Canada

Sharing Environmental Decisions

October 2001
Final Report of the
Task Force on a Canadian Information System for the Environment

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The Honourable David Anderson, P.C., M.P.
Minister of the Environment
House of Commons
Parliament Buildings
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Dear Minister Anderson:

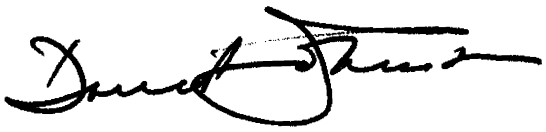
On behalf of the members of the Task Force on a Canadian Information System for the Environment, I am pleased to submit to you our final report: *Canadian Information System for the Environment: Sharing Environmental Decisions.*

We believe that access to credible, integrated environmental information is an effective mechanism to achieve environmental goals and to protect our health and safety. Federal, provincial and territorial environmental agencies, municipal governments, the private sector and the public need extensive, authoritative environmental information to make decisions and craft policies on existing environmental issues, to predict future threats, to manage programs, and to assess the effectiveness of those programs. As existing data are so insufficient, and integration of that data so limited, we believe it is time for Canada to take a new, more strategic approach to ensure that the environmental information needed for responsible decision-making is available to all who need it.

This report contains our recommendations on the design and implementation of a Canadian Information System for the Environment (CISE). We believe that CISE will provide the credible foundation needed for increased accountability; it will strengthen the basis for sound public policies; and it will provide Canadians with the information they need to adapt to environmental change and to play their role in environmental management. CISE will provide the data needed for indicators of sustainable development, which are key to mobilizing national will to preserve and enhance Canada's natural capital.

The state of our environment is inextricably linked to Canada's prosperity, competitiveness and growth. We firmly believe that developing an information system which serves to improve the state of Canada's environment and the effectiveness of environmental management in Canada is an important step to ensuring Canada's economic future. We look forward to you providing the leadership that will be required to make CISE a reality.

Yours sincerely,



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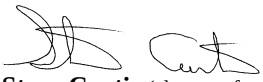

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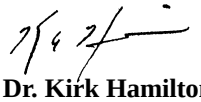

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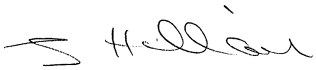

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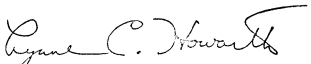

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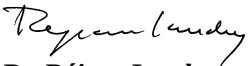

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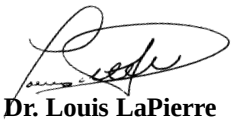

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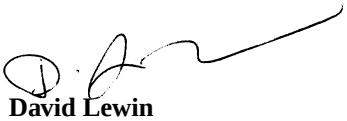

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Executive Summary

Our mandate

In October 2000, federal Environment Minister David Anderson created the Task Force on a Canadian Information System for the Environment (CISE) to provide advice to him on the design and implementation of an environmental information system. Its aim would be to ensure easy and timely access by decision-makers, citizens, communities, researchers, and the private sector to the reliable information they need to make informed decisions relating to the environment.

More specifically, the Task Force was asked to focus on the collection, management, assessment, and communication of the environmental information required to:

- provide a credible foundation for holding governments accountable;
- strengthen the basis for sound public policies; and
- enable Canadian citizens and organizations to adapt to environmental change and to play their individual and collective roles in environmental management.

The case for better environmental information

Canadians lack confidence in governments

In the wake of the contaminated drinking water crises in Walkerton and North Battleford, increased smog advisories, confusion over climate change, and growing protests against globalization, Canadians are questioning the commitment and effectiveness of their governments in safeguarding their environment, their health and their communities. Canadians want to know whether governments and others are fulfilling their environmental responsibilities. In practice, this requires two types of reporting: reporting on environmental status and trends, also known as "state of the environment" reporting, and reporting on the effectiveness and efficiency of policies and programs.

Canadians no longer receive periodic, comprehensive reports on the state of Canada's environment. This is in part due to the lack of long-term data sets on which to base environmental indicators, as federal and provincial monitoring programs have been significantly reduced in the last decade. Complicating matters is the fact that some of the long-term data sets that do exist were created to deal with policy issues of importance 20 years ago and bring little information of relevance to today's situation. Although some provinces, territories, municipalities and sectors regularly produce reports on the state of the environment or on sustainability, Canadians cannot easily compare environmental quality in different regions or sectors of Canada due to a lack of consistency in the indicators chosen.

"Establishing national goals mobilizes national will. And to sustain those goals, you need objective indicators measuring progress or the lack thereof."

Paul Martin, 2001

All levels of government now report regularly on performance. Although the situation is improving slowly, these reports contain few indicators or measurable targets associated with governments' environmental policy commitments. While these reports are public, there is no inventory of environmental policy targets across sectors or jurisdictions, and there are no integrated reports of the progress being made toward those targets. It is difficult, therefore, for Canadians to judge the effectiveness of environmental management in Canada.

As with government performance reporting, corporate environmental reporting is a relatively new field. A recent survey showed that 25% of Canada's 100 largest (in terms of revenue) companies prepare environmental, social or sustainability reports. When this percentage is compared with the level of corporate reporting in 10 other countries, Canada ranks in the middle, behind countries such as the United States (30%), the United Kingdom (32%) and Germany (36%).

We support the efforts that corporate Canada is making, and encourage their continued efforts. However, as the reports in Canada are still few in number, are not centrally accessible and are not prepared using the same protocols, it is still difficult for Canadians to understand and compare corporate environmental performance in Canada.

Canada lacks a strategic approach to environmental information

In a parallel initiative to this Task Force, the National Round Table on the Environment and the Economy, in cooperation with Statistics Canada, is identifying and testing a set of sustainable development indicators. These indicators will provide a useful counterpoint to the existing economic and social indicators that are so influential in the policy process. We welcome this initiative, but we are concerned that development of the indicators may be limited by the lack of sound, credible environmental data from across Canada. We also note that while indicators of the past state of the environment are very important, the development of public policy requires the ability to project future states of the environment based on natural change and on scenarios of human influence.

Canada has a wide range of initiatives in environmental information led by various levels of government and others. Most of these are based on particular projects, sectors, or organizations and are driven by the interests of information producers rather than by the needs of policy-makers. These many systems are not integrated into a coherent information system, nor are they linked to economic or human health information systems. With a few exceptions (e.g., GeoConnections and the National Forest Information System), they have failed to recognize the shared responsibility and objectives of the federal government, provinces, territories, private sector, and other stakeholders. The payoff in better decision-making based on integrated and comprehensive environmental information is missing.

Citizens and communities are insufficiently engaged

According to surveys, Canadians most want to know how the environment affects them personally. Information needs to be timely and should provide guidance on how citizens and organizations can reduce the impact of environmental hazards or environmental change on themselves and their activities, and how to reduce their impact on the environment.

Reports prepared for the Task Force have shown that despite the abundance of environmental information currently available and the desire that Canadians express for environmental information, most Canadians have a profound lack of knowledge of many environmental issues. They do not know where to find environmental information, and the information they do find is frequently not presented in a way that is easily understood and usable by them.

Canada must ensure its citizens are environmentally-literate – that they have the knowledge, skills, and commitment to make responsible decisions that benefit environmental quality and that allow them to adapt to environmental change. By failing to inform and engage Canadians, governments are missing the many opportunities and benefits that engagement can provide.

Canada lacks key environmental information

In the last decade, government-sponsored environmental monitoring programs have been significantly reduced. For example, there is no longer a national water quality monitoring program in Canada. The capacity of federal and provincial governments to monitor the environment has diminished, with fewer parameters being measured, at fewer sites, and with growing inconsistency in sampling and analytical standards. The data that do exist are not integrated, nor can they be synthesized to form a national picture.

Without data and information from a full range of sustained and consistent environmental monitoring programs, governments and the public are not in a position to identify issues that threaten human and ecosystem health, to predict emerging threats, to choose effective solutions, or to assess whether progress is being achieved. This problem has been pointed out by many others before us, including the Commissioner of the Environment and Sustainable Development; the National Round Table on the Environment and the Economy; and the International Joint Commission.

In the course of the last year, environmental managers in Canada have provided us with lists of their key information gaps, and the list is long. The fact that there are so many gaps and dwindling resources to fill them points to the urgent need in Canada for a strategic environmental information infrastructure: one that achieves national consensus on priorities for data development and that enables us to better share and apply the information we already have.

Canada is falling behind

Although Canada is not alone in the challenges faced in collecting, managing, assessing and communicating environmental information, its performance in this area is below that of many other countries. According to the 2001 Environmental Sustainability Index, Canada ranks 25th in the world in the availability of environmental information. This places Canada well behind the leaders, which include the United States, the Netherlands, and Norway.

Other countries are working more effectively in cooperative, integrated efforts with other levels of government and stakeholders to make environmental reporting more relevant, to strengthen their capacity to use integrated information in program management, and to enhance the public's access to the information they need to make decisions about their health and environment.

For example, in the United States, websites produced through partnerships of federal, state, and local governments and stakeholders allow citizens to access integrated environmental information in their community along with interactive maps and tools to answer their questions. The European Union has created the European Environment Agency, which provides the means for Europe-wide environmental data gathering and processing, acts as a centre of excellence and clearinghouse for environmental data, and manages a monitoring network linked to regular reporting.

In Budget 2000 and the October 2000 Economic Statement and Budget Update, the federal government provided $1.4 billion over five years for measures aimed at improving the environment. Government expenditures in 1996 on pollution abatement and control, including provision of clean water were estimated at $8.5 billion. Investment in the environment is an important investment in our quality of life and in the quality of life of future generations. The value of these investments depends on their being deployed effectively towards the right priorities. Given the weaknesses in environmental information described above, we lack confidence that these resources are being used as effectively as they could be.

A Canadian Information System for the Environment – the building blocks

Based on the many deficiencies in Canada's environmental information that we have identified, we believe that, as a minimum, the following data, tools and means are needed to meet the objectives of a national, integrated environmental information system:

1) To provide a credible foundation for holding governments accountable:

- environmental data to support a national set of sustainable development indicators, particularly those currently being developed by the National Round Table on the Environment and the Economy;
- data to support national environmental indicators; and
- comprehensive, continuous and credible reporting to Canadians on the state of the environment and the state of environmental management in Canada.

2) To strengthen the basis for sound public policies:

- means to set priorities for information development, through dialogue between users and producers of environmental information;
- tools to integrate environmental information from various sources and to integrate environmental information with other types of information; and
- tools to explain and predict the connections among environmental change, human actions, and human well-being.

3) To enable Canadian citizens and organizations to adapt to environmental change and to play their individual and collective roles in environmental management:

- means to improve access to and awareness of environmental information, including, but not limited to, the Internet;
- means to foster "communities of practice" on specific environmental topics; and
- tools to foster environmental involvement at the local level.

There is a growing recognition in governments that they cannot do it all. Leading jurisdictions are finding ways of sharing responsibility with others, including the private sector, non-government organizations, and the public. This includes ensuring that data and information are available in forms that can be readily used and understood. These jurisdictions recognize that access to environmental information, including performance information, is an effective mechanism to achieve environmental goals, to protect our health and safety, and to ensure a robust economy. Yet management of environmental information in Canada does not reflect this strategic shift. We believe that it is time for all levels of government in Canada, the private sector, non-government organizations, universities, and others to recognize their shared objectives, adopt

a strategic approach to environmental information and work in an integrated manner. Below is our proposal for how this can be achieved.

Vision of CISE

Our vision of CISE is to enable timely access to and effective application of relevant, credible, integrated environmental data and information in support of decision-making by all Canadians, through a coordinated, cooperative network of government agencies, the private sector, academia, non-government organizations, Aboriginal peoples, and others.

CISE – its design and operation

We propose that CISE be a network or "distributed system" of Canadian organizations engaged in producing and using environmental information. Distributed information systems are an emerging solution in many fields, but especially for environmental information. The Global Biodiversity Information Facility and the Australian Environmental Resources Information Network are two examples of systems adopting this approach.

In achieving integration of the many programs, services, and organizations in Canada, we do not envisage replacing or duplicating existing information services of government or other information producers. The focus of CISE is on fostering cooperation among them to enhance the quality and quantity of environmental information available to users and to bring better focus to these efforts, to ensure the most important information needs are being met.

In order to foster cooperation among the many disparate organizations, we believe that certain tasks must be provided centrally. Without this central capacity, we do not believe that it will be possible to correct the deficiencies we identified above. The tasks that should be provided centrally include provision of a forum for collective priority-setting, promotion of integration of environmental information, promotion of the use of common standards by partners in CISE for effective sharing of data, provision of incentives to partners to fill data and information gaps, and provision of tools to access information of others in the system.

We recommend that this central coordinating role be carried out by an independent organization, jointly sponsored by federal, provincial and territorial governments, and governed by a multistakeholder Board of Directors. We have named this organization the Canadian Institute for Environmental Information (CIEI). Our reasons for proposing that the organization be independent are listed below:

- Credibility of the information available through CISE is perhaps the most critical factor in determining its success. Organizations responsible for environmental management decisions are often perceived by stakeholders to have an interest in shaping the interpretation of environmental information. Users must be able to trust that the data and analysis are not biased toward or against a particular point of view.
- A large proportion of Canadian environmental information is collected and held by provincial, territorial and municipal authorities. Businesses and trade associations, non-government organizations, Aboriginal communities and others also possess significant relevant information resources. In order to attract these partners to CISE, CISE must be perceived by all potential partners as an inclusive system for all Canadians, and not merely a federal system.
- A key function of CIEI is its role as a neutral broker between environmental information producers and between producers and users. CIEI must be viewed by all CISE partners not to have its own policy agenda if it is to effectively facilitate agreement on system-wide priorities and standards.
- CIEI will have a higher profile and greater visibility to Canadians if it is structured as an independent body outside of government.

CISE – its implementation

We recommend that there be a period of transition to the creation of the CIEI, so that resources can be focused on building partnerships and on producing immediate products and services essential to establishing a firm and successful foundation for CIEI and CISE. These include:

- developing a national consensus on priorities for improving environmental information in Canada to create the "roadmap" forward for CISE;
- developing and implementing a data exchange network between federal, provincial and territorial departments and others to implement sharing of data and making the data publicly available in an easily understood, integrated manner; and
- developing a clearinghouse of the environmental standards, indicators, policy targets, and data sets that will form the basis for reports to Canadians and support the first two initiatives.

With the above ground work done, which we anticipate will take two years, CIEI should be established by year three, with its physical infrastructure, its Board of Directors, and its

funding structure in place. The "roadmap" would then guide data development nationally; the data-sharing agreements would be in place with some partners, in particular the provinces and territories; the clearing-house would be established; projects would be underway; reports visible to Canadians would be produced; and the infrastructure would be in place to implement the sustainable development indicators currently being developed by the National Round Table on the Environment and the Economy.

During the transition period, the central coordinating functions of CIEI should be developed under the leadership of the federal Minister of the Environment, with the advice of a multistakeholder management council. Prior to its establishment as an independent organization, CIEI should be funded solely by the federal government, with the expectation that CISE partners will be investing resources to increase their capacity to share their data with, and integrate and use data from, other partners in CISE.

It is imperative that the interim structure be sufficiently funded to demonstrate to potential partners in CISE, in particular the provinces and territories, that the federal government is serious and that there is a real system that they are being asked to join and invest in. Without this commitment and investment by the federal government, we are convinced that the firm basis needed to ensure partnership in CISE will not be established. This will only delay progress, and put the federal government behind other jurisdictions, within Canada and internationally, that are moving forward in developing systems to share and integrate environmental data. The longer that governments and stakeholders postpone working together on these initiatives, the more difficult it will be to influence the process, and the more costly it will be for partners to adapt the systems that they are putting in place.

We believe that this interim structure must be established immediately to build on the momentum that our Task Force has created. Our consultations have demonstrated to us that Canadians agree with the vision we have developed, and that it is time to take the next steps.

