

Natural Capital Committee

How to do it: a natural capital workbook

Version 1

This practical guide is aimed at anyone who wants to use natural capital approaches in making decisions about the natural environment. It is intended to support decision makers, including planners, communities and landowners, but has particular relevance for place based decisions.

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Introduction

The Government has made the bold commitment that this should be “the first generation to leave the natural environment of England in a better state than that in which we found it.¹” Achieving this means looking after the environment we have – our natural capital – and making the most of opportunities to protect and improve it.

The NCC set out its methodology in the Third State of Natural Capital Report², and a summary of the fundamental terms and concepts is presented in Annex 1. This practical guide builds on these. It is aimed at anyone who wants to use a natural capital approach in making decisions about the natural environment. It provides a practical five step model intended to support decision makers, including planners, communities and landowners, in protecting and improving their local environment and natural capital. This is a living document and will be updated from time to time with further information and improvements to the approach, especially those identified by the users.

This guide presents a specific method for improving the environment, based on a more general framework for investing in natural capital. Natural capital is the ‘stock’ of resources upon which society depends, and our approach is intended to secure those assets so they can provide a sustainable ‘flow’ of benefits (Figure 2) (including ecosystem services). Other significant types of capital are human and produced capital, which together with natural capital underpin society’s health, wealth and wellbeing in an interdependent way.

This guide gives you the means to:

- Measure the natural capital in a particular area and the benefits it can provide;
- Identify threats and opportunities to natural capital;
- Weigh up the available options and opportunities to make improvements;
- Develop practical plans.

This approach will not result in specific prescriptions – each situation will have its own priorities and opportunities – but the aim of this guide is to provide a structured way of making informed choices.

¹ H.M. Government (2011) *The Natural Choice: Securing the value of nature* (Natural Environment White Paper), CM 8082, The Stationery Office, London: <https://www.gov.uk/government/publications/the-natural-choice-securing-the-value-of-nature>

² The NCC’s third State of Natural Capital Report; *The state of natural capital: protecting and improving natural capital for prosperity and wellbeing* (2015): <https://www.gov.uk/government/publications/natural-capital-committees-third-state-of-natural-capital-report>

How to use this workbook

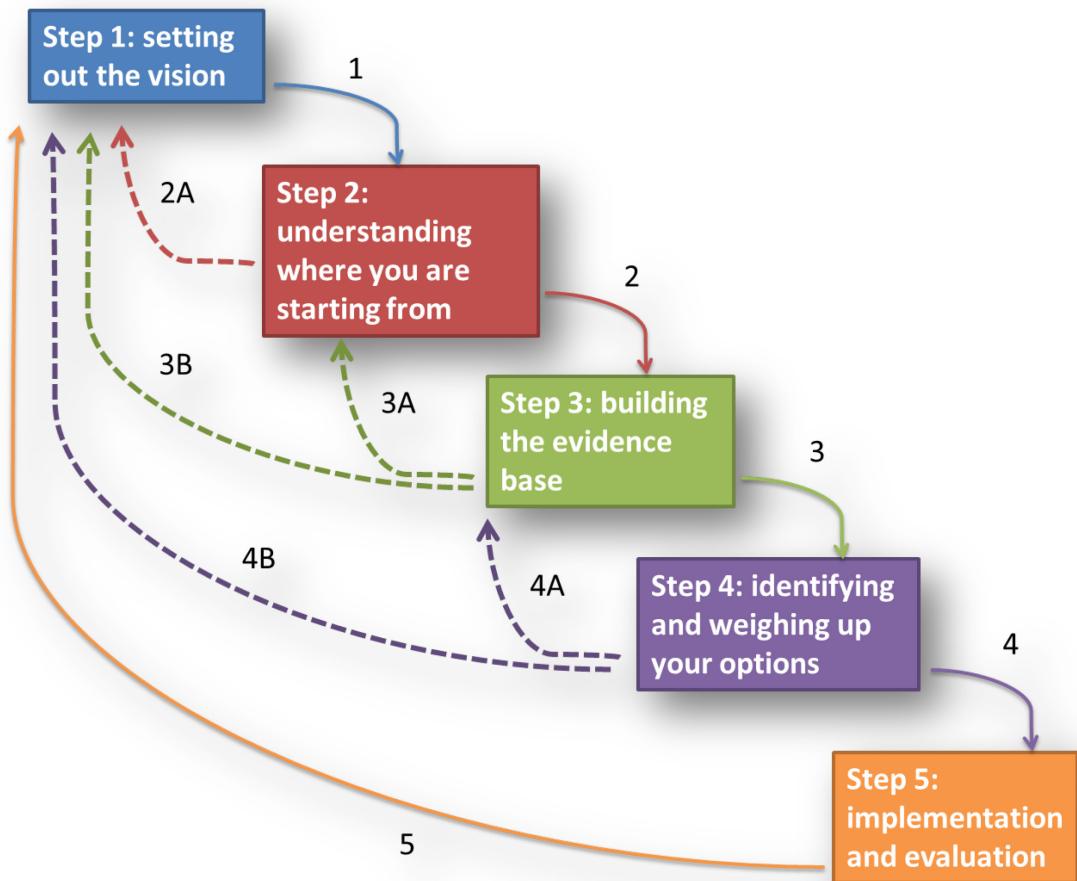
This workbook is arranged around five steps to follow in developing a plan for natural capital. The first section takes you through the process from end to end and introduces each of the steps. We recommend that you start here.

