

HOW TO SURVEY BIRDS ON YOUR FARM TO HELP MONITOR BIODIVERSITY

BIRD FACTS



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American robin

There are 451 bird species across Canada¹ and BC is home to 320 bird species²

Populations of insect-eating birds, like swallows, have declined by 59% since 1970³

In Canada, 1 in 8 birds are threatened with extinction³

Banning the insecticide DDT in Canada in the 1980s has helped increase bird of prey populations by 110%³

Importance of Farmland for Birds

Birds, with their colourful feathers and varied songs, are a beautiful addition to your farm's wildlife diversity. On-farm habitats like hedgerows and field margins, can support migrating and resident bird populations, bringing benefits to your farm and helping to increase bird diversity.

Healthy bird populations can also indicate healthy ecosystems, since birds are impacted by habitat loss, pollution, climate change, invasive species and insect declines.

Birds on farms can be beneficial when they eat pests, but also harmful when they damage crops. Many bird species can also switch roles – being beneficial at one point in the season and more of a pest in another. Ways to attract beneficial birds include adding nest boxes or perches for

specific beneficial species, placing buffers between crops and habitat, adjusting planting times, or blocking access to farm buildings by pest birds.

Impacts of Birds on Farmland

Positive:

- ↓ Decreased rodent populations 
- ↓ Reduced number of fruit-eating birds (due to birds of prey)
- ↓ Lower insect pest populations 
- ↑ Increased pollination services (through nectar feeding) 

Negative:

- ↑ Potential crop damage 
- ↑ Potential risk of avian flu transmission

How to Survey for Birds



With a partner decide on a central location on your farm to observe birds. Try to stay away from buildings and roads. Next, assign roles — one person will record data while the other identifies and counts birds.



Walk to the agreed-upon location on your farm. Make sure that winds are light and it isn't raining. Birds are also usually most active in the early morning. Wait quietly for 5 minutes to start your survey in case birds were startled when you arrived. Fill in the top part of the provided data sheet.



Record the number of individuals of each type of bird seen and heard for 15 minutes. Try not to double-count individual birds!



If you can't identify a bird, jot down a description and use a field guide or a smartphone app like Merlin (see below) to help identify the bird. Once your survey is done, submit the data to a participatory monitoring initiative like eBird.

Bird Identification and Participatory Monitoring Resources

Participatory monitoring occurs when local residents measure and monitor natural resources or biodiversity. There are a wide variety of initiatives and associated apps and websites that can help users identify birds and collect bird diversity data for use in scientific research and land use planning initiatives, including:

- **Merlin** (merlin.allaboutbirds.org): A smartphone app for bird species identification
- **iNaturalist** (inaturalist.org): Users can use their smartphone to observe biodiversity (pictures, sounds), share with other naturalists, and collectively identify species
- **eBird** (ebird.org/canada): Allows bird watchers to track, store and share their bird observations
- **Great Backyard Bird Count** (birdcount.org): Occurs over a span of four days every February
- **Christmas Bird Count** (audubon.org/christmas-bird-count): Held since 1900, this annual bird count occurs from December 14 to January 5
- **Birds Canada Participatory Monitoring Map** (birdscanada.org)

Photo credits: Wolf Read

1. Canadian Wildlife Federation. (n.d.). *Wild about birds*. Retrieved March 23, 2023, from <https://cwf-fcf.org/en/explore/wild-about-birds/>

2. BC Breeding Bird Atlas. (n.d.). Retrieved March 23, 2023, from <https://www.birdatlas.bc.ca/>

3. Environment and Climate Change Canada. (2023, January 26). *Trends in Canada's bird populations*. <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/trends-bird-populations.html>

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WHY BIODIVERSITY MATTERS FOR FARMS AND AGRICULTURE

USEFUL FACTS

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There are 5 main causes of biodiversity loss: habitat loss, climate change, pollution, invasive species, and over-harvesting¹

More than 1/3 of global food crops require animal pollination¹

More than 6000 plants have been grown for food, but only 9 crops contribute the majority (66%) of global food production²

