Searching for GIS Nuggets: Mining Annual Reports by Canada's Commissioner of Environment and Sustainable Development

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ABSTRACT. The Commissioner of Environment and Sustainable Development (CESD) is a Government of Canada oversight agency. CESD reviews and evaluates federal department and agency progress in developing and implementing strategies to serve and promote sustainable development (which applies to both the built and the natural environments); and, CESD also oversees the environmental petitions process involving citizens. This paper discusses CESD's mandate, its annual Reports to Parliament, and the focus of the Reports on the importance of information which is to be collected and processed by federal departments and agencies, and then used to monitor and analyze environmental and sustainable situations and processes, as well as to direct and support policy, program, and strategy decisions, and to communicate with citizens on environmental and sustainable development challenges, opportunities, issues, options, and initiatives. The paper concludes that CESD Reports to Parliament are an important body of literature to be mined for GIS nuggets.

KEYWORDS. Applied Research, Audits, *AutoCarto Six Retrospective*, Built Environment, CESD, Commissioner of Environment and Sustainable Development, Content Analysis, Decision Processes, Decision Variables, Doomsday Map, Earth Summit, Environmental Assessment, Environmental Petitions, Esri, Evaluation Methods, Federal Departments, Federal Sustainable Development Strategy, Geo-factor, Geographic Information Science, Geographic Information Systems, Geographic Variables, Geography, Geospatial Data, Geospatial Information, Geospatial Knowledge, GIS, GIS Applications, GIS Findings, GIS Nuggets, GIS Technology, GIS Uses, GISc, GIScience Methods, GIScience Operations, GIScience Techniques, Government, Impact Assessment, Literature Mining Processes, Minister of the Environment, Natural Environment, News Media, Oversight Agencies, Parliament, Performance Audit, Policy Research, Research Colloquium, Research Design, Research Methodology, Research Mission, Resource Abuse Practices, Resource Care Practices, Retrospective Approach, Retrospective Research Design, Spatial Trend Line Analysis, Stewardship Map, Strategies, Sustainable Development, United Nations.

1. Background of the GIS Mining Mission

As stated in the *Guide for Papers on Using the Retrospective Approach to Mine for GIS Nuggets* (Wellar 2014b), GIS nuggets are findings from the literature or other sources which serve one or more of the three core missions expressed in Figure 1.

Figure 1. GIS nuggets defined

GIS nuggets are findings from the literature or other sources which serve three core, related missions:

M1. Designing and developing geographic information systems technology;

M2. Defining and elaborating geographic information science;

M3. Using geographic information systems technology and/or geographic information science.

Two remaining pieces of background information about the GIS mining mission are examples of GIS nuggets pertinent to M1, M2, and M3 in Figure 1, and a context for oversight agency literature *vis-à-vis* other bodies of literature. Examples of nuggets and the literature context are summarized as follows.

GIS nuggets of possible or probable value include those listed in Table 1. As indicated, each nugget serves one or more of M1, M2, or M3.

Table 1. Illustrative nuggets derived from using the retrospective approach to examine "the literature"

1. New or different reasons to add to GIS technology;
2. New or different ways to add to GIS technology;
3. New or different reasons to add to geospatial data;
4. New or different reasons to add to geospatial information;
5. New or different reasons to add to geospatial knowledge;
6. New or different ways to add to geospatial data;
7. New or different ways to add to geospatial information;
8. New or different ways to add to geospatial knowledge;
9. New or different uses of GIS technology;
10. New or different uses of geospatial data;
11. New or different uses of geospatial information;
12. New or different uses of geospatial knowledge;
13. New or different uses of GIScience research methods;
14. New or different uses of GIScience research techniques;
15. New or different uses of GIScience research operations.

The common feature among all entries in Table 1 is the phrase "new or different", but it comes with a twist, so to speak.

That is, the phrase "new or different" has a range of applicability, from the general or universal to the particular or individual for each of the 15 entries, so Table 1 may have more inherent breadth and depth than immediately gleaned upon first glance.

Preliminary investigations suggest that findings about the new or different ways, reasons, and uses derived from retrospective searches are only in part a function of the literature or other sources(s) being mined. More significant, it appears, are the expertise, experience, and motivations of the person(s) doing the mining.

However, research that I have undertaken to date, and the information provided by participants in the AutoCarto Six Retrospective project (Wellar, 2013), establish that investigations of this nature are still in the early, exploratory, and informal stages. Looking ahead, it is expected that conference presentations in 2016 will begin to provide confirmatory information about the yields from the respective literatures. And, it is anticipated that as a valuable by-product of such research, there will be changes to the entries in Table 1.

Table 2 presents the bodies of literature which have been identified as materials to be mined in the search for GIS nuggets, and also includes an entry labelled 'Other Productions'.

This approach takes into account work(s) which may be or may seem to be outside the purview of what is conventionally regarded as 'literature', and also avoids the frustration of unnecessarily becoming hung up on semantics.

The focus of this paper is on body of literature 5, Oversight Agency Literature, and specifically that of the Commissioner of Environment and Sustainable Development (CESD), Office of the Auditor General (OAG), Government of Canada[1].

Table 2. Bodies of literature and other productions to mine for GIS nuggets

1. Corporate/Institutional-Private Literature
2. Corporate/Institutional-Public Literature
3. Learned Literature
4. Legal Literature
5. **Oversight Agency Literature**
6. Popular (Media) Literature
7. Professional Literature
8. Public Interest Literature
9. Regulatory Agency Literature
10. Special Interest Literature
11. Vested Interest Literature
12. Other Productions

(After: Wellar, B. 2005. ***Geography and the Media: Strengthening the Relationship***. Ottawa: Canadian Association of Geographers, Canadian Royal Geographical Society and the Canadian Council on Geographic Education. http://www.ccge.ca)

The reasons for selecting oversight agency literature for a Colloquium topic arose while writing the paper, Abuse v. Care of Land, Water, and Air, 1990-2015: The Doomsday Map Concept as a Compelling Argument to Retrospectively Mine the Popular Literature for GIS Nuggets (Wellar, 2014a).

Two paragraphs from section 6 of that paper are repeated here to illustrate the basis of my thinking about the connection between popular literature and oversight agency literature.

