



7 BIODIVERSITY

INTRODUCTION

This chapter defines biodiversity and describes how biodiversity can benefit farm productivity and contribute to long term sustainability. The chapter also discusses farm management practices for protection of the biodiversity of aquatic life, wildlife and plants. It contains information on biodiversity, habitat and stewardship, the complex relationship between biodiversity and agriculture and impacts on biodiversity and habitat. It also contains information on environmental concerns, legislation and beneficial management practices related to:

- ◆ aquatic biodiversity
- ◆ biodiversity conflicts
- ◆ terrestrial biodiversity

This chapter is not intended to provide extensive solutions but to raise awareness and to encourage consideration of fish, other aquatic life, wildlife and plants and their habitat where appropriate in farm management. For information on specific local biodiversity concerns and solutions to conflicts refer to AGRI, MOE and DFO staff or other resource people. The following discussion may not apply to all areas of BC.

BIODIVERSITY AND HABITAT

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. 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.

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

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
- ◆ maintaining soil productivity and preventing soil loss due to wind and water erosion
- ◆ nutrient breakdown, storage and cycling
- ◆ making nutrients available to domestic and native plants, preventing organic debris from accumulating, and maintaining water quality
- ◆ reduction of pest populations
- ◆ helps reduce crop losses
- ◆ pollination services
- ◆ enhancing yields for pollinator-dependent crops such as fruit trees
- ◆ supporting wild species that are a source of the genetic material needed to breed crops and livestock that perform better than existing varieties

The above ecosystem 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. 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.

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 are 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

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.

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

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.

Agricultural Landscapes are Important to Biodiversity

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

- ◆ an adequate supply of habitat
- ◆ structurally diverse habitats
- ◆ connectivity between habitat patches
- ◆ healthy, functional habitats
- ◆ storehouses of genetic diversity

Because valley bottoms and coastal lowlands have longer growing seasons and better soils, these landscapes are more biologically productive than other parts of British Columbia. Greater biological productivity makes these landscapes the best agricultural areas of the province, but it also makes these lands disproportionately important to wildlife. Land conversion from natural ecosystems to agriculture has the potential to impact the province's biodiversity, but beneficial management practices can help to mitigate those impacts and maintain biodiversity.

While living in areas abundant with fish and wildlife is considered a positive lifestyle amenity, it comes with added environmental responsibilities. The extent of development and the intensity with which we manage the landscape mean that impacts to, and conflicts with, wildlife are inevitable. Good stewardship and effective land management mean considering the effects of our activities and employing means to minimize conflicts and maximize benefits. Some of these impacts have been mitigated by farms that:

- ◆ provide fish habitat
 - constructed ditches that fish colonize, irrigation reservoirs that are stocked with fish, planted riparian vegetation, assured fish passage at weirs and dams, maintenance of functional riparian areas
- ◆ provide planted or protected wildlife feed and habitat
 - critical winter and early spring forage in feed stacks, pastures and fields, and migratory bird stopover points.
- ◆ practice plant stewardship
 - grassland management and protection

While all farming systems have an influence on the surrounding biodiversity, the degree and type of influence will vary greatly by virtue of the many differences between farms. The relationship between fish and wildlife and agriculture is complex and is most usefully viewed as providing both benefits to agriculture as well as having costs to agriculture.

What is Habitat?

Environmental concerns are often mentioned in the context of their effect on 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. Habitat can include land associated with farms, as well as resources such as constructed ditches, forage areas and woodlots.

→ see Aquatic Habitat, page 7-14

→ see Wildlife Habitat, page 7-21

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. 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 uplands areas. In some intensively farmed areas of the province, retained aquatic and riparian areas provide the only opportunity for connecting habitats.

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.

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.

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.

Healthy, Functional Habitats. Habitats that are healthy and functioning properly support higher levels of biodiversity than habitats that have been compromised. 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.

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 soil 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. Adding different kinds of livestock to a production system can also increase the effective use of pastures.

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.

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.

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.

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.

Species at Risk

A species at risk is defined by the federal *Species at Risk Act* as an extirpated, endangered or threatened species or a species of special concern. The Act protects species at risk by providing legal protection to species at risk and their residences.

The Act applies to all lands and waters in Canada, but some provisions of the Act only apply to areas of federal jurisdiction, including migratory birds, all waters (sea and fresh) in Canada, as well as all federal lands, including Indian reserves and national parks, and the airspace above them.

Under the *Species at Risk Act* there are several species listed as either endangered or threatened in BC. A significant number of these occur in areas that could be impacted by agriculture.

