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Applying the natural capital approach to Sustainability Appraisal

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METHOD SUMMARY
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sweep

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Contact

Tara Hooper
School of Biological and Marine Sciences
University of Plymouth
Drake Circus
Plymouth
Devon
PL4 8AA

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Summary

The natural capital approach is based on recognising the contribution of nature to human welfare, and hence improving the manner in which the natural environment is traded-off against other things that are important to society. The natural capital system has three key components: the assets (species and habitats) and the ecosystem services (useful ecological products) that are provided by nature, and the goods and benefits that we receive from them, access to which requires human intervention through, for example, the availability of skills and infrastructure. There is significant policy momentum in the UK behind the adoption of the natural capital approach in natural resource management, but there remains no systematic or widespread application of the approach within impact assessment.

This report begins to outline the steps that could be taken to apply natural capital principles to Sustainability Appraisal (which was identified by stakeholders as the preferred mechanism for integrating the natural capital approach into local decision-making). As with any new methodology an iterative process is required, including significant engagement. This document represents an initial outline of the proposed methodology. It is expected to evolve, as lessons are learned from additional use of the framework in practice.

Incorporating the natural capital approach does not require a complete overhaul of Sustainability Appraisal. Instead, it offers an alternative means of framing sustainability issues that fits entirely within the existing process. The natural capital approach does not introduce environmental, social and economic factors beyond those that would be assessed for a standard Sustainability Appraisal; it simply suggests approaching the information and issues in a different way. Also, the approach does not require any additional data collection beyond that which would normally be undertaken; the expectation is that best available evidence will be used. The suggested method also seeks to fit to other obligations, processes and tools that may be relevant to planning and decision making at different scales.

The proposed framework is applicable initially during the scoping phase, as it sets up a protocol for gathering evidence and identifying sustainability issues, including using the wider five capitals model to break down overarching aims into their constituent parts from which specific objectives, indicators and targets can be derived that encompass the environment, infrastructure, individuals, and wider society. The method for collecting baseline information has four core elements: an asset register (in which information on the status of natural capital is compiled), an ecosystem services inventory (to list services, benefits and values); an asset-service matrix (to connect services to the assets from which they are derived); and a risk register (which summarises threats to continued system functioning).

Detailed habitat and ecosystem service classifications provide the framework for the collection/collation of baseline environmental information. This systematic approach also facilitates the construction of an evidence database, which supports data analysis, the subsequent evaluation of plan/programme impacts, and the monitoring of trends for subsequent updates and iterations. Holding evidence in a structured database also facilitates the creation of summary tables that present information clearly and coherently.

The process is designed to be comprehensive, but also flexible, recognising that Sustainability Appraisal is undertaken at different scales, in different contexts and with different levels of resource. Asset and service classifications are hierarchical, and so can be expanded or collapsed according to specific needs and scope. Summary tables are designed to be completed for the most part using three-point categorical rating scales, which recognises the likely difficulties in obtaining quantitative data for all elements of the evidence base. Even where complete quantitative data is available, summaries that can easily be given ‘traffic light’ coding are useful in highlighting key areas of concern and thus facilitate prioritisation.

The proposed scoping process provides a comprehensive and systematic baseline of the current status and trends in assets, services and benefits, and the degree to which they are at risk. This allows for the selection of detailed sustainability objectives and indicators that relate specifically to those assets and services, and for the full implications of plan options to be assessed, in turn supporting better outcomes than using high-level objectives and indicators such as the number and condition of protected sites.

The key steps in the method are outlined below, including the sections of the report in which they are described:

STEP 1 Set initial high-level sustainability objectives *[Section 2]*

With stakeholder input, and following identification and review of relevant programmes, policies and plans, define high-level objectives for each of the five capitals (natural, manufactured, human, social and financial)

Main output: A list of high-level objectives that define the scope of the Sustainability Appraisal

STEP 2 Collect baseline information

Step 2.1 Asset register [*Section 3*]

(a) Define assets of interest through a participatory stakeholder process, using the habitat classification hierarchy

(b) Select indicators for, and collect/collate data on, quantity, quality and spatial configuration of assets, including trends

Main output

Summary table of key asset data including 'traffic light' rating indicating where asset status and/or trend is of concern

Step 2.2 Ecosystem service inventory [*Section 4*]

(a) Define ecosystem services of interest through a participatory stakeholder process, using the ecosystem service hierarchy

(b) Select indicators for, and collect/collate data on, quantity and quality of ecosystem service, goods and benefits, including trends

(c) Determine ecosystem service delivery targets from local/national legislation, policy and management objectives

Main output

Summary table of key ecosystem service data including 'traffic light' rating indicating where ecosystem service status and/or trend is of concern

Step 2.3 Asset-service matrix [*Section 5*]

(a) Determine which assets are most important in the delivery of individual ecosystem services

Main output

Matrix with scores for the level of ecosystem service delivered by assets

STEP 3 Identify sustainability issues and problems using a risk register [*Section 6*]

(a) For each asset-service pair identified in the matrix, use the trend in asset status (determined from the asset register) and the target for ecosystem service delivery (defined by existing plans/policies) to assess the risk level.

(b) Amalgamate the individual scores into an overall risk category for each ecosystem service across all asset types.

Main output: Summary table using 'traffic light' coding to highlighting risks to continued delivery of services

STEP 4 Develop sustainability appraisal framework [*Section 7*]

(a) Use the outputs of the preceding steps to support a participatory process of defining detailed sustainability objectives that relate to specific natural capital assets and ecosystem services.

(b) Also use information gathered during the baseline assessment to identify indicators for assets and services that are appropriate in the local context and can be used to monitor progress against the sustainability objectives.

Main output: Table of sustainability objectives and their associated indicators

STEP 5 Evaluate effects of plan/programme alternatives on assets and services *[Section 8]*

(a) Using the same framework as for the previous steps, evaluate the likely level of impact of different plan/programme options on the different assets and ecosystem services to highlight key trade-offs.

(b) Use the outputs within a participatory process to identify the most appropriate options to be taken forward in the final plan/programme.

Main output: Summary table with 'traffic light' coding of impacts of plan/programme options on assets and services

1 Introduction

1.1 Background

This guidance has been prepared as part of the South West Partnership for the Environment and Economic Prosperity (SWEEP)[1], a programme led by the Universities of Exeter and Plymouth and Plymouth Marine Laboratory together with partners in the public, private and third sectors, and funded by the Natural Environment Research Council. This work forms part of a wider project that is exploring ways to improve and extend the use of natural capital approaches in decision-making for the marine environment. The project was integrated within the Marine Pioneer, one of four Pioneers established by Defra through the 25 Year Environment Plan (HM Government, 2018), and led by the Marine Management Organisation.

A stakeholder workshop identified Sustainability Appraisal as the preferred mechanism for integrating the natural capital approach into local decision-making (Hooper, 2017). The proposed method was developed using an iterative process, which included regular discussion with local stakeholders and testing of the different elements and steps, primarily through case studies related to: (i) the South West Marine Plan (MMO, 2016a,b,c; 2018; 2019a); (ii) the North Devon Marine Natural Capital Plan (North Devon UNESCO Biosphere Reserve, 2020); and (iii) the North Devon and Torridge Local Plan (Torridge District Council and North Devon Council, 2018). Wider developments nationally in operationalising the natural capital were also considered.