Individual annexes follow, giving more detailed instructions on each of the five steps, a section explaining key terms and principles, and a reference to sources of data, tools, models and advice. We recommend that you refer to these as you work through the steps.

The steps

Figure 1 is the planning cycle for the natural capital plan. The major steps are shown with solid arrows linking steps 1 to 5, and then back from step 5 to step 1 in order to undertake evaluation and potentially to agree shifts in goals or objectives on the basis of experience. The dotted lines indicate that as the plan develops, earlier stages may need to be revisited.

Figure 1: the steps in sequence.



Step 1: setting out the vision

Why are you reading this? What is motivating you to engage?

- There are many circumstances in which individuals and groups might want to use a natural capital approach to protect and improve the environment;
- Often these might start from an overall goal describing what is to be achieved over time;
- Starting with a goal in mind can help to engage, inspire and gain the involvement and buy-in of local partners (but make sure to consider all the alternatives).

The purpose of this step is to develop some general aims for the plan. This is not intended to pre-empt the outcome of the more systematic and detailed analyses that will follow, but it is important to explore what should be in the plan. This might involve considering outcomes of the plan that will be especially significant in the specific situation in which it is being developed. For example, there may be some locally significant species or habitats, or there may be environmental problems such as high flood risk or deteriorating yields from agriculture, or conflicts over housing or other developments that will need to be considered. An early exploration of such issues will enable all those involved in developing the plan to involve relevant people and gather the necessary data and information.

It is important, however, not to become blinkered about the vision. As the plan develops and options are explored, including more integrated ways of dealing with issues, other beneficial outcomes may become apparent. Set aside ‘business as usual’ constraints and explore the boundaries of the possible. The planning and implementation process is iterative and is likely to be modified as evidence is collected and assessed, options considered, and constraints reviewed. Your vision is the starting point for your plan; not its destination. The same is true at the national level. The Government is setting out its vision for net improvement in England’s natural capital over this generation in its 25 Year Environment Plan. This plan will be underpinned by natural capital and ecosystem services based approaches.

There are various ways that some desirable outcomes can be identified. These will mostly involve some kind of structured discussion and deliberation, and can involve a wider group beyond those directly involved in drawing up the plan. The outcome of Step 1 will be a draft list of general goals for the plan. These should be documented, including how they were developed, who was involved and what information sources were consulted. The goals and objectives will need to be revisited and revised as the plan develops and as more information is gathered and analysed.

Step 2: understanding where you are starting from

Before making decisions about how to proceed, it is important to understand your starting point including:

- The baseline position of the various natural assets;
- Plans and activities already in place;
- Information about any other activities that could have a beneficial or adverse impact on the environment.

The purpose of this step is to ensure that basic information relevant to natural capital in the area being considered is gathered, documented, and synthesised. The information collected will refer to the state and condition of natural assets, their services and benefits. It may highlight problems such as assets at risk, and particularly significant drivers of degradation. It may also highlight other plans and developments relevant to the area. Gathering this detailed information will provide the basis for analysing what to do. It will also enable a clearer understanding of what other plans and

activities are already in place in the area, who is funding them and why; which is important to support financing and implementation decisions.

