move from a weed infested area to a non-infested area.
	12.8	Wash equipment before travelling to “clean” areas to prevent the spread of noxious or invasive species.
	12.9	Before importing animals or plant material from other provinces or countries, check with the Canadian Food Inspection Agency for permit requirements and other restrictions.
	12.10	Report the presence of any unusual plants or animals to the Canadian Food Inspection Agency, the nearest BC Ministry of Agriculture office, or the Invasive Plant Council of BC as soon as possible.
ON THE FARM		CROPS AND LIVESTOCK
Question 13	What are the opportunities to enhance perennial crop areas on your farm to benefit biodiversity?	
	13.1	Wherever possible, use locally adapted native plant species and their seeds.
	13.2	Use forages, including legumes, in crop rotations to improve soil structure and reduce runoff, erosion, and nutrient loss.
	13.3	Use cover crops on annual crop land near vegetative buffers and riparian areas to limit bare soil created by late-season crop harvests.

Question 14	What are the opportunities to modify your farm management practices, including their intensity and/or timing, to benefit biodiversity?	
	14.1	Develop and implement a Nutrient Management Plan using the EFP <i>Nutrient Management Reference Guide</i> .
	14.2	Develop sufficient and appropriate manure storage facilities.
	14.3	Apply fertilizers, composts, and manure based on the nutrient content of last year's crop, petiole testing, and/or soil analysis.
	14.4	Develop and implement an Integrated Pest Management Plan.
	14.5	Develop appropriate pesticide storage.
	14.6	Use pesticide and nutrient application practices and equipment that minimize drift or spray into adjacent watercourses.
	14.7	Avoid spraying in windy or rainy conditions.
	14.8	Plant windbreaks or buffers between sprayed areas and sensitive native habitat and watercourses.
	14.9	Practice alley-cropping by growing crops between trees that are planted in rows.
	14.10	Avoid or minimize the application of insecticides and fungicides during times when pollinating and other beneficial insects are active.
	14.11	Wherever possible, use non-broadcast methods of pesticide application, such as band and spot treatment.
	14.12	Use compost mulch to manage weeds and fungal and insect pests.
	14.13	Develop appropriate storage for petroleum products.
	14.14	Develop and implement an Irrigation Plan using the EFP <i>Irrigation System Assessment Guide</i> .
	14.15	Withdraw irrigation and livestock water at or below licensed rates, and use acceptable water management practices.
	14.16	During exceptionally dry years, manage water use in a manner that preserves biodiversity.
	14.17	Modify irrigation equipment to increase water efficiency.
	14.18	Modify irrigation equipment to prevent backflow of altered irrigation water into watercourses.
	14.19	Use screened intakes to protect fish when using surface water withdrawals.
	14.20	Understand the hydrology of your area.
	14.21	Use drip and other efficient forms of irrigation to minimize water use and maximize water received by trees and vines.
	14.22	Recycle wastewater from milkhouses, fruit and vegetable washing facilities, and greenhouses in order to remove nutrients.
	14.23	Improve irrigation efficiency by increasing soil organic matter content or the depth of organic matter on the soil surface (e.g., mulch, crop residue, or cover crops).

Question 14	CROPS AND LIVESTOCK continued	
	14.24	Review the EFP <i>Drainage Management Guide</i> to identify best practices for drainage management.
	14.25	With appropriate technical assistance and approvals, consider improving drainage features that benefit biodiversity.
	14.26	Maintain or plant hedgerows, shelterbelts, ditches, and riparian areas to prevent runoff containing sediment and nutrients from polluting aquatic areas.
	14.27	Time grazing to allow effective growth or regrowth of native plants to maintain viable populations.
	14.28	Contain and treat livestock diseases.
Question 15	BMP	What are the opportunities to increase the mix of crop and/or livestock species on your farm?
	15.1	Diversify your cropping system to include multiple types and varieties of crops. Consider cultivating heritage varieties and locally-adapted landraces.
	15.2	Grow mixed crops with a variety of flowers.
	15.3	Diversify your crop rotation by adding legumes such as peas and beans.
	15.4	Plant pastures and hayland with multiple species, using legumes and other forage species that are adapted to your area.
	15.5	Diversify your livestock system to include multiple types and varieties of livestock.
	15.6	Consider raising heritage stock or rare breeds.
Question 16	BMP	What are the opportunities to manage for soil biodiversity on your farm?
	16.1	Minimize tillage and other field operations.
	16.2	Prevent soil compaction from livestock and use of heavy machinery on wet soil.
	16.3	Maintain soil health by using potentially lower cost options such as crop rotation, cover cropping, and green manure.
	16.4	Leave plant residues to enhance organic matter.
	16.5	Choose crop rotations that include high residue plants with large amounts of roots. Manage grazing to maintain plants, including roots, in a vigorous state.
	16.6	Keep ground covered with perennial cover, crop residue, standing stubble, or cover crops.
	16.7	Stop harvesting if your vehicles create ruts.
	16.8	Apply only enough fertilizer to replace the nutrients harvested with the crop.
	16.9	Modify seeding and post-seeding implements for low disturbance placement of seeds and fertilizer.
	16.10	Grow winter annuals to minimize field equipment activity in the spring.
	16.11	Use companion cropping or strip cropping.

ON THE FARM		CONFLICTS WITH WILDLIFE
Question 17	BMP	What are the opportunities to minimize conflicts between agriculture and wildlife?
	17.1	Protect food sources from wildlife by using fencing or structures.
	17.2	Remove unsecured food sources such as windfalls in orchards.
	17.3	Where appropriate, design and build fencing that allows passage of wildlife.
	17.4	Use wildlife-proof fencing (e.g., for ungulates or snakes) only in specific areas of concern (e.g., stack yards). When using such fences over larger areas, work with local experts to ensure that critical wildlife travel routes are not completely blocked.
	17.5	Use scare devices, visual or auditory. Scare devices are most effective when they are used over short periods.
	17.6	Understand how to manage bird netting in order to minimize impacts on wildlife.
	17.7	Use guardian animals to protect livestock.
	17.8	Allow hunters access to your land during hunting seasons.
	17.9	Plant lure crops or crops that are less desirable to wildlife.
	17.10	Locate compost heaps, livestock, beehives, and other food sources away from forests, thickets, and natural travel corridors used by bears.
OFF THE FARM		
Question 18	BMP	What are the opportunities to increase connectedness of habitat across neighbouring landscapes?
	18.1	Observe wildlife movements and provide appropriate corridors to neighbouring properties by connecting native and semi-natural areas.
	18.2	Connect habitats to those on neighbouring properties by leaving a corridor uncultivated and allowing natural infilling to occur.
	18.3	Connect habitats to those on neighbouring properties by planting native vegetation, a shelterbelt, or tame grass.
	18.4	Replace pipes or culverts that restrict safe passage of native fish and other wildlife with a clear span bridge or pipe arch.
	18.5	Work with natural resource management specialists and local conservation organizations to identify key actions that will contribute to maintaining biodiversity and related healthy, functioning landscapes and watersheds in your region.
Question 19	BMP	What are the opportunities for your farm to contribute to a regional biodiversity conservation initiative?
	19.1	Participate in regional biodiversity initiatives.
	19.2	Manage native areas as a valuable resource by working with natural resource management specialists and local conservation organizations to identify key actions that will contribute to maintaining biodiversity and related healthy, functioning landscapes and watersheds.
	19.3	Through collaboration with neighbours, strive to maintain at least 20% of the regional landscape as non-cropped (i.e., native and semi-natural areas).

STEP 4 - MONITORING

Biodiversity is like agriculture—situations change from year to year with weather, management practices, and what is happening next door. Therefore, you should consider establishing a monitoring program to determine if your biodiversity goals are being met or if they or your Biodiversity Management Plan need to be modified.

Keep in mind that achieving some goals will take longer than others and will depend on your location. For example, plants grow much more quickly in the Fraser Valley than they do in the Peace River area.

Aim to do your biodiversity monitoring every year, and keep the results on file. To be consistent and to have comparable results, you should try to monitor at the same time each year. You can use your assessment as a record of changes on your property and as a tool to update your management plans and biodiversity goals.

The steps involved in monitoring the success of the BMPs you implemented are as follows:

Identifying Measures of Success Relative to Goals

This can include recording general observations related to your biodiversity goals, such as an increase in bird numbers, or savings on crop inputs.

Developing a Photo Record

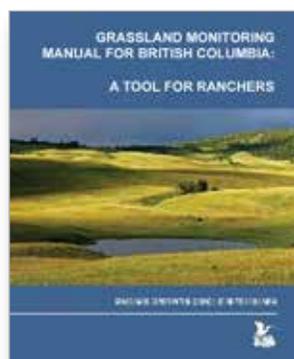
Note and photograph any key changes—for example, take pictures of your field before and after you put in a hedgerow.

Making Drawings

Add the changes you have made to your farm map so you can maintain an overview of the activities you have undertaken.

Accessing Monitoring Information

If you need further guidance on how to use photo-points to monitor the success of your Biodiversity Management Plan, consider accessing Chapter 6 (Conducting Photo-point Monitoring) of the Grassland Conservation Council of *British Columbia's Grassland Monitoring Manual for British Columbia: A Tool for Ranchers* (http://bcgrasslands.org/wp-content/uploads/2018/01/bc_grassland_monitoring_manual_for_bc.pdf) or the Ministry of Agriculture's Monitoring Grazing Lands factsheet https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/biodiversity/grazing/649000-8_monitoring_grazing_lands_grazing_factsheet_no7.pdf



Linking to Stewardship Groups

Biodiversity conservation is most effective when it is coordinated at the community level. Often, local stewardship groups and landowners share a common goal of managing for biodiversity. By working together, they can conserve biodiversity at a scale that extends beyond individual property lines.

Local stewardship groups can help landowners retain or enhance natural areas and resources by providing information, resources, specialists, labour, and even financial assistance for activities ranging from habitat assessment to project planning and implementation. For example, Ducks Unlimited Canada has worked with numerous landowners in constructing wetlands. These areas provide wildlife habitat and help store water which can be used for livestock and irrigation. Both the landowner and the environment benefit from these collaborative efforts.

Local watershed groups can also help landowners contribute to biodiversity conservation beyond their property. For instance, watershed groups may offer funding and resources to help stabilize stream banks and construct off-site watering, which can provide additional benefits of improving fish habitat and water quality. By coordinating their conservation efforts with local stewardship groups, individual landowners can reduce their costs and contribute most meaningfully to broader-scale conservation goals.

ADAPTIVE MANAGEMENT

The approach to managing for biodiversity outlined in this guide is referred to as adaptive management. It gives you the opportunity to refine your management goals and improve your management practices by reviewing the results you have achieved to date. The process can be repeated as long as improvements in your management system are needed or desired. Using this approach will enhance your success in managing for biodiversity on your land.

4 SAMPLE PLAN

CLINE AGRI HEALTH CENTRE

Information for this biodiversity plan was gathered from field reconnaissance work completed on September 10th 2019, in combination with completion of the biodiversity question worksheets (Planning for Biodiversity, A guide for BC Farmers and Ranchers), and reference material available from various sources. Also foundational to the species lists and some other information found in this plan is contributed to the draft Westwood Farm report prepared by University students through the Mount Arrowsmith Biosphere Region Research Institute (MABRRI) at Vancouver Island University (VIU).



Biodiversity Management Plan



Biodiversity Management Plan
Cline Agri Health Centre March 2019

GENERAL LOCATION

Cline Agri Health Centre Farm is located on South-Central Eastern Vancouver Island in Nanaimo in the Westwood area of Jingle Pot road, near Cathers Lake. The Millstone River transects the property. The total area of the property is 19 hectares and is bounded by Westwood Rd to the east, subdivisions to the south, forest and farms to the west and a combination of subdivisions, East Wellington Road Park, forest and hay land (East Wellington Road Park) to the north. West Marsh Park and Buttertub Marsh Park are also close by, across the highway.

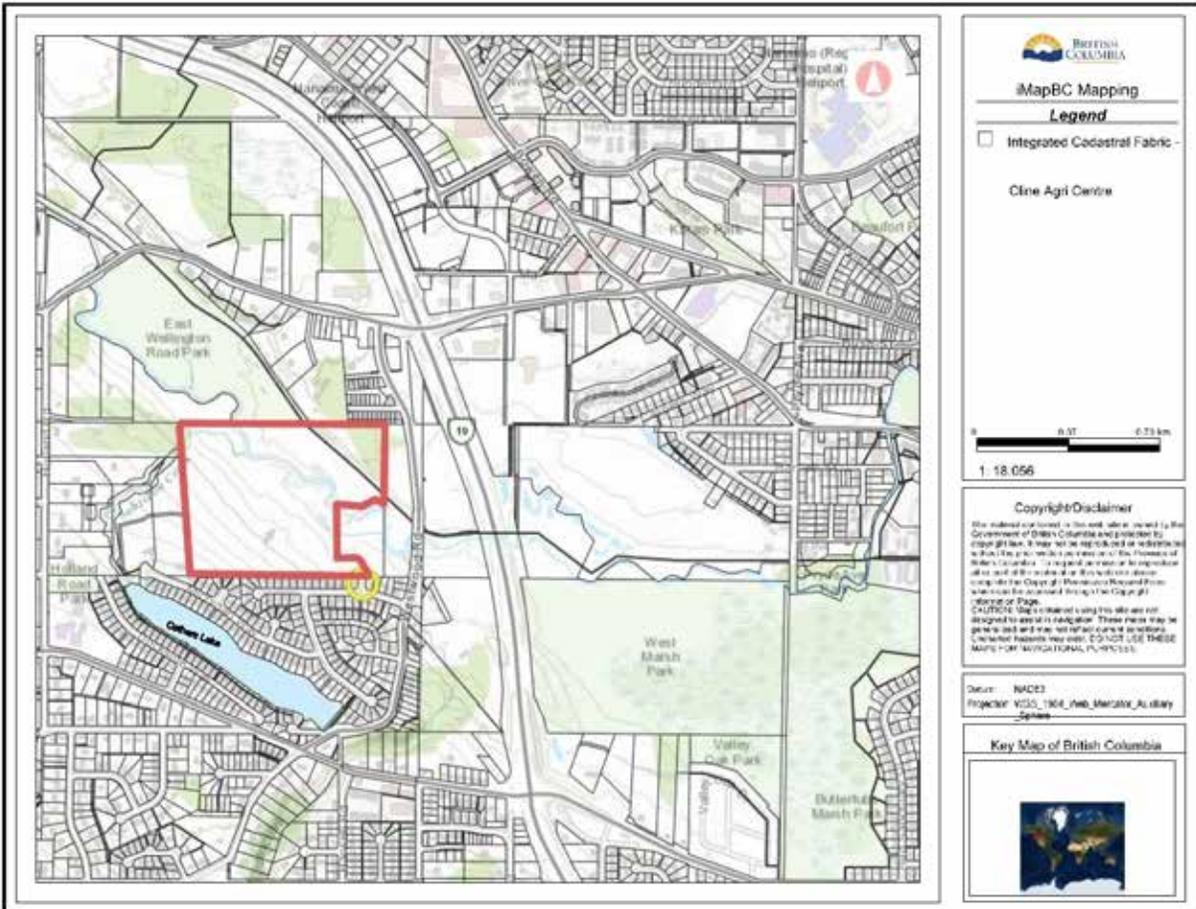


Figure 1: Location of farm

The farm has a varied landscape with natural forests, a river (Millstone River) and ephemeral stream (Sabiston Creek), associated riparian areas and a variety of perennial and annual crops. The farm is within the Georgia Depression (Nanaimo Lowland Ecoregion) and the Coastal Douglas Fir Moist Maritime (CDFmm) Biogeoclimatic Zone.

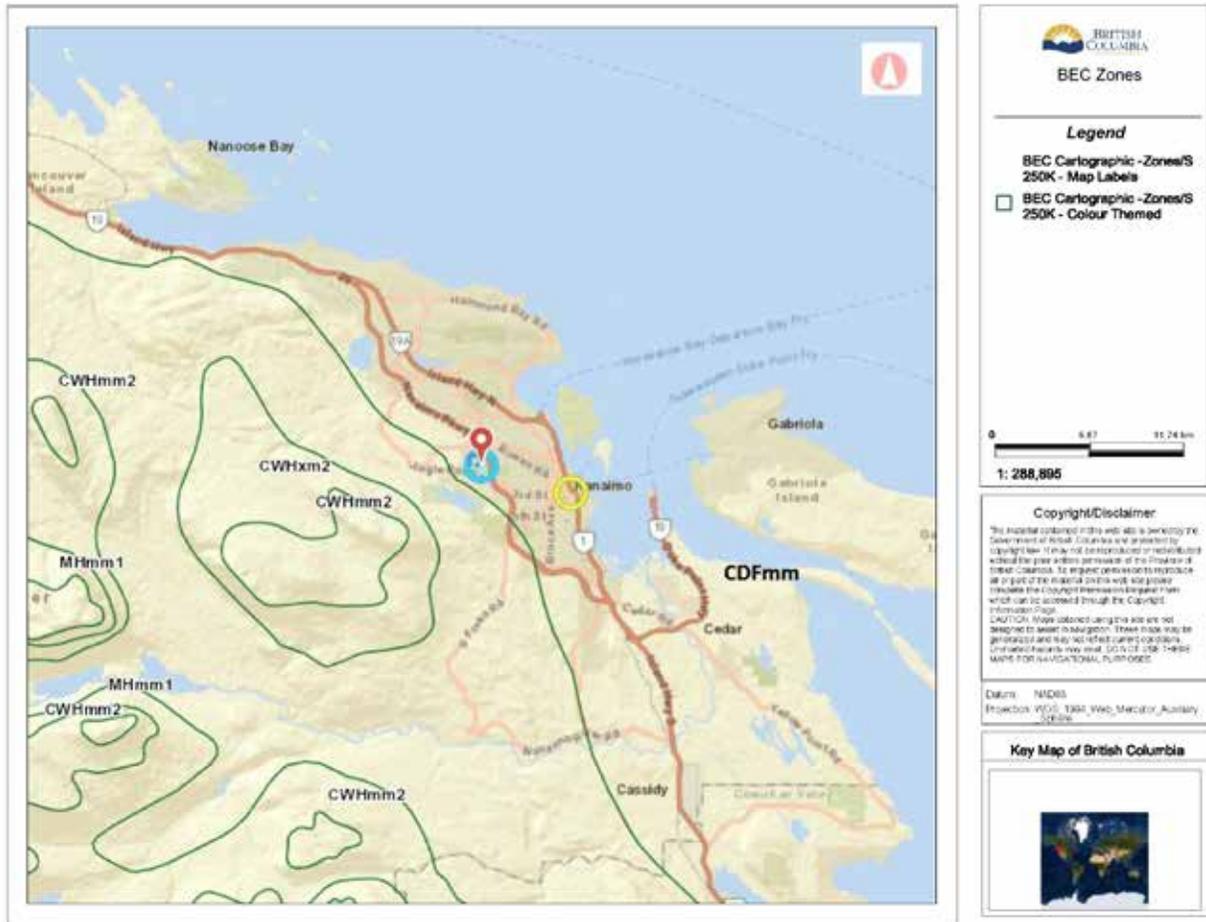


Figure 2: BEC Zones, Subzones, Variants

There is nearby municipal land (green fill area on map below) and conservation land (hatched green area labelled West Marsh, part of the Buttertubs Marsh) that creates opportunities for connectivity with larger somewhat natural ecosystems.

