

## Original article

# Lasting regional gains from non-renewable resource extraction: The role of sustainability-based cumulative effects assessment and regional planning for mining development in Canada



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## ARTICLE INFO

## Article history:

Received 5 October 2016

Received in revised form 9 January 2017

Accepted 10 January 2017

Available online 20 January 2017

## Keywords:

Cumulative effects

Environmental assessment

Strategic environmental assessment

Sustainability assessment

Ring of fire mining development

## ABSTRACT

If mining proposals are to receive more positive reception in host communities and regions, they will need to be planned, reviewed and approved in ways that ensure they contribute to more sustainable regional futures. That transition will require improvements in individual project assessment practice—especially a shift from a focus on mitigating “significant adverse effects” to requiring “positive contributions to sustainability” as well as avoidance of adverse effects. It will also demand more effective regional planning and other strategic level efforts to provide attention to the cumulative regional effects of multiple mining projects, associated infrastructure and other past, current and anticipated activities. Such broader work would provide a better examined context and more authoritative guidance for individual project planning and development. Regional scale planning and assessment are largely a responsibility of governments, not something that individual mine proponents can reasonably be expected to deliver adequately in project-based assessment and approval processes. This paper reviews the current status of assessment regimes, identifies deficiencies and suggests where best practice opportunities exist. The implications are summarized as recommendations for assessment regime design that addresses cumulative effects, largely through regional processes linked to project-level assessments, and that incorporate the following five characteristics:

(i) Multi-dimensional: covers the full suite of cumulative effects of multiple undertakings, past, present and reasonably foreseeable in the relevant regional future (well beyond the individual project level), in light of contribution to sustainability objectives;

(ii) Long term: uses scenarios or some equivalent to explore and illuminate the nature and potential implications of plausible and desirable futures, to identify alternative pathways and plan options to examine;

(iii) Credible: establishes explicit open processes for elaborating and evaluating regional alternatives and justifying decisions in light of context-specified sustainability-based criteria and trade-off rules;

(iv) Authoritative: integrates regional assessment conclusions as decisions in legislatively authoritative regional plans or the equivalent with provisions for ensuring compliance in project level planning and assessment; and

(v) Accountable: ensures clear and accountable assignment of cumulative effects management responsibilities and expectations, including provisions for engaged monitoring, effective responses and public reporting.

Special attention to legacy effects is also emphasized because orebodies are non-renewable resources.

For illustrative purposes, the paper considers approaches to anticipated mining development in the Ring of Fire region, 500 km of Thunder Bay, Ontario, Canada, where reliance on individual project assessments is problematic given the regional cumulative effects issues and the range of alternative response options.

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## 1. Introduction

Every mining project has ecological and socio-economic effects, both positive and negative, during mine life and after closure. But the impacts that matter in the end, and increasingly at the outset in decision making about proposed mines, are the cumulative effects. Often, multiple projects are proposed and undertaken within a given area, due to the geological concentration of mineral resources and the practical demands of access to necessary infrastructure. However, our current assessment and approval processes are ill-designed to address cumulative effects and broad alternatives for enhancing or mitigating these effects (Duinker et al., 2012; Duinker and Greig, 2006; Sinclair et al 2017; Therivel and Ross, 2007).

Assessment scholars and professionals have provided various definitions for cumulative effects or impacts (Duinker et al., 2012). For the purposes of this discussion, "... cumulative impacts are the successive, incremental and combined impacts of one, or more, activities on society, the economy and the environment. Cumulative impacts result from the aggregation and interaction of impacts on a receptor and may be the product of past, present or future activities" (Franks, Brereton, and Moran 2010, 300). Also, cumulative effects include the full range of impacts, whether positive and adverse, near and long term, social, economic and cultural as well as biophysical effects and their interactions.

Cumulative effects assessment (CEA) is described and critiqued in a now vast global literature. In Canada, CEA gained prominence in the mid 1980s via the work of the newly founded Canadian Environmental Assessment Research Council (e.g. CEARC, 1986). By 1995, requirements to consider cumulative effects were embedded in the *Canadian Environmental Assessment Act* as a mandatory component of a project-level environmental assessment (EA). Federal workshops, guidelines and academic interest kept CEA in the forefront of EA innovation in Canada until the late 1990s and early 2000s (Duinker et al., 2012; Duinker and Greig 2006, 154–155; MacDonald, 2000). Despite the attention and investment, however, CEA continues to be poorly implemented within assessment and has, in some regrettable practice, become a glorified checklist (Duinker and Greig, 2006).

Like project level environmental assessments, traditional regional planning processes are often identified as means of anticipating and mitigating serious adverse cumulative effects. Regional land use planning can be defined as "a conception about the spatial arrangement of land uses with a set of proposed actions to make that a reality" (Leung, 2003). Regional planning can aid in determining areas of ecological and sacred significance that may merit protection, as well as in considering the spatial considerations of development. Where multiple interests and system complexities are recognized, regional planning can be appropriately non-linear, openly subjective and dynamic (Arts et al., 2005). However, outside of growing metropolitan areas, regional planning does not often consider the pace and scale of development. Nor does regional planning normally compare multiple alternatives for development trajectories and assess regional needs for policy and service supports in light of explicit and reasonably comprehensive sustainability-based criteria. In Canada, the record of efforts to integrate attention to cumulative effects concerns in regional planning has been uneven, particularly in the North (Hodge and Robinson, 2007). For example, the Yukon, which has a relatively advanced regional land use planning process that is mandated in a land claim agreement with Yukon First Nations, does use scenario-based approaches to regional planning and covers socio-economic, as well as biophysical considerations, but retains a focus on mitigating adverse effects rather than pursuing sustainability (Francis and

Hamm, 2011). Also, it has struggled to complete plans for many regions and approval of the most recent proposed plan—for the Peel Watershed—has been delayed by conflict between the planning authority and the territorial government (Locke and Heuer, 2015; Staples et al., 2013).

Attention to cumulative effects is required in project-level assessments under federal law and some provincial and territorial processes, but has been treated mostly as an effort to determine whether adverse project effects, in combination with other projects' effects, may be significant and therefore affect decision making on project approval (e.g., require added conditions of approval to ensure "adequate" mitigation). In many jurisdictions, the cumulative effects focus has been on ecological considerations. More realistic and useful CEA is about identifying and anticipating all cumulative effects to develop effective means of enhancing lasting positive contributions and opportunities while mitigating or avoiding damages and risks (Duinker et al., 2012; Therivel and Ross, 2007). CEA at that level is most effectively undertaken as constituent part of regional planning (and associated policy making and programming), with identification and comparative consideration of possible and desirable scenarios and strategies for delivering better futures (Duinker and Greig 2007; Peterson et al., 2003; Robinson, 1990). The scope of project assessments is typically too narrow and project proponents rarely have the needed motivations, time, capacities, credibility or authority to act on the results of serious cumulative effects assessment (Morrison-Saunders et al., 2014).

This dissatisfaction with the actual practice of CEA in Canadian assessment regimes has been well-documented (Duinker et al., 2012; Franks et al., 2010; Gunn, 2011; MacDonald, 2000; Therivel and Ross, 2007). So far, that dissatisfaction has not yielded much positive change in assessment process design or application. However, Canadian courts are beginning to recognize cumulative effects problems and stakeholder demands for effective anticipatory attention to cumulative effects are increasing (e.g., Chetkiewicz and Lintner, 2014; Staples and Askew, 2016).

For example, the Blueberry River First Nations have filed a suit in the British Columbia Supreme Court asserting that the effects of incremental provincial approvals of industrial developments throughout their traditional territory has interfered with their constitutional and territorial rights to hunt, fish and trap. The case has brought serious questions concerning development trajectories to light (*Blueberry River First Nations v. British Columbia*, 2015 BCSC 1302, Supreme Court of British Columbia (N. Smith JJ)).

The Blueberry River First Nations argue that the cumulative effects of multiple industrial developments in their traditional territories (dams, mines, oil and gas exploration and development with supporting infrastructure) have not been addressed well enough in BC's approval regime and that the resulting long term social, economic and cultural, as well as biophysical effects, are unacceptable (Askew, 2015). Only 14 per cent of Blueberry territory remains intact forest landscape compared to the 60 per cent average in British Columbia (Macdonald, 2016). Also, less than one per cent of Blueberry River First Nations' traditional territory has been conserved in parks and protected areas. The British Columbia average is 14 per cent. In the court case, Blueberry River First Nations sought an injunction to prevent the BC government from selling 15 timber licences. The application was dismissed because the court was unable to establish "the balance of convenience," despite acknowledgement by the court that there was potential for irreparable harm from not granting the injunction (*Blueberry River First Nations v. British Columbia*, 2015).

The court's ruling illuminates the daunting challenges of dealing with cumulative effects in a post-hoc way that is centred on individual decisions. The judge stated,

However, it must be remembered that the irreparable harm alleged by BRFN is a cumulative negative effect that infringes on its treaty rights. Since BRFN seeks an injunction against conduct that is only one part of that cumulative effect, I must consider the relationship between the alleged treaty breach and the specific activity that BRFN seeks to enjoin. It would be unjust to weigh the full inconvenience to the Crown and the public against the full inconvenience to BRFN because BRFN alleges that the irreparable harm stems from a number of sources, many of which would not be affected by this injunction. Accordingly, the strength or weakness of the connection between the conduct that BRFN seeks to enjoin and the cumulative negative effect that poses a risk of irreparable harm affects the balance of convenience.

Given the small proportion of the territory that these new licences covered (less than 0.1% of the traditional territory), the court deemed the effects of these licences to be insignificant. Additionally, the ruling concluded that amending those licences now would generate a “moving target” for this and other cases that is unacceptable for the necessary predictability of Courts and Crown. However, this ruling will not prevent further attempts at injunctions aimed at managing proposed new activities on such lands, since the court acknowledged that the irreparable damage of cumulative effects applies as evidence for other cases. Specifically, the court indicated that “public interest will not be served by dealing with the matter on a piecemeal, project-by-project basis” (*Blueberry River First Nations v. British Columbia*, 2015). Blueberry River First Nations are now pursuing a lawsuit against the province for “unprecedented industrial disturbance,” including the liquefied natural gas projects and the building of the Site C dam, that threatens their way of life and violates the terms of Treaty 8, signed in 1900. The lawsuit was launched in March 2015 and has yet to be resolved (Proctor, 2015).

Project level CEA does little to alleviate the concerns that the Blueberry River First Nations have brought forward, as the 2014 ruling and 2015 legal action indicate. Irreparable damage may occur, but it is not feasible to manage these problems through individual project decisions. The results indicate insufficiently effective consideration of cumulative effects and incremental establishment of a path dependence that entails more damage from future development schemes, despite evidence of growing adverse effects. The most realistic solution entails moving away from full reliance on project-by-project based assessment towards integrated regional, sustainability-based forms of planning that are authoritatively tiered to guide project level planning and assessment.

In the following analysis, we consider the essential characteristics of cumulative effects and their implications for CEA. We then examine two primary substantive concerns with current CEA practice—first, the limitations of project level assessment as a vehicle for effective CEA and second, the required characteristics for effective CEA—with special attention to implications of and for mining projects.

Mining projects present special imperatives for cumulative effects assessment because they deplete non-renewable resources (orebodies), have limited life expectancies, often leave negative ecological and socio-economic legacies, and can be vulnerable to premature closure or insolvency due to price declines in global mineral markets (Baker and McLelland, 2003; Bowles and Wilson, 2015; Davis and Franks, 2011; Gibson, 2014; Halseth, and Manson 2012; Markey, Panagos and Grant 2013). Regional, as well as individual assessments of mining development, are therefore especially important venues for sustainability-based deliberations, which not only address the full range of effects, but also emphasize attention to the lasting results.

## 2. Essentials of cumulative effects and cumulative effects assessment

Cumulative effects and assessment processes to address these effects have some common characteristics. The actual effects of any undertaking are always cumulative; they result from new stresses that build upon existing natural and anthropogenic stresses and their interactions. Actual cumulative effects include socio-economic and cultural, as well as ecological aspects, which always interact and are not often separable (Weber et al., 2012). Also, cumulative effects can be (usually are) positive and adverse, with the positive effects including opportunities and the adverse ones including risks. The effects occur in dynamic complex social and/or ecological systems and may be direct or indirect, immediate or delayed, simple and linear or interactive and non-linear (MacDonald, 2000). Cumulative effects, therefore, involve combinations and interactions among factors that influence existing social and/or ecological systems or their components. The effects may be additive, synergistic, magnified (e.g., biomagnification of toxic contaminants up a food chain), compounding, or compensating across multiple scales (Harriman and Noble, 2008; Noble, 2015; Spaling and Smit, 1993).