The proposed natural capital methodology is designed to be comprehensive while also recognising that Sustainability Appraisal is undertaken at different scales, in different contexts and with different levels of resource. Therefore, it is flexible and can accommodate differences in the requirements for (and availability of) data. The framework has been developed with the broader planning and licensing system in mind, and so has a wider application beyond Sustainability Appraisal. For example, the framework can be used at more strategic levels such as in setting overarching Local Plan objectives (not just those for the Sustainability Appraisal), and can also be applied to Environmental Impact Assessment, supporting better integration of assessment at site and strategic scales. In order facilitate use of the framework in a range of contexts, the approach seeks to fit to other obligations, processes and tools that may be relevant to planning and decision making at different scales, in particular those for the evaluation of net gain.

This guidance aims to summarise the key steps in applying the approach, and is complemented by a more detailed report (Hooper and Austen, 2020) that provides further explanation and justification of the conceptual framework and the process of method development. The proposed methodology is expected to evolve, as lessons are learned from additional use of the framework in practice. Supporting materials are available in the form of spreadsheets that present full tables which are too large to be accommodated within this document.

1.2 What is the natural capital approach?

The natural capital approach is described by Hooper et al. (2019a, p2) in a report commissioned by Defra to explore its application to the marine environment: *"The natural capital approach is a somewhat broad term that encompasses assessment of the quantity, quality, function and value of environmental assets and the goods and services that flow from them, with the aim of ensuring the sustainable use of natural resources. Fundamentally, the approach is based on recognising the contribution of nature to human welfare, and hence improving the manner in which the natural environment is traded-off against other things that are important to society. The concept of value is central to the natural capital approach, as it seeks to better integrate environmental and economic information and thus to redress the historic trend in which natural capital and ecosystem services were undervalued and overexploited. Equally important is documenting ecological status as the characteristics of assets are usually only partially reflected in monetary values."*

[1] https://sweep.ac.uk/

The natural capital system has three key components: **assets**, **ecosystem services**, and the **goods and benefits** that we receive from them (Figure 1). The ecosystem provides natural capital assets: species, habitats, and abiotic components such as water and substrates. These assets generate ecosystem services including harvestable stocks of seafood and raw materials (provisioning services), carbon storage and mitigation of flood risks (regulating services), and opportunities for leisure and recreation (cultural services). These services in turn allow us to obtain useful goods and benefits that have a market value or contribute to our health and wellbeing. Other inputs are essential in the conversion of ecosystem services into good and benefits. Fish stocks, for example, cannot be exploited without fishing vessels and equipment, and the expertise and knowledge of fishermen. Other inputs including manufactured infrastructure, the skills of individuals, social networks, and financial investment, can also be applied during the production of ecosystem services. This typically occurs within agriculture and aquaculture, for example in the application of fertiliser or the deployment of settlement surfaces for shellfish.

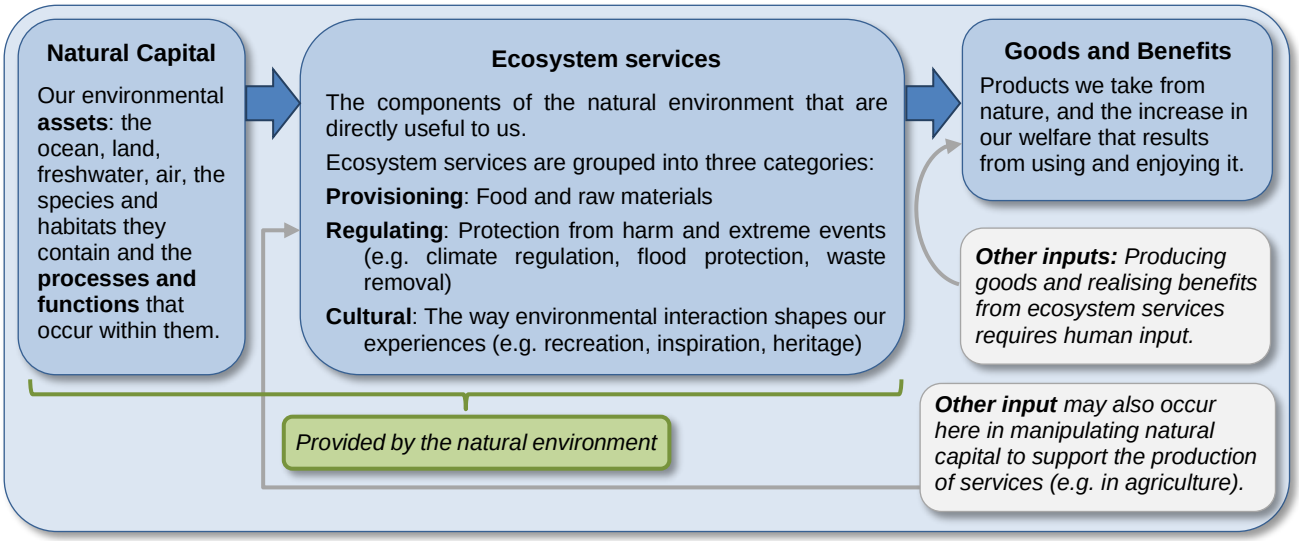

Figure 1. They key elements of the natural capital system (adapted from Hooper et al., 2019b)

Valuation is a central theme of the natural capital approach, and monetary value is an important metric for the measurement of goods and benefits. However, the status of assets, functions, and processes is determined through condition assessment using ecological metrics. Ecosystem services are also usually defined in ecological terms, although value-based metrics may be appropriate. (Hooper et al., 2019a; Figure 2).

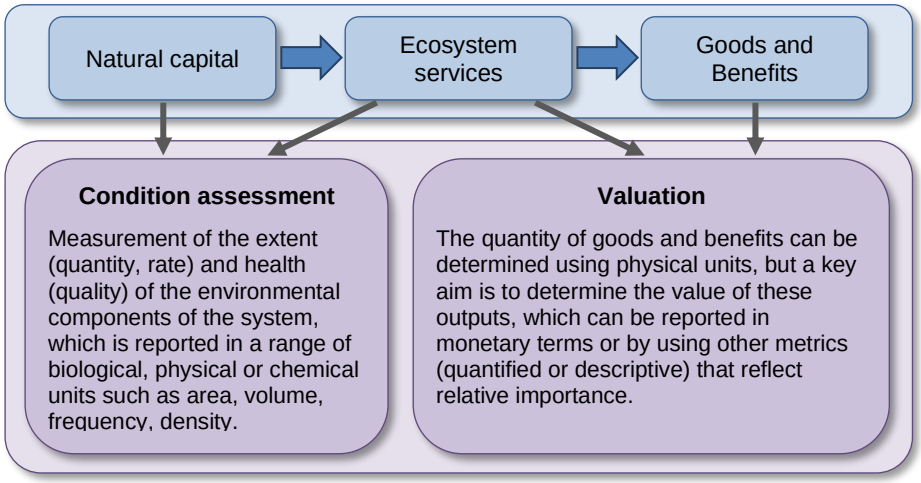

Figure 2. Measurement of the different components of the natural capital system (Hooper et al., 2019b)

In addition to the further information provided in the accompanying full report (Hooper and Austen, 2020), considerable literature exists that provides more detail on the natural capital approach, ecosystem services and valuation. In addition to extensive academic literature, this includes the outcomes of national and international programmes such as:

- The Millennium Ecosystem Assessment (2003)
- The Economics of Ecosystems and Biodiversity (TEEB, 2010);
- UK National Ecosystem Assessment (2011, 2014);
- EU Working Group on Mapping and Assessment of Ecosystems and their Services (MAES; Maes et al., 2013, 2018; Erhard et al., 2016);
- Natural Capital Committee (2013, 2014, 2015, 2017, 2019a,b);
- Common International Classification of Ecosystem Services (CICES; Haines-Young and Potschin 2013, 2018)
- Enabling a Natural Capital Approach (ENCA; Defra, 2020).

