The Problem

Canada’s northern forests and ecosystems are sensitive environmental areas, rich in natural resources. How can Canadian science and technology meet the challenge to protect northern regions from soil contamination while promoting the sustainable development of northern resources?

Industrial activities such as oil and gas exploration and production, mineral extraction and processing, forest products, and hydroelectric generation sometimes lead to contamination of surface and subsurface soils. Soil contamination degrades the land and places significant stress on ecologically sensitive biota and flora.

Standardized biological test methods are currently used nationwide to assess contaminated soils, prioritize sites for clean-up, develop contaminant standards, and monitor the effectiveness of remedial activities. Efforts like these to protect northern regions from soil contamination are not as effective as they could be because Canada’s current suite of soil toxicity tests do not use species representative of the upland and wetland boreal forest ecosystems of northern Canada—species sensitive to contamination from petroleum hydrocarbon releases, salt brine spills from pipeline breaks, and drilling operations or metals deposition from smelter emissions.

Protecting Canada’s Boreal Forests and Northern Ecosystems

Developing Biological Methods to Assess and Preserve Canada’s Soil Environments of the North
Environment Canada’s Biological Methods Section is a primary source of scientific and technical support and analysis to Canadian governments and industrial sectors on the development, validation and standardization of methods to assess and test the impact of contaminants on natural soil systems. By developing tests to examine soil microbial communities and terrestrial plant and soil invertebrate species, scientists can assess the risks associated with individual toxic substances and/or contaminant mixtures that may be present in soils.

Environment Canada’s S&T Integration Division provides expert advice and guidance on the environment to Natural Resources Canada’s Program of Energy Research and Development (PERD). Environment Canada’s Biological Methods Section is currently working with PERD’s Soil and Groundwater Remediation sub-program, and other public and private industry environmental research institutions, to develop and standardize a new suite of soil toxicity test methods. Unlike earlier methods, these tests use species ecologically relevant to Canada’s northern ecozones, including the boreal forest and the subarctic northern region, known as the taiga ecozone (Figure 1). Wetland and peatland regions within those areas are also of particular interest in this method development effort.

Development of new test methods specific to Canada’s northern regions, combined with the existing standardized soil test methods, will provide Canadian scientists with a suite of biological assessment tools that can assess the toxicity of surface and subsurface soils over 65 percent of Canada’s land mass.

### Transforming Knowledge into Action

**Who can use these results?**

Over 90 percent of Canada’s boreal forest and associated northern ecozones is publicly owned, making governments the primary land use decision makers. Governments need standardized methods to help develop effective risk assessment and risk management decisions and policies, as well as to carry out enforcement activities in potential legal cases against polluters. To be effective, government policies, regulations and practices must integrate the scientific knowledge required to preserve the environmental integrity of these lands into strategies and programs for sustainable development of Canada’s rich resources in the region.

Industry sectors need testing methodologies to provide a consistent means of measuring the effectiveness of remediation efforts at contaminated sites and to monitor progress in complying with environmental policies and regulations.

The particularly sensitive environment in Canada’s boreal forest and northern regions requires government and industry to have consistent methods for evaluating risks that could lead to critical loss of ecological value. The biological soil toxicity test methods being developed by Environment Canada scientists will deliver this consistency, helping to reduce risk by providing policy makers with effective tools to help shape their decisions.
Benefits to Canadians

Canada’s boreal region accounts for approximately 15 percent of Canada’s resource-related employment, predominantly in mining, forestry, fisheries and agriculture, and contributes over $28 billion to the economy. The boreal regions account for over 50 percent of Canada’s land mass, and is home to two-thirds of the 140,000 species of plants, animals and microorganisms found in Canada. The boreal forest worldwide, of which one-third resides in Canada, is one of the few remaining relatively intact ecosystems on our planet. Canadians will obviously benefit from environmental tools and technologies that can protect the boreal region while promoting sustainable economic development.

Soils contribute significantly to the overall biodiversity within Canada, our national productivity and the quality of life. Soil, which consists of inorganic material, decaying organic matter, air, water, and many microbial and larger organisms, contains most of the nutrients and biological mass that our forests, wetlands and other lands depend upon. It is important to maintain the ecological integrity of soil systems and to restore historically contaminated or otherwise degraded soils, to ensure a sustainable and healthy environment for future generations.

Until 2004, there were no Canadian-derived biological testing methods available to assess and evaluate soil ecosystems in Canada.

Environment Canada’s biological test methods complement federal, provincial and territorial regulations and guidelines, including the Canada-Wide Standards for Petroleum Hydrocarbons in Soil supported by the Canadian Council of Ministers of the Environment, and soil quality guidelines for the protection of environmental and human health.

The Program of Energy Research and Development is a federal, interdepartmental program operated by Natural Resources Canada that funds energy-related research and development in Canada. www.nrcan-rncan.gc.ca/eneene/science/perdprde-eng.php

Photo credit: EcoDynamics Consulting Ltd.
With the right biological and chemical measurement tools to evaluate contaminated sites, risk management decisions will be based on the best scientific data, leading to better use and protection of our soil ecosystems and safeguarding of the natural resources of Canada’s most vulnerable region, the North.

For more information:
Environment Canada’s biological test methods for earthworms, terrestrial plants and springtails (EPS 1/RM/43, EPS 1/RM45 and EPS 1/RM/47)
www.etc-cte.ec.gc.ca/organization/bmd/bmd_publist_e.html
Canadian Council of Ministers of the Environment (CCME) Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health
documents.ccme.ca