> "6. Comments on Popular Literature Materials Regarding Oversight Agency Productions
>
> As a rule, neither private sector corporations nor government line departments such as Agriculture, Commerce, Defence, Economic Development, Energy, Environment, Finance, Fisheries and Oceans, Forestry, Housing, Industry, Infrastructure, Interior, Land Management, Mining, Municipal Affairs, Natural Resources, Parks and Recreation, Planning and Development, Public Works, Regional Development, Transportation, Urban Affairs, Utilities, or Water/Wastewater rush to publicly admit to committing or aiding and abetting abuses of land, water, and air resources[8].
>
> Consequently, in the case of case of abuses of land, water, and air resources arising since 1990, we tend to learn about them from oversight agencies which are (purportedly) independent of "political strings", and whose mandate is to inform about matters of public interest."

In addition to establishing the popular literature and oversight literature connection, research into oversight agencies in Canada and other countries revealed that the mandates of a number of them extend over many aspects of abuse or stewardship of land, water, and air resources. Consequently, the reports of these agencies contain a great deal of geographic data, geographic information, and/or geographic knowledge about the state of land, water, and air resources in their respective jurisdictions, and the literature of oversight agencies is therefore a prime body of material to mine for GIS nuggets.

In section 2, I provide an introduction to the Office of Commissioner of Environment and Sustainable Development (CESD), Government of Canada, which authored the oversight agency literature of interest in this presentation.

2. Background on Canada's Commissioner of Environment and Sustainable Development (CESD)

The following exhibits from the website of the Office of the Auditor General (OAG) provide the details about CESD which are sufficient for the purposes of this paper.

While excerpts are used here, it is recommended that all pertinent postings about CESD be reviewed prior to commencing the mining process. I return to this topic in section 3 to

re-confirm the expertise aspect of CESD which is discussed in the Doomsday Map and Stewardship Map paper, and to emphasize the advisability of being fully prepared when reviewing materials produced by oversight agencies.

The first exhibit provides the basic terms of reference for CESD activities.

Exhibit 1. Statement describing the Commissioner of the Environment and Sustainable Development

> On behalf of the Auditor General of Canada, the Commissioner of the Environment and Sustainable Development provides parliamentarians with objective, independent analysis and recommendations on the federal government's efforts to protect the environment and foster sustainable development.
>
> The Commissioner conducts performance audits, and is responsible for assessing whether federal government departments are meeting their sustainable development objectives, and overseeing the environmental petitions process.
>
> Appointed by the Auditor General, the Commissioner of the Environment and Sustainable Development is an Assistant Auditor General who leads a group of auditors specialized in environment and sustainable development.
>
> Source: http://www.oag-bvg.gc.ca/internet/English/cesd_fs_e_921.html

The second exhibit describes the origins of CESD, with emphasis on the sustainable development component. It may be instructive to note that the unfolding of sustainable development concepts and strategies in the Government of Canada began in the 1970s. The Ministry of State for Urban Affairs was one of several agencies which took the lead on a series of inter-departmental, eco-development meetings, *circa* 1977-78. That work ultimately provided fundamental inputs to the 1992 Earth Summit in Rio de Janeiro, which popularized the concept of sustainable development. I return to time line and trend line matters in section 4, and the discussion about using GIS to measure the Government of Canada's performance in identifying, adopting, and implementing sustainable development strategies[2].

Exhibit 2. Sustainable Development Strategies

> At the 1992 Earth Summit in Rio de Janeiro, Canada and numerous other participants committed to developing national strategies for sustainable development. Canada chose to make selected federal departments and agencies responsible for sustainable development within the sphere of their mandates. The aim was to ensure that environmental, economic, and social considerations would be systematically taken into account in their decision making, and lead to changes in policies, programs and operations that would further sustainable development.

Departmental Sustainable Development Strategies

Since 1995, designated departments and agencies have been required by law to prepare sustainable development strategies, then update them and present them to Parliament every three years. These strategies are meant to be the main vehicle to drive responsible management, from an environmental and sustainable development perspective, throughout the federal government.

Requirements for departmental strategies are detailed in the federal government publication *A Guide to Green Government*. The Commissioner of the Environment and Sustainable Development has also established certain expectations. The sustainable development strategies of federal departments and agencies are available on their websites, which can be accessed through links in the Government of Canada website. These documents are not published by the Office of the Auditor General of Canada, and are the responsibility of each department.

The Commissioner of the Environment and Sustainable Development assesses the quality of departmental sustainable development strategies and whether the plans set out in the strategies have been implemented. The results are presented in various reports of the Office of the Auditor General of Canada, including the Commissioner's reports to the House of Commons.

Federal Sustainable Development Strategy

The *Federal Sustainable Development Act*, which was passed in 2008, requires the Minister of the Environment to develop an overarching federal sustainable development strategy that includes sustainable development goals and targets as well as an implementation plan for meeting each target. The strategy will also identify the minister responsible for meeting each target. Departmental sustainable development strategies must now include plans and objectives that comply with and contribute to the new Federal Sustainable Development Strategy.

The Commissioner of the Environment and Sustainable Development provided comments to the Minister of the Environment on whether the targets and goals in the draft strategy can be assessed. He will monitor and report on how well federal departments and agencies meet the targets and goals that will be set out in the Federal Sustainable Development Strategy. The Commissioner will also report to Parliament on the fairness of the information in the progress report that the federal government will provide on the strategy.

- Review of the Draft 2013–2016 Federal Sustainable Development Strategy (June 2013)
    - Response from Environment Canada (June 2013)

- Comments on the Draft Federal Sustainable Development Strategy (June 2010)

Source: http://www.oag-bvg.gc.ca/internet/English/sds_fs_e_920.html

The clickable links provide access to a wealth of background information which is pertinent to the mission of mining for GIS nuggets involving each of M1, M2, and M3 in Figure 1. One link which is of particular importance to the search for GIS nuggets is departments and agencies, and a brief note of explanation is needed.

That is, and as shown in Table 3, 27 departments and agencies of the federal government are required to prepare a sustainable development strategy, and respond to environmental petitions. In view of the fact that each of them has responsibility for some geographically distributed element of the natural or built environment, including the core resources (land, water, and air), each of the 27 departments or agencies is a potential source of GIS nuggets which serve one or more of the M1, M2, or M3 missions identified in Figure 1.