Aboriginal peoples and environmental information

Aboriginal peoples have a knowledge of their local environment that is experience-based and is gained over time by careful and critical observations. This knowledge comprises a deep understanding of the complex interrelationships between individual environmental components, the dynamics of local ecosystems, and the peoples that live in them. Linking western scientific knowledge and traditional knowledge can provide a much greater degree of understanding of the environment and afford improved management, conservation and resource development opportunities. The two forms of knowledge should be viewed as parallel systems to be shared when needed, providing ongoing benefits and recognition to their holders.

Development of CISE must recognize the valuable contribution of traditional knowledge to scientific knowledge, and the unique decision-making processes in Aboriginal communities. It must reflect how Aboriginal peoples wish to safeguard their knowledge, which mechanisms are most appropriate to them, and how they might wish to link modern technologies with their traditional systems. We believe that inclusion of Aboriginal peoples and an ongoing dialogue that reflects respect for, and recognition of, the value of traditional knowledge and the rights of the holders of that knowledge are an important next step in the development and implementation of CISE.

The benefits CISE will provide

We believe that CISE will improve the ability of Canadians to hold their governments and others accountable for their environmental record, through, for example, easy-to-read, factual reports that tell Canadians where environmental conditions are improving and where they are not or that report on the progress that governments in Canada are making in meeting their commitments.

We believe that CISE will strengthen the basis for sound public policies by providing the data for sustainable development indicators and for a national set of environmental indicators. It will provide better information to identify the issues that threaten human and ecosystem health, to choose effective solutions, and to assess whether progress is being achieved. It will provide mechanisms to ensure that available resources for data development are being spent on areas that are most relevant to policy needs.

CISE will enhance the ability of Canadians to adapt to environmental change and to play their individual and collective roles in environmental management. It will provide them with tools that help them to locate, use and share environmental information relevant to their communities.

It will provide them with resources to increase their knowledge of environmental issues and to learn about the actions they can take to protect themselves, their families and their livelihoods. It will provide them with information on environmental projects in their communities for which they can volunteer. It will engage the constituency that matters the most – the Canadian public.

The state of our environment is inextricably linked to Canada's prosperity, competitiveness, and growth. Over time, we believe that CISE will serve to improve the state of Canada's environment and the effectiveness of environmental management in Canada. CISE will move Canada from its ranking of 25th in the world in availability of environmental information to a position among the world leaders.

Early projects

In addition to initiating action on the continuing tasks described earlier (i.e., roadmap, data exchange network, and clearinghouse), CISE will need to demonstrate tangible benefits for its partners and potential partners through early projects. These projects will provide the first environmental content for CIEI analytical reports, public services such as electronic data access, as well as form the basis for data sharing agreements, data development, and infrastructure support.

Among other criteria, the early projects should reflect environmental issues on which Canadians have expressed the greatest interest for additional information, and should demonstrate the full range of functions within CISE, thus providing the best test of the system concept. They should also improve public access to integrated information and result in visible reports to the public which address either the state of the environment with respect to that issue, the progress being made towards policy targets for that issue, or the current state of the knowledge about the issue.

Although the list of areas to be included in CISE is long, we recommend that early projects be undertaken in the following areas due to their urgency:

- environment and human health (e.g., water quality, air quality);
- climate change; and
- biodiversity.

Canadians are concerned about how the environment affects their health, thus about the quality of the water they drink and the air they breathe. Climate change is the most significant environmental problem the world has ever faced. It already has had an important impact on the northern region of our country, threatening wildlife and infrastructure. Our agriculture, fishing and forestry industries are threatened by invasive species, about which we know little. In addition, half of Canada's species have not yet been described by science, and even for those that have been described we are unable to assess the status of most of them. Therefore, it is important that projects to develop and share information in these areas be undertaken immediately.

Summary of Task Force Recommendations

1. The Government of Canada should recognize its responsibility to provide leadership in the integrated management of environmental information and the provision of environmental information to Canadians through the creation of a Canadian Information System for the Environment.

2. The Government of Canada should mandate the Canadian Information System for the Environment to provide:
   a) environmental data to support a national set of sustainable development indicators, particularly those currently being developed by the National Round Table on the Environment and the Economy;
   b) data to support national environmental indicators;
   c) comprehensive, continuous, and credible reporting to Canadians on the state of the environment and the state of the environmental management system in Canada;
   d) means to set priorities for information development, through dialogue between users and producers of environmental information;
   e) tools to integrate environmental information from various sources and to integrate environmental information with other types of information;
   f) tools to explain and predict the connections among environmental change, human actions, and human well-being;
   g) means to improve access to and awareness of environmental information;
   h) means to foster "communities of practice" on environmental topics; and
   i) tools to foster environmental involvement at the local level.

3. The Government of Canada should seek the participation of provinces and territories and non-government stakeholders in the collaborative management of environmental information through the Canadian Information System for the Environment.

4. The Government of Canada, in collaboration with provinces and territories, should foster the establishment of a Canadian Institute for Environmental Information to:
   a) support collective priority-setting for information development by Canadian Information System for the Environment partners;
   b) promote integration of environmental information;
   c) promote the use of common standards by Canadian Information System for the Environment partners;
   d) provide incentives to fill data and information gaps; and
   e) help users navigate the system and participate in Canadian Information System for the Environment decision making.

5. The Canadian Institute for Environmental Information should be governed by a Board of Directors representative of all users and producers of environmental information. The principal roles of the Board of Directors should be to:
   a) provide leadership to the Canadian Information System for the Environment;
   b) set priorities and strategic directions for the Canadian Institute for Environmental Information;
   c) establish performance expectations for the Canadian Institute for Environmental Information and monitor and report on progress; and
   d) provide advice to the various ministerial councils (e.g., the Canadian Council of Ministers of the Environment) regarding environmental information.

6. In the initial phase of implementing the Canadian Information System for the Environment, the Minister of the Environment should:
   a) coordinate the development of a national agenda for environmental information in Canada, in collaboration with Statistics Canada;
   b) secure the participation of key partners in the Canadian Information System for the Environment by means of data-sharing agreements, and begin implementation of infrastructure to enable data exchange;
   c) develop a clearinghouse of environmental standards, indicators, policy targets, and data sets, and provide easy access to them; and
   d) establish a multistakeholder management council to provide advice on the development of the Canadian Information System for the Environment during the initial phase.

7. The Minister of the Environment should facilitate pilot projects in Aboriginal communities to enhance community capacity to access local knowledge and to develop the information systems to effectively utilize that knowledge.
8. The Minister of the Environment should support the formation of an Aboriginal Steering Committee, composed of representatives of national Aboriginal organizations, to:
   a) plan and coordinate the development of the pilot projects to facilitate the design and implementation of the Canadian Information System for the Environment with respect to environmental decsion- making of Aboriginal peoples; and
   b) provide advice to and coordinate the undertaking of community-level consultations to identify the range of environmental information needs and information gathering and dissemination capacities of Aboriginal communities.
9. The Minister of the Environment should, as an urgent priority, undertake early projects to improve data quality, integration and reporting in the following areas:
   a) environment and human health;
   b) climate change; and
   c) biodiversity.
10. The Canadian Institute for Environmental Information should be designated as the Canadian node for the Global Biodiversity Information Facility.

1. The Case for Better Environmental Information

CP Picture Archive (Kevin Frayer)

The demand for reliable environmental information began early in Canada's history. Institutions such as the Water Survey of Canada, the Geological Survey of Canada, and the Canadian Forest Service were established to provide policy-makers, businesses and Canadians with information on natural resources and environmental hazards. New demands for environmental information later arose, as in the 1960s and 70s when widespread environmental problems due to pollution were identified.

Over time, we have learned of the close connections among environmental issues, and between the state of our environment and the quality of our life and health. More than ever before, environmental information is essential to Canada's prosperity, competitiveness and growth. The need to integrate environmental information across Canada and across sectors has, therefore, never been greater.

Below we outline the need for environmental information and what we believe to be the serious flaws in Canada's environmental information infrastructure.

Canadians lack confidence in governments

In the wake of the contaminated drinking water crises in Walkerton and North Battleford, increased smog advisories, confusion over climate change, and growing protests against globalization, Canadians are questioning the commitment and effectiveness of federal, provincial, and territorial governments in safeguarding their environment, their health and their communities. After having spent this last year studying the state of Canada's environmental information infrastructure, we do not find this lack of public confidence surprising.

Canadians want to know whether governments and others are fulfilling their environmental responsibilities. They want assurances that governments are identifying issues that threaten human and ecosystem health, and choosing effective solutions. In practice, this requires two types of reporting: reporting on environmental status and trends, also known as "state of the environment" reporting; and reporting on the effectiveness and efficiency of policies and programs.

"It is only by observing trends that one can acquire information that is truly meaningful."

Paul Martin, May 2001[1]

Canadians no longer have access to periodic, comprehensive reports on the state of Canada's environment. The last national report on the state of Canada's environment was produced in 1996 and the program has since been discontinued. When the reports were being produced, they suffered from a lack of current data, a lack of data that was geospatially complete across Canada, a lack of data that were standardized across jurisdictions, and in some cases discontinued data sets. They also suffered from a lack of long-term trend data on which to base indicators and subsequent reporting. Complicating matters is the fact that some of the long-term data sets that exist today were created to deal with policy issues of importance 20 years ago. They bring little information of

relevance to today's situation, but they continue to be reported, as they are the only data sets available.

Although the federal government, through consultations, has developed in the last decade a national set of environmental indicators in specific areas, such as urban air quality, municipal water use and wastewater treatment, and climate change, there are many areas where indicators are not available, such as change in biodiversity, freshwater quality, and solid and hazardous waste generation. For waste generation, national systems of data collection are limited, though some progress is being made on the standardization of concepts and definitions of solid non-hazardous waste. For some types of waste, data are inaccessible or non-existent. Even for indicators that are used, data are limited. For example, for toxic contaminants the data are spatially incomplete in northern regions and data exist primarily for persistent organochlorine substances.

"Limited commonality exists among the 425 broad indicators and environmental parameters found in the various state of environment reports prepared by provinces and territories. For example, among the 115 different water indicators, 24 are the same in two reports, seven in three reports, and one in four reports."

Dr. Virginia Maclaren, Associate Professor, University of Toronto in a study conducted for this Task Force[2]

Although some provinces and territories and some sectors regularly produce reports on the state of the environment or on sustainability, comparisons of environmental quality between regions of Canada or between sectors are difficult due to a lack of consistency in indicators chosen. Similarly, it would be difficult to find a sufficient number of common indicators reported at the municipal level to permit aggregation upwards to provincial-, territorial-, or national-level reports.

With a few sectoral exceptions, Canadians do not have an overview on whether our environment (not just our forests and our fish, but our wetlands, our watersheds, our ecosystems) is being used in a sustainable manner. That is in part because we do not yet have a set of well-accepted, national indicators that will promote the integration of environmental considerations into economic decisions. We welcome the work of the National Round Table on the Environment and the Economy in developing such indicators, but we are concerned that development of the indicators may be limited by the lack of consistent, coherent, compatible and credible environmental data from across Canada.

At the municipal level, lack of access to integrated data limits the ability of local governments to make environmentally responsible decisions. For example, information on land use is often not provided or sought by those making decisions on energy use, and solid waste data are not used by those concerned with potable water issues. With a move towards privatization of community services, many databases are now owned by the private sector (e.g., energy consumption, solid waste collection and disposal). Other databases are held by provincial and federal governments, such as those on local water quality or natural resources.

Reporting on government performance is now done by all levels of government. Although the situation is improving slowly, these reports contain only a few indicators or measurable targets associated with governments' environmental policy commitments. While these reports are public, there is no inventory of environmental policy targets across sectors or jurisdictions, and there are no integrated reports of the progress being made toward those targets. Therefore, it is difficult for Canadians to easily understand the effectiveness of Canada's environmental management system. By not measuring and reporting on progress in a way that engages Canadians, Canada is failing to engage the constituency that matters the most – the Canadian public.

"Canada does not systematically track the implementation of its international environmental commitments. As a consequence, Canada does not have an overall picture of how good a job it is doing at meeting the obligations it has undertaken."

Commissioner of the Environment and Sustainable Development, 1998[3]

Corporate environmental reporting is a relatively new field. A recent survey showed that 25% of Canada's 100 largest (in terms of revenue) companies prepare environmental, social or sustainability reports.[4] When this percentage is compared with that in 10 other countries, Canada ranks in the middle, behind countries such as the United States (30%), the United Kingdom (32%) and Germany (36%).[4] Although we applaud the increasing effort of Canadian companies in this area, Canadians find it difficult to compare corporate environmental performance. The reports that are produced are not centrally accessible, they are written using different protocols, and few are verified by third parties.

According to surveys, Canadians most want to know how the environment affects them personally. Information needs to be timely and should provide guidance on how citizens and organizations can reduce the impact of

environmental hazards or environmental change on themselves and their activities, and how to reduce their impact on the environment.

Reports prepared for the Task Force have shown that despite the abundance of environmental information currently available and the desire that Canadians express for environmental information, most Canadians have a profound lack of knowledge of many environmental issues. When asked what is their greatest obstacle in seeking out more environmental information, a plurality of Canadians say that although they are interested in obtaining more information, they do not know where to find it or believe that the information does not exist.[5]

"Because Canadians have virtually no understanding or knowledge of the government's biotechnology policy or regulations, many think that nothing is being done. This is in part responsible for their low ranking of the federal government's performance in biotechnology."

Pollara and Earnscliffe, 2001[6]

Part of the problem is that Canadians have few reports aimed at a non-technical audience on the state of knowledge (that is, what we know and what we don't know) on specific environmental issues. Focus groups conducted by Earnscliffe Research in June 1999 found widespread and deep uncertainty among Canadians on the subject of climate change. When asked about their lack of knowledge, people say that their confusion is not due to disinterest, but rather uncertainty among experts on complex issues and on the absence of information required to help educate them.[7]

Canada is falling behind

Although Canada is not alone in the challenges faced in collecting, managing, assessing and communicating environmental information, its performance in this area is below that of many other countries. According to the 2001 Environmental Sustainability Index, Canada ranks 25th in the world in the availability of environmental information.[8] This places Canada well behind the leaders including the United States, the Netherlands, and Norway.

Other countries are working more effectively in cooperative, integrated efforts with other levels of government and stakeholders to advance their efforts to make environmental reporting more relevant, to strengthen their capacity to use integrated information in program management, and to enhance the public's access to the information they need to make decisions about their health and environment.

As an example of moves in this direction, the United States Environmental Protection Agency has:

- created the Office of Environmental Information to serve as a focal point for improving data quality and ensuring convenient access to integrated data on environmental quality status and trends;
- developed a National Environmental Information Exchange Network with states, diverse partners, and stakeholders, recognizing their shared objectives;
- reduced significantly the environmental reporting burden on industry and communities by developing a consolidated, one-window approach among jurisdictions;
- expanded the scope of its Community Right To Know programs to provide public access to valuable information about the performance of regulated facilities;
- launched a web site featuring the Envirofacts data-base, which allows public access to environmental data for their community via the Internet; and
- developed a prototype "Window to My Environment" in partnership with federal, state, and local government and partner organizations. It is designed for the public and provides interactive maps and tools to answer popular questions about environmental conditions affecting air, land and water in their community.

For 2002, the United States Environmental Protection Agency will spend $25 million in grant funding to help States better integrate their environmental information systems, $117 million to increase the availability of information and $55 million to provide access to tools for using the information.

Another interesting model is that of the European Environment Agency, "Europe's gateway to environmental information." Its aim is to establish a seamless environmental information system in the European Community, with three pillars:

- networking: develop and interconnect the means for Europe-wide environmental data gathering and processing;
- monitoring and reporting: provide a monitoring and reporting system which seeks to deliver timely, comparable, harmonized data and integrated environmental assessments; and
- reference centre: facilitate environmental action through acting as a centre of excellence and as a single clearinghouse for environmental data.

