Developing IBIA: Process and content?
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Abstract
The Irish Environmental Protection Agency has commissioned research into developing a national procedure termed Integrated Biodiversity Impact Assessment (IBIA). This will provide a spatially-specific biodiversity impact assessment methodology that integrates EU requirements for EIA and SEA with Appropriate Assessment (AA) under the Habitats Directive to enhance the efficiency of legal, administrative and operational procedures. This review addresses the information flow between institutional domains during the biodiversity impact assessment (BIA) process. Effective BIA requires communication between the decision makers in the political or organisational domains and the BIA practitioners in the operational domain. The decision makers need to integrate the outcomes of the assessment process with other societal or organisational goals, whereas the assessors need a means to effectively harness the newest developments in the scientific-technological domain to estimate impacts of the proposals on biodiversity. Even though the operational domain is thus crucial to assure the quality of the assessment process current guidelines are insufficiently addressing how this domain can contribute to information flow. Furthermore, a number of decision support tools that are already widespread in the scientific-technological domain are not used in the operational domain for the assessment. It is therefore recommended that the guidelines for practitioners are improved and include recommendations that can help defined the goals of the assessment process and that can harness the newest scientific developments through a dynamic communication structure.

Key Words: best practice guidelines, institutional context, decision support systems, information flow, public participation.

1. Introduction
Biodiversity considerations only started to be formally incorporated into impact assessments after the Convention on Biological Diversity came into effect (e.g. Burel, 1996; e.g. Rajvanshi et al., 2010), but Biodiversity Impact Assessment (BIA) is starting to complement or replace other procedures such as Ecological Impact Assessment (EcIA) and the EU’s more narrowly-focused Appropriate Assessment (AA). Even though progress on formal guidelines has been achieved (e.g. Slootweg et al., 2006), the process of regulating and legislating for effective biodiversity assessment is still ongoing. A recent Irish example is the publication of the guidelines for revamped Appropriate Assessment procedures (DEHLG, 2009), but other countries are also just publishing their guidelines on various aspects of biodiversity impact assessment (BIA) methodology (e.g. Countryside Council for Wales et al., 2004; Brownlie et al., 2006). Reinforcing these best practices guidelines, a recent review on BIA (Slootweg et al., 2010) outlines how biodiversity concerns are effectively integrated with assessment processes and how conservation of biodiversity can enhance, and be enhanced by, development. These theoretical developments in BIA have not had time to be widely absorbed into planning procedures and, for example, the Irish Environmental Protection Agency has commissioned research into developing a national procedure termed Integrated Biodiversity Impact Assessment (IBIA), which is initially seen as operating primarily at the Strategic Environmental Assessment (SEA) level. It is therefore timely to review the process of BIA to
identify where practical problems may arise from incorporating the specific requirements of biodiversity conservation.

A problem that has been repeatedly identified in BIA practice is 'content delivery': the creation and delivery of the appropriate knowledge base for the assessment process (e.g. Atkinson et al., 2000; Söderman, 2009). Knowledge with regard to biodiversity has two components: data and information (in the sense of interpretation), so addressing this lack does not simply entail data provision, but a complex cross-sectoral institutional context in which expert knowledge on biodiversity can be developed and delivered to the user (Busby, 1997).

Over the past decade, significant progress has been made in the development of tools that can deliver decision support, specifically for conservation planning (Gontier et al., 2006; Sarkar et al., 2006). While potentially useful for impact assessment, these tools are not commonly used in this context. However, González (2010) incorporated spatial data and GIS to improve SEA of land use plans in the Republic of Ireland, demonstrating the opportunities for integrating such tools into BIA.

The objectives of this paper are to:
1) analyse the institutional contexts in which BIA takes place;
2) scrutinise best practice guidelines on BIA regarding their fitness for purpose to assure information flow in this context; and
3) examine current ‘tools for content delivery’ into conservation practice that could potentially also contribute to BIA.

2. Process: information flow of BIA in the institutional context
The importance of BIA in reaching the goal of effective biodiversity conservation has widely been recognized (Gontier et al., 2006; Rajvanshi and Mathur, 2010). For development of an effective BIA methodology it is important to understand the wider institutional context in which the assessment is taking place. Biodiversity conservation requires coordination amongst the ‘political’, ‘organisational’, ‘operational’ and 'scientific-technological' domains of institutional frameworks (Figure 1).