<http://www.sararegistry.gc.ca>

http://www.dfo-mpo.gc.ca/species-especies/home_e.asp

Provincial and local government legislation provides for protection of wildlife on BC crown and private land. The provincial *Wildlife Act* protects wildlife listed under the Act.

The provisions of the *Species at Risk Act* (known as the ‘safety net’) could be invoked on BC crown and private lands using a federal order under the Act if provincial action is not sufficient to protect listed species.

<http://www.env.gov.bc.ca/cdc/>

<http://www.env.gov.bc.ca/atrisk/toolintro.html>

IMPACTS ON BIODIVERSITY AND HABITAT

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.

Agriculture changes the landscape and while farm development typically removes specific habitat types, it will also create other habitat types. For instance, land clearing removes forested habitat and replaces it with fields that may have forage value for some wildlife and waterfowl.

Impacts on habitat may occur as a result of various ongoing general farm activities. Works done near watercourses such as bridge and culvert crossings, or the construction of farm buildings may pose risks to fish and wildlife habitat. Similar risks may occur as a result of transporting, handling, and storing farm products and chemicals. Some of those impacts are listed in the sections below.

Farm Activities and Impacts

Habitat Loss and Fragmentation. Regions that support agricultural production are among the most altered ecosystems on the planet. 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 7.5% of Canada's land base, yet more than half of the terrestrial species at risk are found in agricultural areas. 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 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.

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. 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. These impacts affect both aquatic and terrestrial ecosystems and can be detrimental to biodiversity.

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. 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.

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. 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.

Introductions of Invasive Alien Species. The introduction and spread of alien species poses a 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 alien 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 have the potential to reduce agricultural production by competing with native plants for moisture and soil nutrients but often do not provide suitable forage for wildlife or livestock. Invasive alien plant species reduce native biodiversity and can be extremely difficult and costly to control once established.

Impacts of Genetically Modified Organisms. Genetically modified organisms (GMOs) are plants, animals, bacteria, or viruses whose genetic makeup have been deliberately altered in a way that does not occur naturally through mating or natural gene recombination. 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 fibre quality or fat content. The growing of GMOs reduces biodiversity because all of the plants within a single species come from a genetically modified source plant, so they are all genetically identical. The overall effects that GMOs have on

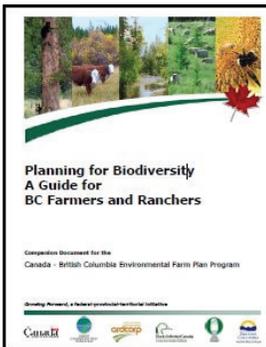
biodiversity are not fully understood, and they can differ among crops, environments, and the types of modifications made to the organism.

Impacts on Wildlife. Agricultural activities can have impacts on native wildlife species in addition to 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 and for which they have no natural resistance
- ◆ agricultural 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

Biodiversity Plans

Biodiversity in and around the farm operation can provide varying degrees of environmental benefit. In order for producers to gain a better understanding of biodiversity and plan for biodiversity a more detailed assessment is outlined in the Planning for Biodiversity publication.



Planning for Biodiversity: A Guide for BC Farmers and Ranchers is a publication that forms part of the Environmental Farm Plan series on Beneficial Management Practices. 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 is the next step beyond the EFP process and is not intended to address regulatory issues specifically. The guide provides an opportunity to assess how the farm operation fits within the eight principles of agricultural biodiversity (see Figure 7.1, next page).

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



Figure 7.1 Eight Principles of Agricultural Biodiversity



AQUATIC BIODIVERSITY

AQUATIC BIODIVERSITY CONCERNS

Primary environmental concerns related to protection of fish and other aquatic life are:

- ◆ contaminants, such as manure, pesticides and sediments, in water that results in fish health concerns
- ◆ reduced water quantity or low watercourse flows or velocities causing fish habitat loss resulting in reduction of fish food production, fish, and number of fish species
- ◆ dredging, dyking and channelizing streams that results in fish habitat loss
- ◆ loss of riparian vegetation that provides shade, leaf litter and insects for fish food
- ◆ lack of screens or incorrectly-sized screens on water intakes that results in fish population losses
- ◆ lack of assured fish passage through or around control structures such as dams or weirs

For information on these concerns:

- ➔ see Impacts on Biodiversity and Habitat, page 7-8, and refer to Farm Activities and Impacts
- ➔ see Water Quality and Quantity Factors, page 9-2, and refer to Contaminants
- ➔ see Buffers, Riparian Areas, and the Environment, page 11-2, and refer to Riparian Areas

AQUATIC BIODIVERSITY LEGISLATION

The following is a brief outline of the main legislation that applies to aquatic biodiversity.

