PAPER 9

EXPLORING EMERGING ENVIRONMENTAL ISSUES: THE RESULTS OF TWO CANADIAN SURVEYS

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ABSTRACT: 'Emerging issues' has emerged as an important theme in recent years, partly as an element in a diverse mix of 'strategic thinking' approaches. Emerging issues can be defined as those issues (both positive and negative) that are not generally or immediately recognized but which will have significant impact on human and/or ecosystem health in the 21st century. This paper details the results of two studies attempting to identify emerging environmental issues in Canada, as well as internationally in the field of atmospheric and climate sciences. Emerging issues of climate change and biodiversity in Canada - and severe weather and climate change detection in the atmospheric and climate sciences - are identified using both written surveys and key actor interviews. Some next steps are identified in the future study of emerging environmental issues.

Keywords: emerging issues; environment; sustainable development; atmosphere; climate; Canada

1. Introduction

'Emerging issues' has emerged as an important theme in recent years, partly as an element in a diverse mix of 'strategic thinking' approaches, including scenario modelling, forecasting, foresight exercises, future scanning, and so on. The Government of Canada explicitly gestures in this direction in *A Framework for Science and Technology Advice: Principles and Guidance for the Effective Use of Science and Technology Advice in Government Decision-Making* (Environment Canada, 2000) when, in the first section of Principles, under 'Early Issue Identification' it states:

1.1. Decision-makers should cast a wide net - consulting internal, external, and international sources - to assist in the early identification of issues requiring science advice;

1.2. Decision-makers, policy advisors and scientists should communicate emerging issues requiring advice, and improve the connections between research and potential policy or regulatory issues.

However, 'emerging issues' are about more than just science advice. One of the non-governmental interviewees for this Project said that "emerging issues raise

all the basic questions: trust, competence, can we cope?" Other interviewees, in different ways, agreed that agencies like Environment Canada are in a complex position with regard to the whole trajectory of modern society. Discussions of emerging issues trigger these complexities.

The obvious motivations in considering emerging issues often include the hope that early identification of emerging issues will assist in:

- developing an overall strategic plan for a ministry, corporation, etc.;
- designing research priorities for the midterm (5-20 years); and
- providing an 'early warning' for policy responses that might be undertaken before an issue has become a serious threat.

This paper considers these, but in addition proposes that responding to 'emerging issues' must engage a wider set of purposes.

The study of emerging environmental issues has become a growth industry in the last few years. Recent works have included a global perspective produced by SCOPE (Scientific Committee on Problems of the Environment) for UNEP (United Nations Environment Programme) (Munn *et al.*, 1999); a study of emerging environmental issues in the province of Ontario, Canada (Munn, 1999); a special emerging issues workshop for the U.S. state of California (California Environmental Protection Agency Office of Environmental Health Hazard Assessment, 1998); a national survey in the United Kingdom of technology and environmental futures (Loveridge *et al.*, 1995); and a local study of future environmental risks facing the Houston area (Mitchell Center for Sustainable Development, 1996), used both for municipal priority setting and for public education.

This paper is a joint project of the Institute for Environmental Studies at the University of Toronto, and Environment Canada. The project has involved the mailing of detailed questionnaires: in the first study to representative scientists and experts across Canada inquiring as to their expectations regarding possible emerging issues of concern for Canada in the 21st century; and in the second study to representative scientists and experts around the world inquiring as to their expectations regarding possible emerging issues of concern in the atmospheric and climate sciences.

For the purposes of the study, emerging issues were defined as those issues (both positive and negative) that are not generally or immediately recognized but which will have significant impact on human and/or ecosystem health in the 21st century. Emerging issues can have impacts globally or regionally and can include local issues that occur in many parts of the globe. The boundaries of

emerging issues for the first study were confined to those specific to the Canadian landscape; while for the second study, emerging issues in the atmospheric and climate sciences were considered globally.