The European Environment Agency does not aim to replace existing structures, but attempts instead to bring together, in compatible formats, the best available environmental data from the individual countries. This is done to assist the European Community in its attempts to improve the environment and move towards sustainability, including their efforts to integrate environmental aspects into economic policies.

Canada lacks a strategic approach to environmental information

Canada has a wide range of initiatives in environmental information led by various levels of government and others. Some of these are listed in Annex A. Our analysis of these initiatives has shown that Canada lacks a strategic approach to collecting, managing, assessing, and disseminating environmental information. Some of the weaknesses that we have identified in our analysis are listed below:

- The numerous, disparate information systems are not linked into one coherent system. The payoff in better decision-making based on integrated and comprehensive environmental information is missing.
- While integration of information and development of data exchange networks are starting, they are limited to specific topics (e.g., GeoConnections for geospatial data, National Forest Information System for forestry).
- Most information systems are project-based. Putting data to use outside the immediate discipline of origin is therefore frequently difficult and expensive, and thus rarely done.
- Most information systems are "producer"-driven rather than "user"-driven. There is no systematic process for identifying user needs in collaboration with producer practicalities and to set strategic priorities for environmental data collection in Canada. Such dialogue would lead to a more cost-effective working partnership between users and producers and a better understanding by both that information is integral to the decision-making process, not an external luxury.
- While indicators of the past state of the environment are very important, public policy decisions require the capacity to see ahead, to project the state of the environment for tomorrow, next season, next decade, based on natural environmental change and on scenarios of the increasingly important influence of human activities. Other than for weather and climate information, our ability to predict future environmental conditions is very limited.
- The burden of reporting on industry for pollutant releases is still high due to a lack of one-window reporting, as well as inconsistent and incompatible requirements of the different jurisdictions. This means that the public is not able to obtain a consolidated picture of pollutant releases.
- There is no organization in Canada responsible for maintaining and archiving core national environmental data sets, and the capacity of environmental information producers in Canada has become greatly reduced in this area. As a result, data are not available for multiple use and are not safeguarded for use by future generations. We are encouraged by the efforts of the Social Sciences and Humanities Research Council and the National Archives of Canada which are investigating the data-archiving needs of the research community. Their recommendations should be considered closely by the environmental community.

"Traditional knowledge holders are the elders who can name the species, the fish, wildlife, what have you ... However due to an aging population, those knowledge holders are likely to be lost over the next few years."

Participant at Aboriginal Focus Group Discussion

- Local knowledge (such as that held by farmers, fishers, loggers, miners) and Aboriginal knowledge are underrepresented in existing information systems. Where long-term data sets are unavailable, this knowledge is often the only information available on historical changes in wildlife resources or in environmental conditions. Given the age of many of the people with this knowledge, it is at risk of being lost if not captured soon.

Canada lacks key environmental information

"The importance of good information is perhaps best illustrated when it is absent."

Commissioner of the Environment and Sustainable Development, 2000[9]

In the course of the last year, it has become obvious to us that the gaps in environmental information in Canada are significant. This is not surprising to most as this fact has been stated by numerous people before us. We cite below a few conclusions provided by those who have studied environmental monitoring programs in Canada to demonstrate the seriousness of the situation today.

- "We believe weaknesses in the federal government's environmental monitoring are impeding the government's ability to detect the presence of toxic substances in our environment, to determine their effects on species, ecosystems and humans, and to measure the effectiveness of risk management initiatives on a long-term basis." (Commissioner of the Environment and Sustainable Development, 1999)[10]
- "Without data and information from a full range of sustained and consistent environmental monitoring and surveillance programs, the governments, the public and the Commission are not in a position to identify issues that threaten human and ecosystem health, to choose effective solutions, and to assess whether progress is being achieved. The governments are not undertaking these programs and the Commission cannot fill this gap. With the cuts made to monitoring and surveillance programs in recent years, we are proceeding blind." (International Joint Commission, 2000)[11]
- "Government-sponsored monitoring of environmental changes has significantly decreased. As a result of fewer resources being allocated by government, we are less able to track and deal with existing environmental challenges and to predict new ones, as the recent contaminated water tragedy in Walkerton, Ontario, illustrates." (National Round Table on the Environment and the Economy, 2001)[12]
- "There is no national network for water-based ambient monitoring. Monitoring of individual watersheds in regional initiatives such as the Atlantic Coastal Action Program or Great Lakes 2000, while important, is tailored to only specific issues and substances. The regional data that do exist are not integrated or synthesized to form a national picture." (Commissioner of the Environment and Sustainable Development, 1999)[13]

In our interim report, we presented many important gaps in environmental information that were identified to us by several federal departments and others. This list was, for the most part, confirmed during our consultations across Canada, and it is provided again in Annex B. The fact that there are so many gaps and dwindling resources to fill them points to the urgent need in Canada for a strategic information infrastructure: one that achieves national consensus on priorities for data development and enables us to better share and apply the information we already have.

Canadian investments in the environment could be more effective

Investment in the environment is an important investment in our quality of life and in the quality of life of future generations. Considerable resources are spent on the environment in Canada. Some indicators include the following:

- In Budget 2000 and the October 2000 Economic Statement and Budget Update, the federal government provided $1.4 billion over five years for measures aimed at improving the environment.
- The Canadian insurance industry pays out up to $3.5 billion per year in response to natural disasters.
- Government expenditures in Canada in 1996 on pollution abatement and control, including provision of clean water, totalled $8.5 billion.
- Total business sector expenditures in 1998 on environmental protection were estimated at nearly $4.7 billion.

"A healthy environment is an essential part of a sustainable economy and our quality of life."

Government of Canada, January 2001[14]

- Environmental industries do about $12 billion in business per year.
- The total value of environmental goods and services produced in Canada in 1998 was $22.3 billion.
- The federal government invests over $350 million per year in environmental science and technology.

The value realized from these investments depends on their being deployed effectively towards the right priorities. This in turn depends on the wise production and use of environmental information. Given the weaknesses in environmental information that we described above in this chapter, we lack confidence that these resources are being used as effectively as they could be.

Moving forward

Addressing these gaps and weaknesses will take time and resources from all levels of government, the private sector, and others. In the chapters ahead, we describe a strategic approach for tackling these weaknesses, the system that should be put in place, the projects with which it should start, and some of the benefits it will provide.

Almost nine out of 10 Canadians believe it is very important for the government to provide Canadians with environmental information, even though it costs taxpayers money.[15] We note that the Prime Minister has stated that "Canada's governments are … taking steps to modernize the [health care] system and make it sustainable by investing in health information systems."[16] To ensure that our environment, and subsequently our economy and our quality of life are sustainable, we believe it is also time for Canada to invest in an environmental information system.

Recommendation

1. The Government of Canada should recognize its responsibility to provide leadership in the integrated management of environmental information and the provision of environmental information to Canadians through the creation of a Canadian Information System for the Environment.

2. A Canadian Information System for the Environment – The Building Blocks

Objectives of CISE

The objectives of CISE are to:

- provide a credible foundation for holding governments accountable;
- strengthen the basis for sound public policies; and
- enable Canadian citizens and organizations to adapt to environmental change and to play their individual and collective roles in environmental management.

To meet these objectives, we believe CISE should focus on the data and information that help Canadians understand the state of the Canadian environment, and the effectiveness of environmental management in Canada.

CISE – the building blocks

In the previous chapter we talked about the many weaknesses we feel currently exist in Canada's environmental information infrastructure. As a starting point to designing CISE, we believe that, as a minimum, it must provide the following data, tools, and mechanisms.

To provide a credible foundation for holding governments accountable:

a) environmental data to support a national set of sustainable development indicators, particularly those currently being developed by the National Round Table on the Environment and the Economy;

b) data to support national environmental indicators; and

c) comprehensive, continuous and credible reporting to Canadians on the state of the environment and the state of the environmental management system in Canada.

To strengthen the basis for sound public policies:

d) means to set priorities for information development, through dialogue between users and producers of environmental information;

e) tools to integrate environmental information from various sources and to integrate environmental information with other types of information; and

f) tools to explain and predict the connections among environmental change, human actions, and human well-being.

To enable Canadian citizens and organizations to adapt to environmental change and to play their individual and collective roles in environmental management:

g) means to improve access to and awareness of environmental information, including, but not limited to, the Internet;

h) means to foster "communities of practice" on specific environmental topics; and

i) tools to foster environmental involvement at the local level.

These are explained below.

a) Environmental data to support a national set of sustainable development indicators, particularly those currently being developed by the National Round Table on the Environment and the Economy.

In a parallel initiative to the development of CISE, the National Round Table on the Environment and the Economy, in cooperation with Statistics Canada, is developing a set of sustainable development indicators focused in large part on the measurement of natural capital (Annex C). Natural capital includes those elements of the environment that provide the material and service flows necessary for sustaining human activity: natural resources, land areas and healthy ecosystems.

Indicators of sustainable development will be key in mobilizing national will to preserve and enhance Canada's natural capital. They will provide a useful counterpoint to the existing economic and social indicators that are so influential in the policy process. And the success of these indicators will hinge to a great extent on the availability of sound, credible data. Just as basic economic data are crucial in the development of economic indicators (e.g., gross domestic product, the unemployment rate, the consumer price index), so too must CISE collect the basic environmental data to support the compilation of sustainable development indicators.

The creation of CISE should ultimately lead to better sustainable development indicators. The best information systems are those in which there is an ongoing interplay between theory and measurement. Thus, as we build our capacity to measure the environment, this will in turn build on our theoretical understanding of the relationship between human activity and the environment. The result will be an ongoing refinement of both the basic environmental data and the indicators that we derive from them.

The development of a set of sustainable development indicators based on natural capital will put Canada in the forefront of similar work around the world. Many nations (e.g., the United Kingdom and Australia) and international organizations (e.g., the United Nations and the Organisation for Economic Co-operation and Development) either have or are working on sets of sustainable development indicators. Among all these initiatives, Canada's stands out as being one of the most conceptually well founded. With the full implementation of CISE, it will also be one of the most well-founded in terms of data.

b) Data to support national environmental indicators.

Although the federal government, as stated in chapter 1, has developed in the last decade a national set of environmental indicators in specific areas, such as urban air quality, municipal water use and wastewater treatment, and climate change, there are many areas where indicators are not available, such as change in biodiversity, freshwater quality, and solid and hazardous waste generation. Even for indicators that are used, data are limited. For example, for toxic contaminants the data are spatially incomplete in northern regions and data exist primarily for persistent organochlorine substances. CISE should serve as the primary source of data for the compilation of an expanded set of national environmental indicators.

c) Comprehensive, continuous and credible reporting to Canadians on the state of the environment and the state of the environmental management system in Canada.

Governments must demonstrate results to gain public confidence. This requires setting targets, developing indicators, collecting data, and reporting on status and trends and on progress being made. Timely reporting of credible information also provides governments with the information they need to ensure that their efforts are focussed on the real issues, and not distracted by the latest environmental "crisis."

We believe reporting through CISE must be evidence-based, must be non-judgemental and must not play an advocacy role. Examples of the types of reports CISE should produce are those of Statistics Canada or the Canadian Institute for Health Information.

d) Means to set priorities for information development, through dialogue between users and producers of environmental information.

Science-intensive policy decisions depend on obtaining and interpreting trusted, high-quality, up-to-date information. Policy-makers do not usually require access to individual data sets; they require processed data and information products. These products come from the integration and analysis of a range of different data types, often across a range of disciplines.

We believe that an important factor in determining the success of CISE will be the ongoing dialogue between the researchers, data managers, analysts, and others who are involved in producing information, and the target audiences (users) who need information to improve the quality of their decisions. This dialogue should improve the ability of users to influence the data being produced by the environmental sciences community so that the information they receive is more timely and relevant to decision-making. It should also foster greater understanding by information users of the quality and limitations of environmental data, and the contraints that affect the production of that information.

e) Tools to integrate environmental information from various sources and to integrate environmental information with other types of information.

Integration of information is important for three reasons. First, integration is necessary to understand environmental issues that are becoming increasingly complex. Environmental monitoring programs and information systems have largely been developed in response to sector-specific or media-specific issues. Understanding and responding to the issues we now confront requires bringing information together from various sources, and bringing together different types of information, including social, economic, and human health information. Second, environmental information is more useful and relevant to decision makers when it is integrated. For example, policy-makers need information that integrates environmental with economic performance, environmental quality with human health, and resource use with ecosystem function. Third, integration enables us to maximize the efficiency and value of investments in monitoring and data collection.

Integrating data depends on three fundamental characteristics: coherence, consistency, and coverage. Coherence refers to whether the data "line up" when integrated. Ensuring data are coherent involves the use of common units of measure, methods, definitions, and classifications during data collection. For example, by using standard industrial classifications from economic statistics for emissions data are becomes possible to integrate much environmental and economic data. Consistency is the need to maintain definitions and methods over time, to the extent possible. Without consistency it is impossible to analyse trends – crucial for understanding most environmental issues. Coverage refers to the desirability for inclusion of all relevant spatial, temporal and sectoral dimensions.

f) Tools to explain and predict the connections among environmental change, human actions, and human well-being.

Environmental policy assumes it is possible to anticipate future environmental conditions and to identify those factors open to influence. Information on future states of the environment is also required if individuals and organizations are to adapt to environmental change, to protect themselves from environmental hazards, and to reduce the effects of their activities on the environment.

Predictive models and related tools (e.g. visualization tools, scenario-building tools) provide the basis for translating environmental data into information relevant to the needs and concerns of decision-makers. Models describe the interactions among key variables for a particular set of environmental processes, and range in complexity from simple conceptual schematics to well-verified, multidimensional quantitative models (e.g., atmospheric models used in the prediction of weather or air quality). Some advanced models permit the generation of real-time forecasts which are particularly useful for warnings of time-sensitive hazards.

The use of models also alerts us to the complex interconnections between environmental systems and the need to maintain and strengthen our basic data resources. For example, in addition to their direct use in forecasting weather and flood conditions, meteorological and hydrological data are also essential for scientifically demonstrating the linkages between pollutant concentrations in ambient air and water and emissions that may be a considerable distance away. Using such methods, it has been possible to demonstrate that about 50% of the air pollutants that affect southern Ontario comes from the United States, a fact that has important implications for policy choices.

We believe that CISE should facilitate the development of models and other tools for understanding and predicting past, present and future states of environmental systems, especially those involving the integration of data and information across disciplines, sectors and organizations.

g) Means to improve access and awareness of environmental information including, but not limited to, the Internet.

Our studies have shown that despite the abundance of environmental information currently available and the desire that Canadians express for environmental information, most Canadians have a profound lack of knowledge of many environmental issues. They do not know where to find environmental information, and the information they do find is frequently not presented in a way that is easily understood and usable by them.

Any citizen should be able to easily access via the Internet environmental data and information that have met CISE criteria as to quality, reliability, and credibility. Emphasis should be on providing national information in a relevant and usable form. Wherever possible, users should also be able to "drill-down" to obtain local- and regional-scale information as well. Information should be comprehensive, understandable, and query-driven.

Innovative tools for searching, presenting and mapping information against geographic areas should make it easier for people to find and display the information they need, when they need it, and how they need it. The system should also allow people to interact with the data sets so that users can undertake further analysis and communities have the opportunity to share traditional and local ecological knowledge.

Although we are proposing the establishment of an Internet-based environmental information system, we recognize that the use of alternative media, formats and languages – including direct access to expert advice – reflecting the needs and varied preferences of Canadians will be necessary. Special provision will also clearly have to be made for Aboriginal and other communities in rural and remote areas where Internet access may be problematic.

Once the partners in CISE have established public access to environmental information over the Internet, a Canada-wide campaign should be launched to tell Canadians where to find environmental information and why they need it. To reach Canadians in all their diversity, the campaign should use a variety of media, appropriate languages, and credible spokespersons.

h) Means to foster "communities of practice" on specific environmental topics.