Table 3. Federal departments and agencies required to prepare a sustainable development strategy and respond to environmental petitions

1. Agriculture and Agri-Food Canada
2. Atlantic Canada Opportunities Agency
3. Canada Border Services Agency
4. Canada Economic Development for Quebec Regions
5. Canada Revenue Agency
6. Canadian Heritage
7. Canadian International Development Agency
8. Citizenship and Immigration Canada
9. Environment Canada
10. Finance Canada, Department of
11. Fisheries and Oceans Canada
12. Foreign Affairs and International Trade Canada
13. Health Canada
14. Human Resources and Skills Development Canada
15. Indian and Northern Affairs Canada
16. Industry Canada
17. Justice Canada, Department of
18. National Defence
19. Natural Resources Canada
20. Parks Canada
21. Public Health Agency of Canada
22. Public Safety Canada
23. Public Works and Government Services Canada
24. Transport Canada

25. Treasury Board of Canada Secretariat
26. Veterans Affairs Canada
27. Western Economic Diversification Canada

The third exhibit is pertinent to everyone in the information field, including those with an interest in GIS and GIScience, and all the more so because of a recent report released by the non-profit group Evidence for Democracy, in association with researchers at Simon Fraser University (Evidence for Democracy 2014). The report assessed the media policies of 16 federal departments, and found them seriously wanting when it comes to open and free communication between scientists and the public through the media. I return to this topic later in section 4.2, Exhibit 14.

Exhibit 3. Environmental Petitions

> The petitions process was established by Parliament to make sure Canadians can get answers from federal ministers on specific environmental and sustainable development issues that involve federal jurisdiction. In addition to providing information to petitioners, petitions have prompted such action by federal departments as new environmental projects, follow-up on alleged violations, and changes or clarifications in policies and practices. The Commissioner of the Environment and Sustainable Development reports annually to Parliament on the petitions process.
>
> The Office of the Auditor General of Canada has prepared a guide to the environmental petitions process. The guide, called Getting Answers (PDF), explains the purpose and mechanics of the petitions process, describes the kinds of requests that can be made, and provides advice on how to prepare a petition.
>
> The full text of most petitions and responses can be found in the petitions catalogue, which currently contains petitions received before 31 December 2013. The catalogue is a useful resource for preparing a petition. Other Canadians may have already raised similar issues. The responses to those petitions may have addressed the concern or they could form a useful basis for a more focused petition.
>
> Source: http://www.oag-bvg.gc.ca/internet/English/pet_fs_e_919.html

The final exhibit is a list of the documents which comprise the oversight agency literature – Reports to Parliament – which is the focus of this paper on mining for GIS nuggets.

Exhibit 4: Reports to Parliament by the Commissioner of the Environment and Sustainable Development

- 2014 Fall Report of the Commissioner of the Environment and Sustainable Development

- 2013 Fall Report of the Commissioner of the Environment and Sustainable Development
- 2012 Fall Report of the Commissioner of the Environment and Sustainable Development
- 2012 Spring Report of the Commissioner of the Environment and Sustainable Development
- 2011 December Report of the Commissioner of the Environment and Sustainable Development
- 2011 October Report of the Commissioner of the Environment and Sustainable Development
- 2010 Fall Report of the Commissioner of the Environment and Sustainable Development
- 2009 November Report of the Commissioner of the Environment and Sustainable Development
  2009 Fall Report of the Commissioner of the Environment and Sustainable Development
- 2009 Spring Report of the Commissioner of the Environment and Sustainable Development
- 2009 March Report of the Commissioner of the Environment and Sustainable Development
  2009 March Status Report of the Commissioner of the Environment and Sustainable Development
- 2008 December Report of the Commissioner of the Environment and Sustainable Development
- 2008 March Report of the Commissioner of the Environment and Sustainable Development
  2008 March Status Report of the Commissioner of the Environment and Sustainable Development
- 2007 October Report of the Commissioner of the Environment and Sustainable Development
- 2006 September Report of the Commissioner of the Environment and Sustainable Development
- 2005 September Report of the Commissioner of the Environment and Sustainable Development
- 2004 October Report of the Commissioner of the Environment and Sustainable Development
- 2003 October Report of the Commissioner of the Environment and Sustainable Development
- 2002 October Report of the Commissioner of the Environment and Sustainable Development
- 2001 October Report of the Commissioner of the Environment and Sustainable Development
- 2000 May Report of the Commissioner of the Environment and Sustainable Development
- 1999 May Report of the Commissioner of the Environment and Sustainable Development

These pages have been archived on the Web

- 2014 Fall Report of the Commissioner of the Environment and Sustainable Development
- 2013 Fall Report of the Commissioner of the Environment and Sustainable Development
- 2012 Fall Report of the Commissioner of the Environment and Sustainable Development
- 2012 Spring Report of the Commissioner of the Environment and Sustainable Development
- 2011 December Report of the Commissioner of the Environment and Sustainable Development
- 2011 October Report of the Commissioner of the Environment and Sustainable Development
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- 2004 October Report of the Commissioner of the Environment and Sustainable Development
- 2003 October Report of the Commissioner of the Environment and Sustainable Development
- 2002 October Report of the Commissioner of the Environment and Sustainable Development
- 2001 October Report of the Commissioner of the Environment and Sustainable Development
- 2000 May Report of the Commissioner of the Environment and Sustainable Development
- 1999 May Report of the Commissioner of the Environment and Sustainable Development

Source: http://www.oag-bvg.gc.ca/internet/English/parl_lp_e_901.html

There is much more which could be presented as background material about CESD. However, I believe that the essentials are included in exhibits 1-4. Further, it is my expectation that the reader is fully capable of following the links of interest which are presented in the exhibits, as well as checking out media/popular literature items about CESD. As a heads up in the latter regard, it is my experience that CESD receives most of its media coverage within several weeks of the release of a Report to Parliament.

In the paper, Abuse v. Care of Land, Water, and Air, 1990-2015: The Doomsday Map and Stewardship Map Concepts as Compelling Arguments to Retrospectively Mine the Popular Literature for GIS Nuggets (Wellar 2014a), I make several comments about the skill levels associated with oversight agencies in general. In the next section I recall those comments, and add several more about the skill levels required to properly mine CESD reports for GIS nuggets.

