STATE OF PRACTICE OF CUMULATIVE EFFECTS ASSESSMENT AND MANAGEMENT: THE GOOD, THE BAD AND THE UGLY[a]

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ABSTRACT

The historical, current, and anticipated future international practice of cumulative effects assessment and management (CEAM) is addressed. The "context" of CEAM is explained and challenges from scientific and policy issues and numerous uncertainties are described. A six step generic process for carrying out CEAM is provided. Opportunities for mitigation and management are highlighted, with emphasis given to "collaboration" as a foundational element for dealing with cumulative effects. This state-of-practice paper concludes by noting six "ugly lessons" (lack of appropriate attention), eight "bad lessons" which reflect cumulative effects practices that need improvement, and 12 "good lessons", which can be used articulate good practice principles related to CEAM. Examples of these good practice principles include: a VEC-based perspective is used in planning and conducting CEAM studies; both proponent and agency context scoping, and public scoping, is conducted; generic CEAM frameworks are applied to specific VECs, and their application and findings are carefully documented and explained; cumulative effects on specific VECs or their indicators are used as integrators of project effects at local, regional, and strategic spatial areas; CEAM is employed as a useful basis for addressing environmental sustainability; and CEAM relies on principles, methods, and tools from EIA practice. In many situations; some modification of EIA methods and tools is effectively carried out for use in CEAM. In summary, the practice of CEAM is growing out of its infancy. As experience is accrued, it is anticipated that good practice principles will be further articulated and utilized on an international basis to improve the professional practice of CEAM.

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INTRODUCTION

The goal of this paper is to concisely summarize the state of the professional practice of cumulative effects assessment and management (CEAM). The authors of this review have experience related to University-level teaching about environmental impact assessment (EIA) and CEAM, and in conducting related sponsored research and advising graduate students in their research. Both authors have independently and collaboratively taught professional-level CEAM short courses for government agencies and the private sector. Further, they both have consulted on the planning and conduct of CEAM studies, and have prepared relevant sections or chapters in subsequent environmental impact statements (EISs) or environmental assessments (EAs). Finally, they both have reviewed impact study documents and provided suggestions for improvement. The latter author has also served on several EIA review panels for the Canadian government. As a result, both authors have planned, reviewed and conducted comparative evaluations of the CEAM features within prepared compliance documents, or as separate study documents (Baxter, et al., 2001; Ross, 1998; and Cooper and Canter, 1997). Such reviews have also been conducted in the United Kingdom (Cooper and Sheate, 2002). As a result, this state-of-practice review encompasses accrued experiences from both the USA and Canada – two countries which have been devoting considerable attention to CEAM over the last two decades, and particularly since 2000.

This state of CEAM practice was included as a keynote topic in the 2008 Special Topic Meeting on CEAM held by the International Association for Impact Assessment (IAIA). The material in this paper provides part of the overall objectives of the meeting: to take stock of key trends, issues and approaches to cumulative effects; to identify areas of strength and weakness of current impact assessment and resource management approaches in addressing cumulative effects; and to document good practice and ways forward to improve and integrate the institutions, science and practice of CEAM. Other keynote addresses related to the state of science of CEAM; comparisons of Canadian, USA, and international EIA frameworks as they apply to cumulative effects; and World Bank experiences with integrating science, institutions and practice in CEAM.

Included herein is a brief historical perspective on the practice of CEAM. This is followed by four highlighted reasons basic to the importance of CEAM. A generic step-wise procedure for conducting CEAM as an extension within the traditional EIA process is then presented. The availability of methods and tools as aids to CEAM practice is then provided via eight illustrations. Positive opportunities for being creative in CEAM work are then presented, followed by several challenges, including the delineation of several scientific uncertainties. The emphasis then moves to three types of lessons derived from practice. The first category, the ugly lessons, represent non-attention and the absence of adequate planning to address CEAM. The bad lessons are indicative of identified

needs which can be addressed via a reasonable and committed pursuit of the subject. Finally, the good lessons refer to positive attitudes and initiatives that can be taken to further improve CEAM practice; these lessons should be further developed into an initial series of “international best practices principles”.

