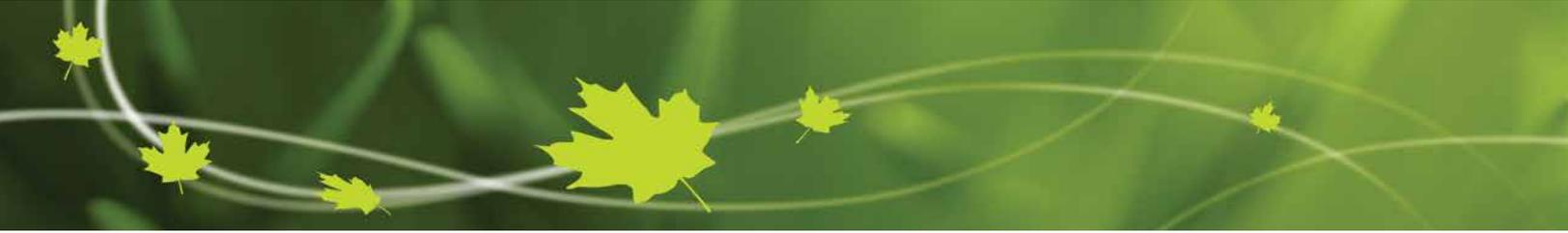




Environment
Canada

Environnement
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ENVIRONMENT CANADA'S **SCIENCE STRATEGY** 2014–2019



Canada 

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MESSAGE FROM THE DEPUTY MINISTERS

Since the origin of Environment Canada in 1971, science has been an integral part of the Department. Today, as environmental issues continue to emerge, evolve and increase in complexity, science is more important than ever to Environment Canada's ability to lead efforts to provide a clean, safe, and sustainable environment for Canadians. Sound scientific monitoring and research are the foundation of our policies, programs and services. Consequently, in 2012-13, Environment Canada science and technology activities represented an investment of more than \$584 million and involved over 3,700 of our employees; that is most of the Department's budget and over half of our workforce. Our science activities include targeted work in key environmental sciences and related fields, such as atmospheric sciences, meteorology, physics, biology, chemistry, toxicology, hydrology, ecology, engineering, and informatics.

The importance of science to achieving our mandate, the broad scope of our science activities and the level of resources dedicated to these activities mean that Environment Canada must devote continual attention to ensuring that our science is relevant, effective and efficient. Our science is at the core of our mandate to enable a clean, safe, and sustainable environment for Canadians. Environment Canada's policies, regulations, programs and services are based on the best available scientific evidence. Transparency is important to the credibility of our science. Environment Canada scientists are actively encouraged to publish their research and we share our science with the public through many channels.

This Strategy, titled *Environment Canada's Science Strategy 2014-2019*, has been developed in recognition of the need for continual improvement. The Strategy builds on the long-term direction set out in the Department's 2007 *Science Plan* and the 2010 *Technology Role* by providing a renewed picture of the science Environment Canada performs, its scientific vision, mission and principles, and where that science is headed. This *Science Strategy* explains the purpose of the science performed by the Department and sets the direction for our science over the next five years. The purpose of the Strategy is to better align our science with federal priorities by identifying the key scientific areas of focus needed to support the Department's mandate. The new mission emphasizes the importance of establishing linkages between the producers of science and its various users. The goal is to strengthen the link between these two broad groups to better support our Departmental mandate with world-class science.

Environment Canada employees from across the country, other federal Departments and Agencies and external science partners were engaged in developing the Strategy. We are very proud of the consultation and engagement process that was used to develop the Strategy, as well as the level of engagement from our staff. Collaboration is a cornerstone of Environment Canada's science, and is integral to the Department's authoritative stature in Canada and on the international stage. We pride ourselves on producing excellent and relevant science to address Canada's most pressing federal priorities.

We invite you to read this *Science Strategy* to learn more about Environment Canada's scientific role and how science is helping us tackle current environmental issues and prepare for the future.

Bob Hamilton
Deputy Minister
Environment Canada

Andrea Lyon
Associate Deputy Minister
Environment Canada

INTRODUCTION

Environment Canada is a science-based department. Its science provides the critical information needed to support the Department's mandate to maintain a clean, safe and sustainable environment for Canada. This means maintaining unique scientific expertise and infrastructure, such as coast-to-coast-to-coast monitoring networks that measure environmental parameters, and large numerical models running on supercomputers that forecast weather, air pollution and climatic changes. Environment Canada performs science to fulfill a key federal role of protecting the environment by supporting environmental regulations, public policies, operations and services. The Department's science must work to support the needs of present regulatory mandates and timelines as well as identify and develop capacity to address emerging environmental challenges. Protecting the environment also means responding to issues and challenges as they arise. Canada faces a variety of environmental challenges, from safely navigating the country's vast landscape under sometimes harsh climatic conditions to protecting ecosystems vulnerable to various stressors and pressures such as toxic substances, climatic changes and industrial development. With one of the largest science programs in the federal government, Environment Canada is a national—and indeed, world—leader in advancing, connecting and applying scientific understanding of the environment to anticipate and address the most pressing environmental issues. The future of Environment Canada's science will contribute to maintaining the Public Service as a world-class institution—the goal of Destination 2020, championed by the Clerk of the Privy Council.

