SCOPING STUDY TO DEVELOP UNDERSTANDING OF A NATURAL CAPITAL ASSET CHECK

Revised Final Report for Defra

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Table of Contents

Summary

This study has scoped a Natural Capital Asset Check, which was a commitment in the 2010 Natural Environment White Paper. The development of this asset check approach is continuing under the UK National Ecosystem Assessment follow-on project, which will conclude in October 2013. This summary attempts to answer some basic questions about a Natural Capital Asset Check that this scoping study has investigated:

What

"Natural capital" refers to natural assets that provide, through their existence and/or some combination of their functions, a positive economic or social value. An asset check can be applied to different definitions of natural capital assets – particular ecosystem services, particular habitats or ecosystems, or a subset of the ecosystem services from particular habitats.

A natural capital asset check (NCAC) is an assessment of the current and future performance of natural capital assets, with performance measured in terms of their ability to support human well-being. It does this through analysis of:

a) How much of a natural capital asset do we have? (amount, condition)
b) What does it produce? and
c) How do our decisions affect a) & b) over time?

An asset check summarises evidence on the underlying condition of the natural capital assets that will support valuable future from ecosystem services.

Why

The UK National Ecosystem Assessment (UKNEA) describes the important contribution of the natural environment to society's wellbeing. For other key contributors to our wellbeing, like economic activity, we check the condition of the underlying assets that support them. For example, educational qualifications, R&D spending and business investment data inform us about trends in the underlying condition of built and human capital that support economic activity. A NCAC aims to provide similar information about the underlying condition of the natural environment – something that currently, decision-makers often lack.

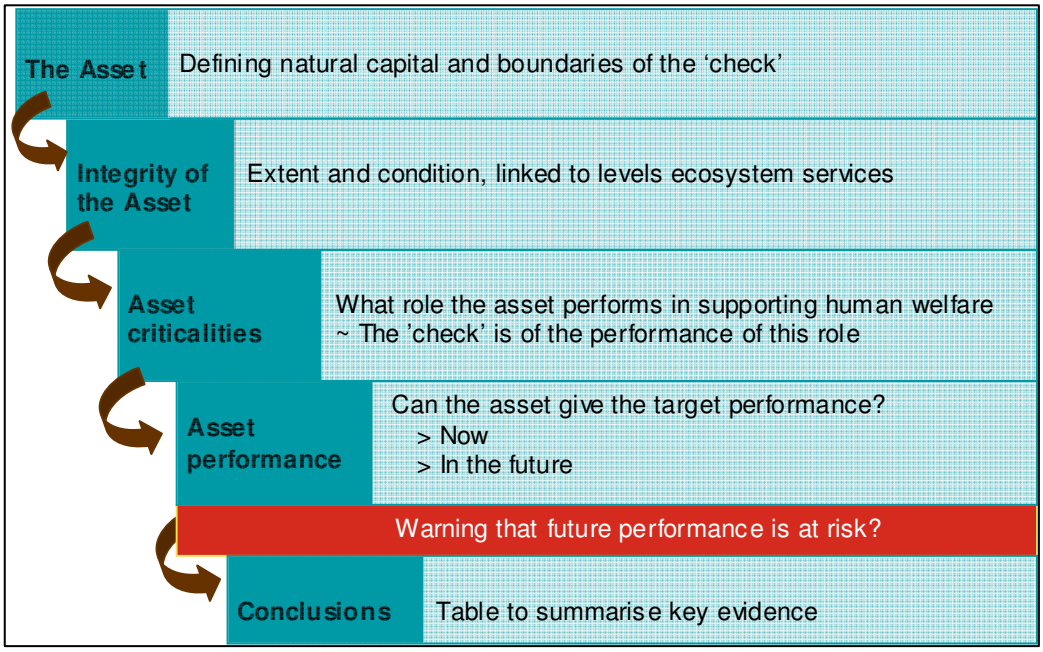
In doing this, a NCAC could help reflect the bigger picture about the condition of the natural environment and the possible impacts of future changes– for example the impact of cumulative effects (e.g. how individual actions that increase surface water runoff can collectively increase flood risks in a catchment), or whether there are thresholds beyond which benefits from the environment will fall irreversibly (e.g. fish stock collapse).

When

Undertaking a NCAC requires a significant amount of environmental and economic data, so may take 5 – 10 days work spread across more than a month of time. This means it may need to be undertaken proactively for more critical environmental assets (e.g. those with highest value to society and/or considered to be at risk), rather than reactively, unless in response to significant decision-making needs (e.g. major policy reforms or reviews). Completed NCACs could be kept as a catalogue to be referenced in appraisal of individual decisions (e.g. through cost-benefit analysis) on the environmental issues they cover.

How

The scoping study defines a **proposed natural capital asset check approach:**



In defining performance, the NCAC requires consideration of what benefits from the natural environment society can expect to be sustained over time. This may draw on science that has informed environmental policy targets, such as targets for conserving areas of natural habitats, or defining sustainable exploitation of resources (e.g. sustainable yields of fish stocks). Alternatively it could use analysis of ecosystem services, such as in the UKNEA, or using tools (e.g. INVEST).

Where

So far the NCAC has initially been developed as a national analysis tool, but can also work at other spatial scales (and this will be tested further). Undertaking a NCAC from scratch at too small a scale may not be an efficient use of resources (if the effort required is not justified by the issues at stake). Once a NCAC has been completed at a larger (e.g. national) scale, it could be efficiently re-scaled to relevant natural capital asset(s) at a smaller (e.g. local) scale.

Who

A NCAC can be undertaken by environmental professionals from different backgrounds. It should have inputs from people from different disciplines – in particular both environmental economists and ecologists. The results of a NCAC aim to provide decision-makers with thorough environmental information, but they may also be relevant to business' strategies for using the natural environment.

Relationship to existing work

The proposed NCAC aims to complement existing environmental-economics approaches that look at natural capital:

- Work is underway in the UK to develop natural capital 'accounts'[1]. The proposed NCAC would provide interpretation of such accounting information, linking knowledge of natural capital assets to the provision of ecosystem services.
- Impact Assessment (IA) is the main process through which economic scrutiny of environmental policy decisions is collated and reported by Government. Two points in the IA process where NCAC information could make a difference are: firstly, in the opening sections that define the problem under consideration, justify intervention and outline intended effects, and secondly in 'other key non-monetised impacts' (such as where an intervention addresses a 'red flag', e.g. reduces the risk of crossing a threshold).

Work under the UKNEA Follow-on

The proposed approach still has limitations that will be addressed under this follow-on work, in particular through undertaking further case studies that look at thresholds and cumulative impacts, spatial scales, different sources of evidence, and links to cost-benefit analysis, national environmental accounts and ecosystem services modelling tools.

It will also seek to investigate the frequency with which checks should be undertaken for natural capital assets, the use of economic value evidence. Other work under the UKNEA follow-on project will examine evidence for the 'problem statement' the NCAC is attempting to address.

[1] http://www.ons.gov.uk/ons/rel/environmental/uk-environmental-accounts/2011---blue-book-update/artnaturalcapital.html

1. Introduction

This is the final report for a study to scope the use of a natural capital asset check in the UK. The study has been led by Economics For The Environment Consultancy (eftec) with inputs from Roy Haines-Young (Fabis Consulting), Giles Atkinson (LSE and eftec associate) and Rosie Hails (CEH).

The aim of this study is to define what the scope of an asset check might be in the UK policy context, and to suggest and test assessment approaches that can be used operationally. To achieve this aim, the team reviewed the theory behind the key issues in an 'asset check' and its relationship to other environmental economics issues and appraisal methods. It did this in order to develop:

- The definition of an asset and an asset check, and how it differs from existing environmental economics techniques that provide decision-makers with information, such as environmental accounting, ecosystem services and impact assessment processes, and cost-benefit analysis.
- A suggested outline for a natural capital asset check method, covering its purpose, how data could be used to undertake it, and the presentation of its results in terms of future values and risks.

Natural capital assets produce value for human society. Our understanding of the links between physical assets, the services they provide and the benefits humans receive as a result has increased through application of ecosystem services concepts, and this in turn informs our management of natural capital. To improve that management, we want to understand how natural capital will continue to produce services over time, i.e. its physical resilience, which reflects both the condition and the size of the stock. We lack a systematic way to assess this resilience and feed it into management decisions – hence the desire to have a 'natural capital asset check' (NCAC).

The emphasis of the work is on enabling a practical outcome – in both methodological, and resource terms. Methodologically, the approach must be robust but also achievable with the current state of environmental-economic knowledge. Resource-wise, it must be deliverable from resources that are realistic in the context of public sector budget constraints and on a timetable that can inform policy and other decisions.

This introduction provides some background to the study and defines the 'Problem Statement' that the work intended to address. Section 2 summarises the project's process of work. Section 3 describes the definition of a natural capital asset check and how it was tested. The findings about the scope of a NCAC approach are described in Section 4. The next steps in the work, primarily issues being carried forward into the UKNEA follow-on project's natural capital asset check work package, are described in Section 5.

1.1 Problem Statement[2]

The UK Government is committed to Sustainable Development (SD), understood as inter-generational equity[3]. The Government Economic Service review of the economics of SD (Price et

[2] This draws on inputs from Tim Sunderland, Natural England, pers com, August 2012.

al. 2010) recognised the difficulties in operationalising SD. The review argued that cost-benefit analysis (CBA), when done well, took us quite a long way towards good decision making for SD (although it was recognised that there was room for improvement in current practice). However, there are weaknesses in economic tools that need to be addressed.

Firstly, when potential non-marginal consequences of exploiting natural capital are identified, using CBA based on marginal economic valuations is unreliable. An alternative approach to analysis is needed, looking at the changes to natural capital in a more strategic way.

Secondly, the concept of 'critical natural capital', which recognises that substitution between different forms of capital (man-made, human and natural) is not always possible which conflicts with assumed substitutability between assets in economic analysis. For example, adjusted GDP approaches are often built on the foundations of weak sustainability – assuming that any non-substitutabilities between capitals are insignificant from a sustainability point of view. However, Price et al (2010) rejected the weak sustainability argument, recognising that some natural capital provided critical life support systems, and so does not have substitutes.

Ecosystem services analysis, which marries economic and ecological concepts, and definitions of natural capital, offers methods to help address these weaknesses of CBA. They can highlight where critical (parts of) natural systems are under-threat, or whether enough natural capital is being saved for the future. To assess this latter point requires consideration of whether there are cumulative long-term impacts on natural capital that may be outside the boundaries of individual decision-making processes, but are collectively significant for future generations' wellbeing. The idea of a Natural Capital Asset Check (NCAC) aims to identify an approach through which to apply these methods to generate information that will inform decision making that will affect natural assets.

To conceptualise the potential role of an asset check, we suggest an analogy to economic data: UK GDP figures are backed up by data on labour (e.g. training and qualifications), innovation (R&D spend) and capital (e.g. investment in infrastructure) because these inform us about trends in the underlying condition of these capital assets that support GDP.

While the existing ecosystem services data tell us about current values from the environment and sometimes predict future values, the data are usually too dispersed to fully capture the state of the underlying environmental assets providing these services. An asset check should ideally involve a practical way of providing simple and concise evidence on the underlying condition of the natural capital assets that will support future values from ecosystem services.

1.2 Policy Context

The broader policy landscape for developing an asset check methodology is just one of a number of environmental-economics initiatives stemming from the Natural Environment White Paper (NEWP) (HM Government, 2011). The asset check scoping work is also being undertaken bearing in mind the needs of the Natural Capital Committee (NCC), an initiative in the NEWP.

[3] i.e. the widely recognised Brundtland Commission definition of SD: '*...development that meets the needs of the present without compromising the ability of future generations to meet their own needs*.' (1987 Brundtland Report, "Our Common Future").

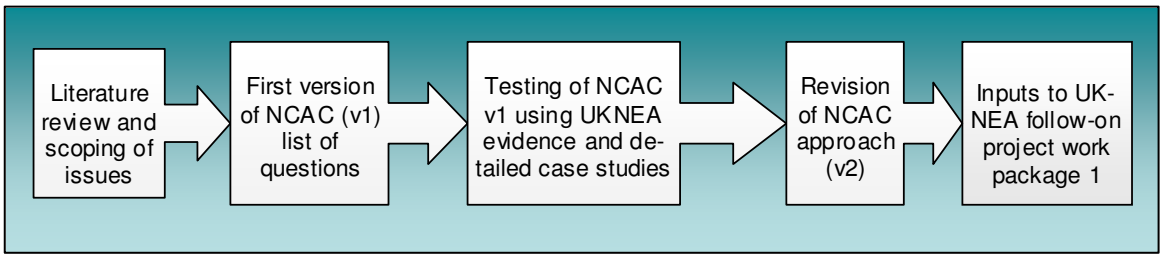
In principle an asset check can be applied to both ex-post and ex-ante decisions and can inform current and future policy requirements. These requirements might include:

- Supporting key commitments from the NEWP to identify areas where natural resources are being used unsustainably. A starting point for assessing this is the UKNEA tables: services that are highly valued *and* declining are logical priorities.
- Addressing the need, identified in Government Economic Service work on the economics of sustainable development (Price et al. 2010), for more understanding of limits/thresholds.
- Giving practical information on ecosystem services to decision makers at different scales (e.g. UK, devolved administrations, regional, local).

1.3 Project Activities

The main elements in this project are shown in Figure 1.1. Each stage of work in the project built on the previous ones. The outputs of the literature review are described in the project's interim report (see Appendix 1 (tbc)).

Figure 1.1. Main project work stages



The testing of an initial NCAC approach framework is described in the case studies report (see Appendix B (tbc)), which provided feedback that informed the design of the approach resulting from this project. The testing used two applications. Firstly, a preliminary UK application that drew upon the UK NEA (see Section 3 of case studies report), and secondly through three more detailed case studies (see Section 4 of case studies report).

The UKNEA application used that document's ecosystem categories with a focus on services that were assessed as deteriorating (of all importance levels), and those assessed as having high or medium-high importance and some deterioration were identified. Economic values available from the UKNEA were then used to prioritise between the different services that are deteriorating.

The habitats with the widest range of services showing deterioration or some deterioration and medium-high value were freshwaters, open waters, wetlands & floodplains; and enclosed farmland. This test application covered:

- A selection of the main habitats used in the UKNEA (Semi-natural grasslands, Enclosed farmland, and Freshwater);
- Lowland heath, which is a subset of one of the UKNEA's main habitats (Mountain moor and heath); and
- Carbon storage, which is a service provided by many habitats.

Further to the UKNEA application, a set of detailed case studies was chosen to test certain key issues; such as high policy relevance, poorer ecosystem states, good and poor availability of data and high value services:

1. Fisheries and saltmarsh fish breeding habitat;
2. Woodland, using ONS, UKNEA, Forestry Commission and other data at different spatial scales, and
3. Using Countryside Survey data on habitats (e.g. farmland).

Following the testing, the NCAC approach was revised again, resulting in a revised version (as presented in Annex 1). This version is being taken forward for use in the UKNEA follow-on project natural capital asset check work package (WP1). The work identified numerous further questions about a NCAC, and these are the main inputs to WP1.

2 Summary of Project's Work

This Section summarises the project's main work to date, in particular the definition of a natural capital asset check approach. The work in this project has defined a draft NCAC approach in terms of:

- Definitions of natural capital assets and an asset check;
- The key potential conclusions from an asset check, on sustainability of its performance and red flags, and
- A matrix of questions/data needs that can build up information to answer these considerations.

2.1 Development of the Asset Check Concept

The purpose of a natural capital asset check is to assess changes to the volume and/or condition/integrity of an asset to understand future changes in the flows of services it can produce, and the implications of this for human wellbeing.

The proposed approach assumes that an asset needs to have some physical measurement, and defines natural capital assets as:

…natural assets that provide, through their existence and/or some combination of their functions, a positive economic or social value.

Natural capital assets can be defined in several different ways, so the scoping of an asset check aims to be flexible to accommodate these definitions. Traditional economic definitions of capital assets refer to ownership and control, but many natural capital assets do not conform with this definition. However, it is still desirable to 'asset check' natural capital that cannot be owned and/or controlled (e.g. plankton, atmospheric carbon). The results of the check can help decision-makers understand and anticipate impacts on human welfare, even if they can only react to these welfare impacts, and cannot influence them. The decision-making implications of such analysis would need to be drawn in the context of how to manage common pool resources.

2.2 Proposed Natural Capital Asset Check Approach

The suggested working definition of an asset check for use in the next stages of its development under the UKNEA follow-on project is:

An assessment of the current and future performance of natural capital assets, with performance measured in terms of their ability to support human well-being.

More specifically, a natural capital asset check (NCAC) is an assessment of the current and future performance of natural capital assets, with performance measured in terms of their ability to support human well-being. It does this through analysis of:

a) How much of a natural capital asset do we have? (amount, condition)
b) What does it produce? and

c) How do our decisions affect a) & b) over time?

The proposed approach is not the only possible form of analysis. Therefore, a natural capital asset check is not defined as a new stand-alone tool, but as an analytical approach that fulfils certain criteria, including:

i. Considering the management of natural capital assets;

ii. Taking account of any changes to the extent and integrity of those assets, including their structure/processes and functions;

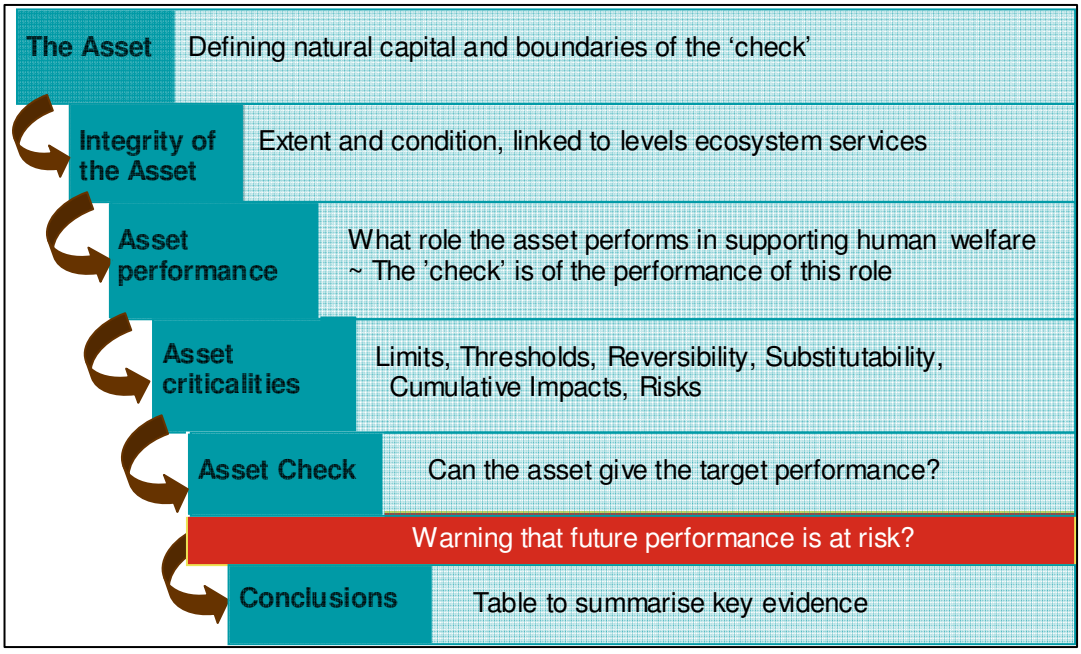
iii. Assessing the implications of those changes for ecosystem services flows in the future, and

iv. Assessing how those changes in service flows will affect human wellbeing.

It is obviously the case that many forms of environmental-economics analysis already fulfil some of these requirements. Most famously, the 2006 Stern Review of the Economics of Climate Change[4], highlighted the significance of climate stability to future wellbeing, providing answers to the above questions in terms of greenhouse gas concentrations in the atmosphere. In this sense it can be regarded as a natural capital asset check of the climate.

In order to ensure a NCAC is adaptable to different ecosystems and change context, NCAC is designed as a series of questions that build up economic and environmental information about a natural capital asset (see Annex 1). The questions are organised in six stages, as shown in Figure 2.1.

Figure 2.1: Summary of Proposed Natural Capital Asset Check Approach.



[4] http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/stern_review_report.htm

A key factor in the proposed approach is that an asset check adds a dynamic element to the way existing economic appraisal approaches are applied to the environment: how the condition and integrity of natural capital assets change over time and how these changes affect the values we derive from them *in the future*[5]. Thus an asset check is defined broadly, looking at both past and future trends, and with both impact assessment (forward looking) and audit (retrospective) seen as part of the NCAC.

Linking back to the working definition at the start of this section, using the concept of *performance* requires consideration of what benefits from the natural environment society can expect to be sustained over time. This may draw on:

- Science that has informed environmental policy targets, such as targets for conserving areas of natural habitats, or defining sustainable exploitation of resources (e.g. sustainable yields of fish stocks); and
- Analysis of ecosystem services, such as in the UKNEA, or the outputs of using tools (e.g. INVEST).

[5] An asset check could equally be concerned with changes in the past, but it is suggested that this only has policy relevance as an indicator of future changes.

3 Lessons from Testing the Approach

The project's first articulation of a natural capital asset check was tested in two ways:

- A UK application drawing on the UK NEA. and
- Through three more detailed case studies.

This testing is described in a case studies report (See Appendix B). The key lessons from this testing are summarised in this Section in terms of the data sources used, design of a NCAC, definition of natural capital assets and specific comments from the Natural Capital Committee.

3.1 Data Sources Used

The testing made use of a variety of different sources of information. The following UKNEA data were used in analysis of:

- A selection of the main habitats used in the UKNEA (Semi-natural grasslands, Enclosed farmland, and Freshwater);
- Lowland heath, which is a subset of one of the UKNEA's main habitats (mountain moor and heath); and
- Carbon storage, which is a service provided by many habitats.

Three detailed case studies were chosen to test certain key issues, they investigated:

- Fisheries and saltmarsh fish breeding habitat: this case study builds on recent work looking at fish populations (e.g. in Charting Progress II), modelling of recovery of fish stocks (ongoing for MSFD analysis), and the science of fish lifecycles (Environment Agency, pers comm, March 2012);
- Woodland: using ONS national accounting data, UKNEA data, modelling of ecosystem services from the English Forest Estate for Forestry Commission by eftec and smaller scale data (e.g. for The National Forest). This examines different spatial scales (local/ regional/ national), and
- Using Countryside Survey data on habitats (e.g. farmland): this case study uses the Countryside Survey which is a data set that the project team have extensive experience of working with. The advances that have been made in the survey enable some condition measures to be examined, and analysis of how land cover data (i.e. broad habitat stock and condition) may produce accounts showing the processes of change to capital from 1984-through 1990, 2000 and 2007.

The NEA typically contained substantial information on the extent and condition of the habitat and some of the provisioning and regulating services that flow from it. For some of the more specific questions in the approach, such as the asset criticalities, the NEA was less useful. Therefore, while the NEA is a very valuable source of information for

undertaking a natural capital asset check, it is insufficient. In general completing the proposed approach requires more information than was contained in the NEA. For example:

- Information is needed on predictions of future ecosystem service levels and criticalities. The UKNEA scenarios may imply these but do not provide predictions.
- Understanding of criticalities often involves expert judgement based on scientific knowledge (e.g. of the extent to which different ecosystem processes are limiting factors in the provision of ecosystem services). Such judgement is needed regardless of which data source is used.

However, the NEA is a useful compendium of data related to the UK's ecosystems and therefore should be the starting point for any UK natural capital asset check. The detailed case studies used further sources of information, and therefore provided further insights some contrasts in results:

- The salt marsh/fisheries case gets close to a very interesting conclusion about a natural capital asset (on whether the integrity of saltmarsh assets is a limiting factor on ecosystem service provision), but only does so for one fish species, albeit an important one. More information that allows this question to be answered across a wider range of species is needed, and
- The Countryside Survey is a strong basis for completing some parts of an asset check, but key questions still need to be answered through expert judgement.
- The woodland case study showed how different data (Countryside Survey, ONS national accounting data, ecosystem services valuation models) can be combined to cover a range of services in a natural capital asset check. The use of different data sources (at different spatial and temporal scales) helps strengthen the conclusions reached.

Much of the information, expertise and understanding required to undertake an asset check, exists in the current literature and datasets used in this study. The most efficient way to utilise these resources and undertake an asset check is to get multidisciplinary teams of experts and wider stakeholders to provide their judgement while answering the key questions in the proposed NCAC approach.

Finding and engaging such participants is not straightforward. A major national research effort like the UKNEA had the academic and political backing to attract inputs from a large number of key experts. The Stern Review (regarded as a natural capital asset check of the climate – see Section 2.1) had significant resources available to undertake research and analysis.

For future NCAC work, it is essential that analysis is able to draw on high-level expertise. This requires inputs from experts from different disciplines (e.g. ecologists and economists) who have detailed understanding of the functions of the natural capital assets in question, and how current changes to the asset may affect ecosystem services.

3.2 Design of a NCAC

The following lessons were drawn from the testing exercise:

- Identification of different drivers is an important part of an asset check, for example because it helps identify different causes of change that can contribute to cumulative impacts, and because it helps identify policy drivers and link the results to policy decisions. Therefore, analysis of drivers is summarised at the start of the proposed approach.
- There are two 'tests' that a NCAC applies to an asset which need to be made clear to the users: the 'integrity test' and the 'sustainability test'. The integrity test looks at the extent and condition of the capital asset, whereas the sustainability test looks at whether the asset can continue to operate as a capital asset into the future (i.e. to sustain the services it provides). A capital asset that fails the sustainability test is expected to fail the integrity test, but one that fails the integrity test might not fail the sustainability test: The extent and/or condition of, and the services provided by, an asset may be declining, but not sufficiently to damage the role as a capital asset. In other words, it may still be able to deliver the target level of performance.
- The proposed approach has questions analysing risks and other criticalities and a concluding question for identifying red flags, which need to be more clearly defined and prioritised. Red flags are defined as a warning that future target performance is at risk, for example because:
    - the asset is underperforming and continuing to decline, or
    - there is prospect of collapse which could be irrecoverable (i.e. being irreversible with no substitute).

  These judgements are based on combinations of variables, like underperformance, decline, collapse, irreversibility and substitutability that are identified in specific preceding questions in the approach (see text against each question in Annex 1).

These lessons for clarification and design and a need to simplify the approach resulted in the version of the NCAC which is reported in Annex 1.

3.3 The Definition of Natural Capital Assets

The testing showed that clear definition of the natural capital asset that is being checked is needed. Natural capital assets can be classified in many different ways (the term 'natural capital' is used in many ways in environmental debates). One way of thinking about natural capital assets, based on the structures of the UKNEA, is across the broad habitat/service matrix used to summarise ecosystem services (e.g. on page 11 of the synthesis of key findings).

The testing suggests that an asset check can be undertaken for natural capital assets at a variety of spatial scales, including:

- Decision-making, reflecting geo-political boundaries (e.g. country, or administrative boundary such as The National Forest or a national park);
- Economic, which can reflect natural capital asset ownership (e.g. water company catchment boundaries, private landholdings);
- Ecological, reflecting interactions within ecosystems and the scales at which ecosystem integrity should be judged (e.g. a shellfish stock may be assessed within a particular inshore area, whereas pelagic fish stocks are assessed across regional seas), and
- Ecosystem service, which could encompass the area providing, or the populations benefiting from, the services.

A check of several ecosystem services from a single natural capital asset is both a very complex and very useful aspect of a natural capital asset check. It can provide a holistic view of levels of ecosystem services from a habitat, which could help identify and present tradeoffs between ecosystem services more clearly (rather than the traditional prioritisation of provisioning/market-based services observed in the UKNEA's results). The case study of woodlands illustrates such potential tradeoffs. Even with such holistic view, however, attention should be paid to ensure supporting services and their values, which are difficult to identify and quantify, are not missed.

The testing conducted in the project also looked at the different combinations of habitat and service to define natural capital as illustrated by the matrix in Figure 3.1. The cells highlighted show checks of different natural capital assets in terms of different ecosystem services and/or habitat combinations. A check that deals with a column in the matrix (i.e. multiple ecosystem services from a habitat) is more complex but could provide a holistic view as mentioned above.

An assessment along a row of the matrix is also possible (e.g. for climate regulation services as shown in Section 3.2.5 of the case study report in Appendix B). This assesses the relative importance, and gains and losses from, the delivery of an ecosystem service from different types and locations of the natural capital assets. This is a particularly relevant approach for more valuable ecosystem services (such as climate regulation), so could be prioritised for other high-value services or those for which risks are changing (e.g. climate hazard regulation).

Checks that fill one or two individual cells (such as the fisheries and salt marsh case in Section 4.1 of the case study report in Appendix B) appear easier to undertake. In fact, one strategy to cover this matrix may be to build up a catalogue of thorough checks dealing with only one or two cells. These may be useful analyses in their own right as well as allowing summation in different combinations (a row, column or a group of cells) to analyse individual services, individuals habitats, or blocks of services/habitats (e.g. provisioning services from coastal and marine habitats).

The definition of natural capital assets also needs to take into account how the results of the asset check will be used. Depending on the decision making context it is aiming to inform, an asset check will need to work from different perspectives based on where in the physical asset-service-welfare linkage the change is observed. For example:

- Conservation strategies affect the physical assets;
- Policies like the Water Framework Directive affects intermediate services and functions by changing quality / condition, and links back to physical assets, and forwards to final services and benefits, and
- The analysis of provisioning services (e.g. wild-caught fish) can start at the benefits, and work back through intermediate services to physical assets.

The issue of defining 'performance' (used in the working definition in Section 2.2) may also influence asset definition (see Section 3.4).

Figure 3.1. Coverage of UKNEA Habitats and Services by some of the Tests and Cases in this Project.

Service			Habitat: MWH	Semi-natural Grassland	Enclosed Farmland	Woodlands	Freshwaters	Urban	Coastal Margins	Marine
Provisioning	Crops				*					
	Livestock/ Aquaculture									
	Fish								~	
	Trees, Veg etc									
	Water Supply									
Wild Species Diversity										
Cultural (env. Settings)	Local places									
	Land/sea scapes									
Regulating	Climate		+		+*	+				
	Hazard				*					
	Disease									
	Pollination									
	Noise									
	Detox. & purification:	Water								
		Soil								
		Air								

Red *: Countryside Survey
Orange *+: Countryside Survey and carbon storage
Yellow +: Carbon storage
Purple ~: Fish habitat

3.4 NCC Comments

The project's work on a natural capital asset check was discussed with the Natural Capital Committee in July 2012. Their feedback on the developing work is given in Annex 2. All this feedback has informed the design of NCAC and is also an important input to the UKNEA follow-on project. Responses to specific elements of the feedback that are reflected in the proposed NCAC approach are:

- Performance (comment 4) is used in the proposed approach and is discussed in more detail below.
- Risk and uncertainty (comment 5) are included in the proposed approach explicitly by giving space to record uncertainties in each of the six stages, and adoption of the uncertainty language in the UKNEA.
- Spatial scale (comment 9) has been tested in the woodland case study which examined services at different spatial scales (local/regional/national), illustrating that asset check questions can be answered at scales smaller than the national level.
- Frequency (comment 11) of undertaking asset checks is not yet established. It will depend on what is practical to devote resources to, and the speed at which risks to natural capital asset performance can change. Therefore, the frequency of asset checks should be higher for capital assets if their:
    - Ability to support ecosystem services changes more quickly. This involves a scientific question about rates of environmental change: Is there enough variation in assets to justify a check every year? This question will be investigated further in the UKNEA follow-on study, and
    - Risks of major change in performance (e.g. in terms of proximity to thresholds or 'red flags') is higher.
- Irreplaceability (comment 12) - the difference between irreversible and irreplaceable needs to be carefully defined – irreplaceability is the irreversible loss of an asset which has no substitutes.

The term 'performance' is a common term in man-made asset management. For example in the water industry, performance is measured for assets (e.g. a pump) within the water supply network. The performance is both relative to the role required of the asset, and its ability to undertake that role. Thus an asset which is under-sized (e.g. a pump which has a capacity that is too low to move sufficient water through the network) scores poorly on performance, even if it is in good condition (i.e. it is pumping at its full capacity).