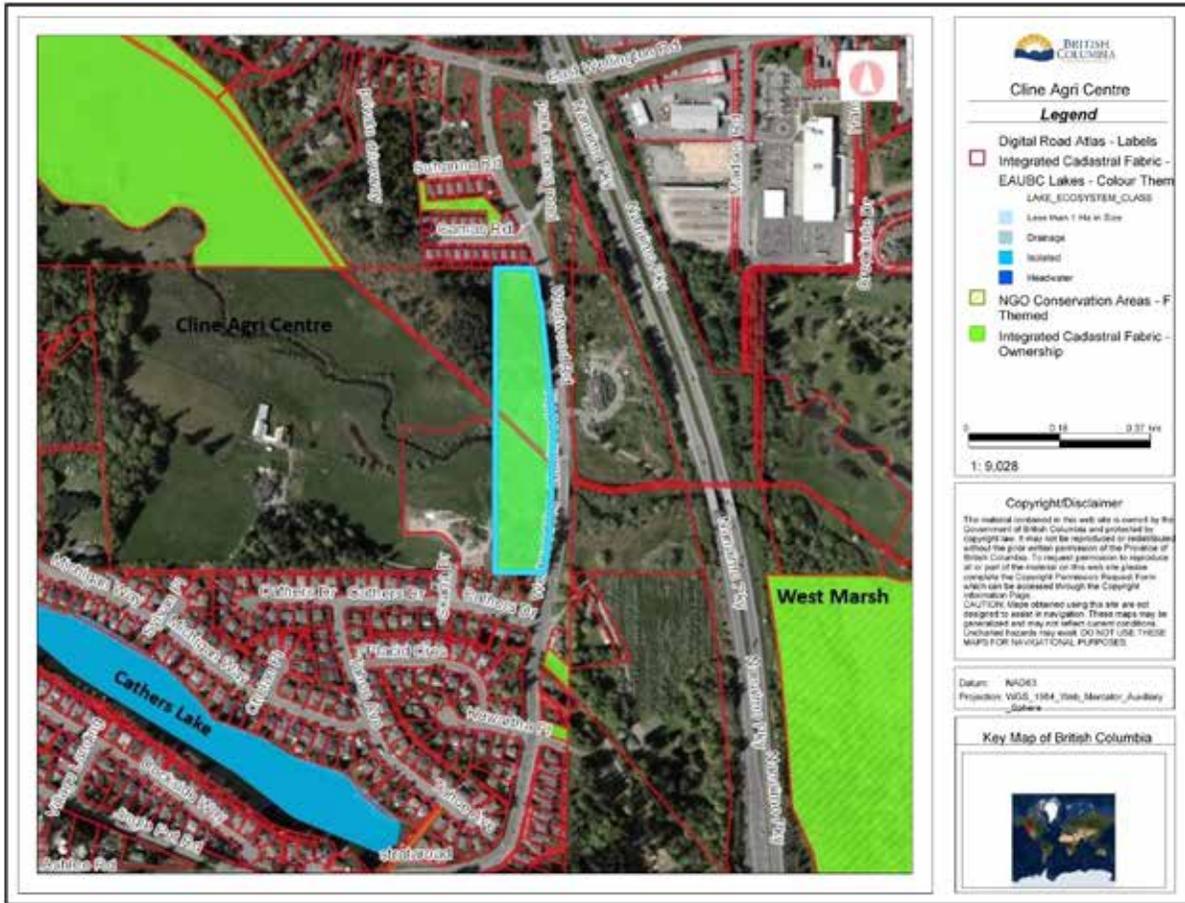


Figure 3: Location of farm and connectivity to natural ecosystems

FARM DESCRIPTION AND PRODUCTS PRODUCED

Cline Agri Health Centre is primarily a blueberry farm with 1.2 hectares (3 acres) in production but also produces 5.6 hectares (14 acres) of hay and is cooperating with Nanaimo Food Share in the development of a large garden to assist Nanaimo's disadvantaged families. A large variety of crops are produced in the Food Share garden area.



Figure 4: Food share garden

The blueberry field consists largely of imperfectly drained Brigantine sandy loams. Most of the hay land lies adjacent to the Millstone River on moderately well drained silt loam Chemainus soils.

A further 2.4 hectares (6 acres) is in the development of a newly planted Empress Tree plantation. The area of the Empress tree plantation consists of moderately well drained loamy sands.

The northeast corner of the property is treed and consists of thin rapidly drained sandy loams of the Salalakim soil series soils over bedrock. Both the Brigantine and Dashwood soils have low nutrient and water holding capacity, therefore benefiting from slow release nutrient applications and drip irrigation systems scheduled to provide regular irrigation. Chemainus soils have excellent water holding capacity.

There is an old barn of over a century in age and newer barn with high roof and eaves with potential to support barn swallows and Barn owls.

The open hay, blueberry and Empress Tree fields currently provide excellent foraging habitats. As Empress Trees Grow there will be significantly fewer foraging opportunities for predator bird species.

SITE HISTORY AND MANAGEMENT PRACTICES

The Cline Agri Health Centre rests on one of the few farmed remnants of the historic Westwood farm which occupied 1000 acres. The land was purchased by Joseph Westwood in 1864 and was passed through the family for generations, even housing former mayor and MLA Earle Cathers Westwood. Large gardens would have been a significant part of pioneer life on the farm. The farm was historically operated as a dairy farm producing milk and feed. The centuries old practice of harvesting up to the edge of the Millstone River and removing all the large tree species, likely contributed to significant incising of the river into the erodible loam soils. More recent changes in farming practices including an expanded riparian buffer have contributed to the recovery of the Millstone River where it transects the farm.

Much of the original historic farm was converted to residential development offering minimal opportunities for biodiversity. The 19 ha Cline Agri Health Centre Farm is one of the few remaining large land parcels in the area and as such it provides opportunity for higher biodiversity values and connectivity to nearby conservation areas.

The farm is 470 metres from the 55-hectare Buttertubs marsh conservation area and bird sanctuary. The Millstone river and its riparian corridor connects the property to this valuable habitat.

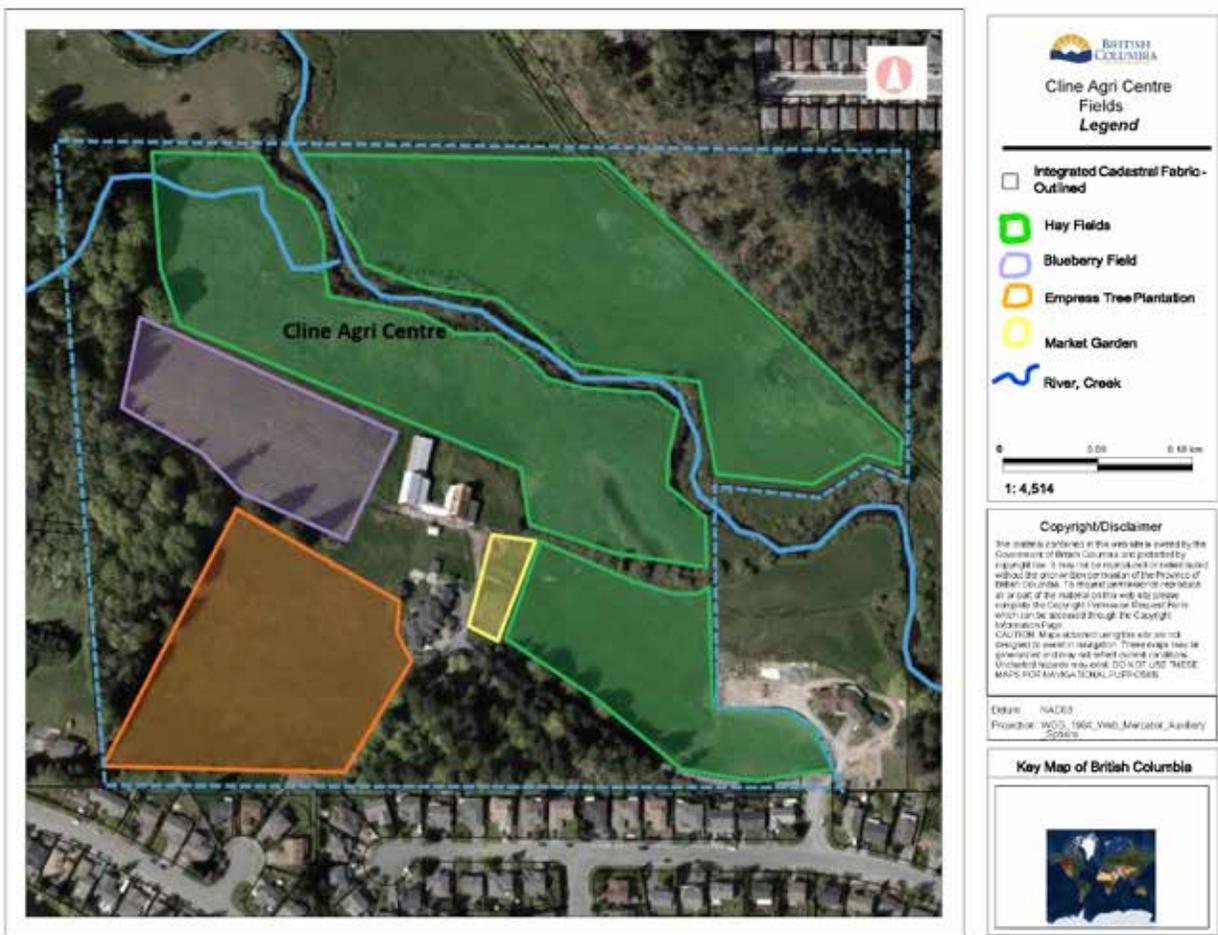


Figure 5: Location of farm crops

The unirrigated hayland is harvested with a single cut of hay late in the year (July-August). Haying is mostly set back from the rivers edge leaving a buffer that helps protect the adjacent riparian river vegetation. The hayed crop is a mix of tall fescue, reed canary grass, quack grass, vetch and other species. The hayed portion of the farm could benefit from being renovated and reseeded to create a more productive crop. Flooding of this area is an issue so flood tolerant species would be more competitive.

Water supplies consist of both a shallow well and reservoir on Cathers Lake. The reservoir is licensed for 27,753.3 m³/year (22.5 acre feet/year). Irrigation water use on the farm is relatively well managed. Drip emitters are used as a water conservation measure. However, due to the low moisture-holding capacity of the Dashwood and Brigatine soils, irrigation management is a challenge.

Both the blueberry and empress trees benefit from high efficiency drip irrigation systems. The empress trees will only be irrigated for the initial years of the planting.

In 2019 the blueberries produced a minimal crop succumbing to bird damage. Both the Blueberries and Empress trees are fenced to exclude deer thus limiting the migration of larger wildlife across the landscape in these areas.

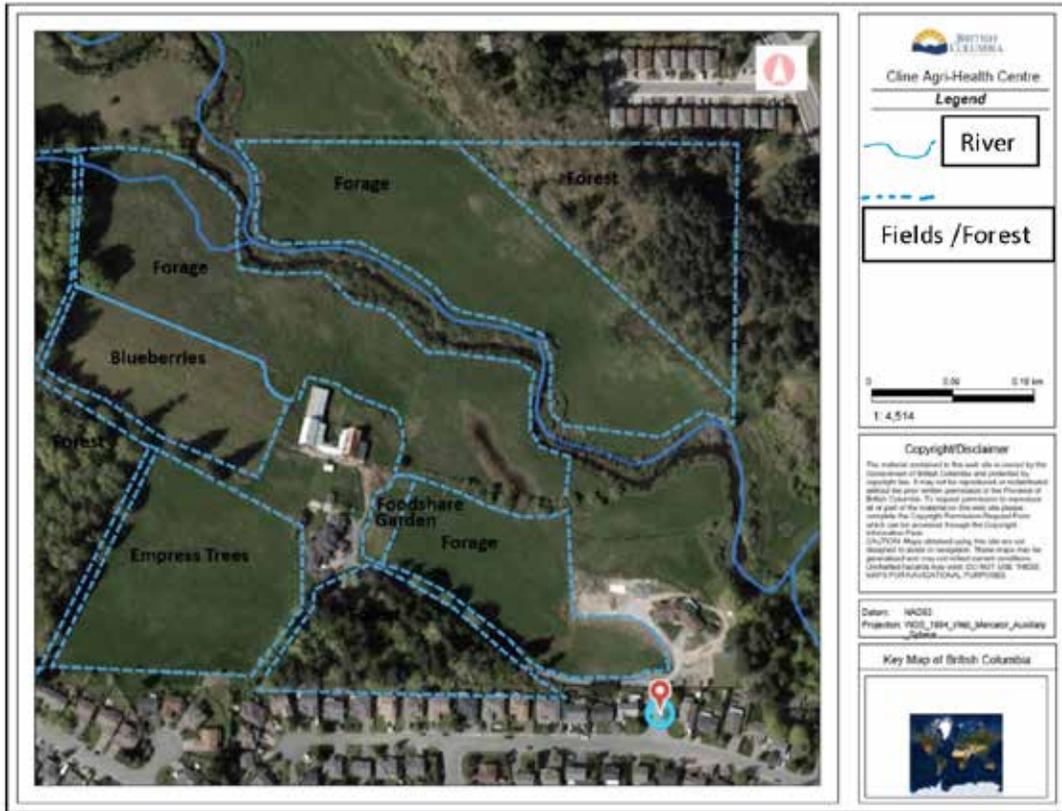


Figure 6: Crops, farm buildings, river, forested areas

Cline Agri Health Centre completed an EFP in the winter of 2018. The farms practices of fuel, fertilizer, and pesticide storage, mixing, and use are in compliance with regulations and EFP recommendations.

Weed management is reliant on maintenance and mowing of competitive vegetation. Invasive weeds are plentiful in the area, both in terms of variety and abundance. Invasive weeds of note include Scotch broom in the Garry oak ecosystem, Daphne in the south and west forest areas, reed canary grass and black berry in riparian areas as well as some Canada thistle and Tansy Ragwort. Of the invasive species the broom in the Garry oak ecosystem is the most damaging to species biodiversity. The rare Garry oak ecosystem contains many plant species at risk which in turn host butterfly and bird species at risk.

Habitat Communities:

The south-east coast of Vancouver Island lies within the Coastal Douglas Fir Moist Maritime (CDFmm) Biogeoclimatic Zone.

- ▶ The Coastal Douglas-fir (CDF) ecological zone makes up about 0.3% of BC's total area.
- ▶ The CDF is by far the smallest and rarest of the 16 ecological zones in BC.
- ▶ The CDF contains the highest diversity of plant species in BC.
- ▶ The CDF contains the highest diversity of over-wintering bird species in Canada.

Cline Agri Health Centre's land base contains a wide range of habitats which are sustainably managed. The Millstone River is possibly the most diverse, providing habitat for many plant, wildlife and aquatic species. The Millstone River flows from NW to SE, dividing the farm north and south. The deep waters and some undercut banks of the Millstone River provide refuge for many species including Coho Salmon Smolts. Historic observations of steelhead were recorded in 1993.

1. Riparian

The riparian vegetation of Millstone River includes both native and non-native shrubs and trees. Maple and oak tree planting is evident. Rose, snowberry, willow, cherry, hardhack, cascara (cascara is a yellow listed species) and hawthorn is also present. Invasive blackberry, daphne, and reed canary grass are also common.



Figure 7: Millstone river, riparian vegetation



Figure 8: Riparian vegetation, shrubs

Tall trees are sparse along the riverbank, except for more recent plantings. Enhancing taller structural vegetation, trees, through infill planting could help protect the banks of Millstone River as well as improve shading of the aquatic area which would improve fish and aquatic species habitat. Managing competing vegetation would be necessary to establish new trees and shrubs. Use of landscape cloth mats is recommended. Tree cages would likely also be needed to control deer browsing.



Figure 9: Planted trees

Sabiston Creek flows out of Cathers Lake and into the Millstone River during precipitation and high water events. It has a shallow streambed, and its riparian area consisting primarily of grasses may be somewhat modified by historic hay and or grazing practices. The remnants of cattails and rushes are present at the lower end of the stream where it flows into Millstone River. This small stream could also benefit from the creation of a buffer from haying and grazing to protect the narrow band of riparian vegetation along its banks.

2. Terrestrial

Terrestrial habitat within the boundary of the Cline Agri Farm includes natural forest areas, farm fields, and cropped areas. Patches of natural forest are found on the north, south and west boundary of the property. The forest areas are modified from past logging and human use. The Garry Oak ecosystem in the north east corner of the property has some good cover of Garry Oak but also has broom and non-native grasses present. The rocky upland bench in the North East corner with rare Garry oak habitats can be host to a diversity of plant species- note at least 95% of Garry oak habitat Provincially has been lost and the remainder is in decline. The rocky plateau area consists of Douglas fir, snowberry, red huckleberry, bracken fern, Oregon grape, salal, arbutus and ocean spray in the denser forested areas. Garbage was observed in this area likely due to the proximity to a main road.



Figure 10: Rocky plateau, douglas fir and understorey vegetation

Garry oak, Arbutus, moss, grass species and invasive broom are present in the open areas and bluffs facing SW.



Figure 11: Garry oak ecosystem, NE corner of farm



Figure 12: Garry oak, arbutus, SW exposed rocky bluff

Garry oak arbutus plant communities are red listed provincially. The bottom of the bluff adjacent to the hay field is rose, hardhack and reed canary grass.



Figure 13: Rose, hardhack, reed canary grass adjacent to hay field and bluff

Forested areas on the south and west boundary of the farm are a mix of Douglas fir, Big Leaf maple and cherry. The understory contains thimbleberry, ocean spray, Oregon grape, sword fern, bracken fern, snowberry with some invasive non-native holly and daphne present.

A newly planted Empress tree plantation is also on the South-west side of the property. Diversity and biodiversity is currently limited but as the plantation becomes established it will connect the two native forest areas to the east and west together.

Perennial cropped areas, hay, blueberry, and Empress Tree fields also provide some habitat diversity. Hay fields may provide cover in the spring for grassland nesting birds like the Savannah sparrow. Haying later in the season after young birds have fledged is the current farm practice. These areas also provide forage and habitat for voles and other small mammals and reptiles. These species in turn provide a food source for raptors such as red-tailed hawks that might frequent the farm.



Figure 14: Hayfield, habitat for grassland nesting birds, small mammals

Annual cropped areas like the Food Share garden can support a host of insects, soil organisms and most importantly pollinators especially if bee friendly crops and intercrops are planted.

3. Aquatic

Cathers Lake, while not on the farm, is the farm's licensed water storage and contains a diversity of aquatic and wildlife species including the Red listed Western Painted Turtle. The University students through the Mount Arrowsmith Biosphere Region Research Institute (MABRRI) at Vancouver Island University (VIU) also noted during their survey that two nonnative turtle species are also now present in the lake, Red-Eared and Yellow-Bellied Sliders, likely domestic pets released into the lake or river. Unfortunately, these non-native turtles can outcompete the native Western Painted Turtle for food and habitat. Note: the farm is responsible for the dam which maintains Cathers Lake. A 1960's agreement between the City of Nanaimo and the licensee allows two thirds of the lakes water to be used for irrigation.



Figure 15: Cathers Lake, reservoir



Figure 16: Cathers Lake home to red listed western painted turtle

The lake historically supported rainbow trout however invasive bullfrogs have likely eradicated this species. Purple Martin are found in nearby Westwood lake and Buttertubs Marsh and would likely do well on the shores of Cathers Lake.

