The Parameters Limiting the Effectiveness of Cumulative Effects Assessment as a Component of Strategic Environmental Assessment in Scotland

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Abstract

The environmental reports of 12 Scottish Strategic Environmental Assessments have been subject to critical analysis in order to assess the extent to which they include Cumulative Effects Assessment (CEA) as a required component under the SEA directive. The anticipated benefits of assessing Cumulative Effects in a strategic setting are wide-ranging and well researched, yet there appears little documented evidence of this in the Scottish context. The level of Cumulative Effects inclusion in the reports studied was investigated, along with the parameters that appear to limit the success of the lauded relationship between these environmental assessment tools.

An 8 criteria review-based methodology was constructed, based on a best-practice framework from the extensive literature synthesis provided, and it served to evaluate Cumulative Effects inclusion throughout the assessment process. In addition, the authors of 5 of the 12 Environmental Reports were interviewed to gauge understanding on the phenomenon of Cumulative Effects, Cumulative Effects Assessment, and how it is best integrated into SEA. The results of these interviews were then subject to thematic analysis, and compared to the findings of the review criteria.

The findings of this research suggested CEA is a low priority in Scottish SEA practice. CEA was found to be carried out in an irregular and sometimes reluctant fashion. In particular, the Environmental Reports under scrutiny showed only limited CEs considerations and methodologies. In interview, practitioners provided largely inadequate definitions of Cumulative Effects and showed limited conceptual understandings of Cumulative Effects Assessment. Overall, CEA appears undervalued as an assessment tool in arguably its most appropriate context.

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Acronym list

CE Cumulative Effect

CEA Cumulative Effects Assessment

EA Environmental Assessment

IEMA Institute of Environmental Management and Assessment

NTS Non Technical Summary

PPP Plan, Policy and Programme

SEA Strategic Environmental Assessment

SEPA Scottish Environmental Protection Agency

VEC Valued Ecosystem Component

CHAPTER 1. INTRODUCTION

Strategic Environmental Assessment (SEA) is a tool to aid decision-making on integrating environmental considerations into proposed policies, plans and programmes (PPPs) (Chaker, *et al*., 2006). Required in the UK under the European Union (EU) Directive 2001/42/EC, it is a 'family' of tools that serve to highlight and assess potential environmental effects at the earliest possible stage in the decision-making process (OECD, 2006; Partidário, 1996; ODPM, 2005). In Scotland, the Environmental Assessment (Scotland) Act 2005 marks the transposition in Scottish legislation. This provides an opportunity to assess Cumulative Effects (CEs) at the strategic level. Indeed, the SEA directive requires the considerations of: *'the likely significant effects….including cumulative and synergistic effects on the environment…'.* But what are CEs, how are they best assessed, and why are they an important component of SEA?

It is posited here that the phenomenon of CEs, and their assessment in a strategic context is deserving of far more attention than it has hitherto received. There has heretofore been very little examination of CEA inclusion in Scottish SEA, about which the SEA directive affords only a mere 'footnote' (Cooper and Sheate, 2004). Yet elsewhere in the Environmental Assessment (EA) community there appears plenteous literature on the importance and anticipated benefits of CEA in a strategic context. This study attempts to reconcile these two points and is concerned with gauging the projected benefits of this assumed relationship and the success of this integration, delineating the parameters that affect its effectiveness, and what steps need to be overcome to ensure CEs are meaningfully assessed.

1.1 Introduction to the conceptual and practical hurdles to CEA, and to SEA-CEA

The need to address CEs in a strategic setting is well argued (see for instance: Gunn and Noble, 2010; Noble, 2003; Thérivel, 2005; Cooper and Sheate, 2004). CEA, it is widely stated, is more appropriately placed within a strategic setting that adopts a broader look at environmental degradation from multiple sources (Thérivel, 2005) at the earliest possible stage. This research will construct a case for SEA being the most appropriate tool to assess CEs, and in no small part, this case hinges around the enduring belief that EIA is an inappropriate tool. While the argument for SEA being the best place for CEA continues here, it is not the central focus of this research. Instead, as is stated earlier, this study is chiefly concerned with the practical and conceptual problems with cumulative effects, cumulative effects assessment, and the implications for the resultant quality of the CEA component in Scottish SEA. From a synthesis of the literature studied, three broad themes emerge at this initial stage which provide impetus for this research and are developed further in chapter 2.

