

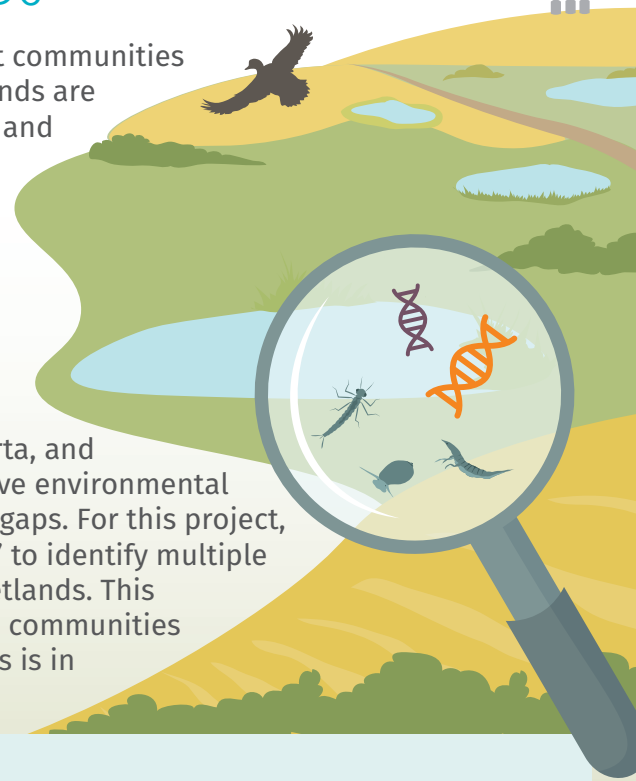
LEVERAGING GENOMICS TOOLS TO EXPLORE RELATIONSHIPS BETWEEN AGRICULTURE, BIODIVERSITY AND WATERFOWL PRODUCTIVITY IN PRAIRIE WETLANDS



Healthy, functioning wetlands play a key role in supporting resilient communities and ecosystems. Throughout Alberta's prairie pothole region, wetlands are increasingly affected by landscape changes, including urbanization and agriculture, and these impacts are amplified by climate change.

Aquatic macroinvertebrates are important biological indicators of wetland health and important food sources for waterfowl and other wetland-dependent species. However, due to the limitations of conventional monitoring techniques, the effects of agriculture and climate change on wetland aquatic macroinvertebrates are poorly understood at broad spatial scales.

The Alberta Biodiversity Monitoring Institute (ABMI), InnoTech Alberta, and Ducks Unlimited Canada (DUC) have teamed up to develop innovative environmental genomics (genetics-based) techniques to help fill these knowledge gaps. For this project, we are using a molecular analysis technique called 'metabarcoding' to identify multiple species (taxa) from samples of water and specimens from select wetlands. This provides a picture of the composition of aquatic macroinvertebrate communities at a wetland, and can potentially indicate how many of each species is in the wetland (relative abundance).



HOW ENVIRONMENTAL GENOMICS WORKS:

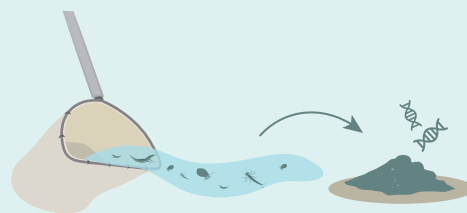
Environmental genomics includes a constellation of methods that use DNA from samples collected from the environment (water, soil, mixed tissue, etc.) to identify species present at a site. Two examples of these methods include water samples and specimen samples.

ENVIRONMENTAL DNA



Water, which is gathered in the field to collect environmental DNA (DNA that has been shed from an organism and dispersed in the environment).

MIXED SAMPLES



Mixed samples of macroinvertebrates collected in wetlands with nets, which are dried and ground up to produce a bulk sample which includes DNA from multiple species.

MOLECULAR ANALYSIS



DNA is extracted and analyzed using appropriate methods (e.g., metabarcoding).



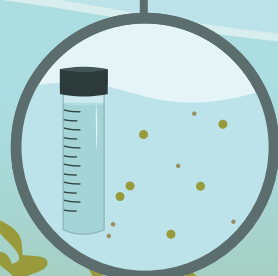
Through conventional techniques, organisms are identified by their physical features. In contrast, molecular analysis techniques used in environmental genomics have the potential to greatly increase the efficiency of this process, enabling a broad assessment of biological communities while reducing pressure on taxonomic experts. **If successful, this approach may provide a more cost-effective option for measuring response of wetland organisms to environmental change and stressors at broad spatial scales.**

PUTTING ENVIRONMENTAL GENOMICS TO THE TEST!

Waterfowl play a critical role in wetland ecosystems, but their productivity is declining across the prairie pothole region.



Aquatic invertebrates are a key food source for waterfowl and are strong indicators of wetland health and environmental change. The team is evaluating environmental genomics tools in comparison to conventional techniques to **determine the amount and diversity of aquatic invertebrates in wetlands.**



Wetland **water quality parameters are also being measured** across a range of agricultural activities from complete crop production to undisturbed grassland.

This work will improve our understanding of how land use pressures (e.g., wetland draining and chemical run-off from agriculture) and climate change are impacting aquatic macroinvertebrates and waterfowl populations, and thus wetland health.

While environmental genomics is not a “silver bullet” solution to wetland biodiversity monitoring, it can complement and elevate existing techniques.

The datasets generated from this work will help develop models for how living organisms respond to environmental changes within Alberta’s prairie pothole region and will provide a foundation for best management practices and future decision-making. Furthermore, these techniques can be applied to biodiversity monitoring projects beyond just wetlands and agricultural landscapes.



Canadian Conservation and Land Management

TO LEARN MORE ABOUT ENVIRONMENTAL GENOMICS ON THE CCLM, VISIT [CCLMPORTAL.CA](https://cclmportal.ca)

Reference: Alberta Biodiversity Monitoring Institute. 2024. Wetland Atlas of Alberta Section 3.3: Effects of Agriculture and Climate Change on Prairie Wetlands.