Almost 50% of the global ice-free land area is utilized for crop or livestock production³

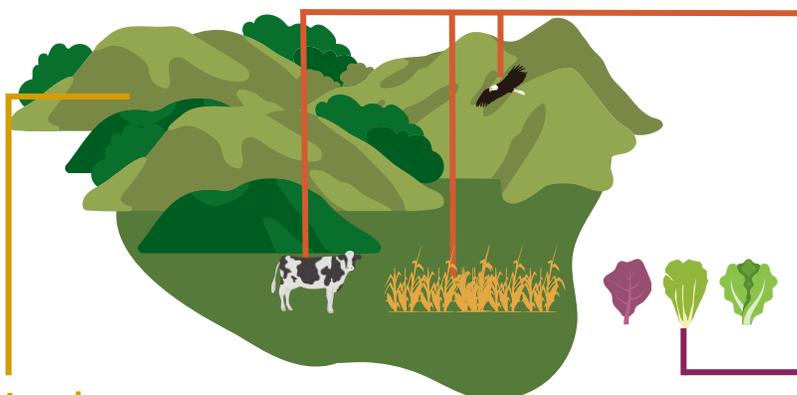
Canada has set a goal to protect 30% of land and ocean areas for biodiversity conservation by 2030⁴

Since the 1900s, ~75% of crop genetic diversity has been lost as farmers switch to high-yielding varieties²

Agrobiodi-what?

“Agro” means on farm and biodiversity refers to all the different types of life present in an area. Agrobiodiversity includes the different crops grown on a farm and all the other “wild” species too (plants, animals, insects, fungi, bacteria). How a farm is managed influences the agrobiodiversity present on farm, which can have positive or negative (or both) impacts on crops and livestock.

Types of Agrobiodiversity



Landscape

The different types of habitats present and their size

Organismal

The different types of species present

- **Planned** — the different types and varieties of crops grown and livestock raised
- **Unplanned** — the “wild” species that occur on a farm that aren’t actively managed

Genetic

The diversity of genes present (e.g. multiple crop varieties)

Agrobiodiversity can Benefit Agriculture by:

- ↑ Increasing soil formation and retention → healthier soils, reduced inputs 
- ↑ Increasing nutrient cycling and storage → more fertile soils, reduced fertilizer use 
- ↓ Reducing pest populations → reduced pesticide usage  
- ↑ Increasing pollination → higher crop yields, reduced need for non-native honeybees

Why Measure or Monitor Agrobiodiversity?

1. Keeping a record of biodiversity monitoring on-farm can help you apply for grants that support biodiversity conservation
2. Understanding biodiversity on-farm can inform farm management for pest, pollinators, weeds, and diseases
3. Tracking changes in agrobiodiversity can help farms be resilient and adapt to changing conditions

How can I Measure Agrobiodiversity?

Agrobiodiversity monitoring requires observation and identification of the organisms present. [iNaturalist](#) is a participatory monitoring smart phone application that helps in identifying and recording species. These observations can then be contributed to a centralized database for use in scientific research projects. See our series of factsheets on monitoring agrobiodiversity at bcfoodweb.ca for more information!



Time commitment: 20-40 minutes per biodiversity monitoring activity



Repeat observations: different times of day, changes in season, or annually



Areas to observe: fields, field margins, hedgerows, riparian areas, forests, and/or gardens



Groups of species to focus monitoring on: birds, insects (pests and predators), and pollinators

1. United Nations. (2019, May 6). *UN report: Nature's dangerous decline 'unprecedented'; species extinction rates 'accelerating'*.
2. Food and Agriculture Organization. (2019). *The state of the world's biodiversity for food and agriculture*.
3. United Nations Environment Programme (2021). *Making peace with nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies*.
4. Government of Canada. (2022, December 9). *Government of Canada recognizing federal land and water to contribute to 30 by 30 nature conservation goals*.

