A Methodological Approach to Integrating Strategic Environmental Assessment and Biodiversity Impact Assessment

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Abstract
Impacts on biodiversity (broadly defined) need to be assessed under the EU's Habitats, SEA and EIA Directives, as well as under additional provisions such as the Water Framework and Environmental Liability Directives. Therefore, biodiversity impact assessment of plans, programmes and projects is required under various legislative remits, to ensure that potential negative impacts in both protected and unprotected areas are efficiently identified in a timely manner, quantified and subsequently avoided or mitigated. The procedural requirements of these legal obligations vary; SEA processes, for example, evaluate potential impacts on flora and fauna in both designated and undesignated areas, while Appropriate Assessment (AA) under the Habitats Directive focuses on the detailed assessment of any potential effects on the qualifying features of designated European Natura 2000 sites. As a result, differing methodological steps, data gathering and processing methods, as well as impact assessment techniques, are commonly applied under each legislative requirement, often leading to uncoordinated assessment efforts and results (in terms, for example, of scale and assessment detail).

The Irish Environmental Protection Agency has commissioned research into developing national procedure termed Integrated Biodiversity Impact Assessment (IBIA). The overall aim of IBIA is to provide a spatially-specific methodology that integrates EU requirements for AA with SEA and EIA to enhance the efficiency of legal, administrative and operational procedures. This paper presents the draft IBIA methodology, describing the progress made in relating impact assessment domains, as well as exploring the key constraints to such integration and the anticipated benefits of its application.

1. Introduction
Under the Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) Directives (CEC 1997, 2001), the assessment process commonly encompasses an evaluation of the quality and, where applicable, the protection status of biodiversity (only in SEA), fauna, flora, population, human health, soil, water, air, climatic factors, material assets, cultural heritage and landscape. Both SEA and EIA assess potential impacts on habitats and species within designated and non-designated sites, examining the overall implications for biodiversity (including those potential secondary impacts associated with changes in water, soil or climatic conditions, for example). Under the Habitats Directive, Appropriate Assessment (AA) mainly refers to the qualifying interests and conservation objectives of discrete designated Natura 2000 sites. Similarly, the Water Framework Directive (CEC, 2000) deals with specific aspects of biodiversity, including protected areas such as salmonid waters, Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and other species-specific sensitivities (e.g. freshwater pearl mussel). The Environmental Liability Directive (CEC, 2004) applies then to any biodiversity aspects that have not been addressed by AA or SEA/EIA; however, it has no protective element as it quantifies impacts after they have happened. Each of the different assessments and consent procedures seek to address broadly similar objectives with regards to biodiversity protection and conservation, but provides a fragmented picture of biodiversity by focusing on specific considerations. Moreover, fulfilling the procedural requirements of these legal obligations leads to significant duplication of efforts. Despite the observed variation in scope and practical approaches (with differing methodological steps and data gathering and

processing methods in each procedure), certain requirements such as habitats and species covered, scale and assessment detail or impact assessment techniques applied are often similar, if not the same, across the different appraisals. All processes complement each other and, if aligned appropriately, they can yield a clear and comprehensive overview of potential biodiversity impacts to inform-decision making, increasing the effectiveness of the individual procedures while avoiding duplication of efforts.

In order to amalgamate processes and coordinate efforts, the Irish Environmental Protection Agency has commissioned research into developing a spatially-specific Integrated Biodiversity Impact Assessment (IBIA) methodology that integrates EU requirements for AA with SEA and EIA to enhance the efficiency of legal, administrative and operational procedures. The progress made in relating impact assessment domains as well as exploring the key constraints to such integration and the anticipated benefits of its application are presented and discussed in this paper. It follows from the discussions on legislative requirements, current AA deficiencies and spatial data and procedural considerations associated with the papers presented at IAIA11 (Fry and O'Connell, 2011; Fry and Scott, 2011; Fry *et al*., 2011a; Fry *et al*., 2011b; González and Fry, 2011; González *et al*., 2011) and links with another paper presented at this meeting (Fry *et al*., 2011c).