Figure 1 gives some sense of the complex web of elements that contribute to the formation of emerging environmental issues; and also sketches a possible phasing of arrival and response.

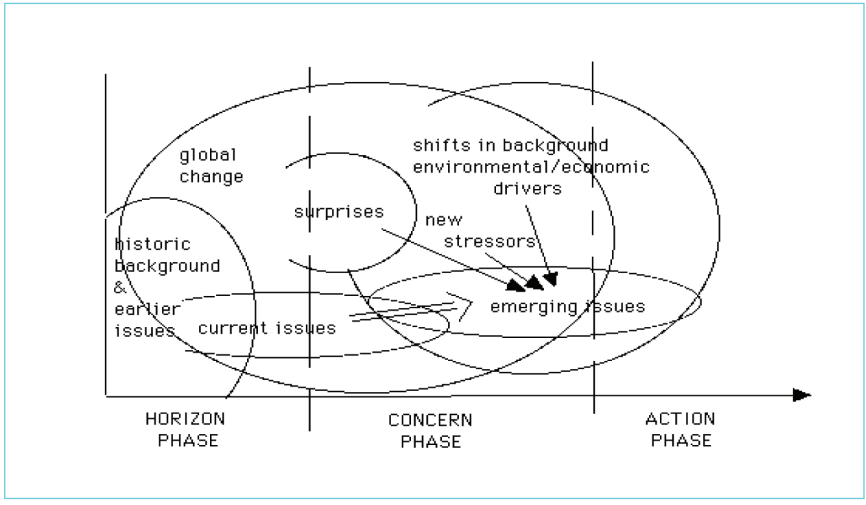

FIGURE 1
Phases of Emerging Environmental Issues.

2. First Study – Emerging Environmental Issues in Canada

2.1 The Questionnaire

For the first study, questionnaires were submitted to 106 scientists or science managers in the environmental sciences from across Canada representing various jurisdictions including federal government departments, provincial and territorial agencies, municipal governments, non-governmental organizations, and a few journalists. See Figure 2 for a regional distribution of the survey across Canadian regions (North), provinces and cities (National Capital Region).

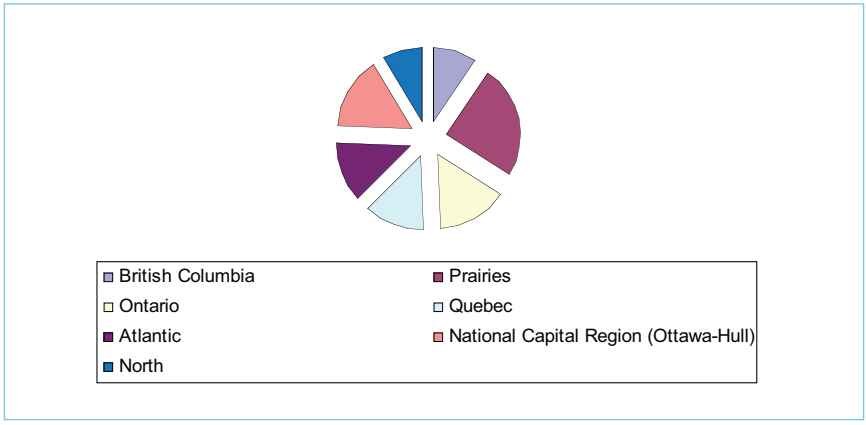

FIGURE 2
Recipients of First Study Questionnaire, by Region in Canada.

There was a 20 percent response rate to the questionnaire, with returns balanced across the regions. This was further supplemented by a handful of key actor interviews carried out through the winter 2000-2001 with representatives from Environment Canada, an NGO leader, and a leading member of the environmental academic community.

The respondents of the first study identified 7 Current Priority Environmental Issues of Concern for Canada as shown in Table 1.