Similarly, the performance of a natural capital asset is assessed through its quantity and condition (quality) and how it contributes to the ecosystem functions to produce the services that are needed and wanted. In other words, the measurement of an asset's performance shows whether the supply of services will meet the demand for them. However, underperformance does not automatically mean supply should be increased to meet demand - it may mean demand is unsustainable. Increasing short term supply could bring the extent and condition of natural capital assets unacceptably close to thresholds (e.g. where supply may have a non-linear response to a pressure). Whether a given asset has a substitute within the ecosystem also influences whether the ecosystem function could still be maintained even when the asset is replaced with something else ('substitutability').

Understanding what the level performance is at and how it is likely to change in the future also requires an analysis of factors such as connectivity, cumulative impacts on the asset over time and thresholds such as fragmentation of the resource (e.g. through which point populations of species are no longer viable).

Introducing '(asset) performance' helps clarify the definition of the natural capital asset being checked. Defining the required performance of natural capital assets captures both the current and future quantity and quality of an asset. This is considered to be a better way of summarising conclusions than through the heavily economics driven language of 'supply' and 'demand' used in the first versions of the proposed approach (even though both terminology is based on the same concepts).

Definition of asset performance in the proposed approach also allows for explicit links to existing policies. These can include policy objectives (e.g. no net loss of biodiversity or maximum sustainable yield in fisheries), processes (e.g. Impact Assessments, Strategic Environment Assessment) and principles (e.g. the precautionary principle). Performance may be defined from science, but this is not always available. Therefore, it will often require subjective debate (effectively on visions of natural capital exploitation) – an asset check can help make this debate, which is considered a useful one in relation to key natural capital assets, transparent.

In summary, thinking about the performance of an asset has some potential advantages as a way of drawing conclusions. Firstly, it may be a more accessible language. Secondly, the performance concept brings in the idea of function within an interconnected set of assets. This reflects the natural world, in which ecosystems, their functions and services, even though separately defined for ecosystem services analysis, are interrelated. Thirdly, it explicitly requires a definition of what society wants from natural capital assets. The latter point can help define exactly what a natural capital asset check is checking – to anticipate the future performance of a natural capital asset in providing services that are beneficial to society.

In the sense that the Stern Report was an asset check of the climate (as described in Section 2.1), it can help illustrate the concept of a natural capital asset's performance:

- It defines the desired future performance of the asset (maintaining relative climate stability). This 'desired' performance is justified through cost benefit analysis through showing the cost of not delivering the desired performance;

- It identifies thresholds above which risks of not achieving this performance are high (i.e. the need to limit global greenhouse gas concentrations to certain levels in order to limit temperature increases to 2 degrees C - a target defined through climate science), and

- It describes uncertainties in the assessment made.

In the context of the climate, the extent of the asset is not expected to change, but its condition (i.e. concentration of greenhouse gases) is changing and is affecting its integrity in terms of its ability to perform a role society relies on.

4 Policy Context and Potential Guidance for Using the NCAC

The natural capital asset check approach is developed to explore ways in which a more explicit focus on natural capital assets (and stocks) might improve policy development and decision-making. Therefore, links to the appropriate policy context, in particular, to policy appraisal must be considered. If it is to become a practical input to policy development, the natural capital asset check will need to be undertaken efficiently in a variety of contexts, and therefore some guidance may be required. This Section discusses each of these issues.

4.1 Policy Context

Although a proposed approach to a NCAC has been defined (see Annex 1), it is not yet regarded as a 'tool' fit for policy and decision-making use. What has been developed is a series of tested questions that will, more often than not, be very difficult to answer, even with a group of experts, but which potentially can give a check of natural capital assets. In further development and refining of the approach, consideration of the policy context in which it is used is worthwhile.

Figure 4.1 shows the developing UK natural capital policy making context in which a NCAC could fit. Some key relationships are with environmental accounts and policy impact assessments. An asset check differs from monetary and physical environmental accounts, which provide a snapshot at point in time on value or scale of environmental assets, respectively. The proposed natural capital asset check would be focused more in the interpretation of such accounting information, linking knowledge of natural capital assets to the current and future provision of ecosystem services. This is discussed further in Section 5.1.

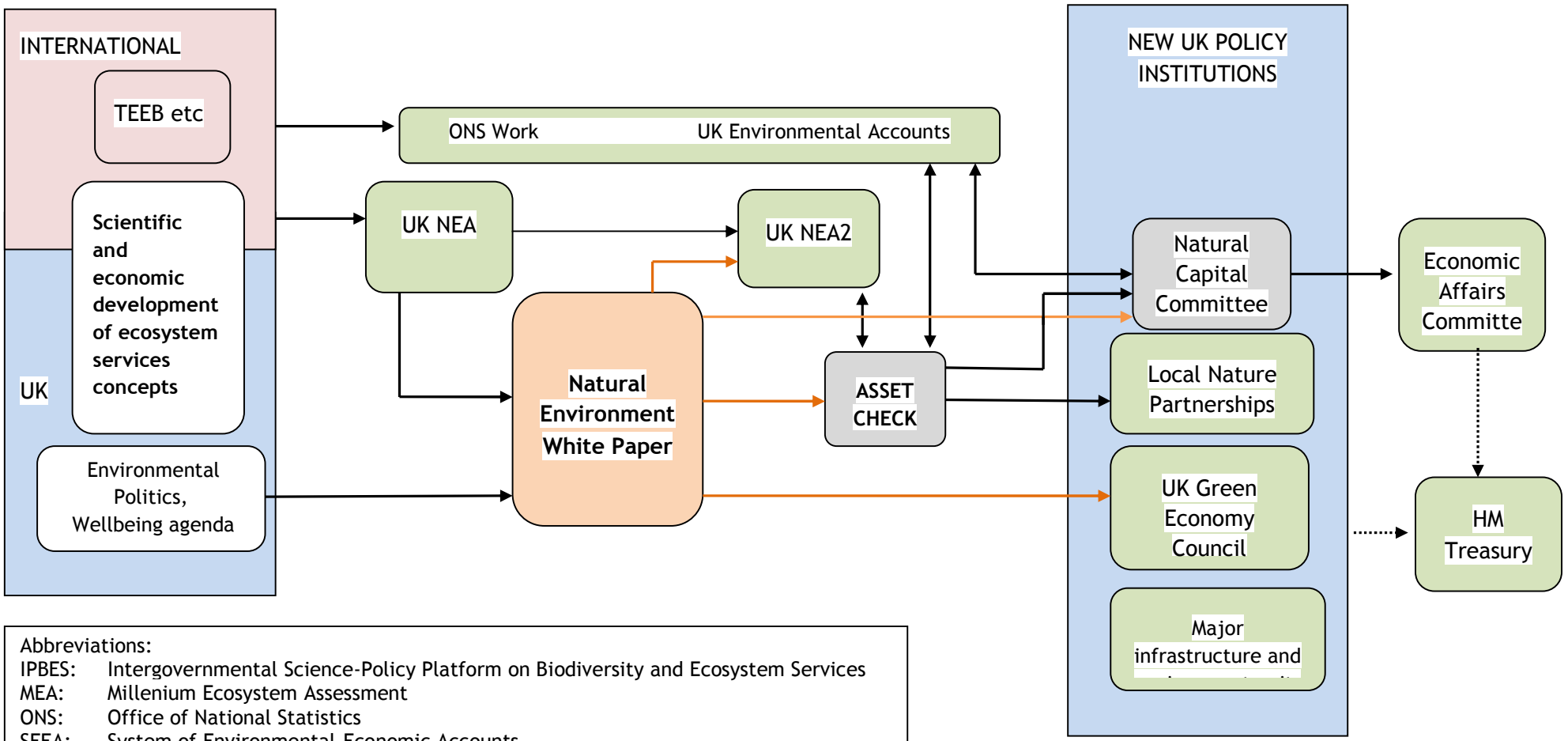
Impact Assessments (IA) are the main process through which economic scrutiny of policy decisions (including most environmental policy) is collated and reported by Government. Two points in the IA process where NCAC information could make a difference are:

- In the opening sections that define the problem under consideration, justify intervention and outline intended effects, and
- In 'other key non-monetised impacts' the findings on a natural capital asset's future performance could be used to justify conclusions on these impacts. For example, where an intervention addresses a red flag (e.g. reduces the risk of crossing a threshold), monetary valuation may not capture this impact well (e.g. because it potentially averts non-linear change) and therefore an asset-check style analysis may be more relevant.

To be practical for policy, a NCAC needs to be undertaken with a reasonable level of resources. It is noted that major analyses like the Stern Review and UKNEA are exceptional one off or perhaps decadal reviews. Nevertheless, without sufficient

resources the answers to NCAC questions will be too general to be of use for specific policy contexts.

Figure 4.1 Mapping of UK Policy Developments in Ecosystem Services Economic Appraisal Activities (October 2012)
Source: eftec



Abbreviations:
IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
MEA: Millenium Ecosystem Assessment
ONS: Office of National Statistics
SEEA: System of Environmental-Economic Accounts
TEEB: The Economics of Ecosystems and Biodiversity
UKNEA: UK National Ecosystem Assessment
UKNEA2: UK National Ecosystem Assessment follow-on
WAVES: Wealth Accounting and Valuation of Ecosystem Services

Another use of asset check information at a variety of policy scales is in predicting what future research is needed. Initial questions that may need more work to develop understanding are:

- How quickly do assets change? and
- How often should we collect new data (e.g. how often Countryside Survey should be repeated)?

The UKNEA has arguably made a step-change in the environmental policy evidence base and understanding of ecosystem services. However, using the UKNEA data for NCAC test in this project produced results that were too general (i.e. they were not able to build on the insights provided in the UKNEA to answer the key questions defined for a NCAC). It may be that a NCAC is more likely to provide useful new information if it is linked to a specific policy / programme / project that a decision relates to.

For policy decisions, information on costs and tradeoffs is vital. Cost information was not a focus of the development of the proposed approach and did not emerge from the testing phase. Some data on the values of service flows was obtained, but little emphasis was placed on it as neither comparative data nor conclusions focussed on monetary figures. A weakness in the proposed asset check approach is therefore a lack of quantification (monetary and otherwise) in the results.

Alongside quantification of results there is a question about the usefulness of the proposed approach's conclusions (sustainability test and red flags) for policy makers. These concluding questions can be developed further to give more specific answers required by policy makers (e.g. linked to changes from management interventions).

The use of 'performance' as a concept in the NCAC (v2) goes some way to providing a 'so what?' for policy makers. It also raises questions about defining how society uses the natural environment, and what society wants from natural capital assets. Some answers to this question link the NKAC to policy targets, which should be helpful in ensuring the policy relevance of results. However, policy objectives do not provide a clear and unambiguous definition of 'performance' for all natural capital assets. Different policy targets can (intentional or unintentionally) be in conflict with one another, and some policies are aspirational, using objectives that lead change rather than targets that will definitely be met.

An alternative way of looking at this problem is that where policy targets and 'target performance' are unknown, an asset check should be undertaken to help understand these. While the NCAC could be incomplete on the performance aspects, its other content (e.g. on criticalities) could help inform identification of policy objectives and target performance. This can then help with the development of policy targets. Another approach is to look at modelling of natural capital asset management and ecosystem services flows (e.g. through a tool like INVEST), in order to define a target performance for an asset.

It is recognised that in different areas of policy the 'target performance' approach will work more or less well. In the fisheries example discussed in the case studies report, performance

is relatively easy to define through targets for maximum sustainable yield (MSY), and red flags can be defined in relation to the risk of fish stock collapse. Similarly in relation to the Stern Review, the target performance is defined in terms of GHG concentration and consequential limits to climate change (in the 2 degrees C scenario), with a red flag defined through the dangers of exceeding this target.

Defining the natural capital assets being checked (as discussed in Section 3.3) on the basis of environmental assets (e.g. soils) may provide results that cut across decision-making boundaries and hence are challenging to react to. Defining on the basis of management boundaries (e.g. enclosed farmland, woodland), can support useful analysis across all the ecosystem services from within these boundaries. However, it encourages a 'silo' mentality and avoids holistic consideration of natural capital assets (e.g. the soil). The aim of a natural capital asset check should therefore be to define assets based on environmental, rather than decision-making boundaries. Decision-making should consider the overall state of natural capital assets, if it does not already do so.

4.2 Scoping Guidance Design

The structure of the proposed approach could be used to develop its design and also to provide guidance on undertaking an asset check. However, this is not yet an appropriate step to look into in detail for the NCAC for two reasons. Firstly, more understanding is needed on how and when an asset check works, in the context of the policy considerations discussed above. Secondly, this approach will be tested further through the UKNEA follow-on asset check work package.

In broad terms two potential elements of guidance can be envisaged to accompany a NCAC approach:

1. A decision tree about *when* to undertake an asset check, and in what ways its results can be used. At this stage, the range of possible uses of the asset check (e.g. at different scales) has not been fully explored and therefore it is felt that there is insufficient understanding to formulate this.

2. A guide on *how* to undertake an asset check, with links to supporting information such as technical reports, practical case studies, links to information sources. Web-based guidance, similar to the online value transfer guidelines[6], could be suitable. The proposed approach in Annex 1 includes an element of guidance (e.g. linking answers between questions) and therefore represents progress on this issue. It is felt that the most important way of further developing guidance is through examples. Some of the case studies in this project (e.g. saltmarsh and fisheries, and woodland) are well-developed, but not yet complete, as potential examplars.

[6] http://www.eftec.co.uk/eftec-projects/valuing-environmental-impacts-practical-guidelines-for-the-use-of-value-transfer-in-policy-and-project-appraisal

A further option is to develop interactive online content (e.g. a tool or a model providing a 'game' in which different asset-management results can be obtained from different permutations or variables). A clear example would improve any guidance significantly (e.g. allowing an analyst to see a relevant example of an asset check as they work on one). It is anticipated that the UKNEA follow-on work package will provide an appropriate example. This further work and development is also expected to identify more relevant information sources, which an online version of the proposed approach could provide links to.

5 Conclusions and Next Steps

This study has attempted to scope a natural capital asset check by:

- Defining what a NCAC could involve and its relationship to other policy and environmental-economics analyses;
- Testing how it could work using UKNEA and other data;
- Defining a proposed approach to a NCAC (see Annex 1) which is worthy of further development, and
- Identifying questions to take this work forward that can be addressed through work package 1 of the UKNEA follow-on project.

It is felt that the approach developed has been relatively successful in that it has enabled development of greater understanding of what a natural capital asset check involves and how it might be undertaken. Further to this the key concluding issues of detail are inputs to the UKNEA follow-on project (see below).

A possible variation to the proposed approach is that a modified balance sheet for all assets affected by an investment decision (with a linked flow/production account) could be explored to give a more strategic 'check' (G. Atkinson, pers comm., Sept 2012). This could use a balance sheet approach to look at how some specific asset change (e.g. arising from a policy intervention or some change over time such as an accounting period) is nested within the overall portfolio of that asset. This would help start to deal with the cumulative impact issue for example. In this context there is the possibility for a variation to the structure of the proposed NCAC approach shown in Annex 1, which could entail:

i. Define the natural capital asset (this is already in the proposed approach);
ii. Define sustainable management (this can use the concept of performance, as is already done in the proposed approach);
iii. Look at the integrity (extent and condition) of the natural capital asset at the start of the accounting period studied;
iv. Do the same for the end of accounting period;
v. Identify the change in the integrity of the asset over the accounting period, and
vi. Analyse the impact of this change on sustainability of the asset's performance, in the context of the asset's sustainability relative to total stock and ecosystem services, as the current NCAC aims to do.

This approach would link more closely to national accounts, but possibly at the expense of some of the contextual analysis (such as the detailed assessment of asset performance). One challenge it would raise is how to set the accounting period used – annual analysis for steps i) –iv) would fit with economic norms, but may not be compatible with environmental understanding or data.

5.1 Issues to be Developed in the UKNEA Follow-on Project

A series of issues have been identified through this study that warrant further investigation including case studies through the UKNEA Follow-on Asset Check Work Package (WP1). Many of these can be looked into through appropriate choice of case studies for WP1. The case study selection should focus on natural resources that are being used unsustainably. A suggested proxy for this is services that are highly valued and declining. These have been identified from the UKNEA (see Table 4.1 in the interim report in Appendix A), which shows the ecosystem services assessed as having high or medium-high importance and some deterioration[7].

The case studies chosen under WP1 should aim to inform understanding of as many of the following issues as possible:

- Detailed investigation of some of the criticalities such as thresholds and cumulative impacts etc. for each case study;
- Coverage of different spatial scales, within a case study or in different case studies (e.g. being applied at a large project level for a manageable scale of land such as a catchment);
- Investigate the assets that do not fit with the traditional economic definition of assets as being something that is controlled and/or owned.
- Greater use of empirical evidence – by allocating sufficient resources in each case study for detailed analysis rather than aiming for a large number of case studies. To pursue more quantitative examples, some of the cases chosen for WP1 should look to:
    - Report ranges of values where a probability or other distribution of future ecosystem services changes is known. This could use scenarios (if possible linked to UKNEA follow-on scenarios, if not to UKNEA scenarios) and sensitivity analysis.
    - Quantification could be developed through different conclusion-tests in the NCAC. This could report a regret matrix and looking at decision rules such as

[7] Deteriorating services were: Marine climate-change related hazard regulation (highest value); Wild species diversity from enclosed farmland and semi-natural grasslands; Crops from freshwaters, openwaters, wetlands & floodplains; and Livestock from mountains moorlands and heaths (mid-value); and Noise and soil quality from urban environments (unvalued). The habitats with the widest range of services showing deterioration or some deterioration and medium-high value are freshwaters, openwaters, wetlands & floodplains; and enclosed farmland.

mini-max regret (minimising the maximum loss) and maximin (maximising the minimum gain).

- More quantification can inform future guidance on data sources, both in terms of the types of data required, and the best sources for them (e.g. from the experience of using UKNEA and countryside survey data from the testing work).

- More specific links can be made to cost-benefit analysis (CBA), especially reflecting how the overall state of a natural capital asset (e.g. the consequences of cumulative impacts) can be better reflected in analysis of marginal changes (as CBA does).
- Using analysis undertaken through existing ecosystem services modelling approaches (e.g. INVEST[8]) or future scenarios such as those in the UKNEA that are being further developed in the follow-on project. As an established accounting / modelling framework this could help quantify project/policy impacts and higher levels of aggregate information on issues like performance.

WP1 will also seek to investigate:

- Further consideration of the purpose and design of the a NCAC approach, and should illustrate more clearly how it can be used:
  - To check whether natural capital is being used unsustainably, and how the conclusions could be used for environmental policy and management, and
  - As an input to CBA, wealth accounting or some other decision making exercise.
- The frequency with which checks should be undertaken for natural capital assets. This involves scientific questions, which might best be assessed through a risk-based approach where the rate of change (such as understanding of the effects of ecosystem restoration, e.g. Bullock et al. 2011), natural rates of variation, the cost of undertaking the check together determine the frequency of the check.
- Which value evidence can be used and how often it needs to be updated (e.g. methods and preferences change).
- Consider variations to the proposed approach, such as the structure linking to accounting outlined above.

Other work under the UKNEA follow-on project (in WP8) will examine evidence for the 'problem statement' the NCAC is attempting to address. WP8 is considering barriers to embedding the ecosystem services approach in decision-making, and so can also inform design of a NCAC approach.

[8] http://www.naturalcapitalproject.org/InVEST.html

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ANNEX 1 Natural Capital Asset Check Proposed Approach

October 2012

Introduction

This is the first elaborated version of the asset check approach being developed through a scoping study for Defra and the UKNEA follow-on WP1. Any comments on this are welcome and should be sent to the project manager, Ian Dickie: ian@eftec.co.uk

This proposed approach lays out a series of questions, the answers to which form the analysis in, and aim to provide conclusions from, a natural capital asset check.

The working definition of a 'natural capital asset check' is:

An assessment of the current and future performance of natural capital assets, with performance measured in terms of their ability to support human well-being.

Thus, the purpose of a natural capital asset check is to assess how changes in a natural capital asset affect human wellbeing. It incorporates concepts of integrity, performance, red flags and sustainability.

It is organised in the following main steps:

1. The asset.
2. Integrity of the asset.
3. Performance of the asset.
4. Asset criticalities.
5. Asset check.
6. Conclusions

Notes on the Tables:

The questions in the tables are in coloured boxes.

The tables also include guidance *on answering the questions in italics* that can be overwritten as the proposed approach is completed.

Uncertainty can be described using the following scale, adopted from the UKNEA:

Well established: high agreement based on significant evidence
Established but incomplete evidence: high agreement based on limited evidence
Competing explanations: low agreement, albeit with significant evidence
Speculative: low agreement based on limited evidence

1. Natural capital asset

Question	Guidance on Answer
A. Define Natural Capital asset being checked	*Specify natural capital asset, e.g. habitat type and/or ecosystem services (e.g. peat bogs, carbon sequestration in woodland, all carbon sequestration in habitats)*
B. What is the spatial scale for which the asset check is being conducted	*UK, England/ Scotland/ Wales, Regional, County, Local?*
C. Define the timescale for the asset check.	*Take into account rate of change in asset, decision-making timescales, and timescales over which services from the asset can change.*

Notes:

It is useful to define these parameters for the analysis clearly at the outset.

Our approach at present assumes that an asset needs to have some physical measurement, and defines natural capital assets as:

…stock that can be managed or protected in order to have a positive economic or social value.

If a subset of a natural asset is being checked (e.g. peat bogs in Scotland are a subset of all peat bogs in the UK), then this can affect availability of data and interpretation of results.

2. Integrity of natural capital asset

Question	Guidance on Answer	Trends			
		Past trend	**Current trend**	**Future Trend**	**Summary of Trends (see key*)**
D. What is the extent of the natural capital asset?	*Can be area, volume, number*	*Describe/ quantify trend*	*Describe/ quantify trend*	*Describe expected future trend*	*Insert symbol*
E. What is the condition of the natural capital asset?	*Can be measured through different ecological data, e.g. conservation status, age structure, or proxies such as ecosystem processes*	*Describe/ quantify trend*	*Describe/ quantify trend*	*Describe expected future trend*	*Insert symbol*
Uncertainties	*Give level of uncertainty in analysis* for D and E and reasons for this.* ** Use Uncertainty scale described in introduction.*				

Key for trends	↑	increasing	↓	decreasing
	↔	evidence shows no trend	0	no evidence
	↑↓	both increasing and decreasing	(this could reflect ambiguous evidence and/or spatially differing trends)	

F. Drivers of changes in Extent and Condition	List policy drivers	*Policy drivers*
	List biophysical drivers	*Biophysical Drivers*
	List socio-economic & other drivers	*Socio-economic & other drivers*

G. What are the main ecosystem services the asset provides?	*List main ecosystem services the asset provides (or contributes to providing)*
H. What are the asset's main ecosystem functions?	*List important ecosystem functions that support the main services from the asset*
I. **Integrity Test**: Is the ability of the asset to support ecosystem services being maintained?	*Give details for different services (if relevant), consider the trends under questions D and E and the services from question G.* *If no, what are drivers of decline (see question F)?*

Notes:

Non-essential supporting information that can be useful for decision-makers includes:

- the ownership of the asset (is it publicly or privately owned, or not owned?).
- are the ecosystem services provided by the asset rival or non-rival goods?
- are the ecosystem services provided by the asset market or non-market goods?

3. Performance of natural capital asset

In this context 'performance' is fitness to carry out the role which is required of a capital asset. This is regarded as useful because defining the target performance of natural capital assets captures both the current and future quantity and quality of an asset. Human 'requirements' include basic human needs, but also reflect infinite wants, so the definition of performance is usually subjective.

Question	Guidance on Answer	
J. Is there a measure of the current output of services from the asset?	*Either a direct measure of levels of services (see question G), or an indication of this based on the amount of the asset (stock) and its ability to provide the service (condition) (see question I)*	
K. What is the target performance from the asset?	*Summarise performance: the role that capital performs in providing beneficial services - see below for guidance on definition*	
Uncertainties	*Give level of uncertainty* in answer to K and reasons for this.* ** Use Uncertainty scale described in introduction.*	
Defining performance: Answering these questions can help define performance, but not all questions can be answered for all assets	What policy targets are there for the asset?	*(e.g. maximum sustainable yield for fish stocks, global concentrations of GHG)*
	What is the trend in the main services the asset provides?	*See question G for services, and UKNEA synthesis report Figure 5 for trends.*
	What types of goods are supported by the asset?	*(e.g. food, drinking water, pollution control) See UKNEA synthesis report Figure 10 for terminology*
	Who benefits from the goods?	*Identify the number and location of beneficiaries*
	What wellbeing results from the goods?	*Use measures of the levels and trends in wellbeing supported by the asset*

L. Are any future changes in target performance expected?	*How is target performance expected to change? Consider exogenous factors like those associated with the drivers under question F, and the asset's role in climate change adaptation.*
M. Can future target performance be defined?	*What is the target level of future target performance of the asset?* *What are the drivers of this (see question F).*

Notes:

Non-essential supporting information that can be useful for decision-makers includes:

- Has target performance changed over time? If so how?
- Distributional issues: what is the distribution of the beneficiaries of the goods supported by the ecosystem services from the asset?
- Do the goods provided by the ecosystem services from the asset have use and/or non-use values?