HISTORICAL CONTEXT OF CEAM

The origins of CEAM began in the early 1970s when it was realized that proposed projects needed to be analyzed in relation to their location and surrounding land uses. Further, agencies that processed multiple concurrent permit approvals for similar types of projects also realized that such approvals needed to incorporate consideration of all applications in close spatial and temporal proximity to each other, as such actions often contribute to cumulative effects.

In the practice of EIA in the USA, the term “cumulative effects” was first mentioned in guidelines of the Council on Environmental Quality (CEQ) in 1973. In mid-1979, CEQ’s first EIA-related regulations defined a cumulative impact (effect) as the (Council on Environmental Quality, 1978):

> “impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertake such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time”.

In the 20-year period encompassing the 1980s and 1990s, environmental impact studies in both the USA and Canada began to routinely incorporate cumulative effects considerations in study documents. Further, other definitions appeared. For example, the Canadian Environmental Assessment Agency (CEAA) has suggested a simple definition (Hegmann, et al., 1999, p. 3):

> “cumulative effects are changes to the environment that are caused by an action in combination with other past, present, and future human actions.”

During the latter part of the 1990s, the Annual Meetings of the International Association for Impact Assessment (IAIA) began to include papers and topical sessions on CEAM, and resultant and related papers have been published in Project Appraisal, Impact Assessment and Project Appraisal, Environmental Impact Assessment Review, Environmental Practice, and Environmental Assessment Policy and Management.

Litigation related to the adequacy of CEAM within impact study documents also began to appear in the USA in both the 1980s and 1990s (Mandelker, 2007; and Smith, 2006). The absence of acceptable frameworks or multi-step processes for addressing CEAM seemed to be fundamental to many plaintiffs' challenges. As a result, in the late 1990s, both the CEQ in the USA and CEAA in Canada published practitioner guidance (Council on Environmental Quality, 1997; and Hegmann, et al., 1999). Both processes were conceptually similar, and they both included 11 steps which were generally matchable. These steps are consistent with the six step process described below.

The first decade in the 21st century has experienced continuing improvements in CEAM practice, particularly as related to proposed projects. Strategic environmental assessments (SEAs), also referred to as Programmatic EISs in the USA, also have given greater attention to cumulative effects issues (Therivel and Ross, 2007; and Canter and Rieger, 2005). In fact, CEAM should be a central feature of these strategic studies. Further, methods and tools used in EIA practice began to be modified to incorporate consideration of the combined effects of multiple actions on selected VECs (Valued Ecosystem Components). New topics such as environmental sustainability have also been recognized as integrators of concerns related to cumulative effects. Finally, the potential benefits of cumulative effects thinking relative to global issues such as climate change are being explored along with the development of appropriate procedures for such evaluations.

IMPORTANCE OF CEAM

The importance of CEAM is an outgrowth of several situations and perspectives. For example, conceptual reasons suggest that in many site-specific locations, as well as regional areas, the environmental effects of primary concern tend to be cumulative effects from multiple actions on specific VECs. Depending on both local and regional conditions, such cumulative effects may overshadow the specific effects from single projects (e.g., Creasey and Ross, 2005).

Pragmatic reasons are also drivers in the increased attention to CEAM. New and modified EIA legislation from the 1990s until now often require that practitioners carry out cumulative effects assessments. Thus, practitioners must do cumulative effects assessments whether they like to or not. Additionally, CEA guidance (handbooks) have become available, thus providing some guidance as to how to carry out the tasks. The CEA handbook in the USA was released in January, 1997 (Council on Environmental Quality, 1997), with the Canadian counterpart guidance being published in 1999 (Hegmann, et al.,1999). While they are not specific regulations, these documents are frequently cited by plaintiffs in litigation on CEAM and also by EIA practitioners to demonstrate that their EIAs are carried out in accordance with good practice.

Regulatory and strategic planning reasons have also elevated the importance of CEAM. One example is the frequent necessity of pro-active planning to maintain development opportunities in specific study areas. While the specific outcomes of such planning should, of necessity, be site-specific, their utilization could provide the context for setting aside lands or areas for future development. Such set-asides could be seen as “making room” for subsequent local and regional developments. Another approach is to “over-mitigate” current actions to reduce cumulative impacts and thus “make room” for future actions.