3. An Advisory on Skills Required to Mine Oversight Agency and CESD Reports

Section 5 of the Abuse v. Care paper (Wellar 2014a), discusses the degree of difficulty, level of expertise, demanding nature, and other measures of the technical challenge of oversight agency reports:

> "…in my experience reports from oversight agencies are usually the most technically sophisticated of all documents published for public consumption by government agencies. Evidence in that regard includes performances by elected officials, pundits, and others who demonstrate that they clearly do not grasp the methodology behind oversight productions. The research colloquium [in 2015] preceding the conference [in 2016] addresses this matter by discussing skill requirements and providing reference materials needed to understand the reports, and to appreciate whether the popular literature is accurately interpreting oversight agency materials."

The finding from reviews of Canadian federal and provincial oversight agency reports is that in terms of methodology, many of them are high-quality documents on a par with such productions as: top-notch research proposals and reports to NSERC and SHHRC; peer-reviewed journal articles; outstanding conference presentations; master's theses in the natural sciences, library and information sciences, management science and operations research, engineering, and mathematics and statistics; and; doctoral-level research papers across the sciences and engineering[3].

Whether slightly generous or grudging in my findings, the point made is that these reports are far from being pieces of fluff. As indicated above, many elected officials (including cabinet ministers), vested interests, ideologues, etc., have been "taken to school" when their remarks reveal a diminished understanding or perversely biased view of oversight agency reports. Consistent with the comparable productions noted in the preceding paragraph, oversight agencies are widely respected for their sound work,

and are known to vigorously defend that work, thereby giving credence to the label of "watchdog" which is often applied to them.

In the case of CESD, members of the Commission who participate in writing Reports to Parliament have Master's degrees and/or professional accreditation as a minimum; their degrees are from a variety of fields, including accounting, biology, economics, engineering, environmental design, geography, geology, law, planning, public administration, and zoology; the agency uses a very rigorous document, the *Performance Audit Manual* (OAG 2014) to direct audit activities; and external advisors are engaged and external experts retained as needed to assist with financial and performance audits or special projects.

All in all, this is a highly-credentialed applied research and policy research group, and CESD Reports reflect a high level of expertise, discipline, tight editing, and, for want of a better word, intensity, in that there are no wasted words or sentences, much less throwaway paragraphs or pages.

In the case of CESD, therefore, mining for GIS nuggets is a particularly apt turn of phrase, since thorough examination of CESD Reports is more likely to involve methodologically designed deep digging than simply picking off "low-hanging fruit".

This is not to say, of course, that CESD reports are beyond improvement. Indeed, the agency itself strives to better its own performance. Rather, the objective is to alert or remind those mining these reports for GIS nuggets that, relatively speaking and in comparison to other federal government productions, CESD materials are not of the skimming variety[4]. They tend to be very carefully written, and are technically solid, which calls for attentive, analytical examination in order to fully appreciate the contents and their GIS nugget possibilities.

On the matter of skill level, then, it appears that in addition to having expertise in GIS and GIScience, mining CESD reports for GIS nuggets is likely to be more profitable for researchers whose credentials include a combination of: graduate-level courses in research methodology; experience in both client-driven and curiosity-driven research; a stint in a federal or provincial agency that involved participation in program or policy activities; experience in evaluating research proposals; and an education and training background in the subject matter domain of the CESD production being mined for GIS nuggets.

4. A suggested methodology for mining CESD reports in search of GIS nuggets

The agency was created in 1995, and in 1999 it submitted a Report to Parliament that could be construed as a baseline document against which to measure progress of the Government of Canada in stating and achieving its environmental and sustainable development objectives.

Drawing on the informative experience of using *circa* 1989-1990 as the base timeline for the Doomsday Map, and subsequently asking the question, "How well are we doing?" over time and up to 2015, I use the same approach for this paper about oversight agency literature. The primary difference, of course, is that of time span, namely, 25 years (1989/1990-2014/2015) for the Doomsday Map-Stewardship Map, and 15 years (1999-2014) for CESD.

In this case, paragraphs are selected from the 1999 CESD Report to Parliament, and they are accompanied by comments which could be used to think about why and how to mine the 1999 CESD report for GIS nuggets[5].

I then move to the 2014 Report to Parliament, and again provide comments which could be used to think about why and how to mine CESD reports for every year after 1999, and for every combination of years between 1999 and 2014.

However, in this case the search does not involve headlines. Instead, the focus is on trend lines, which could be mined for GIS nuggets serving one or more of the three core, related missions identified in Figure 1.

4.1. Exhibits from the 1999 CESD Report to Parliament

In the next several pages, I discuss a selection of paragraphs from The Commissioner's Observations—1999. I hasten to recall my observation above, however, about the high quality of CESD documents, and suggest that most if not all paragraphs in CESD Reports to Parliament bear careful scrutiny for GIS nugget possibilities.

To assist in tracking who wrote what, materials from the 1999 Report to Parliament are black and italicized, and my comments are red, bold, and plain text.

1999 May Report of the Commissioner of
the Environment and Sustainable Development

http://www.oag-bvg.gc.ca/internet/English/parl_cesd_199905_00_e_10166.html#0.2.2Z141Z1.8HM2LO.RR2LBF.LB

Exhibit 6. Federal-provincial agreements to protect the environment

The federal government has entered into environmental partnership agreements with the provinces to reduce overlap and duplication. The seven agreements we audited cover activities such as inspection, enforcement, monitoring and reporting …

Before entering into these agreements, the federal government did not formally analyze and document the potential for failure, including whether both parties could do what they were agreeing to do. There is no ongoing analysis of the impact of the agreements on environmental performance or on the industries involved. The federal government does not have a documented plan in the event that a province is unable to carry out its assigned responsibilities or an agreement is terminated.

Comment. Spatial data files, maps, or other spatial records were possibly part-and-parcel of every federal-provincial agreement. If so, they are a pertinent basis for measuring progress in subsequent years, and could be models for other countries considering such agreements. If not, what was the thinking about how impact assessments would be done without a spatial data base to record spatial phenomena, and to monitor and analyze changes to spatial distributions over time?

It is noted that the literature on impact assessment began more than 30 years prior to 1999, so this Report raises important questions about the state of GIS technology and GIScience, and their uses, across all federal agencies considered in the1999 Report.

