Ensuring Canada's freshwater future

Freshwater ecosystems not only provide water for drinking, agriculture and energy production, but they are also integral elements of climate resilience. With approximately 20 percent of the world's total freshwater resources in Canada, research like that taking place at the Real-time Aquatic Ecosystem Observation Network (RAEON) is helping improve our understanding of these ecosystems so we can better manage and conserve them.

The research team

RAEON's Science Director is Aaron Fisk, who is a Tier 1 Canada Research Chair in Changing Great Lakes Ecosystems as well as a Professor in the School of the Environment at the University of Windsor. He oversees a research program that involves **11 principal investigators** from **five Canadian universities**, as well as some **15 partners**, including universities in Canada and the United States, provincial and federal agencies, and non-profit organizations.

The research

Freshwater ecosystems provide water for drinking, recreation and agricultural purposes, as well as energy production. They are an integral element of climate resilience and natural water purification. However, they face an increasing number of threats from flooding, pollution and harmful algal blooms, which release toxins that contaminate drinking water, causing illnesses in animals and humans.

Approximately 20 percent of the world's total freshwater resources are found in Canada. New strategies are required to study freshwater ecosystems given their importance to the country. By providing infrastructure and data management, RAEON allows researchers and students to better track and understand these ecosystems, which, in turn, allows them to be better managed and conserved.

Since April 2020, research conducted at RAEON using equipment funded by the Canada Foundation for Innovation (CFI) has generated over **150 different research outputs**, including more than **80 conference, symposium**, or **workshop presentations**, as well as **59 peer-reviewed publications**.

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 research infrastructure

As part of the 2017 Innovation Fund competition, the CFI awarded approximately **$6.5 million** to RAEON to support three types of research equipment, which will help Canada **more comprehensively monitor the Great Lakes**:

- Real-time, moveable sensor arrays connected to a cellular network and a cloud-based software program
- Unmanned sub-surface vehicles
- Individual autonomous mobile units that house sampling, testing and analytical instruments.

RAEON is part of the Great Lakes Institute for Environment Research, also funded by the CFI.

The partnerships

- The **Consortium of Great Lakes Gliders** includes RAEON, the University of Windsor, Trent University in Peterborough, Ont., the Michigan-based Cooperative Institute for Great Lakes Research, the U.S. Environmental Protection Agency, and the University of Minnesota Duluth. Among other things, the consortium allows members to share knowledge, plan missions, process and analyze data, and train highly qualified personnel.
- RAEON is also a member of the **Global Waters Futures Observatories** (GWFO), a collaborative freshwater observational research network of nine Canadian universities led by the University of Saskatchewan and supported through the CFI's Major Science Initiatives Fund.

INNOVATION
Canada Foundation for Innovation
Fondation canadienne pour l'innovation

The impacts

RAEON has made important contributions to our understanding of freshwater ecosystems. Its impact extends from residents of the Great Lakes region to Canadians across the country, and from provincial and federal Canadian agencies to American organizations.

Helping municipalities monitor their lakes

RAEON engages in public outreach with residents and municipalities to make them aware of the real-time data available on RAEON's website. This information allows municipalities to monitor **wave height** and **water quality**, which can inform decisions around beach safety and flood risks.

Providing the government with real-time data

RAEON has worked with the Department of Fisheries and Oceans in Lake Ontario to provide data on the lower food web, including phytoplankton, zooplankton and small invertebrates, such as freshwater shrimp and clams. These data are used by **commercial fisheries** and **local water utilities**. RAEON is also working with researchers at Environment and Climate Change Canada to share resources and data about **water quality** and **harmful algal blooms** in the Great Lakes.

Understanding fish movements

In 2021, RAEON conducted missions in four Great Lakes that quantified tagged fish locations in lakes Huron and Ontario and contributed to modelling of harmful algal blooms and surveying fish in Lake Erie. The Lake Erie data set was described by Fisk as "the **most comprehensive water chemistry algal chlorophyll data set in the history of the world** for a single lake ecosystem." This research also allowed researchers to better track and understand fish movements, and to locate biodiversity hot spots in the lake.

Monitoring local water supplies

RAEON collaborates with the Union Water Supply System (UWSS), which provides drinking water to some 66,000 residents in the municipalities of Essex, Kingsville, Lakeshore and Leamington in Southwestern Ontario and to many greenhouses in the region. Using its real-time sensors, RAEON is gathering data and **developing early warning models** that will alert the UWSS of the **development of harmful algal blooms**, allowing them to make rapid and informed decisions.

Making an international impact

In partnering with the U.S.-led Great Lakes Observing System and its public data-sharing platform, RAEON's research is helping inform decision-making at government agencies responsible for **fish stocking and the protection of endangered species**. For example, RAEON used data from its gliders to inform the Ohio Department of Natural Resources of the optimal time for them to begin their fish survey.

Responding to emerging environmental issues

RAEON's equipment and instrumentation can be used to respond to **emerging environmental challenges and crises**. For example, in 2019, during flooding in the community of LaSalle, Ont., RAEON was able to provide real-time data on currents, wave direction and wind speed. The data were used to determine if another flooding event was coming.