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The Ecological Component of Environmental Impact Assessment: A Critical Review of British Environmental Statements

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ABSTRACT *Environmental assessment (EA) of the impacts of development is required under the 1985 European Directive 85/337/EEC, which is implemented in Britain primarily through the 1988 Town and Country Planning (Assessment of Environmental Effects) Regulations. Ecology provides analytical procedures for studying relationships between organisms and their environment and therefore has an obvious role in EA. The status of ecology within the British EA process was investigated by analysing 179 environmental statements (ESs) produced between 1988 and 1993. In many cases, the ecological information provided was so limited in quantity, or of such poor quality, that it was not possible to assess the ecological implications of proposed schemes. Many ESs failed to provide the data necessary to predict ecological impacts. Potential ecological impacts were reported in 93% of statements, but only 9% made any attempt to quantify them. Of those ESs which made references to ecological effects, only 45% based their findings on new ecological survey information. Consultation with statutory consultees for nature conservation was reported in 48% of ESs. Although 78% of ESs mentioned mitigation measures, only 23% described them in detail. A major shortcoming was the universal failure to make any commitment to monitoring of development impacts. In addition to the lack of formal requirements for monitoring, the lack of guidance for ecologists and developers involved in EA is concluded to be a major factor behind some of the shortcomings summarized in this paper.*

Introduction

Environmental assessment (EA) involves the systematic identification and evaluation of the potential impacts of proposed development actions (Canter, 1996) and is intended to prevent environmental degradation by giving decision makers better information about the possible environmental consequences of development actions. In the UK, EA is required under the Environmental Assessment (EA) Directive (85/337/EEC) as implemented through specific sets of Regulations covering different categories of development. The findings of an EA are summarized in an environmental statement (ES) and are taken into

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account by the local planning authority in forming their judgement as to whether or not a proposed development should go ahead (Department of the Environment (DoE), 1989).

An assessment of ecological impacts relating to the viability, sensitivity and value of ecosystems, habitats and species, which might be affected by a development proposal, is required as part of the overall assessment specified under Article III (3) of EC Directive 85/337. Article III (3) states that the direct and indirect effects of a project should be considered as part of the EA, including effects on "human beings, fauna, flora, soil, water, air, climate, any interactions between the foregoing, material assets and the cultural heritage". Annex III (4) then states that the description of the likely significant effects should include "direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects".

There is concern about the general quality of ESs (Lee & Colley, 1990; Lee & Brown, 1992; Lee & Dancey, 1993) and more specifically over the inadequacy of the ecological content of the ESs produced so far (Beanlands & Duinker, 1984; Spellerberg & Minshull, 1992; Treweek *et al.*, 1993; Royal Society for the Protection of Birds, 1995; Thompson, 1995; Thompson *et al.*, 1995; Treweek, 1996). It was therefore decided to examine the ecological content of British ESs. The main aim of this research was to determine the extent to which ESs contain the ecological information required under the current legislation, and to establish the extent to which the EA process is likely to ensure effective assessment of the potential ecological consequences of development.

Methodology

The study was based on a review of ESs produced for a variety of development types in Britain (Table 1); 179 ESs were selected for review from collections held by the Schools of Biological and Molecular Sciences, and Planning, at Oxford Brookes University, representing 9.3% of the total produced between 1988–93 (Frost & Frankish, 1994). The number of ESs reviewed for each development type was intended to represent a constant proportion of the overall total for each category. Between 1988–93, approximately 20% of all ESs were produced for roads, 18% for waste disposal and treatment (including landfill), 16% for mineral extraction with industrial and urban projects making up the remainder (ibid.). Inconsistencies between ESs in their content and presentation of ecological information made comparisons difficult but, wherever possible, the ESs were reviewed on the basis of common criteria.

It was considered necessary to determine whether or not the statements contained the ecological information required under current legislation. Existing guidance on EA and the required content of ESs (Department of the Environment, 1989) was used to derive review headings which were used to compare approaches to ecological assessment and to identify those aspects of the EA process which appeared to give rise to deficiencies in terms of ecological assessment. We summarize the results of the review under the headings: size of proposed development; consultation; existing land use; ecological survey information; conservation status of habitats and species assessed; potential impacts upon designated sites; habitats lost or affected by proposed developments; ecological impacts of the proposed developments; mitigation; and monitoring.