Exhibit 7. A work in progress

Departments are now in the early stages of turning their strategies into action. They are making progress in delivering on their commitments. However, the quality of the information they have provided varies widely among departments. Departments are also just beginning to establish practices to support the delivery of their strategies, and gaps exist in key areas. Departments need to accelerate their plans to put appropriate management systems in place, paying particular attention to staff training and continual improvement practices.

Comment. Canada began down the environmental assessment and sustainable development paths in the 1970s, or more than 20 years prior to the 1999 Report. Further, and as demonstrated by the AuoCarto Six Symposium (Wellar 1983), Canada was an international leader in the design, development, and use of geographic information systems technology and GIScience methods, techniques and operations well before 1999.

I believe that a variety of GIS nuggets could reside in hard questions put directly to CESD as well as to federal departments and agencies about the kinds of spatial data files, maps, and other spatial records, as well as GIS technologies and GIScience capabilities that the departments put in place in 1999. Or, for that matter, were thinking about putting in place to create the data, information, and knowledge foundations upon which to base departmental decisions and actions involved in operationalizing or delivering strategies.

For anyone who is new to contacting federal departments for public information on public matters, it is my experience that not all federal departments are as cooperative and forthcoming as one might like, even when doing research which is arguably in the national interest. It is therefore my suggestion that the electronic (email) paper trail begin with the original communication being addressed to the Deputy Minister or counterpart agency head and copied to various parties, including Ministers with political responsibilities for the

respective agencies, CESD, the Clerk of the Privy Council Office, and members of the media with an interest in CESD matters.

And, as a closing observation about Exhibit 7, CESD could be a critically important source of GIS nuggets if it pursues the information theme in future reports. Again, to be perfectly clear, what we are after here as part of the GIS mining operation is learning whether, when, and how CESD pursued the GIS technology and GIScience dimensions, with what impacts on federal departments and on CESD.

Exhibit 8. Sustainable development challenges

Last year I presented the conclusions from the 1997 special session of the United Nations General Assembly, where Canada had joined more than 165 countries to assess progress toward sustainable development and to set future priorities. The international community expressed deep concern that overall global trends had worsened in the five years since the Rio Earth Summit. Greenhouse gas emissions, toxic pollution and solid waste were increasing; renewable resources like fresh water, forests, topsoil and fisheries were being overused; and the gap between the rich and the poor was growing.

All of these were signs of unsustainable development at the global level - an inability to care for people and, at the same time, the environment that supports them. Canada joined other countries in committing to ensuring that by 2002 - ten years after the Earth Summit - they would demonstrate measurable progress toward sustainable development. We have three years to go.

Comment. There is a high degree of correspondence between the messages presented in the 1989-1990 Doomsday Map headlines of land, water, and air abuses, the unsustainability themes of the Earth Summit in 1992, the concerns about global trends expressed at the special session of the UN General Assembly 1997, and the gap between abusing and caring for land, water, and air resources that was identified in Figure 11, Another look at Doomsday Map headlines *circa* 25 years later: How well are we doing now?, which appears in the Doomsday Map-Stewardship Map paper (Wellar 2014a).

And, most significant with regard to mining for GIS nuggets, there is a high degree of correspondence in the variables used to define and measure sustainability, as well as in the awareness that geography is a central part of defining, measuring, and representing sustainability situations and processes, including the shifts from abusing to caring for land, water, and air resources.

It therefore seems necessary that in order to "demonstrate measurable progress toward sustainable development", federal departments and agencies would have incorporated GIS technology and GIScience methodology in their data, information, and knowledge development and reporting procedures. If so, then the 1999 Report to Parliament points to federal departments and agencies as

highly likely rather than just potential sources of GIS nuggets. And, CESD could also be a continuing source of GIS nuggets if it pursues this theme in future reports.

Exhibit 9. This year's Report

This Report maintains our focus on the challenges the federal government faces in dealing with environmental and sustainable development issues. It illustrates that unsustainable development is not simply a distant global problem: it affects us where we live and where we work. How we manage sustainable development issues has important economic, social and environmental consequences.

Comment. The key word in Exhibit 9 for the purposes of this paper is "where", as in the statement "…*unsustainable development is not simply a distant global problem: it … affects us where we live and where we work*".

Recalling Exhibit 8, the concepts of sustainable development or unsustainable development are expressed by variables, and those of a geographic nature can be dependent or independent variables, depending upon the research design, reporting design, etc. This statement in the 1999 Report could be a catalyst for federal initiatives that produced nuggets pertinent to missions M1, M2, and/or M3 in Figure 1. And, CESD could also be a continuing source of GIS nuggets if it pursues this theme in future reports.

Exhibit 10. The Arctic - A Barometer of Global Environmental Change

31. To meet Canada's environmental commitments in the Arctic, scientists and program managers have been struggling with many of the same challenges discussed elsewhere in this report: building a solid information base through scientific research and monitoring, managing jurisdictional complexity, developing a strong domestic regime for implementing the agreements and contending with budget cuts. Managers in other program areas could learn from this experience.

Comment. The general theme of particular interest to this paper is expressed by the statement, "… *building a solid information base through scientific research and monitoring ….*"

Given that the Arctic accounts for 40 per cent of Canada's land mass and 2/3 of the country's coastline, it appears that departmental efforts to build and maintain geospatial data bases and undertake scientific research, policy research, geopolitical research, etc., would necessarily tie in with missions M1, M2, and M3 in Figure 1. It therefore follows that departments would be highly likely sources of GIS nuggets, and CESD would also be a highly likely and continuing source of GIS nuggets if it pursues this theme in future reports.

Exhibit 11. Implementing sustainable development strategies

38. Monitoring and reporting on federal progress toward sustainable development is a key part of my mandate. Last year, I provided our first assessment of the sustainable development strategies tabled in the House of Commons on behalf of 28 federal government departments and agencies. Through those strategies, departments are being challenged to take environmental, economic and social considerations into account more systematically across the board - in their policies, their programs and their day-to-day operations.