- ➔ see page A-1 for a summary of these and other Acts and Regulations



Environmental Management Act

This Act protects against pollution but makes no reference to habitat protection directly. Similarly, the *Code* under the *Agricultural Waste Control Regulation*, which is concerned with agricultural wastes, makes no direct references to fish habitat. **Compliance with the *Code* does not necessarily ensure habitat protection.**



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 to give local governments greater powers for environmental planning.

- ◆ Section 4: prohibits construction of new dams on specified major rivers

- ◆ Section 6 and 7: 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.



Water Act This Act and Regulations allows “changes in and about a stream” under an approval, licence, or by regulation:

- ◆ Section 9: requires “changes in and about a stream” in accordance with an approval, licence, or order of the Act or Part 7 of the Regulations of the Act

The *Water Regulation*, Part 7, regulates “changes in and about a stream”:

- ◆ Section 40: authorizes Notification to MOE for certain “changes”
- ◆ Section 44: lists “changes” authorized (not requiring an approval or licence)



Wildlife Act The provincial *Wildlife Act* protects wildlife designated under the Act from direct harm, except as allowed by regulation (e.g., hunting or trapping), or under permit. Legal designation as Endangered or Threatened under the Act increases the penalties for harming a species. The Act also enables the protection of habitat in a Critical Wildlife Management Area.



Fisheries Act This Act has several sections regarding aquatic life:

- ◆ Sections 20, 21 and 22: fish passage ways, sufficient flow at obstructions
- ◆ Sections 27 and 29: prohibits obstructions to fish passage
- ◆ Section 30: requires water intakes to be screened to protect fish
- ◆ Section 32: prohibits the destruction of fish except by fishing
- ◆ Section 35: prohibits harmful alteration, disruption or destruction of fish habitat unless authorized
- ◆ Section 36(3): prohibits the deposit of deleterious substances into watercourses (deleterious substances could include many farm products or wastes)
- ◆ Section 37(4): requires approval for work that may impact fish habitat
- ◆ Section 38(4): requires reporting infractions of Sections 35 or 36



Species at Risk Act 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 manage species of special concern to prevent them from becoming endangered or threatened. Once a species is legally listed, the Act requires that recovery strategies be developed for extirpated, endangered and threatened species, and that action plans be developed where recovery is feasible.

- ◆ Schedule 1 of the Act sets out the legal list of species at risk (extirpated, endangered, threatened and special concern) in Canada.

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. Critical habitat is legally identified in a posted recovery strategy or action plan.

While the Act applies to all land and waters in Canada, these prohibitions only apply to areas of federal jurisdiction including migratory birds, all waters (sea and fresh) in Canada, as well as to all federal lands, including Indian reserves and national parks, and the airspace above them.

On **private land**, the SARA 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 provisions of the *Species at Risk Act* (known as the ‘safety net’) could be invoked on BC crown and private lands using a federal order under the Act if provincial action is not sufficient to protect listed species.

Note that SARA prohibitions do not apply to species of special concern, and that species at risk in Canada may also be protected by provincial or territorial laws.

More information about how the Act applies on private land can be found on the Species at Risk Public Registry at:

http://www.sararegistry.gc.ca/involved/you/privland_e.cfm

AQUATIC BIODIVERSITY BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable aquatic related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Protection of fish and other aquatic life on farm operations includes practices that not only directly protect them but also protect water quantity and quality, riparian areas, and habitats as well.

When planning work in or near a watercourse, contact Fisheries and Oceans Canada to ensure that it does not harmfully alter fish habitat or cause a deleterious substance to enter water. Designs for works in and about a stream should be submitted to Front Counter BC where an approval or licence is required; or to MOE where works are being carried out under regulation (*Water Act*, Section 9, and *Water Regulations*, Part 7).

Aquatic Habitat

For fish and other aquatic life, habitat clearly refers to the water and physical features in watercourses. A holistic view of aquatic habitat includes grassed and wooded areas adjacent to the water that provide various services to aquatic life, the water and the watercourse. Habitat concerns include water quantity, water quality, and the loss of in-stream habitat and riparian vegetation.

Where farm activities are present adjacent to watercourses, they will vary from low to high risk but all will require careful management to protect fish and other aquatic life.

