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Integrating a Resilience Approach into SEA

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Abstract:

Climate change and biodiversity loss are among the most important environmental challenges facing the EU today. Both are complex and cross-cutting issues, which impact upon nearly all human activity. Progress towards combating and adapting to climate change, and halting the loss of biodiversity and damage to ecosystems requires sound consideration of these issues within the development and implementation of plans and programmes. To achieve this requires the improved integration of these complex issues into both the SEA and plan- / programme-making processes and the recognition that SEAs, especially within the context of a changing climate, need to assess not just the effect of the plan/programme on the environment, but also the effects future changes in the climate and ecosystem services for example will have on the plan/programme, i.e. its resilience to these changes. This paper considers the value added to SEA, and plan/programme proponents alike, by incorporating climate change and biodiversity in SEA as part of integrating a resilience approach. It seeks to demonstrate that the relationship between a plan/programme and climate change and biodiversity can be conceptualized as either a 'virtuous' or 'vicious' cycle depending on whether, and how effectively, resilience to future change is integrated. Illustrative examples are drawn on to demonstrate how SEA can be used to facilitate a virtuous cycle and therefore the development of more resilient plans/programmes.

Introduction

Reducing the magnitude and managing the impact of climate change and the continued loss of biodiversity are well recognised as the preeminent threats that society currently faces (European Environment Agency, 2010a,b,c; European Commission, 2009). There is no doubt from a wide range of recent analyses that we are significantly altering our climate and that despite commitments to limit average global warming to 2°C it seems increasingly likely that a 4°C increase will be reached and as a result significant negative impacts are predicted (Smith *et al.*, 2011). The story is similar for biodiversity loss, with global and regional analyses suggesting that biodiversity loss is continuing and that the ecosystem service we receive are also declining (UKNEA, 2011; EEA 2010b; United Nations, 2010; GBO, 2010).

In addition to the physical risks presented by climate change and biodiversity loss, there are also certain characteristics that make climate change and biodiversity particularly challenging to assess in the context of SEA. Both are concerned with long-term trends and are affected by cumulative effects and are complex, which pose particular challenges to assessors and plan- / programme-makers alike. These problems elude simple classification or 'solutions' because they involve complex systems and interactions between the biophysical and human environment and relate to multiple aspects of socio-ecological systems and are influenced by many of the interactions within these systems. Furthermore, there is considerable uncertainty within our understanding and management and prediction of climate change and biodiversity.

Resilience is the ability of a system to undergo change and still retain the same effective function and structure (Resilience Alliance, 2011). Resilience has long been recognised as an important characteristic of various systems and many authors have pushed for its integration within various decision making contexts.

A key characteristic of resilience is the presence of a wide range of feedback loops within a system. These loops are fractal, operate across various systems and serve to retain the structure and function of a system via their relationships and combined effects. Resilience as a concept serves to highlight that all relationships operate within feedback loops and as such all relationships are essentially cyclical both directly and indirectly. One of the approaches that the Resilience Alliance – who have long driven this area forward – suggest is that resilience can be increased via the recognition of these feedback loops and by creating tighter feedback loops between human actions and environmental outcomes (Folke *et al.*, 2002). This identification of cyclical relationships between different elements of a system is the key aspect of resilience that this paper seeks to introduce into SEA.

Purpose of the paper

This paper builds on thinking that is being incorporated in guidance on “integrating climate change and biodiversity into the Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) procedures” being developed for the European Commission¹ which the authors are involved in preparing². The guidance was commissioned in recognition of the importance of addressing climate change and biodiversity loss, as well as to address the deficiencies highlighted by many stakeholders that climate change and biodiversity are often not being effectively considered within SEA.

To date the concept of resilience has been largely implicit within environmental assessment - this paper seeks to build on the existing formative work in this area (Slootweg and Jones, 2011; Therivel, 2011) and to introduce a practical SEA specific framing for the resilience concept. It does not present a readymade resilience approach to SEA, but rather seeks to elucidate one of the major concepts introduced in the guidance – the importance and the potential value added of resilience as a concept within SEA – and to start a discussion through the framework proposed as to its potential role within SEA going forward.

Building resilience into the assessment of biodiversity and climate change within SEA

¹ Though the focus of this paper is on SEA the general ideas introduced and discussed are felt to be also relevant to EIA.

² This guidance is being prepared for DG Environment by Milieu Ltd, Collingwood Environmental Planning Ltd and Integra Consulting Ltd

SEA is not an end in itself; rather it is the appropriate approach for including environmental considerations within the development of a plan or programme. There are benefits to the authorities responsible for the plan or programme, the key stakeholders and society more generally from incorporating climate change and biodiversity within development of the plan or programme from the outset. Figure 1 shows that the relationship between a plan or programme with biodiversity and climate change as a cycle, where this relationship can be both positive and negative (positive elements are shown in white and negative in grey). SEA can help ensure a plan or programme considers biodiversity and climate change effectively and therefore help the competent authority take the positive path.