Comment. The word "geography" is notable by its absence from Exhibit 11, and especially because in the real world "*environmental, economic, and social considerations****" do not exist in a vacuum. Rather, they are a function of real-world situations and circumstances which are often affected directly or indirectly by such geographic factors, functions, and structures as: accessibility, adjacency, barriers, boundaries, buffers, closeness, clusters, compactness, concentration, congestion, connectivity, contiguity, density, diffusion, dispersion, distance, elevation, encroachment, intensification, interaction, isolation, location, migration, mobility, morphology, movement, nearness, networks, patterns, proximity, scale, segregation, separation, shape, sprawl, spread, territory, and topography.**

Moreover, with regard to the broader statement, *Through those strategies, departments are being challenged to take environmental, economic and social considerations into account more systematically across the board - in their policies, their programs and their day-to-day operations,* **the implementation challenge can only be met, I suggest, by intense, sustained recourse to GIS technology and GIScience methods, techniques, and operations.**

Consequently, that statement from Exhibit 11 could be the catalyst for a number of GIS nuggets resident in productions by MPs from across Canada, including cabinet ministers, as well as those created by federal departments, and CESD itself, in 1999 and in subsequent years.

As illustrated, the 1999 Report to Parliament by CESD is a potentially rich source of GIS nuggets, and it also points to other sources of GIS nuggets, including Members of Parliament and federal departments.

In closing this section, it is emphasized that the paper is illustrative rather than comprehensive by design, and hence the choice of the 1999 and 2014 Annual Reports to Parliament by CESD. The 1999 Report provides baseline information on the one hand and, on the other, that of 2014 provides the most recent CESD views on federal strategies and actions affecting Canada's environment and sustainable development situations, processes, and prospects. I hasten to add that if this design decision caused me to miss significant developments between 1999 and 2014, then I welcome them being brought to my attention in conference presentations in 2016.

Following the same design for comparability purposes, I use an indicative selection of statements from the 2014 Report to Parliament to expand on suggestions about why and how to mine the annual reports by Canada's Commissioner of Environment and Sustainable Development.

4.2. Exhibits from the 2014 CESD Report to Parliament

In the next several pages, I discuss a selection of paragraphs from The Commissioner's Perspective which are pertinent to this paper on oversight agency literature. I hasten to recall my observation above, however, about the high quality of CESD documents, and suggest that most if not all paragraphs in CESD Reports to Parliament warrant careful scrutiny for GIS nugget possibilities.

To assist in tracking who wrote what, materials from the 2014 Report to Parliament are black and italicized, and my comments are red, bold, and plain text.

2014 Fall Report of the Commissioner of
the Environment and Sustainable Development

http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_e_39845.html

Exhibit 12. Some progress has been made

Our audits found that the federal government is making progress on some of these issues. For example, the federal government is working with the province of Alberta to lay the groundwork for more comprehensive monitoring of the environmental effects of oil sands development. If this program, which is industry-funded, is fully implemented as planned, it will result in more frequent monitoring of more environmental parameters over a greater geographic [underline added] area. These results are important because oil sands development has been proceeding rapidly, a situation that has raised numerous environmental concerns, particularly about cumulative impacts.

Comment. The oil sands development situation in Alberta is only one of many federal actions across Canada with a geographic dimension. Questions such as the following arise about the methodology employed by CESD to monitor and evaluate progress by the federal government:

- **Does CESD maintain a geographic database or require that the federal government maintain such a database informing staff, MPs, and the Canadian public, including the media, about the extent of federal interest in matters geographic?**
- **Do CESD Reports and/or communications to departments and agencies include references to GIS technology and GIScience use by CESD and/or federal agencies in order to meet their respective information and informing requirements?**

Exhibit 13. Information for decision making

We need sound information to ensure that the resources developed today yield lasting social and economic benefits without imposing unacceptable environmental costs in the future.… However, the criteria that were applied to determine which projects should be subject to the Act are not well-documented, nor are they comprehensive. As a result, some projects with potentially significant environmental effects may be excluded from federal assessment without an explicitly stated rationale. I am concerned that, as a consequence, some significant projects will not be adequately assessed and that decision makers will therefore lack the information they require to mitigate environmental impacts.

Comment. The situation described by the Commissioner may well be regarded as appalling by those experienced in the matter of achieving better decisions through better information[6]. Indeed, they may regard it as inconceivable that the federal government in general or any of its departments or agencies in particular would not want to know "which end is up" when it comes to inflicting less abuse and taking better care of Canada's built and natural environments, including its land, water, and air resources[7].

It therefore strikes me that the Commissioner is making an excellent case for specifying and implementing highest order, all-that-is-needed GIS technology and GIScience across all federal departments and agencies having any association with CESD terms of reference.

However, it also strikes me that the critical nature of this connection is not made as explicitly nor as frequently as it could be and, in my opinion, should be.

In brief, it is now more than 15 years since the CESD operation began, and it is unsettling to say the least that after all those years, not months but years, some federal departments or agencies still need to be pushed and prodded by CESD to get up to speed on the matter of information for decision making.

Clearly, something is seriously wrong when one of the world's leading countries in information technology and geographic information systems is having such apparent difficulty implementing the results of its own federal R&D programs, some of which were launched more than 35 years ago.

Exhibit 14. Engaging Canadians

The best decisions are made when people with various perspectives sit at the same table, listening to each other, learning, and coming to consensus where possible.

Comment. For the vast majority of Canadians, concepts such as the environment and sustainable development are best described and most readily understood

through maps and graphic images, as opposed to text and numeric representations.

Simply put, many people, including Cabinet Ministers who insist on one-page, no compound sentence summaries of Cabinet Documents, are not willing to wade through dozens of pages of text much less hundreds of pages. Moreover, rare indeed are Canadians, including Deputy Ministers, who relish pages of linear or non-linear functions and equations, or table after table of population parameters or sample statistics on the hundreds of variables pertinent to analyses of environmental and sustainable development situations, processes, relationships, and futures.

Under the circumstances, the absence of any mention of GIS and GIScience in this section is puzzling to say the least. However, it is anticipated that at least a dozen of the 27 federal departments and agencies reporting to CESD will have looked into this matter, and their files are likely sources of a number of GIS nuggets applicable to M1, M2, and especially M3 in Figure 1.

I know from experience the benefits of reconciling different perspectives on an issue: a more thorough analysis of relevant factors, better decisions, and greater public support for these decisions.