Table 1. Number of environmental statements reviewed for different development categories

Development category	No.	%
Mixed developments	29	16
Roads	26	15
Power stations	25	14
Mineral extraction	18	10
Opencast mines	15	8
Miscellaneous, e.g. railway	14	8
Landfill	12	7
Pipelines	8	4
Waste treatment	8	4
Leisure	6	3
Wind farms	5	3
Agricultural	5	3
Port and harbour	5	3
Power transmission	3	2
Total	179	100

It is possible that, in a number of cases, ecological surveys were undertaken for the purposes of EA which were not adequately summarized or referenced in the ES submitted with the planning application. However, for the purposes of this study, it was necessary to assume that all available relevant information had been included in the ES.

On the basis of the information contained in the ESs, those habitats and species likely to be affected by the proposed schemes were identified. Again these were summarized on the basis of the descriptions contained in the ESs themselves.

Results and Discussion

Size of Proposed Development

There was a wide range of sizes amongst the proposed non-linear developments with no one size dominating (Table 2). Table 2 does not include the dimensions

Table 2. Size distribution of proposed non-linear developments

Size (ha)	No.	%
<10	16	11
10–49	34	24
50–99	19	14
100–199	22	16
200–500	14	10
Not stated	35	25
Total	140	100

or lengths for linear developments, e.g. roads, which sometimes were not stated or were difficult to calculate.

There are two reasons for establishing the actual size or length of a proposed development. First, for some types of development, such as salmon farms, roads and afforestation proposals, it is the size of the development which triggers the need for an EA. Second, the size of the scheme will often determine the overall ecological impact because the larger the scheme the greater the probability that a wide range of habitat types and their dependent species will be affected. ESs which fail to state this are not complying with the EA legislation, which requires that there should be a clear statement of the ecological implications of any proposed scheme.

Of the ESs reviewed 21% were for linear developments, namely roads, power transmission lines and pipelines. In these cases it was the length of the proposed scheme which was stated and not the actual area to be occupied by the development. This is inadequate because many linear developments disturb larger areas of land during the construction phase than when the development is in operation. Of the 140 non-linear developments, 25% did not state the development site area (Table 2).

Consultation

Consultation with statutory bodies (English Nature (EN), Scottish Natural Heritage (SNH) and Countryside Council for Wales (CCW)) and non-statutory bodies (e.g. Royal Society for the Protection of Birds (RSPB)) was very variable (Table 3). In no instance was it possible to ascertain the extent of the consultation.

Only 48% (86) of the ESs stated that the statutory country agency (EN, SNH or CCW) had been consulted, a surprisingly low figure considering that these are the statutory consultees for the EA process with respect to nature conservation issues. There are three possible reasons why consultation is not happening to the extent expected. Firstly, financial constraints result in too few staff being given responsibility for EA. Second, many developers fail to invite comments from the country agencies when formulating the EA framework for

Table 3. Number of environmental statements claiming consultation with different organizations

Organization	No.	%[a]
Statutory bodies (EN, SNH, CCW)	86	48
Countryside Commission	29	16
County museums	10	6
National Rivers Authority	41	23
RSPB	28	16
Local wildlife trust	63	35
Special interest groups	33	18
Other	3	2
None stated	59	33

[a]Percentages do not total 100 because of multiple consultations.

their proposal. Third, there is no statutory requirement to consult at the pre-submission stage. The low level of consultation between development proponents and the statutory bodies is a fundamental flaw in the environmental assessment process and one which urgently needs addressing.

The non-statutory bodies (RSPB, British Trust for Ornithology, Council for the Protection of Rural England, local wildlife trusts and other special interest groups) were often not consulted (Table 3). These interested parties should be consulted for three reasons. First, contact with these groups can save time by both focusing fieldwork attention on the right areas and saving on duplication of any previous surveys. Second, these bodies have long-standing expertise which should be utilized to permit the time saved in using their expertise to be used on another area for which existing information is not available. Third, their expertise can be employed to assess the validity of fieldwork data.

Perhaps of greatest concern are the 33% of ESs which appear not to have included any form of ecological or nature conservation consultation. In some cases consultation may have taken place but was not reported. Failure to consult widely and appropriately can result in neglect of key issues, with subsequent delays while these are addressed, or unnecessary investment of survey effort.