Prior to this Strategy, Environment Canada's science activities were guided by two documents, a *Science Plan*, published in 2007, and a *Technology Role*, published in 2010. These documents outlined broad strategic directions to guide the Department's science and technology activities and priorities. They introduced scientific themes—such as building an integrated environmental monitoring and prediction capability.¹ Environment Canada, in collaboration with the Government of Alberta, has since launched the largest integrated environmental monitoring program in Canada to detect possible cumulative environmental impacts of oil sands development in Alberta. Lessons learned through this and other initiatives will be applied to continue addressing complex environmental issues of national importance.

The *Science Plan* and *Technology Role* continue to be relevant, but Environment Canada's science has different needs today than it had when those previous plans were developed. Since the *Science Plan* was launched in 2007, Environment Canada has reorganized and streamlined some of its activities, including its scientific activities. Today, more than ever, Environment Canada's science is focused on providing the critical information needed to develop the policies, deliver the programs and provide the services that allow the Department to meet its mandate.

¹ The three Strategic Directions from the 2007 *Science Plan* are:

1. Developing an Integrated Environmental Monitoring and Prediction Capability
2. Understanding Cumulative Risks
3. Managing Risks, Optimizing Opportunities and Building Resilience

A streamlined and strategic approach to conducting science helps Environment Canada respond to new and emerging issues, as well as to organizational changes such as the evolving role of federal science and the necessity to operate efficiently and demonstrate value for taxpayer money. Moving forward, Environment Canada must continue to direct its science to serve the Government of Canada's greatest environmental priorities. This involves deploying scientific resources effectively and efficiently, maintaining partnerships, ensuring the right connections are made between producers and users of scientific information, and maintaining the high standards of quality and credibility that Canadians expect from the Department's science. Quality management happens through established metrics and processes such as peer review and accreditation, as well as targeted assessments of the utility and impact of the application of the Department's science. All staff contribute to the goal of focusing on federal priorities by continually adjusting and adapting their science activities to contribute to the Department's current and future priorities.

The *Science Strategy* is organized into three main parts in order to guide Environment Canada's science to serve Canada's federal environmental priorities over the next five years, from 2014 to 2019. The first part, **the Science of Environment Canada**, briefly describes the Department as a science-based organization and the core science it undertakes to fulfill its mandate. The second part introduces a **vision, mission and principles** to guide the Department's science to focus on federal priorities. The third part lays out **future directions** for science by specifying priority issues for the next five years and introducing mechanisms to integrate the Strategy's vision and principles into the Department's operations and strengthen the Department's ability to respond to emerging issues.

1. THE SCIENCE OF ENVIRONMENT CANADA

SCIENTIFIC CAPACITY

People are the heart of Environment Canada's science. Scientific and technical professionals represent over half of the Department's workforce. They include research scientists, physical scientists, engineers, biologists, chemists, meteorologists, technologists and science managers, among others. Environment Canada maintains an in-house scientific workforce because science is so central to delivering the Departmental mandate. Environment Canada's highly skilled scientific and technical workforce possesses the expertise necessary to continually produce cutting-edge science.

The Department's internal science capacity is significantly increased through extensive collaboration across Canada and internationally. Environment Canada's scientists are part of an international community of environmental scientists, collaborating with leading global institutions such as the World Meteorological Organization and the U.S. Environmental Protection Agency to address common environmental issues. Many Department scientists work closely with other federal departments and levels of government, as well as maintain formal collaborative relationships with universities, including adjunct professorships. Over three quarters of the Department's peer reviewed scientific publications are written in collaboration with partners in universities and other organizations outside of government. Collaborating on research projects with other top institutions helps Environment Canada stay at the leading edge of scientific inquiry to inform its policies, programs and services. This effort to support the excellence and collaborative nature of science in support of federal priorities contributes to the goal of Destination 2020 to ensure the Public Service remains a world-class institution.

Scientists at Environment Canada also work closely with Aboriginal governments, organizations and communities, considering perspectives reflecting Aboriginal Traditional Knowledge along with scientific research. For example, Aboriginal Traditional Knowledge offers long-term and historical perspectives on local ecologies and improves understanding of multi-species interactions in those ecologies, especially at times of the year and during cycles of the species when departmental scientists are not normally present. For example, Aboriginal Traditional Knowledge can offer observations on wildlife characteristics such as behaviour, habitat use and distribution, plus the changes in these parameters over time, as well as identify areas for further scientific work.

Environment Canada's scientific and technical infrastructure is a critical national resource. The Department's scientific workforce performs, accesses and uses science across Canada at world-class research and development facilities, monitoring sites, storm prediction centres, in the field and in offices. The Department relies on environmental monitoring infrastructure to deliver weather forecasts, monitor air and water quality, and conduct scientific research. These and other functions support a variety of important decisions—to help protect lives, to support economic sectors sensitive to changes in weather and climate, to protect Canada's environmental heritage and to mitigate losses of species and habitats.