This step will require desk based research on the area under consideration, mapping and documenting assets, and identifying other relevant activities and groups.

At the end of this stage it will be clear what the current state of natural assets are, what is currently planned for them, by whom and over what scales of space and time. This may suggest that some more people or institutions should be involved in developing the plan, and potentially revisiting Step 1.

Step 3: building the evidence base

You will need to understand the extent and condition of the natural capital within your area and its associated benefits, goods and the ecosystem services it provides and the ways of protecting and improving them. This requires measuring and analysing several things:

- The natural assets and the ecosystem services they provide (Figure 2);
- The range of economic and social benefits provided by the natural assets;
- The state/condition of natural assets in relation to the benefits derived from them.

The purpose of this step is to undertake a detailed analysis of the natural capital in the area in order to inform the design of the plan. This is potentially a substantial body of work, and could involve a range of specialists who can provide evidence and information on how different natural assets in the area might be managed to deliver multiple, potentially differing, benefits and what their value would be to different beneficiaries inside and outside the area.

The work will involve mapping, environmental and ecosystem modelling, economic modelling and integration with demographic and infrastructure plans for the area. In Annex 6 we provide a list of data to help with this stage. It will be particularly important that analyses in this step are both relevant and plausible (bearing in mind the objectives identified in Step 1 and the starting conditions set out in Step 2).

The outcome from this stage will a series of potential natural capital plans for the area, indicating in each case what the inputs would need to be, and what the outcomes would be for assets, benefits and beneficiaries. Ideally the evidence base produced at this stage will be widely available to the group, enabling them to challenge and interrogate the results.

Step 4: identifying and weighing up your options

Next you will need to consider the options for action, intervention and investment:

- This is where spatial data, environmental and economic modelling and valuation, and environmental management come together to form the basis for a plan;

- At this stage you can often generate new and better options than those considered earlier;
- The potential prize is a set of outcomes which add up to more than the sum of the existing approaches, creating new value and opportunities.

At this stage the group needs to evaluate the data and models from Step 3, the required inputs (costs and options for financing), as well as benefits (both private market benefits and non-market social benefits), and beneficiaries (present and future; inside and outside the area). It will be important to review these in relation to the objectives from Step 1, and to adjust them as appropriate. This step will involve some kinds of scenario development, modelling and deliberative discussions to agree the nature of the plan. The outcome of this step is a preferred plan, as well as some potential options. The group will need to decide how to agree the plan, as well as the conditions for varying it over time as circumstances change.

Step 5: implementation and evaluation

It is important to develop a practical, implementable and prioritised action plan that all partners buy in to with the necessary funding identified. Where possible the plan should identify the benefits of working together and what is now achievable because of the integrated approach being taken:

- Effective governance, accountability and reporting arrangements should be put in place to enable progress to be made and to address potential differences in emphasis between the various partners;
- Regular meetings should be held to report back on progress and if necessary to decide what corrective actions should be taken;
- A proportionate approach to project management should be adopted to enable delivery and minimise bureaucracy;
- The plan should be reviewed and updated from time to time in the light of changing circumstances and opportunities.

Building on Step 4, this step turns the plan into a reality. It is critical that there is not only a sound plan for natural capital but that there is also a clear governance structure for overseeing its implementation, as well as a plan to finance the work involved. As the work develops and the plan is implemented on the ground there also needs to be an effective process for monitoring and evaluation. The outcomes from the monitoring and evaluation should be fed back into the group responsible for overseeing the plan so they can vary inputs and subsequent outcomes as appropriate.

This step relies on good project management practice and governance. It provides an essential feedback into the management cycle in Figure 1.