The diverse characteristics of cumulative effects can be re-categorized as four types of impacts, particularly relevant to mining: i) coincident effects (independently initiated activities in the same system); ii) induced effects (where one effect or set of effects leads to others; e.g., where one project and its infrastructure in an area facilitate additional projects and associated effects); iii) lifecycle effects (through product chain, cradle to grave, cradle to cradle); and iv) legacy effects (effects that follow and may extend far beyond the active life of the focal undertakings, such as decommissioned mines with tailings facilities that may entail monitoring and management in perpetuity). Most importantly, all these effects interact and need to be considered together.

These complexities of cumulative effects entail uncertainty and imperfect predictability even with good information (which is not always available). In order to identify and evaluate cumulative effects, the assessment process must rely on expertise, including both specialized conventional scientific expertise and traditional knowledge based on local experience (MacDonald, 2000). At the same time, however, assessment of cumulative effects necessarily involves choices for which expert understanding is helpful but insufficient and credible public process is crucial (Adger and Jordan, 2009; Gibson, 2016; Norton, 2005; Stacey et al., 2010).

In order to assess cumulative impacts properly, a core package with the following five key characteristics is needed:

- *Multi-dimensional*: covers the full suite of cumulative effects of multiple undertakings, past, present and reasonably foreseeable in the relevant regional future (well beyond the individual project level), in light of contribution to sustainability objectives;
- *Long term*: uses scenarios or some equivalent to explore and illuminate the nature and potential implications of plausible and desirable futures, to identify alternative pathways and plan options to examine;
- *Credible*: establishes explicit open processes for elaborating and evaluating regional alternatives and justifying decisions in light of context-specified sustainability-based criteria and trade-off rules;
- *Authoritative*: integrates regional assessment conclusions as decisions in legislatively authoritative regional plans or the equivalent with provisions for ensuring compliance in project level planning and assessment; and
- *Accountable*: ensures clear and accountable assignment of cumulative effects management responsibilities and

expectations, including provisions for engaged monitoring, effective responses and public reporting.

Taken together, these characteristics mean that cumulative effects assessment presents technical and procedural challenges. To address the predictive uncertainties and value-laden choices (MacDonald, 2000), cumulative effects assessment processes must apply foresight in identifying and pursuing desirable futures but also adopt precautionary approaches that favour lower risk options and adaptive design with careful monitoring, adaptive management and continuous learning (Sinclair and Diduck, 2016; Adger and Jordan, 2009; Gibson et al., 2005a, 2005b) (Fig. 1).

Beyond the broad complexities common to all cumulative effects assessments, each assessment must be specified for the particulars of the contextual reality. For mining and CEA in Canada, these realities relate not only to the specific character of mineral development undertakings and socio-ecological relations involved, but also to the temporal scope of mining assessments, the need to respect Indigenous rights and issues of geographic scale. Before we enter into a more detailed discussion of design criteria for appropriate approaches to assessing cumulative effects, it is important to discuss the elephant in the existing room—the inadequacy of individual project level assessment in considering and addressing cumulative effects.

### 3. The inadequacy of project level assessment

Cumulative effects assessment is “not well suited for inclusion in project-level EIA” (Duinker and Greig 2006, 155). This judgment is reiterated throughout the literature (Dalmer, 2012; Dubé and Munkittrick, 2001; Duinker and Greig, 2006; Duinker et al., 2012; Gunn, 2011; Taylor, 2010; Therivel and Ross, 2007; Tollefson and Wipond, 1998). The conclusion should not be surprising. Conceptually and practically, it is unrealistic to expect to capture the overall interactive impacts of developments in an area or a sector through a project assessment that is assigned to the proponent of a single new undertaking and is centred on a project approval (Therivel and Ross, 2007). It is nonetheless useful to consider more closely the limitations of individual project environmental assessments as vehicles for CEA.

#### 3.1. The traditional focus of individual project environmental assessments

Most environmental assessment laws have been designed chiefly, if not exclusively, for application to individual proposed projects, usually physical works of some kind. Environmental assessments were an outgrowth from pollution abatement and facility licencing law (Gibson et al., 2005, ch.2). Consequently, the requirements in most regimes have focused narrowly on the anticipated effects of projects for which an approval was sought. As well, these assessments were primarily concerned with potentially significant adverse biophysical effects—the issues traditionally addressed in pollution control regimes and other considerations of agencies with a biophysical mandate (though usually also including human health). Processes in some Canadian jurisdictions (e.g., Ontario, the three territories and some other assessment processes established through land claims agreements) have defined environmental effects broadly to include social, economic and cultural as well as biophysical effects, but even in these jurisdictions biophysical effects have often received most attention in assessment practice (Gibson, 2002; Gibson et al., 2005a, 2005b).

Traditional assessments have also given limited attention to interactive effects. These limited considerations are in part due to the focus on the significant adverse biophysical effects of individual projects. Old assessment practices have been slow to incorporate recently improved understanding of complex socio-ecological systems, especially when the implications threaten to make assessment work more difficult and expensive. A common focus has been on the particular effects of the proposed project on selected receptors—valued ecosystem components (VECs)—that are judged to be especially important (Baxter et al., 2001; Duinker et al., 2012). While some focusing is necessary in EAs to concentrate limited resources on the biggest issues, practice suffers from an over-reliance on simplifying assumptions and from approval-seeking proponents wanting to avoid identifying significant adverse effects.

Despite still common expectations for assessment to be a purely scientific exercise, actual practice involves unavoidable choices in a realm of complex, wicked problems. Traditionally, governments rely on forms of scientific risk assessment (Fairbrother and

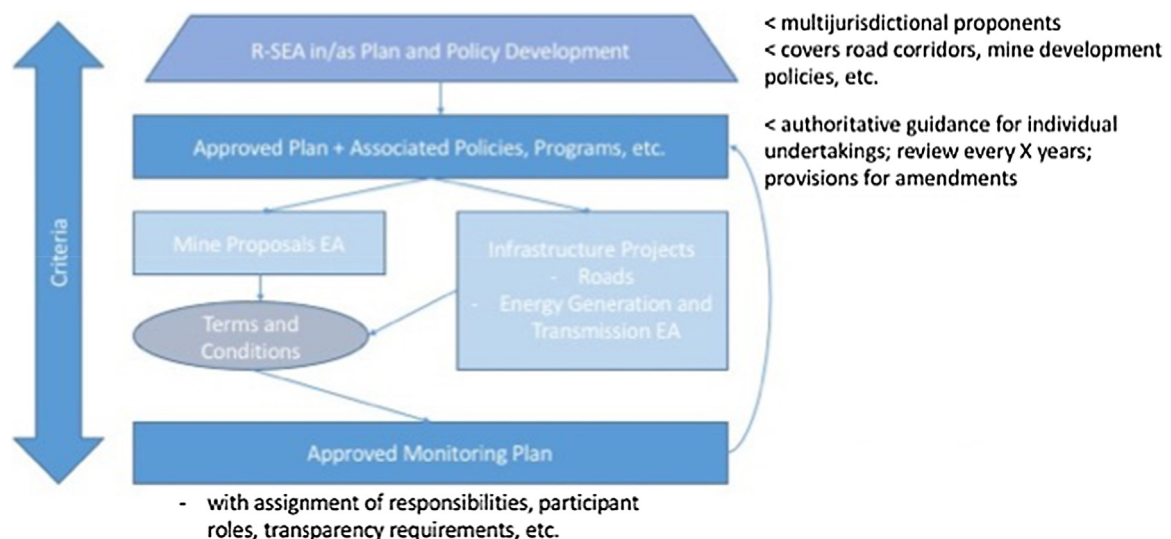


Fig. 1. Basic framework for R-SEA, project assessment and monitoring.



Bennett, 1999) and bureaucratic procedure in decision making to resolve these wicked problems (Lenihan, 2012) because it is assumed that they emerge from cognitive uncertainty due to technical and scientific knowledge gaps (Weber and Khademan, 2008). However, many wicked problems are based on strategic uncertainty or institutional uncertainty. Strategic uncertainty means that multiple actors' "strategies to address the problem are based on perceptions of problems and their solutions, which may differ from the views of others" (Weber and Khademan, 2008, p.193) while institutional uncertainty "results from the fact that decisions are made in different places, in different policy arenas in which various actors from various policy networks participate" (Duinker, n.d.; Duinker et al., 2012).

### 3.2. Adding cumulative effects assessment requirements to traditional assessments

Over the past two decades, pressures to address cumulative effects have led some jurisdictions to expand the scope of traditional environmental assessments to include attention to cumulative effects (e.g., as required under the 1995 and 2012 versions of the *Canadian Environmental Assessment Act*). This obligation for the proponent to consider cumulative effects of the proposed project along with other past, existing and reasonably foreseeable undertakings, ensures some increased identification and understanding of multiple project effects. But while that recognition of cumulative effects has been seen as an important symbolic advance in environmental assessment design, the practical results have been disappointing (Duinker and Greig, 2006).

For example, a common approach has been to identify project effects first and then add the potentially significant project effects to the identified significant effects of other undertakings in the area, rather than attempt to identify potentially interactive multi-project effects and attempt to predict their overall implications. The summed results are then reported in a section of the environmental assessment submission separate from the project findings. While the method is tidy, it neglects the cumulative effects reality that the individually "insignificant" or "acceptable" effects of one undertaking may combine with the similarly modest effects of other activities to produce serious concerns (Baxter et al., 2001; Duinker and Greig, 2006; MacDonald, 2000).

The determination that a specific anticipated effect may be "significant" plays a major role in the potential for approval in the established approach for individual project decision making. Because project level assessments are typically treated as means to project approvals, the focus is on passing an approval test. That test in many jurisdictions is formulated as a demonstration that the proposed project will have no "significant" adverse effects (after proposed mitigation measures are taken into account). Often, for example, under the *Canadian Environmental Assessment Act* (1995 and 2012 versions), projects can be approved if their anticipated significant adverse effects are "justified in the circumstances," but this introduces worrisome uncertainties. The justifying "circumstances" are undefined and not examined with any rigour in public assessments. The result is an understandable motivation for project proponents to concentrate on establishing that no significant adverse effects will result from their proposed project. The accompanying temptation concerning cumulative effects is to claim that if the project itself will have no significant adverse effects, it will not contribute to significant regional cumulative effects (Aschemann et al., 2012; Duinker and Greig, 2006; Harriman and Noble, 2008).

This characteristic of project assessments, centred on "significance" determinations conflicts with the basic concept of

cumulative effects, recognizes that multiple minor effects can combine to have serious implications for ecological and socio-economic wellbeing. Not surprisingly, the results also conflict with regional community and public interests that seek to avoid serious overall damage and risks to gain lasting benefits from multiple projects (MacDonald, 2000; Odum, 1982).

Also, individual attention to some significant adverse (usually biophysical) cumulative effects neglects whole categories of cumulative environmental effects (socio-economic and cultural, positive, interactive, perpetual, etc.) and their assessment. In sum, the cumulative effects practice in conventional project level assessments still only considers a limited portion of the actual range of positive and negative cumulative effects that have important interactive and often lasting effects on the entwined wellbeing of communities and ecosystems.

## 4. Solutions: addressing cumulative effects beyond the project level

The inadequacies of project level assessment as a means of addressing cumulative effects point to needs for more broadly conceived and empowered regional strategic processes with the five core characteristics listed above. The following discussion explores the details.

*4.1. Characteristic 1 multi-dimensional: covers the full suite of cumulative effects of multiple undertakings, past, present and reasonably foreseeable in the relevant regional future (well beyond the individual project level), in light of contribution to sustainability objectives*

Proper attention to the cumulative interactions among the effects of multiple undertakings and stressors—past, present and in the reasonably foreseeable future—requires a larger scale than is available at the project level and more authority than can be expected from individual project proponents. There is a specific need for a regional level examination of cumulative effects, related future considerations and options, and appropriate action in anticipation of them. Where multiple past, present and reasonably foreseeable undertakings will affect a region, an anticipatory regional response is needed. Regional level assessments, often involving multiple jurisdictions, need sufficient scope, authority, access to information and arrangements for meaningful public engagement to ensure credible analysis covering wide-ranging cumulative effects, examining broad implications, comparing future scenarios, and considering multiple alternatives (Arts et al., 2005; Aschemann et al., 2012; Gunn and Noble, 2009).

