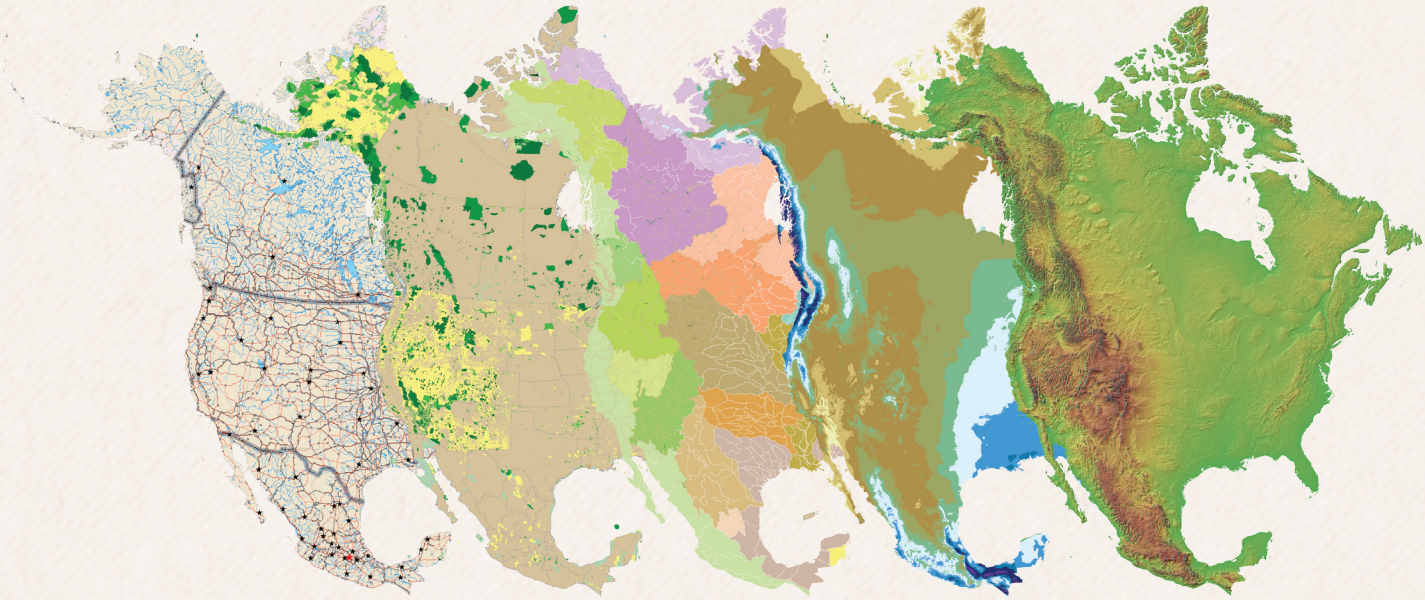
Long-term Impact Assessment

of the North American Environmental Atlas and the North American Land Change Monitoring System (1996–2016)



Executive Summary

Because our environment does not end at the border, the CEC has developed over the last 22 years a unique framework that harmonizes geographic information in a seamless manner across North America's political boundaries. Its North American Environmental Atlas aims at better monitoring environmental trends and land-cover changes in the region.

In 2018, the CEC commissioned a report to assess the long-term impact of the CEC's North American Atlas and the North American Land Change Monitoring System (the NALCMS), together referred to as "the Atlas," over the first twenty-year period from 1996 to 2016. This assessment shows that the Atlas's foundational and thematic maps have helped visualize the continent's shared environment and identify transboundary environmental issues, supporting research, analysis and environmental decision-making and management at national and continental levels.

During this period, the CEC produced over 50 map layers at a scale of one to ten million or finer, and their associated data sets; constructed an interactive Internet portal for the Atlas and made the contents freely available, including a number of related products, such as an e-book, educational videos, Google Earth tours and Atlas newsletters. It also undertook various outreach efforts to make the Atlas known to the public.