1.1.1 *Cumulative effects interpretation and understanding*

A thorough understanding of the nature and definition of CEs is surely vital to their assessment. Anything other than a complete understanding must therefore represent an initial, though perhaps most easily addressed, challenge to good quality CEA. Findings from studies that have reviewed Environmental Statements (ERs), and/or interviewed practitioners, all reveal disagreement or confliction on a basic definition of CEs (see for instance: Gunn and Noble, 2010; Cooper and

Sheate, 2002; Warnback and Hilding-Rydevik, 2009; Burris and Canter, 1997). This lack of standard terminology is perhaps unsurprising in the UK, given the lack of a definition in its associated legislation. An interview study by Cooper and Sheate, (2004) revealed most practitioners interviewed described CEs as primarily additive, with little mention of more complex interactions. This was partially mirrored by Gunn and Noble, (2010) who state responses were poor with 'little consensus on the nature and meaning of cumulative effects'. The so-called 'problem isolation paradigm', whereby assessors break down problems, solve individually, then reconstruct as the answer to the whole problem, goes against the grain of a cumulative effect, whereby one plus one can conceivably equal >two. Yet this is put forward as a problem within CEA (Gunn and Noble, 2010). This echoes the findings of Warnback and Hilding-Rydevik (2009) who found great variation in interviewee responses on how to address cumulative impacts. In essence, the outcome of these reviews suggests CEA needs to be recognised as more than a reductionist approach that looks at individual impacts, then provides a simple summation of effects. Moreover, Cooper and Sheate, (2002) state in a study of impact statements, that a narrower definition *'such as that of interaction of impacts within the project resulted in the analysis of cumulative impacts of the project alone, while a wider definition, which included other projects (past, present and future) led to a broader geographical and temporal scope'.*

1.1.2 Poor inclusion in environmental reports

The ER is essentially the end document that describes the assessment. Examination of these documents in UK practice, and beyond, reveals that careful

consideration of CEs in the ER is inadequate and inconsistent. Cooper and Sheate, (2002) reviewed UK reports from EIA practice and showed a mere 48% mentioned CEs. Further, only 16 provided a definition of the phenomenon. In another similar study by Burris and Canter, (1997), only 3% of reports attempted to define CEs, and 47% used the term cumulative effects/impacts or similar, while Cooper and Canter, (1997), also reveal inconsistencies and generally vague considerations of CEs in the end document. Conclusions from these studies all point to CEs considerations being of little consequence. It is argued in this research that CEs considerations deserve much more attention if Environmental Assessment (EA) is to extend beyond site-specific remediation.

1.1.3 *Lack of suitable guidance*

Recognising that CEs considerations in SEA is not a standardised science, there is nonetheless a need for a 'consistent and systematic approach' (Noble, 2003, from Partidario and Clark (2000)) to CEs in SEA. The SEA directive proffers surprisingly little in the way of procedural frameworks on CEA, while the Scottish executive SEA toolkit offers some useful, but often vague guidelines, and often borrows from Cooper, (2004). This represents the sum total of UK guidance on incorporating CEA into SEA. Since there appears no standardised process set out in the legislation or in the guidelines, it is asserted that some confusion may circulate on what should be assessed, and how. The academic literature synthesised for this research seems to support this notion, although a warning is issued on guidance being overly prescriptive (see: Cooper and Sheate, 2004; James, *et al*., 2003; Warnback and Hilding-Rydevik, 2009). It is further postulated that the previous two themes

discussed (lack of understanding; and poor inclusion in ERs) are a consequence of the issue of guidance. These assertions will be further explored in order to assess what level of guidance is appropriate in the UK SEA context.

CHAPTER 2. CUMULATIVE EFFECTS, CUMULATIVE EFFECTS ASSESSMENT, AND INTEGRATION INTO SEA

Having set out some broad challenges to strategic-CEA practice, a thorough overview of CEs will be provided, followed by a detailed discussion of CEA, and a best-practice framework of CEA within SEA will be constructed from the literature discussed in this study. The difficulties set out previously will also be expanded upon where they provide appropriate context and relevance to the topics discussed.