Lakes, Ponds and Wetlands. These still, and slow moving water environments vary widely through the province but share important functions within an ecosystem that should be considered when addressing farm impacts. They typically:

- ◆ receive and hold water in a watershed reducing runoff peak flows
- ◆ depending on their size, have low tolerance for contaminants; water quality may easily be impacted
- ◆ provide important habitat for a wide range of aquatic life and wildlife
- ◆ have vegetation that varies greatly, some that may be grazed or browsed by livestock
- ◆ will have reduced functionality if riparian and buffer areas are impacted

Wetlands in BC tend to be small and dispersed across the landscape. Some of our most important wetlands occur in off-channel riverine areas. The draining and filling in of wetlands is a major conservation concern, for wetlands tend to be disproportionately important to wildlife, particularly in the more arid regions of the province.



- 📖 **Understanding Wetlands: A Wetland Handbook for BC's Interior Lakes and Wetlands**
- 📖 **Wetlands of British Columbia: A Guide to Identification**
- 📖 **Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia**

Streams, Ditches and Floodplains. These moving water environments vary considerably through the province but share similar important features:

- ◆ stream bank stability, in-stream structure and sinuosity to dissipate the energy of flowing water without significant erosion
- ◆ riparian vegetation to provide habitat, organic debris inputs and shade
- ◆ water quality and quantity for multiple uses, including fish and other aquatic organisms, wildlife, and drinking water supply
- ◆ floodplains that provide high-water relief to help reduce down-stream erosion and flooding, and to provide nutrients and seasonal rearing habitat for fish
- ◆ ground water influence in controlling and moderating watercourse flow and temperature

Riparian Areas. These areas bordering watercourses usually have vegetation that is different than the surrounding upland area due to the presence of water. Healthy riparian areas are important to aquatic life.

→ see Riparian Areas, page 11-13

Aquatic Life and Aquatic Habitat Protection

To protect stream habitat and riparian areas implement the following practices:

- ◆ protect water quality and quantity by following the water quality protection practices listed on the next page
- ◆ limit the number and use of in-stream crossings by constructing bridges or culverts wherever feasible
- ◆ perform an annual assessment of riparian health, implement changes identified, and monitor the results of any changes or improvements made (consider the assistance of local environmental enhancement groups)
- 📖 **Riparian Management Field Workbook**
- ◆ use planned grazing systems with separate riparian and upland pastures
- ◆ avoid grazing in riparian areas or schedule grazing in riparian areas to maintain vegetation diversity
- 📖 **Drainage Management Guide**

Water Quality. To protect water quality in watercourses that fish and other aquatic life depend on, implement the following practices:

- ◆ keep both dissolved and suspended water contaminants out of watercourses
- ◆ establish and maintain adequate vegetated buffers directly alongside watercourses → see Buffers, page 11-4
- ◆ use special nutrient management practices in buffer areas such as avoiding the spreading of manure in the fall
- ◆ manage stormwater to maintain watercourse hydrology and water quality in the state it was prior to land development as much as possible
- ◆ maintain wetlands for reducing peak runoff flows and purifying the water
 - where wetlands have been drained, resulting in marginal agricultural land, re-establish the wetland (conservation incentive programs may be available, such as from Ducks Unlimited Canada)
- ◆ on annual croplands located near vegetative buffers and riparian areas, use cover crops to limit bare soil areas created by late-season crop harvesting
 - see Cover Crops, page 4-5 and
 - see Buffers, page 11-4
- ◆ design livestock watering systems to reduce watercourse impacts either by providing controlled access points or no access whatsoever, if appropriate
- ◆ use pesticide application methods that reduce the risk of direct drift into watercourses or indirect drift onto runoff flows entering riparian areas
- ◆ manage and control grazing programs to avoid negative impacts such as manure deposition or contaminated runoff flow

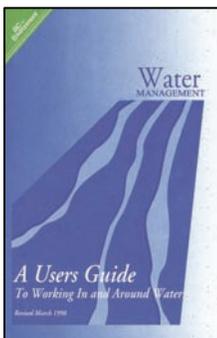
Fish Passage at Control Structures. Water control structures such as reservoir dams, weirs, flood boxes and pump stations on fish bearing watercourses may require fish passage structures. Such structures will be specific to fish species requirements and should be developed after consultation with Fisheries and Ocean Canada. Depending on the structure and location MOE may provide recommendations.

Water Withdrawals. Withdraw irrigation and livestock water at or below the licensed rates, and use acceptable water management practices. During exceptionally dry years, consider the unusual impacts to aquatic life from normal water withdrawals. → see Licencing of Surface Water , page 9-12

Surface water withdrawals require screened intakes to protect fish. They are designed for opening size to prevent fish entry and for low water velocity across the screen to prevent fish loss from being drawn against the screen.