Figure 1 (based on Busby, 1997). Domains of institutional context within which Biodiversity Impact Assessment is taking place. The 'political' and 'organisational' domains need the outputs from biodiversity assessment process, whereas the 'operational' and 'scientific-technological' domains need access to experts and scientific information to effectively participate in the assessment process. Interactions between domains are described in the text.
The 'political' domain defines the legal framework and societal goals within which the 'organisational' domain operates; whereas the 'organisational' domain influences this through resource allocation and lobbying. The 'scientific-technological' domain is where the evidence base on which assessment processes are built is mostly generated. However, this evidence base is seldom generated with the assessment process in mind and is mostly focused on knowledge gaps as identified in specific areas of expertise (Busby, 1997). The 'operational' domain is where the BIA is actually prepared – it includes middle management of public administration and private corporations, consultants, and (through public participation or consultation processes) private individuals. The overall effectiveness of any BIA is highly influenced by the effectiveness of the interaction between this and the other institutional domains, so this domain is the one to focus on in developing an operational methodology.

Best practice guidelines outline the methodology of biodiversity-inclusive assessment, which generally involve the five discrete steps: screening, scoping, impact assessment, mitigation and monitoring. In order for these methodological steps to contribute to effective biodiversity conservation, it is important that they deliver the appropriate level of integration of biodiversity information to the decision-makers. A number of best practice guidelines were therefore analysed in terms of how they further interaction between the institutional domains (Table 1). While these guidelines have certainly been useful in improving the practice of BIA, they (often lack guidance on how the 'operational domain' should interact with both the 'scientific-technological' domain and end users.1 It is therefore up to the expertise of the assessor in the 'operational' domain (e.g. the ecological consultant) to decide on appropriate procedures to interact with these other institutional domains. Potentially, this indicates that significant improvement could be made in terms of guidance regarding information (evidence base) delivery into the assessment process and defining the goals of the process. Recent guidelines aimed at the 'organisational' domain (e.g. ICMM, 2006; IFC, 2007) may also assist with this process as they help end users formulate their questions.

3. Content: conservation practices, biodiversity data management

Whereas the development of impact assessment over the last 50 years was mainly focused on procedural steps to incorporate environmental concerns in decision-making (for a review cf. Kolhoff et al., 2010), the development of conservation biology focused mostly on computer-aided integration of data and modelling tools to assist selection of priority areas for conservation and systematic conservation planning (Gontier et al., 2006; Sarkar et al., 2006). These methods consist of GIS-supported spatial analysis tools (Gontier et al., 2006) and conservation planning tools (Sarkar et al., 2006). They are being used by land managers as decision support systems. Importantly for the selection of priority areas for conservation, the complementarity, irreplaceability, and vulnerability of sites has to be assessed (Sarkar et al., 2006). Complementarity refers to the diversity in terms of biological resources of the sites in the planned conservation area network, irreplaceability refers to the uniqueness of the site within the network, and vulnerability refers to environmental or socio-economic pressures and the sensitivity of populations to these pressures. Conservation planning tools can assist with making informed selections of indicators for biodiversity and they may help with evaluating effects of biodiversity processes such as migration on population viability under different conservation scenarios (Gontier et al., 2006; Sarkar et al., 2006). However, because of their technical complexity and their ability to identify knowledge gaps (the focus of the 'scientific-technological' domain), these systems can only move outside that domain if supported by an institutionalised communication channel that requires 'operational' users/assessors to give feedback to the experts developing the system, while also giving those experts an effective means of updating it when new knowledge becomes available.