2.1 Cumulative effects – A definition, pathways and typology

Common with many of the problems identified so far is the apparent confusion on the intricacies of cumulative effects. This section provides a level of detail on those intricacies, in order to aid the understanding of why this confusion among scholars seems to exist, and how this may contribute to their weak assessment.

As a concept, definitions of cumulative effects or impacts abound, and no one definition has been agreed or accepted. Its basic tenets have been described as: 'destruction by insignificant increments' (Spaling and Smit, 1993; from McTaggart-Cowan, 1976) to note the process of environmental change by seemingly insignificant standalone actions. Perhaps the most overarching is: 'the net result of environmental impacts from a number of projects and activities' (Cooper, 2004; from Sadler, 1996). Other, prominent definitions typically offer something like: 'the impact

on the environment resulting from incremental impacts of the action when added to other actions, either past, present or future' (Ziemer, 1994). These incremental or aggregate environmental perturbations may be collectively significant even though the effects of individual actions may be insignificant when looked at individually.

Box 2.1. Amalgamation of CEs definitions across a range of international guidelines

The Cumulative Effects Assessment Working Group for the Canadian Environmental Assessment Agency. (Heggman, *et al*, 1999): ...*changes to the environment that are caused by an action in combination with other past, present and future human actions.*

Guidelines for the assessment of indirect and cumulative impacts as well as impact interactions. Environmental, nuclear and civil protection: *...impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.*

Guidelines for Cumulative Effects Assessment in SEA of plans. EPMG Occasonal paper 04/LMC/CEA. From Sadler, (1996): ...the net result of environmental impact from a number of projects and activities.

EU guidance on CEA (Commission of the European communities, 1993): ...the accumulation of human induced changes in valued ecosystem components across space and over time; such impacts occur in an additive or interactive manner.

To illustrate the variety of interpretations of the definition, figure 2.1 provides an amalgamation from key scholars and assessment bodies. Cumulative impacts, cumulative environmental change, cumulative environmental impacts and cumulative effects are terms which are frequently used interchangeably (James, *et al*., 2003; from Spaling, 1995). For the sake of ease, these terms are taken to mean the same thing in this study, although for the most part, the term Cumulative Effects (CEs) is used.

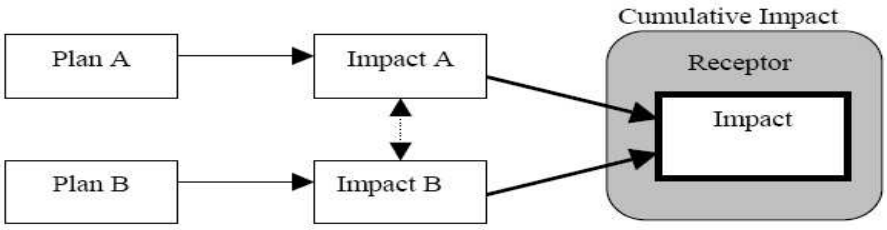

Figure 2.2. Concept of the cumulative impacts of plans. Taken from Cooper, (2004).

One all-encompassing and non-specific definition can be delineated into types of effects, illustrated below in graphics from Walker and Johnstone, (1999), though it should be noted that some overlap invariably exists. This overlap has for the most part, however, ensured that indirect impacts and impact interactions are defined as components of cumulative impacts as a whole. From the outset it is necessary to provide some level of detail to these impacts:

Figure 2.3. Indirect impacts. From Walker and Johnston, (1999).

Indirect impacts: Impacts that are not a direct result of a plan or project and often produced away from or as a result of a complex pathway. Also termed a second or third level impact, or secondary impacts. Examples include an infrastructure from a development (e.g. improved road links) encouraging further developments in the locale; or visual impact from the use of noise attenuation barriers as a mitigation measure.

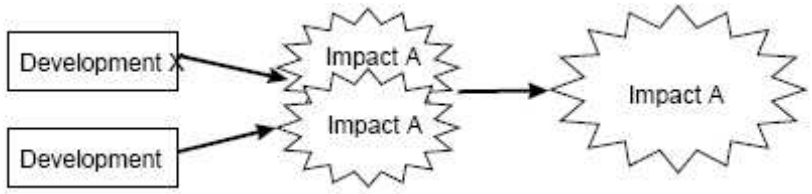

Figure 2.4. Cumulative impacts. From Walker and Johnston, (1999).