Existing Land Use

To comply with the DoE's (1989) guidelines, an ES should describe the site and its environment. Our analysis aimed to discover the existing land use as this would indicate if there were any which were especially prone to development proposals or conversely if there were any for which there seemed to be a presumption against development. In keeping with the DoE's (1989) guidelines, the majority of ESs reviewed did refer to the land use type within the proposed development area. Difficulty was experienced with some statements as they did not make it clear whether the land use types mentioned were to be directly affected by the development, and therefore only data for those developments where a definite indication of the existing land use were collated (Table 4).

The majority (64%) of proposed developments appeared to affect areas where the land use was predominantly agricultural (Table 4). Only 31% appeared to affect urban/industrial areas and only 3% suburban/residential areas. Waste/derelict areas were potentially affected by only 16% of developments. 29% of the

Table 4. Percentage of proposed developments, based on 179 environmental statements, likely to affect different types of existing land-use

Existing land use	% of developments[a]
Agriculture	64
Urban/industrial	31
Nature conservation	29
Waste/derelict	16
Suburban/residential	3

[a]Percentages do not total 100 because of developments affecting multiple land uses.

developments were considered to affect land used for nature conservation. The majority of these sites included woodland as a site habitat component, although some proposed schemes involved substantial areas of wetland/waterbodies.

Ecological Survey Information

Only 45% (81) of the EAs involved a new ecological survey. This is a much lower percentage than that found by Spellerberg & Minshull (1992) who, in their examination of 45 ESs, found that 84% included data from original fieldwork. A possible reason for this difference may be that some ESs did not always refer to any original field surveys which had been carried out. Discussion by Spellerberg & Minshull (1990) with the project proponents or the consultants responsible for the production of the ESs they examined revealed that, in some cases, original fieldwork had taken place but had not been reported. In our study, with its larger sample size, there was not time to make similar enquiries so an underestimate of the number of surveys undertaken is possible.

Surveys of higher plants were referred to in 40% (71) of ESs reviewed, whilst animals were surveyed in only 20% (35) of cases. Of these animal surveys, nine were specified as mammal surveys and seven described as amphibian surveys. The term surveys is used loosely because the ecological sections often suggested that only casual observations of fauna had been made, often whilst undertaking vegetation survey. Those ESs which included quantitative data (less than 10%) were for developments which had specific implications for a particular taxonomic group, such as ditch drainage (dragonflies) or marine aggregate-winning (birds, molluscs and fish).

There are at least three possible reasons for the heavy emphasis on vegetation surveys. First, vegetation surveys can be undertaken quickly and relatively easily, as plants are static; birds and mammals, on the other hand, are often highly mobile and difficult to locate, the surveyor relying upon an ability to identify their presence by other means (e.g. calls, footprints and analysis of faecal material). Second, there is a great deal more knowledge concerning vegetation survey methodology and interpretation of results than for faunal surveys (Morris *et al.*, 1995). The presentation of results from vegetation surveys are more directly related to the needs of EA, as perceived by decision makers, e.g. distribution maps which are easy to produce for static plant populations as compared with more mobile birds and mammals. Third, there are many more ecologists competent to perform higher plant surveys than for most other taxonomic groups, partly because there are relatively few plant species compared to other groups, e.g. terrestrial and aquatic invertebrates. As a result, a specialist may be needed to survey and identify each of the invertebrate groups compared to one individual for vegetation surveys.

The time of year at which an ecological survey is undertaken is important (Institute of Environmental Assessment (IEA), 1995). The timing of surveys was recorded for 63 surveys (78%). Only 37 were carried out between April and September, the period when representative results are likely to be obtained for the majority of species, though for some groups, such as migratory wildfowl and waders, it is obviously appropriate to survey during the autumn and winter. Commercial pressures and contractual obligations have made it difficult for ecologists to lobby for more appropriate field survey schedules (Treweek, 1996).

Because the time of survey is not always recorded, the extent of possible inaccuracies in survey data due to inappropriate timing is unknown.