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HOW TO SURVEY INSECTS ON YOUR FARM TO HELP MONITOR BIODIVERSITY



INSECT FACTS



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There are almost 500 species of native pollinators in BC, the highest diversity in Canada!¹

Native pollinators are often more effective at pollinating crops than honeybees

~45% of the food produced annually is lost to pest infestations²

Honeybees, while not native to Canada, contribute \$538 million annually to B.C.'s economy through pollination³

Insects can be Helpful or Harmful

Insects can be harmful when they damage crops, or helpful when they pollinate crops and control pests. Helpful insects include pollinators, predators, and parasitoids. These insects can increase crop growth, raise yields and contribute to overall agroecosystem health.

How do Insects Benefit Farms?

Pollinate crops 
Control pests and diseases 
Help clean up waste 

How are Insects Detrimental to Farms?

Can damage crops 
Can spread diseases



Types of Helpful Insects

Pollinators like bumble bees, honey bees, and sweat bees pollinate many crops like blueberries, apples, squash, alfalfa, and tomatoes. Predators including ground beetles, spiders, hoverflies, ladybugs, and parasitoids control pests by consuming or parasitizing them. For example, hoverflies prey on aphid larvae while parasitoid wasps lay their eggs in pests, which hatch and then kill the pest. Other insects break down and recycle organic matter in the soil.

Insect Identification and Participatory Monitoring Resources

- **iNaturalist** (inaturalist.org): Smartphone app that can identify species from photos
- **Bumble Bee Watch** (bumblebeewatch.org): Smartphone app with bumble bee species descriptions and instructions to complete pollinator surveys
- **Beetle Watch** (scistarter.org/iue-beetle-watch): Provides ID guides for common ground beetle species
- **LeafByte** (zoegp.science/leafbyte): Measures leaf damage from smartphone photos
- **Caterpillars Count** (caterpillarscount.unc.edu/): Methods and app to quantify caterpillar abundance

How to Scout for Insect Pests

Adapted from *Michigan State University Bulletin E3294*



Scout for pests as soon as plants begin to grow — weekly scouting is often recommended until the crop is harvested or pest risk has passed.



Walk an X or W pattern in your field to assess pests and pest damage.



At 5 widely spaced points along your scouting pattern, check 10 plants and the surrounding area (~3 x 3m) for signs and symptoms of pests. Examine plant leaves, stems, roots, and flowers/fruits.



Identify pests and pest damage using field guides or smartphone apps. Record pest presence/severity and control measures used using a field map.



Other Simple and Common Techniques to Monitor Insects

1 Pan Traps

for pollinators

Shallow coloured pans of water can be used to attract and trap pollinators like bees and flies.

2 Sticky Traps

for pests

A coloured sticky card (usually yellow or blue) is used to trap and monitor pests.

3 Pitfall Traps

for beetles and spiders

Small cups with a cover are dug into the ground, level with the ground surface. Ground-dwelling insects, such as ground beetles and spiders, then fall into the trap.

4

Sweep Netting

for bees, butterflies, flying insects

A net is swept at a plant to capture flying insects such as pollinators (bees, hoverflies, and butterflies).

5

Beating Trays

for foliage-inhabiting pests and predators

A sheet or tray is placed under a plant before gently shaking the plant to dislodge insects onto the tray.

6

Sticky Pi Automated Insect Trap

for pests

A sticky trap is combined with an automated camera to capture insects and automatically identify which insect species has been captured.



Photo credits: Wolf Read and Juliana Cao

1. Native Bee Society of British Columbia. *Bee diversity in British Columbia*. <https://www.bcnativebees.org/bee-diversity>

2. Sharma, A., Kumar, V., Shahzad, B., Tanveer, M., Sidhu, G. P. S., Handa, N., Kohli, S. K., Yadav, P., Bali, A. S., Parihar, R. D., Dar, O. I., Singh, K., Jasrotia, S., Bakshi, P., Ramakrishnan, M., Kumar, S., Bhardwaj, R., & Thukral, A. K. (2019). Worldwide pesticide usage and its impacts on ecosystem. *SN Applied Sciences*.