Cumulative impacts: The result of incremental change caused my multiple past, present or (reasonably foreseeable) future actions together with the project. Typically insignificant individually, the additive nature of multiple activities causes noticeable environmental degradation. Examples include a forest harvest that increases sediment runoff into a stream. This increase is tolerable until sediment from other commercial forestry is also added to the stream which then decreases fish spawning.

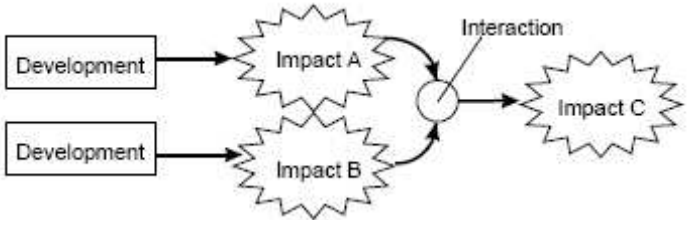

Figure 2.5. Antagonistic effects/impact interaction. From Walker and Johnston, (1999).

Antagonistic effects/impact interaction: The reactions between impacts whether between the impacts of just one project, or between the impacts of other projects in the area. These effects become synergistic where the combined effect is greater than the sum of individual inputs, and is likely where chemicals interact (e.g. acid rain), or when changes in water temperature or hardness alter the form and toxicity of heavy metals (Macdonald, 2000; from Abel, 1996).

In spite of the broad lexicon used to describe CEs, a few recurrent characteristic themes emerge. Impacts on the natural and social environment which first: occur so frequently in time or so densely in space that they cannot be assimilated, and second: combine with effects of other activities in a synergistic manner (Beanlands, *et al*., 1986) transcend the various definitions employed by practitioners during assessment. As an extension to these themes, the general consensus among scholars is that CEs have these general attributes:

Temporal accumulation: Occurs when the interval between perturbations is less than the time required for an environmental system to recover from each

perturbation. This temporal rate may be continuous, periodic, or irregular and occur over short or long time frames

Spatial accumulation: Analogous to temporal accumulation and occurs where the spatial interval in insufficient for the receiving receptor to recover from, or remove and disperse perturbations. Characterised by scale, i.e. local, regional, global; density, i.e. clustered, scattered; and configuration, i.e. point, linear, areal (Spaling and Smit, 1993).

The nature of CEs over temporal and spatial scales is often such that perturbations interact and the aspects of space, time and activity are not mixed but are interdependent (Macdonald, 2000). In addition, CEs may occur where different types of perturbations lead to similar environmental effects, providing that they first meet the temporal and/or temporal criteria detailed above. This interaction is the basis for the inherent complexity of cumulative environmental effects.

2.1.1 *A typology of Cumulative Effects*

Impacts may compound in many ways and their effect upon receptors is also varied. An understanding of the main types is pertinent to their assessment. Table 2.6 sets out the main examples of CEs that have been discussed so far.

Table 2.6. A typology of CEs modified from Cooper, (2004) and James, *et al*., (2003).

Type	Main characteristics	Examples
Time crowding	Frequent, repetitive and simultaneous impacts on an environmental system/resource	Fishing rates exceeds breeding/replacement rate
Time lags	Delays between cause and effect	Exposure to carcinogens
Space crowding	High spatial density of effects on an environmental system	Pollution discharges into streams from non-point sources
Cross-boundary	Impacts occur come distance from source	Acid rain; Upland afforestation and grazing control improving water quality and reducing flooding downstream
Fragmentation	Change in the pattern of a landscape	Fragmentation of historic districts or habitats or of woodlands
Compounding/synergistic effects	Effects arising from multiple sources and pathways. May be different in nature to individual impacts	Synergism among pesticides
Indirect effects	Secondary impacts resulting from a primary activity	Induced development following construction of infrastructure; Water quality improvements in regeneration areas e.g. dock areas contributing to property value increases
Triggers and thresholds	Fundamental changes in system behaviour or structure	Climate change; deterioration of aquatic systems through chemical contamination from run-off and siltation
Nibbling	Incremental or decreasing effects	Gradual loss of natural assets such as woodlands or greenbelt land through discreet developments