2. Methodological Framework

The proposed IBIA methodology integrates legal and procedural requirements of each of the SEA, EIA and AA processes combining them as convenient and feasible. This is achieved by grouping critical and correlating methodological steps and merging their requirements in relation to scope, scale and detail in order to ensure legislative compliance (Figure 1).

Given that the AA process is associated with statutory authority to withhold consent, the AA process initiates IBIA. In this way, the AA screening stage can flag up any potential issues that may lead to consent refusal and inform the SEA/EIA scoping stage to consider whether the assessment of such plan, programme or project alternative should move forward in its current proposed form. Moreover, the findings of this AA stage should be presented to the proponent and the plan, programme or project reconsidered if it appears that significant adverse effects cannot be avoided. AA rarely leads to withholding consent as mitigation measures aim to address any significant impacts on biodiversity. Moreover, the Imperative Reasons of Overriding Public Interest ('IROPI test') option also exists – though generally only for public projects. In this context, AA mitigation, and whether IROPI may be invoked, need to be considered during SEA/EIA (Fry *et al*., 2011a).

Where AA does not identify any significant reasons to withhold consent or when such reasons have been addressed by reconsidering and redrafting the plan or project to avoid impacting the integrity of a Natura 2000 site, the SEA/EIA process can progress. Information gathered and analysed during AA screening can be incorporated into the SEA/EIA baseline to provide a comprehensive and holistic reference basis for biodiversity impact assessment. Stage two of the AA process and assessment of impacts as part of SEA or EIA can be clearly aligned, as long as AA findings are incorporated into SEA/EIA and SEA/EIA findings inform AA. Designated site investigations and exact location of qualifying interests within a site are to inform the impact assessment stage of SEA/EIA. In the same way, SEA/EIA findings with regards, for example, to connectivity (via water features or vegetation, as well as national designations as stepping stones) should be taken into consideration at AA level. Although AA should precede SEA/EIA in the IBIA framework, the definition of alternative ecological solutions envisaged in Stage three may occur on a par or at a later stage than the definition of alternatives required in SEA/EIA, which tends to occur prior to the impact assessment stage. In all cases, the processes must be coordinated through continuous communication to ensure that the ecological alternatives developed at this AA stage are incorporated into the alternatives developed in SEA/EIA, and

correspondingly assessed. Mitigation measures derived from the relevant appraisals need to be compatible and simultaneously considered for their incorporation into the plan/programme/project. Although AA procedures do not formally require the definition of monitoring arrangements, indicators and targets for Natura 2000 sites should be specified as part of SEA/EIA monitoring.