A "community of practice" is a group of people who are brought together by a desire to learn more about common opportunities and problems. These communities develop around topics that matter to people, and are a means by which individuals develop and share the capacity to create and use knowledge.

CISE should provide online forums or discussion groups where Canadians and others from around the world can share ideas, information, knowledge, and experience on specific environmental topics.

i) Tools to foster environmental involvement at the local level.

"Governments alone cannot improve the quality of our environment. We have to encourage environmentally friendly actions and choices in all sectors of society from the local to the national, from the boardroom to the kitchen."

David Anderson, March 2001[17]

Governments are moving towards allowing broader participation in environmental planning and priority setting, as well as towards place-based approaches to environmental management. Canada must ensure an environmentally-literate citizenry that has the knowledge, skills, and commitment to make responsible decisions that improve environmental quality and that allow it to adapt to environmental change.

We believe that CISE should provide leadership and motivation in this area. For example, it should engage Canadians by providing websites where they can enter their own environmental monitoring observations, or learn where they can volunteer for local environmental projects. In addition, it should provide links to information on the impacts of the environment on their health and on how they can act to protect themselves.

Recommendation

2. The Government of Canada should mandate the Canadian Information System for the Environment to provide:
   a) environmental data to support a national set of sustainable development indicators, particularly those currently being developed by the National Round Table on the Environment and the Economy;
   b) data to support national environmental indicators;
   c) comprehensive, continuous, and credible reporting to Canadians on the state of the environment and the state of the environmental management system in Canada;
   d) means to set priorities for information development, through dialogue between users and producers of environmental information;
   e) tools to integrate environmental information from various sources and to integrate environmental information with other types of information;
   f) tools to explain and predict the connections among environmental change, human actions, and human well-being;
   g) means to improve access to and awareness of environmental information;
   h) means to foster "communities of practice" on environmental topics; and
   i) tools to foster environmental involvement at the local level.

3. A Canadian Information System for the Environment – Its Design and Operation

In the previous chapter we described the basic data, tools, and mechanisms that should be part of CISE. In this chapter we outline how many of the programs, services, and organizations handling environmental information can be integrated into a strategic information system for Canada that will provide those components.

Vision

The vision of CISE is to enable timely access to and effective application of relevant, credible, integrated environmental data and information in support of decision-making by all Canadians, through a co-ordinated, cooperative network of government agencies, the private sector, academia, non-government organizations, Aboriginal peoples, and others.

Conceptual design

In our interim report, we rejected the centralization of responsibilities for environmental information in a single organization. Instead, we proposed that the Canadian Information System for the Environment be conceived as a "distributed system" in which users and producers of environmental information (including governments, businesses, universities and others) are linked together in a virtual network.

Among the reasons why we believe a distributed system is best suited to Canada's needs are the following:

- It respects the constitutional and conventional division of political responsibility for environmental management among levels of government.
- It retains existing close connections between primary users of information and specialized information systems.
- It takes advantage of the tremendous capacity of existing systems and the initiative of each organization, thereby minimizing costs for improving environmental information.
- It is least disruptive to the continued provision of environmental information, thus minimizing risk.

Distributed information systems are an emerging solution in many fields, especially for environmental information. The Global Biodiversity Information Facility and the Australian Environmental Resources Information Network are two examples of systems adopting this approach. Recent advances in information and communications technologies such as Extensible Markup Language (XML) and broadband networks, are removing some remaining hurdles to full implementation.

In our proposed design for CISE, existing organizations will continue to perform the functions they do now involving:

- data collection;
- data quality assurance;
- database maintenance and archiving;
- document management;
- analysis, interpretation, and assessment; and
- information dissemination.

Their mandates will not be fundamentally changed.

What is new is the ability to think strategically about the management of environmental information as a whole, and to develop collective plans of action, regardless of who performs a particular function. The focus is on fostering cooperation among information producers to enhance the quality and quantity of environmental information available to users and bring better focus to these efforts to ensure the most important needs are met.

Certain tasks necessary for the management and operation of CISE as an integrated system will need to be provided centrally. These tasks are described in the following section. We believe that these tasks will comprise a relatively small proportion of the total effort involved in producing and providing environmental information to users. Without this central capacity, however, we do not believe it will be possible to correct the deficiencies we identified in the first chapter of this report.

The conceptual design we propose for CISE is that of an interlocking network of partners, supported by a small "hub." We refer to this hub as the *"Canadian Institute for Environmental Information"* (CIEI). This design is illustrated in the figure on the next page.

Recommendation

3. The Government of Canada should seek the participation of provinces and territories and non-government stakeholders in the collaborative management of environmental information through the Canadian Information System for the Environment.

CISE principles

The foundation for collaboration among the various organizations that manage and use environmental information is agreement on a set of common principles. These principles summarize the essential elements that should define CISE as a partnership.

Public good	Environmental information is an essential public good.
Citizen engagement	Public involvement should be encouraged wherever feasible, especially in setting information development priorities, establishing policies for information management, and evaluating the effectiveness and efficiency of the environmental information system.
Freedom of access	Environmental information in CISE should be accessible for non-commercial purposes with minimal charges or restrictions.
Cost-effectiveness	Duplication and overlap of information management functions among system partners, including data collection and database management, should be avoided wherever possible.
Focus on user needs	Information should be timely and available in the forms most suited to decision-making. Information development should be guided by the priorities of users.
Standards	Connectivity between environmental information systems should be enhanced through a standards-based approach.
Access to data	Primary rather than aggregated data should be provided wherever possible. Tools for analysis and display of environmental information should be available as part of the same interface where data are provided.
Transparency	All data in CISE must include information on its sources, methods, and limitations.
Respect for ownership	The right of owners of environmental data and information to set limitations on their use and distribution should be respected.
System sustainability	Expectations and responsibilities of system partners must be sustainable and must not place excessive burdens on their resources or technical capacity.

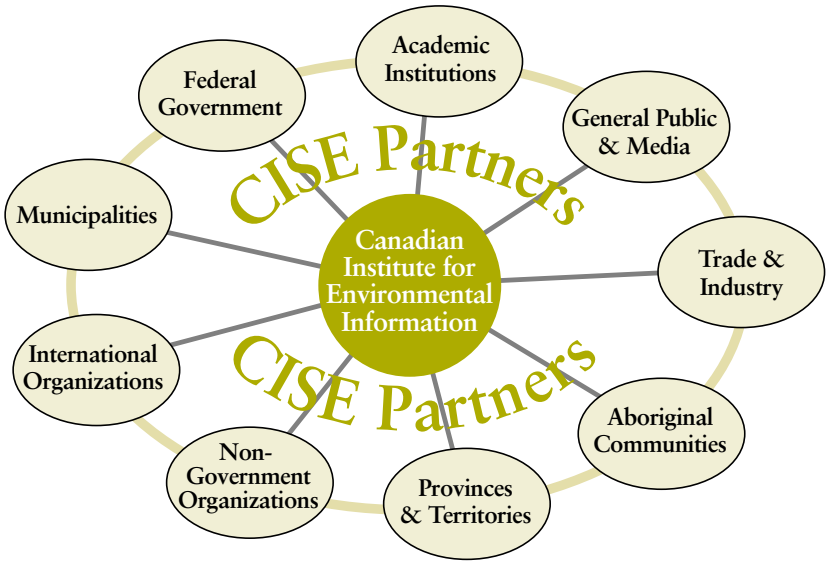

Figure: CISE as a distributed system

Role of the Canadian Institute for Environmental Information

While the network of CISE partners forms the basis for the system, CIEI will be the focal point for managing CISE, its major visible manifestation, and the primary gateway for access to environmental information by public users. Below, we describe what we view as the essential roles and rationale for CIEI. Further details on the division of roles and responsibilities between CIEI and partner organizations may be found in Annex D.

Supporting collective priority setting

For CISE to be considered an integrated system, it must have the capacity to identify system-wide priorities and to mobilize resources to meet those priorities. As a distributed system, CISE lacks the conventional mechanisms of management authority – partners retain the ability to act independently. Partnership in CISE implies, however, a recognition of the benefits of cooperation and a willingness to work together to plan and implement collective projects.

CIEI can provide a venue for partners (in practice, their representatives) to come together in their capacity as managers of the system. At a minimum, this will involve the provision of secretariat support to the governance structures of CISE. More importantly, it requires monitoring the quality and availability of environmental information itself and providing ongoing assessment of information users and their needs.

Promoting integration of environmental information

Environmental management still remains largely organized on a sectoral or media basis, such as by air, water, forests, fish, and so on. While the interactions between these environmental components are widely recognized and integrated science assessments are conducted on specific topics, organizational silos and professional disciplinary boundaries have discouraged widespread integration.

Promotion of integration can take several forms. The development of a unifying conceptual framework or frameworks is desirable as a means for ensuring greater coherence between different types of environmental information (and coherence with health and socio-economic information) and for representing the interactions between causal factors and desired outcomes. CIEI should also explore and support the development of models to explain and predict interactions between multiple environmental factors. Over time, CIEI should seek to become a clearinghouse and centre of expertise in the integration of environmental information as a resource to all CISE partners.

Promoting the use of common standards by CISE partners

Standards are the foundation for effective sharing of information among partners in a distributed system. Standards may establish how data are to be collected, how data can be transferred between systems, how data quality can be assured, and many other aspects of information system operations. By using common standards, data collected in one context can readily be used for other purposes, and data from various sources can be integrated more easily.

International or national standards have been developed for some kinds of environmental information, for example, considerable effort has been directed through GeoConnections in developing and applying national standards for geospatial data. In other aspects of environmental information, no accepted standard exists, competing standards are used in different systems, or standards are available but are not being implemented. Use of common standards remains problematic because the benefits of standards often accrue to secondary data users and not to the organization that initially collects the data.

To encourage the use of standards, CIEI should:

- increase awareness among partners of the standards that currently exist, the extent to which they are being applied, and gaps where standards may be needed;
- act as a neutral convenor to bring together stakeholders in the development of new standards in agreed priority areas; and
- promote the implementation of standards through a mix of incentives.

Providing incentives to fill data and information gaps

Given the distributed nature within CISE of most data collection, quality assurance, and management, it is imperative that CIEI has levers with which it can influence decisions by CISE partners to strengthen information resources.These incentives can take several forms:

- recognition of contributions;
- participation in CISE decision making;
- access to data from other sources;
- technical advice and training; and
- funding support.

Caution must be exercised in the provision of funding to organizations for the rebuilding of data collection programs affected by budgetary cutbacks. Assistance may be viewed negatively if it is directed disproportionately to those organizations that reduced funding for environmental data collection.

Helping users navigate the system

In our consultations, we heard from many users that they found it very difficult to locate the environmental information they need for decisions. The situation is analogous to trying to find a book in a huge library that lacks any sort of catalogue of its contents. As the volume of information increases this problem is further compounded.

Individual organizations are beginning to recognize these difficulties and to develop tools to assist their clients and information users. Internet portals, search engines, and metadata standards are becoming increasingly common elements of information management strategies. A significant challenge remains, though, in ensuring that the tools that are applied by various organizations have the capability to work together coherently.

Recommendation

4. The Government of Canada, in collaboration with provinces and territories, should foster the establishment of a Canadian Institute for Environmental Information to:
   a) support collective priority-setting for information development by Canadian Information System for the Environment partners;
   b) promote integration of environmental information;
   c) promote the use of common standards by Canadian Information System for the Environment partners;
   d) provide incentives to fill data and information gaps; and
   e) help users navigate the system and participate in Canadian Information System for the Environment decision-making.

Governance

The choice of governance structure is an important determinant of the future success of CISE. Our discussion here will focus on the broad outlines of a preferred structure. Many details, however, will inevitably depend on factors that will arise during negotiations with partner organizations. We also anticipate that it may not be possible, or desirable, to implement the preferred structure immediately and that a transitional period will be required.

The structural form we propose for CIEI is that of an independent organization, jointly sponsored by federal, provincial, and territorial governments. This form implies governance by a Board of Directors accountable to, and appointed by, ministers from each level of government. Another essential component of this model is a chief executive officer, chosen by the Board, with sufficient tools to manage the system.

The task given to the Board and the chief executive officer is a highly challenging one, given the decentralized nature of CISE. They will have a dual mandate: to manage the operations of CIEI and to provide leadership and direction to CISE as a whole.

In proposing that CIEI be an independent body, we recognize that this will have implications for accountability,

as traditional mechanisms that are used in government departments will not apply. Alternative mechanisms will be needed to ensure that the public interest is protected, including scrutiny by elected officials over the spending of public funds.

In the course of our work, we examined the institutional arrangements for provision of environmental information in 24 foreign and international environmental information systems. We also reviewed lessons learned from the establishment of several Canadian departments, agencies, and information systems, including the model of the Canada Health Infostructure. Based on this analysis, we believe that an independent organization is the most appropriate structure for CISE, for the following reasons:

- credibility;
- attracting participation of non-federal partners;
- neutrality; and
- visibility.

Credibility

Credibility of the information available through CISE is perhaps the most critical factor in determining its success. This is particularly true for non-expert users who may lack the ability to assess information validity and thus rely on the general reputation of the information provider. As an intermediary between the original collectors of data and the ultimate users, CIEI cannot control all aspects of data quality. It can, however, aim to provide users with full disclosure about the sources and methods used and any limitations of the underlying data. It must also restrict its analyses to description based on objective evidence and eschew judgements on policy. Users must be able to trust that the data and analysis are not biased towards or against a particular view.

Building credibility rests primarily on two factors: quality of the information based on sound methods of collection, analysis, and interpretation; and independence from bias or interference. The second of these factors directly concerns the choice of organizational structure.

Organizations responsible for environmental management decisions, including governments, are often perceived by stakeholders to have an interest in shaping the interpretation of environmental information. This view was often expressed in the course of our consultations. On the other hand, it is also generally acknowledged that government departments and agencies in Canada have a strong record of producing high-quality research and information in many areas, including the environment.

Attracting participation of non-federal government partners

A large proportion of Canadian environmental information is collected and held by provincial, territorial and municipal authorities. Businesses and trade associations, non-government organizations, Aboriginal communities and others also possess significant relevant information resources. To fully realize the benefits from CISE, it is essential that CISE be perceived by all potential partners as an inclusive system for all Canadians, and not merely a federal system.

We have concluded that CISE would be best placed to attract partners if CIEI is formed as an independent body. This would permit governance of CIEI by a Board of Directors that is representative of the full range of partners in CISE.

We also believe that it would be advantageous for CIEI, and its Board of Directors, to work closely with the various councils of federal, provincial and territorial ministers with environmental or natural resource responsibilities. Doing so would help to ensure that CISE priorities are reflective of national policy priorities and that collaborative efforts in developing and sharing data are maximized. In particular, we propose that CIEI have a close relationship with the Canadian Council of Ministers of the Environment, although it should also be available to all of the ministerial councils as a resource to them in furthering their objectives.

Neutrality

A key function of CIEI is its role as a neutral broker between environmental information producers and between producers and users. CIEI must be viewed by all CISE partners not to have its own policy agenda if it is to effectively facilitate agreement on system-wide priorities and standards.

Users of environmental information have diverse and often exacting needs. While many users will be found within government agencies, there are potentially many more outside of government. Systematic means of assessing user needs and priorities, such as surveys and consultations, will be required, but Board representation provides a clear message of the importance of user needs in setting strategic directions for CISE. In some instances, interests of users and of data producers may diverge, with the implication that a relative balance in representation at the Board level be sought.

Visibility

A high public profile for CIEI is important for several reasons:

- It will lead to greater awareness of environmental information by the public, thereby contributing to better environmental decisions.
- It will assist in expanding the network of CISE partners and increase the resources available through CISE.
- It will provide greater leverage in influencing change in systems operated by CISE partners.
- It will enhance protection from political interference.

We believe that visibility is best achieved if CIEI is structured as an independent body. This will enable it to develop its own "brand recognition" with Canadians in a way that is not possible as a unit within an existing department or agency.