The understanding of current and potential cumulative effects and possible options for responding to them can be enhanced through regional studies. Authoritative guidance for individual project planning and assessment, however, typically depends on integration of these studies into the development and approval of legislatively mandated broader undertakings. Broader undertakings may be regional plans developed through processes equivalent to rigorous and participative assessments or policies developed through credible strategic level environmental assessment (SEA) processes. Such regional or strategic initiatives can address many well-recognized project level assessment insufficiencies. SEAs "systematically assess the potential environmental effects, including cumulative effects, of alternative strategic initiatives, policies, plans, or programs for a particular region" (Harriman and Noble 2008, 16). Because of overlapping mandates under the Constitution of Canada, strategic (and project) level undertakings, particularly those involving resource extraction, often involve multiple senior jurisdictions – federal, provincial/

territorial and Aboriginal – as well as municipal and sectoral authorities.

One of the largest problems in project level cumulative effects assessment is that the responsibility for assessing cumulative effects is placed on individual project proponents. Such proponents, especially those in the private sector, rarely have the motivation (beyond legislated obligation), authority, capacity, potential credibility, or information base (at least about other anticipated projects) to do good cumulative effects assessment in a way that addresses the core needs and rising expectations by the public, First Nations and proponents for better decision making. Project-level proponents may be able to identify the likely range and potential importance of cumulative effects, but it is unreasonable to expect them to examine their implications in light of desirable and undesirable future scenarios, consider and assess broad alternatives, and point to the best options for action (Adger and Jordan, 2009, 2012; Duinker and Greig, 2007; Gibson et al., 2005a, 2005b).

Project proponents would benefit from capable cumulative effects assessments and associated regional plans or the equivalent that address these overarching issues and provide credibly developed and authoritative guidance for project planning. The immediate and long term concerns and aspirations surrounding project proposals now often extend well beyond the individual project—especially where there have been and/or will be multiple undertakings with uncertain overall future effects. Where the projects involved include mines, with their limited life expectancies, uneasy combination of opportunities and risks, and often unfortunate legacies, proponents have much to gain from good cumulative effects assessments to clarify and smooth the path for project planning and approval (Gibson, 2014; Gratton, 2016). Such assessments and associated benefits would seem much more likely to be delivered by careful attention to cumulative effects in sustainability-oriented anticipatory regional planning and associated policy and program initiatives than by project level cumulative effects efforts.

In order to achieve sustainable outcomes, regional level planning and assessments that incorporate sustainability-based objectives best align with the public interest concerns presented in recent development controversies and meet best practice expectations recognized by independent EA professionals and scholars (Adger and Jordan, 2009; Arts et al., 2005; Aschemann et al., 2012; Chaker et al., 2006; Fischer 2012; Government of Canada, 2008; MIAC, 2016). These regional and strategic initiatives must go well beyond the standard environmental assessment practices that are focused narrowly on mitigating significant adverse biophysical effects.

The “mitigation of significant adverse effects” concept is especially problematic where adverse effects may already be unsustainable (as they are globally in many key parameters). Moreover, it does not provide the information required to make decisions in wicked problem areas featuring complex and dynamic interactions among multiple factors, or cover the range of considerations involved in meeting expectations for social licence or social “acceptability”. Much more promising is planning and assessment centred on the more comprehensive and positive “contribution to sustainability” objective. In order to determine if a regional plan (or an individual project) can contribute to lasting sustainability gains, alternatives must be compared to see which scenario generates the maximum long term, fairly distributed benefits and minimizes tradeoffs. Sustainability-based assessment covers the full suite of socio-economic, cultural and biophysical factors, and their interactions in its evaluation and determines what supporting programs, policies and initiatives must be in place for the proposed undertaking to succeed (Bond et al., 2012; Gibson, 2016).

*4.2. Characteristic 2 long term: uses scenarios or some equivalent to explore and illuminate the nature and potential implications of plausible and desirable futures, to identify alternative pathways and plan options to examine*

The use of scenarios as a tool for visioning and planning is an often recommended best practice (Amer et al., 2013; Duinker and Greig, 2007). Future scenarios provide a basis for choosing among possible futures and tracing various possible trajectories of development. They give people who might be affected a more informed basis for anticipating and responding to opportunities, to push change towards desirable options, and to avoid undesirable ones. This focus on positive futures is consistent with the agenda of sustainability-based assessment and the objective of enhancing prospects for lasting wellbeing (Gibson et al., 2005a, 2005b).

Project level assessments typically offer one puzzle piece, without a full conception of how it might fit in and contribute to the larger vision. Regional scale scenarios provide a more fulsome picture of possibilities, risks and objectives. Additionally, backcasting (working back from the characteristics of a preferred future scenario, in contrast to forecasting that presents future that present trends will deliver) can be effective for planning and policy generation where we wish exercise some influence over the pathways to be chosen and the future that will result.

Scenarios can be defined as “conjectures about what might happen in the future” (Cornish, 2005). A vision, conversely, is the desirable future state. Neither is a forecast. Scenario building is a useful tool for strategizing to determine how to get to a scenario closest to one’s vision. Beyond clearer thinking about what future we want, scenario-building can help participants to anticipate future opportunities, risks, barriers and uncertainties (Duinker and Greig, 2007; Moriarity et al., 2005). In particular, scenarios play two important roles in policy planning: “one is risk management, where scenarios enable strategies and decisions to be tested against possible futures, while the other is creativity and sparking new ideas.” (Duinker and Greig, 2007, p.210).

Effective scenario design includes creating forecasts of current trends and looming possibilities that represent plausible prospects that the participants may wish to avoid but may also need to be ready to address (combat, soften, accommodate, etc.). Identification of trends including projected developments and land uses can be supplemented by anticipation of changes resulting from climate change, industrial development in other sectors, and other context dependent issues (Duinker and Greig, 2007; Duinker et al., 2012). While the specifics of such impacts cannot be predicted with confidence, they can be broadly identified for anticipatory encouragement, resistance or preparation for adaptation. The use of multiple scenarios helps to ensure that a reasonably full range of future possibilities is taken into account. Project level assessments rarely have the scope or capacity to cover the main regional cumulative effects, much less identify and compare future scenarios and response options (Duinker and Greig 2007; Peterson et al., 2003; Rasmussen, 2008; Therivel, 2012).

Regional plans that have been informed by scenario analysis and that aim to enhance prospects for desirable futures can aid project-level planning and decision making through guidance for “better siting and phasing of development, demand reduction and other behavioural changes, and particularly through setting development consent rules for projects” (Therivel and Ross 2007, 356). This approach for identifying regional cumulative effects concerns and response options has been used in a modest way in some regionally significant project assessments in Canada,

generating significant impacts on recommended conditions for project approval. The Joint Review Panel in the case of the Voisey's Bay nickel mine recommended reducing the capacity of the mine concentrator to extend the life and potential regional contributions of the project (Gibson, 2006; VBEAP, 1999). The Joint Review Panel in the Mackenzie Gas Project recommended careful control of the pace and scale of gas development in the region to keep project related activities from exceeding the capacities of authorities and communities, to monitor and mitigate adverse effects, and to take advantage of positive opportunities (Gibson, 2006, 2011; Government of Canada, 1999; MGPJRP, 2009; TransCanada Corporation, 2014).

There are many formal methods for scenario-building (Amer et al., 2013), but very generally, two to five scenarios are usually created. Reliance on only three scenarios generally shifts the focus to the middle or most moderate one. Using more scenarios has the benefit of creating a larger "possibility space" in which the future is likely to unfold . . . "[the suggested scenarios are] a menu of five, with generic themes: (a) a surprise-free or continuation scenario; (b) a pessimistic scenario; (c) a disastrous scenario; (d) an optimistic scenario; and (e) a transformation (or miracle) scenario" (Cornish, 2005). The scenario types are generic and can then be framed by context dependent drivers, meaning "influential forces of change", including society's value for a given commodity, environmental change, adaptive capabilities, etc. (Duinker, 2008). Scenarios as a product can provide "mental maps of the future," elucidating key assumptions, forcing the design of alternatives, testing for alternatives and options, identifying uncertainty and "provid(ing) a vehicle for communication." Scenario planning as a process fosters shared learning and systems thinking, provides an arena for dialogue across silos, inspires innovation and creativity, and encourages adaptation and learning (Duinker, 2008).

Scenario-based approaches fit well with the core agenda of environmental assessment. They are centred on anticipation of future effects and provide a "more robust way of assessing the potential future consequences of proposed developments" than conventional forecasting (Duinker and Greig, 2007, p.217). Scenario building also has the advantage of enabling people to escape from the entrenched positional boundaries and conflicts that typify immediate controversies and move into discussions about future options where they may find common ground (Kaufman et al., 2003; Rasmussen, 2008). Also, future scenario discussions can often begin with efforts to depict ways of accommodating all key objectives in a manner more consistent with the interdependent requirements for progress towards sustainability, unlike conventional discussions about immediate effects, which often start with clashes over potential trade-offs (e.g., between jobs and environmental stewardship) (Gibson et al., 2005a, 2005b).

Duinker and Greig (2007) argue that scenario building is a suitable tool for the assessment of large regional industrial developments where significant cumulative effects of multiple undertakings are likely- "Scenarios and scenario learning are highly applicable to mid- and long- range futures studies where there are considerable levels of both predictability and uncertainty. Scenario planning attempts to compensate for two common errors in decision-making – under- prediction and over-prediction of change – allowing a middle ground between the two to be charted" (Duinker and Greig, 2007, p.210).

**4.3. Characteristic 3 credible: establishes explicit open processes for elaborating and evaluating regional alternatives and justifying decisions in light of context-specified sustainability-based criteria and trade-off rules**

Cumulative effects assessment is not only about identifying and evaluating the significance of potential effects. It is often also about

identifying and evaluating what to do in light of the effects. Or, more usefully, it is about recognizing that there are likely to be significant cumulative effects resulting from any set of activities, and it is critical to identify and evaluate the potentially reasonable options for maximizing the positive effects and minimizing the negative ones (Morrison-Saunders and Pope, 2013). This approach may involve translating the learning from the scenarios into a set of alternative plan options and undertaking a comparative assessment of these options with context-specified sustainability criteria (Gibson, 2016).

Choices in cumulative effects assessment involve a multitude of evaluation decisions:

- what value to assign to current features or arrangements, potential positive and negative effects, risks and opportunities, and future options?
- how to set priorities among valued ecosystems, valued ecosystem components and valued community components?
- what relative emphasis to give to local versus regional versus national versus global concerns?
- how much protection is required for already vulnerable and stressed systems?
- how much to focus on immediate decision-making needs, or issues for which information is available, or on the availability of time and other resources to learn more?

For public trust, those potentially affected or otherwise involved must be able to understand the means by which above questions are answered. Needs to establish this foundation for public trust underlie arguments for open, participative and rigorous cumulative effects assessment processes.

Sustainability-based cumulative effects planning and assessment is not about balancing economic needs against ecological ones, but rather aims to identify and facilitate achievement of desirable futures in which social, economic and ecological (and cultural, etc.) objectives can be served in mutually supporting ways. Such work needs explicit criteria for effective evaluation and decision making. These criteria need to be specified for the particular context of each application and applied in ways that recognize the interactions among effects and criteria categories.

Context-specified criteria are especially valuable for comparative evaluation of alternative regional options. As opposed to the limitations of determining whether a proposed undertaking should go forward as proposed or be stopped, the comparison of alternatives using credibly developed, context-sensitive criteria opens assessment processes to broader, potentially more positive opportunities. At the project level, alternatives may involve the pace and scale of an operation, the nature and placement of infrastructure, means of revenue sharing and other benefit enhancement for local communities, and approaches to using non-renewable resource royalties and other opportunities to build more sustainable livelihood foundations (Gibson, 2013). In regional level planning and assessment where cumulative effects are a major concern, alternatives should be based on different scenarios and different packages of options to avoid adverse cumulative effects, enhance prospects for positive effects and minimize trade-off risks (Duinker and Greig, 2007). The selection of the best option is guided by application of the context-specified sustainability-based criteria.