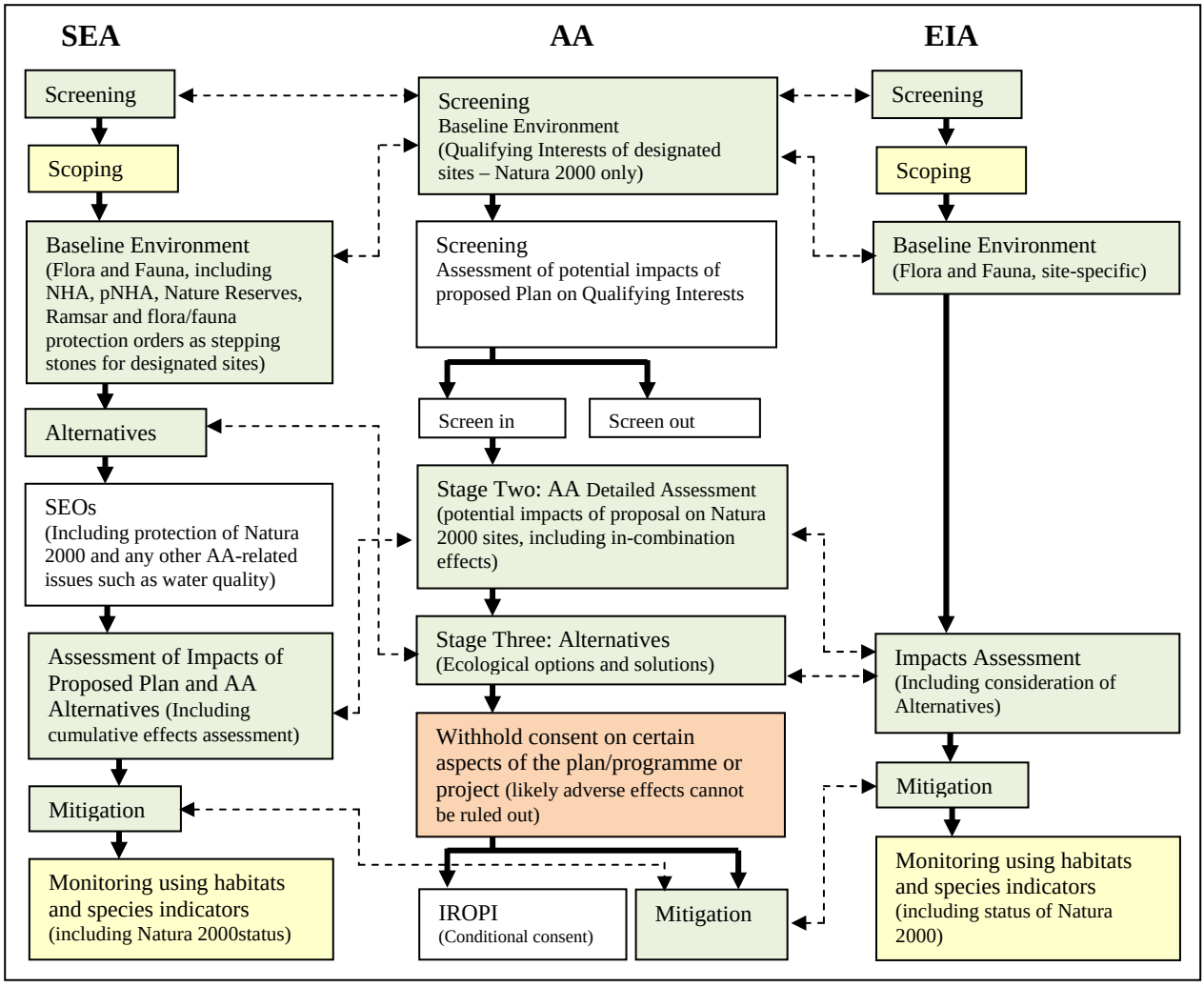

Figure 1. Correlating methodological steps and interactions between AA, SEA and EIA.
Note that green boxes indicate 'common' procedural stages; yellow boxes indicate correlation between some of the procedures; white refers to those stages solely applicable to one of the procedures; and the orange box highlights the primacy of this legislative procedure for refusing consent.

The methodology proposes a legally-conforming output across the processes: an Integrated Biodiversity Impact Statement (IBIS). The IBIS would address both the 'biodiversity, flora and fauna' requirements of the relevant SEA ER or EIS as well as Natura Impact Statement (NIS) requirements, combining and merging the information as appropriate. It could be presented as a stand-alone document replacing all existing reporting procedures (also where AA only is needed) or constitute the 'biodiversity, flora and fauna' section of SEA ER and EIS. In all cases, the legal consequences of the various SEA/EIA/AA findings should be clearly stated, noting which proposed mitigation measures and recommendations derive from which process, as AA has far greater statutory implications.

These grouped methodological steps described above have varied approaches under the different consent processes, which present significant challenges to their integration. Such challenges refer, among others, to the statutory framework and legal implications as previously noted, as well as to geographical scope, reference baseline and data sources, type and coverage of alternatives,

assessment detail, potential for spatial approaches such as Geographic Information Systems (GIS), and extent of consultation. The main constraints, as well as the anticipated benefits, associated with each of these considerations are examined next.