Recommendation

5. The Canadian Institute for Environmental Information should be governed by a Board of Directors representative of all users and producers of environmental information. The principal roles of the Board of Directors should be to:
   a) provide leadership to the Canadian Information System for the Environment;
   b) set priorities and strategic directions for the Canadian Institute for Environmental Information;
   c) establish performance expectations for the Canadian Institute for Environmental Information and monitor and report on progress; and
   d) provide advice to the various ministerial councils (e.g., the Canadian Council of Ministers of the Environment) regarding environmental information.

4. A Canadian Information System for the Environment – Its Implementation

A phased approach

In the previous chapters, we identified our vision of CISE and in general terms, its structure, functions, and operations. We believe these provide sufficient detail and direction for beginning its implementation. As building the capacity of the entire environmental information system to improve environmental data, information, and analysis for decision-making in Canada will be a lengthy process, CISE should be developed incrementally, allowing it to adapt over time as co-operation, trust, and success grow.

To establish a firm foundation for CIEI and CISE, we recommend that there be an initial phase prior to the creation of the independent organization, so that resources can be focused on building partnerships and on producing immediate products and services. The initiatives that should be undertaken to establish that firm foundation include:

- developing a national consensus on priorities for improving environmental information in Canada to create the "roadmap" forward for CISE;
- developing and implementing a data exchange network between federal departments, provincial and territorial ministries and others to implement sharing of data and making data publicly available in an easily understood, integrated manner; and
- developing a clearinghouse of the environmental standards, indicators, policy targets, and data sets that will form the basis for reports to Canadians and support the first two initiatives.

To ensure that CIEI is successfully created, further analyses and consultations also should be undertaken in the initial phase. This would encompass analysing policies such as those on accessibility of data and cost recovery, detailing and achieving agreement on the funding arrangements for CIEI, and determining the most appropriate means to establish CIEI (e.g., legislation, incorporation).

During the initial phase, which we estimate may take two years, the central coordinating functions of CIEI should be developed under the leadership of the federal Minister of the Environment. Prior to its establishment as an independent organization, CIEI should be funded solely by the federal government, with the expectation that CISE partners will be investing resources to increase their capacity to share their data with, and integrate and use data from, other partners in CISE. While the CIEI will not have a formal Board of Directors prior to becoming an independent organization, we believe it is important that a management council, including provincial representation, be created to advise the Minister on the early projects for CISE, the development of the CIEI during the initial phase, and the structure of the eventual Board.

It is imperative that the interim structure be sufficiently funded to demonstrate to potential partners in CISE, in particular the provinces and territories, that the federal government is serious and that there is a real system that they are being asked to join and invest in.

Without this commitment and investment by the federal government, we are convinced that the firm basis needed to ensure partnership in CISE will not be established. This will only delay progress, and put the federal government behind other jurisdictions, within Canada and internationally, that are developing their own systems for sharing and integrating environmental data. The longer that governments and stakeholders postpone working together on these initiatives, the more difficult it will be to influence the process, and the more costly it will be for partners to adapt the systems they are putting in place.

"I feel very excited about the prospect of CISE and I would like to see the momentum informed by a real sense of urgency about its implementation. We have the expertise in Canada to be a world leader in the dissemination of reliable information."

Participant at Toronto session of consultations on CISE

We believe that this interim structure must be established immediately to build on the momentum that our Task Force has created. Our consultations have demonstrated to us that Canadians agree with the vision we have developed, and that it is time to take the next steps.

With the ground work described above completed in the first two years, CIEI should be established by year three with its physical infrastructure, its Board of Directors, and its funding structure in place. The "roadmap" would then guide data development nationally; the data-sharing agreements would be in place with some partners, in particular the provinces and territories; the clearinghouse would be established; projects would be underway; reports visible to Canadians would be produced; and the infrastructure would be in place to implement the sustainable development indicators currently being developed by the National Round Table on the Environment and the Economy. All of these processes would continue to be refined as CISE grows and evolves.

More detail on the initiatives that form the basis for establishing CISE are described below. The projects and reports that we recommend be commenced in the initial phase are described in chapter 7.

A national agenda for environmental information in Canada

One of the key functions of a strategic information infrastructure is to develop a consensus on what the priority data gaps are, from a "user" or policy maker perspective, in dialogue with data producers. This "roadmap," to be developed through dialogue between users and producers of environmental information, should represent a national consensus on priority gaps in our environmental information. It should identify:

- major current and emerging environmental issues;
- associated environmental information needs, and products and services related to those needs; and
- priorities for improving environmental information in Canada.

The "roadmap" should be summarized in a report on environmental information needs and distributed widely to partners in CISE and to funding agencies. The subsequent successful implementation of the Roadmap will depend on the collaboration and cooperation of all partners in CISE, i.e., all levels of government, academia, the private sector, non-government organizations, and others whose role will be to develop the data, information, and products required. We anticipate that this may mean establishing new databases or expanding existing ones, developing additional standards for gathering and managing data, developing research programs in specific or new areas, developing improved tools for analysis, and developing new information products.

A data exchange network

Sharing of data among partners in CISE requires the establishment of a data exchange network, formalized through data-sharing agreements. The data exchange network refers to the technical and policy infrastructure required for CISE (CIEI and its partners) to efficiently exchange and make available environmental data and information. The success of the network will depend on the ability of agencies to negotiate and define the exact format in which data will be exchanged (data exchange templates), to document partnership agreements, and to hold parties responsible for fulfilling those agreements.

Building this network will require the active involvement of partners, initially including federal departments, and

provincial and territorial agencies. The steps to establishing the network will include the following:

- coordinate the establishment of data standards with data exchange templates;
- design and implement the required technical infrastructure;
- implement network administration and maintenance processes;
- negotiate data-sharing agreements; and
- establish an implementation plan.

An environmental information clearinghouse

A critical first step in developing an information system is to build awareness of existing information resources and information management practices. This is necessary to identify information gaps, guide the development of new data and information products, and facilitate access to the right information.

Although the list of types of data and information that should form such a clearinghouse is large and will continually be revised, we believe that those listed below are most relevant, initially, in developing an information system to be used to understand the state of the Canadian environment and the state of the environmental management system in Canada. The clearinghouse should be user-friendly and be available online to all.

"A national effort to incorporate and collate regional data is missing. There is no collective inventory of the substances, locations, and species presently being monitored by federal departments."

Commissioner of the Environment and Sustainable Development, 1999[18]

The clearinghouse should be developed initially with Canada-wide inventories of:

- environmental databases;
- monitoring programs;
- environmental indicators;
- public state of environment or sustainability reports;
- corporate environmental performance reports;
- environmental policy targets, both national and international, to which Canada is committed, with annual tracking of progress towards meeting those targets; and
- environmental data standards in use or being developed in Canada and internationally.

Recommendation

6. In the initial phase of implementing the Canadian Information System for the Environment, the Minister of the Environment should:
   a) coordinate the development of a national agenda for environmental information in Canada, in collaboration with Statistics Canada;
   b) secure the participation of key partners in the Canadian Information System for the Environment by means of data sharing agreements, and begin implementation of infrastructure to enable data exchange;
   c) develop a clearinghouse of environmental standards, indicators, policy targets, and data sets, and provide easy access to them; and
   d) establish a multistakeholder management council to provide advice on the development of CISE during the initial phase.

5. Aboriginal Peoples and Environmental Information

A significant objective of CISE is to enable Canadian citizens and organizations to adapt to environmental change and to play their individual and collective roles in environmental management. Of particular importance in this area are Aboriginal peoples, who are both users and producers of environmental information in Canada.

"What is exciting about this is that once we get into the area of looking at the environment, we are not just looking at cleanup, we are looking at the development of jobs, our own industries, biodegradable products. I think it would lead to economic development down the road if we do the planning."

Participant at Aboriginal Focus Group Discussion

On behalf of our Task Force, Task Force member Ovide Mercredi chaired an Aboriginal focus group discussion in August 2001 to seek input on the directions being proposed and initial guidance on how CISE could be developed to meet the needs of Aboriginal communities. Participants at this focus group came from across Canada and included representatives from the Native Women's Association of Canada, Métis National Council, Inuit Tapirisat of Canada, Métis National Council of Women, Assembly of First Nations, Congress of Aboriginal People, and Pauktuutit Inuit Women's Association.

Despite some concerns about being brought into the CISE process late, focus group participants recognized the importance of an environmental information system in which they would participate fully by both providing information as well as using information to guide decision making. The full report of that workshop can be found on our website at **www.ec.gc.ca/cise.** It can also be found on the website established for, and run by, Aboriginal peoples to provide input to the CISE initiative. The website, entitled Environmental Information Systems for Aboriginal Peoples, can be located at **www.eisap.org**.

"We are not just consumers of information. Our people produce a lot of information too and it is important that government understands that our role is not just to take advantage of a system that they put into place, but our role is to put into place a system that would reflect our own information products."

Participant at Aboriginal Focus Group Discussion

Aboriginal peoples have a knowledge of their local environment that is experience-based and is gained over time by careful and critical observations. This knowledge comprises a deep understanding of the complex interrelationships between individual environmental components, the dynamics of local ecosystems, and the peoples that live in them. Linking western scientific knowledge and traditional knowledge can provide a much greater degree of understanding of the environment and afford improved management, conservation and resource development opportunities. The two knowledge systems should be viewed as parallel systems to be shared when needed, providing ongoing benefits and recognition to their holders.

"Science as a tool combined with traditional ecological knowledge is a legitimate and powerful tool for resource management. When we talk about traditional or ecological knowledge we are talking about the land, water, fish, wildlife, air, the whole universe. It goes beyond just the physical matter, but involves our whole relationship with all of creation."

Participant at Aboriginal Focus Group Discussion

Development of CISE must recognize the valuable contribution of traditional knowledge to scientific knowledge and the unique decision-making processes in Aboriginal communities. It must reflect how Aboriginal peoples wish to safeguard their knowledge, what mechanisms are most appropriate to them, and how they might wish to link information technologies with their traditional systems. We believe that inclusion of Aboriginal peoples and an ongoing dialogue that reflects respect for, and recognition of, the value of traditional knowledge and the rights of the holders of that knowledge are an important next step in the development and implementation of CISE. It should also reflect that means other than the Internet should be acknowledged as essential for Aboriginal communities.

"It [the Internet] might be a primary way [of communication] for a nationally based institute, but certainly not the way at the community level."

Participant at Aboriginal Focus Group Discussion

The Task Force supports the recommendations made to us by representatives of Canada's national Aboriginal organizations that improved capacity is needed for Aboriginal communities both to develop their own environmental information products, services, and systems and to access the skills and knowledge that exist within their communities. Strengthening community capacity in these areas will provide a basis on which Aboriginal governments and national Aboriginal organizations can develop and refine their own environmental information systems.

"Dealing with environmental issues and traditional knowledge, this is something that should be handed down to our next generation and encouraging our youth to get more actively involved with what we do … would be very important and would assist in making excellent decisions in the future."

Participant at Aboriginal Focus Group Discussion

Improving capacity within Aboriginal communities to maintain and utilize their knowledge will be a lengthy and costly process, as the needs and capacities of each Aboriginal community are different. Therefore, we recommend an approach that uses pilot projects within representative communities, upon which commonalities can be identified, best practices shared, and a solid basis on which to develop productive next steps can be formed. This approach should be complemented by the development and ongoing maintenance of an Aboriginal website on the CISE initiative to facilitate information sharing and on-line access amongst Aboriginal peoples to new developments and ideas.

Recommendations

7. The Minister of the Environment should facilitate pilot projects in Aboriginal communities to enhance community capacity to access local knowledge and to develop the information systems to effectively utilize that knowledge.
8. The Minister of the Environment should support the formation of an Aboriginal Steering Committee, composed of representatives of national Aboriginal organizations, to:
   a) plan and coordinate the development of the pilot projects to facilitate the design and implementation of the Canadian Information System for the Environment with respect to environmental decision-making of Aboriginal peoples; and
   b) provide advice to and coordinate the undertaking of community level consultations to identify the range of environmental information needs and information-gathering and dissemination capacities of Aboriginal communities.

6. The Benefits CISE Will Provide

Moving forward with CISE will provide tangible benefits for all Canadians. Below we list some of the benefits that we believe will be realized over time by the public, policy-makers at all levels of government, researchers, teachers, non-government organizations, and the private sector. While we have listed the benefits by group, many of the benefits described will apply to several groups. This list is not comprehensive; rather, it is a snapshot, as the products and services provided by CISE will evolve over time as understanding of the needs of each user group grows.

Canadians

Canadians are ready to take increasing responsibility for the quality of their lives. But they need information to understand how their quality of life is inherently linked to the quality of the environment and they need information to enable them to participate more fully in local, provincial, territorial, and national policy-making.

Benefits that Canadians will receive include:

- easy access to websites that help them to locate, use and share environmental information relevant to their communities;
- easy access to resources to help them become familiar with environmental issues and the actions they can take;
- easy access to information where they can learn of opportunities to volunteer in environmental projects in their communities;
- easy-to-read, factual reports on environmental issues of national priority, based on a national set of indicators, including those linking the environment to the economy;
- factual reports on what we know and don't know about environmental issues of national priority to help improve their understanding of the basis for current policies and action;
- easy access to factual reports on the state of the Canadian environment, including projections of how it will change in the future, to help them better judge where environmental conditions are improving and where they are not; and
- factual reports on the performance of Canada's governments in meeting their environmental commitments.

National Pollutant Release Inventory

A successful example of information leading to positive change in the environment is the National Pollutant Release Inventory (NPRI). Industries are required to submit data to NPRI on quantities of pollutants released into air or water, disposed in landfills or deep wells, or sent off-site for recycling. These data are made available to the public electronically and in annual printed reports. Below are some examples of how communities, industry, non-government organizations, and governments have used NPRI data to catalyze change:

- Imperial Oil put in place an action plan in 1994 to manage its emissions of substances reported to the NPRI. By implementing a leak detection and repair program, improving the accuracy of its emissions estimates, and setting priorities for cost-effective emissions reductions, Imperial Oil reduced emissions from refining, chemicals, and resources operations from 3140 tonnes in 1997 to 2880 tonnes in 1998 and reduced emissions of volatile organic compounds such as benzene, ethylene and propylene by 63%.
- The Société pour Vaincre la Pollution, Union St-Laurent Grands Lacs (Great Lakes United), STOP, and World Wildlife Fund combined to analyse and compare discharges along a strip of the St. Lawrence River between Valleyfield and Sorel. Their analysis showed that the Montreal Urban Community's new sewage treatment plant was having the greatest negative impact on that part of the St. Lawrence River. The groups used this finding to recommend that industries discharging into Montreal's sewers pre-treat or eliminate their toxic discharges.
- In April 2001, the Canadian Environmental Defence Fund, the Canadian Environmental Law Association, and the Canadian Institute for Environmental Law and Policy developed the "Scorecard" to assist Canadians and communities in using data from the NPRI. This website merges NPRI data with about 300 other databases to enable Canadians to access, by their postal code, information on the type and quantity of pollutants being released in their communities and potential health risks. It also ranks facility performance and provides information about applicable federal and provincial environmental laws and policies.

Canadian Institute for Environmental Law and Policy, 2000[19]

Communities

As resource-constrained communities and their governments face an increased demand for environmental action, they are seeking better access to information, tools, and best practices, and a stronger, collective voice for obtaining the information they need to make environmentally responsible decisions.

Benefits that communities across Canada will receive include:

- access to integrated environmental information, e.g., ability to link information on water and air quality, as well as about waste management and local contamination, with other types of information to make better decisions on land use and investments in local infrastructure;
- development of common definitions and standards that can be used to collect and report information in a uniform format comparable across communities (e.g., energy statistics, waste management statistics, land use, pesticide use). This will allow municipal governments to compare themselves with others and learn from others who have developed more sustainable practices. By sharing information with provincial, territorial and federal governments in a consistent format, communities can also ensure that policies and programs are designed with appropriate knowledge of community conditions and needs; and
- input on an ongoing basis to CISE for their environmental information needs in order to help shape priorities for data development.