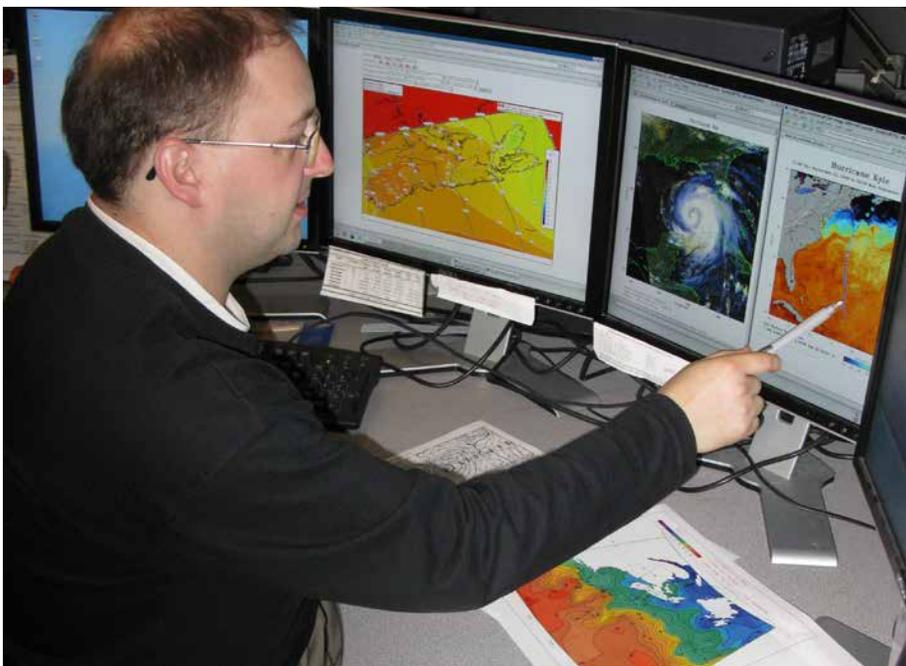
REPUTATION

Environment Canada is consistently regarded as a world leader in environmental science, publishing over 700 peer-reviewed scientific articles per year in recent years, including in top-tier scientific journals. The Department's research publications are cited at a rate that is well above the world average. Canadians consistently turn to Environment Canada for the accuracy and reliability of its weather forecasts. The Department's monitoring data are used extensively by other jurisdictions in Canada, private sector organizations and the wider academic science community.

WORK

As a federal science-based department, Environment Canada is unique among Canadian institutions that perform environmental science in that it has the mandate to perform science targeted to serve federal environmental priorities. The Department's science spans a range of activities, such as short- and long-term monitoring and surveillance, research and development, modelling, risk assessment, reporting and client-driven applications. Annual planning continuously aligns these activities with the Department's mandate and current environmental priorities, as well as assesses operational efficiency and value for money.

Science underpins most of the Department's functions, including its commitment to be a world class regulator, its enforcement activities, its weather services and its policy development functions. Much of Environment Canada's science addresses legislative obligations, such as requirements under the *Canadian Environmental Protection Act, 1999* (sections 44-53) that the Minister conduct research and studies related to the effects of pollution on environmental quality and pollution prevention, as well as maintain a system for monitoring environmental quality. Science also supports the Department's regulatory authorities, such as those under the *Fisheries Act* to prevent harmful materials from being released into waterways. All science undertaken by Environment Canada is directed to contribute to achieving the Department's three Strategic Outcomes—to maintain a clean, safe and sustainable environment—as described in the Department's annual performance documents, the *Report on Plans and Priorities* and the *Departmental Performance Report*. The following sections briefly describe and provide examples of the core science Environment Canada undertakes within each outcome to deliver results.



CLEAN – MINIMIZING THREATS TO CANADIANS AND THEIR ENVIRONMENT FROM POLLUTION

Environment Canada's science supports substance and waste management, actions on climate change and clean air, and regulatory enforcement. Core science activities in this area include identifying and assessing the risks of existing and emerging chemicals of concern, monitoring and reporting ambient air quality and water pollution, producing Canada's National Inventory of Greenhouse Gas Emissions and the National Pollutant Release Inventory, research and development on atmospheric chemistry and processes, and estimating emissions from transportation and industrial sectors.

SAFE – EQUIPPING CANADIANS TO MAKE INFORMED DECISIONS ON CHANGING WEATHER, WATER AND CLIMATE CONDITIONS

Environment Canada's science helps provide Canadians and Canadian economic sectors such as agriculture and transportation with relevant information on immediate and long-term environmental conditions. Core science activities include tools and techniques to improve weather, air and water forecasting and prediction, global and regional climate modelling, and research and development on atmospheric and environmental processes.

SUSTAINABLE – CONSERVING AND RESTORING CANADA'S NATURAL ENVIRONMENT FOR PRESENT AND FUTURE GENERATIONS

Environment Canada's science informs decisions that help maintain and restore Canada's land, water, and biodiversity resources. Core science activities include studying the quality and availability of Canada's vast water resources, including major waterways such as the Great Lakes, Lake Winnipeg and the St. Lawrence River, and researching and modelling species at risk and other wildlife to understand ecosystem health.



Clean

Polybrominated Diphenyl Ethers (PBDEs)

Environment Canada's science helps protect Canadians from harmful chemicals, a mandate the Department has under the *Canadian Environmental Protection Act, 1999* (CEPA 1999). In 2008, following a rigorous scientific assessment based on existing literature by Environment Canada and Health Canada, the government published the *Polybrominated Diphenyl Ethers Regulations* to limit the use of some of these chemical compounds in the Canadian market. The scientific assessment found that PBDEs, which are used as flame retardants in a wide variety of products, are toxic to the environment. Some forms of PBDEs accumulate over time in organisms and the environment, possibly leading to chronic effects even with low exposures. The goal for these substances is, in regulatory language, "virtual elimination" from the Canadian environment. Science and risk management continue to target additional PBDE compounds to regulate those which, based on sound science, are found to be harmful.