3. Geographical Scope and Assessment Detail

The geographical scope of the assessment is commonly determined by the planning hierarchy and the extent of potential impacts. In general, impact assessment in SEA tends to be contained within administrative boundaries although, where applicable, transboundary and transnational areas/counties/countries are also included. Similarly, assessments at EIA level focus on the site boundary but ex-situ areas (within the zone of influence), transboundary and transnational scoped sites and species are also considered where relevant. In contrast, and despite it having no legal or ecological basis, governmental guidance in Ireland recommends the consideration of an ex-situ 15Km buffer area for Natura 2000 sites around the plan/programme/project boundary sites when undertaking AAs; however, the zone of influence can often be defined smaller at project level. In the context of IBIA, the adoption of the larger geographical extent, as defined during scoping, would be most appropriate to ensure compliance with the various legislative requirements.

Similarly, the level of assessment detail provided for each biodiversity aspect depends on their significance and the geographic scale of the plan/programme/project as defined during the scoping stage. However, the scope and level of detail in the baseline information varies for each of the procedures. While the SEA Directive does not require new data collation or generation, EIA practice relies on site-specific intensive field surveys for data gathering. These approaches to baseline detail are respectively transferred to plan/programme and project AAs, influencing impact assessment approaches. The wider geographical scope of SEA or plan/programme AA enables an ecosystem-based approach to biodiversity impact assessment, encompassing specific designated and non-designated areas and addressing species distribution, connectivity of wildlife corridors and ecological stepping stones. In the case of EIA or project AA, the assessment approaches tend to be more detailed focusing on localised habitats and species. Therefore, plan/programme-level assessments tend to provide more inclusive spatial extents than project-level assessments and, more importantly, the opportunity for a better consideration of potential (cumulative) effects. However, they tend to contain coarser data than project-level assessments, which in turn provide relevant detailed data but at a too limited spatial extent. In all cases, accurate, updated and sufficient biodiversity-related information needs to be sourced and gathered for baseline and future conditions to make adequate and reasonable judgments. In this context, the importance of scale becomes significant. Due to the lack of specifications in the relevant directives, EIA, SEA and AA practitioners have the responsibility and flexibility to identify and select the relevant scale(s) at which the assessment, and description of the baseline environment, should be performed. The common practice of adopting the scale of available baseline datasets can potentially compromise assessment detail. A multiple-scale approach is therefore recommended, making optimum use of available datasets at various scales, applying appropriate techniques to the scale of assessment, and acknowledging data availability, quality and scale limitations and associated uncertainties at each assessment stage. Unless SEA and plan/programme AA deliver real pointers to prevent or modify the environmental impact of lower-level plans and projects, they are not effective.

4. Data Considerations

The type and number of datasets used depends on the scope and purpose of the study (González and Fry, 2011). AAs only require the consideration of Natura 2000 sites and any information in relation to their qualifying interest, conservation status and objectives; therefore, additional biodiversity-related datasets tend to be overlooked. At SEA and EIA level, the incorporation of datasets generally depends on their availability, scale and relevance to the plan/programme/project. These commonly cover environmental resources (e.g. ecological designations) and environmental sensitivities (e.g. red list species). In addition, environmental

pressures (e.g. expansion of urban settlements, water contamination or climate change) need to be considered to anticipate potential biodiversity impacts.

As SEA and plan/programme AAs tend to rely on available and secondary datasets, the suitability of available biodiversity data at this level may be compromised due to the quality, scale and, subsequently, high level of uncertainty of such datasets. In Ireland, the National Parks and Wildlife Service (NPWS) online data on Natura 2000 and other national ecological designations (Natural Heritage Areas – NHA, Nature Reserves, etc.) represent the main data source at this planning hierarchy. However, many of the surveys of such sites are incomplete, dated or currently under review, and site boundaries are being revised for accuracy. In addition, data gaps and inconsistencies in relation to, for example, accuracy of boundaries, lack of management plans and/or conservation objectives associated with designated sites are often overlooked in SEA ERs and NISs. Although there are occasional references to conservation status, threats and sensitivities, there are difficulties in knowing where particular qualifying interests are located within Natura 2000 sites, and references to connectivity between sites are rare. CORINE is also frequently used as proxy data in SEA (González and Fry, 2011). However, the last published update of this dataset was undertaken in 2006 (the 2009 update is currently being processed) and the minimum mapping unit (or spatial resolution) adopted in CORINE is 25ha, which entails the grouping of categories that cover areas less than 25ha as mixed classes. This has significant implications for biodiversity impact assessment at the local area plan or project level; categories may not always match reality on the ground and the low level of detail (and accuracy of the inventory) may lead to misleading assessment results. Other relevant data sources such as habitat maps, forest inventories and RAMSAR sites are underused in current Irish practice. In addition, a review of Irish plan/programme AAs by the research team has revealed that baseline surveys are, in many cases, either incomplete or nonexistent; in addition, baseline is rarely detailed enough to support cumulative effects assessment (Fry and O'Connell, 2011; Fry and Scott, 2011). This review highlights the need to enhance quality information and comprehensiveness of assessments at this planning level.

