Alignment of Tipping Points Science with Environmental Impact Assessments under the Canadian Environmental Assessment Act 2012

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Purpose Statement

This document briefly summarizes key statutory and regulatory requirements for conducting environmental and cumulative impact analyses under the Canadian Environmental Assessment Act 2012 and identifies points in the process where tipping points science may be most useful to managers and improving existing practice. The "Summary for Managers" introduces these high level insertion points for tipping points science. A more comprehensive analysis of integration of tipping points science and the Canadian Environmental Assessment Act's required procedures follows.

This document is designed for use primarily by agency practitioners and scientists interested in using tipping points science in their work. However, we have attempted to make this document accessible to a broader audience by including background information on the statutory and associated regulatory requirements of the Canadian Environmental Assessment Act.

This document regularly refers to tipping points scientific strategies, which are not explained in detail in this document. For information on these strategies, please refer to the Ocean Tipping Points Guide.

Summary for Managers

The Ocean Tipping Points strategies are designed to facilitate the identification and consideration of ecological thresholds, leading to informed management actions. Thus, they can help identify ecological thresholds of concern under the Canadian Environmental Assessment Act, explore social preferences and acceptable levels of risk, and enable well-informed decisions. Ocean Tipping Points strategies can also expand the integration of social and cultural concerns and impacts into management decisions. While the essential considerations outlined in this project are not new to agency practitioners, the systematic process and guidance for identifying and managing ecological thresholds of concern provided by the Ocean Tipping Points Guide can improve the use of ecological thresholds in planning and project-level decisions.

The Ocean Tipping Points project team has identified that tipping points science is well-suited to assist agency practitioners to:

- Incorporate broader ecosystem concerns and thresholds into scoping, analysis, and mitigation - The tipping points strategy for characterizing tipping points and their drivers can assist CEAA practitioners in identifying thresholds of concern that may result from the proposed project.
- Incorporate social and cultural preferences and risk tolerance into impact analysis - The tipping points strategy for characterizing social preferences and risk tolerance can assist decisionmakers choose alternatives that are broadly aligned with public opinion and priorities.
- Conduct quantitative watershed- or airshed-level cumulative impact analyses – The tipping points strategy for characterizing drivers and responses in an ecosystem can assist practitioners in creating conceptual models of an ecosystem to evaluate different project alternatives based on ecosystem level and cumulative effects.
- Identify leading indicators that can be used to describe the current environment and determine project consequences – The tipping points strategy for identifying leading indicators can assist practitioners in determining the current and projected future risk of crossing thresholds.

For more detail, continue to the full analysis on page 3.

Introduction

The Canadian Environmental Assessment Act, 2012[1] (CEAA 2012) creates Canada's environmental assessment regime. Pursuant to CEAA 2012, certain types of projects must undergo environmental assessment. The Regulations Designating Physical Activities[2] set out precisely which projects must be reviewed. These include onshore and offshore projects such as mining, pipelines, offshore oil and gas drilling, marine terminals, and nuclear facilities.

Section 19 of CEAA 2012 lists the factors to be considered in the environmental assessment of a project. Cumulative effects is one of those factors. Subsection 19(a) explicitly requires that "any cumulative effects that are likely to result from the designated project in combination with other physical activities" be factored into the environmental assessment.[3] Study of cumulative effects is also one of the stated purposes of the Act in subsection 4(1)(l), "to encourage the study of cumulative effects of physical activities in a region and the consideration of those study results in environmental assessments."[4]

The lead federal entity for environmental assessment is the Canadian Environmental Assessment Agency ("the Agency").[5] That office has published two guidance documents to give effect to CEAA 2012 cumulative effects provisions and to provide clarity for stakeholders. First, the "Operational Policy Statement - Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012" (OPS) was published in 2013 and then updated in March 2015.[6] The OPS sets out the general expectations for assessing cumulative environmental effects related to designated projects reviewed under CEAA 2012. This guidance sets out the five generic steps for the analysis: scoping, analysis, mitigation, significance, follow-up (note that scoping includes identifying valued components (VCs), determining spatial and temporal boundaries, examining physical activities that have been carried out). More detail is provided in Table 1, below.

The Agency has published more specific draft guidance in the document, "Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012" (Technical Guidance).[7] This guidance provides methodological options and considerations to support the implementation of CEAA 2012 and the generic approach outlined in the OPS. The Agency website indicates that, "the Technical Guidance supports practitioners in determining how to conduct a cumulative effects assessment while allowing for flexibility in identifying the most appropriate methodology and methods."[8] The draft guidance is heavily oriented to the first two steps of CEA set out in the OPS, scoping and analysis.