SPECIES AT RISK

The species at risk listed below are either known to be present or have a likelihood of being present on the property. Other species at risk could be present. Red-list: Extirpated, Endangered, or Threatened, Blue-list: Special Concern, Yellow-list: Secure, SNR: Species Not Ranked

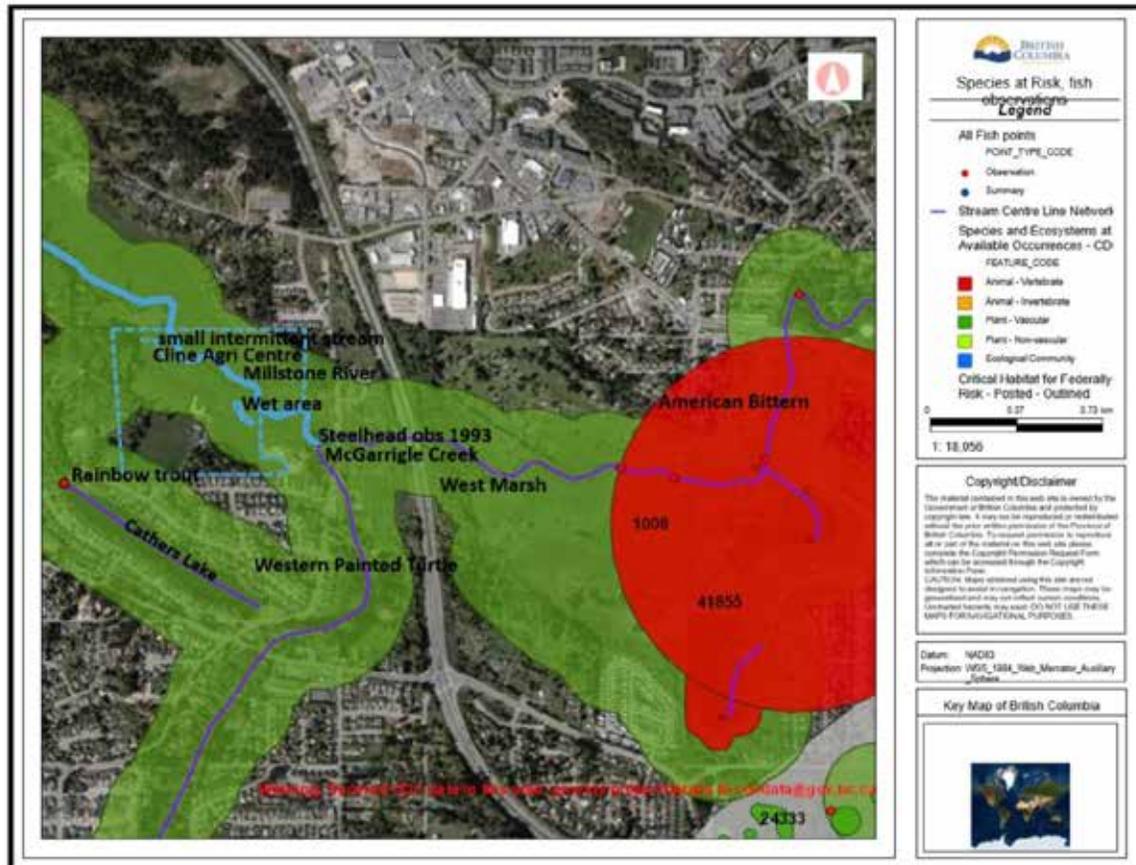


Figure 17: Proximity of farm to species at risk

Cathers Lake contains a highly at risk (red listed) population of Western Painted Turtle which attempts to lay its eggs on the urbanized slopes of Cathers Lake. The Western Painted Turtle is the only freshwater turtle native to British Columbia. Newly hatched turtles may succumb to heavy predation by a very strong invasive population of American bullfrogs also resident in the lake.



Figure 18: Western Painted Turtle



Figure 19: Western Painted Turtle nest areas and protection



Cathers Lake once provided habitat for a vibrant trout population which has been eliminated by the ravages of the bullfrog population preying on fry.

American bittern is a blue listed species and a year-round resident and breeder in the area. It is found more frequently in and near wetlands and lakes but can also be an infrequent visitor to cultivated fields. Adjacent riparian and river ecosystem on the Cline Agri Centre Farm may provide some suitable foraging and possible nesting habitat for this species. It has been observed in nearby Buttertubs Marsh.

Figure 20: American bittern

Purple Martin are found in close by Westwood lake and Buttertubs Marsh and would likely do well on the shores of Cathers Lake : Human encroachment and development caused the loss of almost all natural Purple Martin nesting spots, typically tree cavities along foreshore areas, to less than 10 in British Columbia in the 1980s. Through recovery efforts, there are now 1,150 nesting pairs and 90 colony sites. The artificial nest box program accounts for almost all Purple Martin nesting today. This species was almost extirpated (locally extinct) in BC and through recovery efforts is now listed as a species of special concern (blue-listed). There may be opportunities to provide nest boxes on the shores of Cathers Lake.

4. Terrestrial

Reptiles: The red-legged frog is a resident of cool forest streams and treed wetlands. A blue listed species in BC. The Sharp-tailed snake is small (adults are 20 to 45 cm long and the thickness of a pencil) and harmless, like all snakes on Vancouver Island. A Red listed species in BC.

BIRDS:

Birds	Description	Red listed	Blue Listed
Barn Owl	Barn owls are medium-sized owls, earthy-coloured, with distinctive flat, heart-shaped white faces and no ear tuft.	✓	
Screech Owl	Western screech owls live along the west coast of North America, from Alaska to Mexico.	✓ (Western BC)	✓ (Alaska to Mexico)
Marbled Murrelet	The marbled murrelet lives along the entire coast of British Columbia, and commonly winters in the Georgia Strait region.	✓	
Northern Goshawk	This large hawk is about 60 cm long, has a wingspan of just over one meter, a light grey chest and belly, a blue-grey back, and prominent white stripes over its bright red eyes.	✓	
Purple Martins	Purple martins are the largest swallow in North America, at 17 to 20 cm in length. If not present it could likely be established at Cathers Lake with the placement of nest boxes.		✓
Western Grebe	The western grebe is a large water bird coloured black and white with a long bill and a red eye. It is specialized for diving, with legs set far back on its body (making for effective propulsion but awkward walking).	✓	
Peregrine Falcon	The peregrine falcon is a crow-sized falcon with a dark blue-grey back and head, and lighter underparts, sometimes with a buff-coloured chest.	✓ (Coastal BC)	✓ (Interior BC)
Coastal Vesper Sparrow	The coastal vesper sparrow is considered "critically imperiled" in BC, with only one known nesting site located at the Nanaimo airport. Vesper sparrows nest on the ground in open grassy areas such as Gary oak meadows.	✓	
Green Herons	Green herons are about 43 cm long, with much shorter necks and legs than great blue herons.		✓

The great blue heron is a statuesque bird, standing over 1 metre tall with its neck outstretched. Is Blue listed in BC. Great blue herons have been spotted at the farm.



Figure 21: Great Blue Heron (*Ardea Herodias*). Photo taken July 2019, Millstone River, photo credit to the authors of the Westwood farm project inventory and assessment.

The horned lark has a dark brown back, yellow face and breast with a dark facial mask and breast band, and tiny black feather tufts on the back of its head. with the widespread loss of grassland habitats, it is now on the brink of extinction. Horned larks nest on the ground in open grassy areas such as Garry oak meadows.

Western Bluebird a member of the thrush family is 15 to 18 cm long. Males are deep purple and blue on top and a paler blue underneath; females are a more muted shade of blue, with a grey throat and belly and have a white eye-ring. Once extirpated from Vancouver Island they are now subject to recovery efforts.

Barn Swallow, blue listed. A fair number of barn swallows make home in the large barns at the Cline Agri Centre Farm and 27 were sited by the Vancouver Island University Survey Team led by Dr. Eric Demer (Mount Arrowsmith Biosphere Region Research Institute, September 2019)

- ▶ Olive-sided Flycatcher, blue listed
- ▶ Short-eared Owl, blue listed
- ▶ Long-billed Curlew, blue listed
- ▶ Ancient Murrelet, blue listed
- ▶ Band-tailed Pigeon, blue listed
- ▶ Common Murre, red listed
- ▶ Brandt's Cormorant, red listed
- ▶ Brant, blue listed
- ▶ Cackling Goose, blue
- ▶ Long-tailed Duck, blue
- ▶ California Gull,

- ▶ Blue Surf Scoter, blue
- ▶ Red-necked Phalarope, blue
- ▶ Double-crested Cormorant, blue
- ▶ Snowy Owl, blue
- ▶ Caspian Tern, Blue

BATS:

- ▶ Townsend 's big-eared bat, blue listed
- ▶ Keen's Long Eared Myotis, red listed

BUTTERFLIES:

- ▶ Common ringlet, red listed
- ▶ Icaroides Blue, red listed – may be extirpated
- ▶ Dun skipper, blue listed
- ▶ Greenish blue, red listed may be extirpated
- ▶ Propertius duskywing, blue listed
- ▶ Island large marble, red listed
- ▶ Taylor's checkerspot, red listed
- ▶ Chalcedon checkerspot, red listed
- ▶ Moss's elfin, blue listed
- ▶ Bremner's fritillary / Zerene fritillary, blue listed

Garry Oak meadows are particularly important for many of the plants needed by butterflies.

Yellow Sand-verbena (blue listed), Beach Bindweed (blue listed), American Glehnia (blue listed), Fleshy Jaumea (blue listed) Black Knotweed (blue listed), NAR Contorted-pod Evening primrose (red listed), Western yellow buttercup (red listed) are species associated with Garry oak meadows.

MOTHS:

- ▶ Sand-verbena Moth (red)

SPIDERS:

- ▶ Georgia Basin Bog Spider (blue)

OTHER

Wild pollinators such as bumblebees benefit from the diversity of plants found in the Foodshare garden, however the riparian and Garry oak habitats provide the greatest opportunities for sustaining wild pollinator populations and in turn the wild pollinators sustain the plants requiring pollination and their ecosystems. The Foodshare garden could further provide for wild pollinators by increasing the diversity of wild flowering plants. Controlling the invasive broom in the Garry oak ecosystem would encourage the growth of many plant species at risk.

The Westwood Farm report lists 40 bird species as being present at the Cline Agri Centre Farm.

The bird survey information in the table below is from a draft Westwood Farm report prepared by University students through the Mount Arrowsmith Biosphere Region Research Institute (MABRRI) at Vancouver Island University (VIU), September 2019.

5.2.1.1 Bird Survey (DRAFT)

In the bird survey for Westwood Farm, 40 species of birds were observed:

Scientific Name	Common Name
<i>Spinus tristis</i>	American goldfinch
<i>Turdus mirgatorius</i>	American robin
<i>Calypse anna</i>	Anna's hummingbird
<i>Haliaeetus leucocephalus</i>	Bald eagle
<i>Patagioenas fasciata</i>	Band-tailed pigeon
<i>Hirundo rustica</i>	Barn swallow
<i>Pheuticus melanocephalus</i>	Black-headed grosbeak
<i>Euphagus cyanocephalus</i>	Brewer's blackbird
<i>Molothrus ater</i>	Brown headed cowbird
<i>Bombycilla cedrorum</i>	Cedar waxwing
<i>Poecile rufescens</i>	Chestnut-backed chickadee
<i>Spizella passerina</i>	Chipping sparrow
<i>Corvus corax</i>	Common raven
<i>Gepthiyypis trichas</i>	Common yellowthroat
<i>Dryobates pubescens</i>	Downy woodpecker
<i>Sturnus vulgaris</i>	European starling
<i>Haemorhous mexicanus</i>	House finch
<i>Colaptes auratus</i>	Northern flicker
<i>Stelgidopteryx serripennis</i>	Northern rough winged swallow
<i>Corvus caurinus</i>	Northwestern crow

Scientific Name	Common Name
<i>Oreothlypis celata</i>	Warbler
<i>Empidonax difficilis</i>	Pacific-slope flycatcher
<i>Spinus pinus</i>	Pine siskin
<i>Haemorhous purpureus</i>	Purple finch
<i>Sitka canadensis</i>	Red-breasted nuthatch
<i>Sphyrapicus ruber</i>	Red-breasted sapsucker
<i>Agelaius phoeniceus</i>	Red-winged blackbird
<i>Columba livia</i>	Rock pigeon (feral pigeon)
<i>Selasphorus rufus</i>	Rufous hummingbird
<i>Passerculus sandwichensis</i>	Savannah sparrow
<i>Melospiza melodia</i>	Song sparrow
<i>Pipilo maculatus</i>	Spotted towhee
<i>Catharus ustulatus</i>	Swainson's thrush
<i>Tachycineta bicolor</i>	Tree swallow
<i>Cathartes aura</i>	Turkey vulture
<i>Tachycineta thalossina</i>	Violet-green swallow
<i>Vireo gilvus</i>	Warbling vireo
<i>Piranga ludoviciana</i>	Western tanager
<i>Empidonax traillii</i>	Willow flycatcher
<i>Setophaga petechia</i>	Yellow warbler

Other species identified at the Cline Agri Centre farm by Vancouver Island University Survey Team, 2019.

Contribution	Flora/Fauna	Category	Scientific Name	Common Name
MABRRI	Fauna	Fish		Minnows (unidentified)
MABRRI	Fauna	Fish	<i>Pacifastacus leniusculus</i>	Signal crayfish
MABRRI	Fauna	Mammal	<i>Odocoileus hemionug columbianus</i>	Black-tailed deer
MABRRI	Fauna	Mammal	<i>Lepus sylvaticus</i>	Cottontail rabbit
MABRRI	Flora	Flora	<i>Equisetum arvense</i>	Field horsetail
MABRRI	Flora	Flora	<i>Myosotis scarpioides</i>	Forget-me-nots
MABRRI	Flora	Flora	<i>Heracleum mantegazzianum</i>	Giant hogweed
MABRRI	Flora	Flora	<i>Rubus discolor</i>	Himalayan blackberry
MABRRI	Flora	Flora	<i>Crataegus pinnatifida</i>	Mountain hawthorn
MABRRI	Flora	Flora	<i>Rosa nutkana</i>	Nootka rose
MABRRI	Flora	Flora	<i>Laucanthemum vulgare</i>	Oxeye daisy
MABRRI	Flora	Flora	<i>Physocarpus capitatus</i>	Pacific ninebark
MABRRI	Flora	Flora	<i>Rosa roodsii</i>	Prairie/wood rose
MABRRI	Flora	Flora	<i>Destuca rubra</i>	Red fescue
MABRRI	Flora	Flora	<i>Cirsium vulgare</i>	Spear thistle

Appendix Assessment questions for developing the biodiversity plan

Questions 7, 8, 9 and 10 do not apply

RIPARIAN HABITAT

QUESTION 1

What are the opportunities to enhance the riparian habitat on your farm?

- ▶ Typically, riparian habitats are among the most productive and biologically diverse areas on any farm or ranch.



Regulatory approvals may be required.

Look for the following opportunities to enhance the riparian habitats on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no riparian habitats on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Riparian habitat is vegetated by a variety of healthy native plant species of differing structures and/or heights.	<input checked="" type="checkbox"/> Riparian habitat is vegetated but with a limited number of native plants species, and those present exhibit few differences in structure and/or height.	<input type="checkbox"/> Riparian habitat has few, if any, native plant species present, and those present exhibit minimal differences in structure and/or height.	consider removal of invasive species and planting of more native shrubs and trees in riparian area of Millstone River and Sabiston Creek.
<input type="checkbox"/> No weed or invasive alien plant species are present in the riparian area.	<input type="checkbox"/> Weed species are present but there are no invasive alien plant species in the riparian area.	<input checked="" type="checkbox"/> There are significant populations of weed species and/or invasive alien plant species present in the riparian area.	Significant Reed canary grass, black berry and some Holly, Daphne and Canada thistle
<input checked="" type="checkbox"/> There are no livestock in the riparian area, or livestock are managed in a way that protects the riparian area from damage.	<input type="checkbox"/> Livestock have some access to the riparian area and are damaging vegetation and/or bank stability.	<input type="checkbox"/> Livestock have uncontrolled access to the riparian area and are causing significant damage to native plants and bank stability.	If livestock grazing occurs in the future recommend fencing to maintain riparian buffer.
<input type="checkbox"/> Numerous wildlife species are present in the riparian area.	<input checked="" type="checkbox"/> Some wildlife species are present in the riparian area.	<input type="checkbox"/> Wildlife species are rarely seen in the riparian area.	Blue listed Great Blue heron and many other bird species observed.
<input type="checkbox"/> Machinery is not used in the riparian area.	<input checked="" type="checkbox"/> Machinery is sometimes used in the riparian area.	<input type="checkbox"/> Machinery is frequently used in the riparian area.	Machinery is operated in the area of Sabiston creek which is ephemeral.
<input type="checkbox"/> Roads and/or crops are located well away from riparian areas.	<input checked="" type="checkbox"/> Roads and/or perennial crops are set back a moderate distance from riparian areas.	<input type="checkbox"/> Roads and annual crops are located very near riparian areas.	Approximately 3m buffer in many areas.

QUESTION 2

What are the opportunities to increase the connectedness of riparian habitat within your farm?

- ▶ Connecting riparian areas may be the best way to increase habitat connections on your farm.

Look for opportunities to increase the connectedness of riparian habitat on your farm, and then determine the appropriate practices to achieve them.



Regulatory approvals may be required.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no opportunities to increase the connectedness of riparian habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input checked="" type="checkbox"/> Does not apply. There are no opportunities to increase the connectedness of riparian habitat on your farm.	<input type="checkbox"/> There is one riparian area on your farm, but there are patches of other native or semi-natural areas that could be connected to it.	<input type="checkbox"/> There are several unconnected riparian areas on your land that are close together and could be connected.	The Millstone river transects the property providing habitat connections. Riparian areas are somewhat connected to adjacent forest areas.

AQUATIC AREAS, INCLUDING WETLANDS

QUESTION 3

What are the opportunities to enhance aquatic habitat on your farm?

- ▶ Enhancing aquatic habitat can make significant contributions to biodiversity.

Look for opportunities to enhance aquatic habitat on your farm, and then determine the appropriate practices to achieve them.



Regulatory approvals may be required.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There is no aquatic habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Aquatic habitat on your farm has been maintained, enhanced, and/or created, and is healthy.	<input checked="" type="checkbox"/> Some aquatic habitat can be enhanced by improving water storage, restoring previously drained wetlands, and/or improving water management.	<input type="checkbox"/> Large areas of aquatic habitat can be readily enhanced by improving water storage, restoring previously drained wetlands, and/or improving water management.	
<input type="checkbox"/> Banks of watercourses, including wetlands, are intact and not slumping, compacted, or eroded.	<input checked="" type="checkbox"/> There are some slumping, compacted, or eroded watercourse banks.	<input type="checkbox"/> Banks of watercourses show significant slumping, compaction, and/or erosion.	
<input type="checkbox"/> Watercourses have a mature canopy of vegetation cover, which moderates water temperatures.	<input checked="" type="checkbox"/> Watercourses have some vegetation cover.	<input type="checkbox"/> Watercourses have no vegetation cover.	Tall tree cover over the Millstone is sparse. Shrub cover is good.
<input checked="" type="checkbox"/> There are no livestock present or livestock access to aquatic habitat is controlled, and buffers have been established.	<input type="checkbox"/> Livestock access to aquatic habitat can be controlled, and buffers can be enhanced.	<input type="checkbox"/> There is significant livestock access to aquatic habitat that is causing damage, and the use of buffers is limited.	If grazing occurs in the future, fencing and offsite watering is recommended to maintain riparian health.

ASSESSMENT OF OPPORTUNITIES

Does not apply. There is no aquatic habitat on your farm.

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Where possible, aquatic habitat has been enhanced by developing offchannel habitat within the floodplain.	<input checked="" type="checkbox"/> There are some opportunities to enhance aquatic habitat by developing off-channel habitat within the floodplain.	<input type="checkbox"/> There are significant opportunities to enhance aquatic habitat by developing off-channel habitat within the floodplain.	East of the barn a wetland could be redeveloped. This would reduce hay crop.
<input checked="" type="checkbox"/> Watercourses are able to overflow their banks during high water and access the historic floodplain.	<input type="checkbox"/> Watercourses are able to overflow some of their banks during high water but can not access all of the historic floodplain.	<input type="checkbox"/> Watercourses are not able to overflow their banks during high water or access the historic floodplain.	
<input type="checkbox"/> Aquatic habitats are protected from farming impacts.	<input checked="" type="checkbox"/> Some areas of aquatic habitat could benefit from improved farm management practices.	<input type="checkbox"/> Several or large areas of aquatic habitat could benefit from improved farm management practices.	Increase riparian buffer.
<input checked="" type="checkbox"/> Aquatic habitats are not receiving pollutants and sedimentation from your farm.	<input type="checkbox"/> Aquatic habitats show some evidence of sedimentation and pollutants coming from your farm.	<input type="checkbox"/> Aquatic habitats show extensive evidence of sedimentation and/or pollutants coming from your farm.	

QUESTION 4

What are the opportunities to increase the connectedness of aquatic habitat within your farm?

- ▶ Connecting aquatic habitats, particularly to larger systems, can significantly increase habitat value.
- ▶ Connecting aquatic habitats can also bring incompatible aquatic species into contact with one another. It is very important to get advice from technical experts and agencies on your proposed plans before you begin any work of this nature.



Regulatory approvals may be required.

Look for opportunities to increase the connectedness of aquatic habitat on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no opportunities to increase the connectedness of aquatic habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Connections between aquatic habitats exist or have been restored.	<input checked="" type="checkbox"/> There are few natural or modified aquatic areas (a short drainage ditch or section of channelized stream) that can be relocated and/or restructured to become connected to a more natural functioning area.	<input type="checkbox"/> There are several natural or modified aquatic areas (a long drainage ditch or channelized stream) that can be relocated and/or restructured to become connected to more natural functioning areas.	Sabiston Creek could be vegetated with shrubs.
<input checked="" type="checkbox"/> There is a network of habitats, such as riparian areas, woodlands, hedgerows, fencerows, or uncultivated areas that connect the aquatic areas on your farm.	<input type="checkbox"/> There is an aquatic area on your farm, and there are patches of other native or semi-natural areas that could be connected to it.	<input type="checkbox"/> There are several unconnected aquatic areas on your land that are close together and could be connected.	
<input type="checkbox"/> There are no existing structures such as a dykes, dams, or closed culverts on your property that impair fish passage.	<input checked="" type="checkbox"/> There is an existing structure such as a dyke, dam, or closed culvert on your property.	<input type="checkbox"/> There are existing structures such as a dykes, dams, or closed culverts on your property.	Cathers Lake dam is not on the farm property but is a farm responsibility

FOREST AND WOODLANDS

QUESTION 5

What are the opportunities to enhance forested or woodland habitat on your farm?