EIAs (and project AAs) are generally based on the findings of site surveys; although practice varies, NPWS online data is also most commonly used. Site-specific surveys have the potential to provide a more accurate description of the baseline environment facilitating a more detailed impact assessment. However, such surveys are undertaken within a given scope and purpose and the lack of standardised methods for data collation (e.g. scale, taxonomy, etc.) compromise their applicability in other studies with different scope or project details. In any case, datasets resulting from such surveys are rarely shared; as a result, the lack of ready access to biodiversity information in Ireland leads to unnecessary duplication of data gathering, management and interpretation efforts, particularly at EIA and/or project AA level. Moreover, time and cost implications of biodiversity data collation frequently result in a degree of 'cut and paste' amongst EISs. An international survey involving IAIA academics and practitioners, has revealed that lack of knowledge on available datasets together with scale and quality considerations are the most common constraint to biodiversity data access and use. To resolve this, a centralized directory of biodiversity-relevant database (with a clear set of data collation and compilation standards such as those established by the Global Biodiversity Information Facility) should be created similar to that available in the Irish National Biodiversity Data Centre, where existing biodiversity-relevant datasets and habitats and species data gathered during EIA and research campaigns could be automatically uploaded and freely distributed. This accumulable database could significantly help control duplication, enhance data sharing and use, and assist in the assessment of in-combination effects. Statutory establishment of standards for presenting data to meet AA, SEA and EIA requirements, and requiring data to be placed in the public domain would make an important cumulative contribution to available and usable data.

5. Scope and Definition of Alternatives

In both the SEA and EIA Directives Article 5 requires the consideration of 'reasonable alternatives taking into account the objectives and the geographical scope of the plan/programme' and the provision of 'an outline of the main alternatives studied' respectively. Alternatives are at the heart of SEA and EIA processes, as they provide ways for accommodating future development within the constraints imposed by intrinsic environmental conditions. They are to be defined early in the process and assessed to identify the most suitable solution. In contrast, the Habitats Directive requires that alternative options are defined and examined only where potential significant effects on the integrity of Natura 2000 sites are identified. Therefore, they present alternative ecological solutions that often have the function of mitigating previously identified significant effects.

In SEA, alternatives are commonly developed by the planning and SEA teams through workshops and consultation. In EIA, these are often proposed by the developer and, in some cases formulated in consultation with the planning authority. In both plan- and project-level AAs, alternatives derive from Stage two findings and are commonly defined by the AA team in consultation with the proponent. It is worth noting that SEA and plan/programme AA alternatives are often strategic and include broad policy objectives; in contrast, EIA or project AA alternatives tend to be operational establishing practical site-specific solutions. Current practice suggests a limited consideration of plausible and pragmatic alternatives in environmental assessment. In the context of biodiversity, there is a common lack of ecological expert input in the definition of alternatives in both SEA and EIA. Moreover, the review of Irish AAs undertaken by the research team has revealed that alternatives are rarely dealt with as a Stage three exercise; alternative ecological solutions are occasionally assessed against site sensitivities but these are rarely used as means of mitigation and there is a lack of consistency in approach across NISs. To facilitate IBIA, reasonable ecological options should be incorporated into the impact assessment process. This can be achieved by ensuring that Stage three solutions are incorporated and accordingly assessed in SEA/EIA.