The recent Defra report (Hooper et al., 2019a) provides a thorough review of the natural capital approach, with a focus on UK policy and the marine context, and contains additional references. There is also wide literature on economic valuation, including introductory guides produced by, or on behalf of, the UK Government (e.g. Defra, 2007; eftec & Environmental Futures Ltd., 2006).

1.3 Why use the natural capital approach in Sustainability Appraisal?

There is significant policy momentum in the UK (particularly England) behind the adoption of the natural capital approach in natural resource management. The 25 Year Environment Plan (HM Government, 2018), explicitly states that "*over the coming years the UK intends to use a 'natural capital' approach as a tool to help us make key choices and long-term decisions*." Within planning, the National Planning Policy Framework (MHCLG, 2019a) emphasises that planning policies and decisions should recognise "*the wider benefits from natural capital and ecosystem services*", and "*plan for the enhancement of natural capital.*"

This policy position reflects calls to reframe arguments for the conservation of nature (and hence natural resource management) in ways that better link the environment, society and the economy. Fundamentally, proponents of a natural capital approach believe that what we know about the natural environment is not being effectively synthesized and communicated to decision makers and the public, and so they are poorly equipped to make environmental trade-offs (Daily, 1997). The natural capital approach is intended to provide an alternative perspective and set of tools that can improve understanding of the value of the environment, our dependence on it, and the wider implications of allowing it to decline. The approach is particularly appropriate for, and straightforward to integrate into, impact assessment (in its various forms), because the interaction between the environment, society and the economy is inherent in both processes and there is already implicit consideration of natural capital and ecosystem services within current practice.

However, under the standard approach, Sustainability Appraisal tends to be framed around topics as listed in Annex I of the SEA Directive (and Schedule 2 of the Environmental Assessment of Plans and Programmes Regulations 2004): "*biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape.*" While this provides a functioning process through which to undertake the required assessment, it perhaps does not present the information obtained in a way that best facilitates whole system understanding or highlights key trade-offs. The natural capital approach provides an alternative way to frame the gathering and presentation of the information required under planning regulations. More information on mapping elements of the natural capital approach to SEA topics is provided in the main report (Hooper and Austen, 2020). Developing a natural capital approach to Sustainability Appraisal provides the opportunity to streamline the way in which impact assessment information is summarised and reported, and thus support the decision making process.

1.4 Outline of the method

Incorporating the natural capital approach does not require the accepted Sustainability Appraisal process to be completely overhauled; it fits entirely within the existing stages and steps. Similarly, it does not introduce environmental, social and economic factors beyond those that would be assessed for a standard Sustainability Appraisal; it simply suggests approaching the information and issues in a different way. Also, the approach does not require any additional data collection beyond that which would normally be undertaken; the expectation is that best available evidence will be used.

The steps in the Sustainability Appraisal process for which a natural capital methodology is proposed, and hence the scope of this guidance, are outlined in Figure 3. The framework is applicable initially during the scoping phase, as it sets up a protocol for gathering evidence and identifying sustainability issues. This is done through the four core elements: an **asset register** (in which information on the status of natural capital is compiled), an **ecosystem services inventory** (to list services, benefits and values); an **asset-service matrix** (to connect services to the assets from which they are derived); and a **risk register** (which summarises threats to continued system functioning). The approach also applies when evaluating the effects of plan options. Steps such as consultation, developing alternative options, and proposing monitoring strategies do not require alternative methods, but can be applied to the information as organised under the natural capital framework.

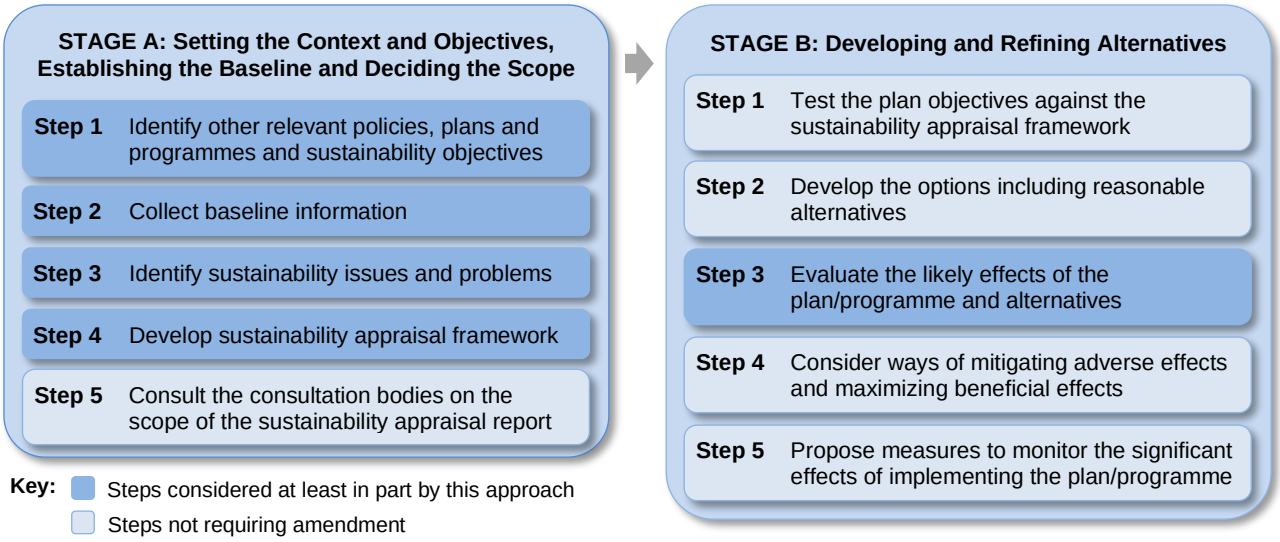

Figure 3. The Sustainability Appraisal steps (from MHCLG, 2019b) for which a natural capital approach is proposed.

The proposed process is comprehensive. In particular, the approach to collecting baseline information and identifying sustainability issues is detailed and systematic. It is important to ensure that the scoping phase provides a sufficient understanding of what natural capital assets are present, what ecosystem services are supplied, and the goods and benefits that result. Documenting the extent and status of individual assets (rather than just, for example, protected areas) allows for the selection of detailed sustainability objectives and indicators that relate specifically to those assets, and for the full implications of plan options to be assessed, which in turn supports better outcomes than using high-level objectives and indicators.

Detailed habitat and ecosystem service classifications provide the framework for the collection/collation of baseline environmental information. Their purpose is to ensure that evidence gathering and presentation is systematic and comprehensive and so supports development of a Sustainability Appraisal framework that is fit for purpose. It is recognised that there is a trade-off between the optimum level of detail required to provide the most complete natural capital assessment and the availability of resources to collect the necessary information. However, initial participatory scoping with stakeholders will quickly reduce the full framework to a subset that is appropriate for the plan/programme. The classifications proposed are hierarchical, and so can be expanded or collapsed according to the needs and scope of a specific context.

A systematic approach also facilitates the construction of an evidence database, which supports data analysis, the subsequent evaluation of plan/programme impacts, and the monitoring of trends for subsequent updates and iterations. Holding evidence in a structured database also facilitates the creation of summary tables that present information clearly and coherently. The content of summary tables is outlined within this guidance, which are designed to be completed for the most part using three-point categorical rating scales (high, medium, low; increasing, stable, declining; etc). This recognises the likely difficulties in obtaining quantitative data for all elements of the evidence base, particularly for marine areas (and hence the need to use expert judgement). Also, even where complete quantitative data is available, summaries that can easily be given 'traffic light' coding are useful in highlighting key areas of concern and thus facilitate prioritisation. The process of determining the rating, the underlying information used and assumptions made should be included as part of the wider evidence base.