The length of time devoted to fieldwork was not stated in the majority of ESs. In those where it was stated the time scale was of the order of one to seven days. In many cases this is likely to be inadequate. There appears to be a lack of knowledge amongst developers regarding the time (and resources) which are required to undertake ecological survey and assessment for EA. Lack of commitment to ecological aspects of EA may also derive from the cost and time implications of undertaking detailed surveys, which is reinforced by the lack of any official guidance. Until this fundamental problem is addressed the ecological content of ESs for proposed development sites will continue to be inadequate.

Conservation Status of Habitats and Species Assessed

Failure to provide information concerning the local, regional, national and international importance of species and habitats affected by proposals makes it difficult to evaluate the significance of ecological impact. Only 17% (31) stated that the species/habitats potentially affected were of local importance, 15% (27) referred to regional importance, 24% (43) to national importance and 6% (10) to international importance. It was not clear whether these figures gave an accurate reflection of conservation status. The relatively high figure for species/habitats of national importance reflects the high number of Sites of Special Scientific Interest (SSSI) directly affected or within the immediate vicinity of proposed developments. In such cases, information taken directly from SSSI citations, and presented either in the text of the report or as an appendix, indicated the conservation status of the habitat(s) or species in question.

The number of ESs noting impacts on protected species and habitats is likely to be an underestimate, given that ecological surveys were poorly conducted, may well have taken place at an inappropriate time of year or simply did not occur. It has to be concluded that official designation for nature conservation may not confer protection from development. Designation certainly does not act as a deterrent to application for development consent.

Potential Impacts upon Designated Sites

The DoE's (1989) guidelines state that information should be provided which relates to "all relevant statutory designations". For certain development types, e.g. road schemes and afforestation proposals, the proximity to designated sites is one of the indicative criteria which necessitate the undertaking of an EA. The majority of the designations considered in this analysis are designed to maintain the integrity of Britain's most important wildlife and landscape areas. It was therefore considered important to ascertain the numbers and types of designation affected, both directly and indirectly, by proposed developments (Table 5).

Our analysis indicates that four types of development—pipelines, roads, power transmission and opencast coal operations—have the potential for larger impacts upon SSSIs than others. There are two reasons for this. First, three of the four development types are linear. Linear developments tend to cover long distances and therefore have the potential to affect directly or indirectly a much larger number of designated areas. Second, the nature of these developments

Table 5. Numbers and types of designated areas which could be affected by developments covered by the 179 environmental statements analysed

Designated area	No. directly affected	No. indirectly affected
Ramsar site	2	2
Special Protection Area	2	3
National Park	2	0
National Nature Reserve	1	3
SSSI	30	160
Area of Outstanding Natural Beauty	16	2
Area of Great Landscape Value	11	3
Heritage Coastline	4	0
Local Wildlife Trust	20	7
RSPB Reserve	0	2
Local Authority	9	6
Tree Preservation Order	9	0

Note: Some developments potentially affected two or more areas with the same designation.

(pipelines and open cast operations in particular), and the public's perception of them, dictate a degree of segregation/separation from human activity. Areas selected for development are often ones with wildlife and landscape designations. This is an important point because it demonstrates the different and often conflicting interests in EA, in this case ecological and socio-economic.

Habitats Lost or Affected by Proposed Developments

Where possible, the habitat types occurring within proposed development sites were determined. This made it possible to gain an overall indication of the habitat types most threatened by development, as well as those most likely to be affected by a particular type of development (Table 6). The four main categories of wildlife habitat potentially affected by the development proposals were woodland, grassland, wetland and coastal. A fifth miscellaneous category included all those habitat types potentially affected which could not easily be assigned to one of the above four categories, e.g. wet heath, limestone outcrops, derelict quarries and railway embankments.

In the majority of the ESs reviewed, some reference was made to the habitat types found on the development site. The level of description was very variable, ranging from one line statements to in-depth classification. Where rare or declining habitats, such as grazing marsh or hay meadows, were likely to be affected, the ES generally argued that the impacts would not be significant, and/or that attempts would be made to keep the level of land-take and disturbance to a minimum. This raises the question of what is meant by 'significant'.

Woodlands were potentially affected by a large number of developments. Overall, 88 (49%) of the 179 ESs reviewed indicated potential impacts on woodland of some description (this figure does not include those developments which affected scrub, hedges and individual trees); included were 11% which affected ancient semi-natural woodlands (Table 6). These are generally valuable for nature conservation and cannot be replaced within reasonable timescales. Given their importance as areas of high landscape appeal and as wildlife sites, possible

Table 6. Number and percentage of developments potentially affecting different habitat types.

