

# Environment

## Collaboration for a better planet

Our future well-being depends greatly on the health of our planet. Guelph supports research dedicated to preserving, protecting and improving the environment, through a wide range of disciplines as diverse as the environment itself.

Collaboration is the key to improving global health. Guelph is immersed in groundbreaking international research efforts dedicated to pressing issues such as combating climate change, protecting precious natural resources and finding more sustainable, cost-effective manufacturing methods.

**The following pages feature stories highlighting the University of Guelph's ongoing world-leading research initiatives and commitment to the environment. Guelph researchers are putting the environment first and foremost, as they investigate and develop new and inventive means of tackling today's environmental concerns from many vantage points.**

### RESEARCH HIGHLIGHT

A unique membrane filter developed at the University of Guelph is being used to monitor the purity of the City of Guelph's water. Researcher Hongde Zhou (left) and graduate student Amanda Farquharson (front) are pictured with City of Guelph manager of wastewater services Cam Walsh and Guelph Mayor Karen Farbridge at the city's wastewater treatment facility.



# Research

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#### RESEARCH HIGHLIGHT

Climate change, growing populations and aging infrastructure are challenging the belief that there will always be lots of clean water, says Prof. Khosrow Farabakhsh, School of Engineering. New rainwater harvesting technology could allow more households to collect and reuse rainwater for certain tasks, thus conserving our drinking-water supply. Farabakhsh's research in this area is proving that rainwater harvesting could be one of Canada's answers to growing concerns about drinking-water shortages.

- Researchers in the School of Engineering are looking at whether adapting to climate change is possible for all Canadian communities, especially within First Nations communities where water treatment capabilities are limited. Many small communities in Canada have conventional, centralized water management systems that may not be able to adapt well to environmental changes. At Guelph, researchers are examining how to **develop adaptive capacity** to determine a water system's ability to change in response to environmental stresses without failing.

groundwater water quality digital story  
promoting environmental awareness gre  
development that preserves ecosystems  
apps for Ontario weather ensuring plant  
designing better wetlands for farms pro

- Insects are greatly affected by changes in climate and will migrate to survive. In response, Environmental Biology researchers are using computer modelling technology to explore how changing atmospheric conditions will affect the location of **invasive, endangered and native insect species**. This way, researchers will be able to determine which pests are most likely to pose future problems and begin taking measures, such as breeding plants for pest resistance, to avoid an ecological disaster.
- Groundwater represents more than 96 per cent of the planet's fresh water supply. Guelph researchers are studying how groundwater movement transports contaminants, as well as methods of treating groundwater already contaminated. They hope to provide solutions and plans for **better protecting groundwater** and reducing the likelihood of harmful contaminants impacting human and ecosystem health.
- Between agricultural waste runoff into water courses and growing urban populations, water quality deteriorates for everyone affected. That's why a team of Guelph researchers are **developing a guide** that they hope will help to break down walls between urban and rural users, offering ways to become engaged and responsible for improving water quality.



#### RESEARCH HIGHLIGHT

At Guelph's Bioproducts Discovery and Development Centre, a dedicated research team – led by Prof. Amar Mohanty, Department of Plant Agriculture – is creating environment-saving solutions through biodegradable, compostable plastics and biomaterials. Each of the bioproducts they develop is made or derived from natural, renewable sources, which keeps manufacturing costs competitive while greatly reducing greenhouse gas emissions and landfill site use.

# ytelling energy from manure packaging from soy eening horse farms benefiting farmers and environment climate change and insect migration resilient soils s receive water safer septic systems immobilizing arsenic tecting the watershed bio-energy adaptive water systems