2.1.2 *Pathways and receptor response*

Of overarching importance to the understanding of CEs is the understanding of environmental relationships. This also proves to be the crux of the difficulties in Cumulative Effects Assessment (CEA) which is discussed in the next section. Also discussed in the next chapter is the apparent ineffectiveness, or at least, the incompatibility of traditional assessment tools. Keeping assessment firmly in the next chapter, the pertinent issue here is the default approach, or perhaps, the natural tendency, to environmental relationships which assumes a linear response to impacts. One example is the discharging of waste water into an aquatic ecosystem where a ton of waste causes a small (and acceptable) a unit of damage. As discharge continues, a point (threshold) may be reached at which the water is unable to support its ecosystem. As such, a linear response such as an adding-up of effects is often too simplistic for complex environmental interactions (Cocklin, *et al*., 1990; from Friend and Rapport, 1989). This recognition is central to CEA.

It is argued throughout this section that perturbations that occur too frequently on spatial and temporal scales broadly define CEs, and sections 2.1 outlines thematic processes of change. Derivatives of these processes are the specific impacts themselves, where impacts might be classified as an ‘accumulation of impacts’, or ‘accumulative impacts’ (Cocklin, *et al*., 1990). The first might be thought of as an extension to the basic concept of an additive environmental effect, outlined earlier in this section, whereby multiple developments result in multiple, but unrelated and unconnected perturbations, and can be considered connected only insofar as they degrade the receiving environment, but in diverse ways (Cocklin, *et al*., 1990).

Accumulative impacts, on the other hand, may be considered a development of the notion of interactive/antagonistic/synergistic impacts in that they singularly stem from unrelated developments, but act in combination to affect the receiving environment. While perhaps only subtle extensions of the broad types of CEs, and may only be discernible in specific circumstances, Cocklin, *et al*., (1990) posits such component analysis 'clarifies the fact that, in referring to cumulative change, we must be careful to distinguish in what specific ways it is cumulative.' Moreover, it is stated that such conceptual analysis serves to identify key stages in analysis and assessment.

2.2 Cumulative effects assessment – A framework and assessment

Having dealt with the concept of cumulative environmental effects, this section serves to provide the basics of CEA practice to date, how it has evolved, where it is falling short, and where its future lies. Given this, Environmental Impact Assessment (EIA) is given some concession here, though it must be noted that while it is not the focus of this study, it is inextricably intertwined with CEA, and methodologies have evolved from those developed for EIA (Piper, 2004), and indeed continue to borrow from EIA (Gunn and Noble, 2009).

CEs being ignored or inadequately addressed has provided some impetus in Strategic-CEA interest (for example: Thérivel, 2005; Gunn and Noble, 2009), and this justifies its considerable mention. Moreover, detailed towards the end of this chapter are components of a basic EIA framework that details systematic CEA considerations – again, this serves to provide a useful context to CEA current practice, and provides a springboard to CEA integration into SEA for this study.

Discussed in the previous section was the broad definition of CEs – that is, the net result of environmental impacts from a number of projects and activities. The bare bones of CEs seem deceptively straightforward (Macdonald, 2000). A motorway bypass, a modest powerplant close to a conurbation or a swath of land given to commercial forestry are unlikely to have pronounced effects on local air quality, noise pollution, or runoff respectively. Increase the number of bypasses, power generation, and commercial forestry however, and the likelihood of detectable change increases. This additive effect defines the most basic tenets of cumulative impacts and CEA is an assessment of those effects. In the context of planning and assessment, the most oft used foundations for a working definition of cumulative effects differ little from the one provided by Ross, (1998): *'effects of the project under review in combination with the effects of other past, present and future human activities'* .

CEA works on the premise that scientific rigour applied to the assessment paves the way for more rational decisions when communicated to decision-makers (Spaling and Smit, 1993). Existing since the inception of formal environmental assessment (James, *et al*., 2003), interest in CEA has risen in parallel with the growing acknowledgement among scholars and planning authorities alike that the most important effects are not those from individual impacts; but the summation and combination of multiple effects over time (James, *et al*., 2003; from US Council on Environmental Quality, 1997); and space (Simpson, F. Personal communication. [interview] 21/06/2010). To develop this thought, it has also been postulated that all effects are cumulative and these are the only ones worth assessing. CEA, it is stated, is merely environmental assessment 'done right' (Gunn and Noble, 2010; from Duinker, 1994; and Duinker and Greig, 2006). CEA, therefore, seeks to: