

# Environmental Science and Ecology

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## Research Theme

Environmental science and ecology involve studies of the biosphere, hydrosphere, and lithosphere that test hypotheses relevant to the sustainable support of life on Earth. In Science at Western, research in environmental science is conducted on spatial scales varying from a single algal cell to the Earth as a whole. Our research spans temporal scales from hours to millennia. Most questions asked by Western's environmental scientists require investigation by an interdisciplinary team, including members from several departments in Science as well as the Engineering, Social Science, and particularly Medicine & Dentistry through the joint Ivey Chair in Ecosystem Health. Our overarching goal is to apply strong environmental science to the formulation of public policy in Canada and internationally.



Our existing infrastructure facilitates unique investigation of environmental science from atomic to global levels. Recently funded by CFI-ORF at \$28 M (scheduled completion 2007), the Biotron is a controlled environment research facility enabling large scale, long term interdisciplinary ecosystem experiments which includes an analytical laboratory for soils and waters. At Western, several facilities support environmental research including Surface Science Western (instrumentation for the study of environmental surface chemistry), SHARCNET



(a multi-institutional network for high performance computing), the Nanofabrication Laboratory, the Laboratory for Stable Isotope Science, the Environmental Fluid Flows Facility, the XPS Surface Analytical Laboratory, the POLARIS facility (Portable Observatories for Lithospheric Analysis and Research Investigating Seismicity) and MoBEES (Molecular Biology Ecology and Evolution facility).

Western's strong connections to the Canadian Light Source in Saskatoon provide expanded potential in the study of natural materials at the submicron scale. Field-based research is an essential part of our activities, whether conducted locally (at the Environmental Sciences Western field station) or anywhere from the high arctic to Antarctica.

To meet the needs of current faculty members, we will seek support to expand research infrastructure in several ways. For example, our immediate goals are to acquire (i) on campus and mobile field laboratories for collecting and analyzing data about organisms and their environments; (ii) geodetic, remote sensing and geographic information systems; (iii) facilities for holding and experimentation with aquatic and terrestrial organisms; and (iv) continuing support for the Biotron and other existing infrastructure. In addition to the support provided by the University, new faculty members will be encouraged and assisted in seeking external funding through CFI and related sources. We anticipate strategic hiring in the areas of conservation genetics and vertebrate paleontology and biology.

Environmental Research Western capitalizes on the combined strengths of Science and Engineering to catalyze increased research collaboration with other Faculties, agencies, and companies. Our commitment to environmental science is further reflected in research chairs, including existing NSERC Industrial Chairs in nuclear-waste technology (D.W. Shoesmith) and reactor safety (J.C. Wren), the Ivey Chair in Ecosystem Health (C.G. Trick), a Tier 2 CRC in Geomicrobiology (G. Southam), and a planned Tier 2 CRC in environmental science and ecology. Future plans include a potential Tier 1 CRC in Environmental Geophysics, NSERC Industrial Chairs in Environmental Science and inclusion of the Fyfe Chair in Natural Resources and Sustainable Development as a top priority in fundraising. Future hires will help to bridge the gap between environmental science and environmental policy.

Environmental and ecological research often involves an individual faculty member working with graduate and undergraduate students and focusing on organisms from mammals and birds to insects and microbes, at levels from the individual to the ecosystem. In other cases, teams of faculty members work with their students and associates. One large interdisciplinary group studies ecosystem-scale processes in watersheds and includes participants from Biology, Chemistry, Earth Sciences and Geography.



Research in environmetrics on topics such as water quality, reservoir systems, air quality, and ground-level ozone, typically involves scientists from different disciplines. Modelling often is used to study contaminant dispersion and diffusion during fluid flow or atmospheric fluid dynamics and their relationship to radiative transfer and global warming. The biogeochemistry of mine tailings during their degradation and geomicrobiology are other foci. Stable Isotope Science Western is a group that focuses on interactions among the lithosphere, hydrosphere, biosphere and atmosphere, and paleoclimate reconstruction. Environmental research also includes the study of nuclear waste containment and disposal, nuclear reactor safety, new green solvent alternatives in chemical reactions, photochemical destruction of pollutants, and metal distribution, function, and sequestration in biological systems. Advanced analytical techniques for environmental surface chemistry are also under investigation, including synchrotron-radiation studies performed at the Canadian Light Source as well as work at Surface Science Western.

Environmental research also has a component that concentrates on atmospheric motions from the surface to the outer reaches of space. These studies have impact in areas of pollution transport, catastrophic weather events, aircraft safety, climate change, and satellite damage. The focus is on fundamental research while targeting pragmatic applications such as: (i) mapping of lower and upper tropospheric wind flow and tornado generation across Ontario; (ii) temperature structure of the atmosphere, including long-term monitoring of temperature change in the middle atmosphere, and (iii) atmospheric constituents, including water vapour and ozone.