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[1] CEAA 2012. http://laws-lois.justice.gc.ca/eng/acts/c-15.21/index.html
[2] Regulations Designating Physical Activities. http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-147/index.html
[3] Subsection 19(a), Regulations Designating Physical Activities. http://laws-lois.justice.gc.ca/eng/acts/c-15.21/page-3.html#h-13.
[4] Subsection 4(1)(l), Regulations Designating Physical Activities. http://laws-lois.justice.gc.ca/eng/acts/c-15.21/page-2.html#h-4
[5] Agency Website. See http://www.ceaa.gc.ca/default.asp?lang=en&n=0046B0B2-1.
[6] Operational Policy Statement - Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012. https://www.ceaa-acee.gc.ca/default.asp?lang=En&n=1DA9E048-1
[7] Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012. https://www.ceaa-acee.gc.ca/default.asp?lang=en&n=B82352FF-1&offset=&toc=hide.
[8] Agency website. https://www.ceaa-acee.gc.ca/default.asp?lang=en&n=4BE638B1-1.

Table 1 - CEAA 2012 Operational Policy Statement five steps for Cumulative Effects Assessment		
Step	**Activities involved in each step**	**Agency Description[9]**
Step 1: Scoping	• Identify VCs for which residual effects are predicted • Determine spatial and temporal boundaries • Examine the relationship of residual effects of the project with those of other activities (including those that have been carried out and those that *will* be carried out)	Defining the scope of the assessment is the first step in the assessment of cumulative effects. Scoping helps determine which VCs should be carried forward into the Step 2 analysis. This helps orient and focus the cumulative effects assessment.
Step 2: Analysis	• Data collection/generation • Predict and analyze cumulative environmental effects • Present types and scale of cumulative effects • Incorporate community and Aboriginal traditional knowledge	Step 2 considers how the physical activities examined during Step 1 may affect the VCs identified for further analysis in Step 1. Step 2 addresses such VCs within spatial and temporal boundaries set for the assessment of cumulative effects during Step 1.
Step 3: Mitigation	• Identify technically and economically feasible measures to mitigate any significant adverse cumulative environmental effects • Consider elimination or control of the project effects; alternatively, identify restitution measures (e.g. compensation, restoration)	Step 3 aims to identify technically and economically feasible measures that would mitigate adverse cumulative effects. Mitigation may include elimination, reduction or control or, where this is not possible, restitution measures such as replacement, restoration or compensation should be considered.
Step 4: Significance	• Consider significance of cumulative effects that are likely • Account for mitigation measures	Step 4 is concerned with determining the significance of any adverse environmental effects that are likely to result from a designated project in combination with other physical activities, taking into account the implementation of mitigation measures.
Step 5: Follow-up	• Address project-specific environmental effects and cumulative environmental effects	With Step 5, a follow-up program is developed that addresses both project-specific environmental effects and cumulative effects. A follow-up program verifies the accuracy of the EA and determines the effectiveness of any mitigation measures that have been implemented.

Table 2 sets out steps for analysis under the Ocean Tipping Points approach.

[9] Technical Guidance for Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012 at p.3 https://www.ceaa-acee.gc.ca/Content/B/8/2/B82352FF-95F5-45F4-B7E2-B4ED27D809CB/Cumulative_Environmental_Effects-Technical_Guidance-Dec2014-eng.pdf.

Table 2: Ocean Tipping Point Strategies
Characterize tipping points in your system a. Define tipping points of concern b. Link ecosystem change to key drivers
Define management objectives in relation to ecosystem state a. Characterize social preferences for ecosystem states b. Analyze risk of crossing a tipping point and characterize people's risk tolerance to changes that could result
Set targets and design monitoring a. Identify early warning indicators that signal approach of a tipping point b. Use social preferences, risk tolerance and social and ecological thresholds to inform target-setting
Evaluate management scenarios and select a course of action a. Develop potential future management scenarios and choose appropriate decision support tools to evaluate them

The requirement of cumulative effects assessment under CEAA 2012 and associated recent guidance offer a fertile area for OTP science and approaches to add value.

The CEAA 2012 Five Step Approach to Cumulative Effects Analysis

Drawing on the CEAA 2012 OPS and Draft Technical Guidance, this section sets out the Agency's five step approach to CEA and identifies OTP "integration points" where OTP science could be of value in CEA.