Comment. As a community activist involved in environmental, sustainable development, planning, land use, transportation, and other matters of a geographic nature for more than 40 years, I observe without the slightest fear of contradiction that the above statement contains a considerable amount of truth, but with a hook.

That is, reconciling different perspectives about natural and built resources must be based on analysis and synthesis that is grounded in geography, and is represented by analogue and/or digital maps and other spatial representations. When that is not the case, citizen participation levels quickly move to low and lower.

One important challenge to CESD is to persuade federal departments and agencies to incorporate the geo-factor in their policies and programs, and to express the geo-factor in ways that have due regard for GIS technology and GIScience methods, techniques, and operations. If this was not done in Reports to Parliament between 2000 and 2013, then perhaps questions could be raised and recommendations made to CESD about incorporating and emphasizing their presence in the 2015 Report to Parliament.

Federal policies and legislation recognize the importance of stakeholder engagement in principle*, but* in practice *the issues we audited this year show that the government could do better in this important area. For example, many stakeholders have noted that they*

can no longer participate meaningfully in federal environmental assessments because they lack the capacity to respond.

Comment. GIS technology in combination with the Internet brings the Government of Canada virtually close to every Canadian with access to a computer or other electronic communication device, which means that there is no technological or technical reason for most Canadians in much of the country to be precluded from participating in environmental assessments.

Unfortunately, It appears that some federal departments and agencies which are subject to CESD review are sorely in need of marching orders from the Commissioner, supported by Parliament, to get their acts together and create the kind of "information society" that federal politicians, including Prime Ministers, have boasted about for at least 25 years to my recollection. Perhaps a forceful push in the direction of GIS technology and GIScience could yield a bounty of GIS nuggets that serve missions M1, M2, and M3, and would also support millions of Canadians becoming actively engaged in federal government deliberations involving the environment and sustainable development.

To make the best decisions, the government needs to engage citizens and share information. In several of the activities we audited this year, I note that the government consulted only narrowly (for example, on its proposed oil and gas GHG regulations) and did not explain its decisions (for example, on how it developed the list of projects that would be subject to environmental assessment under the Canadian Environmental Assessment Act, 2012).

Comment. Following from the position taken in several preceding comments, the failure of the federal government to effectively communicate with Canadians on any matter is here perceived to be a function of incompetence. Fortunately, in the event that incompetence is either the only cause or the main cause for the problems noted in Exhibit 14, help is at hand and simply needs to be brought to bear.

That is, over the years there has been steady progress in advancing GIS technology and GIScience, leading to major strides in accelerating the data->information->knowledge transform process.

As a result, since *circa* the mid-1990s there appear to be few if any technical or technological reasons for federal departments or agencies with a spatial aspect in their mandates to not use GIS technology and GIScience methods, techniques, and operations to provide timely, comprehensive CESD-related analogue and digital data and information to Canadians from coast-to-coast-to-coast.

It is therefore anticipated that mining CESD materials and associated federal government documents for GIS nuggets will be a catalyst to accelerate a

collective federal response that fully addresses the shortcomings identified in Exhibit 14.

Without sufficient information and engagement, Canadians have fewer opportunities to communicate their concerns to decision makers and fewer opportunities to legitimize future resource development decisions.

Comment. The theme, "lack of sufficient information and engagement" is a common denominator among CESD Reports to Parliament, beginning in 1999 and appearing again in 2014. Moreover, that theme has a history which goes back at least to the 1970s when I was Urban Information Coordinator at the federal Ministry of State for Urban Affairs, and had its origins more than 50 years ago in the creation of organizations such as the Urban and Regional Information Systems Association.

However, over the years there has been steady progress in advancing GIS technology and GIScience, leading to impressive strides in accelerating the data->information->knowledge transform process. As a result, since the mid-1990s there appear to be few if any technical or technological reasons for federal departments or agencies with a spatial aspect in their mandates to not use GIS technology and GIScience methods, techniques, and operations to provide timely, comprehensive CESD-related analogue and digital data and information to Canadians from coast-to-coast-to-coast.

And that situation prompts such questions as:

> **If there are no technical or technological constraints to meeting a mandated obligation, why is the information and engagement obligation not being fully met?**
>
> **And,**
>
> **What, exactly, are the failing federal departments and agencies doing to fix the failed information access and engagement problem?**

Of particular interest, I hasten to add and emphasize, is a detailed account of the use made of GIS technology and GIScience methods, techniques, and operations in all government units, but especially in the failing departments and agencies, since this could be a factor in their failed performances.

It seems most likely that questions along those lines, and others of that nature, could be a recipe for productively mining past, present, and future CESD Reports to Parliament for GIS nuggets.

And, in the process, it appears advisable to check and/or ask about federal department and agency responses to every CESD comment or question that can

be tied to the entries in Table 1, which lists a number of possible nuggets to be derived from using the retrospective approach to examine "the literature".

The preceding exhibits from the 1999 and 2014 CESD Reports to Parliament are suggested to be more than sufficient to establish the value of mining them and other CESD Reports, for GIS nuggets.

Further, all the Reports to Parliament include links to additional, relevant materials, which substantially increases and enriches the CESD body of literature as a source of GIS nuggets.

And, as a final methodology suggestion, the reader is referred to the *Guide for Presentations, Conference on Using the Retrospective Approach to Mine for GIS Nuggets* (Wellar 2014b). That document provides a directive context for the design, development, and implications of all Colloquium presentations and papers.

5. Conclusion

It is my recommendation that each Report to Parliament by the Commissioner of Environment and Sustainable Development, from 1999 to 2014 (and in future years) be mined for GIS nuggets.

To recall some of the observations made about the relevance of the Reports to this project, and as demonstrated by comments on the Reports for 1999 (baseline) and 2014 (most recent), the Reports:

- Comprise an exceedingly rich body of literature on geographic phenomena (represented by the terms environment and sustainable development);
- Involve 27 federal departments and agencies;
- Review and evaluate federal government progress in developing and implementing strategies to serve and promote sustainable development (which applies to both the built and the natural environments); and, central to the task of mining for GIS nuggets,
- The Reports maintain a core theme about the importance of information which is to be collected and processed by federal departments and agencies, and is to then be used to: monitor and analyze environmental and sustainable situations and processes; direct and support policy, program, and strategy decisions; and communicate with citizens on environmental and sustainable development challenges, opportunities, issues, options, and initiatives.