Habitat type	No.	(%)
Woodland:	88	(49)
broadleaved	69	(39)
coniferous	11	(6)
mixed	8	(5)
ancient semi-natural	19	(11)*
Scrub	49	(27)
Hedgerow	68	(38)
Individual trees	27	(15)
Grassland:	140	(78)
agricultural	33	(18)
pasture	21	(12)
improved/short term leys	11	(6)
semi-improved/unimproved/rough	51	(29)
chalk	4	(2)
wet	20	(11)
Wetlands/watercourses:	54	(30)
wetlands	11	(6)
rivers	16	(9)
streams	8	(5)
ditches	19	(11)
Coastal:	21	(12)
saltmarsh/intertidal	12	(7)
estuary	9	(5)
Miscellaneous, e.g. wet heath, limestone pavement	30	(17)

*included in woodland total.

damage or removal of such woodlands should be given serious consideration by those involved in the planning process.

Also included in the woodland category are hedgerows, scrub and individual trees. These three habitats were potentially affected by 38%, 27% and 15% of development proposals, respectively. Although not usually considered of landscape value, scrub is often an important habitat for birds and invertebrates and can provide valuable vegetation cover in otherwise urban environments. However, no ES acknowledged this and, without exception, it was stated that scrub was of little or no wildlife interest and that its removal would therefore be of little ecological consequence. Again, these potential losses should be given serious consideration because all three provide valuable habitat for British wildlife and are important components of the landscape. Impacts on hedgerows are of particular concern because an estimated 225 000 km were removed between 1946 and 1974 (Nature Conservancy Council (NCC), 1984). Despite recent grant initiatives to reinstate tracts of hedgerow it appears that potential developments are placing unacceptable pressure upon this valuable habitat type and consequently development likely to remove or damage hedgerow should be closely examined.

Potential impacts on grassland habitats were reported in 78% of statements. Included amongst these, and of particular concern, were the 29% of developments potentially affecting semi-improved/unimproved/rough grasslands, all habitats which have experienced declines and which often have high wildlife value (ibid.). Similar concern must be voiced over the 11% affecting wet

grasslands (Table 6). Wet grassland, defined as managed grassland below 200 m subject to periodic flooding (Buisson & Williams, 1991), is a particularly important habitat for Red Data birds in Britain, e.g. Bewick's swan (*Cygnus columbianus*), black-tailed godwit (*Limosa limosa*) and garganey (*Anas querquedula*) (Batten *et al.*, 1990).

The wetlands and watercourses category encompasses all types of waterways mentioned in the ESs reviewed. Waterbodies, the type most frequently encountered (30% of developments), is effectively a 'miscellaneous' one which includes marshes, bogs, disused gravel pits, ponds and canals. Also of note are the waterways, i.e. rivers, streams and ditches, which were likely to be affected by 9%, 5% and 11% of developments respectively.

Two main coastal habitat types, saltmarsh/intertidal and estuary, emerged as threatened (Table 6). Although estuaries possess intertidal zones, they were kept distinct from the saltmarsh category because 12 developments (7%) stated that their potential impact would be confined to saltmarsh/intertidal habitats, whilst nine (5%) were for development which specifically cited estuaries as being one of the habitat types affected. Estuaries are scarce/threatened wildlife areas in Britain (NCC, 1984) and potential impacts on them should always be assessed in detail.

Miscellaneous habitats were potentially affected by 17% of developments. Many of these habitats occupied small areas and, quite often, they were the product of some previous industrial activity, e.g. quarrying, railway embankments and sand and gravel extraction. There were exceptions to this, and these habitats represent some of Britain's most fragile wildlife areas, e.g. wet heaths, lichen heaths and limestone pavements.

Ecological Impacts of the Proposed Developments

Directive 85/337 states that "a description of the likely significant effects, direct and indirect, on the environment of the development, explained by reference to its possible impacts on a number of environmental factors" is to be given, including effects on the flora and fauna. The ESs were therefore reviewed to determine whether this requirement of the Directive was being met.

Potential ecological impacts of proposed schemes were identified in 93% of statements; the remaining 7% either omitted to mention impacts or stated that there were none (Table 7). The largest category of impact identified was habitat loss, with 65% of schemes indicating that this could occur. Also figuring highly as potential ecological impacts were pollution (25%), constructional disturbance (17%) and operational disturbance (14%). One type of potential indirect impact rarely considered was habitat fragmentation which was mentioned in only 4% of the ESs reviewed (Table 7). This is of concern because the nature and size of many of the developments reviewed had the potential to cause large scale fragmentation both by acting as barriers to species movements and by reducing the amount of habitat available to resident species.

The overall quality of the information on the likely ecological impacts of proposed schemes was poor in the majority of ESs reviewed. Only 11% of the ESs considered the potential complex, cumulative and interactive adverse effects which the developments could cause. Although the majority of the ESs referred to some form of potential ecological impact, few impacts were described in detail. Only 9% of statements quantified the impacts predicted, and only 3%

Table 7. Potential ecological impacts of proposed developments

Potential impact	% of developments[a]
Habitat loss	65
Pollution	25
Constructional disturbance	17
Operational disturbance	14
Habitat fragmentation	4
No ecological impact stated	7

[a]Percentages do not total 100 because of multiple impacts.

attached a timescale to the duration of the impact predicted. None of the ESs mentioned the potential indirect impacts of the development. For example, many of the developments proposed would require some form of access, usually a road. For large scale developments this would involve the extraction of large amounts of road-building materials, often from outside the immediate geographic location of the proposed development.

Mitigation

Most (78%) of the reports mentioned mitigative measures (Table 8). Of the 139 which mentioned mitigation, 89 described the management measures needed to achieve mitigation, and of these only 20 gave prescriptive details. Only four predicted the likely success of mitigation, basing the prediction on similar schemes.

Of the development proposals reviewed, 32% included planting schemes and a further 32% stated landscaping (which included tree planting) as a mitigative measure (Table 8). Planting schemes can be very beneficial to development sites

Table 8. Percentage of environmental statements, out of 179 analysed, which proposed mitigation measures against potential adverse ecological impacts

Mitigation measure proposed	% of statements[a]
Landscaping	32
Amenity tree planting	32
Habitat replacement:	
trees	16
meadows/species rich grassland	3
heathland	1
wetland	2
Habitat creation/re-creation:	
trees	34
meadows/species rich grassland	16
heathland	5
wetland	13
ponds	10
Relocation/translocation of species/individuals	10
Miscellaneous, e.g. species introduction	35
ESs proposing at least one mitigation measure	78

[a]Percentages do not total 100 because of multiple mitigation measures.

if they are correctly planned, taking site details into account and employing native trees suitable for the surrounding habitat; 98% of the schemes did not fit any of these criteria, making only vague recommendations to address the cosmetic problems of the development. The main requirement appeared to be to provide as much green cover as necessary to minimize the potential visual impacts as quickly as possible. Little if any thought was given to the long term impacts of these proposed schemes on the ecology of the surrounding area. Only two schemes proposed detailed planting prescriptions, including the relevant aftercare, which were solely comprised of native species and were stated as having nature conservation as the primary objective.

Restoration to the former habitat(s) or creation of a new one(s) once the development was complete was mentioned by 34% of ESs. Of the habitat types mentioned, some would be easy to create in something resembling the original form, but some almost impossible, e.g. wet grassland or species rich meadow. Mitigation measures were proposed by 7% of the ESs in response to a specific potential impact, and none recommended modifications to mitigative measures in the light of unforeseen post-project impacts.

Monitoring

Monitoring should be a key component of any development proposal so that the success of mitigative measures can be gauged and post-development problems identified and rectified. None of the ESs included a commitment to monitor the impacts of the proposed development, but 5% suggested monitoring as a possibility for the future. We suggest that the main reasons for failure to consider monitoring is that it is expensive to undertake and the findings of monitoring schemes may highlight areas which will be costly for developers to rectify. More importantly, there is currently no statutory requirement to undertake monitoring.

Conclusions

The results of this analysis of ESs demonstrate that there are a number of shortcomings in the current assessment of ecological impacts for EA. A major objective of this study was to determine whether or not ESs comply with the requirements of the EC Directive (85/337), which clearly states a requirement to consider impacts on the flora and fauna associated with proposed developments. The findings indicate that most ESs fail to meet these requirements with respect to ecological assessment.

In most ESs ecological data were either absent, or inadequate as a basis for reliable predictions of development impacts on the natural environment. This poor provision of data is attributable to the inadequacy, or absence, of ecological surveys. The survey information which was provided concerned itself with broad habitat descriptions, with little information about the presence of species and their distributions. Further, where species information was present too few reports placed that information in any context, i.e. the species or populations were not discussed in terms of their local, regional, national or international status.

For many of the development proposals the ability to assess the potential ecological impacts would have been assisted by quality baseline data, but the

acquisition of baseline information is currently hampered by the lack of post development consent-monitoring. Failure to predict the ecological impacts of proposed developments was common despite the fact that ecological impact prediction is a requirement under the EA Directive. It is therefore not surprising that the majority of mitigative measures were not related to any specific ecological impact and that few indications were given of their likely success. The majority of measures proposed were aesthetic and would not mitigate any real ecological damage such as species/habitat loss, pollution related problems, changes in vegetation patterns and disruption to animal breeding patterns.

Several reports were well prepared and appeared to have adequately considered most of the major components of the development site in terms of consultation and survey, but these were the exception rather than the rule. EA is a predictive tool, yet few reports attempted to predict the impacts on the ecology of the proposed development site and its immediate surroundings. This may be due, in part, to the degree of difficulty associated with predicting impacts on habitats and species, which in turn can be linked to ecologists requiring long survey periods and large data sets. These are simply not available to ecologists involved in the EA process, who have had to adapt their approach accordingly. Adding to the problem is the shortage of available advice and guidance for ecologists involved in the EA process with regard to topics such as appropriate survey methods, reporting of baseline conditions and consultation mechanisms. Ideally a series of habitat based guidelines, used in conjunction with existing guidance, e.g. Institute of Environmental Assessment, 1995; DoE, 1989, 1995, which assist ecologists when making value judgements about the ecology of a proposed development site are required. These can then be used to demonstrate simply to development proponents the ecological value of the site impacted upon by the development. These guidelines should provide a quantitative method of habitat assessment in terms of ecological value. This, in turn, should allow the significance of any potentially damaging operations to be identified at an early stage in the planning process and the ES worded accordingly.

Ecology, and more specifically ecological evaluation, has an increasing role to play in decision making regarding the acceptability of proposed developments (Booth, 1984; Bradshaw, 1984; Daniels, 1988; Wathern, 1988). A major problem associated with the role of ecology in planning in general, and EA in particular, appears to be a lack of dialogue between planners and ecologists (Clark *et al.*, 1981). Planners often fail to recognize that ecology is a science requiring the allocation of time and resources for the collection and analysis of information, usually from baseline surveys, which will then allow predictions regarding potential impacts to be made. Although good baseline data will not guarantee accurate impact predictions, the allocation of inadequate resources for data collection will make accurate prediction even less likely. Ecologists have responded to these problems in a predictable manner, with many refusing to make judgements based upon insufficient or incomplete data sets.

Ecological science has an obvious role in EA, but has tended to develop as a sub-discipline which is often under-resourced or ignored altogether (Treweek, 1996). Many of the shortcomings referred to in this paper derive from the widespread failure to consult ecologists early in the design of development projects and in the scoping of EA studies. This results in the provision of ecological information which is either of limited predictive value, or of limited

relevance. As well as much ecological survey and analysis being inadequate, there may also be cases where there is investment in the collection of ecological information which is of no analytical use. The current legislation has resulted in procedural frameworks which draw upon ecology too little and too late and which fail to encourage good practice. If EA is to develop as a tool for environmental management which helps to realize the goals of biodiversity conservation and sustainability, then it is important that ecologists have a greater input to the process, particularly in the development of its scientific basis (ibid.).

There is also a need for investment in the national monitoring data needed to place site-specific data in context. North America has a long history of EA, which has been a formal requirement for some projects since the enactment of the National Environmental Policy Act in 1969. Given this long history in EA in general, and the current commitment to national ecological monitoring (Stevens, 1994), there may well be lessons to be learned which are relevant to the development of ecological assessment for EA in the UK (Andrews *et al.*, 1977; Brink, 1978; Beanlands & Duinker, 1983; Holland, 1990; Kepner & Fox, 1991).

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