6. Spatial Assessment Approaches and Techniques

Although several tools and methods exists for biodiversity impact assessment (González *et al*., 2011), the methodological approach presented in this paper is defined by the scope of the IBIA project, where GIS is adopted as a support tool throughout the assessment process. This relates to the fact that biodiversity impact assessment processes and outputs can be enhanced by examining the location and spatial distribution of sensitive habitats and species. GIS can bring together biodiversity-relevant spatial data for the creation of thematic maps to graphically depict the location and extent of sensitive flora and fauna, habitats, ecosystems and designated sites, and thus support the description of the baseline environment. This in turn enables a rapid and visual examination of any spatial correlations and juxtapositions amongst data, incorporating a spatial dimension into the assessment of potential impacts on biodiversity and, subsequently, helping to identify spatially-specific mitigation measures and monitoring arrangements. Prepared maps can finally be used in the SEA ERs, EISs, NISs or IBISs to facilitate the communication of critical considerations in relation to potential conservation and land use conflicts to planners and decision-makers. Such graphic illustrations can also support stakeholder and public consultation.

The number and type of applied datasets depends on the scope of the plan/programme/project, but the application of spatial data and GIS should aim at a time-effective generation of sufficient, reliable and usable information on biodiversity baseline and potential impacts. It must however be noted that SEA and plan/programme AA maps are based on available spatial datasets, which generally refer to designated sites (Natura 2000 sites only in the case of AAs); this frequently leads to the omission of non available sites/features in the mapped description of biodiversity baseline conditions. In contrast, and even though EIAs are based on field surveys, there is a

common lack of Global Positioning Systems (GPS) and GIS application for identifying key features within sites, which impedes a detailed spatially-specific illustration of the biodiversity baseline within the study area. These spatial assessment limitations must be addressed where feasible, and acknowledged in the relevant documents.

Each methodological step in IBIA benefits from certain GIS approaches (Figure 2). Although it is considered that a "standard" method cannot be applied across all planning hierarchies, the following techniques can be adapted to different assessment scales by adjusting the geographical extent, the assessment detail and the scale of the datasets applied, where feasible. The time-frame and resources allocated to each step as well as the relative accessibility to relevant data sources can also constrain the application of certain techniques.

Basic data display and mapping tools (e.g. editing of layer properties and categorisation based on attribute data to enhance the illustration of information) can be applied for descriptive data display and layout creation to assist screening, scoping and baseline information stages. Editing tools can be used early in the process to complete and correct any data inconsistencies, and appropriately integrate data into the GIS interface. The creation of individual maps for each biodiversity consideration (e.g. critical flora and fauna features) supports a spatially-specific depiction of the baseline environment. The relevant thematic layers can also be overlaid and transparency tools used to visually observe any spatial correlations and determine the degree of overlap of concurring biodiversity sensitivities (e.g. protected woodland habitat and occurrence of red squirrel), as well as any juxtapositions with the proposed interventions. This basic assessment can facilitate the identification and enhance the understanding of potential conflicts between biodiversity conservation, supporting environmental features, and changes in land use and resource management.