- ▶ Sizeable patches of forest provide interior core habitat that supports a wide range of biodiversity values. In large patches, the interior core is buffered from edge effects associated with differences in microclimates and with agricultural activities, such as cultivation and crop management. Enhancing existing forest and woodland areas by increasing their size can enhance the size and integrity of the interior core and protect it from edge effects.

Look for the opportunities to enhance the forested or woodland habitat on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There is no opportunity to enhance forested or woodland habitat on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input checked="" type="checkbox"/> Forests and woodlands are either in a natural state or are managed sustainably.	<input type="checkbox"/> Forests and woodlands could be managed in a more sustainable manner.	<input type="checkbox"/> Forests and woodlands are not managed for sustainability.	Dying trees are selectively harvested. Garbage and weeds present in some areas.
<input type="checkbox"/> Forests and woodlands on your land have a diverse and healthy understory (grasses, forbs, and shrubs) with good structural diversity.	<input checked="" type="checkbox"/> Forests and woodlands on your land have some understory (grasses, forbs, and shrubs), but it is not well established or has limited structural diversity.	<input type="checkbox"/> Forests and woodlands on your farm have little or no understory (grasses, forbs, shrubs) due to grazing or forest management activities.	Rare Garry oak ecosystem contains broom and some conifers. Manage broom and maintain open canopy by controlling conifer regen.
<input checked="" type="checkbox"/> Livestock do not graze in the forest or the grazing is managed to minimize impacts on biodiversity.	<input type="checkbox"/> Livestock do graze in the forest and grazing has some impacts on biodiversity.	<input type="checkbox"/> Livestock do graze in the forest and grazing is unmanaged.	
<input type="checkbox"/> Forests and woodlands have a diversity of native plant species.	<input checked="" type="checkbox"/> Forest and woodland plant diversity could be enhanced by planting native species.	<input type="checkbox"/> Forest and woodland plant diversity could be enhanced considerably through natural regeneration or by planting a variety of native species.	Once the broom and conifers are controlled in the Garry oak meadow, native species could be planted with the support of the Garry oak recovery team.

ASSESSMENT OF OPPORTUNITIES

Does not apply. There is no opportunity to enhance forested or woodland habitat on your farm.

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> There are few weeds and/or invasive plant species in your forest, and they are controlled.	<input checked="" type="checkbox"/> Weeds and/or invasive plant species are present in your forest and may be competing with forest species.	<input type="checkbox"/> Weeds and/or invasive plant species are common in your forest but can be controlled.	Scotch broom, Daphne, Holly compete with native species. Removal of these would benefit native plant recovery.
<input type="checkbox"/> Many wildlife trees/snags and coarse woody debris are present and are protected during harvesting.	<input checked="" type="checkbox"/> Many wildlife trees/snags and coarse woody debris are present and are protected during harvesting.	<input type="checkbox"/> No wildlife trees/snags or coarse woody debris are present or are not protected during harvesting.	Dead or dying trees could be protected for wildlife use. Leave section of trunk for wildlife tree to encourage cavity nesting species.
<input checked="" type="checkbox"/> Numerous wildlife species are present in the forested areas on your farm.	<input type="checkbox"/> Some wildlife species are present in the forested areas on your farm.	<input type="checkbox"/> Wildlife is rarely seen in the forested areas on your farm.	
<input type="checkbox"/> Your forests and woodlands include many non-timber forest products which provide species diversity.	<input checked="" type="checkbox"/> Your forests and woodlands include some non-timber forest products.	<input type="checkbox"/> Your forests and woodlands include few if any non-timber forest products.	

QUESTION 6

What are the opportunities to increase the connectedness of forest and woodland habitat within your farm?

- ▶ Patches of habitat that are connected by perennial vegetation provide much higher quality habitat for plants and animals than isolated patches.

Look for opportunities to increase the connectedness of forested or woodland habitat on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no patches of forest/woodland on your farm, or there is only one patch with no opportunity to connect it to native habitat.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> All forested areas are connected by uncultivated land, shelterbelts, hedgerows, wooded fencerows, and/or riparian corridors.	<input checked="" type="checkbox"/> There are a few patches of forested areas that are far apart but they could be connected.	<input type="checkbox"/> There are multiple patches of forested areas close together that could be connected.	

WILDLIFE SPECIES AT RISK

QUESTION 11

What are the opportunities to enhance habitat for wildlife, keystone species, and species at risk that may occur on your farm?

- ▶ If you have a species at risk on your property, you are doing a good job of managing for biodiversity, and it is likely you are also supporting other species that are benefiting your operation.
- ▶ You may not actually observe species at risk on your farm because some species are very small, secretive, cryptically coloured, or active mainly at night; however, your property may contain specialized habitat features that these species use. These could include wildlife trees/snags, snake dens, or cliffs. Such features are important to protect because they may be quite rare in the surrounding landscape.

Look for opportunities to modify native pasture management practices on your farm, including timing and intensity, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no records of species at risk for your area, and wildlife species, including keystone species, native to your area are well represented on your farm..			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Species at risk are seen regularly on your property, and your farm has specific habitats or habitat features that support these species.	<input checked="" type="checkbox"/> There are historical records (more than 10 years old) or have been occasional sightings of species at risk in your area or on your property, but habitat enhancement is needed to recover the species' habitat or habitat features.	<input type="checkbox"/> Species at risk have been observed in your area or on your property in the last 10 years and have used specific habitats or habitat features, which you can retain and/or enhance.	The rare Garry oak ecosystem has the potential for hosting many rare and endangered species. There are opportunities to enhance Barn owl, Barn swallow and Great blue heron habitat.
<input type="checkbox"/> Keystone species occur on your property, and their habitat is protected.	<input checked="" type="checkbox"/> There are some keystone species on your property and there are others that occur in surrounding habitats similar to those found on your farm.	<input type="checkbox"/> There are no keystone species on your property but they occur in surrounding habitats similar to those found on your farm.	A Savannah sparrow was spotted in 2019 and American bittern are in nearby marshes and could frequent farm. Cathers lake is home to the Western painted turtle.

ASSESSMENT OF OPPORTUNITIES

Does not apply. There are no records of species at risk for your area, and wildlife species, including keystone species, native to your area are well represented on your farm..

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Opportunities to enhance wildlife habitat, diversity, and population levels have been implemented.	<input checked="" type="checkbox"/> There are some opportunities to enhance wildlife habitat, diversity, and population levels.	<input type="checkbox"/> There are numerous opportunities to enhance wildlife habitat, diversity, and population levels.	At risk pollinator species could be enhanced through planting wild flowering plant species. Continue to plant and maintain large trees/ shrubs in riparian area along river.
<input type="checkbox"/> Farming activities are managed in a manner that attempts to avoid wildlife disturbance, injury, or death.	<input checked="" type="checkbox"/> Farming activities are sometimes managed in a manner that attempts to avoid wildlife disturbance, injury, or death.	<input type="checkbox"/> Disturbance, injury, or death of wildlife is not considered when undertaking farming activities.	Ground nesting birds in the hay fields would be protected through late harvesting of hay crops. Savannah sparrows were sited by VIU students.

INVASIVE ALIEN SPECIES

QUESTION 12

What are the opportunities to control invasive alien species on your farm?

- ▶ Non-native plants, animals, and micro-organisms can spread and cause serious and often irreversible damage to Canada's ecosystems, economy, and society.

Look for opportunities to control both terrestrial and aquatic invasive alien species on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES

Does not apply. There are no invasive alien species on your farm..

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> There are few invasive alien species on your farm, and they are controlled with the objective of eradicating them.	<input type="checkbox"/> You can minimize the occurrence of invasive alien species on your farm, but eliminating them is a major challenge.	<input checked="" type="checkbox"/> You may be able to significantly reduce or eliminate invasive alien species on your farm.	Remove invasive plant species such as Daphne, holly and Canada Thistle. Community efforts to control American bull frog populations in Cathers lake should be supported.

CROPS AND LIVESTOCK

QUESTION 13

What are the opportunities to enhance perennial crop areas on your farm to benefit biodiversity?

- ▶ Perennial crop areas include tame pastures, vineyards, orchards, and other long-term crops. These areas are not the equivalent of native areas, but they contribute to biodiversity.
- ▶ Conversion of annual cropped areas to perennial crop areas can increase biodiversity by improving soil condition and creating more diverse habitats.
- ▶ Consideration of the life cycle of wildlife species within perennial crop areas, and timing of farm activities, such as mowing, spraying, pruning, application of fertilizers and manure, so that they have the least impact to wildlife species can make an important contribution to biodiversity.

Look for opportunities to enhance perennial crop areas on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no perennial cropping opportunities on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input checked="" type="checkbox"/> Perennial crop areas are a significant component of your farm.	<input type="checkbox"/> Some perennial crop areas occur on your farm, but there is opportunity to convert additional areas from annual crops to perennial.	<input type="checkbox"/> There are limited areas of perennial crops and annual crops provide the only cover on your farm.	Most of the farm is dedicated to Blueberries, hay and empress tree production.
<input checked="" type="checkbox"/> Perennial crop areas are maintained in a healthy state, which minimizes the need for rejuvenation.	<input checked="" type="checkbox"/> Perennial crop areas are not well maintained and require rejuvenation.	<input type="checkbox"/> Perennial crop areas are not well maintained and require frequent rejuvenation.	Hay crop areas would benefit from tilling and reseeding.
<input type="checkbox"/> Alternate pastures are used to reduce pressure on native pastures at critical times.	<input type="checkbox"/> Alternate pastures could be used to reduce pressure on native pastures at critical times.	<input type="checkbox"/> It is possible to access additional grazing lands and reduce pressure on native pastures at critical times.	NA

QUESTION 14

What are the opportunities to modify your farm management practices, including their intensity and/or timing, to benefit biodiversity?

- ▶ Minimizing pollution is essential to supporting biodiversity in terrestrial and aquatic habitats.
- ▶ Intensive agriculture tends to be associated with increased environmental disturbance, which disrupts the composition, structure, and function of ecosystems, including the productivity of agricultural soils.

Look for opportunities to modify the intensity of crop and/or livestock management practices on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no opportunities to modify the intensity of crop and/or livestock management practices on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input checked="" type="checkbox"/> Integrated pest management is used to determine the best approach to controlling pests.	<input type="checkbox"/> Integrated pest management is sometimes used to determine the best approach to controlling pests.	<input type="checkbox"/> Integrated pest management is not considered when determining the best approach to controlling pests.	
<input type="checkbox"/> Pesticides, including insecticides, herbicides, fungicides, or rodenticides are stored appropriately in secure facilities that are located away from aquatic areas.	<input type="checkbox"/> Pesticides are stored in one facility but in a manner that does not fully meet current standards. They may also be located close to aquatic areas.	<input type="checkbox"/> Pesticides are stored in various locations around the farm. They are neither stored in secure facilities nor in a manner that meets current standards. They may also be located close to aquatic areas.	NA
<input type="checkbox"/> Pesticides are applied only in accordance with label specifications, and an appropriate buffer is maintained to protect waterways from spray drift and runoff.	<input type="checkbox"/> Pesticides are not applied in full accordance with label specifications, and an appropriate buffer is not maintained to protect waterways from spray drift and runoff.	<input type="checkbox"/> Pesticides are not applied in accordance with label specifications, and appropriate buffers are not maintained to protect waterways from spray drift and runoff.	NA
<input type="checkbox"/> The selection of insecticides and timing of application is managed to minimize impacts on pollinating and other beneficial insects.	<input type="checkbox"/> The selection of insecticides and timing of application is sometimes managed to minimize impacts on pollinating and other beneficial insects.	<input type="checkbox"/> The selection of insecticides and timing of application does not consider the impacts on pollinating and other beneficial insects.	NA
<input type="checkbox"/> Where possible, pesticides are applied using non-broadcast applications.	<input type="checkbox"/> There some are opportunities to apply pesticides using non-broadcast applications.	<input type="checkbox"/> There are frequent opportunities to apply pesticides using nonbroadcast applications.	NA

ASSESSMENT OF OPPORTUNITIES

Does not apply. There are no opportunities to modify the intensity of crop and/or livestock management practices on your farm.

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Nutrient inputs are applied at rates based on the requirements of last year's crop.	<input type="checkbox"/> Nutrient inputs are applied at rates based soil testing results.	<input type="checkbox"/> Nutrient inputs are applied at rates using estimated nutrient requirements.	
<input checked="" type="checkbox"/> Manure is stored and applied in such a way that minimizes pollution.	<input type="checkbox"/> Manure is either not stored or not applied in a manner that minimizes pollution.	<input type="checkbox"/> Manure is neither stored nor applied in a manner that minimizes pollution.	Pelletized chicken manure on blueberries
<input type="checkbox"/> Fertilizers are stored in such a way that they minimize pollution.	<input type="checkbox"/> Fertilizers are not always stored in a manner that minimizes pollution.	<input type="checkbox"/> Fertilizers are not stored in a manner that minimizes pollution.	NA
<input type="checkbox"/> Fuel and other petroleum products are stored and dispensed in a manner that minimizes pollution.	<input type="checkbox"/> Fuel and other petroleum products are either not stored or not dispensed in a manner that minimizes pollution.	<input type="checkbox"/> Fuel and other petroleum products are neither stored nor dispensed in a manner that minimizes pollution.	NA
<input checked="" type="checkbox"/> Multiple pastures are rotationally grazed, and the order of grazing is changed each year.	<input type="checkbox"/> Pastures are rotationally grazed but are used in the same order each year.	<input type="checkbox"/> Pasture rotation is infrequent, and pastures are used in the same order each year.	Applies to future proposed grazing.
<input checked="" type="checkbox"/> Pastures are given adequate rest during the growing season.	<input type="checkbox"/> Pastures are given some rest during the growing season.	<input type="checkbox"/> Pastures are grazed continuously and season-long.	Applies to future proposed grazing.
<input checked="" type="checkbox"/> Grazing of areas with thin soils and steep slopes is avoided when soils are wet.	<input type="checkbox"/> Grazing of areas with thin soils and steep slopes sometimes occurs when soils are wet.	<input type="checkbox"/> Grazing of areas with thin soils and steep slopes often occurs when soils are wet.	Applies to future proposed grazing.
<input checked="" type="checkbox"/> Mowing is done in a way that maintains strips of blooming, native flowering plants for pollinating insects.	<input type="checkbox"/> Mowing is sometimes done in a way that maintains strips of blooming, native flowering plants for pollinating insects.	<input type="checkbox"/> Mowing often coincides with peak native flower blooming periods; native flowering plants are not maintained for pollinating insects.	Late season mowing maintains flowering plants
<input checked="" type="checkbox"/> Irrigation is managed to conserve water.	<input type="checkbox"/> Some irrigation practices that conserve water have been implemented.	<input type="checkbox"/> Flood and sprinkler irrigation could be modified to conserve water.	Drip irrigation in place.
<input type="checkbox"/> Drainage is managed in a way that takes biodiversity and best practices into consideration.	<input type="checkbox"/> Most drainage is managed in a way that takes biodiversity and best practices into consideration	<input type="checkbox"/> Drainage is not managed in a way that takes biodiversity and best practices into consideration	NA

QUESTION 15

What are the opportunities to increase the mix of crop and/or livestock species on your farm?

- ▶ Increasing the mix of crop and livestock species contributes to both species and genetic diversity on the farm, and may also increase the overall productivity of your farm.

Look for opportunities to increase the mix of crop and/or livestock species on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no opportunities to increase the mix of crop and/or livestock species on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Your operation includes a wide diversity of crop species.	<input checked="" type="checkbox"/> Your operation includes some diversity of crop species.	<input type="checkbox"/> Your operation includes only a very limited diversity of crop species.	
<input type="checkbox"/> Your operation includes a diversity of livestock species.	<input type="checkbox"/> Some additional livestock species could be included in your operation.	<input checked="" type="checkbox"/> There is an opportunity to include a significant diversity of livestock species in your operation.	
<input type="checkbox"/> The diversity of crops in your operation creates a variety of habitats for desirable wildlife species, including pollinators and the natural enemies of pests.	<input checked="" type="checkbox"/> There is some diversity of crops in your operation, and they create some habitat for desirable wildlife species, including pollinators and the natural enemies of pests.	<input type="checkbox"/> There is a limited diversity of crops in your operation, which creates little habitat for desirable wildlife species, including pollinators and the natural enemies of pests.	

QUESTION 16

What are the opportunities to manage for soil biodiversity on your farm?

- ▶ Maintaining a diverse biological community in soils creates a healthy environment for plants.
- ▶ Maintaining soil biodiversity can also help with pest and disease control.
- ▶ The benefits of diversified crop rotations, together with reduced tillage and especially no tillage, can dramatically increase soil productivity while reducing costs.
- ▶ Generally, mixed- and inter-cropping systems increase above-ground diversity. Because below-ground diversity often mirrors above-ground diversity, these systems tend to have more diverse soil biotic communities.

Look for opportunities to manage for soil biodiversity on your farm, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no soil-bound crops on your farm.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Zero tillage is practiced.	<input type="checkbox"/> Zero tillage is sometimes practiced.	<input checked="" type="checkbox"/> Tillage is commonly used to control weeds and prepare the soil for seeding.	Vegetable production areas use tillage.
<input type="checkbox"/> Nutrient inputs are mainly organic (animal manure and/or green manure).	<input checked="" type="checkbox"/> Nutrient inputs are a mix of organic (animal manure and/or green manure) and commercial fertilizers.	<input type="checkbox"/> Nutrient inputs are almost exclusively derived from commercial fertilizers.	
<input type="checkbox"/> Nutrient inputs are applied at rates based on the requirements of last year's crop.	<input type="checkbox"/> Nutrient inputs are applied at rates based on soil testing results.	<input checked="" type="checkbox"/> Nutrient inputs are applied at rates based only on experience from previous years or on estimated requirements.	Soil testing would be beneficial.
<input type="checkbox"/> Cover crops are used regularly to create green manures and contribute to structural diversity.	<input type="checkbox"/> Cover crops are sometimes used to create green manures and contribute to structural diversity.	<input checked="" type="checkbox"/> Cover crops are not used.	Cover and relay cropping is recommended with the vegetable crops.
<input type="checkbox"/> Crop rotations are regular and include both legumes and grasses, which are selected based on their contribution to soil health.	<input type="checkbox"/> Crop rotations, when practiced, do not include legumes.	<input type="checkbox"/> Crop rotation is not practiced.	Recommended crop rotation and legumes for vegetable production
<input type="checkbox"/> Field activities are managed so that wet soil conditions and soil compaction are avoided.	<input checked="" type="checkbox"/> Field activities are sometimes managed to avoid wet soil conditions and soil compaction.	<input type="checkbox"/> Field activities are not managed to avoid wet soil conditions and soil compaction.	
<input type="checkbox"/> Fall-sown crops are frequently used to protect soil through the winter and early spring.	<input checked="" type="checkbox"/> Fall-sown crops are sometimes used to protect soil through the winter and early spring.	<input type="checkbox"/> Fall-sown cover crops are not used.	Recommend fall sowing of cover crops.

CONFLICTS WITH WILDLIFE

QUESTION 17

What are the opportunities to minimize conflicts between agriculture and wildlife?

- Conflicts generally occur when wildlife have access to agriculturally produced food sources. This can result in unnaturally high concentrations of wildlife.

Look for opportunities to minimize conflicts between agriculture and wildlife on your farm, and then determine the appropriate practices to achieve them.



Regulatory approvals may be required.

ASSESSMENT OF OPPORTUNITIES

Does not apply. There are no conflicts between agriculture and wildlife on your farm.

