Water

Building safe, sustainable supplies

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Research
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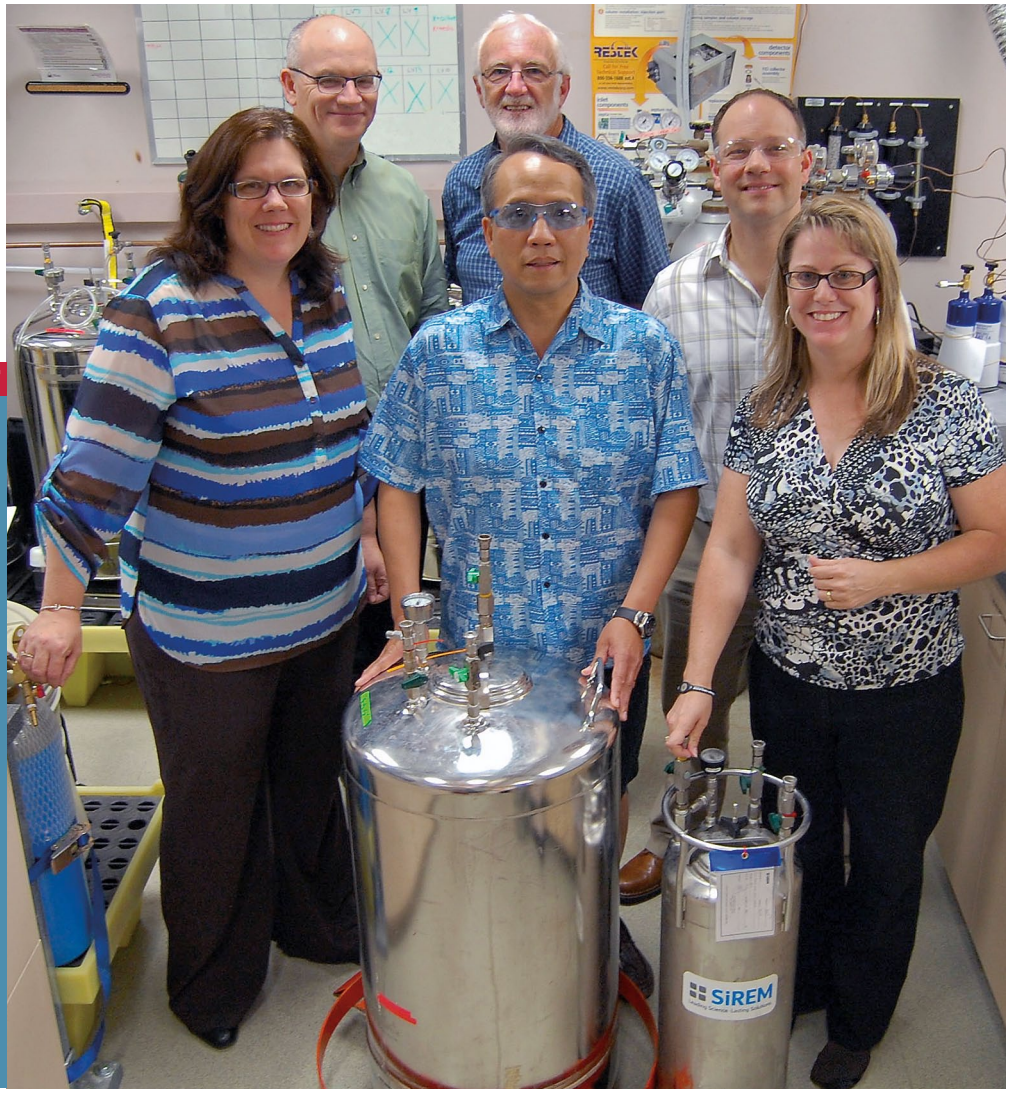


RESEARCH HIGHLIGHT

Tiny, pollutant-eating natural microorganisms found in water are being used by researchers at the University of Guelph in partnership with SiREM, a Guelph remediation services company, as a new way to decontaminate, protect and clean local water sources that people drink and use. Guelph Profs. Jack Trevors and Hung Lee (centre) are pictured with SiREM researchers Peter Dollar and Sandra Dworatzek (left) as well as Phil Dennis and Jennifer Webb (right), at SiREM's Guelph laboratory.

RBC, U of G researchers improving water for First Nations

Canada has the third largest renewable fresh water source in the world. However, more than 100 First Nations communities are under decades-old boil-water advisories — their water is contaminated and cannot be consumed from the tap without serious health consequences.