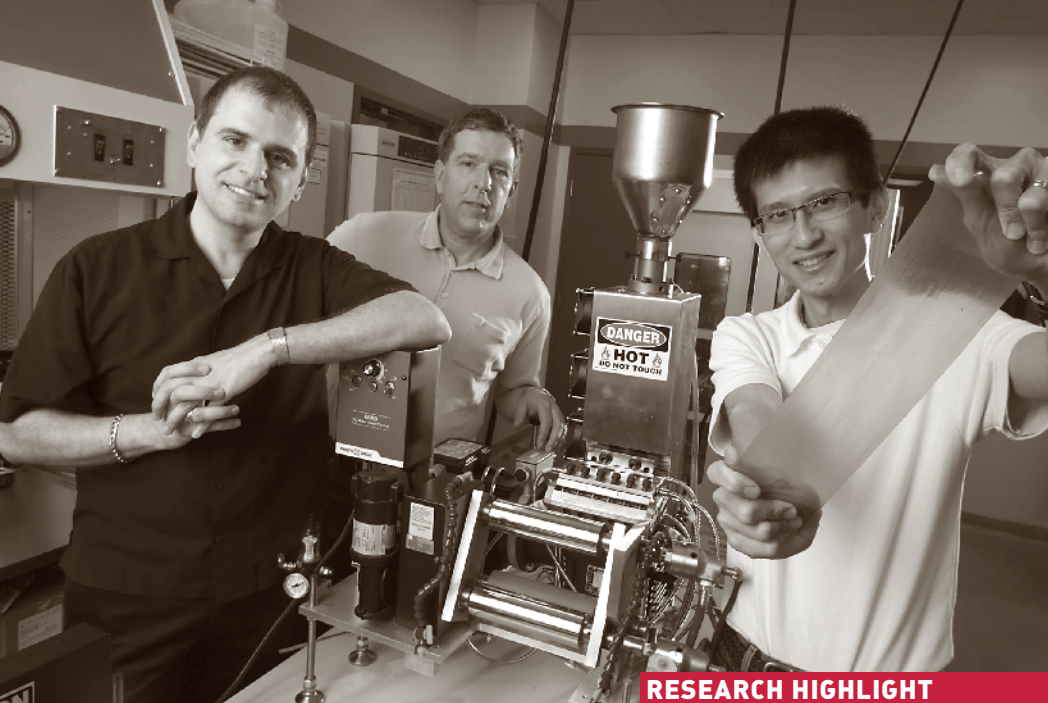
- For generations, Inuit culture, traditions and history have been handed down through a rich storytelling tradition. A group of Guelph researchers have partnered with colleagues in Inuit communities to combine **Aboriginal storytelling tradition with the latest digital media**. The goal is to gather, share and illustrate first-hand accounts of how climate change has affected the lives and health of Inuit people in Canada.
- Creating a sustainable energy source from animal waste makes economic sense and greatly reduces the environmental impact of farming, say researchers from Guelph's Campus d'Alfred. They are looking into how anaerobic digesters can be used to **convert manure into usable energy** and how these systems can be practically implemented by farmers on their own lands.
- Watersheds along the Grand River are home to nearly one million people. How each individual along the river uses the water affects not only the quality of this resource, but their neighbours' quality of life too. Environmental Design and Rural Development researchers have designed a program called the Exceptional Waters Approach, which is meant to help communities along the Grand **take the initiative in preservation**, promoting integrated watershed-based stewardship.
- Geographic Information Systems (GIS) technology—a computer modelling program—is being used by geography researchers to **bring economics and the environment together**. The researchers are using GIS technology to assess the economic impact and cost effectiveness of adopting environmentally friendly farm management practices. This information benefits farmers and the environment, helps inform new conservation programs and keeps costs to a minimum.
- A \$5-million network led by Environmental Sciences researchers at Guelph is aiming to **produce bio-energy and chemical products** from renewable plant biomass—an abundant, available and carbon-neutral energy source. Together, the researchers are working to overcome the technological barriers that currently limit the efficient conversion of Canada's vast quantities of forest waste residues into useable fuels and chemicals.
- Over half of Canada's urbanized areas are located on dependable agricultural lands. So, if communities are going to sprawl and develop, they must do it in a way that preserves these agricultural lands. Researchers from Guelph's School of Environmental Design and Rural Development have put together a guide entitled, *Green Infrastructure for Sustainable Rural Communities*. It gives small rural communities realistic and cost-effective strategies that allow for development while **protecting and preserving fragile ecosystems**, forests and waterways.

## RESEARCH HIGHLIGHT

Crops grown for biofuel production have an impact on the environment throughout the production cycle – from field to final product. To better understand this relationship between agricultural production and the environment, Profs. Claudia Wagner-Riddle (left) and Goretty Dias are developing computer software that will provide an on-farm analysis of biofuel crop production and greenhouse gas emissions.







## RESEARCH HIGHLIGHT

**A team of food scientists led by Prof. Loong-Tak Lim (right), along with Profs. Massimo Marcone (left) and Shai Barbut, is developing edible and biodegradable films from soy that can be used to create reusable food packaging and casings for the meat processing industry. Their work will reduce costs to meat processors and lessen the environmental impact of producing petroleum-based plastic packaging.**

- Constructed or artificial wetlands can play a significant role in purifying water on farms. Acting like giant filters, they treat surface water that passes through them before being released back into streams and rivers. Guelph researchers, in collaboration with other university and industry partners, plan to better design these wetlands to **reduce farms' environmental impact** by treating water at its source.
- In period of unpredictable climate change, **soils need to be especially resilient**, able to store water and nutrients for plant growth, and to resist being blown away when droughts occur. A soil science researcher has found that annually adding crop residues (such as wheat husks and corn stover) to agricultural fields protects soil from erosion and ensures that the soil is fertile and able to regenerate with each growing season.

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- The *Stewardship of the Equine Environment* is a course developed by Equine Guelph that promotes awareness of how **horse farm owners can reduce their environmental impact**. The course offers a host of strategies for making environmentally friendly improvements to horse farms as well as methods for protecting water from contamination, managing waste and preserving nearby natural habitats.
- Deep drainage, or groundwater recharge, occurs when water moves downwards from the surface and past a crop's root zone to become groundwater. This happens naturally when it rains. But it's vital that any excess water lost through deep drainage be balanced with proper field irrigation so that plants have the water they need to grow. Land Resource Science researchers are using the simultaneous heat and water (SHAW) computer model to estimate the amount of irrigation needed to **balance out deep drainage** in different climactic regions.
- U of G researchers are trying to understand arsenic's properties at the molecular level, hoping to find a way to immobilize it in both water and soil. By studying arsenic's oxidation and reduction reactions, the team hopes to develop a series of **wetland treatment cells** that depend on micro-organisms, wetland plants and mineral precipitation to immobilize arsenic for safe removal.
- Computer programs used by Ontario water planners need to be adjusted to Ontario weather conditions to **better predict water quantity and quality**, say engineering researchers. The enhanced programs they are currently developing could give water-resource managers better tools to keep water sources safe and clean.