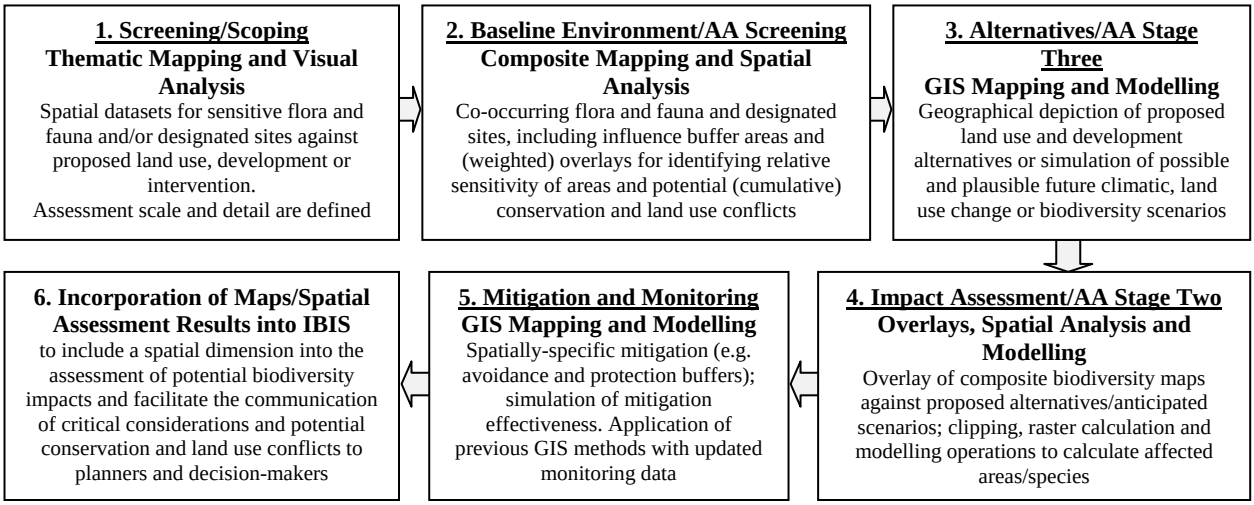

Figure 2. Sequential SEA/EIA/AA stages where spatial data and GIS methods can be applied.

The impact assessment stage can be further improved by incorporating modelling tools that enable simulating future conditions (e.g. anticipating future changes in the connectivity of wildlife corridors or in the climatic conditions affecting species distribution). Model simulations can be subsequently incorporated into the assessment and examined to more objectively predict likely impacts. Public perceptions in relation to the sensitivity of habitats and species can be equally incorporated through the application of weighted overlay tools. Such tools enable assigning a significance weight to each biodiversity dataset and thus emphasize the relative importance of individual biodiversity considerations. Overlay mapping exercises commonly render composite maps illustrating relative sensitivity areas. This approach also helps exploring potential cumulative impacts. The spatial representation and assessment of biodiversity considerations facilitates a spatially-specific definition of mitigation and monitoring measures

and, as noted earlier, the incorporation of mapped results into the final report can contribute to a more transparent and clearer communication of assessment findings.

7. Consultation and Public Participation

There is a statutory requirement to consult the environmental authorities (i.e. Environmental Protection Agency, Department of Environment, Community and Local Government, Department of Communications, Energy and Natural Resources) during SEA scoping, as well as the National Parks and Wildlife Service (NPWS) during AA screening. In both cases, consultation with other stakeholders and transboundary consultation, where required, may also occur. Although there is no legal requirement, consultation with the planning authority is reasonably common in EIA. In all cases where a plan, programme or project AA is undertaken, it is best practice to consult the NPWS throughout the entire assessment process in order to obtain any updates on sensitive issues and threats. In addition, both SEA and EIA have a statutory public consultation period (8 weeks of pre-planning public consultation and 10 weeks once plan/programme has been drafted; 5 weeks of pre-planning public consultation and 10 weeks once planning application has been submitted), which is accordingly applied in AA facilitating the integration of processes.

In all cases, the establishment of communication channels between the proponent and the assessment team, as well as the relevant environmental authorities, stakeholder groups and individuals, is critical to ensure the full integration of the methodological steps and a thorough consideration and examination of all relevant biodiversity data, as well as biodiversity conservation priorities and perceptions (Fry *et al*., 2011b).

8. Conclusion

The IBIA methodological approach presented in this paper is currently under development. However, many of the constraints to the integration of biodiversity impact assessment procedures and potential benefits of an integrated application can be anticipated. Difficulties in amalgamating procedures mainly relate to varying legislative requirements, consent processes and time-scales, but also to practical implementation and technical issues such as scope of assessment, scale of available datasets and applicability of assessment methods. Nevertheless, it is considered that IBIA has the potential to bring about a progressive increase in the efficiency and effectiveness of the individual procedures through improved communication, data collation and sharing, and coordination of resources and efforts.

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