Achieved	Some Opportunity	Considerable Opportunity	Notes
<input type="checkbox"/> Opportunities to reduce conflicts with wildlife have been identified and implemented.	<input checked="" type="checkbox"/> The risk of conflict exists due to the availability of some unsecured food sources and the presence of large wildlife populations, and there are some limited opportunities to mitigate this risk.	<input type="checkbox"/> The risk of conflict is high due to the availability of unsecured food sources, and there are opportunities to mitigate this risk.	Deer and starling pest pressures. Fencing used to reduce deer impact. Bird scare devices considered in blueberry field.

BEYOND THE FARM

QUESTION 18

What are the opportunities to increase the connectedness of habitats across neighbouring landscapes?

- ▶ Large cultivated areas, roadways, and fencelines can fragment habitats and disrupt plant and animal movements across the landscape. This can lead to loss of important habitat, increased mortality risks, and reduced genetic mixing within species. Maintaining habitat connections across the landscape is a key component of managing for biodiversity.
- ▶ Connectedness can be achieved by maintaining native or semi-natural corridors or habitat patches along property lines. Landscape connectedness can be accomplished by working with neighbours to strategically link patches.



Regulatory approvals may be required.

Look for opportunities to increase the connectedness of habitats across neighbouring landscapes, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no uncropped areas or aquatic habitat on your land, or there is only one patch of uncropped area on your land with no opportunity to connect it to habitat in adjacent lands.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input checked="" type="checkbox"/> All uncropped areas of the same type are connected to similar areas in the neighbouring landscape. They are connected by perennially vegetated corridors that are barrier-free and are managed to retain a high diversity of native plant species.	<input type="checkbox"/> There are at least two isolated uncropped areas on your land that could be connected to similar areas in the neighbouring landscape.	<input type="checkbox"/> There are several isolated uncropped areas on your land, and they could be readily connected to similar areas in the neighbouring landscape.	
<input checked="" type="checkbox"/> Corridors from your farm to the neighbouring landscape are managed to minimize disturbance of wildlife that use them and to maintain healthy and diverse plant communities.	<input type="checkbox"/> There is a corridor on your land that could be connected to a neighbouring landscape and could be managed to improve its use by specific species or groups of species. This could be done without adversely affecting your operation.	<input type="checkbox"/> There are several habitat corridors on your land that could be connected to a neighbouring landscape and could be managed to improve their use by specific species or groups of species. This could be done without adversely affecting your operation.	Corridors could be enhanced.
<input type="checkbox"/> All watercourses are barrier-free, or include a safe passage for native fish, amphibians, and other aquatic wildlife around or through the barrier. Natural water flows occur in all watercourses.	<input checked="" type="checkbox"/> Some barriers are present in watercourses, and water flow is occasionally impeded.	<input type="checkbox"/> Water flow in surface watercourses is impeded, and watercourse segments have become isolated or dead-end streams.	Cathers lake dam

QUESTION 19

What are the opportunities for your farm to contribute to a regional biodiversity conservation initiative?

- ▶ Several regional biodiversity initiatives around the province are contributing to biodiversity conservation and enhancement. Participation in these initiatives by landowners is often a key part of achieving success.

Look for opportunities to contribute to a regional biodiversity initiative, and then determine the appropriate practices to achieve them.

ASSESSMENT OF OPPORTUNITIES			
<input type="checkbox"/> Does not apply. There are no active stewardship initiatives in your region.			
Achieved	Some Opportunity	Considerable Opportunity	Notes
<input checked="" type="checkbox"/> Management of important habitat, such as riparian areas, forests, streams, wetlands, and grasslands on your farm is coordinated with a local or regional biodiversity initiative.	<input type="checkbox"/> Management of important habitat, such as riparian areas, forests, streams, wetlands, and grasslands on your farm could be coordinated with a local or regional biodiversity initiative.	<input type="checkbox"/> Management of important wildlife habitat, such as riparian areas, forests, streams, wetlands, and grasslands, at the landscape level has been not been considered in your community but could be initiated.	Cooperation with Vancouver Island University and the City of Nanaimo is great to see. Cooperation with GOERT Garry oak ecosystem recovery team is encouraged.

ACTION PLAN

List the assessment questions that you scored as Considerable Opportunity or Some Opportunity and which you want to take action on. Using the BMP list, select the BMPs that you want to implement on your land. Set goals that are specific to the BMPs and what you want to achieve in your operation. Determine what you will monitor and when to check if your goals are being met. See the Sample Biodiversity Management Plan section of the guide for an example.

Table 3: Action Plan Worksheet

FARM:	Developed By:	Proposed BMP or BMP Practice Code	Specific Goal(s) Related to BMP(s)	DATE DEVELOPED:		Page ____ of ____
				When	What	
Questions to Be Acted Upon						Date Completed, Approvals or Permits Required, and Other Comments
1. Opportunities to enhance riparian habitat.			Improve weed control in riparian area. Remove Reed Canary grass, blackberry and daphne.	2020/2021	Reduce competition with native species. Monitor flora and fauna.	There may be opportunities to work with stream recovery groups and volunteers to help remove invasive species.
3. Opportunities to increase connectiveness of aquatic habitat.		1002: Riparian Habitat Establishment.	Site prep and plant native large trees and shrubs in riparian area of Millstone River and Sabiston Creek. Protection of new planting from competition and deer browse required.	2020/2021		High opportunity to enhance biodiversity of riparian area and improve aquatic habitat for fish and other aquatic species by planting native trees and shrubs increasing shading of river and stream and improving bank holding capacity, reducing erosion.
4. Opportunities to enhance aquatic habitat.		1002/1003	If grazing occurs in future, consider fencing riparian areas to protect from grazing. This can be portable electric.	2020/2021	Monitor health and condition. Riparian habitat assessment.	Funding may be available. Check with Ardcorp. Leave sufficient buffer adjacent to river and stream to protect riparian vegetation from haying and grazing. Funding may be available for fencing. Check with Ardcorp.
5. Opportunities to enhance forest woodland habitat.			The forested northeast corner of the farm contains rare Garry oak ecosystem. Remove invasive and non native species (i.e. broom). Other forest areas remove holly and daphne.	2020/2022	Assess native plant presence and recovery.	Check with Garry oak recovery team. Non native species like broom, holly, and daphne compete with native species.
			Maintain some snags in forested areas for wildlife enhancement (cavity nesters).	2020/2021	Assess cavity nesting species presence, abundance.	This is a trade-off between salvage logging and wildlife. Be sure to consider the net benefit of salvaging versus leaving some potential wildlife trees.

Questions to Be Acted Upon	Proposed BMP or BMP Practice Code	Specific Goal(s) Related to BMP(s)	Proposed Monitoring		Date Completed, Approvals or Permits Required, and Other Comments
			When	What	
11. Opportunity to enhance species at risk		A barn owl nest box could be constructed in the barn.	2020/2021	Monitor success.	
		Reconfigure eaves if necessary to accommodate barn swallows. They are already present so may not be necessary.	2020	Monitor presence, abundance.	
	2207: Create pollinator habitat.	Plant pollinator species. Consider working with a consultant to recommend suitable species. May work well in Food Share garden area or other areas on the farm.	2020/2021	Monitor population and species presence.	Funding may be available. Check with Ardcorp.
	2206: Hayland management to enhance wildlife survival.	Manage timing of haying to accommodate nesting species (Savannah sparrow, snakes)	2020... annually	Monitor nesting birds.	Recommend haying in late July, early August after birds have fledged.
		Funding for flushing bar to mount on hay cutting equipment may be available. Check with Ardcorp.	annually	Monitor nesting birds.	
		Leave sufficient stubble height when haying, not only to benefit crop health but also to provide wildlife habitat, hiding cover for small mammals.		Monitor fatality of species if any.	3-4 inches minimum stubble.

5 GLOSSARY

A

Action plan: An Action plan is prepared in the second stage of species recovery and outlines the specific measures to be taken on the ground to implement the recovery strategy.

Adaptive breeding: Breeding of plant and animals to produce offspring that are better suited for current or future conditions.

Agricultural land: Any land, regardless of zoning, on which agricultural operations take place (see also Agricultural Operation).

Agricultural management practices: Activities related to agricultural production. Includes regular, periodic, sporadic and one-time-only practices.

Agricultural operation: A farm, ranch or other agricultural operation producing agricultural products for sale. Also includes feedlots, greenhouses, mushroom houses and nurseries; farms producing Christmas trees, fur, game, sod, maple syrup or fruit and berries; beekeeping and poultry hatchery operations; operations with alternative livestock (bison, deer, elk, llamas, alpacas, wild boars, etc.) or alternative poultry (ostriches, emus, etc.), when the animal or derived products are intended for sale; backyard gardens if agricultural products are intended for sale; operations involved in boarding horses, riding stables and stables for housing and/or training horses even if no agriculture products are sold. Sales in the past 12 months not required but there must be the intention to sell.

Agroforestry: A land management approach that deliberately combines the production of trees with other crops and/or livestock.

Alleycropping: Growing crops (e.g., grains, forages, vegetables etc) between trees planted in rows.

Amphibian: See Wildlife.

Aquatic area or zone: A body of water (e.g., stream, river, wetland, lake).

Aquatic ecosystem: Any water environment, such as streams, rivers, lakes, and wetlands, in which plants and animals interact with the chemical and physical features in that environment.

Aquatic species: [from the *Species at Risk Act*] a wildlife species that is a fish or a marine plant, as defined in the federal *Fisheries Act* (see fish, and see marine plant).

Behavioural control: Applies to insects. It takes advantage of insect responses to colours (e.g., yellow traps), odours (e.g., attractant-baited traps, sex pheromone dispensers for mating disruption), and light (e.g., black light traps, insect electrocuters) (see also Integrated Pest Management).

B

Beneficial Management Practice: A practice which, when implemented singly or in combination, will reduce any adverse environmental impacts of agricultural activities without sacrificing economic productivity. A Beneficial Management Practice becomes a Best Management Practice when it is successfully implemented in the unique environmental, agronomic, economic, and operating circumstances existing in a particular situation.

Biodiversity: The variety of life. Biodiversity includes all forms of life such as bacteria, fungi, grasses, shrubs, trees, agricultural crops, insects, amphibians, reptiles, wild and domestic animals and humans. Biodiversity can be divided into three levels of organization, (a) genetic diversity, (b) species diversity, and, (c) ecosystem diversity.

Biodiversity Management Plan: A process that optimizes the relationship between biodiversity, farm management techniques, crop requirements and land use. Refer to page 11-1 of the Canada-BC Environmental Farm Plan Reference Guide.

Biogeoclimatic Ecosystem Classification Zone: The Biogeoclimatic Ecosystem Classification (BEC) system divides British Columbia into 14 different ecological zones based on vegetation, soils, and climate.

Biological control: Control of weeds or insect pests by exposing them to their natural enemies.

Blue-listed: List of ecological communities, indigenous species and subspecies that are of special concern (formerly vulnerable) in BC. Blue-listed elements are at risk, but are not Extirpated, Endangered or Threatened. As determined by the Conservation Data Centre. ⁱ

Buffer: A specially managed area that is used to separate farm activities from sensitive areas, such as a strip of crop vegetation, often grass or trees; some can act as a "treatment system" to remove contaminants before they reach the sensitive area such as a stream or wetland.

Buzz pollination: See Pollination.

C

Chemical control: Uses pesticides to control pests. New less toxic, more target-specific products (often referred to as reduced-risk pesticides) are replacing older broad spectrum synthetic pesticides in order to reduce risks to food, environmental and human safety. These products on average cost more, and require more precise application timing and frequency. (see also Integrated Pest Management).

Climate change: [from the United Nations Framework Convention on Climate Change (UNFCCC), Article 1] “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.”

Coarse woody debris: Logs, stumps, or large branches that have fallen or been cut and have been left on the ground, or trees that have died but remain standing.

Connectivity: See Corridor.

Conservation: Preservation, especially of the natural environment.

Conservation covenant: [in BC] is a written agreement between a landowner and a conservation organization (e.g., The Land Conservancy of BC). In the voluntary agreement, the landowner promises to protect the land in ways specified in the covenant. The covenant is filed in the BC Land Titles Office.

Conservation framework: The Conservation Framework is a science-based approach for coordinating and aligning effective conservation efforts in B.C. by:

- ▶ Contributing to global efforts for species and ecosystem conservation
- ▶ Preventing species and ecosystems from becoming at risk
- ▶ Maintaining the diversity of native species and ecosystems

Conservation status rank: A code that identifies the level of concern about risk to a species or ecological community in the Province. Based on their conservation status rank, each species and ecological community is assigned to the red, blue, or yellow list to define their status and help set conservation priorities

Corridor: A travel route that connects areas of plant and wildlife habitat, permits plant and wildlife movement across agricultural land, and provides food, shelter and protection from predators for organisms.

Critical habitat: The habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery

strategy or action plan for the species. The prohibition on destruction of critical habitat applies to endangered and threatened species and species of special concern are not covered.

Cultural control: These practices make the environment less attractive to pests and less favourable for their survival, dispersal, growth and reproduction, as well as promoting the pest's natural controls such as predators. The objective is to achieve reduction in pest numbers, either below economic injury levels, or sufficiently to allow natural or biological controls to take effect. Examples include the design of integrated polycultures, management of adjacent environments, use of companion crops, crop rotations, and timing of seeding, harvesting and field operations. (see also Integrated Pest Management).

D

Daylighting: The removal of culverts to restore natural watercourses by opening them up to daylight.

Desertification: The progressive destruction of existing vegetation cover to form desert. This can occur due to inappropriate grazing, deforestation, the burning of extensive areas and climatic variations such as drought. Once formed, deserts can only support a sparse range of vegetation.

Drainage Management Plan: Provides guidance on the operation and maintenance of drainage systems, including constructed ditches and channelized and natural streams. See page 9-33 in the Canada-BC Environmental Farm Plan Reference Guide and the EFP Drainage Management Guide.

E

Ecological community: A term used by the BC Conservation Data Centre and the NatureServe network. In BC, it incorporates plant associations from the Vegetation Classification of the Biogeoclimatic Ecosystem Classification, and other natural plant communities include both forested and non-forested ecosystems. Ecological communities may represent ecosystems as small as a vernal pool, or as large as an entire river basin, an ecoregion, or a biogeoclimatic zone.

Ecological compensation areas: Areas of native or restored native habitat on agricultural land (also see Habitat).

Ecological goods and services: The benefits Canadians; including agricultural producers, receive from healthy ecosystems on agricultural land. Examples include water regulation, erosion control, nutrient cycling, and pollination.

Ecosystem: The complex set of interactions between living organisms and their environment. Ecosystems include plants, insects, fish, birds, animals, water and soil. An ecosystem is a dynamic complex of plant, animal, and microorganism communities, climatic factors and physiography, all influenced by natural disturbance events and interacting as a functional unit, and subject to large scale and localized small scale processes. Ecosystems vary enormously in size: a temporary pond in a tree hollow and an ocean basin are both ecosystems.

Edge effect: Differences in microclimates (air and soil temperature, wind, light and humidity) in the area where different plant communities meet.

Endangered: A species facing imminent extirpation or extinction; as designated by the *BC Wildlife Act* and/or the Committee on the Status of Endangered Wildlife in Canada. ⁱⁱ

Energy flow: The travel of energy through ecosystems. For example, energy from the sun is converted by plants into plant tissue. Plant tissue is eaten by a deer to provide them with energy. A wolf may eat that deer for its own energy. When that wolf dies, it decomposes and provides food or energy for micro-organisms. Unlike nutrients and water, energy is not recycled; most of it is lost as heat.

Enhancing: Includes all actions and management activities on the farm that improve existing riparian habitat, restore lost habitat, or create new riparian habitat where none existed previously.

Environment: [from the *Environmental Management Act*] The air, land, water and all other external conditions or influences under which humans, animals and plants live or are developed.

Environmental impact: A measurable change to the environment from an activity or action; may be negative or positive.

Environmentally sensitive area: May be a sensitive water body, habitat area or wildlife population on a non-production area on a farm that is sensitive to farm activities, such as pesticide contaminated runoff.

Environmental Farm Plan (EFP): Is a voluntary and confidential process used by individual producers to systematically identify environmental risks and benefits from their operation, and to develop an action plan to mitigate the risks. The EFP process allows producers to set priorities for actions which address on-farm environmental concerns, as well as those which serve the public interest. Producers who develop EFPs may be eligible for technical and financial assistance for implementation of their on-farm action plans through the National Farm Stewardship Program and the Greencover

Canada Program. Workshops and take-home workbook are free of charge.

Evapotranspiration rates: Rate of evaporation of moisture from plants and soil surfaces and water transpired by plants. Hot and windy conditions generate high rates of evapotranspiration. ⁱⁱⁱ

Extinct: A species that no longer exists; as designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Extirpated: A species that no longer exists in the wild in British Columbia, but does occur elsewhere. Ecological communities that no longer exist in British Columbia, but do occur elsewhere. ^{iv}

F

Farmscaping: Designing and maintaining habitats that attract and support beneficial organisms, such as natural pest predators and native pollinators.

Fish: [from the federal *Fisheries Act*] Includes fish or parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat, and juvenile stages of fish, shellfish, crustaceans and marine animals.

Fish bearing stream: A stream that has, or is likely to have, fish at anytime.

Fish passage: A general term used to represent all types of migration including the localized movements of fish within a given type of habitat. The term applies to all species defined as 'fish' as per the federal *Fisheries Act* which includes crustaceans and marine mammals. ^v

Fish screening: See Intake.

Flushing bar: An aluminum bar with dangling chains that is mounted horizontally on the front end of haying equipment. As the tractor moves, chains or belts hanging from the bar rustle the grass and scares nesting birds and other wildlife out of the path of the equipment.

Food web: A diagram that represents the feeding relationships between organisms within an ecosystem. Food webs generally consist of a series of interconnecting food chains and it is important to understand that they are representative diagrams—only some of the many possible relationships can be shown in such a diagram and it is typical to include only one or two carnivores at the highest level.

Free passage of water and fish: Instream structures constructed so as not to restrict "normal" passage of water and fish (i.e., culverts designed to pass the flood flow and allow fish to move through freely).

G

Genetic diversity: Genetic variation found in a population or in a species. For example, in a herd of Hereford cows, each cow is slightly genetically different from each other.

Grazing Management Plan: Assists producers with ensuring long-term, environmentally-sound and economically-viable grazing management practices. See page 3-1 in the Canada-BC Environmental Farm Plan Reference Guide and the EFP Grazing Management Guide.

H

Habitat: The air, soil, water, food and cover components of the environment on which a plant or animal depend directly or indirectly in order to carry out their life processes such as eating, staying safe from predators, and reproducing.

Aquatic habitat: Habitat in water (see also Aquatic ecosystem).

Critical habitat: [from the *Species at Risk Act*] The habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

Fish habitat: [from the federal *Fisheries Act*] Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Native habitat: Includes aquatic and terrestrial habitat. Habitat that has not been significantly altered by human activity from its original state and is able to support native species. Dominated by native vegetation.

Patch: A contiguous area of native habitat that supports native species, providing food, refuge and an area to raise young. For example, a stand of trees or an area of native grassland.

Terrestrial habitat: Habitat on land.

Wildlife habitat: [from the *Wildlife Act*] The air, soil, water, food and cover components of the environment on which wildlife or species at risk depend directly or indirectly in order to carry out their life processes.

Habitat restoration: Returning disturbed areas to native habitat through removal of non-native species and/or restoration of native species. Ideally, ecosystem functions will return when habitat is restored (see also Native habitat).

Hedgerow: A row of shrubs and/or trees enclosing or separating fields (see also Shelterbelt).

Hibernacula: Hibernation sites. Can be for snakes, bears and other BC species that hibernate over winter.

Hydrologic cycle (water cycle): The continuous cycle by which water enters the atmosphere through evaporation and transpiration from soils, vegetation, lakes, rivers, streams; oceans and other bodies of water, accumulates as water vapour in clouds; and, returns to the ground as precipitation (e.g., rain, snow).

Hyphae: Fine, threadlike strings of fungal cells that make up the fruiting bodies of a fungus.

I

Indigenous: Born, growing or produced naturally (native) in an area, region, or country. Endemic.

Ingrowth: excessive tree recruitment, primarily by shade-tolerant species, such as interior Douglas-fir, within low-density, open forests. Ingrowth often results in the retrogression of understory plant communities, the loss of habitat for sensitive wildlife species, and an increased risk of catastrophic wildfires. Changes in forest structure within ingrown forests reduce forage availability for wildlife and livestock.