**4.4. Characteristic 4 authoritative: integrates regional assessment conclusions as decisions in legislatively authoritative regional plans or the equivalent with provisions for ensuring compliance in project level planning and assessment**

A regional plan or regional strategic environmental assessment (RSEA) based on our best understanding of cumulative effects,

desirable and plausible futures, alternatives and context-specified sustainability-based criteria would guide planning and assessment of individual new (or continuing) projects and other undertakings in the region. Strategic environmental assessments apply to policies, plans and programs, while regional plans primarily relate to land-use planning at a large scale. Regional planning and RSEAs are frequently cited as a means for making strategic level decision-making that can then guide planning and decision making at the project level (Aschemann et al., 2012; Dalal-Clayton and Sadler, 2005; Francis and Hamm, 2011; Fischer, 2012; Gualini, 2015; Therivel, 2012; Wilson et al., 1996). Integrated relations among the levels is called tiering, especially where the guidance from one level to the next is authoritative and there are multiple scales of decision making (Arts et al., 2005). Arts et al. (2005) define tiering as “distinguishing different levels of planning – policy, plans, programs – that are prepared consecutively and influence each other. Tiering is about how the different levels of planning relate to each other.”

Effective tiering must be law-based to be authoritative and have public credibility (produced in a properly open, comprehensive, participative and accountable process, and regularly reviewed to keep up to date). Otherwise the guidance from SEAs and/or regional planning is unlikely to be accepted as a legitimate base for project assessment and approval. If authoritative and credible, the plan would provide reasonable clarity and certainty of expectations for proponents of individual undertakings and remove much of the burden these proponents carry under Canadian environmental assessment law to do the cumulative effects assessment themselves (Gibson et al., 2010). Under a tiered structure, a proponent participating in a project level assessment would merely have to ensure the character of the proposed undertaking, its effects, and their associated potential for contribution to regional cumulative effects would comply with the requirements and expectations of the regional plan. Therefore, for regional purposes, the primary objective of the project assessment process would be to ensure its compliance with the larger scale plan.

In Canada, ensuring appropriately authoritative decisions is complicated by the constitutional reality of overlapping jurisdictions. Mining projects may raise issues subject to federal, provincial or territorial and Indigenous authority. The relevant mandates and powers overlap, are often not precisely defined and, especially in the case of Indigenous authority, have been clarified gradually and incompletely by an ongoing series of high court rulings on contested matters. Effective and reasonably efficient attention to cumulative effects and associated options therefore often depends on formal or informal bi- or multi-jurisdictional collaboration, which can take many forms and be established through case-by-case negotiation (MIAC 2016, chapters 4 and 6). The concerns to be addressed in the negotiation of collaborative arrangements include allocation of roles and responsibilities, some of which involve funding and other resources. When RSEAs are driven by needs to anticipate or respond to private sector development project proposals, private sector project proponents may be asked to contribute to RSEA funding. In some past cases, private sector proponents have prepared assessments of regional strategic options that are then reviewed by government panels (e.g., the concept assessment of hydrocarbon development options for the Beaufort Sea region (BSEAP, 1984)).

#### *4.5. Characteristic 5 accountable: ensures clear and accountable assignment of cumulative effects management responsibilities and expectations, including provisions for engaged monitoring, effective responses and public reporting*

Public participants, academics and public advocates have frequently pointed to public distrust arising from insufficient

accountability in project-centred environmental assessment processes (MIAC, 2016; National Research Council, 2008; Depoe et al., 2004). Some of this distrust is due to the absence of explicit criteria or public rationales for decision making at key assessment stages, from initial assessment scope to project approvals. These immediate accountability issues have often been entwined with concerns about exclusion or inadequate consideration of major evident issues, including regional cumulative effects in project level assessments and failures to ensure these concerns are addressed in broader public processes (Duinker and Greig, 2006).

These difficulties have been exacerbated in recent years by efforts in several Canadian jurisdictions, including the federal government, to speed assessment decision making by narrowing the range of considerations and restricting time and resources for participative opportunities (Doelle, 2012). These efforts have often failed to deliver overall process streamlining, in part because the resulting frustrations have led some assessment process participants to find other means, including litigation, to win serious consideration of their concerns. The consequences have led to consensus among diverse authorities and stakeholders that effective project assessment processes need to respect Indigenous rights, facilitate meaningful public participation, ensure convenient public access to assessment information, and be complemented by assessment at the strategic and regional levels to examine cumulative effects, broad alternatives and other issues that lie beyond the usual capacities of project level assessment (Brummans et al., 2008; MIAC, 2016).

While greater use of strategic and regional assessments will provide for better attention to matters not well handled in project assessments, accountability at this level is no less crucial. Strategic and regional assessments too need to incorporate open and timely information access; opportunities for well-informed and effective engagement by relevant publics, authorities and stakeholders; clear responses to that engagement; impartial review and decision making; and transparent application of well-founded criteria for evaluations and decisions. Because many strategic and regional assessments will involve two or more jurisdictions, clearly assigned roles and responsibilities are crucial (MIAC, 2016). Also, because these assessments will involve judgments about big issues and competing options with likely consequences for many proponents, communities, authorities and stakeholders, accountability will depend heavily on the credible development and explicit application of comprehensive, sustainability-based criteria in evaluations and decision making. The criteria will be particularly important for comparing alternatives and for making and justifying decisions.

The capacity for effective elaboration and comparison of broad alternatives is a particular strength of strategic and regional level assessments. Accordingly, the credibility of these assessments relies heavily upon how the options have been identified and the criteria for choosing among the options have been specified and applied. In both matters, evident openness, effective engagement and impartiality are necessary, not only for strengthening understanding and enhancing the quality of decisions but also for establishing the grounds for implementation by the responsible authorities (Duinker and Greig, 2007).

The final key venue for accountability in decision-making related to cumulative effects is post-approval monitoring and action in response to monitoring findings. Monitoring in assessment generally is intended to check on the accuracy of impact predictions and on the adequacy of compliance with approval commitments and conditions, both of which facilitate holding proponents and assessors to account. As well, monitoring findings may reveal needs for responsive action to address unanticipated



problems or opportunities. With transparent reporting, monitoring of effects, compliance and responses can be a crucial tool for public accountability throughout implementation, decommissioning and the tracking of post decommissioning legacies (Gibson, 2014).

### 5. The special problem of legacy effects

In mining cases, long term cumulative effects are especially crucial because orebodies are exhaustible resources and mines have limited and uncertain life expectancies. Not surprisingly, the legacy effects from mining operations have often been negative. These legacy effects include the depletion of a non-renewable resource, boom/bust effects, residual socio-economic damage, residual contamination and risks, inappropriate infrastructure, and adverse cultural effects in Indigenous communities (Gibson, 2014). Therefore, a priority of CEA involving mining operations is that the assessment results should focus on how limited-life undertakings can provide for lasting positive gains while mitigating negative legacies in all areas, socio-economic, cultural and ecological.

Legacy effects dominate much of the public conversation on mining, including current concerns about risks of contamination during and after mine life (e.g., in light of the tailings dam failure at Mt. Polley in British Columbia); the premature closing of mines with insufficient clean-up security (e.g., the Jericho diamond mine in Nunavut); with residual contamination problems and associated costs; post-mining economic bust effects on local and regional communities; mine bankruptcies affecting pensions and liabilities; and continuing downstream effects (e.g., Alaskan worries about the cumulative regional effects of mines in northwest British Columbia watersheds). Therefore, low risk initial designs, infrastructure developments for effected communities as well as mining purposes, effective and adequately funded monitoring and reclamation, community livelihood diversification and other long term preparations for positive mine legacies are increasingly key factors in winning “social licence” (Owen and Kemp, 2013; Prno, 2013).

Additionally, in many Canadian mining regions, there are needs to respect Aboriginal rights and interests. These rights have been reinforced as legal obligations under the Canadian Constitution, clarified in recent Supreme Court of Canada rulings (Chadwick, 2013; McIlwraith and Cormier, 2016), and supported by international initiatives (e.g., the United Nations Declaration on the Rights of Indigenous Peoples and promotion of the concept of “free, prior and informed consent” prior to approval of proposed activities on Indigenous lands).

Both legacy effects concerns and Aboriginal rights considerations involve interconnected social, economic, cultural and ecological factors and expectations for positive contributions to lasting wellbeing. As a result, cumulative effects assessment must go beyond mitigation of adverse environmental effects. For proper attention to cumulative effects, assessment must be re-oriented to serve the objective of positive contributions to sustainability. For cumulative effects assessment involving mining projects, the implication is that mining activities (not merely individual mines), associated infrastructure and surrounding practices must be designed to use the time-limited resource extraction, and some portion of its associated opportunities and revenues, must act as a bridge to more sustainable futures. Bridging contributions include the protection of water, land and other lasting/renewable resources, but extend also to economic diversification and establishment of multiple lasting livelihood opportunities. Mining can then serve for the longer term as a valuable transitional activity with positive legacies.

Positive bridging is more likely to be achieved via a regional strategy than through mine-by-mine decision making (Gibson, 2014). Beyond scenario-based regional plans, establishing a foundation for effective bridging can entail the use of other policy instruments to support the sustainability objectives in the region, including bridging needs. These needs might include the establishment of heritage funds and support programmes for training and other enhancement of local capacities to take advantage of mining opportunities.

The major mining legacy factors may be summarized in five interconnected categories (Gibson, 2014):

- *Depletion of a non-renewable resource* is inherent in mining, which develops but also extracts and removes a valuable resource that will longer be available for future generations. That reality inevitably raises questions about whether what is gained in the long run compensates for what is lost.
- *Boom/bust effects* are commonly associated with economic activities that have highly intensive phases and/or limited overall duration, especially when they are significant relative to the level of pre-existing economic activity in the surrounding communities and region. Mining often involves all of these factors. The best-recognized problems are those of the economic bust at mine closure, especially for communities that have become highly dependent on mining related incomes and other opportunities. However, boom effects can have adverse socio-economic effects. For example, sudden influxes of money, a transient male dominated work force and a lack of strong social programs brings multiple problems for nearby communities, including drugs and alcoholism, increases in violent crime, prostitution and other serious issues (Kilanski, 2015; Ruddell and Ortiz, 2014; Urwin, 2016).
- *Residual adverse effects on or risks to the land, waters and wildlife*, are well known in the record of mining in Canada and elsewhere where public authorities face a huge and costly backlog of responsibilities for remediating abandoned and orphan mines. While regulatory obligations and corporate practices have improved, some mines still leave negative biophysical and associated economic legacies. Many mines generate tailings and other residuals that can have highly detrimental ecosystem effects and require careful treatment, storage maintenance and monitoring, sometimes in perpetuity. If heavy metals or other potentially toxic substances enter the ecosystem, they can cause adverse effects for hundreds, if not thousands, of years (Eisler, 2004; Eisler and Wiemeyer, 2004; Miranda et al., 2003; Franks et al., 2010; DeNicola and Stapleton, 2002). Unfortunately, monitoring and enforcement efforts are unsatisfactory (e.g., Bellringer, 2016) and changeovers in mine ownership from initial exploration to closing often leave declining mines in the hands of poorly resourced small operators unable to meet remediation obligations (Botta et al., 2014; Thomson, 2015).
- *Inappropriate residual infrastructure* results if the extensive development of transportation networks, power generation, waste storage and human settlement that accompanies mining development is not designed with other purposes and post-mining realities in mind. In some cases, the infrastructure can be built to serve lasting needs of regional communities and other livelihood options. Otherwise, once mines close, the infrastructure may be insufficient for continuing purposes, maintainable only at undue expense, or represent another remediation problem for regional communities and the public purse (Stacey et al., 2010).
- *Effects on local, especially Indigenous communities* include the cumulative community results of all the above categories of concerns. Colonialization, poverty and the dependence that Indigenous communities have on the land, economically,

culturally and spiritually, means that Indigenous communities are particularly vulnerable to the negative legacies of mining developments (Baker and McLelland, 2003; Booth and Skelton, 2011; Cameron and Levitan, 2014; Canadian Foundation for the Americas, 2008; Howitt, 2001; O'Faircheallaigh and Corbett, 2005).

Historically, the post-closure legacies of many mines have been negative in all five categories, with an inequitable distribution of legacy burdens placed on communities, regions and future generations, as opposed to investors and governments today. However, mining and associated activities have a considerable, but largely unrealized potential to generate positive legacies. Combined regional and project-specific assessment processes that adopt long term perspectives and focus on desirable futures can foster serious attention to, designing and using mining activities and related revenues to build bridges to more sustainable futures, and develop stronger capacities to manage future opportunities and problems (Gibson, 2014). Regional level assessment should combine attention to cumulative effects and broad alternatives with efforts to identify gaps in local and regional administrative capacity, and work to build technical and managerial knowledge that can have post-mine applications, including how to diversify economies and livelihoods based on continuing and renewable resources. Protecting valued cultural and natural resources can also contribute to positive mining legacies by mitigating adverse social and ecological effects that may leave otherwise lasting damage and adverse residual risks (Gibson, 2014; Gibson and Klinck, 2005; Kemp et al., 2007; Loorbach 2010).