Safe

Severe Weather Forecasts

Canadians are no strangers to severe weather. Winter storms—blizzards, heavy snowfalls and freezing rain—wreak havoc on transportation across the country. As scientists observe climatic changes, one expected outcome is more frequent and more severe weather events. Atmospheric science is central to providing accurate and timely severe weather forecasts and warnings for Canadians. Environment Canada's scientists and meteorologists develop complex weather models that are run on one of Canada's fastest supercomputers. The *Department of the Environment Act* and the *Emergency Management Act* give Environment Canada the mandate to build scientific tools, products and science-based services to help Canadians and weather-sensitive sectors prepare for and respond to emergencies and manage weather-related risks.



Sustainable

Boreal Caribou

In 2012, the Government of Canada issued a recovery strategy for the Woodland Caribou, Boreal population (boreal caribou). The recovery strategy is based on science and Aboriginal Traditional Knowledge and offers a strong, practical approach to conserving caribou populations. Success in implementing the strategy and recovering boreal caribou depends on the commitment, collaboration and cooperation of many different constituencies—provincial governments, Aboriginal communities, industry stakeholders, academics, environmental non-governmental organizations, and the wider Canadian public—all of whom are engaged in work to protect this important species.

TECHNOLOGY

Science and technology are intimately connected. Modern environmental science relies on technological tools to study, monitor and understand the natural environment, and technology innovation can reduce impacts on the environment.

Scientists at Environment Canada develop and use a range of tools and measurement devices (i.e. technologies) to support their scientific activities, monitor the environment (air, water, soil, biodiversity) and produce forecasts and predictions. For example, environmental monitoring exploits a variety of technologies, from tools to measure environmental parameters and collect field samples to the computational infrastructure to analyze, transform and apply the data they collect. In some cases, Environment Canada purchases such technologies and then builds them into Departmental systems and operations. In other cases, the Department develops technologies in-house, often in collaboration with scientists in other sectors.

Environment Canada scientists undertake studies to understand and identify environmental risks and benefits associated with technologies. This information supports risk management actions including the development of environmental regulations.

Environment Canada scientists carry out environmental technology performance studies and develop methods and risk management tools to support regulatory development and enforcement. The Department also supports clean technology development through a variety of programs and collaborations and promotes and drives clean technological innovation in other sectors by developing policies and regulations that act as incentives to improve environmental performance.

The *Science Strategy* takes a broad view of science that includes the use and development of technologies integral to the Department's scientific work, as well as assessing technologies and developing tools to support regulations.

2. VISION, MISSION AND PRINCIPLES TO GUIDE ENVIRONMENT CANADA'S SCIENCE

As described earlier, the *Science Strategy* responds to organizational and contextual changes for the Department. Environment Canada's science continues to be grounded in a mandate to protect the environment, conserve Canada's natural heritage, and provide weather and meteorological information to keep Canadians informed and safe. The Strategy's vision, mission, and principles build on the broad directions outlined in the 2007 *Science Plan*. They seek to refine and focus those directions to move the Department's science forward and focus it on federal priorities, which include environmental priorities identified by the Government of Canada, the Minister of the Environment, and relevant national governance bodies, such as the Canadian Council of Ministers of the Environment. Although the Strategy sets out directions for the next five years, its vision, mission and principles are longer-term objectives.

Vision

To provide leadership on environmental science addressing federal priorities

Mission

To provide the scientific knowledge, data and tools needed to enable Environment Canada's policies, programs and services to help provide a clean, safe and sustainable environment for Canadians

Principles

Relevance, Transparency,
Responsiveness, Excellence, Collaboration

Principle 1: Relevance

Environment Canada's science activities should be relevant to the current and future needs of users. These activities should effectively and efficiently deliver on the Department's mandate and key federal priorities.

Principle 2: Transparency

Increased external scrutiny and the international and global nature of so many environmental problems demand greater transparency. Environment Canada's science activities should be conducted in an open manner and the results of the Department's work should be easily accessible.

Principle 3: Responsiveness

Environment Canada's science should anticipate, respond and adapt to new and evolving environmental realities and priorities. The Department maintains core expertise and capacity across the field of environmental science, which it deploys to generate timely insight and solutions to current issues.

Principle 4: Excellence

Environment Canada maintains and pursues scientific excellence by using and adhering to internationally recognized standards and processes. The Department's stature, reputation, and productivity are a direct result of its culture of scientific integrity, rigour, authority and creativity.

Principle 5: Collaboration

Science is a collaborative enterprise. Environment Canada's scientists collaborate with partners in Canada and internationally through networks across universities, the private sector, other governments and non-governmental organizations. Collaboration involves sharing information and expertise across disciplines, sectors and jurisdictions in order to work collectively to find viable solutions to environmental challenges.

Together, these five principles serve as a framework to set out what Environment Canada strives for, and to explain how it will operate as a science-based organization. These principles guide the work of all staff involved in performing and managing science in the Department. The mechanisms for implementation included in the final section of the Strategy put these principles into practice.

VISION: TO PROVIDE LEADERSHIP ON ENVIRONMENTAL SCIENCE ADDRESSING FEDERAL PRIORITIES



3. FUTURE DIRECTIONS: SETTING PRIORITIES AND IMPLEMENTING THE STRATEGY

To provide leadership on environmental science addressing federal priorities, Environment Canada must identify and communicate its science priorities, maintain the scientific capacity needed to fulfill its mandate, and establish new ways of working to focus the Department's science on maintaining a clean, safe and sustainable environment for Canadians. The Strategy will guide Environment Canada in selecting science priorities through its existing planning processes by specifying key directions and areas of focus over the next five years, and by putting in place mechanisms to increase collaborative planning.