Inputs: Pesticides, herbicides, fertilizers.

Insectary plants: Plants that attract beneficial insects such as native bees and pest predators.

Intake: A structure or mechanism to divert water into a domestic or irrigation system.

Fish screening: A specific design to both prevent fish from being drawn into a water system (with screen openings that do not exceed 2.54 mm) and to prevent fish being forcefully drawn against the screen (by ensuring low intake water velocity), as outlined in Water Intakes, on page 9-13 of the Canada-BC Environmental Farm Plan Reference Guide.

Integrated Pest Management: (a) A management method requiring pests to be monitored in order to target pesticide applications, with the expectation that pesticide use will be reduced; (b) [from the *Pesticide Control Act*] Decision making process that uses a combination of techniques to suppress pests and that must include but is not limited to the following elements: (i) planning and managing ecosystems to prevent organisms from becoming pests; (ii) identifying potential pest problems; (iii) monitoring populations of pests and beneficial organisms, pest damage and environmental conditions; (iv) using injury thresholds in making treatment decisions; (v) reducing pest populations to acceptable levels using strategies that may include a

combination of biological, physical, cultural, mechanical, behavioural and chemical controls; (vi) evaluating the effectiveness of treatments.

Integrated Riparian Management: Riparian buffers are managed forest and shrubs in areas bordering lakes, streams, rivers, and wetlands. Integrated riparian management systems are used to enhance and protect aquatic and riparian resources as well as generating income from timber and non-timber forest products. Similar to shelter and timberbelts, integrated riparian management systems can employ a wide variety of tree and shrub species, with specific plantings tailored to suit the specific growing conditions and production opportunities.

Invasive species: According to the Invasive Species Council of BC, an invasive species is defined as an organism (plant, animal, fungus, or bacterium) that is not native and has negative effects on our economy, our environment, or our health. Invasive species can spread rapidly to new areas and will often out-compete native species as there are no predators or diseases to keep them under control. Not all introduced species are invasive - many ornamental plants won't survive outside of gardens.

Irrigation Management Plan: Assists producers with optimizing water use, hence improving water management during drought, long-term climate change and competing uses for water resources. See page 9-15 in the Canada-BC Environmental Farm Plan Reference Guide and the EFP Irrigation System Assessment Guide.

K

Keystone species: Species that support ecosystem function in a unique and significant manner through their activities; the effect is disproportionate to their numerical abundance. Their removal initiates changes in ecosystem structure and often loss of diversity. Examples of keystone species are salmon, badgers, grizzly bears, Pileated Woodpeckers, and whitebark pine.

Listed: A species that is included on the federal Species at Risk List and is legally protected under the federal *Species at Risk Act* (in Schedule 1 to the Act).

M

Mechanical control: Uses barriers or devices such as window screens, rodent traps, netting, fly paper, horticulture cloth and mulches to exclude or destroy pests. These practices may reduce the need for pesticides (see also Integrated Pest Management).

Migration: Regular, periodic movements of wildlife, usually away from and back to a place of origin. Many birds undertake seasonal migrations, typically in the spring and fall, to find more favourable conditions of temperature, food, or water. Such migrations may involve a change of latitude, altitude, or both, and are intended to provide a suitable breeding area.

Monitoring: The process of checking, observing, or keeping track of something for a specified period of time or at specified intervals.

N

Native bee: Also called pollen or solitary bees, includes bumble bees. Bees that are indigenous to an area (see also Native species). There are about 3500 species of native bees in North America.^{vi} Some native bees found in BC include the Mason bee, the leafcutter bee, the carpenter bee, the bumblebee, and the berry bee (see also Pollination; Pollinator; Native Pollinators).

Native habitat: See Habitat.

Native pasture: Fields with native plant cover, usually dominated by native, perennial grasses, which are used for grazing livestock.

Native pollinator: Indigenous organisms whose activities result in plant pollination; includes native bees, birds, some insects and nectar-feeding bats. Excludes honey bees (see also Pollination; Pollinator; Native Bee).

Native species: [from the *BC Wildlife Amendment Act 2004*] A species that is (a) indigenous to BC, or (b) has extended its range into BC from another part of North America, unless the species was introduced by human intervention or activities, or any part of the extension of its range within North America was aided by human intervention or activities. Native species refer to species that naturally occur in an area, such as antelope sage brush in the Okanagan. Native species includes plants and animals.

Natural cycle: A course or series of events that recurs regularly over an interval of time. For example, the reproduction cycles of species, and predator-prey cycles. Also includes (but is not limited to) the water cycle (hydrologic cycle) and nutrient cycles.

Natural disturbance: a natural event that directly alters the structure of ecosystems (e.g., fire, flood, insect outbreak, landslide).^{vii}

Natural process: A process existing in or produced by nature (rather than by the intent of human beings).^{viii}

Non-timber forest products: Products of biological origin other than wood derived from forests, other wooded land and trees outside forests; may be gathered from the wild or produced in forest plantations, agroforestry schemes and from trees outside forests. Examples include berries, mushrooms, floral greenery, and nutraceuticals.

Not at Risk: A species that has been evaluated and found to be not at risk; as designated by the Committee on the Status of Endangered Wildlife in Canada. ^{ix}

Noxious weed: [from the *Weed Control Act*] A weed designated by regulation to be a noxious weed, and includes the seeds of the noxious weed; specified in Weed Control Regulation, Schedule A. Noxious weeds are typically non-native plants that have been introduced to BC without insect predators and plant pathogens to keep them under control. ^x

O

Old-growth: For the purpose of quantitative analysis, old growth is defined as all Coast region forests more than 250 years old, Interior forests dominated by lodgepole pine or deciduous species more than 120 years old, and all other Interior forests more than 140 years old. ^{xi}

Organism: A living thing.

P

Patches: See Habitat.

Pest: [from the *Pesticide Control Act*] An injurious, noxious, or troublesome living organism, but does not include a virus, bacteria, fungus, or internal parasite that exists on humans or animals (also see weed).

Exotic pest: Non-native species of pests.

Pest record: A record of pest monitoring and of the control methods used on-farm.

Pollination: The transfer of pollen from the anthers of a flower to the stigma of the same type of flower. Pollination is required for plant fertilization. Without fertilization plants cannot produce seeds and associated fruits.

Buzz pollination: A highly efficient type of pollination used by bumblebees and some other solitary bees in which they grab a flower and use their flight muscles to vibrate the anthers, thus dislodging pollen.

Pollinator: An organism that moves pollen from the anthers to the stigmas of flowers. For example, bees, butterflies, hummingbirds, moths, some flies, some wasps, and nectar feeding bats.

Predator: Any organism that lives by preying on other organisms (e.g., cougar, bear, predatory insects).

Predator control: Methods to control or reduce the impact wildlife has on agricultural operations. For example, habitat modification, cultural management, fencing, netting, scare tactics, repellents, trapping, and use of firearms.

Proper functioning condition: Refers to a condition in which an ecosystem is able to organize and regulate itself without management intervention and continues to perform key ecological functions that both support its functioning and generate ecosystem goods (like food and fibre) and services (like decomposition, water treatment and pollination).

R

Raptor: See Wildlife.

Recovery strategy: A recovery strategy is prepared in the first stage of species recovery and outlines the overall scientific framework for recovery. Recovery strategies may be mandated under the federal *Species at Risk Act*.

Red-listed: List of ecological communities, indigenous species and subspecies that are at the greatest risk of being lost (extirpated, endangered or threatened) in BC. Determined by the BC Conservation Data Centre. ^{xii}

Refugia: Areas that remain unchanged while surrounding areas change markedly; the unchanged areas thereby provide refuges for species that require specific habitats.

Reptile: See Wildlife.

Retaining: Refers to keeping existing habitats intact.

Riparian, area or zone: (a) transition area between watercourses and the surrounding, usually drier, upland areas, (b) the area of land that is adjacent to a stream, river, lake or wetland, and contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland; in dry locations, is easily identified by the green vegetation in contrast to the browns and yellows of the drier uplands.

Riparian Management Plan: Assist producers with the management and restoration of riparian habitat in agricultural areas. See the Canada-BC Environmental Farm Plan Reference Guide and the EFP Riparian Management Field Workbook.

Riparian vegetation: Plant communities dependent upon the presence of free water near the ground surface (high water table).

S

Semi-natural: Semi-natural areas include features such as shelterbelts, hedgerows, fencerows, pastures, haylands, buffers, and road margins. These features can contain both native and non-native plant and animal species.

Sensitive Ecosystem Inventories (SEI): Systematically identifies and maps rare and fragile ecosystems in a given area. The purpose is to identify remnants of rare and fragile terrestrial ecosystems and to encourage land use decisions that will ensure the continued integrity of these ecosystems. Project by the BC Ministry of Environment.

Shelterbelt: Windbreak of living trees and shrubs established and maintained for protection of farm lands or buildings (see also Windbreak).

Snag: Any standing dead, dying, or defective tree that is at least three metres tall.

Species of special concern: A wildlife species that is particularly sensitive to human activities or natural events but not endangered or threatened. Species of special concern may become a threatened or endangered species because of a combination of biological characteristics and identified threats. Special concern was formerly referred to as "vulnerable" in BC. Species of special concern are designated by the Committee on the Status of Endangered Wildlife in Canada.^{xiii}

Species: [from the *BC Wildlife Amendment Act 2004*] A species, subspecies, variety or genetically or geographically distinct population of (a) animals, (b) fish, (c) plants, or (d) other organisms, except bacteria and viruses.

Species at risk: [from the federal *Species At Risk Act*] Plants and animals (insects, fish, amphibians, reptiles, birds, mammals) that are extirpated, endangered, or threatened in the province, or those considered to be of special concern (formerly called vulnerable in British Columbia). Species at risk can include mammals, fish, birds, reptiles, amphibians, insects, molluscs, vascular plants, mosses and lichens.^{xiv}

Species diversity: The variety of species.

Species richness: The number of species present in a given area.

Stewardship: The conducting, supervising or managing of something, especially the careful and responsible management of something entrusted to one's care. For example, stewardship of biodiversity on agricultural land.

Strip cropping: The alternation of crop rows and/or forages across the slope of the land to slow water runoff and reduce erosion.

Structural diversity: Structurally diverse habitats have a mix of vegetation types with different heights and forms. This variation in structure provides different types of important habitats for a variety of native species. Farms and ranches that have a mix of cultivated and uncultivated fields, woodlands, hedgerows, fencerows, shelterbelts, and aquatic and riparian areas provide greater structural diversity than operations that have only cultivated fields or native pastures. As a result, they are able to support greater biological diversity.

Sustainable agriculture: Agricultural management practices that meet current and future human needs for food and fibre, for ecological goods and services, and for human health; and that do so by maximizing these societal benefits when all costs and benefits of these practices are considered.

T

Tame pasture: Pasture planted to domesticated or introduced forage species that may require periodic cultural management such as fertilization, weed control, cultivation and re-seeding.

Threatened: A wildlife species that is likely to become an endangered species if nothing is done to reverse the limiting factors leading to its extirpation or extinction; as designated by the *BC Wildlife Act* and/or the Committee on the Status of Endangered Wildlife in Canada.^{xv}

W

Water: [from the *Environmental Management Act*] Includes surface water, groundwater and ice.

Watercourse: [from the *Forest Practices Code*] A place that perennially or intermittently contains surface water, including a lake, river, creek, canal, spring, ravine, swamp, salt water marsh or bog, and including a drainage ditch leading into the foregoing (also see stream).

Watershed: An area of land that collects and discharges water into a single creek or river through a series of small tributaries.

Weed: Any plant that is growing where it is not wanted and/or crowds out cultivated plants. Weeds can also crowd out desirable native plants. For information on how to identify common BC weeds, see *Guide to Weeds in BC* and *Field Guide to Noxious and other Selected Weeds of British Columbia*

Annual weeds: Complete their life cycle in less than 12 months, either summer or winter annuals.

Aquatic weed: Undesirable plant that grows in water, such as Eurasian watermilfoil.

Biennial weeds: Require between 12 and 24 months to complete their life cycle.

Noxious weed: [from the *Weed Control Act*] A weed designated by regulation to be a noxious weed, and includes the seeds of the noxious weed; specified in Weed Control Regulation, Schedule A. Noxious weeds are typically non-native plants that have been introduced to BC without insect predators and plant pathogens to keep them under control. ^{xvi}

Perennial weed: Survive for several years, either creeping or non-creeping types.

Wetland: (a) area of wet soil that is inundated or saturated long enough to promote wetland or aquatic processes as indicated by the presence of poorly drained soils, hydrophytic (water loving) plants, and various kinds of biological activity adapted to a wet environment; (b) [from the *Forest Practices Code of BC Act*] swamp, marsh, bog or other similar area that supports natural vegetation that is distinct from adjacent upland areas.

Wet meadow: A meadow where the surface remains wet or moist throughout the growing season, usually characterized by plants such as water-tolerant grasses, sedges and rushes.

Wildlife: [from the *Wildlife Act*] Raptors, threatened species, endangered species, game or other species of vertebrates prescribed as wildlife and includes fish, but does not include species at risk.

Amphibian: A vertebrate of the class Amphibia and includes the eggs and other developmental life stages. Examples include frogs, toads and salamanders.

Big game: (a) any member of the family Cervidae, (b) mountain sheep, mountain goat, bison or pronghorn antelope, (c) bear, cougar or wolf, or (d) a mammal prescribed as big game.

Bird: An animal of the class Aves, and its eggs.

Dangerous wildlife: Bear, cougar, coyote, or wolf, or a species of wildlife that is prescribed as dangerous wildlife; it is unlawful to feed dangerous wildlife.

Fish: Any (a) vertebrate of the order Petromyzontiformes (lampreys) or class Osteichthyes (bony fishes), or (b) invertebrate of the class Crustacea (crustaceans) or class phylum Mollusca (mollusks) from or in non-tidal waters of BC, and includes their eggs and juvenile stages.

Game: Big game, small game, game birds and fur bearing animals, and other species prescribed as game.

Raptor: A bird of the order Falconiformes known as eagles, falcons, and hawks, or the order Strigiformes known as owls, and includes its eggs.

Reptile: A vertebrate of the class Reptilia and its eggs. Examples include snakes and lizards.

Wildlife feature: Habitat components that support wildlife species (see also Habitat). For example, trees with nesting cavities, rock piles, downed logs, underground burrows. Can also include constructed features such as bird feeders, nesting boxes and bat houses.

Wildlife habitat: See Habitat.

Windbreak: A screen, natural or human-made or of vegetation, that reduces wind velocity so as to protect lands, structures, or livestock.

Yellow-listed: List of indigenous species and ecological communities that are at the least risk of being lost in British Columbia. ^{xvii}

ENDNOTES

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6 APPENDIX

APPENDICES

- APPENDIX 1 Biodiversity Resources for Farms and Ranches
- APPENDIX 2 Agency Contacts for Biodiversity
- APPENDIX 3 Legislation
- APPENDIX 4 Other Sources of Information

APPENDIX 1 - BIODIVERSITY RESOURCES FOR FARMS AND RANCHES

ADDITIONAL SOURCES OF BMPs AND OTHER RELATED INFORMATION		
Resource	Description	Where to Find
BC Environmental Farm Plan Reference Guide	Variety of BMPs for biodiversity and other related farm management topics. Includes related legislation	ARDCorp http://ardcorp.ca/programs/environmental-farm-plan/efp-program-resources/
Guidelines and Best Management Practices	Web page with extensive links to different BMP documents	Ministry of Environment & Climate Change, Environmental Stewardship Division www.env.gov.bc.ca/wld/BMP/bmpintro.html
Ducks Unlimited Canada Beneficial Management Practices	List of BMPs related to different aspects of agricultural management, including biodiversity	Ducks Unlimited Canada www.ducks.ca
Biodiversity Conservation: An Organic Farmer's Guide	Extensive list of different activities suitable for organic as well as non-organic operations (US-based)	Wild Farm Alliance www.wildfarmalliance.org/
Grasslands Conservation Council of BC	Resources and publications pertaining to the sustainable management of grasslands across BC	Grasslands Conservation Council of BC resource webpage http://bcgrasslands.org/resources/
Riparian Areas and Grazing Management	Activities to protect and enhance biodiversity around wetlands, streams, rivers, and lakes	Cows and Fish Program http://cowsandfish.org
Rangeland Handbook for Livestock and Wildlife	Factsheets about rangeland ecosystems, grazing best practices, vegetation assessment, management, planning	British Columbia Cattlemen's Association http://www.cattlemen.bc.ca/facts.htm
Rangeland Best Practices	Rangeland health and best practices	https://www2.gov.bc.ca/gov/content/industry/rangelands/management
Farming for Bees – Guidelines for Providing Native Bee Habitat on Farms	Outlines ways to protect and enhance habitat for native crop pollinators in the farm landscape. Includes advice on simple changes that can be made in farm management for the benefit of native bees, and information on how to enhance or provide important habitat features, such as nest sites and forage	The Xerces Society https://www.xerces.org/publications/guidelines/farming-for-bees
Building Soils for Better Crops, 3rd edition	Contains detailed information about soil structure, the management practices that affect soils, and information on how to interpret soil test results	Sustainable Agriculture Research and Education https://www.sare.org/publications/bsbc/bsbc.pdf
Sustainable Agriculture Research and Education Learning Centre	List of resources and publications regarding sustainable agriculture.	Sustainable Agriculture Research and Education resources website https://www.sare.org/Learning-Center

APPENDIX 2 - AGENCY CONTACTS FOR BIODIVERSITY

The following list provides a starting point for contacting agencies to obtain environmental information. Use the table below to determine which agency to contact for the type of information you need. The agencies and their contact information are listed alphabetically by federal and provincial government. However, agency information changes frequently. If you have difficulty contacting any of the offices listed below, please refer to the agency websites.