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1 With some exceptions - (e.g. Countryside Council for Wales et al., 2004)
<table>
<thead>
<tr>
<th>Source and Context</th>
<th>Definition of biodiversity</th>
<th>Definition of experts for assessment</th>
<th>Guidance on evidence base</th>
<th>Guidance on interaction with end users</th>
<th>Guidance on interaction with scientific/technological domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Environment, Heritage and Local Government (DEHLG, 2009) AA guidance</td>
<td>Legal designation of protected areas</td>
<td>Ecological specialists (with input from other experts)</td>
<td>Not found</td>
<td>Definition of end user group (competent authorities)</td>
<td>Checklists; Annex I Habitats</td>
</tr>
<tr>
<td>Countryside Council for Wales, English Nature, Environment Agency, and Royal Society for the Protection of Birds (2004) SEA guidance</td>
<td>CBD¹, clear explanation of all components of biodiversity; values of biodiversity</td>
<td>For SEA: generalist environmental consultants; For AA²: ecologist</td>
<td>List of organisations with biodiversity information; List of conservation designations</td>
<td>Main objective of plan must be outlined in the SEA; Relevant environmental protection objectives established at different political levels must be outlined</td>
<td>Scoping checklist; Toolkit – some simple explanations and overview of different assessment techniques</td>
</tr>
<tr>
<td>CBBIA-IAIA (2006) Biodiversity impact assessment and decision making</td>
<td>CBD³, ecosystem service, terms used for indicating status, pattern vs. process</td>
<td>A person with competence and experience in ecology</td>
<td>Not found</td>
<td>EMP³: Relevant legislation must be mentioned</td>
<td>Assessor encouraged to verify data; Decision making framework</td>
</tr>
</tbody>
</table>

Table 1. Overview of some current best practice guidelines for BIAs in terms of goal setting and their interaction with other institutional domains of society.

4. How can we adapt the process and content of BIA to meet new challenges and incorporate scientific advances?

From the review, it is evident that further guidance could be developed regarding information flow in the institutional context of BIA. This also includes adaptation of methodological approaches beyond the traditional assessment of projects (EIA) and plans (SEA) to include assessment of diffuse pressures on biodiversity such as trade, farming, recreation and climate change (Treweek et al., 2006; Wilson and Piper, 2008; Stoate et al., 2009). This can be interpreted as an expansion of the requirements put on BIA by end-users in the political and organisational domains (Figure 1). Similarly, significant advances have been made in both the 'operational' and 'scientific-technological' domains in terms of biodiversity knowledge, data and information delivery, as well as technological approaches to BIA. The complexity of effective BIA requires that these information gathering and decision support techniques be extensively used during the assessment process. Not only should current techniques be integrated, but communication channels should also be established that ensure that technique and database updates are flagged and speedily incorporated into the process. Only scientifically up-to-date assessments will instil confidence in the BIA process in the 'political' and 'organisational' domains, where it is essential to have an appropriate evidence base for scenario building and the optimisation of trade-offs between different political or corporate
goals. In the absence of appropriate biodiversity information, biodiversity issues will likely continue to be ignored or take low priority in these domains.

Moreover, it is increasingly recognised that BIA needs to permeate activities in all sectors of society, and thus best practice guidelines may have to allow a more flexible interpretation of the goals of assessment and the procedures necessary for reaching those goals - one size will not fit all. Such guidelines would have to stress the tight interaction of the 'scientific-technological' domain with the 'operational' domain, and with end-users and stakeholders. An example of such iterative adaptation of traditional methodology is given by Kolhoff et al. (2010). One way of addressing institutional integration while dealing with diffuse pressures on biodiversity within BIA at a strategic level may be to adopt an ecosystem services approach in SEA. In 10 case studies, van Beukering and Slootweg (2010 p.288) showed that including an ecosystem service valuation approach into decision-making in SEA 'resulted in major policy changes or decision making on strategic plans and investment programmes'. Such an approach can contribute to closing the gap between the 'scientific-technological', 'operational' and 'organisational' domains (van Beukering and Slootweg, 2010). While the ecosystem services approach may be limited to strategic level applications of BIA, it could potentially provide some of the guidance needed to discuss priorities in the process and thus contribute to halting the loss of at least the essential elements of biodiversity.

5. Conclusion
Significant advances in both the fine-tuning of assessment methodology and the creation and delivery of biodiversity information should help to address BIA in a complex cross-sectoral institutional framework. The challenge is to incorporate guidance on both the use of new procedural pathways and decision support tools into a readily accessible format for users in the 'operational' domain.

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6. References