3. Government of British Columbia. (2019, February 27). *Bees and bee health in British Columbia*. <https://news.gov.bc.ca/factsheets/bees-and-bee-health-in-british-columbia>

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HOW TO SURVEY WEEDS ON YOUR FARM TO HELP MONITOR BIODIVERSITY

WEED FACTS



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Canada thistle ¹

Invasive species, including weeds, are the second biggest threat to biodiversity globally ²

Approximately 250 species of weeds have developed some type of herbicide resistance ³

Crop loss due to uncontrolled weeds amounts to \$43 billion annually in the U.S and Canada ⁴

Corn and soybean yields drop by around 50% when all weed control efforts are eliminated ⁴

Some weed species can indicate soil conditions like phosphorus levels or salt accumulation ⁵

Many invasive weeds were introduced to North America as ornamental plants ³

What are Weeds?

Weeds are simply unwanted plants. On farms, weeds compete with crops for water, space, and nutrients, depleting these resources and reducing crop yields. Many weeds are exotic — they are present outside their usual range or native habitat. This can mean that the pests or diseases that typically control that weed are not present in the new location. This increases the chances of

the weed surviving, spreading, and impacting local agroecosystems.

Why Weed Identification is Important

Identifying weeds can provide information to help design weed control strategies or programs. Knowing what a weed looks like during its different life stages, how it spreads, and where it is present provides key information to decide whether and how to manage a weed.

Recording and Reporting Weeds

- **iNaturalist** (inaturalist.org): Users can use their smartphone to observe biodiversity (pictures, sounds), share with other naturalists, and collectively identify species
- **Invasive Species Council of B.C** (bcinvasives.ca): Has alerts and identification information for all invasive species in the province, including weeds. Invasive species can easily be reported on their app.
- **iMapInvasives** (imapinvasives.org): Used for participatory monitoring and by professionals to keep track of invasive species in Saskatchewan and some participating US states
- **EDDMaps** (eddmaps.org): A mapping tool used to record the distribution of invasive species. Entries can be made on the webpage or the smartphone app.

How to Survey for Weeds



Go to the centre of a field on your farm to start your weed survey.



Walk a “W” pattern within the field where each arm of the W is 100 paces. If your field is smaller, you can reduce the size of the W.



Every 20 paces along the W, identify and count the number of weeds in a 50 x 50 cm square (0.25 m²). If your W is smaller, adjust the number of paces between sampling locations.



If you can't identify a weed, take notes and photos of it, or collect an individual plant. Resources to help you identify weeds can be found below.

Resources for Identifying Weeds

FIELD GUIDES



Field horsetail⁶

[Invasive Species Council of B.C. Website](#)

- This website has alerts and identification information for all invasive species in the province, including weeds. A digital [field guide for provincial noxious weeds](#) and digital list of invasive weeds are also available.

[The Canadian Food Inspection Agency's "Invasive Plant Field Guide"](#)

- This digital guide can be used to help identify and control weeds on farms. It is well-detailed and includes pictures of the different parts of each weed.

[E.S. Croconsult's Factsheet of "Important Agricultural Weeds"](#)

- This guide outlines the life cycles of common weeds and provides descriptions for weed identification, including how to distinguish look-alikes.

[Food and Agriculture Organization \(FAO\) Weed Species Database](#)

- This website provides a list of weeds species for specific crops in different countries around the world and information on each listed weed species.

[Ag Weed ID App](#)

- This Canadian smartphone app can help farmers identify weeds from uploaded pictures, provides descriptions of weed species, and allows farmers to build a weed album specific to their farm.