Finally, idealistic reasons can heighten the importance of CEAM. Such idealism can be demonstrated via planning to minimize negative cumulative effects and promote resource (VEC) sustainability (Swor and Canter, 2008). In fact, by the pursuit of a holistic approach, it may also be possible to develop cost-effective strategies for mitigating cumulative effects and promoting sustainability.

PROCESS CONTEXT OF CEAM

As noted above, CEA frameworks have been promulgated in the USA and Canada. Further, such frameworks (step-wise processes or procedures) have also been developed for usage in the European Union countries, Australia, New Zealand, and elsewhere. The frameworks can generally be condensed into the following six steps:

- Step 1 – Initiate the CEA process by identifying the incremental effects of the proposed project (or policy, plan, or program) on selected VECs within the environs of the project location. The VECs can be selected based on information related to current or anticipated future degraded or stressed conditions, the occurrence of protected species or habitats, and the presence or anticipated presence of other human activities that would (adversely) affect the same VEC. It should be noted that information on incremental effects is also needed to address the direct and indirect effects from the proposed project**.** Further, once the VECs have been selected, they should be subject to each of the following five steps.

- Step 2 – Identify other past, present, and reasonably foreseeable future actions within the space and time boundaries that have been, are, or could contribute to cumulative effects (stresses) on the VECs or their indicators. Based on this knowledge, identify appropriate spatial and temporal study boundaries for each VEC. Guidance related to establishing the scope of the CEA relative to space, time, and other actions is available elsewhere (Council on Environmental Quality, 1997; and Hegmann, et al., 1999). Such guidance is not limited in application to the USA or Canada; it can be used internationally, as can pertinent guidance from other countries as noted above.

- Step 3 – For the selected VECs, assemble appropriate information on their indicators, and describe and assess their historical to current conditions. The historical information should coincide with the selected past temporal boundary (or historical reference point). Further, and depending upon the availability of information, any identified trends in the conditions of the VECs and their indicators should be determined and analyzed. Further, comparisons to numerical standards or policies, or to identified thresholds of significance, should also be presented for each VEC.

- Step 4 – "Connect" the proposed project (or plan, program or policy) and other actions in the CEA study area to the selected VECs and their indicators. Numerous types of tools could be used to establish either descriptive or quantitative connections. Examples of such tools will be mentioned in the next section. Predictions related to future VEC effects resulting from multiple actions may be problematic due to the absence of detailed information; however, identification of "up-or-down" changes in the VECs and their indicators can be useful. Again, several models and other tools will be mentioned later. Finally, emphasis should be given to the aggregation of effects (that is, to the anticipated cumulative effects on each VEC).

- Step 5 – Assess the significance of the cumulative effects on each VEC over the time horizon for the study. Such significance determinations should begin with the incremental effects (the direct and indirect effects) of the proposed action on specific VECs. The focus is on the VEC, not on the action. Criteria for such determinations of significance already exist within the EIA systems in numerous countries; as well as development banks and aid agencies. For example, the USA has a structured definition for significance based on considering the location; compliance with environmental media, natural resources and cultural resources laws and policies; and other factors such as risk, controversy, human values, etc. (Council on Environmental Quality, 1978). The same definition can and should be applied to significance determinations for the composited cumulative effects on the VECs. Further, the concept of environmental sustainability (including social and economic sustainability) could be considered both in relation to incremental effects and cumulative effects. This concept was used in a CEA study on waterway navigation improvements on the Ohio River in the USA (Canter and Rieger, 2005; and Swor and Canter, 2008).

- Step 6 – For VECs or their indicators that are expected to be subject to negative incremental impacts from the proposed project and for which the cumulative effects are significant, develop appropriate action-specific "mitigation measures" for such impacts. Further, if significant cumulative effects are anticipated on any VEC or its indicators, consideration should

be given to multi-stakeholder collaboration to develop joint cumulative effects management measures, either locally or regionally, or both. Two recent reports from Canada provide information on both mitigation measures for incremental impacts, and management measures when there are multiple contributors to regional cumulative effects (Hegmann, 2000; and Braat, 2001). An emerging topic of growing relevance to cumulative effects management, either locally or regionally, is adaptive management (AM) (Canter and Atkinson, 2008). AM is envisioned as a follow-up practice to traditional impact studies, particularly when there are uncertainties. A foundational element for AM is a carefully planned monitoring program, with the results used to inform subsequent operational practices and decision-making (Marcus, 1979). Finally, multi-stakeholder collaboration in follow-up activities can be both cost-efficient and an aid in local and regional planning (Council on Environmental Quality, 2007a).