The base map layers include the first holistic North American ecological classification system; political boundaries (international and state/provincial); major roads; railroads; populated places; hydrography (lakes, rivers, coastlines); glaciers and sea ice; bathymetry (depths of water bodies); and wetlands and watersheds. Thematic and issue-oriented maps include data layers for renewable energy capacity, marine ecoregions, pollutant release facilities, protected areas, priority conservation areas, and important species ranges, among others. The NALCMS products also include land cover and land-cover change for 2005 and 2010 that can be used for carbon sequestration analysis, wildlife-habitat mapping, ecosystem monitoring, environmental planning, water quality assessments, and biofuels production potential, etc.

Base map

The Atlas was produced through collaboration between CEC program managers and partners from the three countries, including Atlas agencies and specialists in their departments as well as other government agencies and academic centers of excellence. The CEC acted as the catalyst and convener and funded the Atlas through its programs. Over the first twenty-year period, the CEC budgeted C$1.9M toward the Atlas, of which it spent C$1.7M.

The assessment was based on information from CEC reports, documents and communications relating to the initiative, as well as the results of interviews with 19 experts from the three countries, involved with steering the Atlas program over the years, and a survey questionnaire of users.

The following two questions are among those investigated and describe some of the findings:

Did the initiative address the environmental objectives stated in Council decisions and the activities and tasks specified in the CEC Operational Plans over the 20-year period?

The Atlas projects successfully addressed the Council goals and the Atlas-related objectives in the CEC's operational plans. After 2010, however, the biannual operational plans did not include specific objectives related to the Atlas work; yet, from 2010 to 2016, mapping outcomes were achieved through mapping objectives contained in the Ecosystem Carbon Sources and Storage and Blue Carbon projects.

Did the initiative reach its intended beneficiaries/audience and, if so, how did they use the information produced?

The Atlas's primary target audiences are the general, interested public; users of CEC reports; researchers; and decision makers. Qualitative feedback received during the interviews identified specific uses of Atlas products and demonstrated the plethora of ways in which the unique interactive mapping products have been used to discover environmental information and issues of shared tri-lateral concern across the North American continent.

Examples of innovative uses of the map layers include:

- Mapping changes in sea-ice extent; use of the watersheds map to help control the spread of invasive aquatic species;
- Showing the amount of land protected in each country, by land-cover type;
- The mapping of CO_2 emissions from freight transportation from Mexico City to Montreal; and
- The impact of the Deepwater oil spill on protected areas.

The evidence also showed that the use of Atlas products increased over the period and underscores the high appreciation users have for the free, reliable, downloadable and easy-to-understand government-endorsed data. Results also indicated the improved visualization and wider awareness and understanding of North American environmental topics among users. However, there may remain a lack of knowledge of the CEC and its mapping products among many Mexican institutions.

Successes

The following outcomes of the Atlas initiative were documented or reported on during the interviews:

- Finances and human resources leveraged from partners in the three countries complemented CEC funding, to accomplish "a lot with little" (CEC 2012).
- The project created a new knowledge-management approach and a new standard with which to harmonize data and create future maps. It has become an example and model of how to create common data standards, policies, models and criteria in a systematic, well-documented and transparent process that helps increase the sharing and exchange of environmental data and knowledge across national boundaries (CEC 2012).
- The Atlas project added value to the relevant CEC projects and served as a clearinghouse for most program-related maps, enhancing the visibility of the issues that the projects address and their continental scale (CEC 2012). Examples of recent CEC projects that had the vision to include a geospatial component include Grasslands, and Marine Protected Areas (MPAs).
- NALCMS data are being used by the Food and Agriculture Organization (FAO) and in submissions to the Intergovernmental Panel on Climate Change (IPCC), among other institutions.