TABLE 1
7 Current Priority Environmental Issues of Concern Identified (descending frequency of mentions)

1. Climate Change
2. Resource exploitation including land-use
3. Threats to biological diversity including invasive species, modified organisms
4. Management of knowledge and data, responsibility, monitoring, coordination
5. LRTAP, air quality especially mercury (Hg)
6. Impacts of environment on human health
7. Water issues: quality and quantity

The respondents of the first study identified 7 Current Priority Environmental Issues of Concern for Canada as shown in Table 1.

TABLE 2

4 Main Environmental Issues Identified as Emerging in the Near Future (descending frequency of mentions)

1. Threats to biological diversity
2. Climate change
3. Air Quality, LRTAP
4. Water issues: quality and quantity

Of note are the following results:

- a large number of respondents did not identify any emerging issues;
- the lack of positive emerging issues in the environmental field;
- the focus on Canada's North and mid-North as an emerging area of environmental concern as resource extraction issues come to the fore; and
- a continuing potential for stronger environmental consciousness among the Canadian public, including a wider and more powerful definition of 'environment' and 'sustainability', including a much clearer connection between the importance of environmental issues to everyday life and overall welfare.

Among the major obstacles cited to responding to these emerging environmental issues were: a lack of current public support; Canada's materialistic society and lifestyle; a lack of government initiative; and the scientific uncertainties.

The need for leadership was a constant theme in the responses. Respondents put the primary responsibility for handling the four main emerging environmental issues identified in Table 2 clearly in the hands of the federal government, and more specifically Environment Canada. The provinces are seen as responsible as well, but not to the same degree as the federal government. The federal government is seen as having the responsibility for thinking broadly and deeply about the longer term. Surprisingly, few respondents identified a coalition of jurisdictional groups as working together to handle any of the emerging issues.

When speaking about Canada's overall capacity to deal with emerging issues in general, the respondents were not optimistic; over half described the capacity as 'poor', and with those who described it as 'good' adding numerous caveats. The respondents who identified Canada's capacity as 'good' were referring to the scientific capacity. 'Bad' responses generally referred to government's unwillingness to take leadership and address the issues.

When asked how to improve personal, group or organizational capacity to manage emerging issues in Canada, respondents focused on funding, and leadership from the federal government (especially Environment Canada) to develop a long-term vision for the environment and partnerships to get all groups involved in addressing the issues.

2.2 Interviews with Key Actors

Characteristic of key actor interviewing is being able to capture specialist expertise and wide-ranging knowledge on the subject in question. It is not a sample from which larger extrapolations or calculations can be made. In academic terms, it is a subset of the 'structured interview' (see, Berg, 1998, for a broader discussion). Among its other virtues is that it can assist in developing what anthropologists refer to as 'thick descriptions' of the field of study.

The identification of key actors to interview usually focuses on pivotal ('key') people who are decision-makers or decision-influencers. Unlike standard questionnaires, key actor interviews involve open-ended questions and only semi-directed structures. Among the difficulties of key actor interviewing is that a similar level of expertise or familiarity with the subject is usually required of the interviewer. The Principal Investigator in this Project was able to carry out the interviews in person.

The interviewees were given a version of the larger questionnaire in advance, and were ensured of confidentiality in their remarks (all subsequent references to content below have been scanned to ensure that identification is difficult). In addition, they were given the opportunity to add questions, or return to the interviewer at a later date to clarify points made.

Virtually all the key actors that were interviewed agreed that 'emerging issues' provided a real challenge to governments, for a variety of reasons. These included:

- The primary commitment to short-term responses to problems faced by governments;
- The related difficulty in finding short-term or incremental steps to the solution of systemic issues, i.e. issues that require a holistic or full-scale intervention to match the potential seriousness of the issue; and
- The lack of funding for some of the key elements in any long-range scanning for emerging issues, including base-line data, monitoring networks, and staff that can be partly or wholly dedicated to focusing on issues that are not of immediate concern.