Another key component for improving prospects for positive legacies involves the earmarking of a suitable portion of mining revenues to establishing local and regional legacy funds. These funds should be used for three purposes: to diversify the economy and mitigate problems that might generate negative legacies during the life of the mine; to support post-mining livelihoods; and to ensure funding is available after mine closure to maintain infrastructure, services and capacities, as well as reduce negative legacy problems (Gibson, 2014; Gibson and Klinck, 2005; Leatherman et al., 1996).

The responsibility of public governments is to develop a policy environment that supports economic transition and positive mining legacies. There is a need for suitable consultative and/or co-governance processes, with openings for public contribution. Arguably, sustainability-based policy making has been most successful when it is locally specified to respect the communities it affects. High level or generic concepts quickly crumble without a commitment to experiential guidance and sensitivity to case and context. Canadian environmental assessment experience over the past decade is an instructive lesson. The previous Canadian federal government narrowed the application and scope of environmental assessment law, constrained openings for public participation and increased the discretion of the responsible authorities (Collyer, 2012; Doelle, 2012) to address perceived excessive time delays and costs to industry from community conflict (*Canadian Environmental Assessment Act*, SC 1992, c 37, 2012; Gibson et al., 2010). Instead, the initiative undermined the credibility of federal assessment processes, moved project proponents to other means of resistance, including litigation, and increased delays and other challenges for project proponents (Gratton, 2016).

## 6. Potential for improvement in project level cumulative effects assessment

A new regime of linked sustainability-based regional and project assessment, with other strategic level steps is unlikely to

be established quickly, since considerable cooperation is needed among federal, provincial, territorial and Indigenous authorities. In the interim, project assessment law and practice could be improved in ways that would allow stakeholders to address cumulative effects more realistically and usefully. Most simply, the practice of cumulative effects assessment could be improved through better guidance and higher applied standards that recognize the interactive nature of cumulative effects. Further steps to integrate attention to socio-economic, as well as, biophysical effects, to address positive, as well as, adverse effects, and to give special attention to lasting effects are also possible. The bounds of current environmental assessment legislation in some Canadian jurisdictions allows for these considerations.

A more comprehensive and consistent but more complex change would involve collaboration by Canadian jurisdictions to adopt a common approach to environmental assessment, with explicit provisions establishing two key foundations:

- a basic objective to ensure that all undertakings make contributions to sustainability while avoiding adverse effects, supported by a broad definition of environmental effects, clear inclusion of positive, as well as, adverse effects and their interactions, and serious attention to long term effects; and
- an overall shift from mitigating significant adverse effects of proposed undertakings to comparative evaluation of best options for making positive contributions to lasting wellbeing, while also avoiding negative effects.

These expectations have already been applied explicitly in three joint panel reviews of proposed mining projects in Canada (Voisey's Bay Mine and Mill Environmental Assessment Panel, 1997; KNJRP, 2007; Whites Point Quarry and Marine Terminal Joint Review Panel, 2007) and could be applied beneficially in all project level assessments for reasons that extend well beyond cumulative effects issues (Bond, Morrison-Saunders, and Howitt 2012, chap. 11). In the Voisey's Bay case, the review panel established under federal, provincial, Innu and Inuit authority, that it would be considering "the extent to which the Undertaking may make a positive overall contribution towards the attainment of ecological and community sustainability, both at the local and regional levels" (VBEAP, 1997). One result was that project approval was conditional on reducing the capacity of the concentrator from 20,000 t per day to 6000 t/d to extend the life of the mining operation and increase possibilities for building local capacities that would serve livelihoods for regional communities after mining ended. In the Kemess North case, the review panel applied a contribution to sustainability test using criteria drawn from the British Columbia provincial policy statements and the mining industry's "Mining, Minerals and Sustainable Development Initiative". It concluded that "the project in its present form would not be in the public interest" because of transient economic and social benefits that would be "outweighed by the risks of significant adverse environmental, social and culture effects, some of which may not emerge until many years after mining operations cease" (KNJRP, 2007: 245).

Such changes have been advocated for project level assessments for many years and are, arguably, long overdue, even without needs for better attention to cumulative effects (Gibson et al., 2016). However, such changes would be insufficient to make project level assessments an adequate platform for cumulative effects assessment. Better project level assessment still needs to be complemented by regional scale attention to cumulative effects with comparative evaluation of future options, and requires translation into anticipatory plans with associated broader policy

making and programming. For this purpose, cumulative effects assessment should be framed in the context of moving to more desirable futures and providing clear guidance for project level planning and assessment (Arts et al., 2005).

## 7. The Ring of Fire case example

### 7.1. Overview

The Ring of Fire is a mineral resource-rich area of approximately 5120 km<sup>2</sup> located in the James Bay Lowlands region of Northern Ontario, approximately 500 km northeast of Thunder Bay. Significant deposits of chromite, copper, zinc, nickel, platinum, vanadium, and gold have been found there. The chromite deposit represents the first discovery of commercial quantities in North America (Hjartarson et al., 2014) and the fourth largest reserves in the world after South Africa, Zimbabwe and Kazakhstan (Sudol, 2015). The Ontario Ministry of Northern Development and Mines has, perhaps generously, estimated the Ring of Fire to contain \$60 billion worth of minerals.

The promise of world-class chromite and other mineral deposits has fostered the Ontario government and industry vision of multi-generational mining activity similar to the Sudbury Basin. They believe that the deposits may be significant enough to sustain mining activity for a century (Hjartarson et al., 2014; Sudol, 2015). However, Cliffs Natural Resources Inc. sold the largest chromite deposit to Noront Resources for a major loss and all activity remains highly speculative because of mineral market price uncertainties and because mine development in the Ring of Fire area will require hundreds of kilometres of new transportation infrastructure (Younglai and Marotte, 2015). The area is currently undeveloped, but mining proposals in this resource rich, inaccessible and ecologically sensitive area have generated controversy and conflict particularly because the hopes for great economic gains are accompanied by the potential for seriously net negative lasting regional cumulative effects and poorly distributed benefits and risks (Chetkiewicz and Lintner, 2014).

The Ring of Fire area includes five isolated First Nations communities—Webequie, Nibinamik, Neskantaga, Eabametoong and Marten Falls—and four other Indigenous communities that are road accessible—Aroland, Long Lake 58, Ginoogaming and Constance Lake. Together, these First Nations make up the nine member, Matawa Tribal Council. The Ring of Fire mining development would affect many other First Nations communities outside of the Matawa region, including those within the same watershed and those with long standing relationships with communities within the Matawa region.

The Ring of Fire area is part of Ontario's ecologically significant Far North, which contains the world's largest area of boreal forest that is free from large-scale human disturbance. The Ring of Fire is also in the James Bay Lowlands, part of the larger Hudson Bay Lowlands, which form the world's largest peatland. Jointly, the boreal forest and the James Bay Lowlands serve as crucial carbon sinks for Canada and the world (Chong, 2014). Ring of Fire mining

and infrastructure development would alter the regional landscape and ecosystems significantly, with effects including habitat fragmentation, potentially serious release of pollutants and effluents into watercourses, possible impairment of carbon sequestration functions, increased hunting and fishing pressures facilitated by easier access, and likely introduction of non-native species, among other concerns (Chetkiewicz and Lintner, 2014; Chong, 2014; Wildlands, 2015).

The need for economic development, employment opportunities, adequate infrastructure and services (especially potable water and sufficient housing) in the remote Indigenous communities has also been a major factor in deliberations about the potential contributions of mining in the Ring of Fire. Poverty, addiction and unemployment are common in the area, and the prospects for mining development has left many community members with mixed desires. The need for livelihood sufficiency is accompanied by the need to maintain the culturally and economically foundation of access to and reliance on traditional lands for hunting, fishing and trapping. The fear of socio-economic and cultural problems associated with mines is accompanied by the desire for opportunities for education and employment in remote centres for present and future generations.

The role First Nations play as ecological stewards, in tandem with the spiritual and cultural connection to the land, is poorly understood and generally not integrated into federal and provincial project level assessment mechanisms. Mainstream discussion has framed the debate as economy versus the environment, implicitly situating the project-centred environmental assessment processes as a venue for battles over these priorities. A broader and more positive approach, using assessments and associated regional initiatives to find pathways to lasting regional benefits, is not yet on the agenda.

Both the federal and Ontario environmental assessment regimes apply to Ring of Fire developments and both jurisdictions have limited their assessment ambitions to individual project-by-project processes. Only one mining project (including associated infrastructure) is currently in the initial stages of a formal assessment process. Ontario has approved environmental assessment terms of reference for Noront's Eagle's Nest nickel-cooper mine project (Noront Resources, 2016). Concurrently, the provincial Ministry of Natural Resources is engaging in land use planning in the region on a community-by-community basis without any evident interest in pursuing regional level strategic level assessment to address cumulative effects and other broad concerns and provide resulting guidance for project level assessments (Ministry of Northern Development and Mines, 2013). Moreover, the ongoing project level assessment and land use planning activities are not linked. Each community is consulted separately, without encouragement or opportunity to negotiate effectively as a block or consider the cumulative effects industrial development can have in the region (Master, 2012, Far North Act, 2010, S.O. 2010, c. 18). Essentially, the preparations for Ring of Fire development at present lack coordination, regional scope and long term perspective.





Source: Northern Policy Institute

The above map is a rendering of the area with communities, the largest claims and potential corridor routes as proposed by the Northern Policy Institute (Northern Policy Institute, 2015). The anticipated development implications are speculative and do not include cumulative effects. However, the map does provide the reader with significant insight into the potential incursion and fragmentation that development in this region could generate. If the provincial and federal government were to apply the five principles of effective cumulative effects assessment (multi-dimensional, long term, credible, authoritative, and accountable), it would require a governance framework different from what is currently in place. At present, preparations for Ring of Fire

development area characterized by evidently negligible attention from federal authorities, fragmented efforts by siloed provincial ministries with a focus on project level assessment, and largely community-by-community engagement of the affected First Nations in planning initiatives (Ministry of Natural Resources and Forestry, 2016).

### 8. Implementing the characteristics in the ring of fire

The best approach to the Ring of Fire case that would address the five desired characteristics discussed above would need to be negotiated by the relevant authorities – the province, First Nations and the federal government. For illustrative purposes, however, the



**Table 1**

Comparison of adherence in the Ring of Fire to the five characteristics of best practice CEA in the current circumstances versus the ideal.

Characteristic	Present Approach to RoF	Best Practice to RoF
Multi-dimensional	<ul style="list-style-type: none"> <li>little consideration of cumulative effects</li> <li>uncoordinated planning, assessment and policy-making</li> </ul>	<ul style="list-style-type: none"> <li>large scale collaborative regional strategic assessment with proper tiering to guide project level deliberations</li> <li>comparison of alternative development options in light of cumulative socio-economic, cultural and biophysical effects</li> </ul>
Long term	<ul style="list-style-type: none"> <li>financial projections</li> </ul>	<ul style="list-style-type: none"> <li>use of scenario-based tools to explore future options</li> <li>careful attention to legacy effects</li> <li>development of a monitoring plan with provisions and responsibilities for re-evaluating development trajectories and applying adaptive management</li> </ul>
Credible	<ul style="list-style-type: none"> <li>development of a regional "Framework Agreement" between the Province and Matawa First Nations</li> <li>establishment of a Ring of Fire Secretariat</li> <li>project level assessment under provincial law</li> </ul>	<ul style="list-style-type: none"> <li>specification of First Nations rights to free, prior and informed consent within the process</li> <li>sustainability-based decision-making criteria and objectives</li> <li>project assessment guided by the regional strategic assessment</li> </ul>
Authoritative	<ul style="list-style-type: none"> <li>decision-making controlled by Province</li> <li>First Nations initiatives to gain more influence through judicial review and negotiations</li> <li>little federal government involvement</li> </ul>	<ul style="list-style-type: none"> <li>collaborative and transparent law based planning and assessment processes, established by agreement among the provincial, indigenous and federal authorities</li> <li>major decisions negotiated by the responsible governments and reported with explicit, sustainability-based rationales</li> </ul>
Accountable	<ul style="list-style-type: none"> <li>unspecified commitment to monitoring in the regional Framework Agreement</li> </ul>	<ul style="list-style-type: none"> <li>transparent processes and rationales for decisions based on explicit criteria,</li> <li>development of a joint monitoring body linked to regional strategic assessment as project approval conditions, with regular reviews of overall trajectories and capacity for adaptive responses</li> </ul>

general nature of a better-integrated and more far-sighted approach are outlined below in [Table 1](#) and the following discussion.