Following are other examples of how Atlas frameworks and data are being used, replicated, and copied:

- Indirect spinoffs of the forest carbon mapping include the use of the same tool, in the states of Pennsylvania and Vermont and in Honduras and Columbia in Latin America; the model is also being used in many Canadian provinces.
- The US Environmental Protection Agency's (EPA's) Office of Research and Development is building a terminology library that uses the nineteen NALCMS classes of land cover (CEC 2018).
- EPA and the US Fish and Wildlife Service (USFWS) have used the NALCMS data for analysis models for protected area and species distribution, to develop comprehensive land-cover data for Latin America and the Caribbean (Latin American Network for Monitoring and Studying of Natural Resources—SERENA) (Conabio n.d.).
- The Canadian Forest Services has used the Atlas's terrestrial ecoregions divisions to organize 2006 National Forest Inventory data on biomass. The Forest Carbon Accounting program used these data to model and report on forest carbon stocks, as required under the Kyoto Protocol (CEC 2010; CNFI 2016).
- Harmonized data were of great interest to the International Joint Commission (IJC).
- The CEC data set is used by the Landscape Conservation Cooperative Network.

Challenges and Opportunities

In the early years, many technical and coordination challenges, such as those related to harmonizing geo-referenced data across the three countries, were overcome to construct the map layers that are now part of the Atlas portal (CEC 2012). Remaining challenges include the need to update the Atlas code more frequently to increase the speed of the map viewer and download times and to address potential difficulties some users express in finding the online Atlas portal. Other challenges include the recent lack of additional thematic layers and the limited analytical capabilities of the interactive layers.

Yet, other challenges relate to funding. CEC funding was sufficient to support the Atlas from 2006 to about 2014, especially given the leveraging of support from the partner agencies. For example, they dedicated additional time, technical expertise and institutional budgets to develop the frameworks, harmonize and validate the data, and maintain the project, reducing the need to hire expert consultants. However, if the CEC's overall budget has helped maintain the Atlas website and support NALCMS activities, the amounts of funding have been insufficient to keep the Atlas properly updated, innovative and useful.

In order to improve the Atlas initiative, the following suggestions were made:

- Improve outreach, especially at the borders and in Mexico;
- Include a map on biomass change;
- Integrate simple reporting and analysis features;
- Develop automated ways to update data; and
- Make the Atlas a node for the World Database of Protected Areas (WDPA) to provide seamless North American coverage.

Recommendations

Given the importance of geospatial data for CEC projects and the shared environment, the Atlas project needs to be renewed and appropriate resources dedicated to it. The Atlas's future could be imperiled if financial and personnel resources are not sufficient and it is not kept up to date.

A regular feedback mechanism is also needed between the Secretariat and the Parties to share how the Atlas meets the Council's interests and needs and to identify any gaps.

In addition:

- The CEC should continue to seek and engage partners within academia, governments and the private sector in the three countries in order to help sustain Atlas activities in the long term, including outreach and the contribution of new maps and map layers to the project. Long-term funding at the Secretariat is also needed for coordination, aggregation and publishing.
- The CEC should review the functioning of its constituencies and partnerships and seek to generate higher added value from its mandate and structure to engage new partners for the Atlas.
- The CEC should also revive inputs from CEC projects by identifying key continental, national and regional environmental issues and needs and then mapping and monitoring them through the Atlas project. It could thus identify "hot spots" of significant environmental change, especially due to trade. The process would also help shed light on the overall effectiveness of the CEC's operational plans and funding strategies.
- The CEC should increase funding for NALCMS to increase the intensity and frequency in processing satellite imagery for cross-border mapping. Scientifically credible, geo-referenced data would support evidence-based policies aimed at addressing the negative environmental changes revealed.

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Commission for Environmental Cooperation
700 de la Gauchetière St. West, Suite 1620
Montreal (Quebec) H3B 5M2 Canada

Phone: 514.350.4300 Fax: 514.350.4314
info@cec.org / www.cec.org

cec.org