→ see Water Intakes, page 9-16

Changes In and About a Stream



When planning any work in or near a watercourse, contact the appropriate agencies to ensure that it does not harmfully alter fish habitat or cause a deleterious substance to enter water.

Provincial Requirements. Work that involves “changes in and about a stream” (such as water intakes, stream crossings, etc) requires an approval or licence from Front Counter BC under the *Water Act*, Section 9. Notification to MOE is required for works that may be done in compliance with the *Water Regulation*, Part 7, such as those that do not involve any diversion of water, can be completed in a short period of time, and have little impact on the environment:

- ◆ installation, maintenance or removal of stream culverts, clear span bridges, docks or wharves, ice bridges, stream fords, and fences

- ◆ installation or maintenance of pipeline crossings, drain tile outlets
- ◆ repair and maintenance of dykes, bridge superstructures
- ◆ cutting of annual vegetation,
- ◆ beaver dam removal for drainage purposes with specific restrictions and in compliance with the *Wildlife Act*.

 **A Users Guide to Working In and Around Water**

 **Standards and Best Practices for Instream Works (lower mainland)**

Federal Requirements. The *Fisheries Act* requires authorization for work that may impact fish habitat (from Fisheries & Oceans Canada, DFO).

 www-heb.pac.dfo-mpo.gc.ca/publications/pdf/fishhablaw.pdf

Aquatic Life Establishment

Farm projects that include water impoundment or conveyance, such as reservoirs, ditches, etc. may also provide habitat for aquatic life. Consider consulting with Fisheries and Ocean Canada to see if measures can be taken (consistent with the farm goals) that may assist in creation of aquatic habitat.



TERRESTRIAL BIODIVERSITY

TERRESTRIAL BIODIVERSITY CONCERNS

Primary environmental concerns related to terrestrial biodiversity are:

Wildlife

- ◆ contaminants, such as manure, pesticides and sediments, in water from agriculture that results in wildlife health concerns
- ◆ grazing intensity and timing not properly managed
- ◆ reduced riparian health that results in wildlife habitat loss
- ◆ land clearing, drainage of wetlands and introduction of weeds that results in
 - wildlife habitat loss
 - loss of habitat connectivity
- ◆ pesticide management that results in loss of beneficial insects

Plants

- ◆ invasive pests that result in reduced populations of native plants
- ◆ pesticide management that results in a loss of beneficial native plants

For information on these concerns:

- ➔ see Pest Management and the Environment, page 5-1
- ➔ see Impacts on Biodiversity and Habitat, page 7-8, and refer to Farm Activities and Impacts
- ➔ see Water Quality and Quantity Factors, page 9-2, and refer to Contaminants

TERRESTRIAL BIODIVERSITY LEGISLATION

The following is a brief outline of the main legislation that applies to terrestrial biodiversity.

- ➔ see page A-1 for a summary of these and other Acts and Regulations



Environmental Management Act

This Act protects against pollution but not habitat directly. Note that the *Code* under the *Agricultural Waste Control Regulation* has no direct references to wildlife habitat. The *Code* is only concerned with agricultural wastes. **Compliance with the Code does not necessarily ensure habitat protection.**



Plant Protection Act

Regulations under this Act provide for the prevention of the spread of designated pests (i.e., insect, plant or pathogen) destructive to specific plants.



Weed Control Act

This Act imposes a duty on all land occupiers to control designated noxious plants.



Wildlife Act The provincial *Wildlife Act* protects wildlife designated under the Act from direct harm, except as allowed by regulation (e.g., hunting or trapping), or under permit. Legal designation as Endangered or Threatened under the Act increases the penalties for harming a species. The Act also enables the protection of habitat in a Critical Wildlife Management Area.

- ◆ Section 7: makes it an offence to alter, destroy or damage wildlife habitat within a wildlife management area
- ◆ Section 9: makes it an offence to disturb, molest or destroy a muskrat or beaver house, den or dam unless you are a licensed trapper or have lawful authority to protect property or maintain irrigation or drainage facilities
- ◆ Section 33.1: makes it an offence to intentionally feed or attract dangerous wildlife to any land or premises
- ◆ Section 34: makes it an offence, except by regulation, to possess, take, injure, molest or destroy a bird or its egg; the nest of an eagle, peregrine falcon, osprey, heron or burrowing owl; or the nest of any bird not mentioned above when the nest is occupied by the bird or its egg



Migratory Birds Convention Act The Regulation under this Act has sections of importance:

- ◆ Section 6: no person shall: disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird without permit
- ◆ Section 24(1): any person may, without a permit, use equipment, other than an aircraft or firearms, to scare migratory birds that are causing, or a likely to cause damage to crops or other property (other control measures require a permit)
- ◆ Section 33: no person shall introduce into Canada for the purpose of sport, acclimatization or release from captivity a species of migratory bird not indigenous to Canada except with the consent in writing of the Director.
- ◆ Section 35(1): prohibits the deposit of oil, oil wastes or any other substance harmful to migratory birds in any area frequented by migratory birds



Plant Protection Act This Act protects plant life by preventing the importation, exportation and transportation of pests.

