Natural England Research Report NERR016

A review of the Environmental Capital Approach in the New Approach to Transport Appraisal

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Project details

This report results from research commissioned by Natural England in order to inform Natural England's response to the Department for Transport's consultation exercise on the refresh of the *New Approach to Transport Appraisal* (NATA) (DfT, 2007). The work was undertaken under Natural England contract PYT02/10/1.29 by the following team: P. Tomlinson, D. Rapson, R. Beaumont, C. Harmer (TRL), Keith Rowe (ADAS) and Allan Provins (Eftec).

A summary of the findings covered by this report, as well as Natural England's views on this research, can be found within Natural England Research Information Note RIN016 – *A review of the Environmental Capital Approach in the New Approach to Transport Appraisal.*

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Summary

This project was commissioned by Natural England - Transport and Local Government Team with the overarching aim of informing Natural England's response to the Department for Transport's consultation exercise on the refresh of the New Approach to Transport Appraisal (NATA) (DfT, 2007). It specifically sought to provide evidence on the use and application of the Environmental Capital Approach (ECA) in NATA, to aid and inform any amendments to the Transport Analysis Guidance web site (WebTAG).

NATA was introduced in 1998 as part of the Transport White Paper and now presented via URL: www.WebTag.org.uk. NATA provides a means by the Government is able to choose between different options for solving a transport problem and also to prioritise proposals. NATA uses a multi-criteria analysis framework that combines both quantitative and qualitative information across environmental, economy, accessibility, safety and integration objectives.

ECA was developed in 1997 by the four statutory environmental bodies (Countryside Agency, English Nature, English Heritage and the Environment Agency) in co-operation with the Department for Transport and provides the methodological basis for the appraisal of environmental objectives within NATA. ECA is a means of understanding *What matters, Why and to Who?* in terms of the attributes and services society gains from its environmental assets. It is a mechanism to interpret and value these attributes and services, which can help ensure that decisions are taken in such a way that due prominence is given to each characteristic feature or asset.

This commission focussed on the application of ECA within the landscape and biodiversity topics to assist Natural England. To inform Natural England of the application of ECA, the study involved the following:

- A review of recent literature and guidance.
- A survey of practitioners.
- A review of a sample of landscape and biodiversity worksheets to identify good practice.
- A workshop to explore issues associated with appraisal practice and solutions.
- A dissemination seminar where the research findings discussed with professionals involved in appraisal practice.

Literature review

The literature review failed to discover articles that dealt with the environmental capital approach in general or the appraisal of biodiversity or landscape within NATA. Instead, the review revealed that research into landscape and biodiversity in a transport context tends to focus on the assessment process rather than appraisal. The review found that the assessment foundations on which appraisal should be based do not fully report on who is affected, why it matters and how significant the effects are judged to be. This leaves these issues to be decided by the practitioner carrying out the appraisal. Much of the assessment practice is based upon professional judgment. This in turn raises issues of transparency and whether the appraisal conclusions would be the same if the appraisal were undertaken by a different practitioner.

The landscape literature suggests that a consensus exists on the need to value the landscape in terms of the functions or services that it provides. The scale at which the landscape is judged has a key influence upon the effort expended in appraisal and assessment since it is always possible or appropriate to look at a finer level of detail. What is not explored is the selection of the appropriate scale for the exploration of landscape issues, particularly when considering the issues of who is affected and whether the impact can be mitigated by substitution.

Similar challenges associated with subjectivity and scale also emerge with biodiversity although there are some developments in ecological modelling that may be applicable to assessment practice.

International experience with appraisal tends to focus upon the broader principles of appraisal rather than landscape and biodiversity. Nevertheless, the HEATCO report recommends that a method very similar to the ECA should be used to include non-monetised impacts within the appraisal process. While no articles were found on the overseas appraisal of landscape and biodiversity in this research, appraisal practice in Norway and the Netherlands appears to capture environmental topics and should be investigated further. However, as most environmental impacts are highly site-specific the transferability of findings may be limited.

The review found that Environmental Services such as the ecosystems approach and Environmental Valuation techniques that seek to develop a monetary value for environmental impacts build upon ECA as an additional step. Thus any weaknesses in the underlying assessment and appraisal would be carried forward into these techniques. The absence of information on who is affected by transport proposals was seen from the literature and the review of practice to be a hindrance to the valuation of environmental impacts. The ecosystem services approach was not regarded as an alternative to ECA, since it is a framework for organising assessment and appraisal findings and thus is seen as offering a common methodology.

Extending monetisation into ECA was seen as being challenging due to the difficulties in separately valuing landscape and biodiversity resources. A way forward could involve the bundling of direct use values such as for recreation, enjoyment of wildlife together these being valued by the public. It would be necessary to separately capture indirect values such as those associated with carbon sequestration, flood alleviation etc. Thus particular emphasis is needed on the perception of environmental effects upon bundled direct use and indirect values of affected populations, rather than seeking monetary values for each NATA sub-objective. In the context of NATA, it is clear that the indirect services are not currently captured nor does it account for effects to user and non-user populations.

Monetisation is intended not to replace the existing appraisal reporting, indeed, it relies upon both assessment and appraisal activities as a starting point for a valuation exercise. While there are many concerns and issues associated with this approach, it may result in environmental costs being better recognised by both project design teams and decision makers.

Practitioner survey

The practitioner survey revealed that difficulties with ECA were being experienced with reports that there was some duplication in the reporting caused by the guidance. It was suggested that this is in part caused by ECA exploring each element that contributes to a topic such as the importance of the resource. The approach was considered to rely on judgement that could affect the reproducibility of the appraisal findings. The following aspects were reported by practitioners as requiring attention:

- too many elements contributing to “importance”
- confusion between substitutability and mitigation
- assumptions on standard mitigation
- scoring
- duplication in the worksheets.

Key issues emerging from the practitioner survey can be grouped as follows:

WebTAG guidance

- Excessive text that is also not prescriptive enough.
- Enhance scoring guidance.
- Relationship with Design Manual for Roads and Bridges Volume 11 needs clarifying.

Appraisal methods

- Over academic.
- Overlapping elements in ECA.
- Approach dependent upon experience of staff.
- Difficulty with tradable impacts and impact scoring.
- Duplication between substitutability and mitigation.
- Cumulative effects not adequately addressed.

Awareness of ECA

- Limited amongst clients especially local authorities.

The general absence of awareness of ECA by the local authorities or the commissioning group along with the dependence on professional judgement required by ECA suggests that there is a need for measures to deliver/ensure greater consistency between appraisals and to ensure that professionals undertaking appraisals are suitably qualified.

Review of other appraisal and assessment guidance

The key conclusions to emerge from a review of UK assessment and appraisal guidance documents, is that the approach to appraisal adopted in Wales and Scotland differs by the ability to have two levels of appraisal in recognition of the different stages of scheme development. The approach to the use of ECA and worksheets also varies with a more flexible approach being taken than in England. However the introduction of greater flexibility operates against the desire for consistency in order to judge schemes on an equal basis.

Review of worksheets

Building upon the perspectives from the practitioners' survey and appraisal guidance, the study explored what might be regarded as good practice. It also reviewed a sample of landscape and biodiversity worksheets to examine the practitioners' views and to provide evidence for the study recommendations.

Good practice in the appraisal of biodiversity and landscape is viewed as:

- An efficient and effective communication of key biodiversity and landscape issues.
- Avoidance of an encyclopaedic or a "list everything" approach since it makes the appraisal less clear and presents information of little relevance for decision makers.
- Organisation of the appraisal of features in a way that makes it clear how the overall topic appraisal score is derived.
- Clear and reasoned explanation of the value of the resource and its substitutability.
- A clear and reasoned statement on the expected impact caused by the project indicating the probability of the effect.
- Recording of key assumptions and uncertainties.
- Where the AST and worksheets are mutually supportive with the main issues included and clearly represented.

The review of worksheets identified numerous issues that suggest difficulties in understanding ECA, practical issues in its application or difficulties in understanding/applying NATA guidance. These

findings support the results from the practitioner's surveys. Both the landscape and biodiversity worksheets reveal, albeit on a relatively small sample, common issues associated with the completion of worksheets. These issues comprise:

- 'Importance, rarity and scale it matters' are often seen to be interchangeable leading to lack of clarity or duplication in the reporting.
- Supporting statements for 'scale, importance and trend' can add meaning and help justify the otherwise one or two word entry.
- Inconsistent approach to environmental capital between landscape and biodiversity as exemplified by the different prominence given to 'substitution'.
- Mitigation measures often described alongside the 'impact' entry.
- The basis on which the overall score is derived can be difficult to follow especially where long worksheets are provided.

Conclusions and recommendations

ECA is seen to be a viable method, but one that it is currently constrained by weak guidance and a strong reliance upon professional judgement that potentially may lead to a lack of consistency or repeatability or robustness in the results. In practice, there appears to be a difficulty in differentiating between the assessment that is undertaken to identify and consider the impacts, and the appraisal which has the role of communicating key information in a standard manner to decision makers. Current ECA guidance in WebTAG is presented in a manner that causes difficulties for practitioners and leads to duplication and thus some revision and simplification of the guidance is called for.

The dependence on professional judgement in ECA could be reduced by the inclusion of more evidence-backed judgements on issues such as trend and importance. In part this could be aided by the enhancement of Natural England databases from which for example, trend information on features could be provided. Reliance on professional judgement also requires that clear audit trails exist to ensure transparency and the possibility of peer review or benchmarking to ensure appraisal standards are maintained and improved.

A key issue for appraisal, and indeed for assessment, is to introduce the landscape geographic scale to biodiversity to deal with issues of fragmentation and cumulative effects that are likely to increase due to climate change. Hence the appraisal guidance should be revised to report such issues.

While the level of effort in ECA appears to be an issue, it should also be recognised that information provided must be delivered at an appropriate manner for decision makers. Here the guidance could be improved so that practitioners are aware of what is expected from them and thus devote resources in an appropriate way. The two-stage appraisal presented in STAG offers a useful model in this respect.

Turning from the application of ECA to the strategic value of the approach in delivering the Government's environmental objectives, it would appear that the environmental capital as affected by transport projects is being drawn down rather than supplemented. This raises the question of whether the environmental capital can become exhausted and how it might be managed. It also raises the question whether the transport programme should deliver negative effects overall given the broader agenda that the Government through the DfT, are seeking to deliver.

The report sets out a series of recommendations that focus upon the workings of ECA at the operational and strategic levels as well as changes that could be made to WebTAG as part of the NATA Refresh process. These recommendations are summarised below.

Table i Report recommendations

Aspect	Recommendations on ECA
Attributes Recorded	DfT should consider amending ECA to introduce a landscape geographic scale to appraisal of biodiversity impacts.
Level of Effort	The level of effort does not appear to be a constraint, however, to do appraisal correctly may involve a greater amount of effort particularly in moving towards a more evidence led process.
Level of Effort	DfT should retain and build on ECA to capture who is affected to deal with issues of substitutability however it should also ensure that the information provided is at an appropriate level of detail for decision makers.
Databases	Natural England should explore the development of its databases to incorporate ECA attributes at landscape and ecosystem levels.
Predictive Models	Natural England should explore the ability of ecological models to enhance quantitative predictive abilities where Natura 2000 sites may be affected by transport proposals that would require an Appropriate Assessment.
Monetisation Techniques	It is suggested that DfT undertake further research is on monetising environmental effects with particular emphasis on the perception of affected populations of these effects, rather than seeking values for each sub-objective. To facilitate the use of monetary values in appraisal, impact assessments should also account for effects to user and non-user populations.
Programme Level Effects	DfT should use the data generated by NATA to investigate the extent to which its transport investments deliver positive outcomes across all Government objectives, and consider how procedures could be changed to encourage the delivery of cost effective beneficial outcomes.
Benchmarking	The DfT could explore whether impacts are appropriately scored by an audit of a yearly sample of appraisals, or by benchmarking appraisals using practitioners undergoing training or accreditation.
Trade-offs	DfT should investigate the use made of ECA in trade-offs between affected sites at the strategy and project level. It should draw attention in the guidance to the issue of trade-offs between landscape, biodiversity and cultural heritage to ensure that the scores applied recognise that the mitigation proposed in one topic may affect the score in another.
Appraisal	The DfT should introduce a two part worksheet separating factual from impact information based on the STAG biodiversity worksheet.
Environmental Assessment	Natural England is advised to engage with the Highways Agency in the development of the revised assessment guidance.
Clarity	The DfT should separate key instructions from other text.
Clarity	The DfT should ensure that all instructions are straight forward to implement.
Description	DfT may wish to consider whether location ought to feature in the description of the landscape features and whether the column “area” in biodiversity worksheet should be removed with location featuring within the description entry.
Scale it Matters	DfT should consider incorporating “scale” within a single importance entry.

Table continued…

Aspect	Recommendations on ECA
Rarity	DfT should consider whether there is value in retaining “rarity” given the duplication that is caused.
Importance	DfT should devise a standardised scale of importance for landscape, habitats and species. This should remove geographic scale from the analysis and also consider who is affected.
Trend	Appraisal guidance should make references to sources for trend information such as the Biodiversity Action Plans and the analysis of “Forces for Change” within landscape character assessments. The use of these should be referenced in the appraisal worksheets.
Value	DfT should consider deleting reference to “value” from the biodiversity worksheet.
Substitution	DfT should introduce “ease of substitution” into the biodiversity worksheet to be consistent to ECA.
Substitution	DfT should amend the guidance such that the description and the magnitude of the impact are provided for both landscape and biodiversity topics.
Substitution	The DfT should consider adopting a scale for substitution (Low, Moderate, High) to reflect the extent to which landscape elements and biodiversity features are likely to be effectively substituted by year 15 after opening of the transport project.
Mitigation	WebTAG should state that mitigation measures should only be taken into account where it is reasonably certain that the impact will be moderated within a given period of time.
Additional mitigation	The DfT should consider replacing additional mitigation by “costed enhancement measures” and include across all environmental objectives.
Tradeable impacts	DfT should bring the guidance from unit 3.3.6 on scoring into all environmental appraisal topics and further explore the robustness of scoring practice.
Cumulative effects	DfT should consider how cumulative effects can be reported within the worksheets in an auditable manner.
Scoring	The landscape worksheet should be amended to capture the effects of visual intrusion upon key viewpoints also recording who would be affected.
Scoring	DfT should review the definitions for the landscape scores.
Scoring	The approach to scoring biodiversity impacts should be reviewed.
Scoring	The scores should be reported as appraisal scores rather than assessment scores to help differentiate appraisal from assessment activities.
Worksheets	DfT should amend unit 3.3.10 to exclude features of negligible nature conservation value from worksheets.
Worksheets	The DfT should limit the extent of species information to be recorded in the biodiversity worksheets.
Worksheets	DfT should enhance the way landscape guidance deals with substitutability.

Table continued…

Aspect	Recommendations on ECA
Uncertainty	The DfT should require that uncertainty should be identified on the worksheets within the impact entry and that where uncertainty attaches to the more adverse scores that the key assumptions should be recorded on the worksheet and agreed with the statutory environmental bodies.
Consultations	The DfT should encourage the project proponent to consult with the statutory environmental bodies where their interests are affected.
Access to information	DfT should require the publication of all ASTs and worksheets to ensure that the appraisal scores are robust.
Access to information	DfT should include within unit 2.5 a requirement that the AST and worksheets should be made available to the public via the internet.
Auditable process	Increase the confidence in appraisal scores such that subjectivity does not play a major role in the scoring or that given the same information, appraisal teams would tend to arrive at the same conclusion.

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1 Introduction

Background

1.1 The New Approach to Appraisal (NATA) was launched in 1998 when the in-coming Labour Government published its Guidance on the New Approach to Appraisal with an accompanying report in which the road schemes following from 'Roads to Prosperity' were appraised. Since then NATA has evolved through the Guidance on Methodology for Multi-Modal Studies (GOMMMS) and then into WebTAG.

1.2 A review of NATA was undertaken; the *NATA Refresh* was a DfT exercise to update NATA (DfT, 2007), open to consultation until 31st March 2008. It was an opportunity for a review of the approach to appraisal with the DfT wishing to explore the following key issues:

- make the guidance fully multi-modal;
- improve its use for non-infrastructure proposals;
- align with DfT's new objectives;
- improve consistency with other advice;
- update presentation;
- rebasing of costs and benefits;
- development of an environmental valuation strategy;
- align with post-Eddington priority links;
- improve summary information.

1.3 In improving consistency with other guidance, the DfT also wish to explore combining Environmental Impact Assessment (EIA), appraisal methodologies and scoring systems into a single guidance resource. This raises issues of the appropriateness of the standard methodologies of appraisal versus the fit for purpose and proportionate methods applicable to EIA. The key distinction between these two methods is that appraisal is used help inform decisions and prioritise allocation of government resources, whereas EIA is an assessment process to determine the likely significant effects of a project on its immediate environment. Environmental assessment is combined with the study of safety, economic and integration to inform transport appraisal reporting.

1.4 A key theme in the current DfT consultation is the valuation of the environmental impacts of transport schemes. This approach is in support of the HM Treasury's Green Book guidance which indicates that wherever possible, appraisal should seek to compare monetary valuations of a proposal's costs and benefits.

1.5 Importantly, monetisation of environmental impacts is not an alternative impact assessment. Appropriate application of monetary values requires an assessment of the impacts that sets out the context that economic valuation should account for. With this in mind, the review of the ECA offers an opportunity to investigate the extent to which, in its current form the ECA could aid valuation of impacts on landscape, biodiversity, heritage of historic resources and water environment sub-objectives.

1.6 ECA was developed in 1997 by the four statutory environmental bodies (Countryside Agency, English Nature, English Heritage and the Environment Agency) in co-operation with the DfT. The approach is a means of understanding *What matters, Why and to Who?* in terms of the attributes and services society gains from its environmental assets. It is a mechanism to interpret and value

these attributes and services, which can help ensure that decisions are taken in such a way that due prominence is given to each important feature or asset.

1.7 The initiative offers a systematic way of recording which landscape areas and features or attributes matter to people and why, by analysing the services and benefits they provide. The approach helps place values on the commonplace as well as the unusual and rare, and allows stakeholder values to be seen alongside scientific and professional values. Analysis of other aspects of environmental capital, namely importance, area and trends relative to the target are also undertaken.

1.8 Outside NATA, the approach was further developed, first into Quality of Life Capital and then became termed Quality of Life Assessment (Countryside Agency et al 2001a and 2001b), which developed the *what matters why and by who?* approach of environmental capital into a tool for guiding decisions on the sustainable management, development and use of land.

1.9 The main questions this approach aims to answer are:

- What are the characteristics or attributes of this place or object(s) which matter for sustainability?
- How important is each of these, to whom, and for what reasons/purposes?
- What, if anything could replace or substitute for each of these benefits?
- On current trends do we expect to have enough of each of them?

Objectives

1.10 This project has the overarching objective of providing Natural England with evidence on the ECA in NATA, to aid and inform any amendments to the WebTAG guidance.

1.11 The brief from Natural England set out a requirement for the following tasks:

- Establish a concise literature review of any research relating to environmental capital, including case studies and similar methodologies.
- Identify and speak to a small selection of key practitioners (DfT, statutory environmental bodies, users of WebTAG and scheme developers) to establish their views regarding the environmental capital approach and its success in identifying environmental benefits and impacts.
- Examine the links between environmental capital guidance in WebTAG and other related areas such as Strategic Environmental Assessment and Sustainability Appraisal, and the DMRB guidance in Volumes 10 and 11, including a discussion of any potential alternatives to the environmental capital approach.
- Identify good practice showing the correct application of environmental capital in appraising the environmental impact of a transport scheme - ideally from both the landscape and biodiversity sub-objectives.
- Examine and discuss the WebTAG guidance and make recommendations for any amendments that might improve the guidance on environmental capital, considering both the theory and the practical application of the environmental capital approach in this discussion.
- Identify issues for further/future consideration that will improve the understanding and application of the environmental capital approach: evidence gaps, trends in policy and decision-making, environmental challenges, training requirements.
- Ensure the report's advice and recommendations are tailored to the DfT consultation on the refresh.

1.12 Our approach to these tasks is outlined in Section 2 of this report. The project has been guided by the input and advice of a Steering Group made up of representatives from Natural England, DfT, Defra and English Heritage.

2 Study methodology

Task 1: Literature review

2.1 The literature review sought to identify articles that had been published since 2005 (or earlier if considered to be of significance to the subject) relating to environmental capital, including case studies and similar methodologies. The approach to identifying articles focused upon:

- Appraisal practice at plan and project levels focusing upon landscape and biodiversity issues.
- Literature associated with environmental valuation and ecosystem services building upon previous research undertaken by Eftec in 2004.
- UK and European literature defining the state of landscape appraisal methodologies and in This task involved identifying and speaking to a selection of practitioners (commissioning bodies, local authorities, and scheme designers) to establish their views on the environmental capital approach and its success in identifying environmental benefits and impacts at both a plan and project scale.

2.2 The literature review sought to establish whether similar methodologies exist and identify case studies. In particular it sought to identify the following:

- The planning scale at which the methodologies apply (policies, plans, projects).
- The landscape issues addressed.
- The extent to which a habitat or species approach are used in biodiversity appraisal.
- Whether the methodologies being described aid issues of the substitutability and trade-ability of landscape and biodiversity assets.
- Whether scoring/significance criteria are provided.

2.3 The literature review did not consider articles dealing with:

- EIA assessment methods;
- survey and assessment methods.

Task 2: Views of practitioners

2.4 This task involved identifying and speaking to a selection of practitioners (commissioning bodies, local authorities, and scheme designers) to establish their views on the environmental capital approach and its success in identifying environmental benefits and impacts at both a plan and project scale.

2.5 A structured questionnaire was prepared and reviewed by the project steering group. It was tailored slightly to reflect the differing roles of three sets of practitioners. Responses were recorded on an Excel spreadsheet.

Task 3: Relationship between appraisal, SEA/SA and DMRB

2.6 Task 3 involved an exploration of the links between environmental capital guidance in WebTAG and other related areas such as Strategic Environmental Assessment and Sustainability Appraisal, and the DMRB guidance in Volumes 10 and 11. This was undertaken through:

- Consideration of how the ECA methodology could be applied to SEA/SA.
- Consideration of the biodiversity and landscape attributes currently being recorded in the HA's ENVIS system to highlight the extent to which the ECA is considered.
- A review of the extent to which the ECA features within the modernised DMRB Volume 11.
- A review of other appraisal frameworks (project assessment for ports; major scheme appraisal in Local Transport Plans; appraisal frameworks for airports; appraisal criteria for rail) to confirm if different interpretations of ECA occur.

Task 4: Good practice

2.7 Task 4 involves identifying good practice showing the application of environmental capital in appraising the environmental impact of a transport scheme from the landscape and/or biodiversity sub-objectives. The following strategies were followed to assemble three examples of what might be regarded as appraisal good practice:

- Review of Highways Agency worksheets prepared within the last two years for biodiversity and landscape where the review process was satisfied with their quality.
- Use the survey of practitioners to collect what are seen to be good examples by others.

Task 5: Recommendations to enhance guidance

2.8 This task examines and discusses the WebTAG guidance and makes recommendations for any amendments that might improve the guidance on environmental capital. There was a need to consider both the theory and the practical application of the environmental capital approach in this discussion. The theoretical approach was therefore led by the findings from Task 1 while the practical approach was informed by practitioner feedback and the relationship with existing and emerging guidance.

2.9 Recommendations were developed through a team workshop (TRL, Eftec and ADAS) held on 25th February 2008, which Natural England also attended.

Task 6: Other issues and opportunities

2.10 The workshop held for Task 5 was also used to identify issues for further/future consideration that may improve the understanding and application of the environmental capital approach: evidence gaps, trends in policy and decision-making, environmental challenges, training requirements. Issues discussed included:

- Whether the ECA methodology is being correctly applied and is helpful at an individual resource level for example, a landscape character zone, or particular habitat.
- Whether the methodology is helping scheme design teams to make trade-offs between landscape and biodiversity features that might be at risk.
- Whether at a programme level (defined either geographically or by organisational type) the capital resource of the natural environment is being maintained. Thus where individual schemes show a draw-down on the capital, that others ought to provides for some replenishment.

Task 7: Reporting and dissemination seminar

2.11 The findings from the draft report were presented to a dissemination seminar held on 7th March 2008 which was also used to collect further views on the research findings. This feedback has been incorporated into the final version of this report.

3 Literature review

Approach

3.1 This literature review sought to explore the application of ECA to landscape and biodiversity. This was based on a search of journal articles and grey literature published since 2005. It also involved a review of recent work undertaken by Eftec in relation to valuation and ecosystem services. In reviewing landscape and biodiversity, the following journals shown in Table 1 below were consulted:

Table 1 Journals consulted for landscape and biodiversity literature review

Landscape	Biodiversity
Agriculture	Environmental Impact Assessment Review 24(1) to 27 (8)
Ecosystems and Environment	Ecological Economics 25(1) to 27(8)
Environmental Impact Assessment Review	Journal of Environmental Assessment, Policy and Management 7(1) to 9(4)
European Environment Geoforum	Journal of Environmental Management 74(1) to 86(3)
Journal of Environmental Management	Journal of Environmental Planning and Management 47(1) to 50(1)
Landscape Ecology	Landscape Research 30(1) to 32(5)
Landscape Research - Land Use Policy	Impact Assessment and Project Appraisal 23(1) to 25(3)
Progress in Planning	Ecosystems 8(1) to 10(7)
Structural Survey	Biological Conservation 121(1) to 141(1)
Transport Policy	

3.2 The total number of references for landscape were 34 (peer-reviewed papers: 29; reports: 5). Of the 34 references found, 19 were used. For biodiversity, a total of 27 journal articles were reviewed based on the literature review. Six articles provided information of relevance to this study.

3.3 It was found that there were no articles that dealt with the appraisal of landscape or biodiversity issues. Much of the literature identified that dealt with appraisal addressed the broad principles of appraisal within transport planning, generally with an economic perspective. The articles identified were screened to focus upon the ECA and appraisal components, thus those dealing with survey techniques were not reviewed.

Landscape appraisal

Landscape Character Assessment (LCA)

3.4 Jensen (2006) observed that the concept of landscape has changed through time, derived from an analysis of the landscape definitions within three different landscape assessment methods:

- Landscape evaluation (applied mainly in the 1970s).
- Landscape assessment (applied in the 1980s).
- Landscape Character Assessment (LCA) (applied from 1990 onwards).

3.5 The concept of landscape found in the LCA guidelines relates to parallel developments in wildlife (English Nature, now Natural England) and heritage conservation (English Heritage), where both were working within a broader perspective to conservation than site-specific protection. As the LCA guidance sees landscape as multi-dimensional by definition, as a relationship rather than a resource, this opens the way for landscape assessment to provide an integrative analysis approach. LCA is a tool that can be applied to a variety of spatial problems.

3.6 Until the Countryside Agency introduced LCA, landscape assessment had mainly been about landscape management. LCA is seen as a suitable tool to bring diverse concerns together to achieve sustainability goals. With its broad range of applications, it seems as if this role is acknowledged, if not on a policy level, at least by landscape professionals. Thus, with both policy and landscape assessment indicating a move towards the socio-economic and environmental concern at a landscape level, a new way of management through landscape seems to be emerging (Jensen, 2006).

3.7 Over the past decade, the Countryside Agency (now Natural England) strongly promoted the mapping, description and use of coherent visual units under the umbrella of its Countryside Character Initiative, partly as a means of reducing reliance on selective designations, and partly as a means of targeting countryside policy delivery. Key elements have included the Countryside Character Programme and the specific methodology of Landscape Character Assessment (LCA) (Swanwick, 2002), and these reflect a desire to move beyond traditional concerns of landscape evaluation towards a recognition of innate landscape distinctiveness (Hamilton and Selman, 2005).

Scale

3.8 Landscape Character Assessment can be applied at scales from the national or indeed European level to the parish level. Ideally assessments at different scales should fit together as a nested series or a hierarchy of landscape character types and/or areas so that assessment at each level adds more detail to the one above (Swanwick, 2002). The three main levels at which Landscape Character Assessment are carried out are:

- **National and regional scale**: Work at this level is to a small scale (typically at 1:250,000) and may cover the whole of a country or a large region (as has been done for both England and Scotland) to identify broad patterns of variation in landscape character. These patterns result from the underlying geology and landform overlaid with the influence of broad ecological associations and key aspects of settlement and enclosure history. This results in the identification of distinct landscape types and areas at this broad scale, for example chalk downland or montane plateau, as well as the character areas where they occur, which are distinct geographical areas such as the South Downs or the Cairngorms.
- **Local authority scale**: Within these broad patterns of landscape character it is possible to identify a finer grain which can be mapped and described through Landscape Character Assessment applied at the county, district or unitary authority level in England or at the council area level in Scotland. The appropriate scale of working is normally 1:50,000 or 1:25,000 scale. This results in the definition of landscape types, which have unity of character due to particular combinations of landform and land cover, and a distinct pattern of elements. They might include river floodplains, plateau moorlands or enclosed farmland. Once again, character areas at this scale are the discrete geographical areas where each type occurs, conveying a sense of place.
- **Local scale**: Sometimes it may be necessary or appropriate to carry out an assessment of a smaller area at 1:10,000 or even larger scales, such as an individual parish, or an estate or farm, a country park or a proposed development site. At this local scale it is important to set

the area firmly in the context of a wider character assessment, to show which landscape type/area it falls within. A detailed assessment may then either map landscape types and/or areas at an even finer scale, or add detail by mapping and describing the individual elements which contribute to the character of the area, such as hedges, arable fields and farm buildings. Local assessments may also consider the contribution made by the site to the character of the surrounding area as well as views into and out of it.

3.9 Swanwick (2002) also notes that assessments can also be carried out at intermediate levels between those noted above but the same general principles should apply:

- There should be a clear distinction between landscape character types and landscape character areas whatever the scale (although at smaller scales it is often appropriate to deal only with local character areas).
- The assessment should relate to landscape character types and/or areas established at higher and lower order levels and should form a seamless connection with assessments on either side of administrative boundaries.
- The more local the scale, the greater the level of detail required.

Landscape issues

3.10 Landscape character is assessed in terms of the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape. Particular combinations of geology, landform, soils, vegetation, land use, field patterns and human settlement create character. Character makes each part of the landscape distinct, and gives each its particular sense of place. Forces for change or key issues will often be identified as well, such as ongoing land use change and types of development pressures (Swanwick, 2002).

Substitutability and trade-ability of landscape assets

3.11 Many Landscape Character Assessments will be used to help in decisions about the ability of an area to accommodate change, either as a result of new development, or some other form of land use change. In these circumstances judgements must be based on an understanding of the ability of the landscape to accommodate change without significant effects on its character. Criteria for what constitutes significant change need to be identified in planning policies or landscape strategies, and will usually be informed by potential effects on character and/or particular features and elements (Swanwick, 2002).

Presence of scoring/significance criteria

3.12 The judgement-making stage of LCA is based on the results of the characterisation process and involves making judgements about landscape character to inform particular decisions. This may result in a range of different outputs, each aimed at a particular need. These outputs may either:

- Directly inform decisions about landscape through, for example, the preparation of planning policies, and strategies for the conservation and enhancement of landscape character. Or
- Feed into broader decision-making tools (such as Environmental Impact Assessment or Quality of Life Capital) and strategies (such as Regeneration Strategies or Woodland Strategies) where landscape is only one of a broad range of environmental issues under consideration (Swanwick, 2002).

LANDMAP

3.13 LANDMAP is an approach introduced by the Countryside Council for Wales (CCW) in 1997, as an evaluative framework to provide information for countryside planning and management (see http://landmap.ccw.gov.uk/). LANDMAP is a landscape assessment framework, using both objective and subjective data collection methods. It aims to incorporate all factors of the landscape into planning decisions to provide a more robust means of assessing land-use potential. LANDMAP assessments have been carried out by the majority of Welsh County

Boroughs and are currently being undertaken at the local scales within these areas (Hamilton and Selman, 2005; Moore-Colyer and Scott, 2005).

Scale

3.14 Mapping is undertaken within a traditional administrative context, and assessments are carried out at various scales within unitary authority boundaries.

Landscape issues

3.15 LANDMAP separates the landscape into five aspects:

- **Geological landscape**: A study of the geology, geomorphology and hydrology of the area.
- **Landscape habitats**: The distribution of vegetation and habitats and the basis for landscape ecology.
- **Visual & sensory**: Those landscape qualities that are perceived through the senses. It deals with the individual physical attributes of landform and land cover, as well as their visual patterns of distribution and sensory characteristics, and the relationships between them in a particular area.
- **Historic landscape**: How archaeological and historical sites relate to each other and to the surrounding landscape.
- **Cultural landscape**: The relationship that exists between people and places; how people have given meaning to places, how the landscape has shaped their actions and their actions have shaped the landscape.

3.16 The LANDMAP approach adopts a descriptive approach to the landscape in which significant contributors to the landscape are identified. The evaluation matrix used to input the qualities of the landscape is presented below (see Table 2). Other evaluation matrices exist for historic landscape (see Table 3) cultural landscape (see Table 4) and visual and sensory (see Table 5).

Table 2 Geological landscape evaluation

Evaluation Criteria	Unknown	Low	Moderate	High	Outstanding
Research value					
Educational value					
Historic value					
Rarity/ uniqueness					
Classic example					
Overall evaluation					
Justification of overall evaluation					

Table 3 Historic landscape evaluation

Evaluation Criteria	Unknown	Low	Moderate	High	Outstanding
Rarity					
Survival/preservation					
Coherence					
Potential					
Amenity value					
Overall evaluation					
Justification of overall evaluation					

Table 4 Cultural landscape evaluation

Evaluation Criteria	Unknown	Low	Moderate	High	Outstanding
Recognition/ transparency					
Period					
Rarity					
Documentation					
Group value					
Survival					
Vulnerability					
Diversity					
Potential					
Overall evaluation					
Justification of overall evaluation					

Table 5 Visual & sensory evaluation

Evaluation Criteria	Unknown	Low	Moderate	High	Outstanding
Scenic value					
Integrity					
Character					
Rarity					
Overall evaluation					
Justification of overall evaluation					

Substitutability and trade-ability of landscape assets

3.17 To use Landscape Habitats as an example, any changes or loss of habitats, vegetation patterns and associated features through lack of management, removal or changing policy affects both biodiversity and landscape diversity, having consequences for biodiversity values. The Aspects are inter-related and the management of one may influence the condition and value of another and any substitution will result from the subjective analysis of the current features and the alternative actions available.

Presence of scoring/significance criteria

3.18 No information was available on scoring criteria.

Environmental Impact Assessment (EIA)

3.19 Within EIA quantification of the more factual or objective dimensions of landscape and visual impacts is possible, however consideration of impact significance is strongly characterised by qualitative approaches. Indeed, landscape considerations are identified as probably the most subjective of all the impacts (Wood, 2008).

3.20 Wood concluded that, for landscape and visual assessment, over one third of the EISs reviewed made little or no attempt to communicate the approach employed to evaluate impact significance. By implication, the use of expert judgement remains essentially an opaque or black box exercise, with limited explanation or justification for the significance determination. In cases where more explicit and transparent criteria were employed, the lack of formal or orthodox standards for determining the significance of landscape and visual assessment necessitates the use of customised approaches that were found to vary. Although the judgement of the expert is potentially more transparent in such customised approaches, issues of consistency and comparability of practice arise and the formulation of criteria is potentially unconstrained and remains open to manipulation.

Landscape issues

- In accordance with the European EIA Directives, the UK regulations require an EIA to consider the direct and indirect effects of a project proposal upon the landscape. In practice, most EIAs distinguish between landscape impacts (on landscape receptors) and visual impacts (on visual receptors). Landscape impacts relate to *changes in the fabric, character and quality of the landscape*, whilst visual impacts may be considered to represent a subset of landscape impacts, focussing upon *changes in the available views of the landscape, and the effects of those changes on people* (Wood, 2008).

Presence of scoring/significance criteria

3.21 Significance is generally determined on the basis of expert judgement. To minimise the risk of challenge by other experts it is important to ensure that the manner in which significance has been attributed is transparent and repeatable. The most effective way of doing this is to devise significance criteria on which to base the decision. Broadly, significance is a function of:

- the value of the resource (international, national, regional and local level importance)
- the magnitude of the impact
- the duration involved
- the reversibility of the effect
- the number and sensitivity of receptors (see Table 6).

3.22 Significance criteria that are devised (see Figure 1) should take account of these factors (DCLG, 2006).

Table 6 Significance thresholds for landscape receptors (after Wood, 2008)

		LANDSCAPE SENSITIVITY		
		LOW	**MEDIUM**	**HIGH**
MAGNITUDE OF CHANGE	**HIGH**	Moderate impact	Substantial impact	Substantial impact
	MEDIUM	Slight impact	Moderate impact	Substantial impact
	LOW	Slight impact	Slight impact	Moderate impact

Major: Where the extent of the impact on landscape character is large in scale or magnitude as a result of high sensitivity to change or a high intrinsic value and as a consequence the integrity of that asset will be significantly changed. The impact of national or regional importance, and will be of long term nature (or very severe short term), irreversible and certain or likely to occur.
Moderate: Where the extent of the impact on landscape character is small in scale or magnitude as a result of low sensitivity to change or low intrinsic value. The impact is of district importance. The impact will be of medium or short-term nature and likely to occur.
Negligible: Where the extent of the impact on landscape character is barely noticeable in scale or magnitude as a result of low sensitivity to change or a low intrinsic value. The impact is of local importance. The impact will be of short-term nature and unlikely to occur.

Figure 1 An example of impact significance criteria (after Wood, 2008)

3.23 Wood recommended participatory approaches, such as the Quality of Life Capital methodology where the emphasis shifts from the determination of significance relating to standard EIA impact themes (noise, landscape, water quality, air quality etc.). Instead the focus is upon the benefits that different groups perceive to be provided by the baseline environmental situation, and the extent to which these might be substituted or improved through project design alternatives.

Quality of Life (QoL) Capital

3.24 The Quality of Life (QoL) Capital assessment is a sustainability appraisal tool used in management and decision making, based on the Environmental Capital Approach, and is a joint project of Natural England, the Environment Agency, and English Heritage. As a process, it seeks to ask the questions: *What matters, why and to who?* This enables practitioners and decision-

makers to better understand the potential consequences of plans, development proposals and management decisions (CAG Consultants and Land Use Consultants, 2001). The QoL Capital approach is summarised below.

- define the purpose of the exercise;
- define the character of the area;
- identify environmental benefits/disbenefits;
- evaluate environmental benefits/disbenefits;
- determine management implications;
- monitor.

3.25 The technique seeks views on:

- How important is each of these benefits or disbenefits, to whom, and why?
- On current trends, will there be enough of each of them?
- What (if anything) could substitute for the benefits?

3.26 The answers to these questions help to define objectives that development/management on that site should deliver, how they could be achieved, and their relative importance. The process identifies the benefits that the development would have to provide before it was considered acceptable.

3.27 CAG Consultants and Land Use Consultants (2001) state that the Quality of Life Capital approach seeks to:

- Identify the main features, or things, which characterise the place or building in question. Consider the various benefits (and any disbenefits) of the features.
- Determine the importance of the benefits (and disbenefits) according to the following criteria:
  - The **scale** (international, national, regional, local) at which they matter.
  - Their **importance** (high, medium, low) at that scale.
  - Whether there are sufficient, insufficient, or more than sufficient, of these benefits, according to society's preferences or any targets for these benefits (and disbenefits).
  - Whether, and if so how, these benefits could be **substituted**, by the same or a different feature, to provide the same benefit.

Landscape issues

3.28 The definition of the landscape character of an area is very similar to that used in the EIA methodology.

Landscape diagnosis

3.29 Bastian and others, (2006) discusses the methodology and application of landscape diagnosis, which is now viewed as a collection of tools and approaches. The objective is to determine the capability of landscapes to meet various societal requirements. As a consequence, landscape diagnosis defines limits and thresholds, to protect the stability of natural conditions and potentially increase its ability to supply goods and services. The diagnosis is derived from the results of landscape analysis that identifies landscape structure and processes. It is also the starting point for both practical landscape management and theoretical landscape prognosis.

3.30 Within the procedure of landscape diagnosis, the assessment of landscape functions is a key element. A landscape's performance or delivery of goods and services, with an appreciation of the systems sensitivity and carrying capacity is needed. The information must be interpretable from the local to the regional perspective not only for appropriate planning and management, but also to enable an assessment of sustainable landscape development.

3.31 This approach goes far beyond the traditional description of the landscape or the analysis of a small set of basic structural parameters. Every landscape has many functions for man and society. Assessing landscape functions solves the crucial evaluation problem of the linkage between (natural) scientific and societal issues. This aspect of landscape diagnosis brings it into alignment with the capital approach.

Scale

3.32 Analysis is undertaken using either biophysical or landscape spatial reference units. The 'biophysical unit' is that part of a landscape, which is determined by its natural components (geological and geomorphologic structure, soil, water, climate, flora and vegetation, fauna). The biophysical units selected are usually river catchments, and analysis can be applied from the local to regional scales. The landscape units are outlined in Table 7 below.

Landscape issues

3.33 Landscape diagnosis aims at the assessment of all functions, goods and services that a landscape is capable of supporting, not just economic (or agricultural) ones.

Table 7 Spatial dimensions, characteristics and criteria used to delimit landscape units (after Bastian et al., 2006)

Spatial dimension	Spatial characteristics	Criteria
Landscape element	Homogeneous, usually clearly delimited land use unit; heterogeneous, small-scale complexes (defined by use), for example; hedges, ponds, roads	Land use, land cover
Landscape unit 1st order	Heterogeneous land use mosaics, usually dominated by one of these land uses and (including villages)	Land use mosaics; clearly defined borders based on microchores; functional areas in cities, or towns with up to 5000 inhabitants
Landscape unit 2nd order	Heterogeneous land use mosaics including small towns of up to 5000 inhabitants	Land use mosaics; less precise border definition based on lower order mesochores; combinations of functional areas in cities, or towns with between 5000 and 20,000 inhabitants
Landscape unit 3rd order	Heterogeneous land use mosaics including small towns of up to 20,000 inhabitants	Land use mosaics; less precise border definition based on higher order mesochores; combinations of functional areas in cities, or towns/ cities with between 20,000 and 200,000 inhabitants
Landscape region	Very heterogeneous land use mosaics	Land use mosaics; less precise border definition based on macrochores; including large conurbations and municipal regions

Substitutability and trade-ability of landscape assets

3.34 Landscape diagnosis looks at performances (that is, benefits, goods and services derived from the landscape) to satisfy human (socio-economic and ecological) requirements. In more detail, this covers:

- The performance and capacity of an area, in particular the resources, potential, goods and services and landscape character.

- The loads and carrying capacity, such as the risks/impacts/pressures, sensitivity and persistence/stability of the features in question.
- The suitability of utilisation, that is, the mono- and multi-functionality, and the suitability of the study area for these functions.

Presence of scoring/significance criteria

3.35 The landscape functions are analysed using the following procedure:

- Selection of landscape functions.
- Data management and parameter derivation: Primary data is integrated in a GIS for analysis, modelling, assessment and visualisation.
- Landscape analysis: Indicators are defined, which are suitable for the assessment of landscape functions based on primary parameters, parameter combinations, or modelling.
- Landscape evaluation: Definition of normative standards is crucial. Environmental quality objectives are needed as a prerequisite for target definition, evaluation and conflict resolution.

3.36 Multiple functions are analysed through overlaying the datasets in the GIS analysis phase.

Landscape conclusions

3.37 The conclusions drawn from the landscape literature review are:

- No articles were encountered dealing with landscape appraisal in support of NATA.
- Role of stakeholder views alongside professional views is valued.
- Literature recognises the effort required by ECA and QoL and this may have contributed to its low uptake in other policy areas.
- While substitutability is recognised by the landscape methods there is little practical guidance on how it is to be judged or reported although landscape diagnosis takes an approach based on the goods and services.
- There is a lack of robust approaches to significance reported in the literature and much relies upon the judgement of landscape professionals.
- No clear indication on how the issue of scheme size is to be considered.
- Difficulties exist with selecting an appropriate level of landscape resolution for appraisal.
- Designation of a landscape implies that it matters to the public, however deciding what matters and to who within non-designated landscapes remains problematic.
- There is a need to use ‘forces for change’ in the landscape to report on trends that may influence the speed and nature of landscape change.

Biodiversity appraisal/assessment

3.38 This aspect of the literature search did not reveal articles dealing with how biodiversity impacts are dealt with under the New Approach to Appraisal, although some articles considered how biodiversity was assessed within EIA and SEA. The other dominant theme to emerge was the development of ecological modelling techniques.

Habitat fragmentation

3.39 As noted from the literature, there is currently a lack of guidance on how to predict the effects of fragmentation caused by projects on habitats. While studies can be found on the analysis of the impacts caused by habitat fragmentation, these tend to focus on modelling the response of one habitat or species and are orientated to site-related conservation plans. Consequently, these are difficult to apply in more general assessments.

3.40 Selier and Eriksson (in Geneletti 2006) suggest the use in EIA of landscape spatial parameters, such as patch size, shape and distribution, to predict disturbances caused by fragmentation. Byron (in Geneletti 2006) also suggests the need to measure the changes in the ecosystems' structural relationships (spatial linkage, connectivity).

3.41 A few techniques do exist to assess fragmentation impacts, for example, Palmeri and Gibelli in Geneletti (2006). Here the authors studied two landscape metrics: patch size and patch density.

Scale issues

3.42 The scale at which ecological issues are being examined is a central issue (Wiens in Gontier 2007). Many ecological components and factors such as habitat, animal density, patch geometry or resource availability vary and act differently at differing scales (Morrison and Hall in Gontier 2007). Different scales govern different ecological processes and the impact of fragmentation on biodiversity may also vary at different scales (Olff and Ritchie in Gontier 2007). Lastly, the scale of observation will influence the patterns being described or predicted (Levin in Gontier 2007). Adopting a specific spatial scale is important for the assessment of specific impact types such as cumulative effects as it can greatly influence the outcome.

Ecological modelling

3.43 In parallel to the application of biodiversity assessment has been the evolution of various forms of ecological modelling reflecting developments in computing power, GIS software, remote sensing, databases and statistical modelling (Guisan and Zimmerman; Lehmann et al in Gontier 2006).

3.44 A study by Gontier et al (2006) identified the need and potential for future methodological improvements in the prediction of impacts on biodiversity within EIA and SEA. The paper presented an overview of GIS-based ecological models which could be used in biodiversity assessment. Predictive models have been developed within landscape ecology, spatial ecology and conservation biology disciplines. By applying these tools the distribution of valued biodiversity components, including habitats, species and communities, can be modelled and visualised in GIS, in a format suitable for scenario-testing (Gontier et al 2006).

3.45 GIS-based habitat models are increasingly being used in the design of ecological networks at large spatial scales and for strategic conservation planning (Gontier et al 2006). Furthermore, a method for landscape ecological assessment in peri-urban areas has been developed, which included the formation of regionally relevant biodiversity targets, indicator selection, predictive modelling, assessment and the ability to examine planning scenarios (Mortberg in Gontier et al 2006). The variety of ecological models available is summarised in Figure 2.

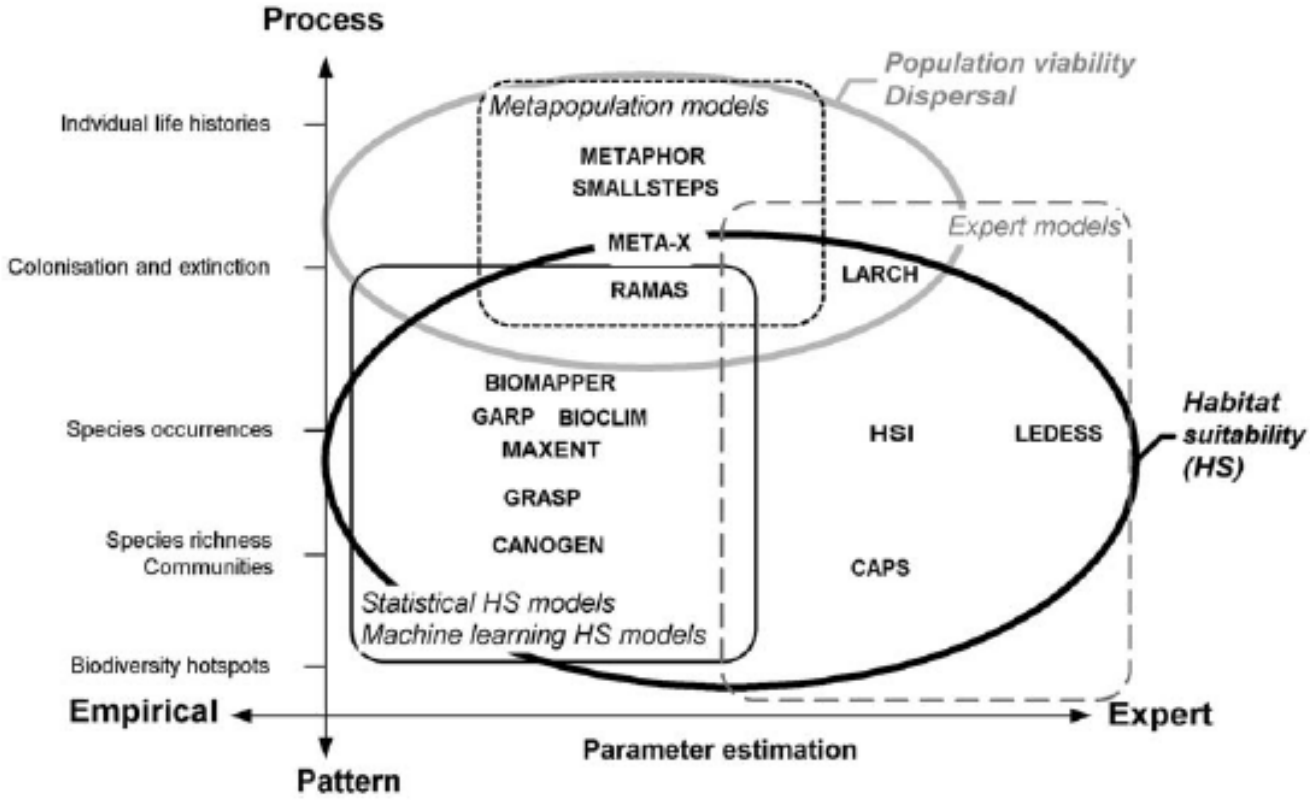

Figure 2 Ecological models with potential as prediction tools (Gontier et al 2006)

3.46 One difference to be noted between habitat suitability (HS) models and meta-population models is that HS models provide distribution maps of occurrence probabilities, based on habitat suitability and/or accessibility for biodiversity components. Meta-population models in contrast, calculate population dynamics and viability of populations in fragmented but partly connected habitats.

3.47 Various biodiversity components can be modelled spatially using GIS-based HS models. These include vegetation types, single species occurrence and density, multiple species, species interactions, functional types of species, species richness, communities and biodiversity hotspots, topography, climate, land-cover, vegetation and human developments (Gusiman and Zimmermann; Lehmann et al in Gontier 2006).

3.48 A further distinction that can be made between the models is between expert models and those requiring empirical data. In expert models, parameters are obtained from literature and/or expert opinion. Empirical models have parameter values that are derived from empirical data (Maurer in Gontier et al 2006).

3.49 Habitat suitability modelling requires a focus upon one species and is thus not assessing biodiversity. The choice of modelled species and the interpretation of results would therefore be critical to their utility for assessment and appraisal.

3.50 Issues to be considered when selecting a model include:

- what biodiversity components are to be modelled
- the availability and quality of data and expert knowledge
- the time frame and resources available
- the competence of those carrying out the analyses
- the limitations and constraints of the different models.

3.51 Process-based models, based on cause-effect relationships, are likely to provide more accurate predictions across a wide range of conditions, however they are data intensive (Maurer in Gontier et al 2006).

3.52 Meta-population models investigate the potential for identified habitat to be colonised by specific species and assess the development and viability of the population (Akcakaya in Gontier et al 2006). These models offer a good potential for assessing the long-term effects of habitat loss and isolation on the persistence of species, but are only able to assess a single species and are data hungry.

3.53 Pattern based models are generally less data intensive and can be used at large spatial and temporal scales (Guisan and Zimmerman; Maurer; Lehmann et al in Gontier et al 2006). However, the quality of data is more critical than model selection.

3.54 Expert models that aggregate scientific knowledge can provide parameters for the persistence of populations in a landscape (Vos at al in Gontier at al 2006).

3.55 GIS models-based ecological models used as predictive tools encounter the following issues:

- Data limitations (Scott et al in Gontier et al 2006).
- Lack of knowledge on the actual response of biodiversity components to infrastructure and other developments (Piepers et al in Gontier et al 2006).
- Current models may not address biotic interaction, disturbance events and ecological processes (Gontier et al 2006).
- Unable to assess impacts that are barely quantifiable or not spatially fixed.

3.56 Yet despite these limitations several authors claim that GIS-based predictive models are of a quality that they may now be considered valuable planning and assessment tools (Guisan and Zimmermann; Lehmann et al; Johnson et al in Gontier et al 2006).

3.57 Gontier et al (2006) identified three potential approaches to biodiversity assessment (see Figure 3). The patchwork approach includes both species and habitat levels, but the assessment is done on a patch by patch basis, one local project at a time and without a general overview of the scale of ecological processes. This is the current approach to biodiversity assessment for transport projects.

3.58 The ecosystem approach is a holistic, functional and dynamic strategy that takes into consideration the interactions between the components of an ecosystem. The Convention on Biological Diversity recommends using an ecosystem approach for biodiversity assessment in EIA and SEA (CBD in Gontier, 2007).

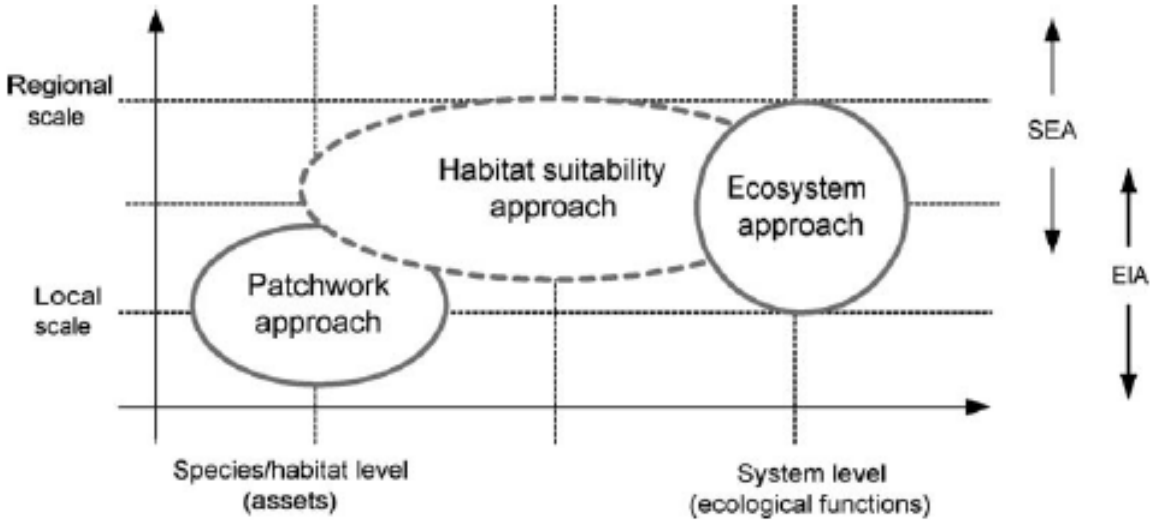

Figure 3 Potential methods for biodiversity assessment (Gontier et al 2006)

3.59 The habitat suitability approach takes into account habitat quality, quantity and connectivity and is seen as suitable for a variety of uses. It is able to use predictive modelling of biodiversity components and GIS-based ecological models as prediction tools. This approach could also allow for the consideration and integration of widespread, long-term and cumulative impacts into the assessments and appraisals. A habitat suitability approach to biodiversity assessment founded on the implementation of GIS-based ecological models as prediction tools could provide a link between the patchwork and ecological approaches (Gontier et al 2006).

Consideration of biodiversity in EIA

3.60 In 2002, a report of the effectiveness of the EU directive on EIA (European Commission in Gontier et al 2006) concluded that little information is available on how biodiversity issues are addressed in practice. However Geneletti (2006) identified the following critical shortcomings:

- Delimitation of the study area on a non-ecological basis.
- An over emphasis given to sites designated for their nature conservation and a failure to consider habitats and species elsewhere.
- Land take of projects are not justified.
- Lack of measurable indicators and quantitative predictions.
- Impact assessment is mixed with impact prediction.
- Assessment of impact relevance, if carried out, is unclear and poorly structured.
- Fragmentation assessed only in a descriptive way.

3.61 A review of 38 road and rail Environmental Impact Statements (EIS), from Sweden, France, the UK and Ireland, published between 1999 and 2003 revealed a lack of consistency in the assessment of biodiversity impacts in EISs. The results showed that fragmentation and barrier effects were not systematically taken into account (Gontier et al 2006). As climate change becomes established so species and habitats will move thereby increasing the importance of fragmentation and barrier effects.

3.62 The review also showed that designated areas may be being prioritised in assessments because of their importance and the readily available data, whereas for non-protected areas data collection may be time consuming and expensive (Gontier et al 2006). A focus upon protected areas alone however, may not be an adequate approach to protect all aspects of biodiversity.

3.63 The authors (Treweek in Gondier et al 2006) highlighted that most biodiversity assessment were descriptive and only considered direct impacts, disregarding indirect, long term, cumulative and/or synergistic ecological effects. The descriptive nature of biodiversity assessments is

thought to be linked to the lack of quantification and prediction of potential impacts. The result of the review showed that despite advances in predictive ecological modelling these are not being used in biodiversity assessment.

3.64 Gontier (2007) comments that although it may be too early to draw conclusions on the efficiency of SEA in assessing impacts on biodiversity, a number of persistent problems have been identified in EIA. Two of these problems include a lack of proper prediction and impact quantification and inadequate consideration of cumulative effects both of which are related to the scale(s) at which the assessment is performed. Gontier (2007) highlights that SEA potentially provides a more adequate framework for dealing with scale-related issues (including cumulative effects) than EIA but that it requires the use of adapted tools. Other studies highlighted the following concerns:

- Vagueness and descriptive nature of assessments.
- Focus on protected areas and protected species.
- Focus on single development actions and on-site changes.
- Lack of assessment at the ecosystem level and at the spatial and temporal scales of ecological processes (Treweek et al; Byron et al; Atkinson et al; Geneletti; Slootweg and Kolhoff in Gontier et al 2006).

3.65 Several authors identified that there is a lack of adequate methodologies for accurate, systematic and quantified predictions of impacts on biodiversity (Treweek et al; Thompson et al; Byron et al; Atkinson et al; Geneletti in Gontier et al 2006 and in Gontier 2007). Thompson et al (in Gontier et al 2006) highlighted that one reason for the lack of impact quantification and prediction could be the lack of ready-to-use and straightforward methodologies, which would allow predictions and comparisons to be made with the current state of the environment. Gontier et al (2006) also recognised that biodiversity assessment needs methods to assess impacts that provide relevant and reliable predictions.

3.66 The topics of impact scoring and the trading of impacts between ecological features to arrive at an overall score did not feature in the literature reviewed.

Issues for biodiversity assessment and appraisal

3.67 The main issues emerging from this brief examination of how biodiversity assessment and appraisal are:

- scale of study area - plan, route selection, project;
- focus upon designated species/sites;
- weaknesses in EIA practice;
- potential use of habitat models;
- availability of data and use of “off-the-shelf” data;
- fragmentation of habitat;
- cumulative impacts.

3.68 The way that impacts upon biodiversity are assessed and reported in NATA is influenced by the scale of analysis being used. When a project is in its formative stages and being compared against other potential solutions to address the transport problem, the ecological data underpinning the appraisal will be broad brush and draw upon readily available datasets. Only when phase 1 habitat surveys are undertaken is it feasible to recognise the local impacts. However, as noted above many elements of biodiversity assessment are omitted or poorly examined, for example cumulative effects.

3.69 The issue of scale links to the focus upon designated sites and species, since these elements are generally the only elements available to the patchwork approach characterising strategic or early stage assessments.

International appraisal methodologies

3.70 Appraisal and evaluation methodologies and frameworks vary widely between countries, with different methods and assumptions used. The resultant information also affects decision making to varying degrees. Generally, Northern and Western European countries have more developed appraisal frameworks. Appraisal in the Netherlands, Sweden and UK forms best practice and is informed by the best evidence bases. Although there are differences, many different countries and international bodies use the techniques of cost-benefit analysis, EIA and ecosystems services in the context of transport appraisal. These types of methods are better known and easier to identify than the ECA, which lacks a commonly recognised definition.

3.71 Little consensus exists over which environmental impacts to include within appraisals. The environmental scope of transport appraisal in most EU countries is largely restricted to air pollution, noise and climate change impacts. EIAs often underlie the ECA, and these cover a greater range of impacts. Monetary values are applied to environmental impacts by countries such as Denmark, France, Sweden, Germany and New Zealand. The resulting information is included in appraisal, but different approaches are used to obtain the monetary values.

The HEATCO project

3.72 HEATCO[1] was a three year EU funded programme of work that reviewed transport appraisal practice across EU Member States[2]. The project proposed a set of harmonised guidelines for project assessment. Amongst the environmental impacts considered by HEATCO were: vibration, visual intrusion, loss of important sites, resource consumption, landscape impairment, ground and water pollution. It was found that countries rarely measure changes in such environmental attributes by assigning monetary values to them.

3.73 HEATCO recommends that where impacts cannot be expressed using monetary values then they should be described in qualitative or quantitative terms and reported alongside evidence on monetised impacts. It also advocates the use of sensitivity analysis to indicate the importance of any impacts that are not monetised. This is already achieved by DfT's Value for Money process, which uses the ECA description and assessment of impacts to examine their potential significance to the overall VfM of a project. An alternative suggestion for including non-monetised impacts in the decision-making process is to explicitly elicit the decision-maker's weights for the impacts.

Studies by the Danish Transport Research Institute

3.74 Two Danish studies of transport appraisal practice (Danish Transport Research Institute, 2002; 2007) found there is no formal method for dealing with non-monetised impacts in Denmark or Finland. Contrary to HEATCO's findings, they also found that systematic methods for taking account of non-monetised impacts do not exist in France, Germany or the Netherlands. They also conclude that unless impacts are monetised and included in cost-benefit analyses, they receive insufficient attention in the decision-making process. Sweden and other Nordic countries are currently undertaking work to improve this aspect of appraisal.

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[1] HEATCO, Developing Harmonised European Approaches for Transport Costing and Project Appraisal, URL: http://heatco.ier.uni-stuttgart.de/
[2] EU25 plus Switzerland

3.75 Norway uses a method similar to the NATA where non-monetised impacts are divided into themes such as cultural environment and water resources, and then assessed by value and by extent. These assessments are combined to generate a social value that is presented alongside cost-benefit figures. Further work would be needed to discover how landscape and biodiversity issues are examined.

Further international comparisons

3.76 A World Road Association (PIARC) study of transport appraisal methods (PIARC, 2003) confirms that many different types of assessment techniques are used internationally, including cost-benefit analysis, multi-criteria analysis, and environmental and socio-economic analysis. PIARC suggest international cooperation to develop appropriate methods for including environmental and social impacts within appraisal and evaluation, for example by determining monetary values for them.

3.77 Appraisal guidance in the Netherlands (Overzicht Effecten Infrastructuur (OEI)) supports taking account of all environmental impacts by applying monetary values to environmental resources[3]. Therefore the Netherlands potentially accounts for all environmental impacts within decision making. Monetary values for a greater range of environmental impacts are being sought, so that these can be included in cost-benefit analyses, but to date these values remain very site specific (Ministerie van verkeer en Waterstat and Ministerie van Economische Zaken, 2004).

3.78 The Netherlands is continuing to integrate environmental assessment procedures and appraisal methods. The Dutch regard attaching the right weight to externalities as important, and in future the OEI may be changed to reflect this by providing further clarification on how to ensure that appraisal results are presented in a balanced way.

3.79 The EC Railway Project Appraisal Guidelines (RAILPAG) (European Commission/European Investment Bank, 2005) recommend using a stakeholder effects matrix to present appraisal results, so as to break down impacts into different categories (such as effects on biodiversity) and clarify how these are distributed. RAILPAG state that it is preferable to give impacts in NPV terms. Any non-monetised impacts presented to the decision-maker should use a colour coding system to determine the weight that non-monetised impacts ought to receive and highlighting any that are critical to the decision.

International appraisal methodologies - summary

3.80 There are many differences in appraisal methods across countries. There is little agreement over which environmental impacts should be included in appraisal, or over the best techniques for doing so. HEATCO recommends that a method very similar to the ECA should be used to include non-monetised impacts within the appraisal process. It also advocates the use of sensitivity analysis to indicate the importance of these impacts, something that is already done as part of DfT's Value for Money process.

3.81 It is difficult to identify instances where methods similar to the ECA are being applied elsewhere. At least one other country, Norway, uses a comparable process to analyse environmental impacts as part of its transport appraisal procedure. Countries rarely describe changes in environmental impacts using monetary valuation techniques, but the Netherlands may have made progress in this area, although it has not proved possible to obtain a copy of their guidance. This should be investigated further, although the transferability of the Netherlands' approach is doubtful because most environmental impacts are highly context-specific.

[3] URL: www.verkeerenwaterstaat.nl/onderwerpen/aanleg_onderhoud/overzicht_effecten_infrastructuur/index.aspx

Environmental valuation and environmental services

ECA and environmental valuation

3.82 The NATA Refresh consultation document identifies the need for a focused research strategy for developing the use of monetary valuation of environmental impacts in the appraisal of transport schemes. This review of the ECA offers an opportunity to consider a series of factors that might influence both recommendations for the refinement of current ECA guidance and a subsequent strategy for environmental valuation[4] in the NATA.

3.83 In this regard, the following paragraphs consider: (i) the background to environmental valuation and its role in appraisal; (ii) valuation of NATA environmental sub-objectives; and (iii) developments with regards to the ecosystem services approach. Current research for the DfT through the study 'Valuing transport's impact on the natural landscape' provides the basis for issues raised under (i) and (ii). The first phase report for this study (eftec et al., 2007) covers the background to valuation of environmental impacts, largely drawing on previous work in relation to the non-market benefits of undeveloped land for the then ODPM (eftec and Entec, 2002). The background for discussion concerning the ecosystem services approach follows from the Millennium Ecosystem Assessment (MEA, 2005) and presently ongoing initiatives in this area for bodies such as Defra, notably in terms of valuing ecosystem services (see for example Defra, 2007a).

Background to environmental valuation and appraisal

3.84 The background to the concept and role of environmental valuation is widely rehearsed in numerous public policy areas relating to the natural environment[5]. Principally, environmental valuation is underpinned by the concept of economic value and is a term that is used to denote that individuals have preferences for the goods and services derived from environmental resources, regardless as to whether they are traded in markets[6]. Expressing environmental impacts in monetary terms implies that decision-making, via an analytical framework such as cost-benefit analysis, is more fully informed by accounting for both market and non-market impacts in a common unit of account. Taking the role of appraisal as to distil key messages to decision-makers, monetisation provides an explicit account of the weight and relative importance of environmental impacts in relation other outcomes of interest, such as economic and efficiency improvements, safety, etc.

3.85 In essence, environmental valuation is a 'democratic' methodology, in that everyone's preferences (summed across the affected population), towards an environmental impact 'count'. In contrast, the ECA provides an expert-based assessment of the relative importance of impacts relating to landscape, heritage, biodiversity and water environment sub-objectives. The choice for appraisal, however, is not a case of 'monetisation or ECA'. Indeed it is important to recognise that environmental valuation is not a substitute for ECA or any other form of impact assessment methodology. In fact monetisation is normally the next step on from impact assessment in which

[4] For consistency with the DfT NATA refresh consultation document, the term 'environmental valuation' is used in this report. 'Economic valuation' or just 'valuation' may be used equally

[5] For example see Defra (2007) which sets out the case of environmental valuation in relation to ecosystem services

[6] Most environmental resources and services are prime examples of non-market goods and services. In simplistic terms, this means that such goods and services are 'unpriced' and hence changes in the quantity and quality of these goods are not readily comparable to other monetary costs and benefits that may result from the impacts of a particular transport scheme

3.86 either qualitative and/or quantitative impact measures are then converted into a monetary metric for the purposes of CBA (see for example Bateman, 1999; and Willis et al., 1997). To illustrate this process, Figure 4 sets out a simple overview the application of environmental valuation in a context such as the appraisal of a transport scheme.

3.87 As Figure 4 illustrates, the ECA appraises elements of the impact that largely pertain to the physical change in the environment, but notably in its present form it does not quantify the impact in some physical unit, such as hectares of habitat lost.

3.88 The key extension of environmental valuation is that changes in the provision of environmental goods or services, whether from landscape or biodiversity elements etc. are related to their effect on human wellbeing[7]. Changes in wellbeing can be understood in terms of the typology of total economic value (TEV) which is comprised of use value and non-use value (see Figure 5).

3.89 Various valuation techniques may be applied to estimate the monetary value of environmental impacts, as expressed by through concepts of willingness to pay (WTP) (to secure a gain or avoid a loss) or willingness to accept compensation (WTA) (to forego a gain or to tolerate a loss) (see Table 8). Note however that these methodologies differ in their applicability to different environmental goods and services and the extent to which they can capture the full change in total economic value.

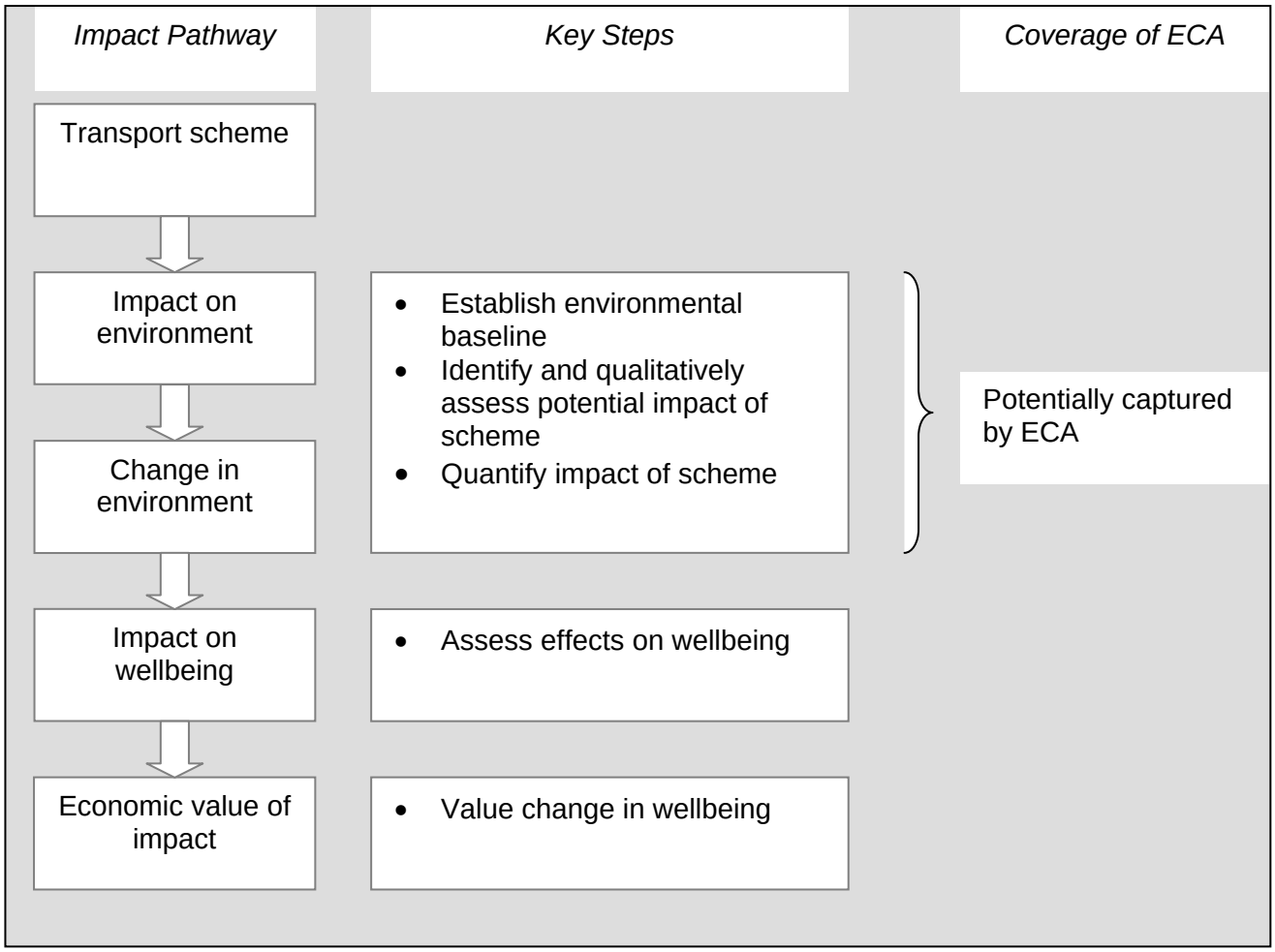

Figure 4 Impact pathway and environmental valuation (adapted from Defra, 2007a)

[7] The link between the natural environment and the wellbeing of individuals and society as a whole is a key aspect of 'holistic view' that is promoted by the ecosystem services approach

Use value involves some interaction with the resource, either directly or indirectly:

- **Direct use value**: Individuals make use of a resource in either a consumptive way (eg fishing or agriculture) or a non-consumptive way (eg recreation).
- **Indirect use value**: Individuals benefit from ecosystem services supported by a resource rather than actually using it (for example, watershed protection for flood mitigation, nutrient cycling processes for agriculture or carbon sequestration).

Non-use value is associated with benefits derived simply from the knowledge that the natural environment is maintained. By definition, non-use value is not associated with any use of the resource, although users of a resource may also attribute non-use value to it. Non-use value can be split into three basic components:

- **Altruistic value**: Derived from knowing that contemporaries can enjoy the environmental goods and services.
- **Bequest value**: Associated with the knowledge that the environmental resources will be passed on to future generations.
- **Existence value**: Derived simply from the satisfaction of knowing that the environmental good continues to exist, regardless of use made of it by oneself or others now or in the future.

Additionally, two categories are not immediately associated with the initial distinction between use value and non-use value:

- **Option value**: Individuals derive benefit from keeping open the option to make use of some aspect of the natural environment in the future, even though they do not currently plan to make such use.
- **Quasi-option value**: A related value arising through avoiding or delaying irreversible decisions, where technological and knowledge improvements can alter the optimal management of a natural resource.

Figure 5 Total economic value

Table 8 Scope of environmental valuation methods

Valuation method	Affected population captured	Value basis	Natural environment / ecosystem service
Market price proxies*	Users only	TEV - use values	Marketed products from the natural environment or their market substitutes; all ecosystem services but limited to their contribution to marketed products (for example, agriculture, forestry, fisheries, genetic information); estimating avoided damage (for example, from flooding, coastal erosion); their marketed substitutes (for example, cost of coastal defences, cost of water treatment); and tangible impacts (for example cost of illness)
Revealed preference methods			
Hedonic property pricing	Users only	TEV - use values	Landscape, amenities, air quality, peace and quiet, and hence all ecosystem services that provide these

Table continued…

Valuation method	Affected population captured	Value basis	Natural environment / ecosystem service
Travel cost	Users only	TEV - use values	Recreation and all hence all ecosystem services that contribute to recreational opportunities
Random utility model	Users only	TEV - use values	Recreation and all hence all ecosystem services that contribute to recreational opportunities
Stated preference methods			
Contingent valuation	Users and non-users	TEV - use and non-use	All natural environment categories and hence all ecosystem services that contribute to these
Choice modelling	Users and non-users	TEV - use and non-use	All natural environment categories and hence all ecosystem services that contribute to these

Source: eftec (2006)

Valuation of NATA sub-objectives

3.90 Progress with monetary valuation has seen guidance for valuing traffic-based impacts in terms of noise (DfT, 2006), carbon and air quality (DfT, 2007) introduced into the NATA. The 'Valuing transport's impact on the natural landscape' is the first study (eftec et al, 2007) to focus on the current ECA-based environmental sub-objectives. The objective is to design and implement a stated preference survey to generate primary evidence on the impact of transport schemes on the environment and human wellbeing. However, it is not possible to undertake such a survey for all possible locations in England that will be affected by transport schemes. Thus, the extent to which the evidence from the stated preference study can be used in appraisal depends on the extent to which the evidence is transferable to the scheme(s) under consideration. The study is designed with this transferability requirement in mind.

3.91 Specifically NATA is orientated towards a benefits transfer approach to environmental valuation. Benefits transfer is commonly defined as the use of economic values estimated in a previous study (the 'study' good) in a new context (the 'policy' good). This approach to valuation is intended to save the effort and expenditure involved in undertaking original research (that otherwise would be required for each appraisal case)[8]. At the crudest level this could entail the application of 'off-the-shelf' monetary values for environmental impacts, although there are many good reasons why such an approach would be less than ideal. Fundamentally numerous scheme and site specific factors are expected to influence both individual (unit) and aggregate valuations of environmental impacts. The 'Valuing transport's impact on the natural landscape' phase one report (see eftec et al. 2007) characterises these as either:

[8] In the transport appraisal context some reference has been made to benefits transfer in terms of the landscape and heritage of historic resources sub-objectives of NATA (see eftec, 2005; and eftec et al. 2007). These reviews of valuation literature however find a paucity of studies that could be used presently for benefits transfer in appraisal. The common finding is that existing studies typically offer highly site-specific valuations which generally limit the degree of transferability to appraisal cases – as previously highlighted with respect to the appraisal guidance in the Netherlands. In addition, the HEATCO project's review found across Europe greater use of monetary values for impacts related to noise, air pollution and climate change than for other impacts such as visual intrusion, loss of important sites, landscape impairment, ground and water pollution

- Scheme and site characteristics: for example, linear or area based; road, rail etc.; new route or enhancement to existing route; mitigation actions; operation of the scheme such as volume and type of traffic; nature of site for development in terms of topography and ecology; extent of substitute sites.
- Population characteristics: for example socio-economic and demographics; attitudes and perceptions of transport schemes; distance from scheme; use of affected site in terms of recreation.

3.92 For appraisal evidence to be robust, some account must be made for such factors, both in the impact assessment stage and valuation. However the ECA in its present form of describing and appraising environmental capital and how a proposal impacts upon key features is not suited to providing the kind of information needed to facilitate environmental valuation through benefits transfer. Principally ECA was not designed with this task in mind. A key omission is that it does not capture the affected population elements, particularly in terms of users (for example, local residents or recreational visitors to a site). Greater use of GIS evidence in this regard - recognised as a priority issue in the NATA consultation - could address this issue, particularly in terms of identifying aspects such as affected resident populations, visual receptors and recreation sites, and would also tie in with the potential to improve ecological modelling.

3.93 Aside from the practicalities of how environmental valuation evidence might be used and how its use is dependent upon the efficacy of the impact assessment generating the information on the specific impacts, there are also more strategic issues pertaining to environmental valuation to consider. Foremost the carbon and air quality sub-objectives relate to impact pathways that are fairly discrete; in contrast the distinction between aspects such as landscape and biodiversity and wellbeing is less clear cut. Both may be taken to relate to the perception of environmental amenity. In particular undeveloped land offers a potential range of non-market benefits that affected populations may enjoy (see Eftec and Entec, 2002).

3.94 How individuals perceive benefits is of interest: the expectation is that preferences may be bundled, focusing on key outcomes such as recreation or perceived amenity (for example living in a pleasant environment), rather than individual components that are the focus of the NATA sub-objectives and ECA (see Eftec et al. 2007 for further discussion). The implication is that seeking to monetise each sub-objective is not the appropriate approach.

3.95 Extending monetisation into ECA is challenging due to the difficulties in separately valuing landscape and biodiversity resources. A way forward could involve the bundling of direct use values such as for recreation, enjoyment of wildlife together these being valued by the public. It would be necessary to separately capture indirect values such as those associated with carbon sequestration, flood alleviation etc. As the public may be unfamiliar with these values, expert opinion may well be needed. In the context of NATA, such indirect services are not currently captured. Thus, a strategy to extend environmental valuation in the NATA will require a detailed exploration of the potential for double-counting. For example, valuing landscape and biodiversity separately when the outcome to the affected population is some environmental amenity benefit, comprised of elements such as landscape, biodiversity, recreation and tranquillity[9].

3.96 Further context-specific and often confounding issues relate to the overall wellbeing impact of a proposal. The population who may suffer disamenity from a scheme in terms of its environmental

[9] In the main, this point refers to 'part-whole' effects, which is recognised as a common phenomenon that effects market priced as well as non-market goods (Bateman et al., 1997). When a set of the goods (the 'parts'; for example 'landscape', 'biodiversity', etc.) are valued individually, the sum may exceed that for the same set of goods valued together (the 'whole'). The implication is that valuing sub-objectives individually may lead to double counting of impacts in an instance where individuals in the affected population actually perceive some composite good (for example, 'environmental amenity') rather than the components discretely

impact may also benefit in terms as users of the scheme, from improved access to transport networks and faster journey times. Adequately disentangling preference for improvements from preferences to avoid disamenity is likely to represent a significant challenge in research to further the use of environmental valuation in the NATA. What is required is an understanding of the inter-linkages between different NATA objectives and sub-objectives and ensuing outcomes for affected populations. In the environmental objective area at least, recent work under the 'ecosystem services' approach offers an insight into achieving this.

Ecosystem services

3.97 Ecosystem services is a term that has come to describe a framework for analysing the linkages between the environment (in terms of natural capital) and people. This approach:

- Enables a better understanding of the trade-offs involved in decisions concerning the environment.
- Provides an explicit recognition that ecosystems[10] and the biological diversity contained within them contribute to human wellbeing. And importantly,
- Recognises that the contribution to human wellbeing extends beyond the provision of transportable goods such as food and fuel, to services which support life by regulating essential processes.

3.98 The Millennium Ecosystem Assessment (MEA, 2005) provided the first comprehensive global assessment of the consequences of ecosystem change for human wellbeing. This demonstrated not only the importance of ecosystem services to human wellbeing, but also highlighted that at global scales many of these key services are being degraded and lost. It outlines the responses that could be made at local, national, or global scales to improve ecosystem management and achieve human development goals. The MEA assessment framework (MEA, 2003) specifies four categories of ecosystem services (Figure 6):

- Provisioning services - products obtained from ecosystems.
- Regulating services - benefits obtained from the regulation of ecosystem processes.
- Cultural services - non-material benefits obtained though the recreation, cultural and heritage, educational and aesthetic value of ecosystems.
- Supporting services - processes that are necessary for the production of all other ecosystem services.

3.99 Significantly, the impact of supporting services is either intermediate or occurs over a very long period of time. This has implications for the assessment of changes in these services.

3.100 The MEA categorisation is a functional grouping (see also Lobo, 2001; de Groot et al., 2002) that highlights services such as regulation and production (provisioning). There is however no single 'correct' categorisation. Alternative categorisations include a descriptive grouping and an organisational grouping. The former emphasises renewable resource goods, non-renewable resource goods, physical structure services, biotic services etc., while the latter classifies via associations with certain species that regulate or organise biotic entities (MEA, 2003).

[10] Under the Convention on Biological Diversity (CBD), an ecosystem is defined as "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit" (United Nations, 1992: Article 2). Ecosystems differ in scale from a local to global level; here the interest is most likely in the local to regional scale, focussing largely on the impact of transport schemes on different types of habitat (for example, woodland, grassland, heathland, marshes, rivers etc)

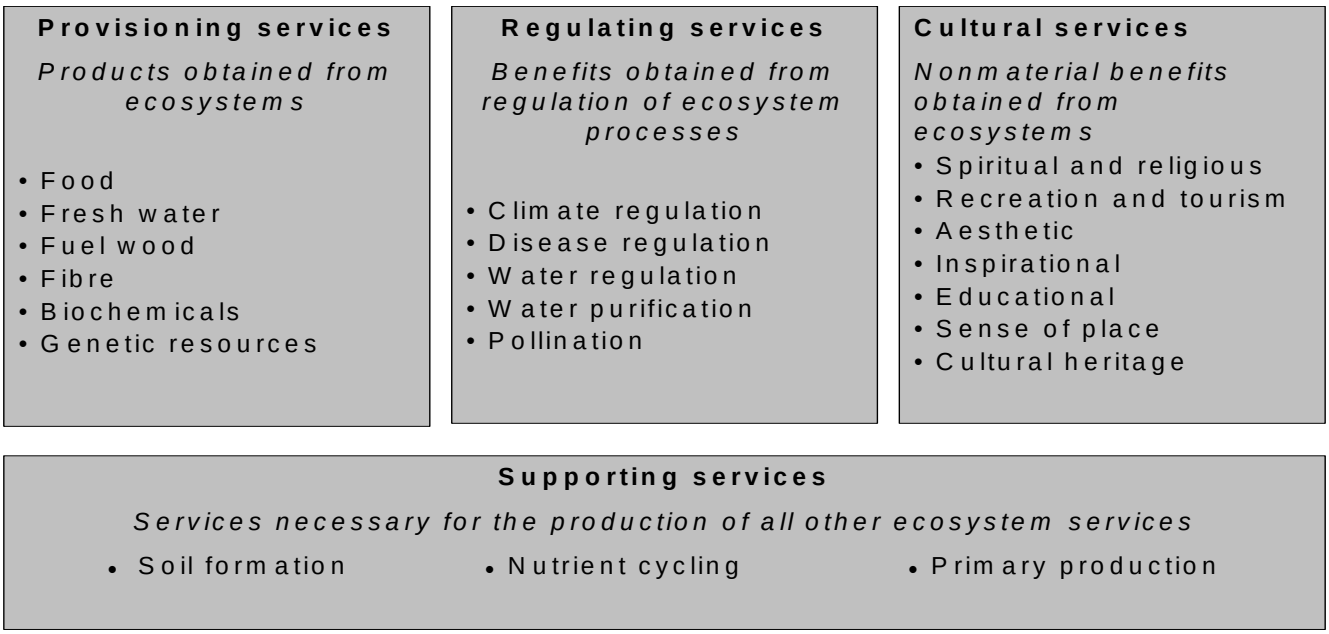

Figure 6 MEA ecosystem services categories

3.101 Defra's recent action plan for developing and implementing an ecosystems approach identifies the general evidence needs with respect to securing a healthy natural environment (Defra, 2007b):

- Improved information on ecosystem functioning and its relationship with the supply of ecosystem goods and services.
- Information on the state of and trends in ecosystems and ecosystem services, and ways to monitor this over time.
- Information on the impacts of ecosystem change on human wellbeing and public participation.
- Improved methodologies for valuing ecosystem services and application of ecosystem services valuations in decision-making.
- Understanding the decision-making context and appraising response options.
- Understanding the global impacts of UK activity.

3.102 With respect to appraisal of actions impacting upon the natural environment, the Defra action plan includes two specific actions of interest here: (i) the review of existing policy and project appraisal tools to explore how the principles of an ecosystems approach, including the valuation of ecosystem services, could be incorporated; and in conjunction with DfT (ii) to work on a long-term strategy for the development of environmental valuation in transport appraisal, including the valuation of ecosystem services.

3.103 Significantly, the incorporation of the ecosystems approach into appraisal and valuation will be dependent upon the timely availability of robust scientific assessment information that permits the identification of changes in ecosystems through to impacts on wellbeing, which is specifically focussed on the needs of the policy area. Hence much 'groundwork' is required for the adoption of the approach in an area such as transport appraisal.

3.104 In this regard some reference may be made to existing research; the present Defra led research programme on ecosystem services offers some potential insight to the application of an ecosystem services approach in the context of the appraisal of transport schemes. For example:

- The selection of the M6-Heysham link road route.
- Inventory study on natural environment data.
- England's terrestrial ecosystem services and the rationale for an ecosystem-based approach.

3.105 Future developments may include a 'Millennium Ecosystem Assessment for England'. Specifically the House of Commons Environmental Audit Committee has recommended that 'ultimately the Government should conduct a full MEA-type assessment for the UK to enable the identification and development of effective policy responses to ecosystem service degradation'[11]. At present a Defra funded project is underway to evaluate progress and examines whether a formal MEA-style assessment would contribute to further informing Government policy and decision making.

Ecosystem services and valuation

3.106 The ecosystem service approach formalises the impact pathway approach detailed in Figure 4 previously, recognising that ecosystem services are the aspect of ecosystems that generate use and non-use values. For example, 'nutrients cycling' is a service which can result in the outcome of clean water. But while nutrients cycling and clean water provision are processes, only the latter is also a benefit (for example, for household drinking water). This latter example also highlights the need to carefully distinguish between the direct or 'final' ecosystem services and the indirect or 'intermediate' services, as is common practice in economic national income accounting (see Fisher et al, forthcoming).

3.107 Defra's guidance document, 'An introductory guide to valuing ecosystem services' (Defra 2007) highlights several themes with relevance to the application of valuation in transport appraisal, namely that:

- Ecosystem services offers a common methodology that considers the impact on the environment more systematically.
- While valuation methodologies themselves are not new, their appropriate application still entails significant challenges.
- The ecosystem as a whole needs to be considered and stresses that change or impact on one part of an ecosystem have consequences for the whole system; therefore, considering the scale and scope of the services to be valued is vital if meaningful values are to be estimated.

3.108 The advantage of the ecosystem services approach is that it presents, for both a given appraisal case and indeed in terms of an overall appraisal structure and guidance, a framework that can address these issues. While this is yet to be demonstrated in a transport context, either in the UK or internationally, some reference can be made to other sectors, such as valuation of marine biodiversity (Beaumont et al. 2006) and in particular flood and coastal erosion risk management in the UK. The recent 'Economic Valuation of Environmental Effects' (EVEE) handbook for the Environment Agency (eftec, 2007) develops a framework that permits evidence from SEA and EIA to be drawn together to provide a qualitative and quantitative impact assessment to which monetary valuation evidence can be applied.

3.109 The guidance is largely based on a benefits transfer; the likely context for widespread use of environmental valuation in transport scheme appraisal. Key emphases in the handbook are:

- **Determining the appropriate effort for both assessing and valuing impacts**: the decision-making context, legal requirements, scheme characteristics, location, habitats affected, uses of the environment, scale of environmental effects and so on will determine the 'accuracy' that is needed for appraisal evidence. This, in turn, determines the effort that is appropriate.

[11] House of Commons Environmental Audit Committee (2007a; 2007b)

- **Sensitivity analysis**: limitations of data and uncertainty over environmental effects and monetary values can be compensated by appropriate sensitivity analysis. Analysis should be proportionate to the decision in-hand.
- **Transparency of analysis and ensuring an 'audit trail'**: fundamentally key assumptions, limitations, omissions and uncertainties in assessing and valuing impacts should always be explicitly reported.

3.110 Moreover, a distinct feature of the framework is that it highlights problematic issues such as double-counting in valuation, and permits for an explicit account for both monetised and non-monetised impacts. With regards to the former, this is particularly relevant to the issue of the preferences of affected populations towards impacts on landscape and biodiversity, but also other land-take impacts too. Where monetary valuation is not possible, then the framework also retains qualitative and quantitative evidence for the use in decision-making, and importantly relates these to the underlying ecosystem services, giving some measure of relative importance. In fact the recommendations in this respect concur with those of HEATCO and the DfT VfM process; reporting of non-monetised impacts alongside monetised impacts and also the use of sensitivity analysis (such as switching analysis) to determine the magnitude of impact (in monetary terms) that non-monetised elements would need to be in order to change decision-making indicators such as positive net present value and benefit-cost ratios.

Conclusions

3.111 The following conclusions are drawn from this brief review of valuation and ecosystem service techniques:

- The role of environmental valuation in transport appraisal is to succinctly summarise the relative importance of environmental impacts in relation to all to other impacts of a proposal. It does not replace the need for an ECA type methodology.
- The current assessment of environmental impacts and collation of information does not easily facilitate an approach to environmental valuation via benefits transfer. Whether via a revised ECA, or additional element of assessment, for example through wider use of GIS, this omission would need to be addressed to enable the monetisation of landtake impacts.
- Further research is required to determine how individuals perceive impacts that arise from transport schemes. The present study 'Valuing transport's impact on the natural landscape' will inform this issue in its phase two report, due in Summer 2008. Lessons from this research should provide a good basis for developing a future strategy for valuing further impacts. The key issue to highlight presently is that seeking values for each environmental sub-objective may not be the appropriate approach.
- The ecosystem services approach provides a way of 'organising' information on individual impacts and the synergies between different impacts. This could potentially draw together all aspects of the Environmental Objective in the NATA. However as recognised by the Defra action plan, much work is needed to develop the approach to the point where it can contribute to informing Government policy and decision making. In the transport context, reviewing the alignment of sub-objectives to ecosystem service categories would prove a useful action; for example landscape and cultural heritage largely fall within cultural services, but biodiversity can be attributed across several services and categories.
- The framework does however formalise the link between the environment and wellbeing. This relationship is not explicitly recognised in the NATA, particularly through the application of the ECA.
- Good practice for use of monetary values for environmental impacts entails key assumptions and parameters should be subject to sensitivity analysis. The expert-based ECA does not currently test sensitivities. Use of sensitivity analysis can also inform decision-makers as to what value non-monetised impacts, such as those currently appraised by ECA, would need to take to fundamentally change CBA indicators.

Overview of findings from the literature

3.112 The literature review has revealed an absence of articles that deal with the practical issues of appraisal in the context of landscape and biodiversity. Instead, it has revealed that the assessment foundations on which appraisal should be based on do not report fully on who is affected, why it matters and how significant the effects are judged to be, thus leaving these issues to be decided by the practitioner carrying out the appraisal. Much of the assessment practice is based upon professional judgment that raises issues of transparency and repeatability.

3.113 The landscape literature suggests that a consensus exists on the need to value the landscape in terms of the functions or services that it provides. The scale at which the landscape is judged has a key influence upon the effort expended in appraisal and assessment since it is always possible to look at a finer level of detail. What is not explored is the selection of the appropriate scale for the exploration of landscape issues, particularly when issues as who is affected and whether the impact can be mitigated through substitution.

3.114 Similar issues associated with subjectivity and scale also emerge with biodiversity although there are some developments in ecological modelling that may be applicable in assessment practice.

3.115 International experience with appraisal tends to focus upon the broader principles of appraisal in general rather than as applied to landscape and biodiversity. Nevertheless, HEATCO report recommends that a method similar to the ECA should be used to include non-monetised impacts within the appraisal process. It has not been possible to review overseas practice in the appraisal of landscape and biodiversity in this research. Appraisal practice in Norway and the Netherlands appears to capture environmental values and should be investigated further, although the transferability of overseas approaches is doubtful as most environmental impacts it values are highly context-specific.

3.116 Environmental Services and Environmental Valuation techniques build upon ECA and where weaknesses exist in the underlying assessment and appraisal then these would be carried forward by these techniques. The absence of information on who is affected by transport proposals was seen to be a hindrance to the valuation of environmental impacts. The ecosystem services approach was not regarded as an alternative to ECA, since it is instead a framework for organising assessment and appraisal findings. These combined with the difficulty in valuing each environmental impact separately were seen to be key findings from the investigation.

4 Practitioner survey

Overview

4.1 This task involved identifying and making contact with a selection of practitioners (commissioning bodies, local authorities and scheme designers) to establish their views on the environmental capital approach and its success in identifying environmental benefits and impacts at both a plan and project scale. A press release was issued to range of relevant publications including 'Local Transport Today' and 'Planning' and articles were placed in the RTPI Transport Planners Network and Transport Planners Society Bulletin. 'Surveyor' magazine also ran a short piece as a result of the press release. Practitioner views were obtained by a structured telephone survey that had been reviewed by the study Steering Group (Appendix 1).

4.2 Table 9 below summarises the attempts made to arrange interviews with the three groups and the outcome. Observations on this table are discussed later in the section.

Table 9 Summary of completed interviews

		Questionnaire completed	Contacted, but interviewee felt knowledge of appraisal not great enough to contribute	Contact sought but unable to setup interview
Consultants	Cons 1	✓		
	Cons 2	✓		
	Cons 3	✓		
	Cons 4			✓
	Cons 5	✓		
Commissioners	HA 1			✓
	HA 2	✓		
	DfT Aviation			✓
	DfT ERLT	✓		
	DfT Maritime		✓	
Local Authorities	LA 1		✓	
	LA 2		✓	
	LA 3			✓
	LA 4		✓	
	LA 5			✓

Summary of question response

4.3 Questions were structured around the following key areas:

- guidance
- landscape appraisal
- biodiversity appraisal
- awareness of environmental capital
- strengths of environmental capital
- weaknesses of environmental capital
- alternative proposals/suggestions.

4.4 The key responses collected under these headings are summarised in Table 10 below.

Table 10 Summary of practitioner responses

	Consultants	Commissioning Bodies	Local Authorities
Guidance	- WebTAG guidance should be 'slimmed down' and refer to the relevant section within DMRB. - If further assessment is required to fulfil the requirements of WebTAG, then this should be clearly stated.	- Guidance is frequently too 'wordy' and it is easy to get bogged down in ambiguities. - Clearer guidance on how to achieve a final assessment score could be given.	No comments from LA's group
Landscape Appraisal	<u>Difficulties:</u> - Rather over-academic - Timescale relating to residual impact needs clear definition within landscape. - Difficult to judge the 'trade-ability' of landscape features. - Systematic approach can make the task of appraisal seem more simple than it actually is. Proposed changes: - Simplification of all environmental capital columns into one, named 'importance'. Currently all columns are shades of importance and they all overlap. - Ensure that those carrying out appraisal meet a particular standard; e.g. suitably qualified or a minimum experience level.	<u>Difficulties:</u> - Understanding of headings can present problems. Proposed changes: - Overall score on AST can come out as insignificant though isolated pockets can have very adverse impact; reporting method could be improved.	No comments from LA's group

Table continued…

	Consultants	Commissioning Bodies	Local Authorities
Biodiversity Appraisal	Difficulties: - Guidance could be clearer as to when and where to apply certain methods. - WebTAG guidance is open to professional judgement and hence can be subjective. It is sometimes felt that the resulting appraisal is contrived depending on what specific issues are highlighted and 'pushed'. Proposed changes: - Provision of more specific guidance so that there is no ambiguity in how a particular feature should be rated.	Difficulties: - Assessment of impacts is very dependant on the experience of the assessor. Proposed changes: - Clearer guidance on what specifically constitutes a good or bad assessment score.	No comments from LA's group
Awareness of Environmental Capital	Generally good	Limited	Limited
Strengths of Environmental Capital	Comparability between different topic areas; gives a collective value to the features and thus emphasises the importance of different elements. Easier to make comparisons between different assessments than it was prior to the use of Environmental Capital.	Gives a value to the feature; acknowledges that there is something 'there'.	No comments
Weaknesses of Environmental Capital	Generally introducing artificial distinctions - trying to divide things down which aren't that helpful when they are divided. There are grey areas in terms of the interpretation of the item to be assessed. Cumulative issues aren't adequately covered.	The ascribed value is subjective, unless an economic formula is applied and this would also be subjective; relies heavily on personal judgement.	No comments
Alternative proposals / suggestions	Common sense and keeping things simple. Operating a dual stream - one to consider subjective expert appraisal, and something else that goes straight to monetary values. Environmental Capital in words doesn't assist either cause - a monetary appraisal of the impact should not replace the qualitative appraisal.	Monetary analysis, but recognising that this would also be subjective when applied to unique features. In general, taking a more balanced view of appraisal as a whole, looking beyond the environment alone.	No comments

Discussion of interview responses

Transport/Environmental consultancies

4.5 Of the consultancy representatives contacted, the overall view (of those that carried out appraisal of schemes) was that the Environmental Capital approach tended to encourage the over-analysis of particular aspects of those sections to which it applied. It was noted that there necessarily existed a large element of judgement where particular features of an area were balanced off against each other in the pursuit of assigning an overall impact score for the AST. In this respect,

it was considered that the AST itself did not correspondingly provide an adequate insight for many aspects in terms of actual impact level. Thus the AST was felt to be increasingly an economic decision making tool rather than providing decision makers with an accurate overview of the real world impacts.

4.6 One representative commented, in the context of the Environmental Capital methodology, that *the more you take things apart the more difficult it becomes to put them back together as a meaningful summary*. It was noted that there seemed to be significant overlap between the various worksheet criteria, in particular the current criteria 'substitutability' and 'mitigation'. It was suggested that these criteria could be re-assembled into one overall section, in this way avoiding the potential for double or triple counting and simplifying the worksheet.

4.7 A significant comment was that there was no timescale given within the current guidance for the effects of mitigation; this was deemed to be more significant for landscape and biodiversity than for other aspects. For example, if replacement woodland would take 20-30 years to mature, could this still be classed as being mitigated?

4.8 It was suggested that the guidance could be tested by asking a number of consultants to appraise the same scheme and then comparing the results; this would allow corrections to the guidance to address significant differences between the way the guidance is interpreted by those using it.

4.9 Consultants were asked whether they considered that worksheets should be limited to a maximum number of pages. This question split opinion, with some considering that the limit should be around 10 pages, whilst others argued that there should be no limit and that the length should be determined by the complexity of the scheme or the number of scheme specific issues.

Local authorities

4.10 Local authorities largely reported that their involvement in the appraisal process is limited to the commissioning of consultants to undertake the necessary level of appraisal and presenting the results of this appraisal to the relevant statutory body. Of those contacted, none felt that they had the necessary depth of knowledge to provide comment upon the appraisal process to the level of detail required for an evaluation of the Environmental Capital Approach.

Commissioning bodies

4.11 It was found through contact with various commissioning bodies that the level of involvement in the appraisal process varied across those spoken to. Some of those contacted were aware of the appraisal process but did not feel that their knowledge of the subject was sufficient to comment upon specific appraisal techniques such as environmental capital.

4.12 Of those that were familiar with the appraisal process, it was felt that within those areas appraised using the Environmental Capital Approach, particularly landscape; there was still a large reliance upon professional judgement. This led to difficulties in transparently ascribing an appropriate appraisal score. This was deemed much easier within, for example, the noise sub-objective where the appraisal score can be derived directly from the worksheet figures.

Discussion of emerging issues

4.13 As illustrated by Table 9 of those selected for the survey the consultants group appeared to have the broadest knowledge of the application of the ECA, followed by the commissioners who had a varying level of involvement in the process. Of those contacted within local authorities, none had enough specific experience of the appraisal process to make comment upon the ECA.

4.14 Key issues emerging from the consultation can be grouped as follows:

WebTAG guidance

- Excessive text and not prescriptive enough.
- Enhance scoring guidance.
- Role of Design Manual for Roads and Bridges needs clarification.

Appraisal methods

- Over academic.
- Overlapping elements in ECA.
- Approach dependent upon experience of staff.
- Difficulty with tradable impacts and impact scoring.
- Duplication between substitutability and mitigation.
- Cumulative effects not adequately addressed.

Awareness of ECA

- Limited amongst clients especially local authorities.

4.15 Taking WebTAG guidance first, it is clear that the current texts are not as helpful as might otherwise be presumed. Its excessive length and ambiguities were raised as issues. It is also suspected that some of the criticisms concerning the methods could be accounted for by a lack of clarity in the guidance.

4.16 There is undoubtedly some issues associated with the guidance, however, this may stem from the separation of “importance” into its sub-elements as well as separation of the scoring guidance (at section 1.5.8 of unit 3.3.6) from the landscape and biodiversity guidance in units 3.3.7 and 3.3.10.

4.17 It might be inferred from the comments that the problem is purely with the guidance. Given pressures to use minimise costs and the lack of critical review capability provided by the client groups (especially the local authorities), there is a risk that the appraisals are not supported by staff with a detailed understanding of the method and thus, as a practitioner noted, that the appraisals are not necessarily robust. Thus there is perhaps a need to determine whether the source of the failings is the guidance or the level of practitioner training and the lack of robust review procedures.

4.18 Currently, the worksheets are not published and it would appear that only the Highways Agency have an internal review process in place. Statutory environmental bodies are generally only provided with the AST to comment upon and thus are unable to react to any underlining issues arising from the poor application of the ECA.

4.19 The need for review procedures also emerges from recognition that the application of ECA places considerable reliance upon judgement particularly in the following aspects:

- assigning importance;
- substitutability and mitigation;
- standard mitigation;
- scoring;
- duplication in the worksheets.

5 Relationship between appraisal, SEA/SA and DMRB

Overview

5.1 This section involves an exploration of the links between environmental capital guidance in WebTAG and other related areas such as Strategic Environmental Assessment and Sustainability Appraisal, and the DMRB guidance in Volumes 10 and 11. This section also considers the approaches taken in Wales and Scotland through their separate appraisal guidance WelTAG and STAG.

Strategic environmental assessment

SEA and Biodiversity Guidance for Practitioners, 2004

5.2 This guidance sets out an approach that often implies that the plans being assessed present a high level of spatial definition. It advises that biodiversity should be considered at the following levels:

- bioregion
- landscape
- ecosystem
- habitat
- community.

5.3 The guidance sets out a series of components to be examined at each of these levels relating to composition, structure, function that are to be considered while scoping the SEA (see Figure 7).

5.4 While the SEA guidance does not make reference to environmental capital, it suggests a similar process. When evaluating the significance of impacts on biodiversity, it records that is necessary to consider:

- The characteristics of the biodiversity resource which are affected to comprise its state or condition (including measures of rarity, trends) its recoverability or the extent it can be replaced or substituted.
- The environmental changes that would occur as a result of the plan activities.
- The nature of the impact including the types of change and their severity, the scale and magnitude and duration of impacts.

Composition • What are the main components of biodiversity in the area affected by the plan? • What is the distribution pattern and richness/abundance of biodiversity? • How does biodiversity composition in the study area compare with that outside the study area? • Are there any flagship (popular, charismatic) biodiversity components in the area? • Which biodiversity components are particularly vulnerable/sensitive to proposed plan activities? • What are trends in composition
Structure • Structural relationships include: connectivity, patchiness, fragmentation, vertical habitat differentiation, distribution of key physical features, availability of niches, seasonal availability of habitat, water availability. • How are biodiversity components organised in time and space (location, distribution, variation)? • What are the requirements or 'drivers' for high or characteristic biodiversity to be maintained (e.g. environmental gradients)?
Function • Consider how current levels and types of biodiversity are being maintained. Take an ecosystem perspective to identify important functional relationships, • What role do biodiversity components play in maintaining processes and dynamics, or supporting other biodiversity components? • What processes maintain boundaries and structure (competition, herbivory, predation, dispersal)? Are any threatened components present? What is their functional role? What are their requirements? • What are the demographic processes determining the status of species populations

Figure 7 SEA and Biodiversity Guidance

DMRB Volumes 10 & 11

5.5 DMRB Volume 10 *Environmental Design and Management*[12] deals with the management of the environmental asset base and environmental design of highways. Recently, the Highways Agency has enhanced its awareness of its environmental assets through the introduction of a system called ENVIS (see Highways Agency, 2007 Interim Advice Note 84) where attributes are recorded and placed in a GIS. The information recorded on landscape and biodiversity is presented in Table 11 and Table 12. Each field is then supported by a detailed record for which there is a field labelled *Asset Status* and others labelled *HA Objectives* or *Env. Objectives*. No opportunities are currently provided within the Asset Status to record the environmental capital status of the features being recorded.

5.6 DMRB Volume 11[13] deals with environmental assessment practice. Since 2001, Volume 11 has been subject to a programme of modernisation that has been undertaken as a series of revisions in the form of:

- Interim Advice Notes (IANs) applicable only to the Highways Agency.
- Replacement guidance within DMRB applicable to all overseeing organisations across the four administrations in the UK.

5.7 Interim Advice Notes are to be published for landscape in March 2008 and April 2008 for biodiversity. Revisions to DMRB Volume 11 are expected for landscape in November 2008 and biodiversity in March 2009.

[12] URL: www.standardsforhighways.co.uk/dmrb/vol10/section0/preface.pdf
[13] URL: www.standardsforhighways.co.uk/dmrb/index.htm

Scottish Transport Appraisal Guidance

5.8 In March 2006 the Scottish Transport Appraisal Guidance (STAG) was issued after a draft was issued in 2003 (Scottish Executive, 2006). As with the Welsh appraisal guidance, STAG employs a simple and quick Part 1 appraisal in advance of a more comprehensive appraisal of impacts. This also allows for refinement of a proposal early on if there are notable shortfalls in its performance which can be overcome. Once all parties are satisfied with those proposals which appear promising, a more detailed Part 2 appraisal is carried out into the extent of the likely impacts of the proposals.

Table 11 Environmental elements - landscape

Landscape	
Grassland	
Amenity Grass Areas	Open Grassland
Grass Reinforced Walls	Rock and Scree
Grassland with Bulbs	Species Rich (or conservation) Grassland
Heath and Moorland	
Native Vegetation	
High Forest	Shrubs with Intermittent Trees
Individual Trees	Tree Preservation Order (TPO)
Linear Belts of Trees and Shrubs	Veteran Tree
Scattered Trees	Woodland
Scrub	Woodland Edge
Shrubs	
Ornamental Vegetation	
Amenity Trees and Shrubs	Offsite Planting
Climber or Trailers	Ornamental Shrubs
Groundcover	
Native Hedgerows	
Combined Hedgerow and Wall	
Historically Important Hedgerow	Native Species Hedgerows
Native Hedgerows with Trees	Native Species Hedgerows (Managed)
Ornamental Hedgerows	
Ornamental Species Hedgerows	

Table continued…

Landscape	
Earthworks	
Earthworks returned to Agricultural use	Strengthened Earthworks
False Cuttings	
Water Bodies	
Banks and Ditches	Reed Beds
Marsh and Wet Grassland	Water Bodies and Associated Plants
Hard Landscape	
Block Walls	Railings
Brick Walls	Art
Dry Stone Walls	Gateway Features
Stone Walls	Paving
Highway Boundary fences	Street Furniture
Accessibility	
Bridleways	Pedestrian Route
Cycle Route	

Table 12 Environmental elements - biodiversity

Nature Conservation and Ecology	
Habitats	
Phase 1 Habitat (JNCC)	Local BAP Habitat
UK BAP Habitat	Wildlife Corridor
HA BAP Habitat	
Species	
Species Record and Pest Classification (Taxon Look up)	HASAP
Species Latin Name	Local SAP
Survey Season Start	(Other) Species of Conservation Interest
Survey Season End	Citation
UKSAP	
Wildlife Features	
Breeding Site	Nesting Site
Commuting Route	Nursery Site
Foraging Site/Area	Over Wintering Site

Table continued…

Nature Conservation and Ecology	
Hibernation Site	Spawning Site
Migration/Dispersal Route	Terrestrial Site
Wildlife Observation	
Anecdotal	Sighting
Call	Sign
Road Kill	Observation Date
Wildlife Barrier	
Antidazzle Fencing	Livestock-proof Fencing
Badger-proof Fencing	Newt/Amphibian-proof Fencing
Combined Fencing	Otter-proof Fencing
Deer-proof Fencing	Rabbit-proof Fencing
Electric Fencing	Reptile-proof Fencing
Wildlife Underpass Structures	
Amphibian Tunnel	Combined Tunnel
Badger Tunnel	Otter Ledge
Wildlife Overpass Structures	
Badger Bridge	Green/Wildlife Bridge
Bat Bridge	Livestock Bridge
Deer Bridge	Squirrel Bridge
Dormouse Bridge	Wildlife Warning Posts
Wildlife Housing	
Artificial Badger Sett	Dormouse Box/Tube
Artificial Otter Holt	Frog/Toad Box
Artificial Refuge	Hedgehog House
Bat Box	Insect Box
Bird Box	

5.9 STAG appraisals have two parts:

- Part 1: this is an initial appraisal of impacts designed to decide whether a proposal meets the planning objectives, fits with relevant transport, land use and other polices and hence should proceed to -
- Part 2: the detailed appraisal against the Government's objectives.

5.10 Where a preferred proposal has been identified at the option generation stage, the Part 1 appraisal should be used to scope and test that preferred option. Where alternative proposals are generated then a Part 1 appraisal is used to scope and test alternatives. During Part 1 the appraisal against the Government’s five objectives for transport does not descend to the detailed

reporting against each of the environmental sub-objectives. This element is examined during Part 2. Part 1 information is updated as part of completing the full Part 2 appraisal.

5.11 Worksheets are not compulsory under STAG, but the guidance notes that it is frequently appropriate to use them when conducting the Part 2 appraisal. It is recommended that the scope and complexity of all worksheets be adapted to the nature of the proposal being appraised and that planners use their professional judgement to determine the most appropriate methodology in a particular case.

5.12 For options that are dismissed early in the process, the corresponding AST does not necessarily need to be completed in full. The incomplete AST does however form part of the documentation to demonstrate why this alternative was removed from further consideration.

5.13 Unlike the one A4 page restriction on AST size in NATA, when completing the AST under STAG, the Part 1 AST should not extend to more than four A4 pages and the Part 2 AST to no more than ten A4 pages. The AST consists of five parts:

- the proposal
- background information (geographical, social and economic context)
- planning objectives
- implementation issues (technical, operational, financial and public)
- appraisal against the Government's five objectives.

Biodiversity appraisal

5.14 At the strategic level, a broad appraisal of biodiversity is undertaken, identifying in particular, the presence of international, national or locally designated sites in the study area. The relative importance of parts of the study area according to STAG is to be evaluated using the environmental capital method presented in WebTAG unit 3.3.10:

- attribute/feature
- scale at which it matters
- importance
- abundance/trend
- substitution possibilities.

5.15 Worksheets B1 and B2 may be used to assist in the appraisals.

Landscape appraisal

5.16 At strategic level, a broad assessment of landscape character and quality is to be attempted and specific designations identified. Without identifying a methodology STAG notes that reference should first be made to landscape character assessments published by Scottish National Heritage prior to undertaking any more detailed assessment. STAG recognises that in the absence of detailed project proposals it may only be possible to say whether the proposal may have a positive, neutral or negative impact on the landscape.

5.17 A similar approach to that above may be adopted at a project level, though at a finer level of detail. Different landscape methodologies exist and reference is made to DMRB Volume 11 Sections 3.83 - 3.117.

5.18 The Part 2 AST should record, and describe impacts on the fabric and character of the landscape. For strategic appraisals this will perhaps focus on the areas most vulnerable to the type of change envisaged. For project level appraisals the impacts may be examined for each character area. If necessary, all designated sites affected by the proposal, with their designations, are also to be recorded. The qualitative field of the AST is used to summarise the overall effect

on each affected character area or designated site. The appraisal of strategic proposals may have to be reported in the qualitative field only.

5.19 There are no landscape worksheets in STAG.

Table 13 STAG worksheet B1: Biodiversity - strategic & project level, baseline information

Proposal Name			**Worksheet B1: Biodiversity - Strategic & Project Level, Baseline Information**			
Existing & Future Issues					Assessment Date	
Location/Status[1]	Attribute/Feature Habitats/Species[2]	Scale it Matters	Importance[3]	Trend/Status	Ease of Substitution	Relevant Objectives[4]
International Designated Features						
National Designated Features						
Regional Designated Features						
Local/Other Designated Features						

[1] The name / location and designation of any relevant site / area should be provided.

[2] Key characteristics of note.

[3] As discussed in Section 7.4.6.5 of the STAG Technical Database, the assessment should be carried out according to the Ratcliffe criteria.

[4] Relevant objectives to be taken from BAPs and other relevant documents.

International: Special Protection Areas, Special Areas of Conservation, Ramsar Sites, Natura 2000 sites and other international convention sites.

National: Site of Special Scientific Interest, National Nature Reserves, National Biodiversity Action Plans, National Parks and other statutory designated national sites.

Regional: SNH's Natural Heritage Futures, structure plan designations and other sites of regional importance.

Local/Other: Local Nature Reserves, Sites of Interest to Nature Conservation (SINC), SWT sites, other Local Plan designations, Local Biodiversity Action Plans.

Table 14 STAG worksheet B2: Biodiversity - strategic & project level, baseline information

Proposal Name							
Location	Potential Impacts	Potential for Cumulative Effects[1]	Timescales: When/Duration		Uncertainty	Mitigation	Impact Significance Assessment[2]
Key Assumptions							
Key Data Sources							

[1] Consider potential for impacts not just within the proposal but also with other external actions potentially affecting the site or resource.

[2] Use 7-point scale as described in STAG Technical Database Section 5.4.

Visual amenity

5.20 At the strategic level, STAG notes that impacts on views will be difficult to determine as the precise relationship between the proposal and receptors will be unclear. Thus a subjective assessment may be made of the key views and sensitivity of receptors. Detailed methods can be used at the project level appraisal including those from DMRB Volume 11.

5.21 The qualitative field of the AST should be used to summarise the overall effect on the topic for both strategic and local proposals. Where sufficient detail is available an estimate of the number and type of affected locations should be made in the quantitative field, with potential magnitude and significance of impact recorded.

5.22 There are no worksheets provided for visual amenity within STAG.

Welsh Transport Appraisal Guidance

5.23 The final report of the Welsh Transport Planning and Appraisal Guidance was issued by the Welsh Assembly Government in January 2007. WelTAG applies to strategies, programmes or plans and to individual projects or schemes.

5.24 A full appraisal is to apply to options that pass the initial sifting, development and testing stages. Thus a two stage process involves stage 1 where the best or dominant proposal is identified. Stage 1 appraisals are undertaken at the strategy (plan/programme levels) and potentially also at the route options level. Stage 2 is based on a more detailed and evidence-based appraisal of the options selected for further development.

5.25 Paragraph 6.1.4 of WelTAG notes that the general approach that should be adopted to the prediction and evaluation of environmental effects embodies the principles known as the Quality of Life (QoL) Capital Approach. However WelTAG also offers users the opportunity to use the Environmental Capital Approach or other specific established appraisal and assessment methodologies contained in WebTAG and Volume 11 of the DMRB (IANs, July 2006).

5.26 WelTAG does not require the production of worksheets unlike WebTAG and thus while the Quality of Life Capital Approach principles are said to be embodied; this is not clear from the appraisal reporting.

Landscape appraisal

5.27 The approach to landscape appraisal is set out in section 6.7 of WelTAG, although the topic has been combined with that of townscape. The assessment of landscape and visual impacts in rural or urban areas should follow the approach set out in detail in DMRB (Section 2, Part 5) and the Guidelines for Landscape and Visual Impact Assessment issued by the Landscape Institute and IEMA in 2002. This broadly consists of:

- Identifying any impacts (number and type) and their locations.
- Describing the features, importance and designation of these locations (e.g. designated sites, Areas of Outstanding Natural Beauty (AONBs), conservation areas of local, regional, national or European importance).
- Determining the scale of the impact.

5.28 The focus for Stage 1 is upon national and local landscape designations. Thus no hard data is required for the assessment of this criterion; however, a map overlaying the scheme on the local area, showing the main environmental features, is noted to be useful to help determine the scope for any impacts. Strategic and/or detailed constraint maps should be prepared showing how the entire proposed transport scheme may affect the neighbouring existing environmental features and the hinterland in general. At early stages of proposal development, a constraints plan and a

statement of the likely effects of the proposal should be prepared. A brief visual survey also will be required. Limitations and assumptions are to be made clear.

5.29 At Stage 2, more detailed appraisal is to be undertaken with the LANDMAP Methodology being an important resource for taking landscape into account in decision-making. In addition to the analysis required for Stage 1, estimates of the number and type of feature affected, as well as the degree of impact, may also be required.

Biodiversity

5.30 Section 6.8 of WelTAG reports that, in summary, the appraisal of biodiversity effects should:

- Describe sequentially the characteristic biodiversity and earth heritage features.
- Appraise environmental capital - using a set of indicators, this is done by assessing the importance of these characteristic features, why they are important, and their inter-relationships.
- Describe how proposals impact on biodiversity and earth heritage features, including effects on its distinctive quality and substantial local diversity.
- Produce an overall assessment of the significance of the impact based on a seven-point scale.

5.31 Where strategic level or corridor studies involve options with clearly defined routes and modes of transport, the principles of the appraisal process are the same as those described in the *Landscape and Townscape* section above. Where the strategic study does not provide clear definition of routes or possible modes of transport, a more strategic level of appraisal will be necessary. Account should also be taken of the advice on assessing ecology and nature conservation effects given in the DMRB, Volume 11, Section 3, Part 4. At early stages of strategy or scheme development (for example, Stage 1), a constraints plan and a statement of the likely effects of the proposals should be produced. Limitations and assumptions made should be made clear in each case.

5.32 Stage 2 will need to follow the same method as for Stage 1; however, a greater level of detail and as much quantitative assessment on the extent of the impact as possible will be expected. At later stages of development (for example, Stage 2), a more detailed analysis of the important features, possibly including walkover surveys, will be required. Again, all known information of relevance should be included, together with a statement of the limitations and assumptions. The representation of the expected impacts on a local map would be preferred.

5.33 The LANDMAP approach adopts a landscape approach to biodiversity employing a description of the area that include features that significantly influence the biodiversity character of the area including those that have an appreciable negative or positive impact on biodiversity. The evaluation matrix used in the LANDMAP methodology is presented below (see Table 15).

Table 15 Landscape habitat evaluation

Evaluation Criteria	Unknown	Low	Moderate	High	Outstanding
Priority habitats					
Opportunity					
Decline rates					
Threat					
Fragmentation					
Habitat evaluation					
Importance for key species					
Habitat and species evaluation					
Justification of overall evaluation					

Key Features of DMRB/TAG Frameworks

5.34 Figure 8 below places the key features of the DMRB/TAG frameworks alongside each other for ease of comparison.

5.35 The key conclusions to emerge from this review of different guidance documents, is that the approach to appraisal adopted in Wales and Scotland differs by the ability to have two levels of appraisal in recognition of the different stages of scheme development. The approach to the use of ECA and worksheets also varies with a more flexible approach being taken than in England. However, the flexible approach towards worksheets would appear to raise issues of transparency and consistency and is thus not an approach that would be recommended for England.

DMRB Volume 10:

- Highways Agency Environmental asset system (ENVIS) to record environmental features including biodiversity and landscape.
- Records Asset Status but not its environmental capital status.

DMRB Volume 11:

- Provides guidance on the environmental assessment of HA road schemes for use by the Overseeing Departments' Design Organisations.
- How to determine the level of assessment required at stages of scheme development.
- Requirements for reporting environmental effects.
- Guidance on the assessment techniques needed for most environmental impacts associated with the construction and operation of a trunk road scheme.
- Guidance on Ecology and Nature Conservation (covering biodiversity) and Landscape Effects.

STAG:

- Two stage appraisal.
- Multiple page ASTs.
- Environmental sub-objectives not individually reported during Part 1 appraisals.
- Worksheets optional.
- Worksheet provided for biodiversity using environmental capital elements.
- No landscape worksheets.

WelTAG:

- Two stage appraisal.
- Single page AST templates for Stage1 and 2 - no advice on length of AST.
- Environmental sub-objectives reported during Stages 1 and 2.
- Embodies the principles known as the Quality of Life (QoL) Capital Approach but no reporting.
- No worksheets.
- Reliance upon LANDMAP for base information on value of resource.

WebTAG:

- Single stage appraisal.
- Single page AST.
- All environmental sub-objectives reported at each appraisal.
- Plan and strategy level biodiversity worksheets.
- Based on Environmental Capital Approach.

Figure 8 Key features of DMRB/TAG frameworks

6 Identifying good practice

Overview

6.1 For this element of the research, two approaches were adopted to explore good practice in the use of the ECA in landscape and biodiversity appraisals:

- Review of worksheets prepared for biodiversity and landscape.
- Use the survey of practitioners to collect what are seen to be good examples by other organisations.

6.2 Good practice needs definition and here the focus is upon the appraisal worksheets rather than the Appraisal Summary Table itself since it is in the worksheets that the practical application of the ECA is presented. Essentially, good practice is viewed as being:

- An efficient and effective communication of key biodiversity and landscape issues.
- Avoidance of an encyclopaedic or a “list everything” approach since that approach is suitable only for the Environmental Statement supporting documents.
- Grouping of issues by topic or theme leading to a clear transition from site based appraisal scores to the overall topic score.
- Clear and reasoned explanation of the value of the resource and its substitutability.
- A clear and reasoned statement on the expected impact caused by the project indicating the probability of the effect.
- Recognition of key assumptions and uncertainties.
- Where the AST and worksheets are mutually supportive without clear issues being omitted or poorly represented.

6.3 The review identified numerous issues that indicate either a low level of understanding of the ECA, practical issues in its application or difficulties in understanding/applying NATA guidance. It should also be noted that worksheets for small schemes have not been reviewed.

6.4 This section considers the findings from the review of worksheets since no examples of good practice were received from those consulted.

Observations on landscape and biodiversity worksheets

6.5 The observations presented below are based upon analysis of eleven biodiversity and landscape worksheets drawn from the following types of projects:

- urban road improvements
- dual carriageway improvements
- motorway widening.

6.6 Below in Figure 9 is a summary of the findings from the review of the landscape worksheets using the elements that WebTAG identifies as needing to be reported/considered in the appraisal.

Description:

- Variable length and quality of worksheets. In one instance the cultural description extended over 2 pages.
- Occasional tendency to describe the scheme instead of the landscape pattern.
- Landscape pattern is generally well reported.
- Descriptions of tranquillity can be confused with topography.
- Agricultural land grades have been recorded under landcover.

Scale it Matters:

- Can have multiple scales (local, regional, national) being applied to features, affecting clarity of the worksheet.
- A feature may be described on the basis of its geographic scale rather than the scale it matters to decision makers.
- Agricultural land grades have been described instead of a scale of importance in one instance.

Rarity:

- Can be repetitive across the different landscape features.
- Frequency of agricultural land grade has been described.
- Loss of features common to an area of recognised landscape value may be seen to be locally not rare.

Importance:

- Can vary within scheme's area of impact for example unless the landscape is uniform, then its importance will vary.
- Different elements can be important in terms of pattern, tranquillity cultural and landcover.
- Importance often stated without a reason being given.
- Importance of features occasionally recorded as local and regional.

Substitutability:

- Can be difficult to describe where a complex set of features are affected.
- One worksheet distinguished between the ability to substitute the topography from that of the vegetation and other features.
- The ease of substitution is often graded rather a "yes" "no" response.
- Tendency to describe mitigation rather than ability to substitute for the impact.
- Ancient woodland landscapes considered to be substitutable.
- Failure to consider substitution on a site specific basis.

Impact:

- Presentation of impact on multiple elements can become complex.
- Impacts not relevant to landscape have been described.
- Impact scores are often omitted.
- Tendency to report impact and mitigation measure.

Additional Mitigation:

- Can be unclear whether the mitigation is additional to that assumed for the impact score.

Stakeholder views:

- Worksheets fail to show evidence of views of authorities, statutory bodies and public.

Uncertainty:

- Rarely recorded.

Scores:

- Often difficult to determine basis for the overall score.

Figure 9 Summary of landscape worksheet review findings

6.7 A review of the biodiversity worksheets revealed the following findings as summarised in Figure 10.

Area:

- Designated sites are identified under area.
- Other features such as hedgerows, streams, ponds and improved grassland identified without reference to location.
- Occurrence of species recorded without necessarily being clear on location.
- Often prioritised: designated sites; habitat; protected species, but sometimes species recorded in relation to an area.
- Can descend to commentary on semi-mature trees, scrub and semi-improved grassland.

Feature/Attribute:

- Habitats details are generally described at phase 1 level on separate rows.
- Entries of variable length and quality from two words through to a paragraph or more.
- Little quantification on extent of feature or proximity/relationship with proposed transport measure.

Scale:

- Scale of importance can be difficult to judge from the features description.
- Basis for assigned scale can be lacking leading to some difference of opinion on appropriateness of entries.

Importance:

- Reference to importance associated with wildlife corridors occasionally takes place.
- Description given that may reproduce feature entry without describing importance.
- Description of the attribute's value e.g. potential for range of nesting birds, rather than an actual statement of its importance based upon rarity, representativeness, distinctiveness and quality.
- Description of importance often ought to be description of the feature.
- Used to describe potential for species to exist.
- Used to describe the impact of the transport measure and when further surveys are required.
- Importance may be stated without a reason being given.
- Potential for substitution sometimes recorded under importance rather than value.

Trend:

- Unclear whether the trend represents a national trend, regional or local trend particularly where the target reference e.g. BAP is not identified.
- Evidence on to support trend judgement is generally weak or not presented.
- May be difficult to judge early in the development of the transport measure occasional unknown entries are made.
- Users can be unclear on the objective of the trend entry as some worksheets make entries such as "not rare" and "vulnerable".

Biodiversity Value:

- Unclear whether biodiversity value delivers meaningful content when reporting species given uncertainties on population affected and extent of substitution. Importance of species may dominate value over that of substitution of habitat.

Substitution:

- Omitted from worksheet thus not explicitly reported within biodiversity value.

Impact:

- No reporting of the actual impact required, but impact descriptions do occur.
- Some evidence of recording mitigation measures.
- Rarely do worksheets identify indirect effects, and then mainly within the qualitative comments.
- Construction impacts sometimes recorded.

Scores:

- Where worksheet records extensive array of local features it then generally records many "neutral" impact entries.
- Mechanical basis of scoring each feature seems to work.
- Often difficult to determine basis for the overall score.
- An overall beneficial score recorded in only one of the worksheets reviewed.

Qualitative comment:

- Can extend to several pages.
- Used to describe uncertainty, future survey need and potential mitigation measures.

Figure 10 Summary of biodiversity worksheet findings

Common issues

6.8 Both the landscape and biodiversity worksheets reveal albeit on a relatively small sample, common issues associated with the completion of worksheets. These issues comprise:

- Importance, rarity and scale it matters are often seen to be interchangeable leading to lack of clarity or duplication in the reporting.
- Supporting statements for scale, importance and trend can add meaning and help justify the otherwise one or two word entry.
- Inconsistent approach to environmental capital between landscape and biodiversity as exemplified by the different prominence given to substitution.
- Mitigation measures often described alongside the impact entry.
- The basis on which the overall score is derived can be difficult to follow especially where multi-page encyclopaedic worksheets are involved.
- Observations on potential enhancements to landscape worksheets.
- Where multiple elements are to be described then the scale, rarity, importance, substitutability, impact and additional mitigation should be clearly reported against each.
- Revise scoring table to clearly reflect importance of resource in similar manner to biodiversity.
- Worksheet should show evidence of views of authorities, statutory bodies and public, but perhaps this needs qualifying for different types and stages of project.
- Uncertainty in the analysis should be recorded, particularly where the effectiveness of mitigation might exist.
- While one reference is made to landscape trends, the worksheet does not require trends to be recorded unlike that for biodiversity.
- Substitution has sometimes been presented using a scale of low, medium and presumably high. However the basis for such grading is not presented. Perhaps substitution is simply a matter of whether it is deliverable, difficult or impossible over a defined timescale such as 15 years.
- Rarity and importance often confused in the worksheet entries, while rarity is omitted from the biodiversity worksheet. Perhaps rarity should be addressed at the same point as importance in the landscape guidance using the guidance set out in WebTAG 3.3.10 - Table 1, particularly as the guidance itself recognises the duplication that is possible.
- Some examples exist of consultants trying to enhance the legibility of worksheets by the use of bolded text to highlight key statements from the supporting text.

Observations on potential enhancements to biodiversity worksheets

- Inconsistency in structure of worksheets between landscape and biodiversity.
- Little evidence that Natural Area profiles or Local Biodiversity Action Plans are used to underpin the worksheet, although the ability to record reference sources is available.
- When there are identical entries across all the indicators then the individual areas or locations should be amalgamated. Where designated sites are grouped then they should be individually identified.
- The plan level worksheet does not require that the impact is described - only its magnitude.
- Advice on recording of species impacts is not clear contributing to long worksheets recording species such as badger, great crested newt; fish, deer etc.
- Tendency to describe all habitat and species including arable land, trees etc. leads to long worksheets with numerous entries of slight or neutral scores. Given the focus of appraisal is

upon informing decision makers this suggests that such features should be excluded from worksheets.

- Worksheets that group species by area tend to enhance the understanding of the individual locations but can lead to repetition of protected species information.
- Presentation of several protected species on a single row leads to entries with considerable uncertainty or range e.g. medium to very high importance.
- It is unclear that the scoring system is balanced. A positive measure of any magnitude can deliver a large beneficial score. For example the creation of new ponds benefiting water vole or the provision of a new holt for otters. This could balance a large adverse caused by an effect upon a national site.
- Basis for at the AST score when worksheet presents a mix of scores for the affected attributes is generally unclear.
- Little evidence of trade-offs or consideration of cumulative effects influencing overall score. This suggests that the scores underplay the actual effects that result from transport projects. It is noted that wider economic impacts and the STAG Economic Activity and Location Impacts are a means to capture cumulative effects within the economic domain.
- Strategy level worksheets appear to be rarely used and could be deleted.
- The length of biodiversity worksheets can extend to at least 17 pages making it difficult to appreciate how the overall appraisal score is determined.

Good practice examples

6.9 The review of the worksheets and the practitioners' survey failed to provide examples of good practice worksheets. Nevertheless, it was apparent that some worksheet authors had attempted to enhance the clarity of the worksheets. Thus there were elements of good practice rather than a single coherent good example. Among the elements of good practice was the use of bold fonts to highlight the key finding to separate it from descriptive text. Another approach was to describe the impact rather than simply entering the impact score in the worksheet. Others sought to arrange the biodiversity worksheet in a way that minimised the amount of repetition that would otherwise have resulted.

7 Conclusions and recommendations

Introduction

7.1 This section examines and discusses the WebTAG guidance and offers recommendations for any amendments that might improve the guidance on environmental capital by focusing upon the following topics:

- ECA as a viable method
- value of ECA in identifying benefits and impacts
- relationship of ECA to other guidance
- good practice.

7.2 Before examining these points, it is helpful to separate the generation of core information and that of appraisal and indeed differentiate between assessment and appraisal. As noted in Chapter 1, assessment is based upon a context specific definition of the issues to be examined using methods appropriate to the situation with reporting in a robust manner that meets legal requirements and is defensible at public inquiry. It has a tendency therefore to produce an encyclopaedic approach to reporting (often stimulated by poor scoping) with high reliance on professional judgement in the synthesis of the overall environmental performance of the development proposal.

7.3 In contrast, appraisal adopts a formulaic approach in which predefined issues are examined and reported in a rigid manner to achieve a consistency required for decision makers. While elements of appraisal give the appearance of delivering highly objective and quantified findings, in practice, appraisal is also reliant on the professional judgement of the practitioner. Unlike EIA, appraisals do not consider temporary impacts or those associated with construction activity unless they result in a long term effect.

7.4 Assessment can be seen as providing the base information for project appraisal as illustrated by Figure 11. In this relationship assessment provides the basic knowledge that is then reported in different ways the Environmental Statement, AST and worksheets. Similarly at a strategic level, assessment may result in an Environmental Report (SEA), multi-modal study or integrated transport report as well as ASTs and worksheets for the transport strategies being considered.

7.5 Given the relationship between assessment and appraisal, debates on the value of ECA or methodologies should distinguish between whether the discussion relates to the assembly or communication of information. For example, both landscape and biodiversity appraisals and assessments are based upon survey information at an appropriate geographic scale along with an appreciation of how the strategy/project interacts with the identified features. Reporting within NATA is highly structured through the worksheets and AST while a flexible approach to reporting is available to ESs provided the legislative requirements are net.

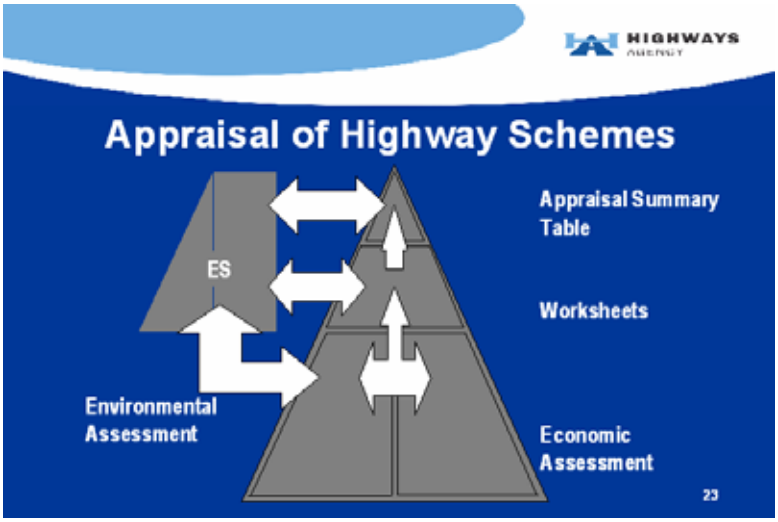

Figure 11 Relationship of assessment and appraisal at the project level

ECA as a viable method

7.6 While the literature reviewed did not pass comment upon ECA or the appraisal as opposed to the assessment of biodiversity and landscape, it did raise questions relating to the following issues:

- which attributes should be recorded
- the level of effort required for appraisal
- the role of worksheets
- the use of databases of environmental information
- the opportunities afforded by predictive models
- opportunities afforded by monetisation techniques
- whether ecosystem services offers an alternative.

Attributes recorded

7.7 Drawing upon the review of other appraisal and assessment guidance in Chapter 5, particularly the approaches taken to landscape and biodiversity appraisal in Scotland, the following paragraphs consider the usefulness of the attributes recorded by the ECA approach and propose some changes. This analysis is also based upon the weaknesses encountered with the reviewed worksheets discussed in Chapter 6.

7.8 The approach to landscape and biodiversity of necessity involves different geographic scales. In the assessment and appraisal, landscape is typically viewed at broad scale (such as a landscape character area) down to the micro scale (where concerns rest with individual landscape features). Biodiversity however, has traditionally been viewed at a habitat and sometimes at an ecosystem scale both of which tend to have a finer resolution than that of landscape at the joint character area level.

7.9 A further difference is that many of the landscape attributes are capable of being identified without a high level of effort and thus the attributes can be available at all stages in scheme development. The same cannot be said for biodiversity. Typically habitat and species survey information is only available during work during the preferred route studies. Earlier studies tend to place reliance upon readily available information such as the boundaries of designated sites.

7.10 While the current approach to the appraisal of biodiversity does not acknowledge the different levels of effort needed between the preferred route studies and earlier stages of scheme development, this need not be the case.

7.11 In theory the application of biodiversity guidance within strategic environmental assessment could set a framework for the appraisal of schemes at the early stage of development. The SEA guidance seeks to focus attention upon composition, structure and function. While much of the detailed information identified in the guidance seems to demand a high level of effort, some principles could be taken forward in a revised approach to ECA particularly as it offers a way beyond a focus upon designated sites.

7.12 **DfT should consider amending ECA to introduce a landscape geographic scale to appraisal of biodiversity impacts.** This might be better described as pattern instead of composition as in the SEA guidance. Taking pattern and structure (connectivity and patchiness) at a landscape level could help to move the focus from sites to the wider focus of biodiversity. This in turn should assist in reporting issues of fragmentation and cumulative effects.

7.13 There does not appear to be any issues associated with the application of ECA to landscape appraisal apart from comments to be made on the guidance presented in Chapter 8.

Level of effort

7.14 ECA is a well based theoretically sound method, but has been found wanting in its practical application. The limited literature would suggest that ECA is too resource intensive, however at least in the context of the appraisal of major schemes that has not found to be the case. If anything the issue has been one of confusion over duplication and distilling the information to provide meaningful summaries. **Thus the level of effort does not appear to be a constraint. However, to do appraisal correctly may involve a greater amount of effort particularly in moving towards a more evidence-led process.**

7.15 Linked to the level of effort required by ECA is the question how much information is actually required for appraisal in contrast to that of assessment. As noted above, there is a tendency for worksheets to capture all of the information gathered rather than focusing upon that which is important to the decision maker. **DfT should retain and build on ECA to capture who is affected to deal with issues of substitutability however it should also ensure that the information provided is at an appropriate level of detail for decision makers.**

7.16 Both the Welsh and Scottish appraisal procedures have introduced two levels of appraisal. In the case of biodiversity STAG adopts a strategic and project level of appraisal with the latter level using phase 1 habitat survey data. In reality this does not offer much difference to the level of effort for appraisal, since the survey data would normally be required as part of the environmental impact assessment.

7.17 There is little to suggest that there would be any benefit to be gained in altering the landscape and biodiversity worksheets to accommodate preliminary and detailed levels of appraisal.

Worksheets

7.18 The approach to the completion of biodiversity worksheets is variable in terms not just of the quality of the descriptions, but also in terms of the range of features recorded. As noted in Chapter 6, some biodiversity worksheets include features as diverse as highway verge and managed grasslands as well as a diverse range of species including deer and badgers. It is questioned whether for the purposes of appraisal, that such low level information is required. Therefore it is proposed that **DfT should amend unit 3.3.10 to exclude features of negligible nature conservation value from worksheets**.

7.19 Protected species should be excluded from worksheets where standard mitigation measures would result in no adverse effects, for example the translocation of great created newts and badgers. However, where there is doubt on the viability of the mitigation, such as in the translocation of a maternity bat roost then the protected species should feature in the worksheet.

7.20 **The DfT should limit the extent of species information to be recorded in the biodiversity worksheets.**

7.21 Section 8.4, below notes that there should be some rationalisation of the overlapping elements with scale it matters, rarity, value and importance being consolidated.

7.22 Apart from consolidating scale it matters, rarity and importance, the **DfT should enhance the way landscape guidance deals with substitutability** (see Sections 8.13 and 8.17).

Databases

7.23 Landscape appraisal is seen by practitioners as involving too many elements that are closely inter-related introducing professional judgement. Also, in terms of biodiversity, the review of worksheets suggests that much of the information regarding trends and substitutability is not evidence based. One response is to reduce the amount of information required. The other is to make key information more readily available from online databases.

7.24 The study briefly explored two databases ENVIS and LANDMAP. The ENVIS database developed by the Highways Agency marks a key step in providing access to environmental data at all stages of scheme development (at least in the case of on-line projects). Unfortunately this database does not yet go far enough for ECA as it does not record the importance, trend and substitutability of the features along the highway. Given the plan-led approach to the development of transport measures, there would appear to be merit in rolling-out the ENVIS database in advance on-line proposals in order to enhance the resource available for appraisal.

7.25 LANDMAP offers both landscape and biodiversity information at four hierarchical levels. The search capability appears to capture many of the elements required for appraisal of these two topics (see Table 2 and Tables 13 and 14). The capabilities of the system seem to be established given that WelTAG promotes use of LANDMAP.

7.26 There would appear to be opportunities for Natural England and other organisations holding environmental databases to incorporate information on importance, abundance/trend, pattern, fragmentation etc within the existing databases or building an equivalent to LANDMAP for England with a start being made in the South East where major development pressures exist. **Natural England should explore the development of its databases to incorporate ECA attributes at landscape and ecosystem levels.**

Predictive models

7.27 The literature review for biodiversity revealed that there was a low level of quantification applied during the environmental assessments. While the literature also revealed the development of a variety of quantitative modelling techniques, it does not appear that they are at an appropriate state of development for widespread use in assessment or appraisal. Nevertheless, the habitat suitability models and ecosystem models may have some scope for application in some specific areas. It is suggested that **Natural England should explore the ability of ecological models to enhance quantitative predictive abilities where Natura 2000 sites may be affected by transport proposals that would require an Appropriate Assessment.**

Monetisation techniques

7.28 Monetisation techniques rely on and supplement the ECA for landscape and biodiversity. Much work remains to be done in areas particularly if the approach to monetisation for the purposes of appraisal is benefits transfer. This relates to both: (i) identifying impacts (for example what and who is affected); and (ii) research to generate monetary value evidence for such impacts. For the former the question is whether monetisation could or should have any effect upon the appraisal of impacts upon both these topics. For example, it is suspected that the monetisation of landscape impacts would require some level of landscape characterisation. It remains to be seen whether the current range of landscape elements would be required, or that the indicators such as scale it

matters or rarity etc would be needed. The monetisation of biodiversity impacts could potentially assist in addressing issues such as fragmentation and cumulative effects were a nationally agreed value assigned for these types of effects. Given the absence of these impacts within appraisal and assessment, this would represent an added factor to appraisal. It might be feasible to apply monetary values to non-designated sites and some protected species impacts, such as those where protected species are typically addressed by translocation. It would also be useful to assign a value to the new habitats that are often created alongside transport corridors.

7.29 Overall emphasis should be placed on not only physical impacts as currently dealt with by the ECA, but also the affected population (extent, demographics, socio-economic characteristics, etc.) and their use of the affected resource directly via recreation activities, indirectly via "amenity" benefits and the availability of substitute resources.

7.30 With regards to further research, a 'strategic' approach is required. Monetisation is concerned with the preferences of individuals and these preferences are rarely as disaggregated as the individual environmental sub-objectives. As noted, seeking to value aspects such as landscape, biodiversity, heritage, etc. separately could potentially lead to double-counting. Rather than approaching from the expert-led assessment perspective, further research should be developed from the standpoint of what affected populations perceive as key impacts on the environment from proposals.

7.31 With the application of monetary values there is also the need to recognise that the costs of ecological mitigation are frequently an insignificant component of the cost of a scheme. Nevertheless, as mitigation measures may well be captured within the scheme costs, at least at the later stages of scheme development, there may be scope for a further element of double counting. In particular, it is suggested that monetisation of landscape and biodiversity impacts could have its greatest effect during the option selection processes where they act at the margin of overall scheme costs. There is a cautionary note to applying monetisation at the option selection stage unless a judgement is made on the potential for design and mitigation during the detailed design stage. For example option A with a landscape or biodiversity cost of £7m may be preferred over option B with a cost of £8m. However option B may be capable of design and mitigation such that the final cost is £6m whilst that for option A drops to £6.5m. Consequently, all things being equal the incorrect option would have been selected.

7.32 **It is suggested that DfT undertake further research on monetising environmental effects with particular emphasis on the perception of affected populations of these effects, rather than seeking values for each sub-objective. To facilitate the use of monetary values in appraisal, impact assessments should also account for effects to user and non-user population.**

Ecosystem services

7.33 Great promise is held out for ecosystem services given the integrated approach it provides. It would challenge the current separate reporting of environmental topics, but has yet to be seen to be a practical approach across the range of transport projects. Ecosystem services is however a framework for communication. With this approach there would still be a need to gather information through ECA. Thus ECA remains a viable approach that instead of being challenged by other methods is in reality a necessary input to them. However, it is recognised that ECA these methods would be better served if ECA were applied in a more repeatable and integrated manner than at present.

Value of ECA in identifying benefits and impacts

7.34 It is helpful to consider the value of ECA at several levels:

- Whether at a programme level (defined either geographically or by organisational type) the capital resource is being maintained. Thus where individual schemes show a draw-down on the capital, others should provide for some replenishment of the capital.
- Whether the methodology is being correctly applied and is helpful at an individual resource level e.g. a landscape character zone, or particular habitat.
- Whether the methodology is helping scheme design teams to make trade-offs between landscape, cultural heritage and biodiversity features that might be at risk.

Programme level effects

7.35 Although no direct evidence has been reviewed, based upon a review of ASTs undertaken by TRL, it would appear that the environmental capital as affected by transport projects is being drawn down rather than supplemented. This raises the question at what point does environmental capital become exhausted or whether it can be increased. It also raises the question whether it is appropriate for the transport programme to consistently show negative impacts on the natural environment given the broader agenda that the Government through the DfT are seeking to deliver.

7.36 There are several ways to address this perceived situation. As in the Australian transport process (Australian Transport Council, 2006) The Australian approach recognises that policy choices can involve critical trade-offs between efficiency gains and equity impacts. Equity issues involve variations across the community with a focus on stakeholder expectations about accessibility and social cohesion as well as the distribution of funds between regions with different population densities. The Australian guidelines make an important distinction between policy choices and other decisions made later in the transport system management process. Transport policy choices are made by governments and provide direction for others.

7.37 The approach in New Zealand to the delivery of wider Government objectives is to encourage the project proponent to provide an “incremental BCR” in which additional benefits are offered over the proposed scheme with an additional incremental cost.

7.38 It is suggested that the DfT need to be seen to deliver across all Government objectives and thus improvements should be considered at both the point at which the scheme brief is agreed and at the draft order/ES stage where the value of additional benefits can be judged by the Minister rather than the project proponents. Essentially this would lead to a preferred and enhanced scheme being submitted for decision. Given that environmental costs are a small proportion of project costs, if enhanced benefits were provided then perhaps this more rapid progress through the consents processes may result. It is therefore suggested that **the DfT should use the data generated by NATA to investigate the extent to which its transport investments deliver positive outcomes across all Government objectives and consider how procedures could be changed to encourage the delivery of cost effective beneficial outcomes.**

Application at the level of the resource

7.39 The value of ECA in identifying benefits and impacts at the level of the resource has been found in this study to be affected by the following:

Fragmentation and cumulative impacts

- Failure to record the fragmentation of ecosystems and cumulative effects is a critical weakness of ECA, however the failings have more to do with the manner in which the focus is upon designated sites.

Reliance upon professional judgement while neglecting community values

- It would appear that particularly in the case of biodiversity appraisal that the absence of information leads to subjective opinion in completing the worksheet. This may have a bearing upon the robustness of the scores. This is of concern as community values are not sought. It

also appears that Natural England is not consistently provided with worksheets to comment upon the robustness of the appraisal.

Problems with substitutability, mitigation, tradability and scoring

- There is no evidence to suggest that these factors influence the impacts upon nationally designated sites as they would typically carry a large adverse score. However, it is suspected that as issues of judgement become more important in the description of moderate and slight impacts so the lack of appreciation of issues of substitution, tradability, mitigation and scoring may become more important.

Subjective approach dependent upon experience of staff

- Where judgement is called upon in completing an appraisal, then the robustness of that judgement is often dependent upon the expertise of those making that judgement. Without a review process or the involvement of Natural England in checking worksheets the robustness of appraisals may be open to discussion.

7.40 While these may be deficiencies in the performance of ECA, it is suspected that they are more likely to emerge in the context of slight or moderate scored impacts. As a result it is suspected that should such effects be occurring that it would be unlikely to have a bearing upon the decision informing purpose of the appraisal. Essentially, these are concerns that could be seen to be at the margin of the appraisal process; however this could have a bearing upon the level of confidence and robustness of the overall approach to appraisal. There is no evidence base to indicate whether the impacts reported via the AST are being under reported. **The DfT could explore whether impacts are appropriately scored by an audit of a yearly sample of appraisals or by benchmarking appraisals using practitioners undergoing training or accreditation.**

Trade-offs

7.41 There has been no evidence reviewed on the success of ECA in assisting with trade-offs during the development of schemes. The issue of trade-offs can be important to ECA at two levels. At the micro-level, there can often be trade-offs between landscape, biodiversity and cultural heritage that are currently not recognised within appraisal. For example, archaeological features may preclude the planting of trees or earthworks for landscape of biodiversity objectives. Should scheme design become more objectives led then such trade-offs would need to become more transparent.

7.42 At the strategy level, trade-offs may occur within studies between different types of transport solutions. Here the question is whether the different implications of area from linear transport projects are fully captured in a balanced way through the ECA process. This could be seen in terms of contrasting the effects of a park & ride site to a new road or the effects of a port expansion. It is suspected that this would need further consideration to support the DfT move to a truly multi-modal.

7.43 At a project level, ECA may be being used to assist in the selection of different options. However, it is strongly suspected that unless radically different alignments are being investigated that the scoring system of ECA is too blunt to differentiate between options in the same corridor. It is therefore suggested that in such circumstances that there is relatively little value in requiring repeated worksheets for each option and that the 7 point appraisal scoring range may be best replaced by a three or four point system similar to the Highways Agency Project Appraisal Reporting system.

7.44 It is proposed that the **DfT should investigate the use made of ECA in trade-offs between affected resources at the strategy and project level and draw attention in the guidance to the issue of trade-offs between landscape, biodiversity and cultural heritage to ensure that**

the scores applied recognise that the mitigation proposed in one topic may affect the score in another.

Relationship of ECA to other guidance

7.45 A key issue that must be considered before addressing the relationship of ECA to other guidance is to recount the difference between appraisal and assessment summarised in the introduction to the report and the introduction to this chapter. Thus relationship of ECA to other guidance is first considered in relation to the other appraisal guidance before considering EIA and SEA guidance.

Appraisal

7.46 The Scottish Transport Appraisal Guidance (STAG) adopts a two part biodiversity worksheet that essentially separates elements of fact from the judgement elements of appraisal. It provides for the same elements to describe the biodiversity resource supplemented by relevant objectives. However the appraisal element provides a more informative description of the environmental effects than WebTAG. WebTAG simply requires a single word to describe the impact magnitude. The STAG worksheets do not capture landscape ecology but it does provide for the recording of cumulative effects and this could include fragmentation and indirect effects since these elements are highlighted in the guidance. **The DfT should introduce a two part worksheet separating factual from impact information based on the STAG biodiversity worksheet.**

Environmental assessment

7.47 The Highways Agency is in the process of revising the EIA guidance on biodiversity and landscape that will form part of the Modernisation of DMRB Volume 11. Recommendations were made in a TRL research project for the Highways Agency on the Modernisation of Volume 11 that recommended each topic address appraisal methods (TRL, 2002). Given that some of the issues identified for biodiversity are essentially associated with assessment, **Natural England is advised to engage with the Highways Agency in the development of the revised assessment guidance.**

Strategic environmental assessment

7.48 It would be incorrect to give the impression that SEA follows a single methodology. Instead, SEA is more diverse reflecting upon the subject of the plan and also the planning scale (regional, county, local) that is under consideration. Unless databases such as LANDMAP were assembled it would seem unreasonable to expect the uptake of ECA within general SEA practice owing to the level of information that would need to be assembled and the frequent lack of spatial detail within many plans.

Good practice

7.49 It is good practice for the statutory environmental bodies to be consulted on the AST and worksheets. **The DfT should encourage that project proponent consults with the statutory environmental bodies where their interests are affected.**

7.50 The landscape WebTAG unit notes that “the views of all the relevant authorities, statutory bodies, organisations and local residents should be brought to bear in making a decision as to the extent and significance of the impacts on the character and quality of each landscape feature and its constituent elements.” There is no requirement in the biodiversity unit that requires the views of these groups. However, paragraph 1.5.28 of unit 2.5 stresses the importance of involving key stakeholders in judging the acceptability of the strategy. **DfT should include within unit 2.5 a requirement that the AST and worksheets should be made available to the public via the internet.**

8 Improving WebTAG

8.1 Emerging from this study there are aspects where WebTAG could be improved these include:

- Excessive text that is often overly academic and not prescriptive enough.
- Overlapping elements in ECA leading to too many elements contributing to “importance”.
- Duplication between substitutability and mitigation.
- Enhance guidance on scoring.
- Presentational issues.

Excessive text and lack of clear guidance

8.2 WebTAG takes 12 and 13 pages to deal with the appraisal of biodiversity and landscape respectively. Within this the actual instructions are interwoven with background and contextual information. This risks many key instructions being overlooked in the AST or worksheet. **The DfT should separate key instructions from other text.**

8.3 WebTAG also suffers from a lack of clear guidance with ambiguous statements being common place (see for example Table 14). Much of the ambiguity is unhelpful particularly in the context of appraisal where a standard and consistent approach is called for. Indeed, it is suspected that much of the ambiguous advice make little difference to the appraisal. **The DfT should ensure that all instructions are straight forward to implement.**

Overlapping elements

8.4 This issue was evident from both the practitioners’ responses and also from the review of appraisal worksheets. It is noted that importance, rarity and scale it matters are often seen to be interchangeable. Indeed, WebTAG itself notes that some duplication is possible.

Description

8.5 While a description of the resource occurs in both the landscape and biodiversity methods, only the biodiversity guidance requires a description of the feature and a location. **DfT may wish to consider whether location ought to feature in the description of the landscape features and whether the column “area” in biodiversity worksheet should be removed with location featuring within the description entry.**

Scale it matters

8.6 Scale it matters should be described in relation to the importance to decision makers. However there is some evidence that at least for landscape it is being interpreted in geographic terms i.e. a small scale intimate landscape. The review of biodiversity worksheets revealed that it can be difficult to judge scale on the basis of the descriptions provided. **DfT should consider incorporating “scale” within a single importance entry.**

Rarity

8.7 Rarity only features in landscape appraisal and is closely related to scale it matters as noted in paragraph 1.2.11 of the landscape WebTAG guidance. It is noted that rarity is omitted from the biodiversity worksheet, but included in the landscape worksheet suggesting an inconsistent application of the ECA. **DfT should consider whether there is value in retaining “rarity” given the duplication that is caused.**

Importance

8.8 Importance is recorded in both the landscape and biodiversity. The landscape description of importance states "how important is this feature/attribute and at what level, for example high, medium or low at national/regional/local level. **DfT should devise a standardised scale of importance for landscape, habitats and species. This should remove geographic scale from the analysis and also consider who is affected.**

Trend

8.9 Trend is only considered within biodiversity and frequently there is an absence of evidence behind the entries. Trends are to be reported for each feature recorded. Thus for those worksheets where an encyclopaedic approach is taken, listing all habitats and species, then numerous trend entries are made.

8.10 It appears that generalised views are presented in the worksheets. It is also unclear whether the trend is one applicable to the feature, locality, the region or a national trend. This ambiguity causes difficulties in interpreting the worksheets. There is also no evidence how the information informs the judgement of the impact score. Nevertheless, trend is potentially an important element indicating the direction that the resource/feature is taking. It is unclear why trend only applies to biodiversity and not also to landscape.

8.11 **Appraisal guidance should make references to sources for trend information such as the Biodiversity Action Plans and the analysis of "Forces for Change" within landscape character assessments. The use of these should be referenced in the appraisal worksheets.**

Value

8.12 Value only features in biodiversity and is an amalgam of importance and rarity and is therefore a duplication of effort. The approach to value set out in the biodiversity guidance might act as a template or a standard scale of importance called for above. **DfT should consider deleting reference to "value" from the biodiversity worksheet.**

Substitution

8.13 While substitution is to be examined later in the context of mitigation, this section notes that the task of reporting substitution does not feature in the biodiversity worksheet. **DfT should introduce "ease of substitution" into the biodiversity worksheet to be consistent to ECA.**

8.14 Impact represents the next aspect on which there could be greater clarity within the guidance. The landscape WebTAG unit requires that a description of and the score for the impact of the proposed transport initiative be reported on the worksheet. In contrast the biodiversity guidance requires an entry to describe the magnitude of the impact. Practice, however deviates from the guidance. Reporting within the landscape impact entry is highly variable. While for biodiversity some descriptions of the impact are provided. Failure to describe the impact, in the case of biodiversity can make it impossible to judge the merits of the appraisal score that has been assigned. **DfT should amend the guidance such that the description and the magnitude of the impact are provided for both landscape and biodiversity topics.**

Additional mitigation

8.15 Additional mitigation is an entry provided for landscape but not for biodiversity. It has been a cause of confusion amongst practitioners, but it does have value in the early stages of project development where uncertainties exist. It is however, not clear what use is made of the entry by decision-makers, perhaps making it not much more than a side note for the design team.

8.16 It is suspected that if the entry were changed to opportunities for enhancements, then this could go some way to informing decision makers of opportunities to deliver improvements across a wider range of Government objectives. Assigning a cost to the enhancement measure would be of benefit. This may take the appraisal process someway towards the New Zealand approach of the incremental Benefit Cost Analysis as the New Zealand government seek to promote delivery across a wider set of objectives than those normally assigned to transport projects. **The DfT should consider replacing additional mitigation by "costed enhancement measures" and include across all environmental objectives.**

Substitutability and mitigation

8.17 There is a lack of guidance over the phrase "standard mitigation" and how it is applied to the appraisal scoring process. While the concept was coined to allow multi-modal studies to make assumptions on the level of mitigation of outline schemes, in dealing with projects the feedback from practitioners reveals some problems.