Ensuring appropriate science capacity is an ongoing focus for the Department; good science requires good science management. Environment Canada will continue to focus on having the right people, facilities, equipment and systems in place to make sure its science is relevant, transparent, responsive, excellent and collaborative. The Strategy aims to strengthen science capacity by focusing on specific mechanisms to improve science infrastructure, by supporting the Department's workforce and better managing its data.

To stay focused on delivering the science needed to provide a clean, safe and sustainable environment for Canadians, Environment Canada will continue to work to more effectively integrate scientific activities with functions such as policy development, program delivery and service provision.

Below are specific details on how the Department plans to achieve the Strategy's vision. First are a set of science priorities, followed by science management tools to improve the way the Department performs and supports its science.

PRIORITIES

Over the next five years, Environment Canada will continue to drive its science to focus on environmental issues of significance to the Government of Canada. The complex and protracted nature of some issues such as eutrophication, the global scope and scale of issues such as air pollution, climate change and loss of biodiversity and the increasing need for multidisciplinary approaches require new ways of thinking and doing. This means undertaking many activities in a horizontal, cross-cutting way, devising innovative tools and approaches, and taking the Department's science in new directions, where needed, to respond to emerging and persistent issues. In selecting issues and priorities to focus on, Environment Canada will strive to:

- Focus on current and emerging issues of significance to the Government of Canada;
- Build on the Department's existing expertise, knowledge, methods, tools and products;
- Target science that supports effective solutions to pressing environmental problems;
- Direct efforts toward activities and topics in line with the federal role for science and technology.

The four broad science issues identified below are issues that the Department anticipates may drive much of its work over the next five years. These are priority issues for Environment Canada that will help fulfill the Government of Canada's environmental agenda. They are issues of national and global importance; finding solutions to key challenges within these areas will become increasingly important for Canadians. These issues are based on Departmental and government-wide priorities, as well as discussions with Environment Canada staff and key partners and stakeholders that focused on articulating the impacts of the Department's current science activities and identifying emerging environmental issues the Department should pursue. The specific activities needed to address these priorities may change over time as the issues evolve and scientific understanding matures. To account for this, the Department will evaluate these priorities annually and adjust as relevant and necessary. This will help the Department's science remain relevant and responsive.

Priority area 1

Reducing the impacts of contaminants and other environmental stressors on the natural environment

One focus for Environment Canada's science will be on understanding and tracking the origin, fate and impact of critical contaminants on the environment. In particular, the Department will focus on limiting the impacts of harmful substances, including chemicals found in air, water, soil and wildlife, and air pollutants and greenhouse gases. These contaminants can interact with each other to produce different and sometimes unexpected results. The impacts of contaminants can also be exacerbated by interactions with other environmental stressors, such as climate change. **Environment Canada will also focus on understanding and tracking the cumulative effects of environmental stressors, including climate change, on wildlife and ecosystems of national interest.**

This work on contaminants and environmental stressors will support a broad range of policies, regulations, guidelines, evaluations and enforcement activities across the Department. It will also help inform and advance the integrated management of Canada's aquatic and terrestrial ecosystems, and will provide the science understanding necessary to conserve Canada's habitat, biodiversity and ecosystem functions.

This priority area is linked to Environment Canada's programs on Substances and Waste Management (3.1) and Climate Change and Clean Air (3.2).²

² Detailed information on Environment Canada's programs can be found in the Department's annual *Report on Plans and Priorities*.

Priority area 2

Providing early warnings about changing weather, climate and other environmental conditions

In order to improve the Department's prediction, forecasting and warning capabilities for weather, climate, and air and water quality, **Environment Canada will focus its science on developing new monitoring and modeling systems and tools, and improving existing systems.** This work will also help provide high quality, science-based tools and services to Canadians, policy-makers and targeted economic sectors.

This priority area is linked to Environment Canada's programs delivering Weather and Environmental Services for Canadians (2.1) and Weather and Environmental Services for Targeted Users (2.2).

Priority area 3

Climate change mitigation and adaptation

Environment Canada develops and implements regulations and other control measures to address greenhouse gas emissions and improve air quality. In order to support these measures, **Environment Canada will focus its science on understanding, tracking and predicting the emissions and atmospheric processes that affect climate change.** The Department also provides historical climate data and develops climate models to help Canadians adapt to climatic changes as they occur. **Environment Canada will also focus its science on providing the foundational knowledge to understand anticipated climate change to help Canadians plan and adapt to future change.** In order to further support adaptive management across Canada, **the Department will also focus its science on understanding, tracking and predicting the impacts of climate change on species and ecosystems.**

This priority area is linked to Environment Canada's programs on Climate Change and Clean Air (3.2), and Weather and Environmental Services for Canadians (2.1).

Priority area 4

Strengthening environmental conservation and protection to support responsible resource development

In order to work toward the sustainability of Canada's natural environment, including preventing biodiversity loss, protecting water resources and sustaining ecosystems over the long term, **Environment Canada will focus its science on proactively understanding, tracking and providing information on the environmental impacts of selected resource development projects.** The science will look at both primary and cumulative impacts, and will help minimize disturbance of ecosystems and wildlife, inform landscape and habitat management, and support environmental restoration where needed.

This priority area is linked to Environment Canada's programs on Biodiversity – Wildlife and Habitat (1.1), Water Resources (1.2) and Sustainable Ecosystems (1.3).

Please see Appendix I for a detailed list of specific science activities in each priority area.