The evidence base should further include confidence assessments, to highlight possible inadequacies in the available data, and list sources of data and other references used. Such information should not be limited to published documents, and details of any sources such as personal communications, stakeholder workshops or expert judgement should also be given. Approaches for confidence assessments are not included (they are not specific to natural capital); reference should be made to general best practice. Geographical Information Systems (GIS) should be used where possible, as mapped outputs aid visualisation and interpretation and support spatial planning. Again, GIS techniques are not specific to natural capital and so are not described here. A database, summary tables and GIS are intended to complement, not replace, a comprehensive narrative that provides additional qualitative information and discusses context, existing management and governance, evidence gaps, national trends and other factors that relate to sustainability issues.

There are many resources to support environmental mapping and monitoring, and a growing number that focus specifically on practical assessment of natural capital and ecosystem services. Some important examples used to inform the development of this methodology are given in Table 1. These are all applicable at the national level; additional resources and data (through local Biodiversity Records Centres, for example) will be available locally. Identification of a full suite of resources and data sources for specific contexts is beyond the scope of this guidance. References relevant to specific methodological steps are given in the relevant sections.

Table 1. Examples of resources to support undertaking a natural capital approach to Sustainability Appraisal

Resource	Reference	Webpage
UK Habitat Classification	UK Habitat Classification Working Group, 2018	ecountability.co.uk/ukhabworkinggroup-ukhab/
Biodiversity Metric 2.0	Crosher et al., 2019	publications.naturalengland.org.uk/publication/5850908674228224
The Countryside Survey	Maskell et al, 2008	countrysidesurvey.org.uk/
The Land Cover Map	CEH, 2017	ceh.ac.uk/services/land-cover-map-2015
Natural Capital atlases	Wigley et al., 2020	publications.naturalengland.org.uk/publication/6672365834731520
Common International Classification of Ecosystem Services (CICES)	Haines-Young and Potschin 2013, 2018	cices.eu
European Nature Information System (EUNIS)		eunis.eea.europa.eu/habitats-code-browser.jsp
UKSeaMap		jncc.gov.uk/our-work/marine-habitat-data-product-ukseamap/
EUSeaMap	Populus et al., 2017	emodnet-seabedhabitats.eu

Each step of the process is outlined in the sections that follow, using a standard format with three main parts:

(i) *Framework*: A brief discussion of conceptual issues and reasoning.
(ii) *Approach*: The main elements of the method.
(iii) *Output*: The generic structure of the output and the information it should include.

2 Setting high level sustainability objectives (Step 1)

2.1 Framework

Employing a natural capital approach has no effect on methods for identifying other relevant policies, plans and programmes, and so those components are not considered here. However, a specific framework is proposed for identifying sustainability objectives. Although the full five capitals model has been presented below, only environmental inputs (natural capital, and manufactured capital where this relates to built heritage) will be discussed further in the remainder of this document. Wider issues related to, or attempts to classify, other capitals and other (non-environmental) services are beyond the scope of this guidance.

The natural capital approach is intended to increase emphasis on the natural environment, what it provides for people, and the value of this. However, decision-making bodies such as Local Authorities have wide-ranging responsibilities (including for social services, crime and education for example) some of which may have only minimal, or even indiscernible, direct relationships to the natural environment. Therefore, integrating the natural capital approach into Sustainability Appraisal requires an overarching framework that captures all the elements likely to be pertinent to this wider decision-making context. The Five Capitals model (Figure 4) provides this framework, and is already widely used in sustainable development contexts, including in local planning (e.g. Powys County Council, 2017; Calne Town Council, 2012).

The high-level objectives defined in this step are appropriate initially as a means of steering the scope of the Sustainability Appraisal, but need to be supported by detailed sustainability objectives and indicators. These are developed through an iterative process as baseline information and sustainability issues are identified (Steps 2 and 3; Sections 3 to 6) and defined within the final sustainability appraisal framework (Step 4; Section 7).

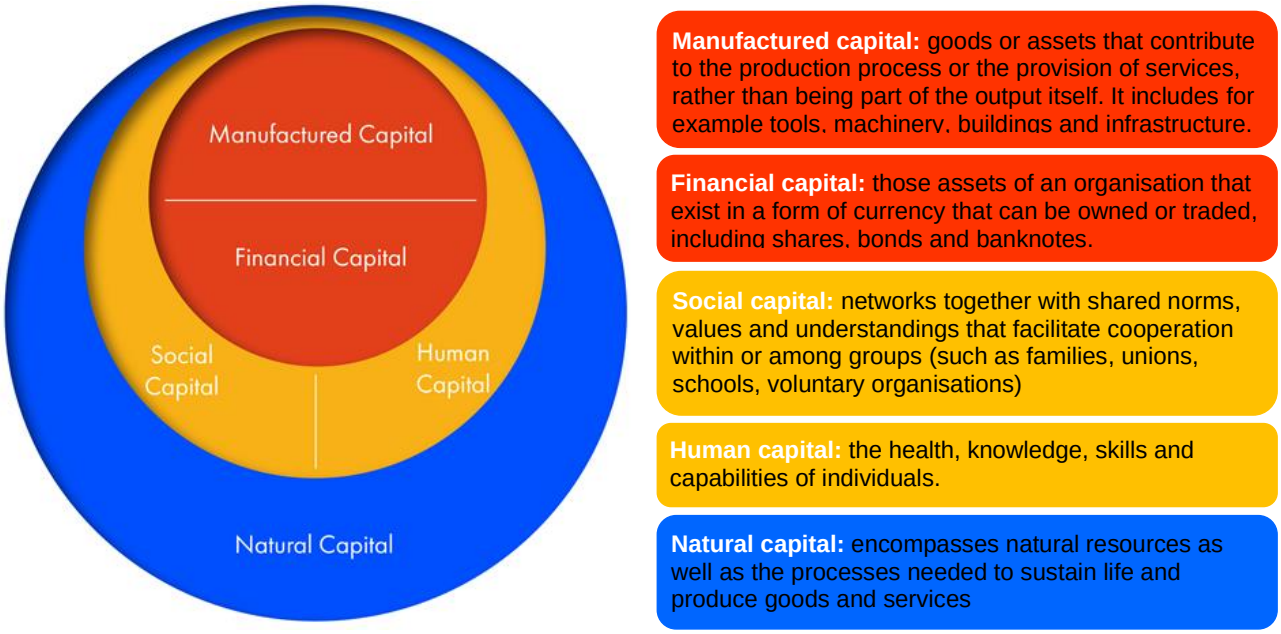

Figure 4. The Five Capitals Model (Forum for the Future, undated) with associated definitions of each type of capital (Forum for the Future, undated; Hattam et al., 2017)

2.2 Approach

Applying the natural capital approach does not require a new method for defining objectives. It is assumed that this will proceed as usual for a Sustainability Appraisal and so will be based on the content of existing policies, plans, programmes, as well as consultation with the stakeholders developing, and affected by, the plan/programme to which the Sustainability Appraisal applies. Sustainability objectives will be specific to individual contexts, but in all cases these should seek to secure environmental improvements, an ethos encouraged by the 25 Year Environment Plan (HM Government, 2018) and the National Planning Policy Framework (MHCLG, 2019a).

The five capitals model should be used to break down overarching aims into their constituent parts from which objectives specific to the environment, infrastructure, individuals, and wider society can be derived. For example, an aim to manage and adapt to climate change can be considered in terms of:

- the ability of the environment to sequester carbon and to protect infrastructure from flooding and erosion (*natural capital*)
- the availability and suitability of renewable energy infrastructure, public transport and flood protection infrastructure (*manufactured capital*)
- the required skills, employment opportunities and need to encourage behaviour change around e.g. transport use (*human capital*)
- the opportunity for community-led energy projects (*social capital*)
- mechanisms to encourage related inward investment (*financial capital*)

2.3 Output

The output from this step is a list of high level objectives that define the scope of the Sustainability Appraisal, such as in the example given in Table 2.

Table 2. Examples of high-level sustainability objectives for each of the five capitals (Torridge District Council and North Devon Council, 2016; Powys Council, 2017; Halcrow Group Ltd, 2009; Calne Town Council et al., 2012).

Main capital type	Examples of high-level sustainability objectives
Natural	• Protect and enhance biodiversity and important wildlife habitats • Protect and enhance the countryside, natural landscape and townscape. • Maintain and enhance heritage assets and their settings. • Maintain and enhance air quality. • Protect high-grade soils
Manufactured	• Provide suitable housing that meets the needs of the population and maximise affordable housing • Improve energy efficiency and use of sustainable construction materials • Make public transport, walking and cycling easier and more attractive • Ensure that new buildings are of a high quality both in main town centre areas and within the remainder of the town,
Human	• Provide access to learning, training, skills and knowledge for everyone • Diversify the range of local employment opportunities • Improve health of population and reduce health inequalities • Strengthen research, technology and innovation
Social	• Reduce crime and the fear of crime • Promote development which supports community wellbeing and cohesion, especially in those areas facing multiple deprivations • Use information technology to promote and facilitate opportunities within the community planning process including buildings and services which can be utilised by the community, using business networks to provide opportunities for new enterprise • Contribute to a diverse and growing population with a balanced demographic structure • Fully engage with and positively involve the local community and other interested parties at all stages of the planning process
Financial	• Foster sustainable economic growth • Contribute to a private sector that is a high-level economic contributor • Provide export opportunities • Become a location of choice for startup businesses

3 Asset Register (Step 2.1)

3.1 Framework

The first constituent of the natural capital evidence base is an asset register, defined simply as "*an inventory of the natural assets in an area and their condition*" (Natural Capital Committee, 2017). Much of the development of the natural capital approach has been in relation to changes in land use, which can be mapped and are often amenable to remote-sensing approaches. This has led to a focus on habitats as key assets and the units which supply ecosystem services. There are some limitations to this 'land cover' approach particularly for the marine environment (Hooper et al., 2019a), but an alternative that has the same level of understanding and acceptance has not yet been developed. Populations of mobile species are also important natural capital assets, and heritage assets should be considered. While heritage assets are not 'natural' capital, they are important environmental inputs to the socio-ecological system (and generate ecosystem services in tandem with ecological assets) and so should be part of the asset register.

It is recommended that baseline information on habitats is collected and organised based on a recognised classification hierarchy, as this enables systematic and comparable assessment. For terrestrial (including intertidal) and freshwater habitats, the UK Habitat Classification (UKHab; UK Habitat Classification Working Group, 2018) is recommended, with the European Nature Information System (EUNIS) more appropriate for marine areas. The high levels of the proposed classification for natural capital assets are given in Table 3, and the full classification in the supporting material. It is not expected that abiotic assets (such as bodies of freshwater, mineral reserves, energy sources and geological landscape features) should be categorised separately from habitats but these need to be recognised in determining the supply of ecosystem services.

Table 3. Broad and component habitat types for assessment of natural capital assets in Sustainability Appraisal, (based on UK Habitat Classification Working Group, 2018; and EUNIS)

Zone	Broad Habitat	Component Habitat
Land	Grassland	Acid grasslands Calcareous grasslands Neutral grasslands Modified grassland
	Woodland and forest	Broadleaved, mixed and yew woodlands Coniferous woodlands
	Heathland and shrub	Dwarf shrub heath Hedgerows Dense scrub
	Wetland	Bog Fen, marsh and swamp
	Cropland	Arable and horticultural
	Urban	Built up areas and gardens
	Sparsely vegetated land	Inland rock Supralittoral rock Supralittoral sediment
Freshwater	Rivers and lakes	Standing open waters and canals Rivers and streams
Marine	Marine inlets and transitional waters	Littoral rock Littoral sediment
	Sublittoral habitats	Sublittoral rock Sublittoral sediment Pelagic water column

3.2 Approach

Context-specific asset lists will be required for different Sustainability Appraisals and should be determined using a participatory process with stakeholders. It is expected that there will be focus on protected assets; these have already been designated as important, are easily identified, and are relatively data rich. Non-designated assets that are important in the supply of ecosystem services should not be overlooked. Examples of appropriate types of asset include:

- *Species*: protected species (e.g. Habitats Directive Annex II, IUCN red list), flagship species (those that are iconic or symbolic such as large mammals, birds of prey, emblematic plants), species that support particular ecosystem services (e.g. commercial fish, bees and other pollinators).
- *Heritage assets*: designated assets (as in the National Planning Policy Framework (MHCLG, 2019a) but also locally significant buildings, monuments, sites, places areas or landscapes identified by Local Planning Authorities.
- *Habitats:* The resolution for collecting, reporting and mapping habitat information should be defined. This is expected to be to at least UKHab/EUNIS Level 3 for county/district scale, but may rise to Level 4-5 for particular aspects of the assessment (and for individual sites) or be at only Level 2 for national-scale assessments.

The key information required for an asset register is the extent (quantity), condition (quality) and the spatial configuration of each asset. A comprehensive assessment of indicators appropriate for the measurement of these parameters was undertaken by Natural England (Lusardi et al., 2018), which has been applied in the development of their national natural capital atlas (Wigley et al., 2020).

- *Quantity:* Habitat extent can be determined from sources such as the Land Cover Map, UKSeaMap, and Natural England's natural capital atlases (see Table 1); population data also exist for certain species (e.g. the Wetland Birds Survey[2]) and individual Local Authorities hold data on heritage assets in the form of Historic Environment Records[3].
- *Quality*: In determining the quality of assets, an existing formal quality assessment may be available, for example for protected sites that undergo statutory condition monitoring. Otherwise, literature providing guidance on conducting condition assessment is available, including in relation to net gain (Crosher et al, 2019) and for determining the Likely Relative Condition of marine areas (Rees et al., 2019). Quality information for species can include factors such as breeding success, and for heritage can be used to capture information about the setting of the asset.
- *Spatial configuration:* applies only to habitats and should be considered in terms of (i) the extent to which the overall area of the habitat is fragmented, and (ii) whether the asset is appropriately located for the provision of ecosystem services. There is not a straightforward and universally accepted mechanism for assessing spatial configuration, although the connectivity of habitats is considered within the Biodiversity Metric 2.0 (Crosher et al., 2019) and experimental indicators are being developed (JNCC, 2019).
- *Trends:* Information on temporal trends for asset quantity, quality and spatial configuration is also important for highlighting those assets most at risk and understanding the likely impacts of any plan or programme. Maintaining the asset register in database form supports understanding of trends. Many plans and programmes (particularly local plans, marine plans, and some strategic environmental assessments such as that for offshore energy) are refreshed or repeated after an interval of several years. The systematic storage of data from previous assessments facilitates its comparison with updated information.

3.3 Output

The format for capturing headline information in the asset register summary table is given in Table 4. The creation of corresponding GIS layers is also encouraged. Open access shapefiles are available for many datasets, including Natural England's natural capital atlases.

[2] https://bto.org/our-science/projects/wetland-bird-survey
[3] https://www.heritagegateway.org.uk

Table 4. The format of the asset register summary table, with a description of the information required and suggested options/examples of cell content

Column header	Description	Options/*examples** for cell contents
Quantity	A quantified assessment of the area, volume or number of individuals (as appropriate).	*e.g.6.7km^2, 3,184 individuals*
Quantity trend	Where time series data is available or can be estimated, the broad trend in the quantity of the asset should be noted, which can be represented visually, e.g. as directional arrows.	Improving; Stable; Declining
Quality rating	Quality rating should be given on a categorical scale, which can be represented visually, e.g.as a traffic light system.	Poor; Moderate; Good
Quality trend	Where time series data is available or can be estimated, the broad trend in the status of the asset should be noted, which can be represented visually, e.g. as directional arrows.	Improving; Stable; Declining
Spatial configuration *(habitats only)*	The degree to which the asset is spatially coherent (i.e. occurs in patches of sufficient size to support effective ecological functioning, and has connections to other areas) and appropriately sited to provide ecosystem services.	Poor; Moderate; Good
Spatial configuration trend *(habitats only)*	Where time series data is available or can be estimated, the broad trend in the spatial status of the asset should be noted, which can be represented visually, e.g. as directional arrows.	Improving; Stable; Declining

* the associated categories/scales to be used in recording (given in normal type) or, where category lists are extensive or not applicable, examples of possible content (*in italics*)

The summary table should be supported by the relevant data but also a wider narrative containing additional information about each asset, to aid understanding of the likely response of the asset to any change resulting from the plan/programme. Noting any conservation designations and other relevant management systems in place for particular assets will also support understanding of the interactions between the proposed plan/programme and existing policies. Further information related to the status of the habitat (such as reasons for declining quantity, poor quality or fragmentation; proximity to thresholds/tipping points; and comparisons with wider national trends) should be included, together with reference to any other factors that constrain, inform or otherwise affect aspects of resource use and management.

4 Ecosystem Services Inventory (Step 2.2)

4.1 Framework

As is the case for assets, a standard classification should be used to identify and categorise the ecosystem services that will feature in the inventory. The Common International Classification of Ecosystem Services (CICES; Haines-Young and Potschin, 2013; 2018) is designed to be a comprehensive and precise categorisation, with unambiguous, mutually exclusive categories. However, to improve its usefulness from the end-use perspective, the ecosystem services framework proposed for Sustainability Appraisal combines the individual CICES classes (the most detailed level of that hierarchy) with a higher level classification used by Natural England in the development of accounts for National Nature Reserves (Sunderland et al., 2018). The higher levels of this framework are shown in Table 5, with the CICES classes (Level 4 of the hierarchy) included in the supporting material. The hierarchy includes a provisioning category of 'Carrier' services to recognise the role of waterways in the transport of goods (following Hooper et al., 2014).

Table 5. The higher levels of the ecosystem service hierarchy proposed for supporting Sustainability Appraisal, (developed from Sunderland et al., 2018; Haines-Young and Potschin, 2018; Hooper et al., 2014).

Level 1	Level 2	Level 3
Provisioning	Food	Cultivated food crops
		Livestock
		Cultivated seafood
		Foraged plants
		Game and wild fish
		Food products from non-living sources
	Materials	Non-food products from plants, animals & algae
		Non-food products from non-living sources
		Genetic resources
	Water	Water supply
	Energy	Energy from non-living sources
		Energy from plants
		Energy from animals
	Carrier	Commercial and other transport
Regulation and maintenance	Environmental quality	Water quality
		Air quality
		Soil health
	Maintaining wild populations	Pollination & seed dispersal
		Maintenance of nursery populations and habitats
	Hazard and nuisance reduction	Erosion control
		Flood protection
		Storm protection
		Pest and disease control
		Fire protection
		Noise reduction
		Visual screening
	Climate regulation	Climate regulation
Cultural	Physical, experiential and intellectual interactions	Recreation, tourism and other experiential opportunities
		Scientific and educational opportunities
	Cultural significance of nature	Aesthetic
		Heritage, spiritual and representational significance
	Non-use values	Existence, bequest and option values

4.2 Approach

A participatory process with stakeholders should be used to refine the full list of ecosystem services to an appropriate subset for the specific context. The wider narrative accompanying the summary table should capture additional information such as who are the beneficiaries of particular services, which can link to other aspects of the plan/programme related to human and social capital.

The main information relevant to an ecosystem services inventory is:

- *Quantity*: This is likely to be in physical units representing, for example, an area, volume or rate. The work at a national level to develop natural capital indicators (Defra, 2018; Lusardi et al., 2018; Wigley et al., 2020) includes those for ecosystem services, and further recent work has been undertaken with a particular focus on cultural services and heritage (Burdon, 2020).
- *Trend:* Changes in the level of ecosystem service delivery will again help to highlight areas of particular concern for management.
- *Targets:* These are likely to include existing policy targets (such as those specifying minimum standards for bathing water quality), which should have been determined as part of the first Sustainability Appraisal scoping step to identify other relevant policies, plans and programmes. Details of the specific target should be recorded, but this should also be converted for the purposes of the summary table to a rating reflecting whether the service is at, below or substantially below

the target (as proposed by Mace et al., 2015). This will highlight potential sustainability issues and also links directly to inputs for the risk register (see Section 6).

- *Value:* Market data on the monetary value of goods and benefits such as fish and timber and for tourism and recreational activities are potentially already published or relatively easy to obtain. Reference to wider literature should be made in attempting to obtain monetary values for non-market benefits arising from ecosystem services.
- *Significance*: There is no expectation that all goods and benefits will be monetised. Instead, a categorical rating of the importance of the service, based on the scale of supply and types of beneficiary can be used to indicate the significance of particular services.
- *Risk rating:* The risk to the continued delivery of the ecosystem service should be recorded. In practice, this will be done after the risk register has been compiled (see Section 6).

4.3 Output

The format for the ecosystem service inventory summary table is given in Table 6. As for the asset register, key information should be presented visually in GIS layers where possible. The risk rating category for the summary table is shown here for convenience, but it will be completed after the risk register has been compiled (see Section 6)

Table 6. The format of ecosystem service inventory summary table, with a description of the information required and suggested options/examples of cell content

Column header	Description	Options/*examples** for cell contents
Quantity	A quantified assessment where possible of the quantity of the service (which may be an area, volume or rate).	*e.g.93 tonnes/year*
Trend	Where time series data is available or can be estimated, the broad trend in the supply of the service should be noted, which can be represented visually, e.g. as a traffic light system or directional arrows.	Improving; Stable; Declining
Target	A categorical rating scale to demonstrate whether the service is being delivered at an acceptable level.	At/above target; Below target; Substantially (>50%) below target
Value of goods/benefits	Monetary value can be provided where available.	*e.g.£480,906*
Significance	Where monetary value for benefits is not available, an indicative rating of the significance of the service should be given on a categorical scale, which can be represented visually, e.g.as a traffic light system.	Low; Moderate; High
Risk rating	A categorical rating scale that indicates the degree to which continued delivery of the service is at risk (*to be completed following compilation of the risk register*)	Low; Moderate; High

* the associated categories/scales to be used in recording (given in normal type) or, where category lists are extensive or not applicable, examples of possible content (*in italics*)

5 Asset-Service Matrix (Step 2.3)

5.1 Framework

It is important to make the connection between the ecosystem services and the assets from which they are generated to ensure that the proposed plan/programme does not affect the assets in a way that jeopardises the continued delivery of services and benefits. The process will highlight those assets that require prioritisation due to the type and level of ecosystem services they provide but which may lack protected status. Local Plans often include sustainability objectives that are not explicitly linked to the environment, but are supported by ecosystem services (e.g. tourism, health and wellbeing, climate change adaptation). Understanding how these are delivered is fundamental in supporting objectives and options that are coherent across the plan.