A number of the key actors articulated their views about how issues got onto the political agenda, and stayed there. Among the complexities were:

- Issues became characterized very early according to incidents, or initial reports that defined their nature and responsible agencies - and this happened often in ways that were not ultimately beneficial to the outcome of the issue. There are major problems with the definition of who does what with each issue in government, university, and industry. One often has to spend disproportionate amounts of time reframing an issue that has already 'set'.
- Many issues needed a champion with scientific credibility or political power or (what one actor referred to as) "the bureaucratic patience of an ox."
- There are different standards of evidence and credibility required for different issues; standards which are not a function of science, but a function of "how the game is played." In this context, reference was made to emission standards and health risks (and their relationships) as well as public indices, that are - as one respondent remarked - "as much of an art as a science".

It was noted that many of the institutions in the environmental system had been put in place to deal with previous emerging issues, and that they had lifecycles as well that were not matched with the needs of the new issue. One respondent noted that a major long-term management issue was how to have staff that were generalist enough or adaptive enough to translate and transform the existing teams and mandates into new territories. There was concern about whether the next generation of managers would have this capacity.

An emerging issue that was raised by a number of the key actors was the Arctic as a whole. It was considered to be a convergence point for concerns over climate change, biodiversity, the long-range transport of air pollutants (LRTAP), and so on, but it also had great potential because of the arrival of new governance systems both nationally and internationally. One key actor went so far as to say that "the Arctic is a key laboratory for emerging issues."

Questions of capacity were often raised in discussion. Institutionally, a major problem noted was that the existing scientific and policy units were very species and issue specific, which makes it difficult to spot larger or 'meta-level' emerging issues, and to respond to them collectively. There were major gaps in environmental monitoring systems, and fundamental gaps in ecological knowledge.

Key actors were asked about how they obtained information about emerging issues, and how they weighed their credibility. Virtually none of them had the time to rely on primary documents, and scanned the newspaper, TV, and radio

like anyone else. They relied very much on personal contacts, conferences, and in-house scientists to weigh the seriousness and credibility of an emerging issue. They found that if they could assimilate the new concern to an already existing issue, that the management response was usually clear. Respondents considered the most troubling issues those that challenge basic scientific norms, or for which there was only one information source or expert.

3. Second Study – Emerging Issues in the Atmospheric and Climate Sciences

After the first study identified that climate change was the number one current priority issue of concern to Canadian scientists, and that climate change and other atmospheric issues are some of the most prominent emerging issues of concern, a second study was undertaken to focus on the mid-term prospects for scientific research in the climate and atmospheric sciences.

For the second study, questionnaires were submitted to scientists from around the world who are editors of major international journals in the atmospheric and climate sciences (see table 3); to scientists from across Canada who were successful in receiving a research grant from Canada's Natural Sciences and Engineering Research Council (NSERC); and to scientists from across Canada who were successful in receiving research grants from the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) (a distribution is shown in Figure 3). There was a 15 percent response rate to the questionnaire, with returns from Canada doubling those internationally.

The respondents of the second study identified the state of the earth's climate and atmosphere in the next 5 to 25 years as including:

1. Increased air pollution;
2. Increased frequency and magnitude of weather extremes including heat, drought, flooding, freezing rain, tornadoes, hurricanes; and
3. A dissipating cryosphere (ice, permafrost, glaciers, snow).

It is interesting to note that 15 percent of the respondents thought that the atmosphere would not change much in the next 5 to 25 years.