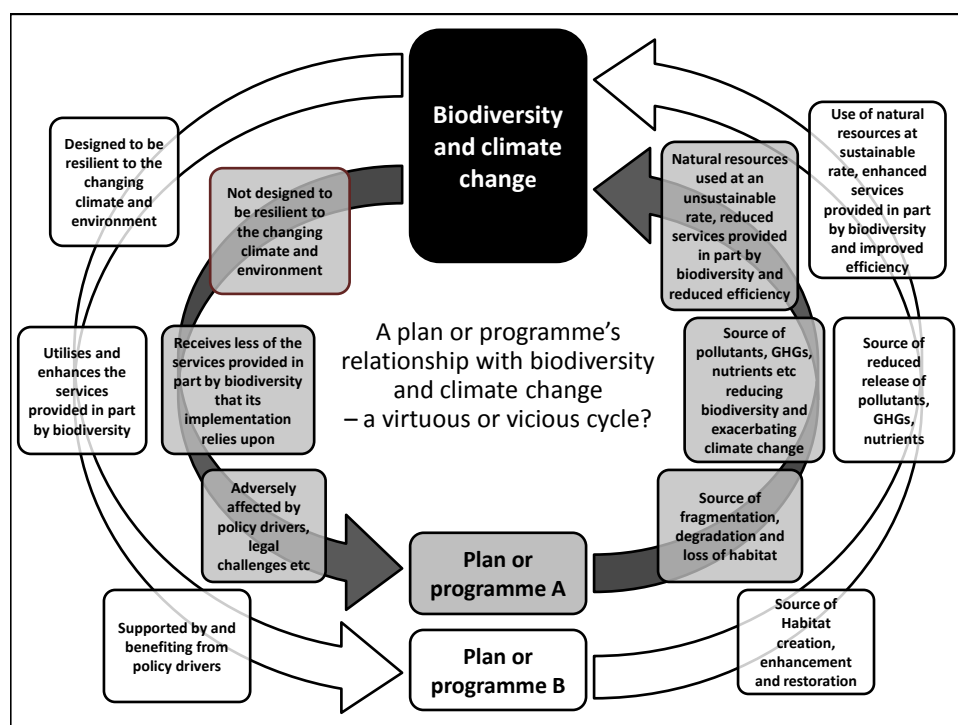


Figure 1: Virtuous / vicious cycle – relationship between plans / programmes and climate change and biodiversity

Adapting to a changing climate

A number of recent studies on the vulnerability of the EU and specific sectors and territories to the changing climate have shown that Europe's infrastructure needs to be more adapted to natural phenomena caused by the changing climate. This represents a shift in thinking from the traditional assessment of the impacts on the environment alone. Over the potentially long lifespan of a plan or programme the parameters relevant at its inception may not be valid as the climate changes. Insurance firms, for instance, are already recognising the value of this form of thinking and including it within their assessments of risks from natural hazards. SEA can allow plans or programmes to adapt to this through the concept of resilience.

Building resilience - the capacity of systems to cope with environmental change and recover from disturbance – is increasingly recognised as a key focus for adaptive management responses to climate change. In the context of SEA this entails considering that a plan or programme operates within an evolving environmental baseline and as such the SEA needs to understand the impacts of

this changing baseline on the objectives and implementation of the plan or programme and how it may respond over time. Adaptation should not be left until the end of the development of the plan or programme – resilience needs to be built from the very beginning of its development as many are likely to experience a significantly changing environment.

The SEA process is particularly important in that it has the potential to set the context for projects – therefore the effective consideration of potential climate change impacts within SEA has huge potential to contribute to more resilient projects (supported by EIAs). Equally ineffective consideration could reduce resilience and effectiveness of projects.

Ecosystem services received by the plan or programme

The ecosystem services provided by biodiversity also need to be considered as part of the development of a plan or programme. Biodiversity can provide a range of ecosystem services that potentially support the objectives of a plan or programme and its implementation. For instance, a plan promoting economic and social development could provide aesthetic, spiritual and cultural services offered by biodiversity through the creation and protection of green spaces and other natural areas associated with residential and commercial development. The long term sustainability of the economic development may be reliant on the climate change adaptation benefits provided by these natural areas in terms of provision of cooling during hot temperatures and/or the attenuation of flood water for example.

Considering and responding to the reliance of a plan or programme upon these services, and hence on biodiversity, can lead to a more effective plan or programme, as well as supporting biodiversity and biodiversity policy objectives. However, the degree to which a plan or programme receives these services will depend upon local and wider environmental limits which will be affected by not just the plan or programme in question, but also other plans and programmes as well as wider drivers for change. SEA can play an important role in helping to understand these relationships and wider context.