That's where the RBC Blue Water Project and the University of Guelph come in. RBC has committed $1-million to support Guelph researchers in assisting First Nations communities. The donation will help support teaching and field projects to improve and promote water protection and ecosystem conservation on reserves.

The goals of the program are to train community members to properly treat and monitor wastewater, remove toxins and pathogens from water, improve drinking water and develop emergency response and water protection plans.

Researchers will also raise awareness about the importance of keeping aquatic ecosystems healthy and help communities determine solutions to protect biological diversity.

Ultimately, the research that stems from the Blue Water Project donation will seek to develop a long-term partnership that combines scientific tools with aboriginal traditional knowledge.

anti-pollutant bacteria wetland treatment septic systems remediating groundwater safer fertilizing testing water quality responsible to aboriginal people finding where life starts clean water methods reusing water irrigation harvesting rainwater fighting water-borne disease educating students

RESEARCH HIGHLIGHT

Engineering Prof. Ramesh Rudra is dissecting current watershed models and tailoring them to Ontario conditions, to give water-resource managers better tools to keep water sources safe and clean. These improved watershed models will improve water quantity and quality predictions, by incorporating Ontario-specific conditions.

PHOTO: MARTIN SCHWALBE

- Guelph Environmental Engineering researchers have found that biofilms — that is, colonies of micro-organisms that adhere to surfaces such as river rocks — can be utilized to protect drinking water and prevent groundwater contamination. Now, they're creating models of biofilm bacteria that will help ecologists and environmental engineers understand how these biofilms work, and reveal how they can use these beneficial bacteria towards designing and implementing effective **barriers against groundwater pollutants**.

- Deep drainage occurs when water moves downward from the surface and past a crop's root zone to become groundwater. Irrigation is needed to balance this natural effect to decrease the negative impacts of deep drainage on the environment and crop yields. Land Resource Science researchers are using a simultaneous heat and water computer model to **estimate the amount of irrigation** needed to balance out deep drainage in different climates, to protect crops.

- Groundwater contained in freshwater aquifers is an important source of fresh water. But as populations grow and industrialization spreads, much of this groundwater is exposed to contamination. Guelph researchers are studying how groundwater movement within aquifers can transport harmful organic chemicals, as well as how they can **provide solutions for remediating groundwater** that's already been contaminated.

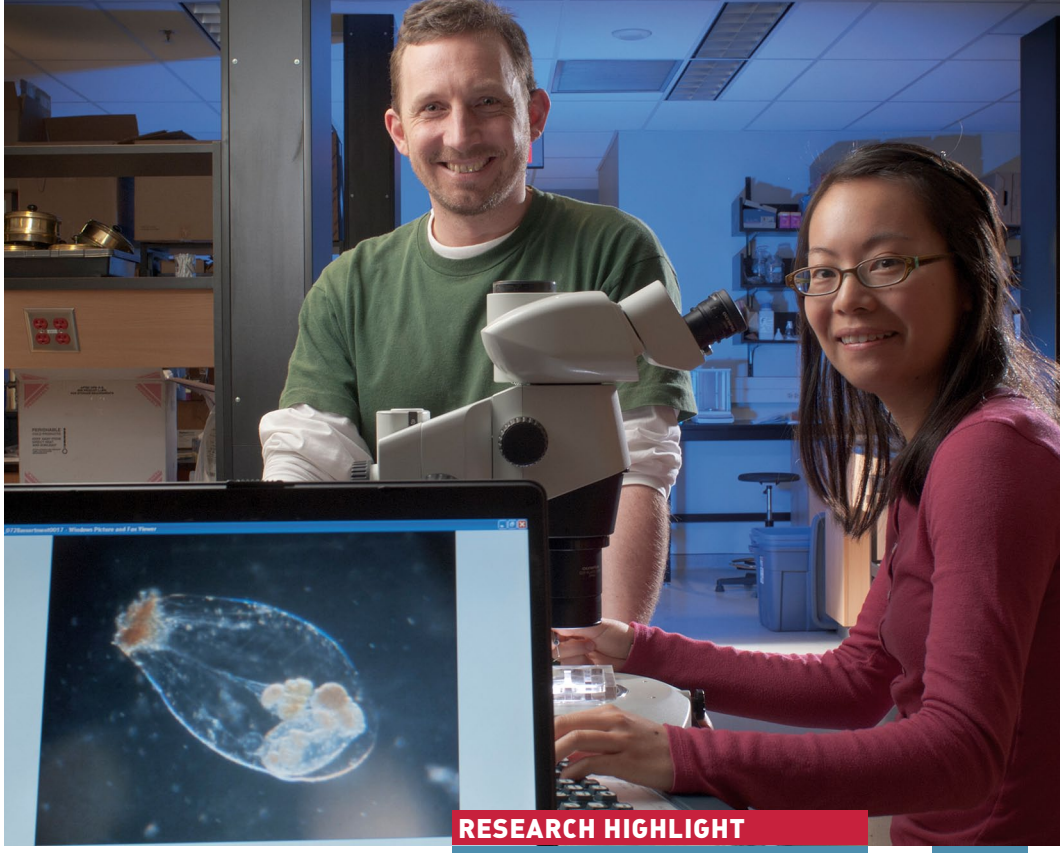
- Septic systems require a thick layer of soil to remove harmful bacteria and chemicals and to prevent groundwater contamination. Groundwater contaminated by septic systems can affect surface water and nearby wells. Guelph engineering researchers have found that proper soil depths can **reduce the number of bacteria present** to acceptable levels. They plan to examine the impact of adding a treatment unit between the septic tank and soil layer to improve filtration of bacteria.