4. Natural capital asset criticalities

Question	Guidance on Answer
N. What is the trajectory of change for the asset?	*Specify if any linear or non-linear changes are known or anticipated (see trends from questions D and E)*
O. Are there any standards or agreed limits of change to the asset?	*Specify if there are any relevant standards or limits for the condition of the asset (e.g. adult spawning stock biomass for fish) or the services from it (e.g. fish landing quota).*
P. Are there likely to be any threshold effects?	*State knowledge of any thresholds - thresholds can include where the integrity of an asset declines in a non-linear way, where the influence of feedbacks on an asset change, or where the ability of an asset to recover declines.*
Q. What is the reversibility of changes to the asset?	*Can changes to the asset be reversed? (e.g. can the asset, and its functions, be restored or recreated?)*
R. What is the cumulative effect of impacts on the asset?	*What patterns of impacts result from past, current and future trends and drivers (see questions D. E. and F.)?*
S. What risks are associated with current trends in the asset integrity?	*Identify risks of significant detrimental impacts: see answers to questions N, and relate this to answers to questions O – R.*
T. What substitutes exist for the main ecosystem services from the asset?	*For the services identified in G, are substitutes available? If so what supplies are available or potentially available?*
Uncertainties	*Give level of uncertainty* in analysis and reasons for this.* ** Use Uncertainty scale described in introduction.*

Non-essential supporting information that can be useful for decision-makers includes:

- What is the level of investment needed in the natural capital to maintain it above the limits/thresholds identified above?
- What are the intergenerational implications of the criticality identified?
- For question T, define on what basis the substitute(s) are identified (e.g. which ecosystem services the substitute provides).

5. Natural capital asset check

Question	Guidance on Answer
U. Tradeoffs?	*If one or more of the asset's key ecosystem services (see question G) are increased, does this lead to reductions in other services?*
V. Synergies?	*If one or more of the asset's key ecosystem services (see question G) are increased, does this lead to increases in other services?*
Uncertainties	*Give level of uncertainty* in analysis and reasons for this.* ** Use Uncertainty scale described in introduction.*
W. Sustainability test: is the asset currently able to give the target performance?	*Compare integrity in question I and performance in question K.*
If yes - will this performance be sustained into the future?	*Relate trends from question N and criticalities from O and P to future changes identified in questions L and M. Give timescale – from question C.*
If no – state why?	*Is this because target performance is unrealistic, or because integrity of asset is compromised, or both?*
X. Red flags?	*This is a warning if future target performance is at risk, for example because:* *- the asset is underperforming (see question W) and continuing to decline (see Question N), or* *- there is prospect of collapse (a limit or threshold – see questions O and P) which could be irrecoverable (i.e. being irreversible, see question Q, and with no substitute, see question T)*
Uncertainties	*Give level of uncertainty* in analysis and reasons for this.* *Use Uncertainty scale described in introduction.*

6. Conclusions

A summary of the asset check should reflect the uncertainties in the evidence available, conclusions on integrity and sustainability of the natural capital asset, and future sustainability of the asset is assessed in terms of whether it is expected to deliver the target performance, and the presence of red flags. Where these issues are quantified relevant data should be included.

Table: Summary of natural capital asset check

Asset	Trends in natural asset integrity	Target performance	Criticalities	Sustainability of performance	Red Flags
Questions A & B	*Question I*	*Question K*	*Key issues from part 4, particularly question O and P*	*Question W*	*Question X*

If a formal report write-up of the asset check is required, it is suggested the information above is presented under these summary heading:

- State of the asset (extent, condition)
- Drivers/threats to asset
- Services
- Drivers influencing future services
- Future services from the asset
- Natural asset integrity test
- Current and future target asset performance
- Synergies
- Thresholds
- Cumulative impacts
- Reversibility
- Uncertainties (missing information)
- Sustainability test.

ANNEX 2. Natural Capital Committee Input

The latest thinking from the project was presented to the Natural Capital Committee (NCC) at Defra on the 18th July 2012. The presentation given to the NCC is provided as a separate file (NKAC to NCC 180712 final.pdf).

The summary of the initial response by the Committee to the presentation is below. It draws on more extensive comments from all NCC members, and aims to act as a focus for liaison between the NCC and the asset check team. It does not represent an official or consolidated opinion from the NCC:

1. **Working definitions** of natural capital need to be revisited to ensure they are consistent with the analysis. Role of ownership may not be relevant.

2. Framework presented looks promising and potentially useful as a high level heuristic tool, but it is currently **complex in its presentation**. Thought needs to be given to a simpler output that highlights crucial strategic issues in the next phase. For example, the issue of cumulative impacts, risk and uncertainty, past and future temporal trends are all addressed in the case study given, but hidden in the detail, and thus raised as issues by NCC members.

3. It is currently envisaged that conclusions would be based on the balance between supply and demand, but it is suggested that **performance** might be a better expression of the overall conclusion. Performance of a capital asset can be defined as its fitness to carry out the role which is required of it within the network of other assets. This is a term used widely in man-made asset management (e.g. water industry). If it is adapted for NKAC, the performance would be determined by the quantity and condition (quality) of a given asset and its interactions with other assets in the ecosystem. The asset check should summarise current and future performance of natural capital, risks (risk of performance deteriorating), thresholds (will performance deteriorate in a non-linear way or cease altogether?) and uncertainty.

4. There is also a lack of clarity on the **purpose of the tool**, or indeed whether it could be considered a tool to provide specific answers (e.g. how would it be applied to individual investment decisions?). Further development of case studies should illustrate more clearly how this high level tool can be used to check whether natural capital is being used unsustainably, and how the conclusions could be used as an input to CBA, wealth accounting or some other decision making exercise. One suggestion is that modified output which looks like a balance sheet for all assets affected by an investment decision (with a linked flow/production account) could be explored to address this. In some cases it may be that the questions being pursued cannot be answered with precision due to knowledge gaps.

5. The consideration of **risk and uncertainty** should be expanded: a) reporting ranges of values where the probability distribution is known; b) using scenarios and

sensitivity analysis, and instead of computing expected values, reporting a regret matrix and looking at decision rules such as mini-max regret (minimising the maximum loss) and maximin (maximising the minimum gain).

6. **Unsustainable use** of an asset requires the asset check to take account of remaining stock size: this is implied but not explicit in the current version.

7. An initial indication about how the asset check links to **national accounts** should be given in the pilot project, although it is anticipated that this will be followed up in the NEA2 project.

8. There is a need to **link the asset check team with the ONS ecosystems team**, to ensure common approaches.

9. How will the issue of **spatial scale** be addressed? Certain assets will vary in value depending upon location; at what spatial scale will an asset check be carried out? Will it be possible to aggregate up to higher spatial scales? Will it be sufficiently spatially explicit to help decision makers at a site level or landscape level? These issues could be explored in NEA2 case studies, with forestry as a particularly relevant example.

10. To what extent will **valuation** of assets be part of the check? This is something for further discussion between the NCC and the asset check team.

11. What will be the **frequency** of an asset check? This could be variable. One suggestions is that a risk-based approach is taken where the rate of change, importance and cost of checking together determine the frequency of the check.

12. **Irreplaceability** as well as irreversibility should be included: currently irreversibility and substitutability are included, but irreplaceability (= irreversible and unsubstitutable) is probably the more useful concept.

13. How does the asset check tool **compare and contrast** with the current set of ecosystem service evaluation tools available? It would be useful to set this context as part of the work for NEA2.

14. A next step would be to consider how this links to **global natural capital,** but this is out of the current scope.

Appendices:

See separate files.

A: Interim scoping study report.

B: Case Studies report