Policy makers

Science-intensive policy decisions depend on obtaining and interpreting trusted, high-quality, up-to-date information. Policy makers do not usually require access to individual data sets, but require processed data and information products. These products come from the integration and analysis of a range of different data types, often across a range of disciplines.

"Environmental information is an essential tool to assist in bringing about the changes in lifestyle necessary to achieve a more sustainable society in the 21st century."

Noel Dempsey,
Minister of Environment, Ireland, 2000 [20]

Benefits that policy makers will receive include:

- better-quantified relationships between the environment and the economy, based on improved data to support sustainable development indicators;

Weather and Climate Information

For Canada's weather-sensitive industries, timeliness and reliability of weather, climate and forecasting information can significantly affect their productivity and their competitiveness. In agriculture, this includes the planning of crop planting, pest management and harvesting; in construction, setting design and construction standards; and for travel industries, planning routes and schedules for air, road, and marine travel.

Governments also use weather and climate information in the delivery of public services, such as search and rescue and emergency preparedness, and in regulation, including building design standards. The Saguenay flood of July 18-21, 1996 was Canada's first billion-dollar disaster. The surge of water, rocks, trees, and mud killed 10 people and forced 12000 residents to flee their homes. Many roads and bridges in the region disappeared. Prediction of such events allows for the planning of economically feasible relief measures and the development of warning systems.

The examples below illustrate the power of environmental information to influence behaviour, leading to better health protection and monetary savings:

- The UV Index is a simple numerical scale of the strength of the sun's ultraviolet rays, reported with weather forecasts on a daily basis throughout the summer months. Messages developed by Health Canada to encourage "sunwise" behaviour accompany the UV forecast. Within four years, awareness of the Index had risen to 91%, and 51% of Canadians indicated that they took extra precaution to protect their health when the UV Index was high.
- Smog is a serious public health problem for those with respiratory illnesses and for healthy people who engage in moderate to vigorous physical activities. The Ontario Medical Association estimates that air pollution costs the Ontario economy $10 billion annually due to lost time at work, emergency room visits and hospital admissions. Smog forecasting and smog advisories enable Canadians to reschedule their outdoor activity when a smog episode is expected. This information is also used by schools to reduce outdoor activities of students and by hospitals, which can schedule for increased demands on their services due to increased respiratory ailments.

- better information on effectiveness of actions taken based on improved data and indicators;
- better ability to establish strategic priorities across issues;
- improved ability to influence data being produced by the environmental sciences community so that the information they receive is more timely and relevant to decision-making;
- better understanding of the scientific basis of environmental issues; and
- better ability to anticipate and act on emerging threats through improved interaction with the environmental sciences community and scientifically-based projections and scenarios of the future.

Provinces and territories

Jurisdiction on many areas of the environment are shared between the federal, provincial and territorial governments. Provinces and territories also collect and organize significant amounts of community-level environmental information.

Benefits that provinces and territories will receive include:

- harmonization of standards for data collection, data exchange, data management, etc.;
- increased availability of standardized information allowing them to make comparisons and identify best practices;
- increased access to integrated information of other jurisdictions and stakeholders; and
- reduced expenditures due to economies of scale which will occur as part of the system (e.g., development and application of metadata standards in the area of information management, adoption of common templates for citizen monitoring programs; or collaboration with others in the development of new data on the environment).

Non-government organizations

Non-government organizations can be extremely effective in mobilizing their communities. They have the ability and the motivation to use data and information to produce information products and tools that motivate others and improve the debate on many issues. Many non-government organizations are poorly resourced, and free and easy access to credible

E-Science: Collaboration Through Grids

E-science refers to the large-scale science that will increasingly be carried out through distributed global collaboration enabled by the Internet. Typically, such collaborative scientific enterprises rely on very large data collections, very large-scale computing resources, and high performance visualization for individual users. A much more powerful infrastructure than the World Wide Web is needed to support e-Science, often termed the "Grid". The Grid is an emergent infrastructure capable of delivering dependable, pervasive and uniform access to a set of globally distributed, dynamic and heterogeneous resources. Just as the Web continues to change the way we communicate, the Grid aims to change the ways we access and think of data creation.

Many environmental applications can benefit from the development of Grids, including environmental modelling, earth observation and bioinformatics. The following are some Canadian examples:

- Earth Observation for Sustainable Development of Forests is a national project of the Canadian Forest Service and the Canadian Space Agency, in cooperation with provinces and territories. The project will monitor, using space based technology, the status and major changes over time in the composition, distribution, structure and function of Canada's forests. In addition to supporting the sustainable use of forest resources, the project will also help Canada meet international commitments for forest information under the Kyoto Protocol on climate change.
- Bioinformatics is the application of mathematics and computer science to biological information, especially to the vast quantities of data now being generated through automated gene and protein sequencing technologies. Bioinformatics is expected to yield benefits in health care, agriculture, environment, forestry and aquaculture. Two major Canadian initiatives in this area are the Canadian Bioinformatics Resource, a collaborative venture of several National Research Council institutes and the Canadian Network for the Advancement of Research, Industry and Education, and the Bioinformatics Supercomputing Centre, based at the Hospital for Sick Children in Toronto. The latter organization is the central repository for data generated by the Human Genome Initiative.
- The Neptune Grid is a joint Canada/United States project to build a large undersea network linking sensors, robotic submarines, undersea cameras and other devices. The Neptune Grid will be used to gather data related to seismology, sea vents, fish migrations and populations, and deep-sea aquatic life.

information with which to develop their products and their actions is necessary for increased effectiveness.

Benefits that non-government organizations will receive include:

- improved access to credible environmental data and information;
- improved ability for greater scrutiny of policy decisions, and hence greater ability to hold governments and others accountable for their actions;
- increased opportunities for displaying information in ways that motivate action at the individual, community, regional, or national level;
- improved ability to use credible information in their products, and consequent decreased time in debating the "facts";
- reduced costs due to easier access to the data and information of others; and
- information and tools to assist them in delivering successful programs for environmentally related behavioural change. These could include information and tools to identify and overcome behavioural barriers to change, as well as to aid in the design and evaluation of the effectiveness of programs. CISE could also provide web-based tool kits to support such campaigns and make available best practices on the conduct of such campaigns.

Businesses

Businesses require environmental information to make critical decisions that directly affect their productivity and overall competitiveness. In addition, by demonstrating their sound environmental performance and best practices, they can achieve a competitive edge in a market that is increasing its environmental scrutiny of corporate activities.

Benefits that businesses will receive include:

- improved access to tools and best practices to report on environmental issues and performance;
- improved ability for eco-efficiency and bench marking;
- increased opportunities for partnership and for innovation, particularly in the development of value-added services due to greater accessibility of environmental data; and
- reduced burden of reporting through common federal, provincial and territorial standards and one-window access.

Researchers

Widespread use of powerful new technologies for data acquisition, storage, and communication has resulted in a rapidly growing quantity of data that scientists are generating, preserving, and distributing. Moreover, because of increasingly diverse applications for the results of scientific research, these data are becoming ever more useful and valuable in many sectors outside the specific areas of research that generate them. Collaboration among members of the scientific communities within and among several countries is resulting in knowledge networks and data centres supporting collaborative data-sharing. The scientific community is increasingly dependent on these networks for their skills in data management and distribution and on their capacity to support national and international scientific efforts.

Benefits that researchers will receive include:

- greater understanding of the needs of policy makers, and hence a greater ability to produce data and subsequent information products of increased relevance to policy decisions;
- common standards for data collection, data management and data sharing to effectively participate in national and international knowledge networks;
- enhanced opportunities for analysis of research data and development of models and other analytical and predictive tools due to greater access to standardized data sets;
- greater opportunities to develop new lines of research due to improved access to data or awareness of data sets of others; and
- increased opportunities for partnerships nationally, internationally, and across disciplines due to improved sharing and integration of data and increased awareness of data sets of others.

Students and teachers

University professors on a daily basis are faced with students who are interested in conducting research projects using data. For a graduate or undergraduate student, the ability to quickly locate relevant data sets and identify questions of interest permits the student to devote most of his or her time to learning how to analyse data rather than to searching for data.

Benefits that students and teachers will receive include:

- easier and faster access to data and information for class projects;
- enhanced opportunities for developing analytical skills, and analytical tools, particularly for horizontal analyses; and
- websites where they can enter their own environmental monitoring observations or learn where they can volunteer to help the environment.

7. Early Projects for CISE

In addition to initiating action on the continuing tasks described in chapter 4, CISE will need to demonstrate tangible benefits for its partners and potential partners through early projects. These projects will provide the first environmental content for CIEI analytical reports and public services such as electronic data access, as well as form the basis for data sharing agreements, data development, and infrastructure support.

The priorities we recommend for early projects are based on consideration of the following factors:

- environmental issues on which Canadians have expressed the greatest interest for additional information;
- requirements of the Environment and Sustainable Development Indicators initiative;
- presence of critical gaps in information required to support national policy decisions;
- likelihood of establishing cooperative data sharing arrangements among essential partners;
- ability to yield products or services of benefit to a broad spectrum of users within the initial phase;
- opportunity for linkages between the projects, to maximize efficiency of effort and resources;
- ability to demonstrate the full range of functions within CISE, thus providing the best test of the system concept.

Based on the factors listed above, we recommend that early projects be undertaken in the following areas:

- environment and human health;
- climate change; and
- biodiversity.

Our recommendations and rationale for each of these areas is given in the following sections, along with some suggested specific projects.

These projects range from development of standards, to integration of data within a specific topic, to integration of data from several different topics. We strongly urge that each project undertaken include provision of a report to Canadians that addresses the state of the environment with respect to that topic, the progress being made toward policy targets for that topic, or the current state of knowledge about the topic.

Environment and human health

Canadians consistently identify the health impacts of environmental contaminants as their greatest environmental concern. We lack comprehensive, reliable information on exposure to contaminants in air, water, food and soil needed to fully understand health risks and assess effectiveness of policies and programs.

Within this area we have identified four topics on which projects should be commenced in the initial phase of CISE implementation: water quality, air quality, pollutant releases and the Great Lakes and St. Lawrence River ecosystem. These are described below.

Water quality

Jurisdiction for water is shared in Canada. As late as 1987, a water quality and quantity monitoring program

existed across the country which was planned and delivered by a national team. Since then, federal and provincial funding has been reduced, resulting in a decline in monitoring activities, including analysis, interpretation and reporting. Fewer sites and parameters are being monitored, and inconsistencies in monitoring, testing, and data management standards are growing. In addition, information on water quality is based on measurements which are of little relevance to today's issues, which include, pesticides, microbial pathogens, and endocrine disrupting substances. The disparate water quality monitoring programs of today are rarely linked, and do not provide a cohesive national picture; nor do they provide adequate trend assessment information (i.e., improving / stable / deteriorating conditions) or early detection of threats (chemical or biological stressors).

The Canadian Council of Ministers of the Environment (CCME), at their September 2001 meeting, initiated collaborative actions to complement their individual initiatives to protect the quality of drinking water "from source to tap." One of those actions consists of providing information to Canadians through the CCME website with links to water quality information from all jurisdictions.

CISE should support the efforts of CCME by facilitating the integration of existing databases on source and ambient water quality (surface water and ground water), drinking water quality, and water flows and levels in lake and streams from federal, provincial, territorial and municipal water agencies. This integrated information on water quality and quantity should be provided to Canadians with tools for mapping, analysis of trends, and comparison with water quality guidelines, standards and objectives. A report, intended for the public, should be prepared which provides Canadians with clear statements on what is known, and not known, about their water. Analyses of the integrated data should also be done to identify key gaps in the monitoring information to facilitate discussion by CCME and others on the next steps to fill those gaps.

Over time, Canada should also have a safe water information network whereby source water quality, finished drinking water quality and waterborne disease surveillance information is integrated and provided to decision-makers as a basis for detecting, predicting and preventing waterborne illness such as that seen in North Battleford and other cities in Canada this year. CISE should initiate a pilot project for a safe water information network. This would include selecting pilot communities where concomitant disease surveillance and source and drinking water quality monitoring occur, and mapping waterborne disease incidence with associated water quality.

Air quality

Like water quality, constitutional jurisdiction for managing air pollution is shared between the federal and provincial governments. Several ambient air quality monitoring programs are in place in Canada, for example,

- Canadian Air and Precipitation Monitoring Network which monitors acid rain and smog-related constituents in 19 sites across Canada.
- Canadian Atmospheric Mercury Measurement Network which measures mercury levels in air at 11 sites across Canada.
- Integrated Atmospheric Deposition Network in the Great Lakes Basin which measures various persistent organic substances and their deposition from the atmosphere.
- National Air Pollution Surveillance Network which has 239 air monitoring stations in 136 urban areas across Canada and gathers measurements for sulphur dioxide, carbon dioxide, nitrogen oxides, ozone and particulate matter.

As a first step, CISE should facilitate the integration of existing information from federal, provincial and other air quality monitoring programs. This integrated information on air quality should be provided to Canadians with tools for mapping, analysis of trends, and comparison with air quality guidelines, standards and objectives, where they exist. Near real-time reporting of this information should be explored. A report, intended for the public, should be prepared which provides Canadians with clear statements on the state of air quality in Canada.

Pollutant releases

Currently pollutant release information can be found in several federal government departments, provincial and territorial agencies, and municipalities. The data are not necessarily comparable due to lack of common identifiers, common units of reporting, etc. Some do not exist electronically. Other than those releases available through the National Pollutant Release Inventory, the data may not be routinely accessible to Canadians nor are they necessarily accompanied by information which provides context, such as information on environmental or human health effects.

The lack of a single window for reporting pollutant release information poses a burden on industry. It also does not provide Canadians with one window to access the information. Currently the federal government and the province of Ontario are working together to develop a one-window approach.

CISE, in partnership with Environment Canada, provincial agencies, the private sector and others should facilitate the development of a standard data exchange format for reporting of pollutant releases, and subsequent one window reporting to Canadians.

Great Lakes and St. Lawrence River ecosystem

Hundreds of millions of dollars have been invested in programs to clean up and conserve the Great Lakes and St. Lawrence River Basin, the largest freshwater ecosystem in the world. Recent audits of these programs, however, have concluded that there is not an overall clear picture of the state of the ecosystem, nor of the progress that the programs have made on improving the state of the environment over the last several years.[21]

A considerable amount of information has been collected by federal, provincial and municipal governments as well as others on this ecosystem. Existing data from these many sources need to be integrated (e.g., data on air quality, water quality, biodiversity, and contaminant levels) to strengthen the basis for setting priorities and developing effective plans for the future.

CISE, through partnerships with federal, provincial, municipal governments and others, should facilitate the development of standard protocols to integrate existing information on the Great Lakes and St. Lawrence River ecosystem. Following analyses of the integrated information, a report should be provided to Canadians about what is known and not known about the state of the ecosystem, and that describes the next steps in filling key information gaps.

Climate change

In order to comply with the requirements of the United Nations Framework Convention on Climate Change, Canada prepares an annual, national inventory of anthropogenic emissions and removals of greenhouse gases. Challenges in developing this inventory include collecting, organizing and storing large amounts of data of various types and formats; integrating the information generated from the various sources; reconciling the format required for preparing emission inventories to meet international reporting requirements while meeting the "place-based" information needs of the public, governments at all levels, and the private sector.

Municipal emissions

Municipal governments consume energy in their own operations and influence directly or indirectly energy consumption and emissions throughout communities through land use and transportation planning, codes, bylaws and procurement. Municipal governments have the potential directly or indirectly to influence up to half of Canada's greenhouse gas emissions (360Mt). The first step for municipalities in taking action to reduce greenhouse gas emissions is to develop an inventory of current emissions. It is important that the data developed in these inventories are standardized so that they can be aggregated at the regional, provincial and national levels. Currently, just over 20 inventories at the municipal level have been developed, and securing the data to do so is a struggle for most municipalities.