Building a virtuous, or vicious, cycle

The title of the SEA Directive³ implies that it is only relevant to consider effects in one direction – the effects of the plan or programme on the environment). At its simplest, the integration of resilience into SEA – particularly in relation to climate change and biodiversity – requires that the relationship between a plan or programme and the environment is considered in both directions as the relationship is reciprocal. As discussed above, a plan or programme will not just have effects on the environment, but it will also be affected by the environment both now and in the future as the environment changes.

Expanding upon this basic premise, it can be considered whether the plan or programme's impact on climate change and biodiversity could alter the effect that biodiversity and climate change will have on the plan or programme. This relationship operates largely within a positive feedback loop in that if the initial impact (from plan / programme to climate change / biodiversity) is negative (i.e. it damages the adaptive capacity of the area, increases GHG emissions or reduces biodiversity) then the responding effect (from climate change / biodiversity to plan / programme) will also be negative

³ "Directive on the assessment of the effects of certain plans and programmes on the environment"

(reduction in ecosystem services, adaptive capacity). This cyclical relationship is presented graphically in Figure 1.

Having set out this cyclical relationship between climate change and biodiversity and the plan or programme, SEA has the potential to be used to help understand and manage this relationship and in doing so increase the resilience of the plan or programme (and natural environment). In Figure 1 two idealised alternative relationships are presented – these can be termed ‘virtuous’ or ‘vicious’ cycles (the outside and inside circles with Figure 1 respectively). SEA’s potential role in delivering this concept is to facilitate the plan or programme down the virtuous cycle by facilitating the effective integration of climate change and biodiversity considerations into the plan or programme.

This role of SEA in facilitating the effective consideration of climate change and biodiversity issues potentially improves the resilience of the plan or programme in various ways and in turn can lead to an improvement in the status of biodiversity and climate change. As discussed, this relationship is a positive feedback loop in that the more effectively a plan or programme (via SEA) considers climate change and biodiversity, the more opportunities the plan or programme receives.

The role of SEA within this cyclical relationship is to inform the development of the plan or programme in such a way that the opportunities relating to climate change and biodiversity are maximised and the risks and vulnerabilities are reduced and managed. SEA is able to do this as it provides a neutral, procedural, legally supported framework to consider this relationship. This type of thinking should be integrated across the whole of the SEA process, but may take different forms at the various different SEA stages.

The consideration of resilience requires the consideration of in what ways the plan or programme is affected by biodiversity and climate change. To explore this further, some of the functional elements of climate change and biodiversity are considered below:

- Climate change impacts;
- Ecosystem services; and,
- Socio-economic and policy drivers.

(These are shown on the left side of Figure 1)

SEA is able to consider the extent to which these are relevant and, then via the consideration of alternatives and assessment, the nature of the relationship between these and the plan or programme – i.e. a vicious or virtuous circle.

Climate change impacts

Over the potentially lifespan of the implementation of a plan or programme the parameters relevant at its inception are unlikely to be valid as the climate changes. Therefore, the effective consideration of climate change impacts should acknowledge that the implementation of a plan or programme will operate within an evolving baseline. The SEA therefore needs to understand the impacts of this changing baseline on the objectives and implementation of the plan or programme and provide guidance on how it should respond and adapt over time.

During the scoping stage of SEA the future situation as well as the current baseline should therefore be considered and this should be continued through the assessment. This approach is consistent with the requirement in the Directive, as set out in Annex I, which requires the consideration of the

relevant aspects of both “the current state of the environment and the likely evolution thereof without implementation”.

There are several key challenges in considering climate change impacts, including uncertainty and the long term and cumulative nature of climate change impacts. At the scoping stage this does not need to be a hugely technical exercise rather simple questions can be used to explore the potential impact of climate change on a plan or programme – e.g. *in what ways is the plan or programme be dependent upon the climate, both now and in the future, and how could the climate impact upon its implementation?* These basic question could form a focus of stakeholder engagement at the scoping stage and should be considered when analysing the baseline.

This sort of thinking should also be integrated into the consideration of alternatives as a criteria within the assessment, e.g. *which alternatives are most resilient / susceptible to the identified climate change impacts?*

The SEA process is particularly important in this regard as it has the potential to set the context for projects – therefore the effective consideration of potential climate change impacts within SEA has huge potential to contribute to more resilient projects (supported by EIAs). Equally, ineffective consideration could reduce resilience and the effectiveness of projects.