TOOL KIT FOR THE PRACTICE OF CEAM

The first decade of EIA practice occurred in the 1970s, and one topic which received considerable attention was related to appropriate methods and tools which could be used by practitioners. Over the ensuing three decades, the types of EIA-related methods and tools have continued to expand. Since the practice of CEA is now into its second decade, interest is continuing on appropriate methods and tools which could be used to improve professional practice. Based upon the review of various CEA informational sources, it can be concluded that many of the current and developing methods and tools are similar to those used for EIA practice. The primary difference is related to the need to incorporate other actions and their contributions to cumulative effects on specific VECs. Such incorporation is often done by simple modifications to existing EIA methods and tools. Brief examples of such modifications include: (1) adding “other actions” questions to questionnaire checklists focused on identifying direct and indirects of proposed actions; (2) modifying interaction matrices to include columns related to past, present, and future actions; and (3) modifying network diagrams to include other actions.

Table 1 includes a listing of methods and tools which have been or could be modified to address CEAM. Codes within the table delineate which of the above listed six steps in the generic CEA framework could or have been addressed in CEA studies. The overriding conclusion from Table 1 is that there are numerous methods and tools that can be applied, with appropriate modification, to CEA studies.

CREATIVITY IN CEAM

Due to the relative newness of CEAM, and to the absence of robust information and comparative case studies related thereto, there are numerous

Table 1: Examples of CEA Methods and Tools

Type of Method or Tool	Applicability to Steps 1-6 in Generic CEA Process	Reference(s)
Questionnaire checklist	1,2,3,4	Canter and Kamath (1995)
Identifying Reasonably Foreseeable Future Actions	2	Rumrill and Canter (1997)
Indicators of VECs and their functions	1,2,3,4	Canter and Atkinson (2008b)
Indices of VECs	1,2,3,4	Canter and Atkinson (2008b)
Conceptual models	3,4	Canter (2008a)
Matrices and networks	1,2,3,4	Canter (2008a); Canter and Tomey (2008); Cooper (2008b); Council on Environmental Quality (1997); and Hegmann, et al. (1997)
Geographic Information Systems (GIS)	1,2,3,4,5	Atkinson, et al. (2008)
Habitat suitability modeling	1,2,3,4,5	Canter and Atkinson (2008b)
Quantitative modeling	4,5	Canter (1997, 1999); Reid (1993); Hegmann, et al. (1999); and Council on Environmental Quality (1997)
Scenarios	4,5	Greig and Duinker (2007)
Photomontages	4	Council on Environmental Quality (1997)
Mitigation for incremental impacts	6	Canter (2008b)
Environmental Management Systems	6	Boling (2005); Council on Environmental Quality (2007b)
Local and regional cumulative effects management	6	Braat (2001); Hegmann (2000); and Spaling, et al. (2000)
Documentation of CEAM	1,2,3,4,5,6	Canter (2000)

opportunities to “think outside the box” and be creative. Specific examples of such needs and opportunities include, but are not limited to:

- Adaptation of traditional EIA methods and tools to meet CEA study needs, and to learn from such new experiences and develop further methods and tools

- Development of innovative means to address environmental sustainability (including social and economic sustainability) for the selected VECs

- Examination of existing local, province or state, and federal environmental management programs for their inclusion of usable tools for cumulative effects management (examples include trading programs, local and regional resource programs, etc.) (Canter, 2008b)

- Development of regional programs with multiple stakeholders, including building upon current and emerging information (Braat, 2001; and Hegmann, 2000)

- Consideration of AM for large-scale concerns, and conduct appropriate planning of a monitoring program, decision process, and coordination with Environmental Management Systems (Canter and Atkinson, 2008a; Council on Environmental Quality, 2007a; and Boling, 2005)

- Development of appropriate frameworks for incorporating CEAM as the central feature of Strategic Environmental Assessments and Programmatic EISs (Therivel and Ross, 2007; Canter and Rieger, 2005; and Cooper, 2008a).