SCIENCE MANAGEMENT

Putting the Strategy's vision, mission, and principles into practice will affect how Environment Canada plans, communicates and manages its science. It will impact how we work internally, but also the linkages and partnerships we build to work more effectively and efficiently. It will require using existing governance structures effectively as well as implementing mechanisms to strengthen linkages and communication across the Department, as well as bolster support for key organizational assets such as people and data. Some of these mechanisms are new to this strategy; others will draw on current processes to build on existing capacity.

Governance

In order to successfully implement the Strategy, the Department will bring key science decision-makers together to put the Strategy into practice. A senior group of Assistant Deputy Ministers will meet 1-2 times per year to provide broad strategic direction and report to the Deputy Minister on progress. Environment Canada's existing Executive Management Committee could be the forum for these tasks. A managerial (Director General-level) committee, supported by a working group, will deal with operational issues, such as assigning responsibility for specific initiatives, developing and maintaining an implementation plan, and monitoring progress.

Mechanisms

Enhancing linkages between science producers, science users and decision-makers

This *Science Strategy* will facilitate effective, on-going internal dialogue between scientists, policy makers and program managers across Environment Canada to plan science activities together where appropriate. It will also focus on bringing relevant science information to senior decision-makers, such as the Department's Executive Management Committee, which will help Environment Canada's policies and priorities respond to new scientific developments.

Improving science infrastructure

Environment Canada maintains important infrastructure and resources to carry out and support its science activities, from its world-class scientific and technical workforce to its wealth of scientific data to the specialized laboratories, facilities and instruments that monitor environmental conditions across the country. This Strategy will help strengthen these resources by improving data management, facilitating greater external access to Departmental science, investing in weather and monitoring instrumentation, and developing tools and policies to support leadership development and quality management across the Department. Environment Canada is committed to maintaining cutting-edge infrastructure to support its world-class science. Partnerships are an important part of this goal. The sharing of our knowledge and data with collaborators and partners helps to advance scientific understanding and increase the impact of our science, thereby enhancing the effectiveness and relevance of our work. In addition, an important part of performing science efficiently and in a responsive manner is working with partners, be it other federal departments, provinces or universities, to maximize world-class infrastructure and resources.

Please see Appendix II for more details on the proposed mechanisms.



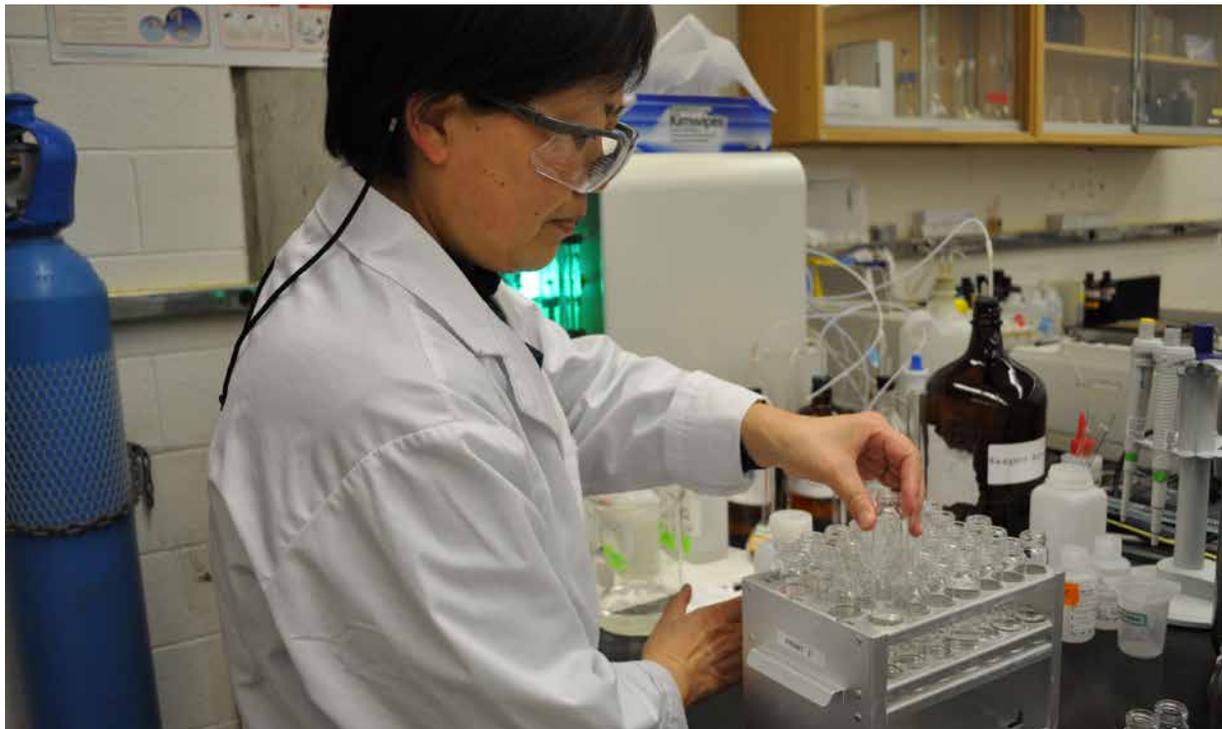
4. PATH FORWARD

The Strategy's successful implementation will rely on the commitment of staff from all parts of the Department. In keeping with the consultative process used to develop the Strategy, engagement with staff will also constitute an important part of its implementation.

Implementation will involve developing and adopting detailed internal work plans as operational companions to the Strategy, which will be linked with annual departmental planning and will put the priorities and mechanisms into practice to achieve the objectives outlined in the Strategy. These plans will assign responsibility for initiatives and set clear timelines, targets and indicators to measure progress. Wherever possible, the plans will leverage existing metrics and reporting processes to avoid duplication. They will be periodically reviewed and updated as required.