Ecosystem services

One of the most useful concepts when considering this two way relationship between climate change and biodiversity and a plan or programme is ecosystem services. Biodiversity can provide a range of ecosystem services that potentially support the objectives of a plan or programme and its implementation. For instance, a plan promoting economic and social development could identify the aesthetic, spiritual and cultural services offered by biodiversity through the creation and protection of green spaces and other natural areas via spatial / territorial planning. The same plan may also identify that it is reliant on the climate change adaptation benefits provided by these natural areas in terms of provision of cooling during hot temperatures and/or the attenuation of flood water for example.

SEA can help to identify and evaluate how a plan or programme is reliant upon these services, and hence on biodiversity. If those managing the plan or programme are able to include this information there is the possibility to maintain or even to enhance the provision of these services to the plan or programme (and society) and in doing so deliver more effective and resilient plan or programme and natural environment.

Socio-economic and policy drivers and legislative compliance

Mitigation and adaptation to climate change and biodiversity are not just physical entities they are also a significant part of the current socio-economic and political space. Therefore climate change and biodiversity affect the resilience and effectiveness of a plan or programme via socio-economic and policy drivers – as such the effective consideration of this functional element within SEA can benefit both the plan and programme and the natural environment.

The consideration of climate change and biodiversity within SEA will have the benefit of facilitating compliance with the Directive and relevant national legislation on SEA – this in itself is of clear benefit to the SEA as a basic requirement of an SEA process should be compliance with the Directive. Moreover, climate change and biodiversity are the subjects of a large number of EU legislation,

policies and strategies, including binding targets on Member States; as such Member States are also likely to have a suite of legislative instruments relevant to climate change and biodiversity. SEA therefore provides opportunities to ensure that plans and programmes are consistent with the requirements of these policy and legal instruments, whether at the international, European, national, regional or local level. The effective consideration of climate change and biodiversity will therefore increase compliance with these objectives and policy drivers and support the planning of any projects that result from the implementation of a particular plan or programme, as well as any EIA or Natura 2000 Assessments undertaken as part of the project planning process.

Beyond these public policy requirements, there is increasingly pressure on authorities responsible for plans and programmes from stakeholders and the general public to demonstrate that a plan or programme has minimal environmental effects and where possible has positive environmental effects – as such there are reputational benefits to the effective consideration of climate change and biodiversity within SEA. This is particularly true for greenhouse gas (GHG) emissions, in part due to climate change concerns, but also because reducing GHG increases energy efficiency and tends to save costs. As such the effective consideration of climate change and biodiversity can add value to the SEA and plan or programme making processes.

Impact on environmental limits

Thus far the effects of biodiversity and climate change on a plan or programme have been considered – however the effective consideration of resilience requires a completing of this circle and the potential effects of a plan or programme on climate change on biodiversity. This is of course well trodden ground, but what is important to stress within the context of this paper is that the extent and nature of these impacts – for example habitat fragmentation, emission of GHG and other pollutants, use of resources inefficiently – can effect climate change and biodiversity in such a way as to effect the impacts that a plan or programme receives.

Biodiversity and climate change can react in unpredictable ways to external pressures, and the thresholds for sudden decline or collapse in biodiversity or resilience may not be fully understood. This is in part due to the complexity of the relevant cause-effects relationship and their potentially cumulative nature. This requires SEA to consider a wide range of related actions and impacts that may seem insignificant when considered individually. As with climate change, uncertainty presents the need to research and develop more resilient alternatives and “no regrets” solutions, and potentially to take a precautionary approach. Figure 1 shows examples of pressures a plan or programme may exert on environmental limits (the right side of the diagram) – the extent to which a plan or programme impacts negatively on these will reduce the opportunities, described above, that a plan or programme receives.

Considering climate change and biodiversity within SEA should reduce the negative effects of the implementation of a plan or programme upon these aspects of the environment, for instance by limiting fragmentation of habitat, emission of materials which harm biodiversity and GHGs, and the unsustainable exploitation of resources such as water and timber. Beyond reducing these negative impacts, SEA has the potential to provide net gains in both biodiversity and by supporting a plan or programme to be carbon neutral or negative can form a virtuous cycle where the plan or programme contributes to adaptation, biodiversity improvement and GHG reduction and in return is more compliant, resilient and better supported by ecosystem services.

Conclusions

There are of course potential barriers to the uptake of this sort of thinking. For instance, the apparent lack of information, the uncertainty over trends and predictions of the “future” baseline and the fact that the systems are complex and as such require integrated working practices. These challenges, and others, will be considered within the forthcoming guidance as are appropriate responses.

SEA is not an end in itself; rather it is an approach to help integrate environmental considerations within the plan- / programme-making process. SEA therefore provides a framework that allows the integration of climate change and biodiversity into the development of a plan or programme and by doing so to increase resilience by effectively considering not just the impact of the plan or programme on climate change and biodiversity, but also the effect of a changing climate and biodiversity (i.e. an evolving baseline) on the plan or programme in the future during its implementation.

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