APPS



Creeping buttercup⁷

1. *Cirsium arvense* © [Ivar Leidus](#) (https://commons.wikimedia.org/wiki/File:Cirsium_arvense_-_p%C3%B5ldohakas.jpg) CC BY-SA 3.0.
2. Invasive Species Council of BC. (n.d.). What's the big deal? <https://bcinvasives.ca/whats-the-big-deal/>
3. Weed Science Society of America. (n.d.). *Facts about weeds* [Fact sheet]. <https://wssa.net/wp-content/uploads/WSSA-Fact-SheetFinal.pdf>
4. Weed Science Society of America. (2016, May 4). WSSA calculates billions in potential economic losses from uncontrolled weeds. <https://wssa.net/2016/05/wssa-calculates-billions-in-potential-economic-losses-from-uncontrolled-weeds/>
5. Frick, B., & Johnson, E. (n.d.). *Weeds — when are they a good thing?* <https://www.dal.ca/faculty/agriculture/oacc/en-home/resources/pest-management/weed-management/organic-weed-mgmt-resources/weeds-good.html>
6. Field horsetail (*Equisetum arvense*) © [Oleg Kosterin](#) (https://commons.wikimedia.org/wiki/File:Equisetum_arvense_117578473.jpg) CC BY 4.0.
7. Creeping buttercup (*Ranunculus repens*) © [Jörg Hempel](#) (https://commons.wikimedia.org/wiki/File:Ranunculus_repens_LC0036.jpg) CC BY-SA 2.0 DE.

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HOW TECHNOLOGY CAN HELP WITH MONITORING ON-FARM BIODIVERSITY



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Technology and Biodiversity

Monitoring biodiversity can be challenging. It takes time and expertise to learn how to identify different species. Technological advancements like smartphone apps and automated sensors are making it easier to identify and keep track of biodiversity. Apps are used by scientists and the public for participatory monitoring of biodiversity.

Biodiversity Technologies

1 SMARTPHONE APPS

iNaturalist

Observe biodiversity (pictures and sounds), share with other naturalists, and identify and catalogue species.



Merlin Bird Identification

Guides users through visual bird identification, and listens to bird songs through your phone's microphone to identify bird species in real time.

Bumble Bee Watch

Assists users in identifying bumble bee species, completing bumble bee surveys, and users can upload any sightings to a centralized public database.

eBird

Allows bird watchers to track, store, and share their bird observations. This data is combined into a central database used for science and conservation.

2 AUTOMATED MONITORING TECHNOLOGIES



Camera Traps

Motion-sensing automated cameras can be used to take photos or videos of wildlife that pass by. Used by scientific researchers, hunters, and wildlife enthusiasts, there are an increasing number of companies producing these types of cameras (Reconyx, Bushnell, Browning, Spypoint, and others) for the consumer market.



HOW TECHNOLOGY CAN HELP WITH MONITORING ON-FARM BIODIVERSITY



Audio Recorders

Recording bird songs, ultrasonic bat calls, or all the sounds in an area (the 'soundscape') can help monitor biodiversity. Companies like Wildlife Acoustics and AudioMoth produce increasingly small, inexpensive, and user-friendly recorders. Ultrasonic microphones are also available for smartphones and can automatically identify bat species when paired with an accompanying app such as Kaleidoscope Pro.

In Development

Researchers at the University of British Columbia are developing camera trap technology for trapping and automatically identifying insects. StickyPi devices take pictures frequently, allowing researchers to monitor insect response to changes in weather and time of day.



3 WEBSITES AND DATABASES



Barred owl
Photo credit: Wolf Read

EFauna BC and EFlora BC

These websites provide detailed accounts of animal and plant species in BC, including photos, occurrence maps, and information on the biology, habitat, distribution, and conservation status of most species present in BC.

NatureWatch

Canadian organization that runs multiple participatory monitoring projects, including Wormwatch, Frogwatch, Plantwatch, and Milkweedwatch.



GBIF

The Global Biodiversity Information Facility is a free and open global database of biodiversity data, including university samples and data as well as sightings from eBird and iNaturalist. Currently at over 2 billion records.

NatureServe

Provides information on threatened, rare, and endangered species in North America, including maps, models, and metrics. Many maps and datasets are freely available on the NatureServe website.

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