As an early project, CISE should facilitate the development of standardized inventories of greenhouse gases at the municipal level, in partnership with the Federation of Canadian Municipalities, and the provincial, territorial and federal governments.

Cryosphere information

The cryosphere (snow, sea ice, freshwater ice, permafrost, glaciers and ice caps) is a major component of the Canadian environment. Changes to the cryosphere can affect water supply (e.g. 15% of Alberta's water comes from glaciers), drought and flood conditions, ice jams, navigation, transportation (especially for northern ice roads), moisture recharge in agricultural soils, and hydroelectric power reservoirs. Observations have documented significant changes to the Canadian cryosphere during the past 50 years, with further changes projected by climate models.

CISE should support collaborative industry-government-university efforts to develop a Canadian Cryosphere Information Network, especially the integration of key data sets and the development of tools for data visualization. Outreach pilot projects are also needed to explore how online cryospheric information can incorporate traditional and local knowledge and reflect the needs of northern communities that will be most affected by a changing cryosphere.

Biodiversity

Through its ratification of the Convention on Biological Diversity, Canada has confirmed its commitment to conserve biological diversity, to use biological resources in a sustainable manner, and to share equitably the benefits arising from the use of genetic resources. Canada faces many challenges in meeting this commitment, including significant gaps in the data and information required to identify threats to biodiversity and to manage biological resources.

"The electronic biodiversity knowledge base we are creating will become one of the building blocks for Canada's success in life sciences … Our challenge is to make this information accessible to everyone."

Lyle Vanclief, March 2001[22]

Arguments for preserving biodiversity often rely on the potential utility of species as sources of new medicines, foods and biofuels – and there is no doubt that the benefits to be derived from uncovering nature's secrets are virtually unlimited, and the wealth of nations will increasingly depend on biological resources. Species, however, are worth protecting for another reason. Declining species counts is an indicator of imbalance in ecosystems, an imbalance that may eventually impact us and the quality of life we currently enjoy. While there are more than 70,000 species known to live in Canada, there are probably about as many again still undescribed by science. Even more alarming, is that we are only able to assess the status of about 1,600 species.

At their September 2001 meeting, federal, provincial, and territorial ministers with responsibility for wildlife, forests, and fisheries and aquaculture agreed to collaborate on the following implementation priorities for biodiversity issues of Canada-wide concern:

- develop a biodiversity science agenda;
- enhance capacity to report on status and trends;
- deal with invasive alien species; and
- engage Canadians by promoting stewardship.

Central to implementing these priorities is the need to establish a biodiversity knowledge network for Canada as a system partner of the CISE initiative. The following suggested projects, which focus on strengthening the basis for the sharing of, and access to, biodiversity information, have been identified as critical to establishing such a network. They also draw on the recommendations in the strategic document *Towards a Biodiversity Knowledge and Innovation Network,* the outcome of the March 2001 Natural Capital Conference (See Annex E for list of recommendations from the conference).

Canada is now a signatory and a voting member to the Global Biodiversity Information Facility (GBIF) which commits Canada to building our biodiversity knowledge and making it accessible to the public through the Internet. Canada does not yet have adequate infrastructure to participate in the GBIF. We believe that the CIEI should be designated as the Canadian node for the GBIF and to be the national focal point for GBIF activity.

Canada is active in a very limited fashion in work related to international standard-setting exercises for the naming and classification of species. Establishment of an agreed-upon standard for species names and classifications is a critical first step to effectively sharing data. CISE should facilitate the development and adoption of internationally-accepted taxonomic and metadata standards through the North American Integrated Taxonomic Information System and Species 2000, an index of all the world's known species. It should also facilitate the development of a vegetation classification system in accordance with international standards.

CISE should facilitate case studies on data management to identify what Canada needs to do to improve public access to key biodiversity data. These case studies should be undertaken in the priority areas identified by the federal, provincial and territorial ministers, (e.g., invasive species, species at risk).

CISE should also facilitate the development of strong nodes as part of the biodiversity network and support development of tools to manage biodiversity knowledge in the network. This network capacity building is critical to the establishment of a biodiversity network as part of CISE.

Recommendations

9. The Minister of the Environment should, as an urgent priority, undertake early projects to improve data quality, integration and reporting in the following areas:

   a) environment and human health;

   b) climate change; and

   c) biodiversity.

10. The Canadian Institute for Environmental Information should be designated as the Canadian node for the Global Biodiversity Information Facility.

Glossary

Biodiversity (Biological diversity)

The variability among living organisms from all sources including, inter alia, terrestrial, marine and other ecosystems and the ecological complexes of which the are part; this includes diversity within species, between species and of ecosystems.

Data

Basic observations or measurements. For example, weather data could include measurements of wind speed, temperature and precipitation at a particular location, time and date.

Data Standards

Documented agreements on formats and definitions of common data to bring better consistency and quality to the information that organizations maintain.

Data Exchange Agreements

Documents formally adopted by two or more partners for the purpose of defining the responsibilities of each party, the legal standing (if any) of the proposed exchange and the technical details necessary to initiate and conduct electronic information exchange.

Distributed Information System

An information system of relatively independent subsystems which are, however, tied together within the organizational framework.

Environmental Indicator

A selected key statistic that represents or summarizes a significant aspect of the state of the environment, natural resource sustainability or related human activity. Environmental indicators focus on trends in environmental changes, the stresses that are causing them, how ecosystems and their components are responding to changes, and societal responses to prevent, reduce or ameliorate these stresses.

Environmental Information

Information about the past, present and future states of the environment, as well as information on how human activities affect the natural environment, how natural processes affect human well-being, and how people affect one another through changes they make to the natural environment.

Interoperability

The ability of two or more hardware devices, or two or more software routines, to work together.

Metadata

It is “structured data about data.” The criteria that defines a data field. Metadata can be generated either “by hand” or derived automatically using software.

Monitoring (or Environmental Monitoring)

Continuous or frequent standardized measurement and observations of the environment.

Natural Capital

Natural assets in their role of providing natural resource inputs and environmental services for economic production. There are three main categories of natural capital: renewable and non-renewable natural resource stocks (i.e., sub-soil resources, timber, fish, wildlife and water), land and ecosystems.

Sustainable Development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable Development Indicators

Indicators that measure progress made in sustainable growth and development.

Notes

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4. Stratos, Inc. *The Role of Corporate Environmental Reporting in a Canadian Information System for the Environment*. Report prepared for the Task Force on a Canadian Information System for the Environment. Ottawa, 2001.
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17. The Hon. David Anderson, Minister of the Environment. Speech to the National Conference on Sustainable Development Indicators organized by the National Round Table on the Environment and the Economy. Ottawa, March 27, 2001.

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20. The Hon. Noel Dempsey, Minister of the Environment, Ireland. "Governments and Non-governmental Organizations Join Forces In Adopting The Dublin Declaration On Access To Environmental Information." United Nations Environment Programme (UNEP) press release. September 2000.

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22. The Hon. Lyle Vanclief, Minister of Agriculture and Agri-Food Canada. Speech to the Canadian Biodiversity Network Conference. Ottawa, March 2, 2001.

Background papers prepared for the Task Force are available on-line at: **http://www.ec.gc.ca/cise**

Annex A:
Environmental Information Systems in Canada

We have listed below several environmental information systems in Canada that are designed to provide data or information concerning ecological matters or natural resources. This is not a comprehensive list but a representative list of inventories, gateways and clearinghouses, as well as systems that integrate data within a sector or topic.

We have not included health information systems or economic information systems. However, we firmly believe that a Canadian Information System for the Environment should link to such systems, including those being developed by the Canadian Institute for Health Information and Statistics Canada's System of National Accounts.

- The **Air Pollutant Emissions Inventories** of Environment Canada, provide emission summaries and maps for selected pollutants such as particulates, sulphur oxides, nitrogen oxides, volatile organic compounds and carbon monoxide.
- **Canadian Consumer Information Gateway,** led by Industry Canada, is designed to provide Canadians with easily accessible tools to help them make better decisions about goods and services in the marketplace. It provides online links to projects or research that deal with consumer issues that are closely linked with environmental issues.
- The **Canadian Pollution Prevention Information Clearinghouse,** maintained by Environment Canada is a database providing Canadians with information they need to practice pollution prevention.
- **Canadian Soil Information System,** managed by Agriculture and Agri-Food Canada, contains soil, landscape and climate data collected by federal and provincial/territorial field surveys or land data analysis projects.
- **Catalogue of Environmental Information,** maintained by the Quebec Ministry of the Environment, provides environmental information and status reports on issues, such as water quality, air quality, climate change, soil quality and biodiversity.
- The **Conservation Data Centres network** includes provincial biodiversity information centres that are leading sources of data about at-risk species and habitats, and are supported by the Association for Biodiversity Information-Canada. The Canadian data centres link to a western hemisphere-wide information initiative coordinated by the Association of Biodiversity Information.
- **Econnections,** an information system managed by Statistics Canada that links the environment and the economy through the use of key indicators.
- **GeoConnections,** a national partnership initiative led by Natural Resources Canada to coordinate Canada's numerous databases of geographic information and make them accessible through the Internet.
- The **Integrated Data Management Initiative** in British Columbia to develop a process to bring together data from multiple sources to facilitate obtaining answers to environmental business issues.
- The **Integrated Taxonomic Information System**, led in Canada by Agriculture and Agri-Food Canada, is an international effort by the United States, Canada and Mexico to build the first comprehensive, standardized reference for the scientific names of the flora and fauna of importance for North America.
- **Land Information Ontario,** an initiative led by the Ontario Ministry of Natural Resources to restructure the management and use of Ontario's land information assets. One of its components is the Ontario Geospatial Data Exchange, a multi-party agreement which provides for the centralized sharing of geospatial data sets among government (provincial, federal, municipal), broader public sector agencies, post secondary institutions, and Aboriginal communities.

- **Marine Environmental Data Service** which manages and archives ocean data collected by the Department of Fisheries and Oceans, or acquired through national and international programmes conducted in ocean areas adjacent to Canada. Examples of data included are contaminants, currents, global sea surface meteorological and oceanographic observations and ocean profiles.
- The **National Forest Information System** (NFIS), with federal, provincial, and territorial governments involved in implementation, is intended to provide a national monitoring, integrating and reporting system in order to respond to Canada's international and domestic forest reporting commitments.
- The **National Land and Water Information Service** being developed by Agriculture and Agri-food Canada to develop decision support tools for use at the local level.
- The **National Pollutant Release Inventory** of Environment Canada which provides Canadians with access to pollutant release information for facilities located in their communities.
- The Federation of Canadian Municipalities **Quality of Life Reporting System** which uses nationally consistent data to monitor aspects of the social, economic, and environmental health of communities.
- The **Sustainable Development Information System,** developed by Environment Canada, provides one-window access to sustainable development information in the Government of Canada.

Annex B:
Gaps in Environmental Information

In this Annex, we present a summary of some of the gaps in environmental information, identified to us during the course of this last year. The gaps below are primarily in the area of monitoring or surveillance programs, not research. They also do not include the list of "orphan" data sets that are being lost due to lack of digitization or proper archiving. Therefore the list presented below, although lengthy, is considerably shorter than it should be.

"The problems identified here result from an imbalance in our environment, our economy, and our standard of living, which are all interconnected and subject to rapid change. Correcting that imbalance involves significantly increasing investments in scientific research and monitoring capacity in order to manage – to understand, track, and predict – environmental change. Not doing so puts our children at risk."

National Round Table on the Environment and the Economy. Achieving a Balance. 2001

This list confirms that the ability to make effective policy decisions to protect the health of Canadians and the health of Canada's ecosystems is compromised by lack of information. We believe that over the next several years governments will need to invest heavily in research and monitoring to correct this situation. We have not set priorities for data gathering, as we believe that Canada needs to take a more strategic approach in this area. These priorities should be set in a dialogue between the users and producers of the data. Given the large mandate which we were given and the short period of time in which to fulfill it, we felt that setting of this national agenda was both beyond the scope of our time and our resources. However, we firmly believe that development of the "roadmap" to address data gaps is an essential next step in implementing CISE (see chapter 4).

The gaps listed below are organized by a modified version of the natural capital framework proposed by the National Round Table on the Environment and the Economy as the basis for Environment and Sustainable Development Indicators.

Natural capital

Terrestrial and freshwater ecosystems

- Monitoring and assessment of the health and status of wildlife and their habitats, with priority given to migratory birds, in order to anticipate and prevent the decline in species, the disappearance of habitat and the degradation of ecosystems.
- Assessments of the status of butterflies, moths and molluscs to determine whether they are at risk.
- Monitoring to provide information on the spatial and temporal trends in the movement and fate of toxic substances and other substances affecting wildlife, especially in certain ecosystems (such as the sensitive ecosystems of the north).
- Development of standard national classifications for terrestrial and inland water communities, including a national vegetation classification system, as a means of facilitating landscape-level approaches that conserve and use biological resources in a sustainable fashion.
- Rebuilding of Canada's taxonomic capacity, including digitization of key natural history collections essential for identifying and controlling invasive alien species and identifying and conserving species at risk.
- Monitoring and assessing the health and status of species at risk and invasive alien species, in order to anticipate and prevent declines in species, the disappearance of habitat and the degradation of ecosystems.
- Modeling of the potential ranges of native and invasive species.
- Development of a common benchmark set of data to be tracked through the network of Conservation Data Centres, as a basis for roll-ups to the eco-region or national level, as well as for landscape-level conservation planning and project-specific environmental assessments.
- An updated and comprehensive ecological inventory of national parks.
- Improved capacity to monitor and report on the health and status (i.e., biodiversity) of, and within Canada's forests, protected areas, and agricultural areas.
- Amount and location of critical habitats, such as wetlands and woodlands, in agricultural areas.
- Studies on the risk to biodiversity and health of ecosystems from farm practices (such as pesticide use).

- Status of domesticated biodiversity (such as farm animals or crops) to assess the potential, and impacts, of the use of genetically modified organisms.
- Increasing the ability to measure types and levels of genetically modified organisms (GMO) inadvertently released into the environment and increasing the availability of verified and standardized testing protocols to help assess the potential effects of GMOs on the environment.
- Research to develop methodologies for measuring the integrity of ecosystems.
- A comprehensive science program to deal with the risks associated with alien invasive species and an adequate research program to determine the best methods for preventing new introductions or control of existing invasive species.

Forests

Canada must better equip itself to describe its forest resources and the effects of activities taking place within them, with the view to enabling more effective decision-making with regard to sustainability, and enabling Canada to report better against domestic and international commitments. Requirements include:

- Updating and "ground proofing" of the national forest inventory (species, age classes, protected forest lands, etc.).
- Improving the capacity to present more timely and accurate representation of Canada's forests and sustainability (changes in forest cover, harvest levels, regeneration, rates of growth, etc.).
- Increasing the ability to respond authoritatively to domestic and international questions regarding sustainable forest management in Canada, and to respond to misinformation.

Marine ecosystems

- Assessment of status of fish stocks and habitat for conservation and sustainable economic use of Canadian fishery resources.
- Research on the interactions between wild and cultured stocks to support the environmental sustainability of aquaculture.
- Research into the functioning of marine ecosystems.
- Research and monitoring of the effects of natural and human activities on marine ecosystems including environmental threats such as the toxins and contaminants in the ecosystems that affect human health, and the many land- and sea-based activities that may damage the ocean environment.
- Monitoring of wild and cultured stocks of finfish and shellfish for diseases.