8.18 WebTAG is not particularly clear in dealing with mitigation. In relation to biodiversity it offers the following advice in paragraphs 1.2.18 to 1.2.22 (emphasis added) as summarised in Figure 12 (below). The biodiversity guidance deals with substitution in paragraphs 1.2.13 and 1.2.14. It notes that this involves judgement about:

- whether habitat(s) are technically replaceable to a sufficient quality
- whether species can be successfully relocated
- whether the ecosystem services can be substituted.

8.19 In the case of the WebTAG unit dealing with landscape, paragraph 1.2.11 notes that a timescale of 100 years may be required to replace landscape features, but that a landscape pattern may be replaced within 10-15 years and that cultural landscapes are irreplaceable. Further guidance is presented in Figure 13 below. There is no discussion on whether the resource is viewed as being substitutable by the affected communities.

8.20 The landscape WebTAG unit advises that there may be uncertainty on the extent to which a mitigation measure would be successfully implemented. Where this occurs then it is to be recorded on the worksheet. As with the biodiversity guidance WebTAG also suggests that additional mitigation not expressed in the ES be included in the worksheet. It is rare to see additional mitigation beyond that within the ES; however for early stages in the development of a scheme it can be helpful to identify additional mitigation beyond the standard responses.

8.21 It is noted that substitution is given greater attention in biodiversity than that of landscape within WebTAG. However practitioners have sometimes simply reported substitution using a scale of low and medium, without any underpinning rational. **The DfT should consider adopting a scale for substitution (Low, Moderate, High) to reflect the extent to which landscape elements and biodiversity features are likely to be effectively substituted by year 15 after opening of the transport project.**

8.22 Apart from the lack of clarity in the text, the following conclusions emerge:

- In order for mitigation measures to feature in the appraisal they must either be likely to be specified or be recorded in the Environmental Statement.
- Offsite or non-guaranteed mitigation should not feature in the appraisal but should be recorded in the worksheet as "additional mitigation".
- Separate sub-options dealing with mitigation are seldom if ever prepared and the effort is unlikely to be proportionate to the value gained.
- Mitigation assumptions must be recorded, but this is rarely undertaken.

1.2.18 **Mitigation** - Where scheme options include proposals for mitigation, this should **generally** be taken account of in the appraisal of impacts. However, an exception to this general rule is described below. There are three categories to consider:

- Design proposals to minimise the impact of the proposal on the site (reducing run-off, for example).
- On-site, or near-site, mitigation to help conserve existing biodiversity interest where the impacts can not be minimised (e.g. dedicated animal crossings, land management regimes).
- Off-site proposals (such as habitat replacement) to compensate for biodiversity and earth heritage losses.

These categories should be developed sequentially in scheme design.

1.2.19 The first two categories are essentially about minimising the effects on or near the site. It is **appropriate for these to be considered in appraising impact, provided they have been documented properly in the Environmental Statement**. The key is to make an appropriate judgement about net impact. **Where there is some risk in the mitigation proposals, it is appropriate to complete separate appraisals, for the 'with' and 'without' mitigation cases**.

1.2.20 The third category above is about compensation for expected loss, though in Environmental Statements it is often described as 'mitigation'. A precautionary approach needs to be taken here: **often it is not appropriate** to lower the impact category on the basis of off-site compensation proposals, as these are unlikely.

1.2.21 In later stage appraisals, mitigation proposals should be documented in an Environmental Statement. New ideas for mitigation not documented in the Environmental Statement should not be taken account of in the impact appraisal, though they should be suggested in text on Worksheet 1. **Such ideas could then be worked up as a separate sub-option, to allow the consequences of adoption to be appraised**.

1.2.22 At earlier appraisal stages, Environmental Statements may not be available. In such circumstances it is reasonable to assume usual mitigation designs for a scheme of this type (such as dedicated animal crossings, for example). **Mitigation proposals should be considered in the appraisal only where these are feasible and likely to be specified in the Environmental Statement**. Evidence from previous schemes of a similar type should be considered. **There must be a documented audit trail of mitigation assumptions on which the appraisal is based**.

Figure 12 WebTAG guidance on mitigation - biodiversity

The period required for substitution must be considered in relation to the time required for the construction and operational phases of any investment proposal and the maturation of landscape mitigation measures. Substitution should be interpreted as the replacement of features lost with an acceptable and appropriate substitute, that is, something that provides the same benefits. In the case of landscape the feasibility of substitution of features should be considered on a site-specific basis, that is, is there suitable land available locally to recreate the features being lost or affected.

Figure 13 WebTAG guidance on substitution - landscape

8.23 It is possible to add that the guidance should apply the precautionary principle where there is uncertainty on not just the ability to specify a given mitigation measure, but also whether the

mitigation measure is reasonably certain to deliver the desired outcome. For example, is it reasonable to lower the score as a result of mitigation measures applied to the loss of ancient woodland when its features are essentially non-replaceable in a human lifetime? **WebTAG should state that mitigation measures should only be taken into account where it is reasonably certain that the impact will be moderated within a given period of time**. A standard time period should be assumed such as 15 years after opening regardless of the landscape or biodiversity feature involved.

Enhance guidance on scoring

8.24 The approach to scoring in theory involves a logical and auditable process of building from the scores assigned to individual resources or features that are affected to arrive at an overall score that is presented on the AST. This theoretical situation is rarely as straight forward in practice with the following issues being observed:

- difficulty with tradable impacts
- cumulative effects not adequately addressed
- aggregation guidance
- ambiguity in the scoring criteria
- uncertainty not addressed
- lack of an auditable process of scoring.

8.25 **Tradable impacts** are those where the loss of one feature is substitutable by beneficial effects occurring to another thus balancing or moderating the score. At one level, the loss of one wetland may be traded with the enhancement of another pond nearby. WebTAG unit 3.3.6 paragraph 1.5.9 provides guidance on balancing adverse and beneficial effects. It is also found in the biodiversity guidance in paragraph 1.3.1 where it is strangely titled as positive effects.

8.26 A long worksheet containing numerous features or resources is often produced when every feature in the vicinity of the transport proposal is recorded. This can result in 20 or more scores being generated. There is then the potential for some slight beneficial impacts to be traded with some slight adverse impacts or exceptionally to trade amongst some moderate impacts.

8.27 There is little evidence from the worksheets examined, that the trading of scores takes place in a transparent manner. In theory the absence of tradable scores should not be a problem since in the main it only affects slight impacts. However, it appears that the overall appraisal score is formulated from several individual scores without much transparency or justification in some situations.

8.28 A further potential issue arises where several slight adverse scores could be considered to give rise to cumulative effects. Thus an overall slight adverse score may be elevated to a moderate adverse score. However in a situation where some impact scores been traded then a moderate adverse cumulative effects score may not have been recorded.

8.29 This is a rather theoretical point since, as is observed below, there is little evidence that the process of arriving at the overall score is based upon advice within WebTAG. **DfT should bring the guidance from unit 3.3.6 on scoring into all environmental appraisal topics and further explore the robustness of scoring practice.**

8.30 The biodiversity WebTAG unit makes reference to cumulative effects within paragraph 1.3.1 while there are apparently no **cumulative effects** upon landscape despite the requirement to separately score the effects upon features, pattern, tranquillity, cultural and land cover. There is little evidence to suggest that cumulative effects are being reported through the appraisal process or that the guidance on the subject is being applied. **DfT should consider how cumulative effects can be reported within the worksheets in an auditable manner.**

8.31 Regardless whether impact scores ought to be traded or whether cumulative effects result from the project, the landscape and biodiversity worksheets require the **aggregation** of the individual scores to arrive at the overall score. The guidance provided in WebTAG unit 3.3.6 requires that the most adverse score should be carried forward to the AST on the basis that decision makers should be informed about the full consequences of the proposal. Thus a score should not be diluted or masked by less adverse impacts.

8.32 Unless the scores are identical across all features recorded in the worksheets, then there is a need to arrive at an overall score. Here there is a tension between the guidance of unit 3.3.6 and the desire to present the transport proposal in the best light. Thus very large adverse scores are presented as large adverse or a "*large adverse score will become moderate adverse as the mitigation matures*".

8.33 It has also been evident from AST review work undertaken for other organisations that the AST score does not always correspond to that on the worksheet. This raises questions of the robustness of reporting. In making the guidance clearer, the DfT should address this issue. An approach would be for the **DfT to require the publication of all ASTs and worksheets to ensure that the appraisal scores are robust.**

Scoring criteria

8.34 The approach to scoring differs between that for biodiversity and landscape, with the former being an essentially mechanical exercise, while the latter requires considerable judgement with the advice being that "*for a proposal to qualify for a particular score, most of the statements relating to that score must apply*" (paragraph 1.2.18 unit 3.3.7). While the landscape scores allow for visual intrusion, the worksheet fails to provide an opportunity to record the intrusion caused to key viewpoints. **The landscape worksheet should be amended to capture the effects of visual intrusion upon key viewpoints also recording who would be affected.** Further the scoring criteria are not strongly linked to the elements reported in the landscape worksheet.

8.35 An area of particular interest to Natural England is the three separate scores that can be accorded to actions that affect National Parks and AONBs under PPG7 since there is no clarification given to the difference between "conflict", "serious conflict" and "cannot be reconciled". **DfT should review the definitions for the landscape scores**.

8.36 The biodiversity guidance recognises uncertainty and focuses upon effects on the integrity of sites in assigning the magnitude of impact. This is then combined with the nature conservation value of the site to arrive at the "*overall appraisal category*" rather than appraisal score. Perhaps it would be helpful if the biodiversity worksheet were to explicitly record whether there were effects on the integrity of a site recognising that lack of knowledge leads to a major negative score being assigned.

8.37 A further issue with the biodiversity scoring is that a positive impact of whatever magnitude can deliver a large beneficial score. For example the creation of new ponds benefiting water vole or the provision of a new holt for otters. Such a score could then be used to balance a large adverse caused by an effect upon a national site. This raises the issue of whether there is equivalence in the scoring system between beneficial and adverse scores.

8.38 **The approach to scoring biodiversity impacts should be reviewed.**

8.39 **The scores should be reported as appraisal scores rather than assessment scores to help differentiate appraisal from assessment activities.**

Uncertainty

8.40 Uncertainty only features in the biodiversity guidance where an intermediate negative impact can be graded as a major negative impact as a result of it not being possible to confirm that integrity would not be adversely affected. Uncertainty, makes only one appearance in the landscape

guidance where the advice is that any uncertainties concerning the impact and its score should be described (paragraph 1.2.11). Given that uncertainty is particularly evident in the early stages of the development of a proposal, the guidance within paragraph 1.4.3 of unit 3.3.6 is relevant (see Figure 14).

> 1.4.3 The level of detail and confidence achievable by the appraisal will vary according to the scale of the proposals and their stage of development. Where data on the local environment or the potential impacts of the proposal are unavailable, or highly uncertain, then assumptions will need to be made. Sensitivity testing should be encouraged, with any assumptions clearly stated and, where appropriate, the precautionary principle applied.

Figure 14 WebTAG guidance on uncertainty - 1.4.3 of unit 3.3.6

8.41 **The DfT should require that uncertainty should be identified on the worksheets within the impact entry and that where uncertainty attaches to the more adverse scores that the key assumptions should be recorded on the worksheet and agreed with the statutory environmental bodies.**

Auditable process

8.42 While ECA sets out to be an evidence-based process, in practice subjective judgements are common partly due to the guidance and partly due to the available knowledge at the time of the appraisal. Nevertheless, opportunities exist to make appraisals more evidence-led in both the short and medium term by enhancing the guidance and by enhancing existing environmental databases. By adopting the STAG approach with a two part worksheet separating the characteristics of the resource from the impacts ought to make it clear where judgement is being applied and thus where uncertainty exists.

8.43 It is suggested that **one objective for the NATA Refresh should be to increase the confidence in appraisal scores such that subjectivity does not play a major role in the scoring or that given the same information appraisal teams would tend to arrive at the same conclusion.**

Presentational issues

8.44 Some matters of detail were also identified these include:

- The effects of lighting, signs, automatic traffic management and IT infrastructure should be reported in landscape worksheets.
- Bold text may be used in worksheets to highlight the key message amongst the supporting narrative.
- The grouping of features that have common entries across all the indicators should be encouraged with geographic locations also being identified.
- The advice on recording of species impacts is not clear. This contributes to worksheets that are too long recording species such as badger, great crested newt; fish, deer etc for which standard mitigation is available. It is suggested that these are issues of secondary importance to scheme decision making.
- Tendency to describe all habitat and species including arable land, trees etc. leads to long worksheets with numerous entries of slight or neutral scores. Given the focus of appraisal is to inform decision makers, this suggests that such features should be excluded from worksheets.
- Grouping species by area tends to enhance the understanding of the area but can lead to repetition over that of entries dealing solely with protected species.

- Strategy level worksheets appear to be rarely used and could be deleted.

Summary of recommendations

Table 16 Summary of recommendations

Aspect	Recommendations on ECA
Attributes Recorded	DfT should consider amending ECA to introduce a landscape geographic scale to appraisal of biodiversity impacts.
Level of Effort	The level of effort does not appear to be a constraint, however, to do appraisal correctly may involve a greater amount of effort particularly in moving towards a more evidence led process.
Level of Effort	DfT should retain and build on ECA to capture who is affected to deal with issues of substitutability however it should also ensure that the information provided is at an appropriate level of detail for decision makers.
Worksheets	DfT should amend unit 3.3.10 to exclude features of negligible nature conservation value from worksheets.
Worksheets	The DfT should limit the extent of species information to be recorded in the biodiversity worksheets.
Worksheets	DfT should enhance the way landscape guidance deals with substitutability.
Databases	Natural England should explore the development of its databases to incorporate ECA attributes at landscape and ecosystem levels.
Predictive Models	Natural England should explore the ability of ecological models to enhance quantitative predictive abilities where Natura 2000 sites may be affected by transport proposals that would require an Appropriate Assessment.
Monetisation Techniques	It is suggested that DfT undertake further research is on monetising environmental effects with particular emphasis on the perception of affected populations of these effects, rather than seeking values for each sub-objective. To facilitate the use of monetary values in appraisal, impact assessments should also account for effects to user and non-user populations.
Programme Level Effects	DfT should use the data generated by NATA to investigate the extent to which its transport investments deliver positive outcomes across all Government objectives, and consider how procedures could be changed to encourage the delivery of cost effective beneficial outcomes.
Benchmarking	The DfT could explore whether impacts are appropriately scored by an audit of a yearly sample of appraisals, or by benchmarking appraisals using practitioners undergoing training or accreditation.
Trade-offs	DfT should investigate the use made of ECA in trade-offs between affected sites at the strategy and project level. It should draw attention in the guidance to the issue of trade-offs between landscape, biodiversity and cultural heritage to ensure that the scores applied recognise that the mitigation proposed in one topic may affect the score in another.
Appraisal	The DfT should introduce a two part worksheet separating factual from impact information based on the STAG biodiversity worksheet
Environmental Assessment	Natural England is advised to engage with the Highways Agency in the development of the revised assessment guidance.

Aspect	Recommendations on ECA

Table continued…

Consultations	The DfT should encourage the project proponent to consult with the statutory environmental bodies where their interests are affected.
Access to information	DfT should include within unit 2.5 a requirement that the AST and worksheets should be made available to the public via the internet.
Clarity	The DfT should separate key instructions from other text.
Clarity	The DfT should ensure that all instructions are straight forward to implement.
Description	DfT may wish to consider whether location ought to feature in the description of the landscape features and whether the column “area” in biodiversity worksheet should be removed with location featuring within the description entry.
Scale it matters	DfT should consider incorporating “scale” within a single importance entry.
Rarity	DfT should consider whether there is value in retaining “rarity” given the duplication that is caused.
Importance	DfT should devise a standardised scale of importance for landscape, habitats and species. This should remove geographic scale from the analysis and also consider who is affected.
Trend	Appraisal guidance should make references to sources for trend information such as the Biodiversity Action Plans and the analysis of “Forces for Change” within landscape character assessments. The use of these should be referenced in the appraisal worksheets.
Value	DfT should consider deleting reference to “value” from the biodiversity worksheet.
Substitution	DfT should introduce “ease of substitution” into the biodiversity worksheet to be consistent to ECA.
Substitution	DfT should amend the guidance such that the description and the magnitude of the impact are provided for both landscape and biodiversity topics.
Substitution	The DfT should consider adopting a scale for substitution (Low, Moderate, High) to reflect the extent to which landscape elements and biodiversity features are likely to be effectively substituted by year 15 after opening of the transport project.
Mitigation	WebTAG should state that mitigation measures should only be taken into account where it is reasonably certain that the impact will be moderated within a given period of time.
Additional mitigation	The DfT should consider replacing additional mitigation by “costed enhancement measures” and include across all environmental objectives.
Tradeable impacts	DfT should bring the guidance from unit 3.3.6 on scoring into all environmental appraisal topics and further explore the robustness of scoring practice.
Cumulative effects	DfT should consider how cumulative effects can be reported within the worksheets in an auditable manner.
Access to information	DfT should require the publication of all ASTs and worksheets to ensure that the appraisal scores are robust.
Scoring criteria	The landscape worksheet should be amended to capture the effects of visual intrusion upon key viewpoints also recording who would be affected.

Aspect	Recommendations on ECA

Table continued…

Scoring	DfT should review the definitions for the landscape scores.
Scoring	The approach to scoring biodiversity impacts should be reviewed.
Scoring	The scores should be reported as appraisal scores rather than assessment scores to help differentiate appraisal from assessment activities.
Uncertainty	The DfT should require that uncertainty should be identified on the worksheets within the impact entry and that where uncertainty attaches to the more adverse scores that the key assumptions should be recorded on the worksheet and agreed with the statutory environmental bodies.
Auditable process	Increase the confidence in appraisal scores such that subjectivity does not play a major role in the scoring or that given the same information, appraisal teams would tend to arrive at the same conclusion.

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Appendix 1 Practitioner survey questions - consultants group

Table A Section 1 - personal details

	Personal Details	Prompts
1	Interviewee name	
2	Organisation	Dropdown
3	Telephone Number	
4	Role	Dropdown
5	Professional training (background?)	Dropdown
6	How many years have you been working on transport projects?	Dropdown
7	Which types of transport projects have you worked on?	Dropdown (Any overseas work?)
8	Which types of transport feasibility projects or plans have you worked on?	
9	Have you worked on the SEA/SA of transport plans?	
10	Are you able to answer questions on: AST's	**If No then ignore section 2**
10	Are you able to answer questions on: Landscape aspects	**If No then ignore section 3**
10	Are you able to answer questions on: Biodiversity aspects	**If No then ignore section 4**

Table B Section 2 - the appraisal process and appraisal guidance

(ONLY ASK IF ANSWERED 'YES' TO Q10.1)

	Appraisal Process and Appraisal Guidance	Prompts
11	Would you view appraisal to be the same or different to assessment?	
12	How do you think they are the same/different?	
13	What guidance do you use for your transport projects?	Dropdown
14	Where do you go to obtain this guidance?	Dropdown
15	Have you used WebTAG unit 3.3.7 Landscape?	Dropdown (IF ANSWERED NO - GO TO Q17)
16	Are there elements of the Landscape guidance you think should be enhanced during the NATA refresh?	Dropdown - Prompt by asking if guidance is appropriate to respondent's needs (for example, length/complexity/detail).
17	Have you used WebTAG unit 3.3.10 Biodiversity?	Dropdown (IF ANSWERED NO - GO TO Q19)
18	Are there elements of the Biodiversity guidance you think should be enhanced during the NATA refresh?	Dropdown - Prompt by asking if guidance is appropriate to respondent's needs (for example, length/complexity/detail).
19	Have you experienced any difficulties completing the Environmental sub-objectives of the Appraisal Summary Table (AST)?	for example, coverage of landscape/biodiversity/heritage/water topics; Relevance to all project types and stages; links with worksheets; assigning scores to impacts; gathering information
20	How do you deal with uncertainties (for example, site knowledge, scheme design and mitigation) present in the earlier stages of plan/scheme development?	Do these uncertainties present particular problems when carrying out the appraisal?
21	Do you think there should be a maximum length to worksheets?	Dropdown

Table C Section 4 - ASTs and worksheets - landscape

(ONLY ASK IF ANSWERED 'YES' TO Q10.2)

	ASTs and Worksheets - Landscape	Prompts
22	Have you experienced any particular difficulties when completing the Landscape worksheet?	for example, understanding of worksheet headings; repetitive nature of entries; particular project/plan types
23	Have you had any difficulties with the Landscape worksheet in describing any of the following: the Landscape character; scale it matters; rarity; importance; and substitutability?	
24	What factors do you use to judge the tradability (substitutability) of landscape impacts?	What do you base decision on? For example, local knowledge, expert judgement?
25	Do you feel that any changes are needed in Landscape appraisal to recognise the importance of the affected features?	Does landscape appraisal lead to a meaningful valuation of the landscape capital?
26	Do you know of any specific examples of good practice in appraising the landscape aspects of a transport scheme?	Please obtain details and ask if it's possible to have a copy of the AST and worksheet.
27	Have you experienced any particular difficulties when completing the Biodiversity worksheet?	for example, understanding of worksheet headings; repetitive nature of entries; particular project/plan types
28	Have you had any difficulties with the Biodiversity worksheet in describing any of the following: the biodiversity attributes; scale they matter; rarity; importance; and substitutability?	
29	What factors do you use to judge the tradability (substitutability) of biodiversity impacts?	What do you base decision on? For example, local knowledge, expert judgement?
30	Do you feel that any changes are needed in Biodiversity appraisal to recognise the importance of the affected attributes?	Does biodiversity appraisal lead to a meaningful valuation of the biodiversity capital?
31	Do you know of any specific examples of good practice in appraising the biodiversity aspects of a transport scheme?	Please obtain details and ask if it's possible to have a copy of the AST and worksheet.

Table D Section 5 - environmental capital

	Environmental Capital	Prompts
32	Can you describe what you understand is meant by the term Environmental Capital?	
33	Do you know which topic areas in the appraisal process employ the Environmental Capital Approach?	(correct answer: Landscape; Biodiversity, Heritage of historic resources, and water)
34	What do you feel are the main strengths/benefits of the Environmental Capital Approach?	
35	What do you feel are the main weaknesses with the Environmental Capital Approach?	How could ECA be improved?
36	How well does the Environmental Capital Approach handle issues of substitutability and trade-offs between the deterioration of some resources and improvement of others?	For different areas of a scheme and for different species or habitats
37	Does the ECA adequately capture information on cumulative impacts?	
38	Are you aware of any alternatives to the Environmental Capital Approach?	Such as other economic/environmental valuation methods; methods in other countries
39	Do you think Environmental Capital can be applied to SEA/SA?	What are the barriers/issues with using ECA in SEA/SA?
40	Do you think Environmental Capital can be applied to all plans and projects?	Which types in particular is it most suitable for? How well does it facilitate option generation? Is it applicable across modes and sizes of scheme? Is it applicable to innovative transport interventions (for example, traffic management schemes)?

Natural England works for people, places and nature to conserve and enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas.

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