In order for the planning and assessment processes meet the five characteristics, they would require a collaborative approach to governance that linked regional and project specific considerations and addressed the long, as well as, more immediate options for development that respects the concerns and aspirations of the communities in the region. The major new component would be a collaborative RSEA resulting in a plan that aimed to foster and guide regional development in ways that would maximize lasting gains for the region and its communities, while avoiding significant adverse effects and risks. Like a master plan for an urban region, the Ring of Fire plan would provide an authoritative basis for planning, approval and implementation of more specific undertakings, including individual mining projects and associated infrastructure. It would also include provisions and responsibilities for follow-up monitoring of effects, to facilitate enforcement of compliance with project approval conditions and to guide responses to emerging concerns and opportunities.

The linked regional strategic planning and project level assessment would be required to identify and compare development alternatives, including different options for road placement and other infrastructure development. Scenario building could help clarify relations between desired future characteristics and alternative development options. The focus would be on positive and adverse cumulative effects, with special attention to legacy effects. Also the planning would need to consider what pace and scale of development would provide needed gains without exceeding the biophysical resilience of ecosystems, the managerial abilities of governments, and the capacities of communities to take advantage of new opportunities and deal with new stresses. Throughout the processes, the deliberations and decision making would use explicit sustainability-based criteria for evaluations that would need to be designed and applied collaboratively by a multi-authority body or bodies with the capacity and resources to make informed decisions.

The approved regional plan have time-limited application, but be open to review, revision and renewal. The plan could, for example, include provisions to manage the pace, as well as extent and location of particular activities, estimate infrastructure needs, identify requirements of accompanying social programming, provide guidance for anticipating and responding to induced development, and determine standards for remediation. A key role of the plan would be to provide credible and authoritative responses to big issues that would otherwise burden project level assessments, and provide other guidance, giving project proponents, communities and other parties more certainty about expectations and less risk of project related social conflict.

The monitoring plan and accompanying monitoring body would gather effects data, identify emerging issues and evaluate response options based on set criteria. Like the body or bodies established to direct the R-SEA and project-level assessments, the monitoring body would need to be established collaboratively, and have sufficient authority, responsibility, resources and transparency to be credible and effective. Over the long term, it could act as public venue for discussing development concerns, lodging complaints and recommending responses including plan modifications.

The image above represents a potential governance framework for the region. The process outlined would also require decision-making capacity and authority shared among the Province, the Matawa Tribal Council and the Federal government. This could be manifest in a variety of ways, but any approach must respect s. 35 indigenous rights under the Canadian constitution and could be structured to respect the federal commitment to free, prior and informed consent ([Fontaine, 2016](#); [Papillon and Rodon, 2017](#); [Nicol, 2016](#)).

Tiered governance structures of this nature are not on the current agenda of the Ontario government. Provincially, the Far North Act or through the Regional Framework Agreement between the Province and the nine Matawa Nations could be used as methods to engage in a tiered governance system for assessment ([Matawa First Nations and the Crown, 2014](#)). Deliberations on

proposed road corridors may also offer First Nations a better opportunity to consider cumulative effects, development scenarios and mining legacies due to the general breadth of the undertaking when compared to the scope of traditional project assessment. The roads will cross boundaries and affect all the communities, requiring coordination and strategic consideration between multiple First Nations authorities and across the larger ecosystem to consider fragmentation and development trajectories. So far, however, the planning for road infrastructure projects has not been accompanied by comprehensive regional and development planning.

Overall, the case illustrates an important unmet opportunity where a sustainability-based, regional strategic cumulative effects assessment could be beneficial. The regional, as well as local effects of the mining and infrastructure development on the ecosystems and remote Indigenous communities will be significant. Moreover, evident tensions already exist among the authorities and stakeholders, including the First Nations, mining companies, federal and provincial agencies, and environmental conservation advocates over the potential cumulative effects and response options (Fletcher, 2015; Matawa First Nations and the Crown, 2014; Ministry of Northern Development and Mines, 2013). The Ring of Fire region for anticipatory regional assessment is relatively well bounded, and clearly involves regional concerns, opportunities and options that cannot be addressed effectively, efficiently or fairly through the current individual project assessment and individual community-centred planning approaches (Chetkiewicz and Lintner, 2014). However, the province continues to maintain that a focus on project-level assessment is sufficient for understanding cumulative effects and sustainability concerns.

## 9. Conclusion

The purpose of this paper has been to consider how cumulative effects can be integrated in assessment in Canadian mining developments to address some of the on-going inadequacies of current project-centred assessment regimes. At present, cumulative effects are poorly considered in Canadian resource development. The limited scope and motives of project proponents and the narrow focus on “significant adverse effects” leave project level assessments with little potential for integrating serious attention to cumulative effects. We recommend that the primary foci of future policy building for cumulative effects include emphasis on:

- designing and delivering tiered regional assessment regimes, where credible public processes for assessing cumulative environmental effects and broad alternatives are used to address regional concerns and opportunities and to guide the planning and assessment of individual projects; and
- requiring the adoption and use of explicit sustainability-based criteria for assessment evaluations and decision-making, duly specified for particular applications. The criteria must be applied to and incorporated into mining related cumulative and project assessments with particular attention to legacy concerns and the use of mines as bridges to more sustainable futures.

The Ring of Fire case provides a useful illustrative example of a region where an approach incorporating the two improvements above would be highly beneficial.

Key larger scale issues of complexity (e.g., understanding cumulative interactive effects and comparing broad alternative development options) are usually best considered at a strategic level. The dominant project-oriented model for environmental assessment is not well-designed to consider the strategic level concerns that typify cumulative environmental effects issues.

Strategic regional environmental assessments attempt to anticipate cumulative effects and regional scale issues and development objectives, providing guidance to project level assessments (Aschemann et al., 2012; Gibson et al., 2010). Strategic level environmental assessments that utilize sustainability principles could address many classic project level EA insufficiencies.

New mining undertakings should be chosen, designed and implemented in ways that contribute to sustainability-enhancing cumulative outcomes (Hodge, 2003). While it is challenging for mining developments to generate sustainable outcomes since non-renewable resource exploitation depletes the resource (e.g., the orebodies), mining development can be designed and undertaken in ways that enhance prospects for lasting regional wellbeing. Sustainable decision-making considers how to enhance prospects for multiple, mutually reinforcing gains, while avoiding significant adverse effects, ensuring fair sharing of benefits, establishing the necessary technological capacity, and focusing on the long term as well as immediate considerations (Dalal-Clayton et al., 2002; Gibson, 2014; Poocharoen, 2012). These overall aims can be pursued through fair process design, development and comparative evaluation of multiple options, and facilitation of effective stakeholder inclusion through capacity building and the provision of meaningful opportunities to participate (Hemmati, 2002; Rasmussen, 2008; Sinclair, 2001). These considerations take assessment from the old focus on mere mitigation of adverse effects to a more positive agenda that matches current expectations. They also shift a substantial portion of assessment weight from the project level to the strategic level of cumulative effects and regional options.

For mining, the delivery of sustainability-enhancing results entails special attention to cumulative legacy effects. Enhancing cumulative prospects for positive legacies from mining involves the usual efforts to minimize lasting social, economic and culture damage and environmental risks during the life of the mines, but also entails avoidance of post decommissioning risks and management obligations, smoothing of boom-bust effects, and enhancement of lasting gains (e.g. capacities, concurrent economic diversification, fostering of livelihood options based on renewable resources).

This sustainability focus entails using mines and mining as a bridge to more sustainable futures. This bridging is not something that the mining industry can address adequately by itself. Governments need to consider themselves as partners in these endeavours and use mining opportunities and a portion of revenues to invest in associated programmes that work towards feasible and desirable futures, on a regional, as well as a project-by-project basis.

As an illustrative example, the mining developments in the Ring of Fire will generate significant cumulative effects. The region's future prospects would be better served by steps to establish tiered regional and project planning and assessments, to plan for positive legacies and to orient approaches for sustainable futures. In order for developments to bridge towards positive legacies, better coordination and collaboration within government and between parties is necessary. The transition to such approaches would benefit from extensive focus and research from the academic community to illuminate opportunities and generate innovative approaches to the considerable complexities in the development of the Ring of Fire region and other regions with similar challenges. The relevant processes should consider broader strategic level concerns, alternatives resulting from comprehensive development agendas, and positive and negative legacy effects as opposed to focusing only on adverse effects (Gibson et al., 2005a, 2005b). These approaches aid in visioning and re-orienting the analytical processes required for sustainability (Frame and O'Connor, 2011; Loorbach, 2010; Özkaynak et al., 2004).

Mining development is challenging to get right. However, with greater interest in and consideration of cumulative effects, new opportunities for better futures can emerge. We need to foster new policy environments and encourage dialogue in order to achieve these outcomes. Focusing on tiered regional processes, oriented towards sustainability and long term legacies is a good place to begin.

## Acknowledgements

This work was supported by the Wildlife Conservation Society via the W. Garfield Weston Foundation and the Social Sciences and Humanities Research Council.