Water quantity

- Research to develop predictive models on water levels and flows.
- Studies to determine the effectiveness of water conservation efforts.
- Quantification of consumptive and non-consumptive use of groundwater, to assess the long-term viability of water sources and to protect freshwater habitat.
- Expansion of the national water quantity monitoring system to provide coverage in Canada's North (where the greatest impacts of climate change are expected) and in northern Ontario and Quebec (where large areas are exposed to development without adequate information to make sound decisions).
- Co-location of water quality and water quantity monitoring sites in key areas, as quantity data plays an important role in interpreting data on quality.
- Water management at farms and food processing facilities (e.g., irrigation methods and quantities of water used) to determine the impacts on the environment.
- Development of a groundwater inventory, including mapping of aquifers, and enhancement of federal-provincial-territorial networks to ensure consistent, regular monitoring of groundwater levels.
- National large-scale mapping of watersheds.

Land

- A national program monitoring land cover with field surveys, large-scale photography and remote sensing technologies to assess the impacts of changes in land use on wildlife habitats, carbon sinks, water yield and quality, and the stability of the climate system.
- Information over time on changes in land cover and use, particularly estimates of the expansion of agricultural lands and changes in forest lands.
- Digital base maps for most of the territories, especially in areas of active development, to encourage participation by citizens and interest groups in review and planning of developments.
- Geological mapping of surface features in the territories.
- A standardized, national map of "protected" lands and waters, public and private.
- Updating of soil surveys (since most are more than 40 years old) to support soil management decisions related to agricultural production, habitats, etc.
- Location of existing agricultural operations to support local decision-making on locations for new development consistent with a healthy

environment and sustainable use of land and water.

- Studies on the possible effects, particularly to children, of risks from pesticide use in agriculture.
- Use of land for transportation.
- Amount and location of land protected for soil and water conservation.
- Monitoring of sources of radioactivity (e.g., radon gas).

Material and energy flows

- Maintenance and expansion of current mechanisms for gathering information on the flows of recycled/ recyclable materials in Canada, including minerals and metals, as well as wood-based and petroleum-based products.
- Statistics on the quantities and types of solid waste and hazardous and non-hazardous waste produced in Canada.
- A data base on resource use and eco-efficiency to facilitate life-cycle analysis, benchmarking and development of indicators for the manufacturing and resource industries.
- Improved data on activity related to the transportation of dangerous goods.
- An inventory of wastes by region, related to potential uses.
- Development of indicators to measure progress toward sustainable development in minerals and metals which address the environmental goals and objectives outlined in the *Consultation paper on Canadian Values Underlying the Sustainable Development of Minerals and Metals.* To this end, information is required on the impacts/contribution of the minerals and metal industry on:
  - pollution prevention;
  - mine site reclamation and rehabilitation;
  - wildlife habitat; and
  - protection of ecosystems and endangered species.
- Effects of acid mine drainage and metal leaching on watersheds and ecosystems, and the direct link to human health and human socio-economic well being.
- Impacts/contribution of mineral development on the environment and communities in the short and long run.
- Information on the development and take-up of alternative sources of materials and energy.
- Information on technical options and choices for addressing environmental issues in order to expand decision-making capabilities.
- An inventory of inactive mine sites.
- Regional background levels of metals in water and soils.
- Aquatic environmental effects monitoring of metal mining.
- Life cycle information regarding minerals and metals for use in life cycle assessments.
- Information to assess effects of transportation, including user response to some measures aimed at reducing transportation activities, shifting travel between modes and shifting to different fuels, as well as descriptions of the road vehicle fleet, its use and information on the number and use of off-road vehicles in Canada.

Ecosystem services

Air quality

- Enhanced national air quality monitoring of the pollutants causing smog.
- Atmospheric research into the composition, transport and transformation of air pollution from sources and into ambient air to inform air quality predictions.
- Development of models that can represent complex air pollutants in the Canadian atmosphere for use in the design of cost-effective emission reduction planning.
- Better understanding of how air quality affects human health as a basis for standards and risk management decisions.
- Expansion of the Canadian Air and Precipitation Monitoring Network and the National Air Pollution Surveillance Network to improve monitoring and reporting to Canadians on the growing problem of air pollution.
- Monitoring capacity that would allow estimates of the emissions of particulate matter from agricultural sources (e.g., cropland and feedlot operations) as an information foundation to help the agri-food sector reduce risk and promote action towards solutions.
- Monitoring of small particulate (with a particle size 2.5 microns and smaller) air pollution in order to produce routinely available, standardized data from health regions across the country. This aspect of outdoor air quality is currently viewed as having the most impact on human health.

Climate

- Research on the effects of climate change on variations in water levels and subsequent impacts on water quality.
- Oceanic information to understand the role of oceans as major climate regulators and understanding climate change and its impacts.
- Indicators of the effects of climate change on certain ecosystems (e.g., northern ecosystems and wetlands).
- Research on the effects of UV-B radiation on ecosystems.
- Effect of predicted climate-change scenarios on the sustainability of agricultural production.
- Monitoring of greenhouse gas emissions from existing technologies in the agricultural sector, as well as studies on alternative technologies to reduce those emissions.
- Expansion of the Cooperative Climate Network into certain areas (especially the north and mountainous regions) to enhance our ability to detect climate change and assess the state of the environment.
- Increased monitoring of the distribution and condition of permafrost because of its importance as an indicator of global environment and climate change, and its implications for local communities and wildlife.
- More localized coverage by the monitoring network to determine localized impacts of a changing climate and allow proper decisions on adaptation decisions (e.g., changes in building and zoning codes or whether to restore a wetland that may dry out due to lower water levels).
- Development of warning systems (to provide, for example, heat alerts and cold alerts) for municipalities so that they can take measures to warn people at risk (such as children or the elderly) and implement emergency plans (such as power conservation measures or provision of air-conditioned centres for elderly people without air conditioners at home).

Water quality

- Development of a national surveillance system to quantify the incidence and impact of waterborne diseases on human health as a basis for detecting, predicting and preventing illness (i.e., enhance the ability to link source water quality to drinking water products, shellfish and fish, and processed food to human health outcomes).
- A national (federal/provincial/territorial) water quality monitoring system (network of networks) to provide comprehensive (surface and ground water) water quality information using up-to-date, nationally standard protocols for collection, analysis and data management, as a way of building an information base for the protection of source and ambient waters.
- Monitoring systems on federal lands, including Canada's North (where microbiological pathogen monitoring in source waters is carried out in the proximity of less than five per cent of communities) and National Parks (which have more than 25 million visitors a year, while monitoring takes place in only 19 of 39 parks).
- Monitoring of agricultural contaminants (such as pesticides, nutrients or endocrine-disrupting substances) in surface water and groundwater and assessing their impacts on ecosystems, particularly in areas of intensive agricultural activity (e.g., 80 percent of Canadian pesticide use occurs in the prairie provinces, but currently no routine pesticide monitoring takes place. Meanwhile, concern over nutrients is rising due to the growing number of intensive livestock operations or factory farms).
- Monitoring the performance of wastewater treatment facilities to assess their effects on ambient water quality.
- Research on the impacts of land use practices, municipal and industrial facilities, wastewater and urban and industrial growth on the protection of sources of drinking water.
- Research to develop hydrometeorological models to estimate and predict water quality.
- Development of a water quality index and other performance-based reporting mechanisms to communicate water quality results to Canadians.
- Production of routinely collected drinking water quality data in a standardized, comparable format at the community level across the country.
- Research to develop standard testing procedures for routine testing for some of the organisms that represent significant risks for widespread epidemics leading to considerable morbidity and mortality. Organisms such as cryptosporidium, giardia and toxoplasmosis have experienced extensive outbreaks in the United States and Canada in recent years, causing considerable morbidity and sizable social and economic costs. Standard testing procedures do not detect these organisms and there is now no cost-effective way of routinely testing for them.

Annex C:
Environment and Sustainable Development Indicators Initiative

In September 2000, the National Round Table on the Environment and the Economy (NRTEE) launched its Environment and Sustainable Development Indicators (ESDI) Initiative, a three-year program to develop and promote a focussed set of national indicators that are credible, relevant and well-accepted. This project originates from the NRTEE's Greening the Budget 2000 recommendations, and came to fruition in the 2000 Federal Budget.

Recognizing the influence of economic indicators, the ESDI Initiative intends to broaden the existing frame of reference by developing indicators that link economic activity to its long-term effects on the environment, impacts that are often left out of decision-making. As Minister of Finance Paul Martin recently stated regarding the ESDI Initiative: "Environmental indicators will provide us with the hard, quantitative data to ensure a sound basis for both environmental and economic policy in the future… In effect, these indicators can serve as a continuous call to arms – an ongoing protection against environmental complacency."

A three phase process has been planned, which will take place over three years:

- Phase 1: Determine the approach for measuring indicators.
- Phase 2: Develop specific indicators.
- Phase 3: Test and disseminate proposed indicators.

The NRTEE has selected the "capital model" as its approach. The indicators will track the quantity and the quality of stocks of key capital (produced, natural and human) that will be needed in the future. This emphasis on capital will supplement traditional measures of economic performance, such as GDP, and will illuminate whether the current generation's economic performance is being obtained at the expense of future generations. The most important asset to be tracked is the "stock" of crucial ecosystems services (such as the maintenance of forest cover and the provision of clean water).

Currently in its second phase, the ESDI Initiative is in the process of defining specific indicators. Existing information and data collection is being examined by advisory "cluster groups" of experts, which will recommend possible national indicators. The ESDI Steering Committee will use the cluster group's recommendations as the basis for selecting a core list of indicators, which will be ready for testing and outside review by May 2002. A final report, with analysis and recommendations will be released in March 2003.

Annex D:

Rates of Institute and Partners

The table below provides further details on the roles of the Canadian Institute for Environmental Information and of partner organizations of the Canadian Information System for the Environment.

Information Management Function	Roles of the Canadian Institute for Environmental Information	Roles of CISE Partners
Needs assessment and priority setting	Facilitate dialogue between the users and producers of environmental information.	Identify information needs of users within the partner organization and among the organization's clients.
	Identify gaps between needs of users and information supplied by producers, and publish.	Consider needs of secondary users in determining organizational information development priorities.
	Facilitate the setting of collective information priorities across CISE in order to develop a national agenda for environmental information.	Participate in setting priorities for information development.
		Look for ways to incorporate CISE information development priorities in organizational planning.
Conceptual frameworks and data standards	Facilitate development of conceptual frameworks for integrating environmental information from various sources, and integrating environmental information with other types of information (e.g. health, socio-economic).	Document conceptual frameworks used for environmental information and make this documentation available to CISE partners.
	Monitor the availability and application of environmental data standards, both among CISE partners and internationally.	Document environmental data standards in use and make this documentation available to CISE partners.
	Identify gaps in environmental data standards and facilitate the setting of priorities for development and / or application of standards for CISE.	Participate in the identification of gaps in data standards and the setting of priorities for standards development in CISE.
	Facilitate development and implementation of common data standards, including standards for data gathering by volunteers and for collection and use of local and traditional knowledge.	Participate in the development of common data standards.

Information Management Function	Roles of the Canadian Institute for Environmental Information	Roles of CISE Partners
	Publish documentation of conceptual frameworks and data standards for environmental information.	Implement data standards where feasible.
	Provide incentives for partners to adopt and apply common standards and protocols for data gathering.	
Data gathering	Facilitate cooperation among CISE partners to minimize duplication and increase efficiency of data gathering.	Gather data through monitoring programs, research projects, surveys, and administrative processes.
	Identify gaps in data gathering, particularly for new or emerging areas and provide rationales and incentives for investments in data gathering.	Examine ways to address gaps in data gathering in the context of organizational programs.
	Encourage citizen participation in data gathering.	Enable citizen participation in data gathering.
Data storage, quality assurance and access	Develop standards for documenting databases (metadata standards) and provide tools to enable partners to implement these standards.	Document environmental databases maintained by the organization and provide this documentation to CISE partners.
	Build and maintain a comprehensive inventory of environmental databases.	Participate in the identification and establishment of core national data sets.
	Facilitate identification and establishment of core national data sets and their custodians.	
	Act as the custodian of core national data sets where appropriate, and provide assurance of data quality.	Act as the custodian of core national data sets where appropriate, and provide assurance of data quality.
	Develop and establish data access agreements with partners and prospective partners.	Provide access to data according to the provisions of data access agreements.
	Provide one-window public access to CISE data, including tools for data search and retrieval.	
	Monitor and report on the availability of environmental data through CISE.	

Information Management Function	Roles of the Canadian Institute for Environmental Information	Roles of CISE Partners
Integration and structuring	Integrate and structure data for NRTEE's environmental and sustainable development indicators.	Integrate and structure data to meet organizational needs.
	Integrate and structure data for a national set of core environmental indicators.	
Analysis and interpretation	Analyse data about environmental information and CISE itself.	Analyse data to meet organizational and client information needs.
	Perform limited primary descriptive analysis of environmental data in support of broad types of environmental decisions.	Perform detailed analysis and assessment relevant to specific decision contexts.
	Provide general-purpose analytical and visualization tools to users.	Undertake research based on environmental data.
	Provide opportunities for users to interact and share their interpretations of environmental data and information.	Develop and apply specialized models and other tools.
	Where practicable, conduct more detailed analyses or specific types of analyses, if requested by a CISE partner.	Enable local communities and communities of practice to come together around issues.
Reporting and dissemination	Provide regular, factual reporting on: • "state of Canada's environmental knowledge" • performance against international standards • emerging environmental issues • national environmental conditions / stressors, based on indicators	Continue to produce and disseminate reports and other information products to meet client and organizational needs.
	Develop standards for documenting information products (metadata standards) and provide tools to enable partners to implement these standards.	Document reports and information products and make this documentation available to CISE partners.
	Publicize information available in CISE to increase user awareness.	
	Conduct periodic surveys of users to determine preferences for format of reports and information products.	
	Provide one-window public access to CISE documents, including tools for data search and retrieval.	

Annex E:

Towards a Biodiversity Knowledge and Innovation Network

The following recommendations are those presented in *"Towards a Biodiversity Knowledge and Innovation Network (BKIN) for Canada."* They reflect the ideas and recommendations coming from the Natural Capital Conference held in March 2001 in Ottawa. They are regarded as the key starting points in helping ensure Canada meets its biodiversity knowledge needs:

Establish a focal point in Canada for biodiversity knowledge networking activities. This would help ensure momentum following the conference and give a lead to co-ordinating and taking maximum benefit from initiatives already underway or in the process of forming.

Increase resources for the development of the Integrated Taxonomic Information System (ITIS) which is an internationally-supported attempt to build the first comprehensive, standardized reference for scientific names of North American species.

Digitize information from key biological collections as an essential step in making data available on the Internet to all Canadians.

Increase support for the management and maintenance of key biological collections. All major institutions holding biological collections should review and enhance their capacity, both physical and human resources, through new funding to ensure the long-term protection of these national treasures.

Develop a "BioConnections" program that would aid network node capacity by providing matching funds, links to geomatics databases, and a strong focus on data sharing, metadata standards, and communications without decreasing the autonomy or profile of existing data sets.

Fund university biodiversity chairs as a quick start approach to create "new millennium taxonomists," with combined skills in basic biology and advanced computational sciences.

Ensure employment for university biodiversity graduates through a fully financed national human resource strategy for the biodiversity sciences and bioinformatics.

Increase resources to the Conservation Data Centres network offices in each province and territory to build and share conservation tools, including decision-support tools.

Carry out a red-tape review by governments of cost recovery policies that act as a barrier to interdisciplinary, science-based solutions that can address complex policy issues and on-the-ground resource management challenges.

Complete a national vegetation classification system for Canada. Such a classification system, underlain by a database of site-specific community data, would be highly valuable for assessments of how Canada's biodiversity is changing.

Support Parks Canada in establishing Co-operative Research Units at universities across the country. These units would be starting points for applying biodiversity information in on-the-ground decision-support solutions in the national parks.

Annex F:

Secretariat to the Task Force

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Many others made significant contributions to the work of the Task Force. They include staff from Environment Canada and other federal departments, as well as consultants and technical experts who prepared papers on specific issues to inform the discussions of the Task Force. The Task Force especially appreciated the input received from individual Canadians to the recommendations made in its interim report.