CHALLENGES IN CEAM

Despite the above list of topics wherein creativity could be utilized, numerous challenges remain relative to the practice of CEAM. These challenges are a result of combinations of scientific uncertainties, inadequate institutional policies, and needs for collaboration and pertinent CEAM case studies. The following five challenges represent examples of scientific, policy, and institutional challenges:

- Increasing the scientific understanding of complex ecosystems characterized by multiple stressors

- Modifying institutional policies which do not take into account holistic needs (and CEAM) for specific VECs.

- Reducing uncertainties related to project incremental effects and future actions and their effects, determining whether linear or non-linear

relationships can be used for charactering cumulative effects, and determining the effectiveness of local mitigation measures and regional management programs.

- Achieving effective collaboration among developers, proponent and regulatory agencies, and multiple stakeholder groups regarding mitigation and management of cumulative effects. This is important because it must be remembered that cumulative effects require cumulative solutions.

- Developing appropriate and effective cumulative effects management efforts (and programs), and meeting their necessary budgetary and time requirements, including the accomplishment of periodic program evaluations.

INTRODUCTION TO THE LESSONS

This keynote address concludes with a series of CEAM lessons grouped into three categories. The first one, the “ugly lessons”, reflects minimal attention, if any, to a professional approach for conducting and documenting CEAM. The “bad lessons” are indicative of identified needs for improvement; in most instances, such needs can be reasonably addressed and, if they are, the practice of CEAM will improve. The “good lessons” are reflective of good practices and commitments which can lead to still further improvements in CEAM practice.

It should be recognized that the three categories of lessons reflect the authors’ collective experiences over the last 15 to 20 years. As noted earlier, these experiences are based on University-level and professional-level teaching experiences, the preparation of CEAM chapters or sections in environmental assessments (preliminary studies in USA practice) and EISs, and the review and evaluation of EIA process documents (including CEAM chapters or sections) prepared by others.

THE UGLY LESSONS (LACK OF APPROPRIATE ATTENTION)

The following six ugly lessons (ULs) are reflective of the lack of professional attention given to CEAM:

- UL 1 – EIA documents include minimal attention to CEAM, with the included information being very brief and reflective of “assertions without analyses” (Smith, 2006).

- UL 2 – The CEAM information is very brief and does not indicate that any efforts were made to follow systematic CEA processes such as the six steps noted above. One example of this poor practice includes no information on other actions in the study area, nor any documentation of attempts to identify such other actions. Another example is the non-

admission that significant adverse cumulative effects will occur for a particular project in a specific location.

- UL 3 – Key decision makers within the private sector or governmental agencies may not be committed to “good practices”; thus CEAM is not adequately emphasized or funded.

- UL 4 – CEAM may be given minimal attention because of concerns about potential cumulative effects and who will be responsible for funding mitigation and management efforts.

- UL 5 – Even though a CEAM study indicates that there are multiple contributors to significant adverse cumulative effects on specific VECs, there is no indication that multi-stakeholder collaboration was utilized in the conduct of the study and the planning of management measures.

- UL 6 – On occasion, an attitude that CEAM cannot be done may be espoused, particularly in situations where the uncertainties related to cumulative effects are large. However, as this paper has demonstrated, there are multiple methods and tools for conducting CEAM studies.

THE BAD LESSONS (THE NEEDS FOR IMPROVING THE PRACTICE)

The following eight bad lessons (BLs) are indicative of specific needs for improving CEAM practices. Each of these needs can be readily addressed by assembling the proper subject matter experts (SMEs) to address them. Accordingly, addressing these needs could become a professional practice initiative of IAIA and/or the current EIA Effectiveness Study. The BLs are as follows:

- BL 1 – The topical attention in most CEAM studies is related to environmental media, ecological components, and natural resources. Attention should also be given to processes, methods, and tools for addressing cumulative social and economic impacts.

- BL 2 – CEAM studies can become complex from both scientific and institutional perspectives. Accordingly, all parties associated with planning and conducting such studies need to be in agreement regarding the selected VECs and the methods to be utilized. This would promote positive collaboration between project proponents, regulatory and environmental agencies, impact study consulting firms, and pertinent stakeholders.

