

Nature's bellwethers

Birds are widely recognized as biological indicators of environmental change. With wild bird populations at half of what they were 50 years ago, the Facility for Applied Avian Research (FAAR) aims to understand how agricultural pesticides and pollutants are having an impact on them.

The researcher

The principal investigator at FAAR, **Christy Morrissey** has a joint appointment in the Department of Biology and the School of Environment and Sustainability at the University of Saskatchewan. She is also a Member of the Royal Society of Canada's College of New Scholars, Artists and Scientists.



The research

Today's **wild bird population** is estimated to be **half of what it was in the 1970s**, and finding out why has important implications for both human and environmental health. Morrissey studies how **pesticides** and **other pollutants** move through ecosystems and their impacts on birds whose habitats are on agricultural land.

Research conducted in the facility includes:

- Studying the effects of current pesticide use on the migratory activity of songbirds
- Understanding how exposure to polycyclic aromatic hydrocarbons from petroleum products affects the ability of birds to obtain and store energy before migration
- Determining the effects of endocrine-disrupting chemicals on the growth, development, learning and behaviour of birds
- Developing and validating stress biomarkers in birds to better understand how they respond to stress hormones
- Assessing stress responses of birds and bats to virus exposure, temperature change and artificial light intensity under controlled settings.

Since 2016, research conducted at FAAR has generated 27 peer-reviewed publications and presentations at conferences, symposia and workshops, several of which were student-led. Research at FAAR has also been widely publicized in national and international media.

About the Canada Foundation for Innovation

Since its creation in 1997, the CFI has committed more than \$10 billion in support of more than 13,000 research infrastructure projects in all disciplines at 173 institutions in 81 municipalities across Canada.

The infrastructure

The Canada Foundation for Innovation (CFI) awarded almost \$800,000 to FAAR, which opened in May 2016. The facility includes:

- Six large, indoor climate- and light-controlled rooms
- 12 outdoor covered aviaries, including wet pens that can be flooded to create a shoreline
- A freshwater pond
- A fully equipped lab for experimental work on research animals and storing samples.

"FAAR allows us to do really complicated and unique experiments that we otherwise would not be able to do," says Morrissey. "These facilities are rare in Canada."

The partnerships

Since it opened in 2016, collaborators from the University of Saskatchewan and other Canadian universities such as McGill, York and Western have advanced their research at FAAR. The facility has also been used by the scientists at Environment and Climate Change Canada responsible for Canada's migratory birds.

Morrissey is also working with provincial governments to identify ways to reduce reliance on agrochemicals, thereby improving water quality and biodiversity. She is also collaborating on a research project led by the Mistawasis Nêhiyawak and Muskeg Lake Cree Nation in Saskatchewan and co-designed with farmers to reduce chemical use and improve biodiversity.

The impacts

By observing changes in wild birds and understanding the mechanisms that cause those changes, **research conducted at FAAR will inform efforts to remediate and improve environmental conditions.** The implications are far-reaching, including advances in pollution abatement, wildlife conservation, and human and animal health.



Growing awareness and knowledge

FAAR-based research on the effects of pesticides on migratory birds has shown that even minute quantities of the world's **most used** pesticides cause changes to the migratory behaviour and body mass of wild birds, with potentially detrimental consequences for avian populations as well as for human and environmental health. Research findings have captured the attention of the scientific community and the general public. For example:

- A paper Morrissey published in *Science* has been rated among the **top one percent of all peer-reviewed papers when it comes to research impact.** Other researchers, inspired by evidence accumulated using FAAR, are studying the concentrations of pesticides in wildlife.
- Broad media coverage of FAAR research has **raised public awareness about how food is grown and its impacts on biodiversity.** The CBC's *The Nature of Things* series, for example, featured Morrissey's research in an episode on songbirds.
- Morrissey's outreach initiatives aim to inform farmers about the **harms caused by some pesticides** in order to **encourage more sustainable farming practices.** For example, canola seed is often treated with neonicotinoids to prevent the young plants from being eaten by flea beetles. However, if these seeds are spilled during normal farming activities and are not buried or cleaned up, they pose a risk to birds that feed on them.



Influencing regulation

The results of FAAR-based research about the **safety of commonly used pesticides** are directly influencing policy and regulatory decisions. A notable example is the ban on the outdoor use of three neonicotinoids, including imidacloprid, in Europe. During a presentation made at the Society of Environmental Toxicology and Chemistry's annual conference, a regulator from the European Union described Morrissey's research as having changed everything about the way she thinks about the risks of these chemicals.

In Canada, regulators use FAAR-based research to make decisions on the safety of certain chemicals. Data on the effects of a pesticide compound (imidacloprid) on wildlife contributed to the Pest Management Regulatory Agency (PMRA) introducing a proposed ban of this chemical in 2016. (In 2021, concerns raised by the pesticide industry contributed to PMRA's reversal of the proposed ban — a decision that highlights the tension that sometimes exists between environmental concerns, science, farmers and industry interests.)

In June 2022, Morrissey was appointed to Health Canada's Science Advisory Committee on Pest Control Products, which is comprised of nine scientists with expertise in pesticide impacts on human and environmental health. She attributes her success to the research made possible through FAAR and the high-impact publications it has yielded.



Saving bats: a side benefit

In an unexpected way, FAAR has **contributed to saving bats.** When a town near Saskatoon began reroofing their curling and hockey arena, they discovered 400 bats hibernating in the old roof. These bats were removed and housed over the winter in FAAR's environmental chamber and safely released in the spring.