- ◆ policy directives outline requirements for the importation and/or domestic movement of straw to prevent the introduction and spread of the cereal leaf beetle



Species at Risk Act 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 manage species of special concern to prevent them from becoming endangered or threatened. Once a species is legally listed, the Act requires that recovery strategies be developed for extirpated, endangered and threatened species, and that action plans be developed where recovery is feasible.

- ◆ Schedule 1 of the Act sets out the legal list of species at risk (extirpated, endangered, threatened and special concern) in Canada.

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. Critical habitat is legally identified in a posted recovery strategy or action plan.

While the Act applies to all land and waters in Canada, these prohibitions only apply to areas of federal jurisdiction including migratory birds, all waters (sea and fresh) in Canada, as well as to all federal lands, including Indian reserves and national parks, and the airspace above them.

- ◆ On **private land**, the SARA 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 provisions of the *Species at Risk Act* (known as the ‘safety net’) could be invoked on BC crown and private lands using a federal order under the Act if provincial action is not sufficient to protect listed species.

Note that SARA prohibitions do not apply to species of special concern, and that species at risk in Canada may also be protected by provincial or territorial laws. More information about how the Act applies on private land can be found on the Species at Risk Public Registry at:

http://www.sararegistry.gc.ca/involved/you/privland_e.cfm

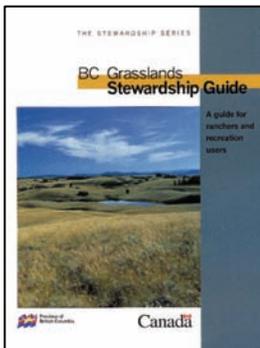
TERRESTRIAL BIODIVERSITY BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable wildlife biodiversity related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Wildlife habitat concerns include the reduction or loss of habitat due to the establishment or expansion of farms, such as drainage of wetlands for crop production. Wildlife protection on farm operations includes practices that protect both wildlife and their habitat. Assess the type and density of wildlife on or around a farm to ensure that a desired agricultural development, activity, or operation does not cause adverse affects.

Grasslands. Grasslands cover only 1.5% of BC’s land area, and about 70% is located on privately owned land. Nevertheless, grasslands are important both as wildlife habitat and as forage for grazing livestock. Grasslands often contain species at risk.

 **BC Grasslands Stewardship Guide**



Woodlands. Farm woodlots may be operated on privately owned and/or Crown land. Impacts from harvesting trees may affect both fish and wildlife. Specific concerns include the growth management activities, the timing and method of tree removal, the size of harvest area, and post-harvest activities.

Riparian Areas. Healthy riparian vegetation supports a diversity of bird and wildlife species with both food and shelter. This vegetation is particularly important to wildlife, including species at risk, as it is very productive and located next to water. → see Riparian Areas, page 11-13

Wetlands. These still, and slow moving water environments vary widely through the province but share important fundamentals when considering farm impacts. Many wetlands do not have fish, and as such do not have direct legal protection, except as they relate to the *Species at Risk Act* and to bird nests.

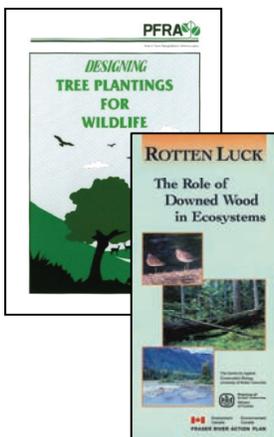
Wetlands are important to biodiversity because the presence of a vast range plant and animal species. They typically:

- ◆ receive and hold water in a watershed, reducing runoff peak flows
 - ◆ depending on their size, have low tolerance for contaminants; water quality may easily be impacted
 - ◆ provide important habitat for a wide range of aquatic life and wildlife
 - ◆ have vegetation that varies greatly, some that may be grazed or browsed by livestock
 - ◆ will have reduced functionality if riparian and buffer areas are impacted
-  **Understanding Wetlands: A Wetland Handbook for BC's Interior**
 **Wetlands of British Columbia: A Guide to Identification**
 **Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia**