The first step toward implementation will be to update terms of reference for existing departmental committees and put in place new committees as described in the previous section. These committees will then assign responsibility for specific initiatives, and will oversee development of work plans and reporting on progress.

Effective implementation also means having means to measure performance and incorporate best practices and lessons learned. By regularly reporting on results and by facilitating communication across the department, the Department will be able to make adjustments to the details of the Strategy as required. This Strategy is an opportunity to achieve new goals and demonstrate successes, while minimizing additional reporting burden and collaborating more effectively.



ACKNOWLEDGEMENTS

This *Science Strategy* was developed through a consultative and engagement process with a variety of stakeholders. Consultations occurred through several mechanisms: an online questionnaire distributed to departmental employees and key external stakeholders; and federal workshops held in seven locations across Canada. Numerous targeted meetings also took place to engage departmental staff and review elements of the Strategy.

The development of this Strategy was led by Environment Canada's Science and Technology Executive Committee and an inter-branch steering committee with representation from Science and Technology Branch, Environmental Stewardship Branch, Meteorological Service of Canada, and Strategic Policy Branch. Many more individuals from across Environment Canada, including representatives from the branches of Audit & Evaluation, Communications, Corporate Services, Enforcement, Finance, Human Resources and International Affairs, also participated in the development process, as did other federal departments and external partner organizations.

Thank you to all who contributed.

APPENDIX I: PRIORITIES FOR ENVIRONMENT CANADA'S SCIENCE FOR 2014–2019

FEDERAL PRIORITY ISSUES	ENVIRONMENT CANADA'S SCIENCE GOALS	SPECIFIC ACTIVITIES
<p>Reducing the impacts of contaminants and other environmental stressors on the natural environment</p>	<p>Understand and track the origin, fate and impact of critical contaminants in the environment (air, water, wildlife) and on Canadians to support policy, regulatory and guideline development, evaluation and enforcement</p>	<p>Collect and integrate consistent emissions and ambient data on air pollutants of national interest to support development of emissions reductions strategies and air quality standards</p>
	<p>Understand and track the cumulative effects of environmental stressors, including climate change, on wildlife and ecosystems of national interest</p>	<p>Conduct research and monitoring and develop methods and tools to support the development of water pollution regulations, and water quality targets and guidelines for ecosystems of national interest</p>
	<p>Inform and advance the integrated management of Canada's aquatic and terrestrial ecosystems</p>	<p>Identify key stressors and collect baseline and trend data for wildlife populations of national interest</p>
	<p>Provide the science understanding necessary to conserve Canada's habitat, biodiversity and ecosystem functions</p>	<p>Collect or access data related to habitat and protected areas of national interest</p>
	<p>Apply a systems approach to avoid transferring problems from one medium to another</p>	<p>Conduct research and develop tools to support setting clear and achievable population objectives for species at risk and migratory birds of national interest</p>
	<p>Develop and use models for predictive capacity</p>	<p>Develop models, conduct research, and collect and integrate consistent baseline and trend data on chemicals of national interest</p>
		<p>Improve tools and approaches to understand contaminant and pollutant impacts on the Canadian environment</p>
		<p>Improve air and water quality/quantity predictions in at-risk areas and for transboundary impacts</p>
		<p>Integrate research on climatic changes (e.g. changes to temperature, water, precipitation) with other stressors</p>
		<p>Conduct research on environmental processes, and develop tools to mitigate contamination of the atmosphere and aquatic and terrestrial ecosystems</p>
	<p>Contribute to developing national environmental indicators</p>	

FEDERAL PRIORITY ISSUES	ENVIRONMENT CANADA'S SCIENCE GOALS	SPECIFIC ACTIVITIES
Providing early warnings about weather, climate and other environmental conditions	Support the development and operation of monitoring and modelling systems and tools in order to improve prediction and forecasting of weather, climate and other environmental systems, and to provide high quality, science-based tools and services to Canadians, policy-makers and targeted economic sectors	Develop, refine and apply tools and methodologies for high-resolution modelling to improve weather and air quality forecasting, nowcasting and climate prediction
		Collect, assimilate and integrate consistent nationwide data on weather systems
		Improve regional and national climate scenario analyses, including modelling weather and climate extremes
		Improve access to water, climate and air quality information for partners and Canadians as part of open science initiatives
Climate change – mitigation, adaptation	<p>Provide the foundational science to understand anticipated climate change to help Canadians plan and adapt to future change</p> <p>Understand and track and predict the emissions and atmospheric processes that affect climate change to support the development and implementation of regulations, policies and enforcement</p> <p>Understand and track and predict impacts of climate change on species and ecosystems to support adaptation and management</p>	Collect, integrate and analyze data on greenhouse gas sources and sinks
		Refine greenhouse gas inventories to support development of greenhouse gas targets
		Perform foundational climate science to help inform on climate change vulnerabilities
		Deliver enhanced climate services at relevant time and spatial scales to inform climate impact studies and adaptation planning
		Perform research on species distributions
		Conduct black carbon research and measurements and develop black carbon inventories
Strengthening environmental conservation and protection to support responsible resource development	Proactively understand, track and provide information on the environmental impacts (primary and cumulative) of selected resource development in order to minimize disturbance of ecosystems and wildlife, inform landscape and habitat management, and support environmental restoration where needed	Collect and integrate consistent baseline data in selected areas facing increased resource development, such as the North; undertake evaluations and report on results
		Develop models and other tools to understand and predict the impacts of resource extraction on the environment
		Collect and analyze consistent environmental monitoring data (air, water, land and biodiversity) to understand the potential cumulative environmental effects of resource development, including the oil sands industry
		Improve data collection and monitoring techniques for emissions related to resource development
		Enhance information collection on species and habitats of national interest to better support conservation and sustainable development
		Enhance the ability to use earth observation and remote sensing in environmental monitoring