TYPES OF INFORMATION AVAILABLE FROM AGENCIES	
Desired Information	AVAILABLE FROM (AGENCY SOURCES)
Agroforestry	BC Ministry of Agriculture
Air (air quality)	BC Ministry of Environment & Climate Change Metro Vancouver
Biodiversity – species at risk	BC Ministry of Environment & Climate Change
Buffers	BC Ministry of Agriculture BC Ministry of Environment & Climate Change Fisheries and Oceans Canada
Burning – venting index	Environment and Climate Change Canada BC Ministry of Environment & Climate Change Metro Vancouver
Composting	BC Ministry of Environment & Climate Change Regional Districts
Dams (water control studies)	BC Ministry of Agriculture
Drainage (installation and maintenance) – draining wetlands	BC Ministry of Environment & Climate Change BC Ministry of Forests, Lands, Natural Resource Operations & Rural Development (Front Counter BC) Fisheries and Oceans Canada Environment and Climate Change Canada – Canadian Wildlife Service
Drinking water	BC Ministry of Environment & Climate Change Regional Health Authority
Fertilizers	Agriculture and Agri-Food Canada BC Ministry of Agriculture Canadian Food Inspection Agency
Fish	BC Ministry of Environment & Climate Change Fisheries and Oceans Canada
Groundwater (location, vulnerability and maintenance)	BC Ministry of Environment & Climate Change BC Ministry of Forests, Lands, Natural Resource Operations & Rural Development (Front Counter BC)
Habitat – Terrestrial	BC Ministry of Environment & Climate Change Environment and Climate Change Canada – Canadian Wildlife Service
– Aquatic	BC Ministry of Environment & Climate Change Fisheries and Oceans Canada

TYPES OF INFORMATION AVAILABLE FROM AGENCIES	
Desired Information	AVAILABLE FROM (AGENCY SOURCE)
Land use	Regional District and local municipal governments Agricultural Land Commission
Manure management	BC Ministry of Environment & Climate Change BC Ministry of Agriculture
Odour	BC Ministry of Environment & Climate Change Regional District
Pesticide	Agriculture and Agri-Food Canada BC Ministry of Environment & Climate Change Environment and Climate Change Canada
Septic system	Regional Health Authority
Siting of buildings	Agricultural Land Commission Regional District and local municipal governments
Soils	Agricultural Land Commission BC Ministry of Environment & Climate Change BC Ministry of Energy, Mines and Petroleum Resources BC Ministry of Agriculture
Stormwater	Regional District and local municipal governments
Stream work (working in or about a stream, riparian areas)	BC Ministry of Environment & Climate Change BC Ministry of Forests, Lands, Natural Resource Operations & Rural Development (Front Counter BC) Fisheries and Oceans Canada
Surface water (water course classifications, water quality objectives)	BC Ministry of Environment & Climate Change BC Ministry of Forests, Lands, Natural Resource Operations & Rural Development (Front Counter BC) Fisheries and Oceans Canada Environment and Climate Change Canada
Waste Management – General Farm	BC Ministry of Environment & Climate Change
– Mortality	BC Ministry of Environment & Climate Change Canadian Food Inspection Agency
– No Agriculture	BC Ministry of Environment & Climate Change
Water licences	BC Ministry of Environment & Climate Change BC Ministry of Forests, Lands, Natural Resource Operations & Rural Development (Front Counter BC)
Weeds	Regional District
Woodwaste	BC Ministry of Environment & Climate Change
Zoning, Land use	Regional District and local municipal governments Agricultural Land Commission

FEDERAL AGENCIES

AGRICULTURE AND AGRI-FOOD CANADA

Website: <http://www.agr.gc.ca>

BC Regional Office

4th Floor, Suite 420
4321 Still Creek
Burnaby, BC V5C 6S7
Email: atsbc@agr.gc.ca
Telephone: 604-292-5858
Fax: 604-292-5891

Agassiz Research and Development Centre

6947 Highway 7
PO Box 1000
Agassiz, BC V0M 1A0
Telephone: 604-796-6100
Email: AAFC.AgassizRDC@agr.gc.ca

Summerland Research and Development Centre

4200 Highway No. 97, PO Box 5000
Summerland, BC V0H 1Z0
Tel: (250) 494-7711
Fax: (250) 494-0755
Email: AAFC.SummerlandRDC@agr.gc.ca

CANADIAN FOOD INSPECTION AGENCY

Website: <http://www.inspection.gc.ca>

Canadian Food Inspection Agency

4th Floor, Suite 400
4321 Still Creek Drive
Burnaby, BC V5C 6S7
Tel: (604) 666-6513
Fax: (604) 666-1261

ENVIRONMENT AND CLIMATE CHANGE CANADA

Website: <http://www.ec.gc.ca/>

Environment and Climate Change Canada Pacific and Yukon Region

201 – 401 Burrard Street
Vancouver, BC V6C 3S5
Tel: (604) 664-9100
Fax: (604) 713-9517

Environment and Climate Change Canada – Canadian Wildlife Service

Pacific Wildlife Research Centre
5421 Robertson Road
Delta, BC V4K 3N2
Tel: (604) 940-4700
Fax: (604) 946-7022

Fisheries and Oceans CANADA Website: http://www.dfo-mpo.gc.ca/index.htm	
Lower Mainland	
Fisheries and Oceans Canada Vancouver (Regional HQ) Suite 200 – 401 Burrard Street Vancouver , BC V6C 3S4 Tel: (604) 666-0384 Fax: (604)-666-1847 Email: info@dfo-mpo.gc.ca	Fisheries and Oceans Canada A1-7266 River Place. Mission , BC V5S 0A2 Tel: (604) 814-1055 Fax: (604) 814-1064
Fisheries and Oceans Canada Lower Fraser Area Office Unit 3 – 100 Annacis Parkway Delta , BC V3M 6A2 Tel: (604) 666-8266 Fax: (604) 666-7112	Fisheries and Oceans Canada 327-44500 South Sumas Road Chilliwack , BC V2R 5M3 Tel: (604) 824-3300 Fax: (604) 858-0002
Fisheries and Oceans Canada 5550 – 268th St. Langley , BC V4W 3X4 Tel: (604) 607-4150 Fax: (604) 607-4199	Fisheries and Oceans Canada 1120 Hunter Place, Box 2360 Squamish , BC V0N 3G0 Tel: (604) 892-3230 Fax: (604) 892-2378
Fisheries and Oceans Canada 12551 No. 1 Road Richmond (Steveston), BC V1T 1T7 Tel: (604) 664-9250 Fax: (604) 664-9255	
Vancouver Island and Sunshine Coast	
Fisheries and Oceans Canada 315 - 940 Alder Street Campbell River , BC V9W 2P8 Tel: (250) 850-5701 Fax: (250) 286-5852	Fisheries and Oceans Canada 148 Port Augusta Street Comox , BC V9M 3N6 Tel: (250) 339-2031 Fax: (250) 339-4612
Fisheries and Oceans Canada 5245 Trans Canada Hwy Duncan , BC V0R 2C0 Tel: (250) 746-6221 Fax: (250) 746-8397	Fisheries and Oceans Canada 4706 Tebo Ave. Port Alberni , BC V9Y 8B1 Tel: (250) 720-4440 Fax: (250) 724-2555
Fisheries and Oceans Canada 501 Muchalat Drive Gold River , BC V0P 1G0 Tel: (250) 283-9075 Fax: (250) 283-9058	Fisheries and Oceans Canada PO Box 10, 8585 Wolloson Road Port Hardy , BC V0N 2P0 Tel: (250) 949-6422 Fax: (250) 949-6755
Fisheries and Oceans Canada 304-60 Front Street Nanaimo , BC V9R 5H7 Tel: (250) 754-0230 Fax: (250) 754-0309	Fisheries and Oceans Canada 7255 Duncan Street Powell River , BC V8A 5N6 Tel: (604) 485-7963 Fax: (604) 485-7439
Fisheries and Oceans Canada 3225 Stephenson Point Road Nanaimo , BC V9T 1K3 Tel: (250) 756-7270 Fax: (250) 756-7162	Fisheries and Oceans Canada (Institute of Ocean Sciences) 9860 West Saanich Rd PO Box 6000 Sidney , BC V8L 4B2 Tel: (250) 363-6517
Fisheries and Oceans Canada (Pacific Biological Station) 3190 Hammond Bay Road Nanaimo , BC V9T 6N7 Tel: (250) 756-7000 Fax: (250) 756-7053	Fisheries and Oceans Canada 2-161 1st Street Tofino , BC V0R 2Z0 Tel: (250) 725-3200 Fax: (250) 725-3944
Fisheries and Oceans Canada 4250 Commerce Circle Victoria , BC V8Z 4M2 Tel: (250) 363-3252 Fax: (250) 363-0191	

Fisheries and Oceans CANADA (continued)

Website: <http://www.dfo-mpo.gc.ca/index.htm>

Interior, Central Coast, and Haida Gwaii

<p>Fisheries and Oceans Canada Box 130 Highway 20 Bella Coola, BC V0T 1C0 Tel: (250) 799-5345 Fax: (250) 799-5540</p>	<p>Fisheries and Oceans Canada 417 2nd Avenue W. Prince Rupert, BC V8J 1G8 Tel: (250) 627-3499 Fax: (250) 627-3427</p>
<p>Fisheries and Oceans Canada 280C 3 Avenue N Williams Lake, BC V2G 4T5 Tel: (250) 305-4002 Fax: (250) 305-3017</p>	<p>Fisheries and Oceans Canada Box 99, 137 Bay St Queen Charlotte City, BC V0T 1S0 Tel: (250) 559-4413 Fax: (250) 559-4678</p>
<p>Fisheries and Oceans Canada 985 McGill Place Kamloops, BC V2C 6X6 Tel: (250) 851-4950 Fax: (250) 851-4951</p>	<p>Fisheries and Oceans Canada 1205 North Cariboo Highway 97 Quesnel, BC V2J 2Y3 Tel: (250) 992-2434 Fax: (250) 992-7232</p>
<p>Fisheries and Oceans Canada Box 315 654 Industrial Place Lillooet, BC V0K 1V0 Tel: (250) 256-2650 Fax: (250) 256-2660</p>	<p>Fisheries and Oceans Canada Box 1160, 1751 – 10th Ave. SW Salmon Arm, BC V1E 4P3 Tel: (250) 804-7000 Fax: (250) 804-7010</p>
<p>Fisheries and Oceans Canada 1590 Old Beach Road Masset, BC V0T 1M0 Tel: (250) 626-3316 Fax: (250) 626-3253</p>	<p>Fisheries and Oceans Canada Box 578, 3177 Tatlow Road Smithers, BC V0J 2N0 Tel: (250) 847-2312 Fax: (250) 847-4723</p>
<p>Fisheries and Oceans Canada 118 McDonald Drive Nelson, BC V1L 6B9 Tel: (250) 352-0892 Fax: (250) 352-0916</p>	<p>Fisheries and Oceans Canada 5235 A Keith Ave. Terrace, BC V8G 1L2 Tel: (250) 615-5350 Fax: (250) 615-5364</p>
<p>Fisheries and Oceans Canada 3690 Massey Drive Prince George, BC V2N 2S8 Tel: (250) 561-5366 Fax: (250) 561-5534</p>	<p>Fisheries and Oceans Canada 111 Nass Road, PO Box 216 Upper Nass (New Aiyansh), BC V0J 1A0 Tel: (250) 633-2408 Fax: (250) 633-2439</p>

PROVINCIAL AGENCIES

AGRICULTURAL LAND COMMISSION

Website: <http://www.alc.gov.bc.ca/>

Provincial Agricultural Land Commission

201-4940 Canada Way
Burnaby, BC V5G 4K6
 Tel: (604) 660-7000
 Fax: (604) 660-7033

BC Ministry of Agriculture

Website: <http://www.gov.bc.ca/al/>

Enquiry BC: 1 800 663-7867

Lower Mainland

Agriculture/Horticulture/Dairy Ministry of Agriculture

1767 Angus Campbell Road
Abbotsford, BC V2G 3M2
 Phone: (604) 556-3001
 Fax: (604) 556-3030
 Toll Free: 1-888-221-7141

Plant Diagnostic Lab Ministry of Agriculture

1767 Angus Campbell Road
Abbotsford, BC V2G 3M2
 Tel: (604) 556-3001
 Fax: (604) 556-3154
 Toll Free: 1-888-221-7141

Animal Health Branch Ministry of Agriculture

1767 Angus Campbell Road
Abbotsford, BC V2G 3M2
 Tel: (604) 556-3003
 Fax: (604) 556-3010
 Toll Free: 1-800-661-9903

Resource Management Branch Ministry of Agriculture

1767 Angus Campbell Road
Abbotsford, BC V2G 3M2
 Tel: (604) 556-3001
 Fax: (604) 556-3099
 Toll Free: 1-888-221-7141

Vancouver Island

Ministry of Agriculture BC Access Centre

2500 Cliffe Avenue
Courtenay, BC V9N 5M6
 Tel: (250) 897-7540
 Fax: (250) 334-1410

Ministry of Agriculture Minister's Office

PO Box 9043 Stn Prov Govt
Victoria, BC V8W 9E2
 Tel: (250) 387-1023
 Fax: (250) 387-1522

Ministry of Agriculture

5785 Duncan Street
Duncan, BC V9L 5G2
 Tel: (250) 746-1210
 Fax: (250) 746-1292

Ministry of Agriculture

808 Douglas Street
Victoria, BC V8W 2Z7
 Tel: (250) 356-2521
 Fax: (250) 953-5162

BC Ministry of Agriculture (continued)

Website: <http://www.gov.bc.ca/al/>

Enquiry BC: 1 800 663-7867

Interior

<p>Ministry of Agriculture 1902 Theatre Road Cranbrook, BC V1C 7G1 Tel: (250) 420-2167 Fax: (250) 420-1767</p>	<p>Ministry of Agriculture Room 200 – 1690 Powick Road Kelowna, BC V1X 7G5 Tel: (250) 861-7211 Fax: (250) 861-7490 Toll Free: 1-888-332-3352</p>
<p>Ministry of Agriculture 1243 Northwest Boulevard Creston, BC V0B 1G6 Tel: (250) 402-6429 Fax: (250) 402-6497</p>	<p>Ministry of Agriculture Suite 815 – 299 Victoria Street Prince George, BC V2L 5B8 Tel: (250) 565-7200 Fax: (250) 565-7213 Toll Free: 1-800-334-3011</p>
<p>Ministry of Agriculture 1201 - 103rd Avenue Dawson Creek, BC V1G 4J2 Tel: (250) 784-2601 Fax: (250) 784-2299</p>	<p>Ministry of Agriculture 3rd Floor, 3726 Alfred Ave Smithers, BC V0J 2N0 Tel: (250) 847-7246 Fax: (250) 847-7556</p>
<p>Ministry of Agriculture 10043 100th Street Fort Street John, BC V1J 3Y5 Tel: (250) 787-3240 Fax: (250) 787-3299</p>	<p>Ministry of Agriculture 4607 – 23rd Street Vernon, BC V1T 4K7 Tel: (250) 260-3000 Fax: (250) 549-5488 Toll Free: 1-800-702-5585</p>
<p>Ministry of Agriculture 162 Oriole Road Kamloops, BC V2C 4N7 Tel: (250) 371-6050 Fax: (250) 828-4631 Toll Free: 1-888-823-3355</p>	<p>Ministry of Agriculture 300 – 640 Borland Street Williams Lake, BC V2G 4T1 Tel: (250) 398-4500 Fax: (250) 398-4688</p>

BC Ministry of Environment & Climate Change
 Website: www.gov.bc.ca/env
 Enquiry BC: 1 800 663-7867

Vancouver Island Region

2080-A Labieux Road
Nanaimo, BC V9T 6J9
 Tel: (250) 751-3100
 Fax: (250) 751-3103

Lower Mainland Region

Regional Headquarters, 2nd Floor
 2nd Floor, 10470 - 152nd Street
Surrey, BC V3R 0Y3
 Tel: (604) 582-5200
 Fax: (604) 930-7119

Thompson Region

1259 Dalhousie Drive
Kamloops, BC V2C 5Z5
 Tel: (250) 371-6200
 Fax: (250) 828-4000

Skeena Region

PO Box #5000
 3726 Alfred Avenue
Smithers, BC V0J 2N0
 Tel: (250) 847-7260
 Fax: (250) 847-7591

Cariboo Region

400 - 640 Borland Street
Williams Lake, BC V2G 4T1
 Tel: (250) 398-4530
 Fax: (250) 398-4214

Okanagan Region

102 Industrial Place
Penticton, BC V2A 7C8
 Tel: (877) 356-2029

Omineca Region

4051 18th Ave
Prince George, BC V2N 1B3
 Tel: (250) 565-6135
 Fax: (250) 565-6940

Kootenay Region

Environmental Stewardship Division
 205 Industrial Road G
Cranbrook, BC V1C 7G5
 Tel: (250) 489-8540
 Fax: (250) 489-8506

Peace Region

400-10003 - 110 Avenue
Fort St John, BC V1J 6M7
 Tel: (250) 787-3411
 Fax: (250) 787-3490

Environmental Protection Division

401 - 333 Victoria Street
Nelson, BC V1L 4K3
 Tel: (250) 354-6333
 Fax: (250) 354-6332

BC Ministry of FORESTS, LANDS,
NATURAL RESOURCE OPERATIONS & RURAL DEVELOPMENT

Website: <https://www2.gov.bc.ca/gov/content/governments/organizational-structure/ministries-organizations/ministries/forests-lands-natural-resource-operations-and-rural-development>

Enquiry BC: 1 800 663-7867

**West Coast and Vancouver Island Region
Campbell River Natural Resource District**
370 South Dogwood Street
Campbell River, BC V9W 6Y7
Tel: (250) 286-9300
Fax: (250) 286-9490

Haida Gwaii Natural Resource District
1229 Oceanview Drive
Queen Charlotte, BC V0T 1S0
Tel: (250) 559-6200
Fax: (250) 559-8342

**North Island Natural Resource District
North Island District Office**
2217 Mine Road
Port McNeill, BC V0N 2R0
Tel: (250) 956-5021
Fax: (250) 956-5005

Central Coast District Office
1681 Airport Road
Bella Coola, BC V0T 1C0
Tel: (250) 982-2000

South Island Natural Resource District
4885 Cherry Creek Road
Port Alberni, BC V9Y 8E9
Tel: (250) 731-3000
Fax: (250) 731-3010

Cascades Natural Resource District
3840 Airport Rd
Merritt, BC V1K 1B8
Tel: (250) 378-8400
Fax: (250) 378-8481

Okanagan Shuswap Natural Resource District
2501-14th Ave
Vernon, BC V1T 8Z1
Tel: (250) 558-1700
Fax: (250) 549-5485

Thompson Rivers Natural Resource District
1265 Dalhousie Drive
Kamloops, BC V2C 5Z5
Tel: (250) 371-6500
Fax: (250) 371-6565

**South Coast Region
Chilliwack Natural Resource District**
46360 Airport Road
Chilliwack, BC V2P 1A5
Tel: (604) 702-5700
Fax: (604) 702-5711

Sea to Sky Natural Resource District
101-42000 Loggers Lane
Squamish, BC V8B 0H3
Tel: (604) 898-2100
Fax: (604) 898-2191

Sunshine Coast Natural Resource District
7077 Duncan Street
Powell River, BC V8A 1W1
Tel: (604) 485-0700
Fax: (604) 485-0799

Mackenzie Natural Resource District
1 Cicada Road
Mackenzie, BC V0J 2C0
Tel: (250) 997-2200
Fax: (250) 997-2236

Prince George Natural Resource District
2000 South Ospika Boulevard
Prince George, BC V2N 4W5
Tel: (250) 614-7400
Fax: (250) 953-0413

Stuart Nechako Natural Resource District
1560 Hwy 16 East
Vanderhoof, BC V0J 3A0
Tel: (250) 567-6363
Fax: (250) 567-6370

P.O. Box 100 Stonesbay Road
Fort Street James, BC V0J 1P0
Tel: (250) 996-5200
Fax: (250) 996-5290

Cariboo Region

200 - 640 Borland Street
Williams Lake, BC V2G 4T1
Tel: (250) 398-4574
Fax: (250) 398-4836

100 Mile House Natural Resource District

300 Cariboo Hwy 97
100 Mile House, BC V0K 2E0
Tel: (250) 395-7800
Fax: (250) 395-7810

Skeena Region

Nadina Natural Resource District
183 Highway 16 West
Burns Lake, BC V0J 1E0
Tel: (250) 692-2200
Fax: (250) 692-7461

Skeena Stikine District Office

3333 Tatlow Road
Smithers, BC V0J 2N0
Tel: (250) 847-6300
Fax: (250) 847-6353

Hazelton Field Office

2210 Hwy 62 West
Hazelton, BC V0J 2N0
Tel: 1-888-540-8611

Coast Mountain Natural Resource District

200-5220 Keith Ave.
Terrace, BC V8G 1L1
Tel: (250) 638-5100
Fax: (250) 638-5176

Quesnel Natural Resource District

322 Johnston Ave.
Quesnel, BC V2J 3M5
Tel: (250) 992-4400
Fax: (250) 992-4403

Peace Natural Resource District

9000 17th Street
Dawson Creek, BC V1G 4A4
Tel: (250) 784-1200
Fax: (250) 784-0143

Fort Nelson Natural Resource District

6100 Alaska Hwy.
Fort Nelson, BC V0C 1R0
Tel: (250) 774-5511
Fax: (250) 774-3704

Kootenay Region

Selkirk Natural Resource District

1907 Ridgewood Road
Nelson, BC V1L 6K1
Tel: (250) 825-1100
Fax: (250) 825-9657

Rocky Mountain Natural Resource District

1902 Theatre Road
Cranbrook, BC V1C 7G1
Tel: (250) 426-1766
Fax: (250) 426-1767

APPENDIX 3 - LEGISLATION

PLEASE NOTE: This section has been prepared for information purposes only and has no official sanction. It is not a substitute for the Acts mentioned or any regulations under these Acts. In the event of an inconsistency between the information included here and the Act or its regulations, the latter would prevail. Official or more detailed information can be found in the legal text of the Acts.

FEDERAL LEGISLATION

The Impact Assessment Act

This *Impact Assessment Act* (IAA) replaces the *Canadian Environmental Assessment Act*. This Act recognizes the impact of assessments to provide in effective integration of scientific information and Indigenous knowledge in decision-making on projects. Public (directly impacted by projects or not) has the opportunity to participate in the impact assessment process as well as other government jurisdictions. Beyond the *Canadian Environmental Assessment Act* scope of environmental effects of proposed project, the IAA addresses the need for the project; if there are potential alternatives to the project; Indigenous and community knowledge; and climate change impacts. The Act applies to projects or undertakings in which the Government of Canada has decision-making authority, whether as a proponent, land manager, funding agency or regulator. It requires that such projects undergo a review before they are allowed to proceed to ensure that they do not cause significant adverse environmental effects.