Wildlife and Wildlife Habitat Protection

To protect wildlife habitat, implement the following practices:

- ◆ follow the beneficial practices to protect water quality as previously mentioned in the fish protection section
 - ◆ know the wildlife species on the farm and what habitats are present to determine if there are any threatened or endangered species
- <http://www.env.gov.bc.ca/cdc/>
<http://www.sararegistry.gc.ca>
<http://www.env.gov.bc.ca/atrisk/toolintro.html>
- ◆ perform an annual assessment of habitat health, implement changes identified, and monitor the results of any changes or improvements made
-  **Riparian Management Field Workbook**
 **Planning for Biodiversity: A Guide for BC Farmers and Ranchers**
- ◆ use planned grazing systems that consider impacts on wildlife habitat
 - ◆ improve livestock management to minimize impacts on habitat by
 - using cross fencing to move livestock
 - installing off-stream or off site-watering
 - ◆ use devices such as flushing bars when cutting hay to reduce wildlife mortality
 - ◆ buffer sensitive habitats from loss or alteration due to road and building construction, outdoor livestock areas, land clearing, wetland drainage, cultivation, crop harvest, soil erosion, compaction, and air contaminants that result from agricultural activities → see Buffers, page 11-4
 - ◆ provide wildlife with corridors for moving across the landscape (where appropriate, work with neighbours to establish continuous corridors)
 - ◆ conserve wildlife trees and other habitat features
 - ◆ contain and treat livestock diseases
 - ◆ use Integrated Pest Management (IPM) to decide when and how to control pests



Wildlife Habitat Establishment

Under some circumstances land owners may choose to plant trees and other vegetation specifically for wildlife.

Conservation organizations such as Ducks Unlimited Canada, The Nature Conservancy, The Nature Trust of BC, The Land Conservancy of BC, the Grassland Conservation Council, or local land trusts work in partnership with producers and may have access to funds or incentives to support stewardship activities, particularly for species at risk.

-  **Designing Tree Plantings for Wildlife**
 **Rotten Luck: The Role of Downed Wood in Ecosystems**

PLANT BIODIVERSITY BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable plant biodiversity related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Livestock Management

Livestock may have an impact on plant biodiversity. The main concerns are over grazing and trampling of sensitive vegetation on native grasslands, rangelands and riparian areas. → see Outdoor Livestock Areas, page 3-7

 **Grazing Management Guide**

Weeds

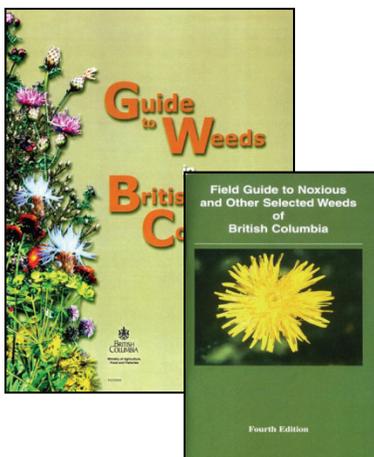
Noxious weeds are typically non-native (alien) plants that have been introduced into British Columbia without the insect predators and plant pathogens that help keep them in check in their native habitats. For this reason and also because of their aggressive growth characteristics, these alien plants can be highly destructive, competitive, and difficult to control. Non-native weeds are among the leading cause associated with loss of the natural diversity in the environment.

It is important that any unusual or unfamiliar weeds be reported to AGRI or the Canadian Food Inspection Agency so that the species can be identified for appropriate action to be taken to eradicate the pest before it spreads.

 <http://www.al.gov.bc.ca/cropprot/weeds.htm>

To reduce the possibility of introducing new weeds to a farm, implement the following practices:

- ◆ before importing plant material from other countries or provinces, check with the Canadian Food Inspection Agency for permit requirements and other restrictions  www.inspection.gc.ca
- ◆ report the presence of any unusual weeds to the nearest AGRI office as soon as possible



To reduce the impact of weeds, implement the following practices:

- ◆ learn to identify weeds, particularly at the seedling stage
 - ◆ prevent problem weeds from going to seed
 - ◆ always use clean certified seed sources
 - ◆ practice crop rotation to discourage build up of specific weeds
 - ◆ use Integrated Pest Management (IPM) to decide when and how to control weeds
 - ◆ apply appropriate controls at the recommended stage of crop and weed development
 - ◆ control perennial weeds prior to planting crops
 - ◆ prevent the movement of weeds to new locations
 - prevent movement that can occur when livestock move from a weed infested area to an uninfested area
 - by cleaning farm equipment before moving from one location to another
 - ◆ control weeds along farm roads and trails → see Invasive Pests, page 5-5
-  **Seven Steps to Managing Your Weeds: A Manual for Integrated Weed Management in British Columbia**
-  **A Guide to Weeds in British Columbia**
-  **Invasive Plant Alert: Prevent the Escape of Aggressive Plants**
-  **Field Guide to Noxious and Other Selected Weeds of British Columbia**
-  www.invasiveplantcouncilbc.com and  www.weedsbc.ca



BIODIVERSITY CONFLICTS

This chapter has outlined environmental impacts that may occur *to* biodiversity from a farm operation. However, farms may be affected by impacts *from* biodiversity.

BIODIVERSITY CONFLICT CONCERNS

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. Examples of concerns related to biodiversity and agriculture conflicts are:

- ◆ deer and rabbits can damage fruit trees
- ◆ coyotes can damage drip irrigation lines and emitters
- ◆ birds can raid fruit crops and contaminate feeders
- ◆ deer and elk can consume standing crops and stored forage
- ◆ bears can damage apiaries
- ◆ large carnivores such as wolves, coyotes, cougars and bears killing or maiming of livestock; or causing damage to fences and water piping
- ◆ waterfowl can consume standing crops and compact soils of cropped fields, particularly during fall migration or overwintering
- ◆ waterfowl can transmit infectious disease
- ◆ bats, birds, rodents, skunks, beavers and raccoons and other small wildlife can damage buildings by roosting and nesting in attics, digging and denning under foundations, or sheltering within walls
 - causing damage to feed, and crops
 - carrying pathogens that cause disease in humans, such as Tularemia (beaver), Hantavirus (mice)
- ◆ birds causing a nuisance concern for affected neighbours from the need to use noise makers for bird control

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.

BIODIVERSITY CONFLICT RESOLUTIONS

Minimize Wildlife Damage. To aid in reducing conflicts or damage, implement the following practices:

- ◆ minimize waterfowl damage
 - delay fall tillage of already harvested fields (waterfowl will use the waste grain or crop residue)
 - straight combine grain crops instead of swathing
 - plant lure or sacrifice crops
 - post harvested fields as “no-hunting” (essentially creating your own lure crop-preventing damage on unharvested crop)
- ◆ minimize ungulate (i.e. deer and elk) damage
 - stack bales at least two tiers high, keeping stack edges as straight as possible (prevents climbing) and stack bales near human habitation
 - use farm machinery to prevent access to stacks
 - clean up spilled grain, loose forage and other food sources which may attract wildlife
- ◆ follow the pest management strategies in Chapter 5
- ◆ minimize the impact of problem wildlife by
 - not attracting them to feed, by disposing of mortalities in an appropriate and timely manner
 - by excluding them from feed, such as with fencing orchards, vineyards, or other high value crop production areas
 - by excluding them from habitat, such as screening culverts to exclude beavers
 - 📖 **Beaver Damage Control in Agricultural Areas of B.C.**
 - 📖 **Control of Beaver Damage**
 - 📖 **Mitigating Cattle Losses Caused by Wild Predators in British Columbia: A Field Guide for Ranchers**
- ◆ producers are encouraged to follow normal farm practices as defined by the *Farm Practices Protection (Right to Farm) Act* and as outlined by previous Farm Industry Review Board rulings. See <http://www.firb.gov.bc.ca/>
 - 📖 **Wildlife Damage Control - Interior BC**
 - 📖 **Wildlife Damage Control - South Coastal BC**
- ◆ various projects and programs have been developed in BC to solve local wildlife conflicts including the following examples:
 - The Delta Farmland and Wildlife Trust is voluntary on-farm stewardship organization that encourages demonstration and research. The Trust has supported planting lure crops, grassland set-asides, buffers, and public education and awareness projects
 - The Comox Valley Waterfowl Management Project has been involved in monitoring swan behaviour, planting lure crops, developing hazing programs to scare off birds, and encouraging producer/agency/public communication
 - Provincial Agriculture Zone Wildlife Program (PAZWP) coordinates crop damage prevention, mitigation and compensation strategies, increases hunting opportunities in agricultural zones and promotes healthy hunter-landowner relationships.
 - The Wild Predator Loss Prevention Pilot Project provides education to producers aimed at reducing losses to wild predators and also provides predator response and compensation for verified losses.