CEAA Step	Sub-steps & Methodology[10]	OTP Integration point[11]
Step 1: Scoping Defining the scope of the assessment is the first step in the assessment of cumulative effects. Scoping helps determine which VCs should be carried forward into the Step 2 analysis. This helps orient and focus the cumulative effects assessment.	1.1 Identifying Value Components – Identification of VCs is based on the assessment of environmental effects of the project. Where residual environmental effects from the project are expected, those VCs are identified for consideration in the cumulative effects assessment.[12]	In conjunction with identifying VCs, the CEA could **define thresholds of concern** in the affected ecosystems. These thresholds would be 'scoped in' as part of the CEA analysis and pointed to as key areas for concern where residual environmental effects are expected. This scoping work would also include **identifying drivers of relevant thresholds and characterize relationships between drivers and VCs**. All of this would take place within the defined spatial and temporal boundaries, both of which would be set with consideration of potentially relevant thresholds. A CEAA 2012 review context where this is foreseeably relevant is an offshore oil and gas drilling program or construction of a marine terminal.
	1.2 Determining spatial boundaries – Spatial boundaries are to encompass the potential environmental effects on the selected VC of the designated project, in combination with other physical activities that have been or will be carried out.[13]	
	1.3 Determining temporal boundaries – Temporal boundaries should account for past and existing physical activities, as well as future physical activities that are certain and reasonably foreseeable. They should also account for the degree to which the environmental effects of the physical activities overlap those predicted from the designated project.	
	1.4 Examining physical activities that have been and will be carried out – Examining other physical activities that have been carried out up to the time of analysis or will be carried out in the future.	
Step 2: Analysis This step considers how the physical	2.1 Analyzing Various Types of Data and Information – Analysis should consider information about current and past environmental conditions (i.e. baseline	To incorporate OTP approaches, the analysis of cumulative effects, including analyzing various types of data and

[10] These are taken from the Technical Guidance and cited as appropriate. However, the Technical guidance only includes details for steps 1 & 2.
[11] Specific OTP steps or sub-steps are identified here in this column in **bold**.
[12] Tech Guidance at p.10.
[13] Tech Guidance at p.14.

activities identified during Step 1 may affect the VCs identified for further analysis in Step 1. Step 2 addresses such VCs within spatial and temporal boundaries set for the assessment of cumulative effects during Step 1.	information), information on environmental effects of physical activities, and Aboriginal traditional knowledge and community knowledge. 2.2 Addressing Data Limitations and Uncertainty in the Analysis – Potential cumulative environmental effects should be considered even when there is little supporting data or there is predictive uncertainty.	uncertainties, could **identify and characterize relationships between drivers and ecosystem components** with particular attention to the **thresholds of concern** identified in Step 1. Such work would be integrated with analysis devoted to baseline information and Aboriginal traditional knowledge, for example. A valuable part of this work would be **analyzing risks of crossing a threshold and ecosystem changes** that could result.
Step 3: Mitigation	This step aims to identify technically and economically feasible measures that would mitigate adverse cumulative effects. Mitigation may include elimination, reduction, or control or, where this is not possible, restitution measures such as replacement, restoration or compensation should be considered. [no sub-steps provided by Agency]	This dimension of the CEA could include the OTP step of **evaluating scenarios and selecting courses of action**, including **future management scenarios** and **evaluating management alternatives**.
Step 4: Significance	Step 4 is concerned with determining the significance of any adverse environmental effects that are likely to result from a designated project in combination with other physical activities, taking into account the implementation of mitigation measures. [no sub-steps provided by Agency]	OTP approaches could be of critical value in determining significance in this context. Specifically relevant are the OTP steps of **defining thresholds of concern** and then **identifying leading indicators that signal the approach of a threshold** and **setting targets and limits based on known thresholds, social preferences, and risk analysis.** Consideration of thresholds could be used as a primary basis for determining whether or not an environmental effect should be considered significant (note that under CEAA 2012 identifying a "significant adverse

		environmental effect" (after mitigation measures are factored) provides a legal basis to reject a project.
Step 5: Follow-up	With Step 5, a follow-up program is developed that addresses both project-specific environmental effects and cumulative effects. A follow-up program verifies the accuracy of the EA and determines the effectiveness of any mitigation measures that have been implemented. [no sub-steps provided by Agency]	Required follow-up could be augmented with the OTP of **monitoring the ecosystem state and response to management intervention**. A follow-up program could include **adaptive management and model refinements** aimed at ground-truthing identified risks and avoiding the crossing of ecosystem thresholds**.**

Conclusion

Integration of OTP steps into CEA is a natural fit in the Canadian environmental assessment context. In Canada, Agency guidance sets out five generic steps for CEA. There is a great deal of room in each of these steps for integration of one or more OTP approaches, as set out in the analysis above. Overall, environmental assessment managers and decision-makers, and ultimately terrestrial and marine ecosystems, would benefit from integrating OTP concepts and methods in practice.