Connecting the dots leads to a compelling argument, I suggest, about the merits of mining CESD Reports to Parliament.

That is, the information topic which is repeatedly referred to in the Reports is directly affected by the extent to which GIS technology and GIScience are incorporated in the day-to-day operating procedures of most if not all the 27 federal departments and agencies listed in Table 3, and within CESD as well since it needs a similar capability to review and evaluate the geographic information submitted by departments and agencies.

Further, and this point cannot be over-emphasized, the named federal departments and agencies are required to prepare a sustainable development strategy and respond to environmental petitions.

It therefore appears most likely, if not inevitable, that mining CESD literature for GIS nuggets will also provide directions about where and how to mine federal department and agency literature for GIS nuggets that directly contribute to M11, M2, and M3 in Figure 1, which is repeated for the convenience of the reader.

Figure 1. GIS nuggets defined

GIS nuggets are findings from the literature or other sources which serve three core, related missions:

M1. Designing and developing geographic information systems technology;

M2. Defining and elaborating geographic information science;

M3. Using geographic information systems technology and/or geographic information science.

6. Endnotes

1. The primary reasons for selecting the Commissioner of Environment and Sustainable Development (CESD) as a producer of oversight agency literature are presented in the paper. In addition, however, I have a longstanding professional interest in CESD as a result of public service publications (e.g. *Sustainable Transport Practices in Canada: Exhortation Overwhelms Demonstration;* Wellar 2006); consulting assignment reports (e.g. *Results of an Inquiry into the Methodologies, Methods, and Techniques Used to Make Decisions about Sustainable Transport Practices;* Wellar 2009*);* and public service presentations (e.g. *Transportation: Inspiring a Sustainability Action Agenda*; Wellar 2011) on topics within the purview of CESD. Selecting CESD for this project provides an opportunity to continue my involvement in those lines of research, and to present ideas about GIS technology and GIScience methods, techniques, and operations which could be instructive to CESD as it evaluates the progress of federal departments and agencies in using environmental and sustainable development information, and in making it available to Canadians in a timely and accessible manner.

2. At the time of writing I had not located any publication which formally graded, rated, evaluated, etc., oversight agency reports, or which provided substantive comments about the relative quality of the methodology employed in the various oversight agency reports. I welcome information in that regard being brought to my attention by email to: wellarb@uottawa.ca.

3. To be clear about the basis of my assessment, it is driven by methodology, with more emphasis on methods than on techniques, for good reason. CESD Reports to Parliament are not being sent to proverbial "rocket scientists". Rather, they are submitted to Parliament, which consists of appointed Senators in the Senate and elected Members (MPs) in the House of Commons, very, very few of whom in either institution appear to have earned credentials – via higher education, specialist training, methodologically designed and supervised practical experience – involving either the environmental sciences or the economics, geography, engineering, planning or other discipline-related aspects of sustainable development. (Note: I stand ready to be corrected in that regard, and upon receipt of pertinent evidence I will revise the paper accordingly.)

Further, as the author of a number of reports to the management or executive functions of government over the past four decades, I am well aware of the actual significance of the KISS principle when sending policy papers "upstairs", and/or to elected officials at any level of government, including the federal level.

It is my perception that the CESD Reports to Parliament are near the limit for some MPs and Senators, and over the limit for others in terms of complexity, and that any additional complexity would negatively affect Report reliability and/or utility in the minds of MPs and Senators. A case in point is illustrated in reported media comments (e.g., Aglukkaq lashes out at watchdog – Minister slams new environment commissioner's report, Ottawa Citizen, October 9, 2014), which suggest to me that the Minister did not understand the Report, or, perhaps, rather than attempt the difficult task of rebutting an evidence-based report with evidence, and having to answer questions about her statement in the House of Commons, she simply chose to engage in political posturing, rhetoric, etc., much along the lines of "Blame the messenger" when one cannot cope with the message.

4. Based on a number of direct experiences, it is my belief that CESD reports are comparable to materials produced for or by Canadian federal research-oriented agencies such as the Natural Sciences and Engineering Research Council, and the Social Sciences and Humanities Research Council. CESD reports are also becoming increasingly comparable in robustness to the best of those released by federal line departments, in part because (as suggested by my network of contacts across Canada in various fields), there has been a serious decline in the quality and quantity of scientific reports entering the public domain over the past 6-8 years.

Summarizing the situation, it appears fair to say that productions by federal departments and agencies which are allowed into the public domain are increasingly perceived to be

more show than substance, and relatively few productions are deemed to be of a deep-think nature. An indicative comment along these lines which appeared in print at the time of this writing is a letter to the editor titled "Government treats scientists as fools – Re: Health Cda 'vanity press' peer review questioned", Ottawa Citizen, Oct. 31, 2014.

5. The comments and questions could also be used to mine documents submitted to CESD by federal departments and agencies, but that is a topic for a different body of literature, namely, Corporate/Institutional-Public Literature in Table 2.

6. Variations of the observation by the Commissioner that "*We need sound information to ensure that the resources developed today yield lasting social and economic benefits without imposing unacceptable environmental costs in the future"* were around in principle in the mid-1960s during my graduate school days at Northwestern University. And, as I learned from Prof. William Garrison, currently Professor Emeritus at Berkeley and one of my professors at Northwestern, the purported need for sound information has been around since the onset of bringing computers into government more than 50 years ago.

As learned over the years, however, the claim of waiting for more or better information before making decisions is often used as an excuse to do nothing, or, to re-phrase, having information is one thing and acting on it quite something else. The CESD Reports to Parliament may therefore need to sharpen the distinction between having sound information and acting on it, in order to more definitively identify federal departments and agencies that are willfully not meeting their duty of care obligations and standard of care responsibilities on environmental and sustainable development matters.

7. Decisions by governments are affected by various considerations, including ideological biases or inclinations that have more to do with serving special or vested interests, including political parties, than the public interest. However, exploring that issue is outside the purview of a paper about mining oversight agency literature for GIS nuggets. The premise of the mining for GIS nuggets exercise is that government decisions are based on competence supported by information, and our task is to identify ways to improve the geographic information available to competent decision makers, and the use of that information in the public interest.

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