## References

- Adger, W. Neil, Jordan, Andrew, 2009. *Governing Sustainability*. Cambridge University Press.
- Amer, Muhammad, Daim, Tugrul U., Jetter, Antonie, 2013. A review of scenario planning. *Futures* 46 (February), 23–40.
- Arts, Jos, Tomlinson, Paul, Voogd, Henk, 2005. EIA and SEA tiering: the missing link? Position paper presented at the international association for impact assessment conference. *International Experience and Perspectives in SEA*, Prague 26–30 September 2005, Prague.
- Aschmann, Ralf, Jahn, Thomas, Partidario, Maria Rosario, Sadler, Barry, Verheem, Rob, 2012. *Handbook of Strategic Environmental Assessment*. Routledge.
- Askew, Hannah, 2015. Does the Province Have a Duty to Conserve? *West Coast Environmental Law*. (March 18) <http://wcel.org/resources/environmental-law-alert/does-province-have-duty-conserve>.
- BSEAP, Beaufort Sea Environmental Assessment Panel, 1984. Beaufort Sea Hydrocarbon Production and Transportation Proposal: Report of the Environmental Assessment Panel/Federal Environmental Assessment Review Office, Hull, Quebec. (Available at) <http://www.aina.ualgary.ca/scripts/mwmain.dll/144/hiproe/hiproesa/sisn+14686+or+sisn+47667?COMMANDSEARCH>.
- Baker, Douglas C., McLelland, James N., 2003. Evaluating the effectiveness of british columbia's environmental assessment for first nations' participation in mining development. *Environ. Impact Assess. Rev.* 23 (5), 581–603.
- Baxter, Wanda, Ross, William A., Spaling, Harry, 2001. Improving the practice of cumulative effects assessment in Canada. *Impact Assess. Proj. Appraisal* 19 (4), 253–262.
- Bellringer, Auditor General of British Columbia, C., 2016. An Audit of Compliance and Enforcement of the Mining Sector. Office of the Auditor General of British Columbia, Victoria (available at: <https://www.bcauditor.com/sites/default/files/publications/reports/OAGBC%20Mining%20Report%20FINAL.pdf>).
- Blueberry River First Nations v. British Columbia, 2015. BCSC 1302. Supreme Court of British Columbia (N. Smith J.).
- Bond, Alan James, Morrison-Saunders, Angus, Howitt, Richard, 2012. *Sustainability Assessment: Pluralism, Practice and Progress*. Routledge.
- Booth, Annie L., Skelton, Norm W., 2011. 'You spoil everything!' indigenous peoples and the consequences of industrial development in British Columbia. *Environ. Dev. Sustain.* 13 (4), 685–702. doi:<http://dx.doi.org/10.1007/s10668-011-9284-x>.
- Botta, N., McFaul, S., Xavier, A.M., 2014. Economic diversification and mine closure: an analysis of the Misima mine case. *Proceedings of Mine Closure Solutions*.
- Bowles, Paul, Wilson, Gary N., 2015. *Resource Communities in a Globalizing Region: Development, Agency, and Contestation in Northern British Columbia*. University of British Columbia Press.
- Brummans, Boris H.J.M., Putnam, Linda L., Gray, Barbara, Hanke, Ralph, Lewicki, Roy J., Wiethoff, Carolyn, 2008. Making sense of intractable multiparty conflict: a study of framing in four environmental disputes. *Commun. Monogr.* 75 (1), 25–51.
- Cameron, Emilie, Levitan, Tyler, 2014. Impact and benefit agreements and the neoliberalization of resource governance and indigenous-state relations in Northern Canada. *Stud. Political Econ.* 93, 25–52.
- Canadian Environmental Assessment Research Council, 1986. *Cumulative Environmental Effects: A Bi-National Perspective*. Canadian Environmental Assessment Research Council, Hull, Quebec.
- Canadian Foundation for the Americas, 2008. *Sustainable Communities Mining and Indigenous Governance*. FOCAL, Ottawa, Ont.
- Chadwick, Megan, 2013. *The Duty to Consult First Nations Within the Environmental Assessment Process: A Resource Industry Perspective*. University of Victoria. <http://dspace.library.uvic.ca:8080/handle/1828/5140>.
- Chaker, A., El-Fadl, K., Chamas, L., Hatjian, B., 2006. A review of strategic environmental assessment in 12 selected countries. *Environ. Impact Assess. Rev.* 26 (1), 15–56.
- Chetkiewicz, Cheryl, Lintner, Anastasia, 2014. *Getting It Right in Ontario's Far North: The Need for Regional Strategic Environmental Assessment in the Ring of Fire [Wawangajing]*. Ecojustice and WCS Canada..
- Chong, Jed, 2014. *Resource Development in Canada: A Case Study on the Ring of Fire*. Library of Parliament Research Publications. <http://www.parl.gc.ca/Content/LOP/ResearchPublications/2014-17-e.htm#8>.
- Collyer, D. (2012, March 23). Regulatory reform recommendations improve jobs, growth, prosperity outlook while continuing to deliver responsible environmental outcomes. Canadian Association of Petroleum Producers. Retrieved from <http://www.capp.ca/aboutUs/mediaCentre/CAPPCommentary/Pages/regulatory-reform-recommendations>.
- Cornish, Edward, 2005. *Futuring: The Exploration of the Future*, 1 edition World Future Society, Bethesda, Md.
- Dalal-Clayton, D. Barry, Sadler, Barry, 2005. *Strategic Environmental Assessment: A Sourcebook and Reference Guide to International Experience*. Earthscan.
- Dalmer, Denise, 2012. Cumulative impact assessment: is it just a fancy way of identifying and managing risk? *Environ. Energy Bull.* 4 (6), 1–6 (available at <http://www.bcbc.com/content/659/EEBv4n6.pdf>).
- Davis, Rachel, Franks, Daniel, 2011. The costs of conflict with local communities in the extractive industry. *SR Mining 2011, First International Seminar on Social Responsibility in Mining* (October 2011).
- DeNicola, Dean M., Stapleton, Michael G., 2002. Impact of acid mine drainage on benthic communities in streams: the relative roles of substratum vs. aqueous effects. *Environ. Pollut.* 119 (3), 303–315. doi:[http://dx.doi.org/10.1016/S0269-7491\(02\)00106-9](http://dx.doi.org/10.1016/S0269-7491(02)00106-9).
- Depoe, Stephen P., Delicath, John W., Elsenbeer, Marie-France Aepli, 2004. *Communication and Public Participation in Environmental Decision Making*. SUNY Press.
- Doelle, Meinhard, 2012. CEEA 2012: the end of federal EA as we know it? *J. Environ. Law Pract.* 24 (1), 1–17.
- Dubé, Monique, Munkittrick, Kelly, 2001. Integration of effects-based and stressor-based approaches into a holistic framework for cumulative effects assessment in aquatic ecosystems. *Hum. Ecol. Risk Assess.* 7 (2), 247–258.
- Duinker, Peter N., Greig, Lorne A., 2006. The impotence of cumulative effects assessment in Canada: ailments and ideas for redeployment. *Environ. Manage.* 37 (2), 153–161.
- Duinker, Peter N., Greig, Lorne A., 2007. Scenario analysis in environmental impact assessment: improving explorations of the future. *Environ. Impact Assess. Rev.* 27 (3), 206–219.
- Duinker, Peter N., Burbidge, Erin L., Boardley, Samantha R., Greig, Lorne A., 2012. Scientific dimensions of cumulative effects assessment: toward improvements in guidance for practice. *Environ. Rev.* 21 (1), 40–52.
- Duinker, Peter, 2008. *Scenarios of the Forest Futures Project: Why and How We Created Them, and How to Use Them*. Sustainable Forest Management Network. [https://era.library.ualberta.ca/files/ht24wk22z/ScenariosFFP\\_WhatWhyHow\\_02\\_04\\_2008.pdf](https://era.library.ualberta.ca/files/ht24wk22z/ScenariosFFP_WhatWhyHow_02_04_2008.pdf).
- Eisler, Ronald, Wiemeyer, Stanley N., 2004. Cyanide hazards to plants and animals from gold mining and related water issues. *Reviews of Environmental Contamination and Toxicology*. Springer, pp. 21–54.
- Eisler, Ronald, 2004. Arsenic hazards to humans, plants, and animals from gold mining. *Reviews of Environmental Contamination and Toxicology*. Springer, pp. 133–165.
- Fischer, Thomas B., 2012. Strategic environmental assessment-Related research projects and journal articles: an overview of the past 20 years. *Impact Assess. Proj. Appraisal* 30 (4), 253–263.
- Fontaine, Tim, 2016. Canada Now Full Supporter of UN Indigenous Rights Declaration. *CBC News*. (May 10) <http://www.cbc.ca/news/indigenous/canada-adopting-implementing-un-rights-declaration-1.3575272>.
- Fletcher, T. (2015, January 19). Rocky year ahead for B.C. mining. Retrieved February 17, 2015, from <http://www.thenorthernview.com/business/289083861.html>.
- Francis, Shawn R., Hamm, Jeff, 2011. Looking forward: using scenario modeling to support regional land use planning in Northern Yukon, Canada. *Ecol. Soc.* 16 (4), 18.
- Franks, Daniel M., Brereton, David, Moran, Chris J., 2010. Managing the cumulative impacts of coal mining on regional communities and environments in Australia. *Impact Assess. Proj. Appraisal* 28 (4), 299–312.
- Gibson, Ginger, Klinck, Jason, 2005a. Canada's resilient north: the impact of mining on aboriginal communities. *Pimatisiwin* 3 (1), 116–139.
- Gibson, Robert B., Holtz, Susan, Tansey, James, Whitelaw, Graham, Hassan, Selma., 2005b. *Sustainability Assessment: Criteria and Processes*. Routledge.
- Gibson, Robert B., Benevides, Hugh, Doelle, Meinhard, Kirchhoff, Denis, 2010. Strengthening strategic environmental assessment in Canada: an evaluation of three basic options. *J. Environ. Law Pract.* 20 (3), 175–211.
- Gibson, Robert B., Doelle, Meinhard, John Sinclair, A., 2016. Fulfilling the promise: basic components of next generation environmental assessment. *J. Environ. Law Pract.* 27.
- Gibson, Robert B., 2002. From Wreck Cove to Voisey's Bay: the evolution of federal environmental assessment in Canada. *Impact Assess. Proj. Appraisal* 20 (3), 151–159.
- Gibson, Robert B., 2006. Sustainability assessment and conflict resolution: reaching agreement to proceed with the Voisey's Bay nickel mine. *J. Clean. Prod.* 14 (3/4), 334–348.
- Gibson, Robert B., 2011. Application of a contribution to sustainability test by the joint review panel for the Canadian Mackenzie Gas Project. *Impact Assess. Proj. Appraisal* 29 (September (3)), 231–244.
- Gibson, Robert B., 2013. Avoiding sustainability trade-offs in environmental assessment. *Impact Assess. Proj. Appraisal* 31 (1), 2–12.
- Gibson, Robert B., 2014. Turning mines into bridges: gaining positive legacies from non-renewable resource projects. *J. Aboriginal Manage.* 15 (October) .