APPENDIX II: SPECIFIC MECHANISMS TO IMPLEMENT THE STRATEGY'S PRINCIPLES

RELEVANCE

TRANSPARENCY

RESPONSIVENESS

EXCELLENCE

COLLABORATION

Enhancing linkages between science producers, science users and decision-makers

Annual horizontal priority-setting exercises

Bringing science producers and users together from across the Department annually to discuss their science needs and priorities helps strengthen linkages and align science activities to Departmental priorities. Horizontal planning meetings on themes such as air, chemicals, water, specific ecosystems, wildlife, weather and climate could be held prior to the departmental planning cycle to allow for incorporation into existing planning processes. Horizontal planning already occurs in some parts of the Department; this initiative would broaden and formalize it. The integrated approach of the Meteorological Service of Canada and the Atmospheric Science and Technology Directorate is an example of a best practice.

Collaborative information-sharing platforms

In order for the Department's science to remain responsive to users and policy needs, it is important to share information openly and continually. Online platforms open to all staff within Environment Canada have already begun to facilitate this sharing of information. A platform focused on science planning could allow science producers to post details of research projects and findings, and allow science users to outline their program's scientific needs. The platform would help forge new connections across the Department, and would allow for greater collaboration on projects and initiatives of mutual interest and expertise.

Science engagement – "EC Science Connect"

Scientific staff and managers from across scientific and technical disciplines within the Department could meet annually or as needed to discuss emerging environmental issues and provide advice to managers. This could build on a model of issue-based forums convened by senior managers.

Science Alert

Environment Canada maintains a database of peer-reviewed publications called Science Alert. Notifications of new publications are delivered on demand to subscribers within the Department. This database has great potential as a tool to bring relevant science information to decision-makers, and to Canadians. Strengthening the policy relevance and uptake of this tool could increase its utility in helping keep senior managers and science users abreast of the Department's scientific activities. Opening the database to the public would help keep Canadians at large informed of the ongoing science Environment Canada produces.

Improving science infrastructure

Data management

Environment Canada's ability to manage and analyze data has not kept pace with its ability to collect and store data. Collecting, sharing, using and making the most of the Department's data require constant effort. Proper systems must be in place and data must be maintained, organized, accessible, integrated and properly contextualized. Environment Canada will take steps to catalogue, standardize, describe and integrate its wealth of data to improve access to and use of its data. It will also work to update electronic data submission systems critical for regulatory development.

Open government science

Transparency, collaboration and excellence are hallmarks of good science. Opening Environment Canada's science to partners and Canadians will improve the uptake, reuse and impact of the Department's science activities, and will allow for greater dialogue across disciplines and sectors. This may include increasing open access to data and publications, and exploring more open and collaborative approaches to conducting science. It will also help strengthen capacity within and outside Environment Canada to anticipate, respond, and adapt to changing environmental issues and conditions.

Weather and monitoring instrumentation

Maintaining leading-edge technology and instrumentation is crucial to support and enable world-class science. The Government of Canada has committed to revitalize Canada's weather services through new investments in infrastructure such as the supercomputer, radars and surface weather and climate monitoring stations.

Scientific integrity and quality management

In order to maintain high standards for excellence and transparency, Environment Canada follows internationally accepted scientific practices and standards in many of its scientific, program and service activities. This includes accreditation of analytical laboratories, quality assurance and quality control of data collection, and integrated quality management systems governing weather and water monitoring. The Department will work to broaden and implement new quality management processes. One activity will be to follow the lead of top science institutions around the world by developing a Science Integrity Policy to support our scientists in maintaining high standards of excellence.

Cross-department project teams

In order to support high-priority projects and issues, the Department will support the establishment of cross-department teams to tackle priority science issues as needs arise. These teams would be modelled on the Department's approach to deploying cross-disciplinary expertise to large-scale projects, such as the Chemicals Management Plan or the Clean Air Regulatory Agenda. These teams would allow managers to use similar approaches for smaller-scale or shorter-term projects. These teams will draw upon Environment Canada's wide range of skills and expertise, from scientific research to engineering to economic analysis to law enforcement, and will provide staff with opportunities for cross-disciplinary collaboration, leadership development and learning.

The following table links the mechanisms to the Strategy's five principles. These principles will be used as a framework to develop specific metrics to track progress in implementing the mechanisms. The goal is to use these mechanisms to put the principles into practice.

Table: Summary of mechanisms to implement the five principles

		Principles				
		Relevance	Transparency	Responsiveness	Excellence	Collaboration
Linking science with users and decision-makers	Annual horizontal priority-setting exercise	✓				✓
	Collaborative information-sharing platforms	✓	✓	✓		✓
	“EC Science Connect”	✓		✓	✓	✓
	Science Alert		✓	✓	✓	
Improving science infrastructure	Data management		✓		✓	✓
	Open government science		✓		✓	✓
	Weather and monitoring instrumentation			✓	✓	✓
	Science integrity and quality management		✓		✓	
	Cross-department project teams	✓		✓	✓	✓

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