5.2 Approach

The key component of the matrix is the level of service provision, with a categorical scale used to indicate the degree to which a particular asset generates a particular ecosystem service. These linkages between assets and services may be clear (such as how the presence of certain bird or mammal species supports recreational wildlife watching activities). However, it is expected that there will be a limit to the extent of stakeholder knowledge (particularly for regulation and maintenance services such as mediation of hazards and climate regulation) and so additional reference to literature will be required. Published matrices such as that used in Scotland's Natural Capital Asset Index (Watkinson, 2017), the original work on which it is based (Burkhard et al., 2014), and detailed marine examples (Potts et al. 2014, Burdon et al., 2017) are a useful starting point for a specific Sustainability Appraisal (and examples are reproduced in the supporting material). However, they provide a generic assessment of ecosystem service potential (i.e. what the asset has the capacity to deliver), which may not be the actual situation in the context of the plan/programme.

The process of developing the asset-service matrix may highlight the presence of ecosystem services that were not initially apparent, which may require the ecosystem services inventory to be modified.

5.3 Output

Table 7 provides an example of an asset-service matrix taken from Scotland's Natural Capital Asset Index (Watkinson, 2017).

Table 7. An excerpt from the table of ecosystem service potential contained within the model used for Scotland's Natural Capital Asset Index (Watkinson, 2017)

Key: Ecosystem service potential

0	No relevant potential
1	Low relevant potential
2	Relevant potential
3	Medium relevant potential
4	High relevant potential
5	Maximum relevant potential

	PROVISIONING					REGULATION AND MAINTENANCE							CULTURAL		
	Cultivated crops	Reared animals and their outputs	Water for drinking purposes	Materials from animals, plants and algae (for direct use or processing)	Plant-based energy sources	Mediation of waste, toxins and other nuisances (by biota)	Mediation of mass flows and erosion	Mediation of liquid flows (hydrological cycle/flood protection)	Pollination and seed dispersal	Maintenance of nursery populations and habitats	Soil formation and composition	Global, regional and micro-climate regulation	Physical and experiential interactions	Heritage, scientific and educational interactions	Aesthetic and entertainment interactions
B. COASTAL HABITATS															
B1 Coastal dunes and sandy shores	1	1	0	0	0	1	5	5	3	2	2	1	5	4	5
B2 Coastal shingle	1	1	0	0	0	1	5	5	3	2	2	1	5	4	5
B3 Rock cliffs, ledges and shores, including the supralittoral	0	1	0	0	0	0	3	1	0	1	0	0	3	3	3
E. GRASSLANDS AND LANDS DOMINATED BY FORBS, MOSSES OR LICHENS															
E1 Dry grasslands	0	3	0	1	0	2	4	2	3	1	4	4	3	4	3
E5 Woodland fringes and clearings and tall forb stands	0	2	0	1	2	2	4	3	4	2	3	3	3	4	3
E7 Sparsely wooded grasslands	1	5	0	1	2	4	4	2	4	2	3	2	2	3	2
G. WOODLAND, FOREST AND OTHER WOODED LAND															
G1 Broadleaved deciduous woodland	0	2	0	5	5	4	5	4	4	4	5	5	5	5	5
G3 Coniferous woodland	0	1	0	5	5	4	5	4	4	4	5	5	5	5	5
G6 Exotic woodland and scrub	0	1	0	2	3	3	3	2	2	1	2	3	3	4	3
I. CULTIVATED AGRICULTURAL, HORTICULTURAL AND DOMESTIC HABITATS															
I1 Arable land and market gardens	5	1	0	3	3	3	1	1	4	1	1	2	1	2	1
I2 Cultivated areas of gardens and parks	2	1	0	2	1	3	1	1	4	2	2	2	3	2	3

6 Risk Register (Step 3)

6.1 Framework

Sustainability issues and problems should be identified though compiling a risk register, which is used to connect the continued delivery of ecosystem services with the status of natural capital assets. It thus identifies those assets at greatest risk from current human activity, allowing their management to be prioritised (Natural Capital Committee, 2013). For the purposes of Sustainability Appraisal, the risk register needs to link to the wider plan/programme objectives rather than simply providing a generic assessment of where asset status is of concern, so that (i) appropriate sustainability objectives can be defined; and (ii) to highlight (and hence amend) wider plan objectives that may contradict those related to natural capital aspirations. Making this connection includes the need to understand the pressures to which assets are vulnerable, and the ongoing or proposed activities within the context of the plan/programme to which the Sustainability Appraisal relates

6.2 Approach

The method proposed by Mace et al. (2015), has four main steps:

(i) define natural asset classes;
(ii) determine trends in asset status;
(iii) determine asset-benefit relationships; and
(iv) establish targets and acceptability limits.

These steps will have already been completed, with the asset classes relevant to the plan/programme defined at the start of the process (Sections 4.1.1 and 4.1.2), and the trends in asset status also already recorded in the asset register (Section 4.1.3). Mace et al. (2015) propose using asset-benefit relationships, but the recommendation here is that asset-service relationships are used. This is because service delivery is connected more directly to asset status; the value of benefits can be affected by wider issues that are not related to the health of the environment (wider market trends, for example). These asset-service relationships have already been defined in the asset-service matrix (Section 4.3), and targets for ecosystem service delivery form part of the ecosystem service inventory (Section 4.2.2). Criteria for allocating the level of risk to the continued delivery of the service for each asset-service pair are given in Table 9.

Table 9. The criteria for rating risks to the continued delivery of benefits as low, medium and high (adapted from Mace et al., 2015)

		Status of service		
		Above, or at, target	Below target	Substantially below target (>50%)
Trend in asset status	Positive or not discernible	Low	Medium	Medium
	Negative	Medium	Medium	High
	Strongly negative	High	High	High

Mace et al. (2015) proposed that the risk register be compiled for all three dimensions of the asset status: the quantity, quality, and spatial configuration, as changes to each of these has the potential to affect the generation of ecosystem services and the delivery of benefits. In practice, there will be limitations on the availability of evidence and so this may not be possible for all assets or services.

An overall risk rating for each service should be added to the summary table for the ecosystem service inventory (Section 4.2.2), which will be derived from amalgamating the ratings across the different asset types. Amalgamation can be achieved by, for example, taking a precautionary approach (with the highest risk category from an individual asset being used to represent the service as a whole) or by using the most common risk rating.

6.3 Output

An example of a summary table from a risk register is given in Table 10. As before, the summary tables should be supported by a narrative that includes discussion of how evidence gaps may have led to the omission of certain assets or services from the risk register and any known risks associated with these.

Table 10. An excerpt from an example risk register output, showing risks associated with the three components of asset status: quantity (*Qun*), quality (*Qul*) and spatial configuration (*Sp*) (from Mace et al., 2015)

	Enclosed farmland			Woodlands			Freshwaters			Coastal margins		
	Qun.	*Qul.*	*Sp.*	*Qun.*	*Qul.*	*Sp.*	*Qun.*	*Qul.*	*Sp.*	*Qun.*	*Qul.*	*Sp.*
Food												
Fibre												
Energy												
Clean water												
Clean air												
Recreation												
Aesthetics												
Hazard Protection												
Wildlife												
Equitable climate												

Risk level: Low Medium High No significant relationship/no available information

Lighter shading indicates increasing uncertainty

7 Sustainability Appraisal Framework (Step 4)

7.1 Framework

The Sustainability Appraisal framework requires the identification of sustainability objectives, and indicators by which progress towards these objectives can be measured. This is a standard part of the process, and does not have a specific conceptual framework under the natural capital approach.

7.2 Approach

The ultimate purpose of compiling an asset register, ecosystem service inventory and risk register is to summarise the current state of the environment within the plan/programme area and hence allow sustainability issues to be identified. The key outputs from these preliminary stages of the Sustainability Appraisal are:

- The current status of habitats, species and heritage assets in terms of quantity, quality and (for habitats) spatial connectivity;
- Trends in this status over time;
- The level of, and trend in, delivery of ecosystem services, and the value of the benefits arising;
- The key areas of risk to the continued delivery of ecosystem services.

These are mostly presented as categorical summaries with ‘traffic light’ coding so that areas of potential concern can be easily identified, and are enhanced by summaries of the evidence and a wider narrative. These outputs therefore provide useful materials to support a participatory process of defining detailed sustainability objectives that relate to specific natural capital assets and ecosystem services. Also, the process of gathering baseline information will have identified indicators for assets and services that are appropriate in the local context and can be used to monitor progress against the sustainability objectives.

7.3 Output

An example of natural capital objectives and their associated indicators from the North Devon Marine Natural Capital Plan is given in Table 11.

Table 11. The sustainability objectives and indicators from the natural capital elements of the sustainability appraisal for the North Devon Marine Natural Capital Plan (from Hooper et al., 2020)

Objectives	Indicators
Disturbance of waterbirds, sea birds and marine mammals is reduced	Number of disturbance incidents (from disturbance surveys)
All mussel beds in the Taw Torridge estuary rated at least Class B by 2030	Annual rating of shellfish water quality
All designated bathing waters reach guideline standards by 2025	Annual rating of bathing water quality
All estuarine and coastal water bodies reach appropriate standards under the Water Framework Directive	Annual water body status rating
Commercial stocks of fish and shellfish (wild capture) are within safe biological limits, and where possible are increased	(i) Stock sizes for, particularly, herring, bass, whelk, squid, skates and rays; (ii) Extent of Taw Torridge mussel beds; (iii) Size structure of Taw Torridge mussel beds
Stocks of salmon and sea trout are maintained above their conservation limits	(i) Catch per unit effort (from stock surveys) (ii) Stock status category
Health of fish habitats is maintained and where possible improved	Extent and condition of spawning and nursery habitats
Disturbance of intertidal mudflats in the Taw Torridge estuary from recreational bait collection (bait digging, crab tiling) is reduced	Size of disturbed area (from aerial photography)
The quantity of plastic waste and litter on beaches is reduced	Quantity of litter removed from beaches
Carbon storage capacity of the Taw Torridge estuary is increased	Extent/condition of saltmarsh (from aerial photography/LiDAR)
Disturbance (scour) of subtidal sediments is reduced	(i) Frequency of anchoring within restricted zones (from aerial photography) (ii) Area of scoured seabed around moorings (from surveys)
Levels of protection for environmental assets are maintained and where possible improved	(i) Percentage area within designated and voluntary marine protected areas; (ii) Percentage area protected by management measures;
Environmental quality in protected areas reaches at least minimum acceptable status	Condition assessment in protected area monitoring reports
Likely relative condition of subtidal habitats is maintained and where possible improved	Intensity of fishing and other activities (e.g. aggregate extraction) that impact on the seabed
The cultural heritage value of ongoing inshore fisheries is maintained	Number of licenced inshore fishing vessels

8 Evaluation of effects and alternatives (Step 5)

8.1 Framework

The sustainability objectives provide the basic framework against which to evaluate overarching plan/programme policies and delivery options. Using a natural approach to sustainability appraisal as described in the steps described above will ensure that the sustainability objectives are explicit and relate to specific assets and ecosystem services. Having appropriately focused objectives (rather than those referring to environmental issues in vague or general terms), will facilitate more robust evaluation of likely impacts, and so support decision making that improves environmental outcomes.

8.2 Approach

Typical Sustainability Appraisal outputs include tables in which the relative magnitude of positive/negative impact upon each objective by each policy or option is indicated. Other approaches to Sustainability Appraisal go further, and compare the impacts of different plan/programme options on the individual receptors identified within the scoping process. That latter approach is recommended here in order to highlight important trade-offs and thus support a participatory process for evaluating the different options and selecting which to take forward in the final plan/programme. The framework described above should be carried through into this phase of developing and refining alternatives; i.e. the implications of different plan/programme options should be considered against the constituent natural capital elements used in the scoping phase (e.g. assets, ecosystem services, benefits).

8.3 Output

In reporting, it is again suggested that summary tables are provided, using a 'traffic light' (or similar) system to report how the plan/programme options affect the different natural capital assets, services and benefits, as in the example below from North Devon marine Natural Capital Plan (Table 12).

Table 12. An example output showing how the implications of plan/programme options on assets, ecosystem services and benefits, and human, social, and financial capital could be presented (based on and plan vs no plan scenario, and taken from Hooper et al., 2020)

Key: Strongly positive | Neutral | Strongly negative | Not assessed

	Short term (1-5yrs)	Longer term (>5yrs)
Natural capital assets		
Geology		
Supralittoral rock		
Supralittoral sediment		
Littoral rock		
Littoral sediment		
Saltmarsh		
Mussel beds		
Sublittoral rock		
Sublittoral sediment		
Commercial finfish		
Crab and lobster		
Wetland birds		
Seabirds		
Marine mammals		
Heritage assets		
Designated and non-designated sites		
Ecosystem services and benefits		
Cultivated seafood		
Foraged plants		
Game and wild fish		
Non-food products from plants, animals & algae:		
Bait		
products from cultivated macroalgae		
Genetic resources (*mussel spat*)		
Energy from non-living sources (*tidal energy*)		
Commercial and other transport		
Water quality		
Maintenance of nursery populations and habitats		
Erosion control		
Flood protection		
Climate regulation		
Recreation, tourism and other experiential opportunities		
Scientific and educational opportunities		
Aesthetic		
Heritage, spiritual and representational significance		
Existence, bequest and option values		
Social and human capital		
Community networks		
Knowledge, skills and capabilities		
Financial capital		
Inward investment		

9 Conclusions

The different elements of the process described above provide the framework for applying a natural capital approach to Sustainability Appraisal. Compilation of the asset register, ecosystem service inventory and risk register (and the wider evidence database) will show the current status and trends in assets, ecosystem services and benefits, the degree to which they are at risk and the activities most likely to impact upon them. This provides a comprehensive and systematic baseline against which to assess the implications of a plan/programme. This process also identifies the key sustainability issues and so allows the definition of sustainability objectives explicitly for natural capital assets and ecosystem services (as opposed to the general and high level objectives that are often used in current sustainability appraisals).

The proposed process helps to fulfil the Natural Capital Committee's call for a methodology for baseline natural capital assessments at a local level (Natural Capital Committee, 2019). The framework developed has the potential to support consents and licensing decisions based on Environmental Impact Assessment, as well as Sustainability Appraisal and other elements of the planning process, including, potentially, the application of net gain principles. Finally, a systematic baseline methodology and joined-up assessment process could further link to natural capital accounting and economic evaluation to support investment decisions.

As with any new approach, an iterative process, including significant engagement, is required to develop a robust and applicable method. This document represents an initial outline of the proposed methodology. It is expected to evolve, as lessons are learned from additional use of the framework in practice.

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