- Gibson, Robert B. (Ed.), 2016. *Sustainability Assessment: Applications and Opportunities*. Routledge.
- Government of Canada, C. E. A. A. (1999, February 9). Canadian Environmental Assessment Agency – Policy and Guidance – Cumulative Effects Assessment Practitioners' Guide. Retrieved February 17, 2014, from <http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=43952694-1&toc=show&offset=6#h2>.
- Government of Canada, C. E. A. A. (2008, May 22). Canadian Environmental Assessment Agency – Policy and Guidance – Public Participation Guide. Retrieved January 29, 2014, from <https://www.ceaa-acee.gc.ca/default.asp?lang=En&n=46425CAF-1&offset=6&toc=hide>.
- Gratton, Pierre 2016. Finding Solid Ground in a Shifting Environment for Mining, speech to the Greater Vancouver Board of Trade, 21 September 2016.
- Gualini, Enrico, 2015. *Planning and Conflict: Critical Perspectives on Contentious Urban Developments*. Routledge.
- Gunn, Jill Harriman, Noble, Bram F., 2009. A conceptual basis and methodological framework for regional strategic environmental assessment (R-SEA). *Impact Assess. Proj. Appraisal* 27 (4), 258–270.
- Gunn, Jill, 2011. Conceptual and methodological challenges to integrating SEA and cumulative effects assessment. *Environ. Impact Assess. Rev.* 31 (2), 154–160.
- Harriman, Jill A.E., Noble, Bram F., 2008. Characterizing project and strategic approaches to regional cumulative effects assessment in Canada. *J. Environ. Assess. Policy Manage.* 10 (01), 25–50.
- Hemmati, M., 2002. *Multi-stakeholder Processes for Governance and Sustainability: Beyond Deadlock and Conflict*. Routledge.
- Hjartarson, Josh, McGuinty, Liam, Boutilier, Scott, 2014. *Beneath the Surface: Uncovering the Economic Potential of Ontario's Ring of Fire*. Ontario Chamber of Commerce ([http://www.occ.ca/Publications/Beneath\\_the\\_Surface\\_web.pdf](http://www.occ.ca/Publications/Beneath_the_Surface_web.pdf)).
- Hodge, T., 2003. Out of Respect: the Tahltan Mining and the Seven Questions to Sustainability (Report of the Tahltan Mining Symposium). IISD; The Tahltan First Nation, Dease Lake, British Columbia.
- Howitt, R., 2001. *Rethinking Resource Management: Justice, Sustainability and Indigenous Peoples*. Psychology Press.
- KNJRP, Kemess North Joint Review Panel. 2007. Panel Report: Kemess North Copper-Gold Mine Project, 17 September. <http://www.acee-ceaa.gc.ca/052/details-eng.cfm?pid=3394>.
- Kaufman, Sanda, Elliott, Michael, Shmueli, Deborah, 2003. *Frames, Framing and Reframing. Beyond Intractability* (<http://www.beyondintractability.org/essay/framing>).
- Kemp, René, Loorbach, Derk, Rotmans, Jan, 2007. Transition management as a model for managing processes of co-evolution towards sustainable development. *Int. J. Sustain. Dev. World Ecol.* 14 (1), 78–91.
- Kilanski, Kristine Michelle, 2015. *A Boom for Whom?: Gender, Labor, and Community in a Modern Day Oil Boomtown*. Thesis. <https://repositories.lib.utexas.edu/handle/2152/32545>.
- Leatherman, John C., Marcouiller, David W., others, 1996. Persistent poverty and natural resource dependence: rural development policy analysis that incorporates income distribution. *J. Reg. Anal. Policy* 26, 73–94.
- Lenihan, D.G., 2012. *Rescuing Policy the Case for Public Engagement*. Public Policy Forum, Ottawa, Ont.
- Leung, H.-L., 2003. *Land Use Planning Made Plain*. University of Toronto Press.
- Locke, Harvey, Heuer, Karsten, 2015. *Yellowstone to Yukon: global conservation innovations through the years*. In: George, Wuethner, Eileen, Crist, Butler, Tom (Eds.), *Protecting the Wild*. Island Press/Center for Resource Economics, pp. 120–130. doi:[http://dx.doi.org/10.5822/978-1-61091-551-9\\_14](http://dx.doi.org/10.5822/978-1-61091-551-9_14).
- Loorbach, Derk, 2010. Transition management for sustainable development: a prescriptive, complexity-based governance framework. *Governance* 23 (1), 161–183. doi:<http://dx.doi.org/10.1111/j.1468-0491.2009.01471.x>.
- Master, W. (2012, May 15). *Land Use Planning [Text]*. Retrieved April 11, 2016, from <http://www.mndm.gov.on.ca/en/ring-fire-secretariat/land-use-planning>.
- MGPJRP, Mackenzie Gas Project Joint Review Panel 2009. *Foundation for a Sustainable Northern Future*, December 2009. Available at <<http://www.acee-ceaa.gc.ca/default.asp?lang=En&n=155701CE-1>>
- MIAC, Multi-Interest Advisory Committee. 2016. *Advice to the Expert Panel Reviewing Environmental Assessment Processes*, 9 December 2016, 64pp., available at <http://eareview-examenee.ca/what-weve-heard/multi-interest-advisory-committee/>.
- MacDonald, Lee H., 2000. Evaluating and managing cumulative effects: process and constraints. *Environ. Manage.* 26 (3), 299–315.
- Macdonald, Eliana 2016. *Atlas of Cumulative Landscape Disturbance in the Traditional Territory of Blueberry River First Nations*, 2016. Vancouver: David Suzuki Foundation and Ecotrust Canada. (Accessed 22 August). <http://www.davidsuzuki.org/publications/reports/2016/atlas-of-cumulative-landscape-disturbance-in-the-traditional-territory-of-bluebe/>.
- Markey, Sean, Halseth, Greg, Manson, Don, 2012. *Investing in Place: Economic Renewal in Northern British Columbia*. Vancouver; Toronto : UBC Press.
- Matawa First Nations and the Crown, 2014. *Regional Framework Agreement*. Ministry of Northern Development and Mines. [http://www.mndm.gov.on.ca/sites/default/files/rof\\_regional\\_framework\\_agreement\\_2014.pdf](http://www.mndm.gov.on.ca/sites/default/files/rof_regional_framework_agreement_2014.pdf).
- McIlwraith, Thomas, Cormier, Raymond, 2016. *Making place for space: site-specific land use and occupancy studies in the context of the supreme court of Canada's Tsilhqot'in decision*. *BC Stud. Br. Columbian Q.* 0 (188), 35–53.
- Ministry of Northern Development and Mines, 2013. *Ring of Fire Secretariat. Ring of Fire Secretariat*. <http://www.mndm.gov.on.ca/en/ring-fire-secretariat>.
- Miranda, Marta, Burris, Philip, Bingcan, Jessie Froy, Shearman, Phil, Briones, Jose Oliver, Viña, A.L., Menard, Stephen, 2003. *Mining and Critical Ecosystems: Mapping the Risks*. World Resources Institute, Washington, DC. [https://www.comdev.org/userfiles/files/876\\_file\\_WRI\\_mining\\_critical\\_ecosystems\\_full.pdf](https://www.comdev.org/userfiles/files/876_file_WRI_mining_critical_ecosystems_full.pdf).
- Morrison-Saunders, Angus, Pope, Jenny, 2013. Conceptualising and managing trade-offs in sustainability assessment. *Environ. Impact Assess. Rev.* 38 (January), 54–63. doi:<http://dx.doi.org/10.1016/j.eiar.2012.06.003>.
- Morrison-Saunders, Angus, Pope, Jenny, Gunn, Jill A.E., Bond, Alan, Retief, Francois, 2014. *Strengthening impact assessment: a call for integration and focus*. *Impact Assess. Proj. Appraisal* 32 (1), 2–8. doi:<http://dx.doi.org/10.1080/14615517.2013.872841>.
- National Research Council, Division of Behavioral and Social Sciences and Education, Board on Environmental Change and Society, and Panel on Public Participation in Environmental Assessment and Decision Making, 2008. *Public Participation in Environmental Assessment and Decision Making*. National Academies Press.
- Nicol, Heather N., 2016. From territory to rights: new foundations for conceptualising indigenous sovereignty. *Geopolitics* 0 (0), 1–21. doi:<http://dx.doi.org/10.1080/14650045.2016.1264055>.
- Noble, Bram, 2015. *Introduction to Environmental Impact Assessment: Guide to Principles and Practice*, 3rd edition Oxford University Press, Toronto.
- Noront Resources, 2016. *Eagle's Nest Mine*. (Accessed 11 April). <http://norontresources.com/projects/eagles-nest-mine/>.
- Northern Policy Institute, 2015. *Ring of Fire and Transportation Infrastructure*. Toronto, Ontario: Northern Policy Tavern. <http://www.northernpolicy.ca/upload/documents/publications/maps/research-ring-of-fire-map-15.04.23-revis.pdf>.
- Norton, Bryan G., 2005. *Sustainability: A Philosophy of Adaptive Ecosystem Management*. University of Chicago Press.
- O'Faircheallaigh, Ciaran, Corbett, Tony, 2005. Indigenous participation in environmental management of mining projects: the role of negotiated agreements. *Environ. Politics* 14 (5), 629–647.
- Odum William, E., 1982. Environmental degradation and the tyranny of small decisions. *Bioscience* 32 (9), 728–729.
- Owen, John R., Kemp, Deanna, 2013. Social licence and mining: a critical perspective. *Resour. Policy* 38 (1), 29–35.
- Özkaynak, B., Devine, P., Rigby, D., 2004. Operationalising strong sustainability: definitions, methodologies and outcomes. *Environ. Values* 279–303.
- Panagos, Dimitrios, Grant, J. Andrew, 2013. Constitutional change, aboriginal rights, and mining policy in Canada. *Commonw. Comp. Politics* 51 (4), 405–423.
- Papillon, Martin, Rodon, Thierry, 2017. Proponent-indigenous agreements and the implementation of the right to free, prior, and informed consent in Canada. *Environ. Impact Assess. Rev.* 62 (January), 216–224. doi:<http://dx.doi.org/10.1016/j.eiar.2016.06.009>.
- Peterson, Garry D., Cumming, Graeme S., Carpenter, Stephen R., 2003. Scenario planning: a tool for conservation in an uncertain world. *Conserv. Biol.* 17 (2), 358–366. doi:<http://dx.doi.org/10.1046/j.1523-1739.2003.01491.x>.
- Poocharoen, O., 2012. Exploring the challenges of energy and resources network governance. *Energy Policy* 42, 409–418.
- Proctor, J. (2015, November 23). *First Nation seeks to quash landmark LNG agreement*. Retrieved December 4, 2016, from <http://www.cbc.ca/news/canada/british-columbia/landmark-lng-agreement-under-fire-in-lawsuit-1.3329129>.
- Pono, Jason, 2013. An analysis of factors leading to the establishment of a social licence to operate in the mining industry. *Resour. Policy* 38 (4), 577–590.
- Rasmussen, Lauge Baungaard, 2008. The narrative aspect of scenario building? How story telling may give people a memory of the futureIn: Gill, Satinder (Ed.), *Cognition, Communication and Interaction*. Springer, London, pp. 174–194. . (Human-Computer Interaction Series) [http://link.springer.com/chapter/10.1007/978-1-84628-927-9\\_10](http://link.springer.com/chapter/10.1007/978-1-84628-927-9_10).
- Robinson, John B., 1990. *Futures under glass: a recipe for people who hate to predict*. *Futures* 22 (8), 820–842. doi:[http://dx.doi.org/10.1016/0016-3287\(90\)90018-D](http://dx.doi.org/10.1016/0016-3287(90)90018-D).
- Ruddell, Rick, Ortiz, Natalie R., 2014. *Boombtown blues: long-term community perceptions of crime and disorder*. *Am. J. Crim. Justice* 40 (1), 129–146. doi:<http://dx.doi.org/10.1007/s12103-014-9237-7>.
- Sinclair, A. John, Diduck, Alan P., 2016. Public participation in Canadian environmental assessment: enduring challenges and future directions, In: Hanna, K.S. (Ed.), *Environmental Impact Assessment: Practice and Participation*. 3rd ed. Oxford University Press, Toronto, pp. 65–95.
- Sinclair, A.J., 2001. Public involvement in EA in Canada: a transformative learning perspective. *Environ. Impact Assess. Rev.* 21 (2), 113–136.
- Sinclair, A. John, Duinker, Peter N., Doelle, Meinhard, 2017. Looking up, down, and sideways: reconceiving cumulative effects assessment as a mindset. *Environ. Impact Assess. Rev.* 62, 183–194.
- Spaling, Harry, Smit, Barry, 1993. Cumulative environmental change: conceptual frameworks, evaluation approaches, and institutional perspectives. *Environ. Manage.* 17 (5), 587–600.
- Stacey, J., Naude, A., Hermanus, M., Frankel, P., 2010. The socio-economic aspects of mine closure and sustainable development: literature overview and lessons for the socio-economic aspects of closure-report 1. *J. South Afr. Inst. Min. Metall.* 110 (7), 379–394.
- Staples, Lindsay, Askew, Hannah, 2016. *Regional Strategic Environmental Assessment for Northern British Columbia: The Case and the Opportunity*WCEL, Vancouver. . (May 2016) <http://wcel.org/category/publications/environmental-assessment>.
- Staples, Kiri, Chávez-Ortiz, Manuel, Barrett, M.J., Clark, Douglas, 2013. *Fixing land use planning in the Yukon before it really breaks: a case study of the Peel Watershed*. *North. Rev.* 37, 143–165.



- Sudol, Stan, 2015. Mining Marshall Plan for Ontario's Far Northwest. Republic of Mining. June 18. <http://www.republicofmining.com/2015/06/18/mining-marshall-plan-for-ontarios-far-northwest-part-1-of-2-by-stan-sudol-june-18-2015/>.
- Taylor, Duncan, 2010. The Parameters Limiting the Effectiveness of Cumulative Effects Assessment as a Component of Strategic Environmental Assessment in Scotland. Universal-Publishers.
- Therivel, Riki, Ross, Bill, 2007. Cumulative effects assessment: does scale matter? *Environ. Impact Assess. Rev.* 27 (5), 365–385.
- Therivel, Riki, 2012. Strategic Environmental Assessment in Action. Routledge.
- Thomson, Jeffrey, 2015. The Duty to Consult and Environmental Assessments: A Study of Mining Cases from Across Canada. University of Waterloo, Waterloo, Ontario, Canada.
- Tollefson, C., Wipond, K., 1998. Cumulative environmental impacts and aboriginal rights. *Environ. Impact Assess. Rev.* 18 (4), 371–390.
- TransCanada Corporation, 2014. Mackenzie Gas Project. TransCanada Corporation. <http://www.transcanada.com/mackenzie-valley.html>.
- Urwin, Jack 2016. Boomtown Bust: How the Sputtering Oil and Gas Industry Is Destroying Men | VICE | Canada. *VICE*, April 26. [http://www.vice.com/en\\_ca/read/boomtown-bust-how-the-sputtering-oil-and-gas-industry-is-destroying-men](http://www.vice.com/en_ca/read/boomtown-bust-how-the-sputtering-oil-and-gas-industry-is-destroying-men).
- VBEAP, Voisey's Bay Mine and Mill Environmental Assessment Panel. 1997. Environmental Impact Statement Guidelines for the Review of the Voisey's Bay Mine and Mill Undertaking, 2- June 1997.
- VBEAP, Voisey's Bay Mine and Mill Environmental Assessment Panel. 1999. Report on the Proposed Voisey's Bay Mine and Mill Project. March. <http://www.aceaa-cee.gc.ca/default.asp?lang=En&n=0A571A1A-1&xml=0A571A1A-84CD-496B-969E-7CF9CBEA16AE&offset=2&toc=show>.
- Weber, Marian, Krogman, Naomi, Antoniuk, Terry, 2012. Cumulative effects assessment: linking social, ecological, and governance dimensions. *Ecol. Soc.* 17 (2) doi:<http://dx.doi.org/10.5751/ES-04597-170222>.
- Whites Point Quarry and Marine Terminal Joint Review Panel, 2007. Report on the Whites Point Quarry and Marine Terminal Project. October. <http://www.aceaa-cee.gc.ca/default.asp?lang=En&n=CC1784A9-1>.
- Wildlands, League, 2015. New Photos Reveal Extensive Damage Done by Ring of Fire Mining Exploration. Wildlands League (June 29, <http://wildlandsleague.org/news/new-photos-reveal-extensive-damage-done-by-ring-of-fire-mining-exploration/>).
- Wilson, Anne, Roseland, Mark, Day, J.C., 1996. Shared decision-making and public land planning: an evaluation of the Vancouver island regional core process (commission on resources and environment). *Environments* 23 (2), 69–86.
- Younglai, Rachele, Marotte, Bertrand, 2015. Cliffs Natural Resources Completes Costly Exit from Ontario's Ring of Fire The Globe and Mail. . (May 23) <http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/cliffs-to-exit-ontarios-ring-of-fire-with-sale-of-chromite-assets/article-23576822/>.