Full legal text of the Act is available at

<https://laws-lois.justice.gc.ca/eng/acts/I-2.75/page-1.html#h-1160082>

Canadian Impact Assessment Registry

<https://iaac-aeic.gc.ca/050/evaluations/050?culture=en-CA>

Canadian Environmental Protection Act, 1999

This Act establishes the legal framework for pollution prevention in Canada, and is intended to ensure the protection of the environment and human health from toxic substances and wastes. It addresses both air and water pollution from diverse sources, including nutrients; fuels; and vehicle, engine and equipment emissions. It also provides the Minister of Environment with the authority to require the development of pollution prevention plans in specific circumstances.

Full legal text of the Act is available at

<https://laws-lois.justice.gc.ca/eng/acts/c-15.31/>

CEPA Environmental Registry

<https://pollution-waste.canada.ca/environmental-protection-registry/regulations>

Fisheries Act

Administered by both Fisheries and Oceans Canada and Environment and Climate Change Canada, this Act is established to manage Canada's fisheries resources, including fish habitat. The Act can also be administered provincially by FLNRORD and ENV. The Act applies to all Canadian waters that contain fish, including ditches, channelized streams, creeks, rivers, marshes, lakes, estuaries, coastal waters and marine offshore areas. It also applies to seasonally wetted areas that provide fish habitat such as shorelines, stream banks, floodplains, intermittent tributaries and privately owned land. The Act includes provisions for stiff fines and imprisonment to ensure compliance.

The purpose of this Act is to provide a framework for (a) the proper management and control of fisheries; and (b) the conservation and protection of fish and fish habitat, including by preventing pollution.

This Act was updated in 2019 and now empowers the Minister to make regulations for the purposes of the conservation and protection of biodiversity. The definition of fish habitat is: "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas." The quantity, timing and quality of the water flow that are necessary to sustain fish habitat are also deemed to be a fish habitat. Furthermore, serious harm to fish includes the death of fish or any permanent alteration to, or destruction of, fish habitat.

Provisions of the 2019 *Fisheries Act* relevant to agricultural operations include:

- ▶ protection for all fish and fish habitats;
- ▶ prohibition against the death of fish or the 'harmful alteration, disruption or destruction of fish habitat';
- ▶ a permitting framework and codes of practice to improve management of large and small projects impacting fish and fish habitat
- ▶ protection of fish and/or fish habitats that are sensitive, highly productive, rare or unique; and
- ▶ consideration for the cumulative effects of development activities on fish and fish habitat.

Full legal text of the Act is available at
<https://laws-lois.justice.gc.ca/eng/acts/f-14/>

Migratory Birds Convention Act, 1994

The purpose of this Act is to ensure the protection and conservation of migratory birds in Canada, both as populations and individual birds. The Act makes it illegal to disturb, destroy or take an egg, nest, or other shelter of a migratory bird without a permit. The Act also prohibits the possession, purchase, sale or other exchange of a migratory bird or its nest without authorization. The Act further prohibits the deposit of any substance that may be harmful to migratory birds, (for example, oil, pesticides) in waters or other areas that they frequent. The Act allows for the use of equipment, other than aircraft or firearms, to scare migratory birds that may be causing damage to crops or other property. Native birds that are not protected by this Act but are protected by the provincial *Wildlife Act* include raptors (including owls), upland game birds, pelicans, cormorants, kingfishers, crows, ravens, jays, magpies, and blackbirds. Selected introduced bird species that have proven to be invasive and problematical are not protected by either Act. The *Migratory Birds Convention Act* is administered by Environment and Climate Change Canada.

Full legal text of the Act is available at
<https://laws-lois.justice.gc.ca/eng/acts/m-7.01/>

Pest Control Products Act

Administered by Health Canada, this Act serves to protect human health and safety and the environment by regulating products used for the control of pests (for example, herbicides, insecticides, fungicides, biological controls). The Act applies to all pest control products, whether they are used in agriculture, forestry, industry, public health or domestic situations. The Act requires that pest control products be registered and bear a *Pest Control Products Act* registration number on the label before they can be used legally in Canada. It is an offence under the Act to use an unregistered pesticide or to use a pest control product in a way that is inconsistent with the directions or limitations as shown on the product label. Provisions exist in the Act to approve the use of products not registered in Canada if no acceptable alternative control is available. The expanded use of registered products for non-registered uses may also be granted under specific circumstances.

Full legal text of the Act is available at
<https://laws-lois.justice.gc.ca/eng/acts/p-9.01/>

Plant Protection Act

Administered by Agriculture and Agri-Food Canada, this Act serves to protect plant life and the agriculture and forestry industries by preventing the import, export and spread of injurious pests. Under the Act, a pest means anything that is known or suspected to be injurious, whether directly or indirectly, to plants or to products or by-products of plants. A plant can be considered a pest. The Act prohibits the introduction of pests, whether deliberate or unintentional, and provides for the control and eradication of such pests where they occur. The Act further allows the Minister of Agriculture and Agri-Food Canada to provide financial or technical assistance to any person or government outside Canada in order to control or eradicate a pest that could affect plants in this country.

Full legal text of the Act is available at
<https://laws-lois.justice.gc.ca/eng/acts/p-14.8/>

Species at Risk Act

Administered by Environment and Climate Change Canada, the purpose of this Act is to prevent native species in Canada from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species and to encourage the management of other species to prevent them from becoming at risk. Schedule 1 of the Act sets out the list of species legally considered to be at risk in Canada. The Act applies to all waters in Canada as well as to all federal lands, including Indian reservations and national parks, and the airspace above them. Under the Act, the Minister of Environment and Climate Change Canada has the authority to apply the provisions of the Act to provincial lands if it is felt that provincial laws are not providing effective protection.

Where the Act applies, it makes it illegal to kill, harm, harass, capture or take a species at risk, or to possess, collect, buy, sell or trade any individual or parts of an individual that is at risk. The Act also prohibits the damage or destruction of either the residence (for example, the nest or den) or the critical habitat of any species at risk. On private land, these prohibitions apply only to:

- ▶ aquatic species at risk; and
- ▶ migratory birds listed in the *Migratory Birds Convention Act*, 1994 and also listed as endangered, threatened or extirpated in Schedule 1 of the Act.

The Act requires that recovery strategies be developed and implemented for all species at risk. Fisheries and Oceans Canada leads the recovery planning process for aquatic species, while Environment and Climate Change Canada and Parks Canada lead the process for all other species.

Full legal text of the Act is available at
<https://laws-lois.justice.gc.ca/eng/acts/s-15.3/>

Species at Risk Public Registry
<http://www.sararegistry.gc.ca>

Aquatic Species at Risk Homepage - DFO
<https://www.dfo-mpo.gc.ca/species-especes/sara-lep/index-eng.html>

PROVINCIAL LEGISLATION

Community Charter

The Community Charter contains provisions enabling municipalities to establish bylaws and services that can help protect biodiversity. This includes the authority for municipalities to create bylaws to protect trees and the concurrent authority to develop other regulatory bylaws to protect the environment, subject to provincial involvement and regulation. The Environment and Wildlife Regulation (B.C. Reg. 144/2004) establishes the specific types of bylaws that municipalities can adopt under this concurrent authority to protect the natural environment. By bylaw, municipalities can:

- ▶ regulate and prohibit activities affecting waterways;
- ▶ regulate, prohibit, and impose requirements for sale of wild flowers;
- ▶ regulate, prohibit, and impose requirements in relation to the application of pesticides for certain purposes (with some restrictions);
- ▶ regulate, prohibit, and impose requirements to control and eradicate some alien invasive species; and
- ▶ regulate, prohibit, and impose requirements to control some wildlife species.

Text of the Community Charter is available at
http://www.bclaws.ca/Recon/document/freeside/--%20c%20--/community%20charter%20%20sbc%202003%20%20c.%2026/00_act/03026_00.htm

Text of the Environment and Wildlife Regulation (B.C. Reg. 144/2004) is available at
http://www.bclaws.ca/Recon/document/freeside/--%20c%20--/community%20charter%20%20sbc%202003%20%20c.%2026/05_regulations/41_144_2004.xml

Environmental Management Act

The purpose of the *Environmental Management Act* is to protect human health and the quality of water, land and air in British Columbia through authorizing the introduction of waste into the environment in a manner that will not cause adverse impacts to the environment and human health. Waste is defined as including “air contaminants, litter, effluent (liquid), refuse (solid), biomedical waste, hazardous wastes” and any other substance designated by Cabinet. Pollution is defined in the Act as “the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment.”

Within this Regulation, the Code of Practice for Agricultural Environment Management describes agricultural practices for using, storing and managing agricultural waste in a manner that is environmentally sound.

Agricultural activities are subject to several other regulations under this Act, such as the Contaminated Sites Regulation and the Open Burning Smoke Control Regulation. The full Agricultural Waste Control Regulation and Code of Agricultural Practice for Waste Management, along with information on the other regulations can be found in Appendix A.6. of the EFP Nutrient Management Reference Guide.

Text of the Act is available is at

http://www.bclaws.ca/Recon/document/freeside/--%20e%20--/environmental%20management%20act%20%20sbc%202003%20%20c.%2053/00_act/03053_04.xml

Text of the Waste Discharge Regulation is available at

http://www.bclaws.ca/Recon/document/freeside/--%20E%20--/Environmental%20Management%20Act%20%20SBC%202003%20%20c.%2053/05_Regulations/50_320_2004.xml

Fish Protection Act

The *Fish Protection Act* enables the protection of fish and fish habitats. Four main objectives of the Act are to ensure sufficient water for fish; enable fish habitat to be protected and restored; improve riparian habitat protection and enhancement; and, give local governments greater powers of environmental planning.

One major section of the Act prohibits construction of new dams on specified major rivers. Another part of the Act allows designation of sensitive streams and recovery plans. Such streams would have restrictions placed on new water licenses or approvals, or amendments to existing ones until the stream has recovered.

Under the Act and through the Riparian Areas Regulation the province can provide directives to local government to protect riparian fish habitat during their approval/allowance of residential, commercial, and industrial development. This includes residential buildings on land zoned for agricultural purposes. The Riparian Areas Regulation is administered by the Ministry of Environment & Climate Change.

Text of the Act is available at

http://www.env.gov.bc.ca/habitat/fish_protection_act/act/documents/act-theact.html¹

Text of the Riparian Areas Regulation is available at

http://www.bclaws.ca/Recon/document/ID/freeside/00_97021_01

¹ This version of the Statutes and Regulations of British Columbia, and the other links to provincial legislation in this section, are for private study or research purposes only, and are not the official version. The Province of British Columbia does not warrant the accuracy or the completeness of this electronic version of the Statutes and Regulations and in no event will the Province be liable or responsible for damages of any kind arising out of the use of them.

Integrated Pest Management Act

This Act, administered by the British Columbia Ministry of Environment & Climate Change, establishes conditions for the sale and use of pesticides in BC. It requires that pesticides not be stored, handled, transported, used or disposed of in a manner that causes, or is likely to cause, an unreasonable adverse effect. The legislation establishes standards for pesticide storage, transport, sale and use and requires that pesticides applied on public land, private forest land, rights-of-way or on a fee-for-service basis be used as part of an Integrated Pest Management program.

Text of the Act is available at

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_03058_01

Text of the Integrated Pest Management Regulation is available at

http://www.bclaws.ca/civix/document/id/loo91/loo91/604_2004

Summary of the Act and Regulation is available at

http://www.llbc.leg.bc.ca/public/pubdocs/bcdocs/378602//leg_summary.pdf

Local Government Act

Local governments in British Columbia (municipalities, regional districts, and the Islands Trust) are responsible for regulating private land use and development through planning, zoning, and subdivision control. The *Local Government Act* is the primary provincial statute that enables local governments in British Columbia to establish local planning bylaws that can contain policies for protecting the natural environment and reducing greenhouse gases. Regional districts and municipalities can also work together to develop regional growth strategies to protect environmentally sensitive areas and address other growth issues. A regional growth strategy has to cover a 20-year time period and must include provisions for addressing regional-scale issues related to parks and natural areas.

Text of the Act is available at

http://www.bclaws.ca/civix/document/id/lc/statreg/r15001_00

Plant Protection Act

Administered by the Ministry of Agriculture, this Act is the provincial counterpart to the federal *Plant Protection Act* that focuses on plant protection issues affecting Canada. It provides for the prevention of the spread of pests destructive to plants in BC. Inspectors have powers to enforce the provisions of the Act, including the authority to establish quarantine areas. To assist in the enforcement of the Act, the BC Plant Protection Advisory Council advises and coordinates the actions of provincial and federal officials to deal with potential hazards to BC agriculture and forestry from insects, plant diseases, weeds or other biotic agents. The Council's power comes from the mandates of the agencies whose members sit on committees struck to deal with plant protection issues in specific commodity sectors.

Text of the Act is available at

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96365_01

Water Users' Communities Act

The *Water Act* of British Columbia provides a scheme for the licensing and regulation of the diversion, use and storage of water and for authorizing changes in and about streams. The *Water Act* applies only to surface water in streams, which include "a natural watercourse or source of water supply, whether usually containing water or not, and a lake, river, creek, spring, ravine, swamp and gulch". At this time the provisions do not apply to the diversion and use of groundwater.

Water licences may be granted by designated statutory decision makers – either the Comptroller of Water Rights or Regional Water Managers – in response to applications. Similarly, approvals may be granted that authorize changes in and about streams. Regulations under the *Water Act* also allow for making low risk changes in and about streams without the need for an approval, subject to prescribed conditions and requirements of a habitat officer. Most prescribed activities under the Water Regulation require that the Ministry of Environment & Climate Change must be notified of the proposed change 45 days prior to commencement of work.

The process to acquire a licence or approval usually involves consideration of the potential impact on the rights of other licensees as well as possible impacts on the instream flow required for fish and aquatic ecosystems. Applications may be refused or licences granted that include specific conditions to protect instream environmental values. Water use or changes in and about streams may also be subject to review and approval by Fisheries and Oceans Canada under the *Fisheries Act*.

Water Management Planning provisions which have recently been added to the *Water Act* may be implemented to address conflicts between users or between users and instream flow requirements or water quality.

Text of the Act is available at

http://www.bclaws.ca/civix/document/id/complete/statreg/96483_01

Weed Control Act

Administered by BC Ministry of Agriculture, this Act places the responsibility for the control of noxious weeds on the occupiers of the land. It provides for the appointment of inspectors to ensure compliance and, failing that, for a method by which they can control weeds and recover the costs from the occupier. Weed Control Committees may be established by municipal councils to administer the Act within a municipality. Committees report to the municipal council and the Minister.

Text of the Act is available at

http://www.bclaws.ca/civix/document/id/complete/statreg/96487_01

Wildlife Act

The purpose of the *Wildlife Act* is to protect and conserve wildlife species and ensure the sustainable use of wildlife resources. The Act regulates human activities (hunting, fishing, possession, import, trafficking, etc.) that affect listed "wildlife" species. The majority of species listed as "wildlife" are native species of mammals, birds, amphibians, reptiles and freshwater inland fish. The Act provides government officials with the authority to regulate personal, recreational, and commercial uses of wildlife and protect wildlife and wildlife habitat from exploitation and destruction. It sets out the rules that must be followed when hunting, trapping, and angling for freshwater fish and possessing live and dead wildlife. The Act is administered by the BC Ministry of Environment & Climate Change.

Text of the Act is available at

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01

Wildlife Amendment Act, 2004

The *Wildlife Amendment Act, 2004* expands the provincial government's ability to list and protect species at risk under the *Wildlife Act* (See above). It enables government to list as endangered, threatened or extirpated the full range of species that can be similarly listed under the federal *Species at Risk Act* (including plants and invertebrates). It also allows the protection of residences, such as nests or dens, for species at risk. These changes to the *Wildlife Act* must be brought into force through regulation.

Species at risk may include species, subspecies, varieties, or genetically or geographically distinct populations of: animals, fish, plants, or other organisms (except bacteria and viruses). Species residences are a place or area in, or a natural feature of, the habitat of the species at risk that is habitually occupied or used as a dwelling place by one or more individuals, and is considered as necessary for that occupation or use. With listing comes a series of prohibitions against the killing, trading, trafficking and transport of individuals of that species, and against the damage or destruction of its residence. Subject to the regulations, permits may be issued, or agreements entered into, that authorize exceptions to the prohibitions under certain circumstances.

Text of the Act is available at

http://www.leg.bc.ca/37th5th/3rd_read/gov51-3.htm

APPENDIX 4 - OTHER SOURCES OF INFORMATION

- Agriculture and Agri-Food Canada: Agricultural Partnership (CAP) <http://www.agr.gc.ca/eng/about-us/key-departmental-initiatives/canadian-agricultural-partnership/?id=1461767369849>
- Alberta Agriculture, Food and Rural Development. 2007. Biodiversity conservation guide for farmers and ranchers in Alberta.
- Alberta Riparian Habitat Management Society. Cows and Fish website www.cowsandfish.org/
- ATTRA Sustainable Agriculture. Master publication list: <https://attra.ncat.org/publication.html>
- Balvanera, P., A.B. Pfisterer, N. Buchmann, J.-S. He, T. Nakashizuka, D. Raffaelli and B. Schmid. 2006. Quantifying the evidence for biodiversity effects on ecosystem functioning and services. *Ecol. Lett.* 9: 1146-1156.
- BC Agriculture and Food Climate Action Initiative. Farm Adaptation Innovator Program. <https://www.bcagclimateaction.ca/farm-level/adaptation-innovator-program/>
- BC Cattlemen's Association: Farmland–Riparian Interface Stewardship Program www.cattlemen.bc.ca/FRISP.htm
- BC Cattlemen's Association: Livestock Protection Program <http://www.cattlemen.bc.ca/lpp.htm>
- BC Conservation Data Centre <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre>
- BC Conservation Data Centre iMap tutorial video <https://www.youtube.com/watch?v=DPEUboAeaWY>
- BC Ministry of Agriculture. AgriService BC website <https://www2.gov.bc.ca/gov/content/industry/agriservice-bc>
- BC Ministry of Environment & Climate Change: Biodiversity in BC www.env.gov.bc.ca/wld/bio.htm
- BC Ministry of Environment & Climate Change: Ecology website www.env.gov.bc.ca/ecology/index.html
- BC Ministry of Forests: Ecosystem brochures www.for.gov.bc.ca/hre/becweb/resources/classificationreports/provincial/index.html
- BC Ministry of Forests: Forest District biogeoclimatic maps www.for.gov.bc.ca/hre/becweb/resources/maps/fieldmaps.html
- BC Ministry of Forests: Forest Region field guides www.for.gov.bc.ca/hre/becweb/resources/classificationreports/regional/index.html
- Biodiversity Conservation Strategy for the Greater Vancouver Region www.metrovancouver.org/services/regional-planning/PlanningPublications/BiodiversityActionProfiles2007.pdf
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- Bullock, J.M., R.F. Pywell, M.J.W. Burke, and K.J. Walker. 2001. Restoration of biodiversity enhances agricultural production. *Ecol. Lett.* 4: 185–189.
- Canadian Biodiversity Information Facility <http://www.cbif.gc.ca/eng/home/?id=1370403266262>
- Canadian Intermountain Joint Venture <http://cijv.ca>
- Convention on Biological Diversity www.cbd.int
- Delta Farmland and Wildlife Trust <https://deltafarmland.ca>
- Develop with Care: Appendix D: Sources for environmental mapping and inventory <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/develop-with-care/dwc-appendices-a-f.pdf>
- Ducks Unlimited Canada <http://www.ducks.ca>

Environment and Climate Change Canada Species at Risk public registry <https://www.registrelep-sararegistry.gc.ca>

Environment and Climate Change Canada Species at Risk information <https://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html>

FrontCounter BC www.frontcounterbc.gov.bc.ca/

GeoGratis free web-based map site for Canada <http://geogratis.cgdi.gc.ca/>

Google Earth <http://earth.google.com/>

Habitat Wizard BC

<https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/ecosystems/habitatwizard>

Hectares BC www.hectaresbc.org/app/habc/HaBC.html

Invasive Species Council of BC <https://bcinvasives.ca>

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South Okanagan-Similkameen Conservation Program <http://www.soscp.org/>

Stewardship Centre BC <http://stewardshipcentrebc.ca/resources/>

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Wild Farm Alliance. Biodiversity resources <https://www.wildfarmalliance.org/biodiversity>

Yellowstone to Yukon Conservation Initiative www.y2y.net