TABLE 3

International Journals in the Atmospheric and Climate Sciences Canvassed for 2nd Survey

1. Atmospheric Environment
2. Atmospheric Research
3. Boundary Layer Meteorology
4. Climatic Change
5. Climate Dynamics
6. Dynamics of Atmosphere and Ocean
7. International Journal of Climatology
8. Journal of Air and Waste Management Association
9. Journal of Applied Meteorology
10. Journal of Atmospheric and Oceanic Technology
11. Journal of Atmospheric and Solar Terrestrial Physics
12. Journal of Atmospheric Chemistry
13. Journal of Atmospheric Science
14. Journal of Climate
15. Meteorology and Atmospheric Physics
16. Nature
17. Quarterly Journal of the Royal Meteorological Society
18. Theoretical and Applied Climatology
19. Weather and Forecasting

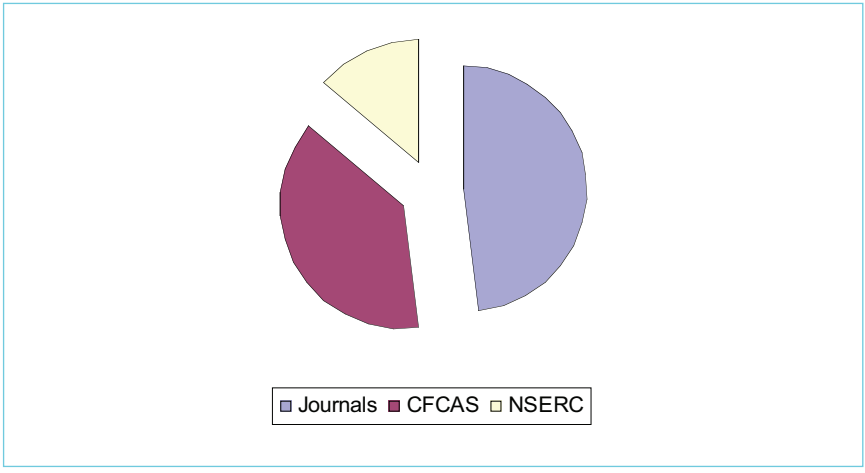

FIGURE 3
Recipients of Second Study Questionnaire, by Focus.

The respondents of the second study managed to zero in on only two priorities for research and development (R&D) in the atmospheric and climate sciences – severe weather and climate data analysis. Eleven other R&D priorities were identified by the respondents, but these reflected a ranking of their own area of research (see Table 4 for the top 10).

TABLE 4

Top 10 Emerging R&D Priorities in the Atmospheric and Climate Sciences (descending frequency of mentions)

1. Detection and prediction of severe weather
2. Climate data analysis
3. Numerical weather prediction
4. Data assimilation
5. Finer resolution climate models
6. Integrated environmental modelling
7. Cryospheric applications of remote sensing
8. Atmospheric chemical characterization and speciation
9. Air quality prediction for smog advisories
10. Land-climate and ocean-climate interactions

These priorities for R&D in the atmospheric and climate sciences were identified as such by the respondents because of:

- the availability of new technologies;
- a rapidly developing science;
- its urgency to society (linked to human health)
- the natural progression of science; and
- its links to developing policy.

Capacity is the main obstacle to addressing these priorities in the atmospheric and climate sciences. Funding is seen as the number one obstacle, with the dearth of trained personnel coming second.

Responses to who should respond to these R&D priorities in the atmospheric and climate sciences focus on national governments, academic research centres and international organizations to bring together important resources and build – what one respondent calls – an epistemic community.

Roles of the various players in this challenge are clear. The public is seen as needing to become more educated about issues, and apply pressure on

governments to ensure that research is conducted. The academic community is seen as responsible for leading research. And the private sector is seen as developing the technologies and methods for addressing these priorities.

4. Conclusions

This paper detailed the results of two studies attempting to identify emerging environmental issues in Canada, as well as internationally in the field of atmospheric and climate sciences. Emerging issues of climate change and biodiversity in Canada - and severe weather and climate change detection in the atmospheric and climate sciences - were identified using both written surveys and key actor interviews. Some next steps for future study in the area of emerging environmental issues include:

- The study of emerging issues in a specific geographic area, such as the Far or Near North in Canada.
- An effort to determine ways of enhancing the capacity for identifying, exploring, and responding to emerging issues on the part of government, industry, and the public and private sectors generally.
- The exploration of ways of engaging the wider public in discussions over emerging issues.

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