- Arsenic, a poisonous compound, has been found in the drinking water of more than 50 million people worldwide. Land Resource Science researchers are studying how arsenic converts into the mobilized form that causes soil and water contamination. They hope to develop **wetland treatment cells** that will immobilize the arsenic for safe removal.

- Sheep manure, a common fertilizer, has been linked to multiple groundwater contamination outbreaks in Europe. Are there similar implications for Canada? Guelph researchers have found that conditions near the soil surface can encourage bacteria from sheep manure to multiply and can contaminate surface water during heavy rain falls. That's why they're working to create a **safer fertilizing method** by incorporating the manure deeper in the ground. This delivers the manure bacteria to soil microbes and reduces problems.

- Deteriorating water transport pipelines and dated water quality testing methods could lead to contamination in underground water supplies. Guelph researchers are identifying older underground **water supply systems** that are most at risk, and investigating updated, more effective water quality testing methods.

- The University of Guelph is part of a groundbreaking $60-million clean-water partnership, called the **Southern Ontario Water Consortium**. Researchers and their industry and government partners are working together to develop clean-water technologies and solutions for improving access to clean water and the safe treatment of wastewater. This investment also allows for the construction of a new wastewater research centre to be located at the University, which will enable the sophisticated testing of technologies designed to treat and recycle wastewater.



RESEARCH HIGHLIGHT

Understanding microscopic aquatic communities can help better predict the effects of logging and climate change. Integrative Biology Prof. Karl Cottonie and Ingrid Ng are using a biological process called metacommunity dynamics, which examines a species' ability to survive and thrive in its natural surroundings, to explore the effects that logging has on the neighbouring water bodies and ecosystems.