- BL 3 – Terms of reference for consultants preparing CEAM documentation have been vague and have not provided necessary direction. More explicit terms of reference would be advisable or even necessary.

- BL 4 – CEAM study reports have not been recognized as having continuing useability and value for other future projects in the study area. The CEAM study reports tend to be cumulative regarding the included information, and so they should be so used. Further, such reports should be periodically updated in order to enhance their useability for regional or strategic cumulative effects assessments.

- BL 5 – Inadequate guidance is provided for determining relevant VECs and their appropriate level of analysis. To aid the scoping process for selecting VECs and their indicators, it would be useful to develop a series of VEC-specific "quick look questions" for this purpose. For example, would a brief review of CEA issues be appropriate for a given VEC, or would a more detailed study be appropriate? Without such guidance, CEAM has floundered.

- BL 6 – There is a lack of CEAM expertise in government agencies. While generic CEAM frameworks have been developed for consultants in the USA, Canada, and elsewhere; guidance for specific agencies routinely dealing with common types of actions would be useful. Such guidance would facilitate more effective scoping and the conduct of focused CEAM studies.

- BL 7 – Inadequate direction is provided for large scale CEAM studies. Large-scale CEAM studies are becoming more commonplace, with such studies frequently characterized by numerous scientific, policy, and institutional uncertainties. Specific guidance related to planning monitoring and AM programs is needed for these large-scale studies if their quality is to be improved. If new or adjusted management measures are needed, instructions are also needed relative to triggers for further CEAM studies.

- BL 8 – Dealing with new topical cumulative effects issues, especially climate change, has been a challenge. Generic CEAM frameworks should be responsive to such issues. Guidelines for addressing the cumulative effects of climate change are available in Canada, the US and in Britain, but this has not resulted in an entirely satisfactory treatment. Special topical committees of the International Association for Impact Assessment could be used to address such emerging issues.

THE GOOD LESSONS (POTENTIAL BEST PRACTICES FOR CEAM)

The following twelve good lessons (GLs) are reflective of useful concepts which could be used to articulate good practice principles related to CEAM. Only brief statements are used to delineate the following GLs:

- GL 1 – A VEC-based perspective is used in planning and conducting CEAM studies.

- GL 2 – Both proponent and agency context scoping, and public scoping, is used in CEAM.

- GL 3 – Generic CEAM frameworks are applied to specific VECs, and their application and findings are carefully documented and explained (Canter, 2000).

- GL 4 – Scenarios are used as an effective tool when reasonably foreseeable future actions are uncertain. (Greig and Duinker, 2007).

- GL 5 – Careful delineation of an outline and topics to be addressed relative to a CEAM study is employed for an effective presentation of information (Canter, 2000).

- GL 6 – Cumulative effects on specific VECs or their indicators are used as integrators of project effects at local, regional, and strategic spatial areas.

- GL 7 – CEAM is employed as a useful basis for addressing environmental sustainability (including social and economic sustainability).

- GL 8 – The professional practice of CEAM is seen to improve, and contributes to raising the quality of CEAM.

- GL 9 – CEAM relies on principles, methods, and tools from EIA practice. In many situations; some modification of EIA methods and tools is effectively carried out for use in CEAM.

- GL 10 – Internet data and information aids in the planning and conduct of CEAM studies.

- GL 11 – A proactive approach is used when incremental effects mitigation and local and regional cumulative effects management measures are planned.

- GL 12 – The proposed action, subject to CEAM, is not viewed as isolated, either in space or time.

SUMMARY

This presentation has summarized historical, current, and anticipated future practices related to CEAM. A generic six-step framework is also described, along with multiple methods and tools which comprise a CEAM “tool kit”. This state-of-practice paper concludes by noting six “ugly lessons” (lack of appropriate

attention), eight “bad lessons” which reflect topical subjects which need improvement, and 12 “good lessons” which can be used articulate good practice principles related to CEAM. In summary, the practice of CEAM is growing out of its infancy. As experience is accrued, it is anticipated that good practice principles can be further articulated and used on an international basis.

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