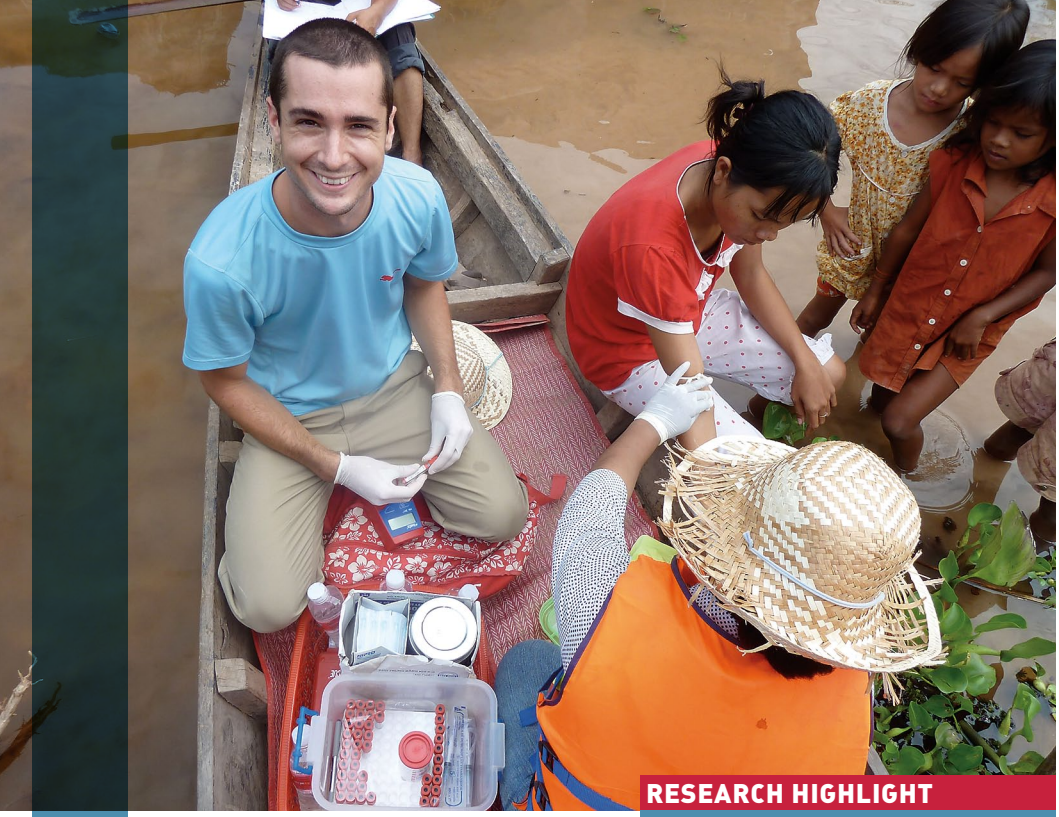
PHOTO: MARTIN SCHWALBE

- Freshwater mussels play a critical role in the natural biodiversity of Ontario's aquatic ecosystems. However, due to increasing pollution, many species have become endangered. Integrative Biology researchers are trying to gain a better understanding of what mussels eat, their life cycle and the other organisms they depend on. By understanding these complicated creatures, researchers hope to be able to **protect and increase threatened mussel populations** across the province.

- Poverty-stricken communities in under-developed countries face impaired water accessibility every day, due to limited financial and human resources, as well as water-borne diseases. School of Engineering researchers found multiple sources of contamination in wells, spring boxes and buckets used to transport water. In response, they are **traveling overseas to offer life-saving advice** and techniques for keeping water sources clean and hygienic.

- A disease called cryptosporidiosis—one of the most common and deadly water-borne diseases—causes gastrointestinal illnesses. Worse, it's difficult to detect. In response, Environmental Biology researchers have **engineered antibodies** that will help detect the microorganisms responsible for the disease before they become a problem.

- To improve wastewater treatment systems, Environmental Biology researchers are working to better understand how bacteria behave. From there, they can develop effective strategies and techniques that water engineers and operators can use to **remove pathogens** and disinfect polluted water sources.



RESEARCH HIGHLIGHT

Guelph epidemiologist Christopher Charles's doctoral work focused on creating an creating an inexpensive fish-shaped iron supplement to help poor Cambodian villagers combat life-threatening anemia. When boiled with drinking water, iron leaches from the fish, providing villagers with 75 per cent of their daily iron requirement. Charles is pictured here collecting blood samples to measure iron levels from Cambodian villagers.

PHOTO COURTESY OF CHRISTOPHER CHARLES

- Researchers from the Department of Chemistry are looking for the origins of life in a seemingly unlikely place—hydrothermal vents on the ocean floor. Here, they suspect that the high-pressure, 350 degree C jets of water and gas could provide the perfect conditions for the formation of DNA and RNA molecules. Moving forward, this research could **provide essential clues as to where life starts**…not only on Earth but on other planets as well.

- Negative environmental effects are a reality due to climate change, especially in the North. The Inuit are a target of exposure to bacteria in water and are faced with a choice of tradition versus health when drinking this raw surface water. That's why Population Medicine researchers are working to **educate high school students** in Inuit communities about the potential risks of drinking untreated water straight from rivers and lakes.

- Harvesting and reusing rainwater could be a viable solution to growing concerns about drinking-water shortages. A researcher in the School of Engineering has created an underground rainwater harvesting system that collects, recycles and reuses rainwater for other tasks, such as bathing and washing around the house. This system, says the researcher, can help **cut the average household's potable water consumption** by up to 70 per cent.

- Plant Agriculture researchers are testing the effects of reclaimed water on turfgrass growth and soil quality. This reclaimed water contains nutrients that help plants' fertility. Researchers are looking at how **recycled water** can be used as a more practical alternative to municipal water supplies for field irrigation.

- Artificial wetlands are an environmentally **friendly and inexpensive solution** for reducing wastewater contamination on farms and improving air quality. Guelph researchers are working to better design these wetlands to be inexpensively constructed near farms, to filter wastewater runoff at the source before it trickles into water systems.

- Environmental Design and Rural Development researchers have developed a program and practical guide that will help communities on Ontario's Grand River become more involved with **water preservation**, protection and management. The program examines environmental factors as well as biological factors that relate to watersheds, and encourages those living on a watershed to become involved with its protection.

- During a dairy cow's transitional period between lactations, it has a suppressed appetite but remains as thirsty as normal. With this in mind, Animal and Poultry Science researchers are working on using water as a transfer tool to give **nutrients to dairy cattle** to overcome nutrient deficiencies during physically demanding periods—saving farmers time and money.

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