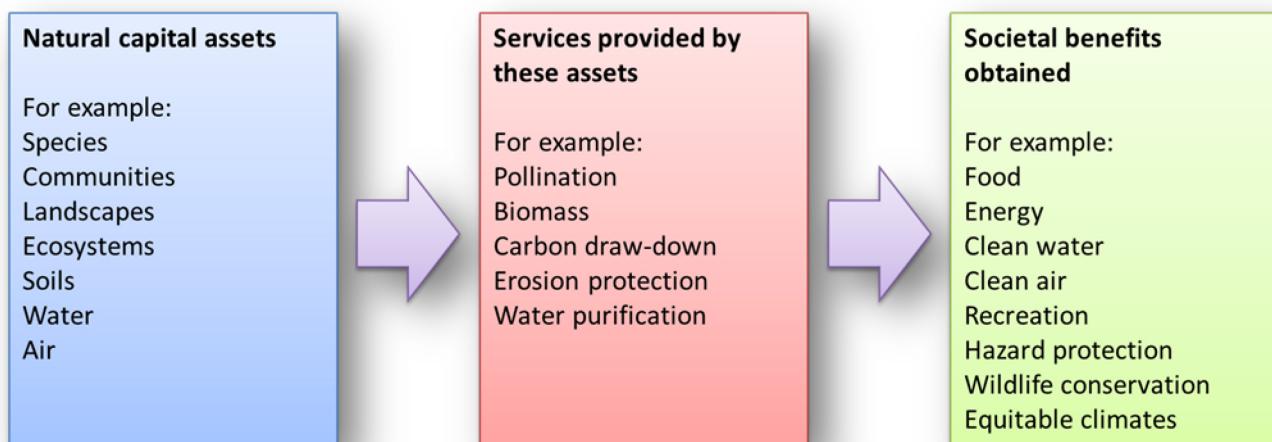
Key concepts

When we talk about **natural capital**, we mean the elements of nature that directly or indirectly produce value to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions. Natural capital is a broad term that includes many different components of the living and non-living natural environment, as well as the processes and functions that link these components and sustain life.

When we talk about natural capital, we talk in terms of **assets**. Any capital asset has the capacity to produce various goods and services. Natural capital is simply those assets provided by nature with the capacity to generate goods and services. In fact, natural capital can be regarded as the source of all other types of capital: whether manufactured, financial, human or social.

Natural capital comprises individual assets, such as ecological communities, species, soils, land, freshwaters, minerals, sub-soil resources, oceans, the atmosphere, and the natural processes that underpin their functioning. Often the pathways linking these assets to goods and services that benefit humans is complex.

Figure 2: natural capital approaches consider the relationships between natural assets, the services they support and the benefits derived from them.



Usually natural capital assets need to be managed to generate goods and services, and other types of capital are usually necessary to generate benefits. For example, crop production relies upon assets such as soil, water and possibly pollinators, but it also requires human capital such as labour and manufactured capital such as farm machinery. Ultimately, to turn the crops into the benefit of

food will require substantial human and produced capital including roads, factory processes, marketing and distribution³.

A clear understanding of the benefits obtained from natural capital; the assets that underpin them; and how investment, intervention or management might affect these benefits, is needed to shape a long-term plan such as the 25 Year Environment Plan being developed by the UK Government.

The relationships between natural capital assets and the benefits that flow from them are multiple and complex. They are affected by how people manage the assets, and by the effects of the history of their use and the application of other sorts of capital (manufactured and human). However, it would be misleading to suggest that the consequences of different management inputs to natural capital assets are simple to predict or that there are in fact predictable outcomes in most cases.

Natural systems are complex assemblages of different components and processes interacting with each other in different ways. The form and function of any particular landscape, seascapes or ecosystem depends on many such factors, and small changes in conditions (either natural, such as the weather; or human, such as harvesting or additives) may have large outcomes in terms of structure or function. These non-linear responses, often called thresholds, are commonly observed. There may also be tipping points in the system whereby a small change in conditions leads to major shifts in the structure or function of the system. In many natural systems these thresholds and tipping points lead to irreversible changes, so that by simply reversing the driving factor to its starting condition does not re-establish the system to its starting condition.

These features of systems are crucial to their management and analysis and are one reason why interventions need to often be moderate and precautionary, and why monitoring and evaluation is of great importance. Much has been learned in practice about the behaviour of natural systems and there is new and active scientific research that can be accessed. For example the NERC BESS⁴ and NERC Valuing Nature⁵ programmes have been exploring these topics with a strong focus on UK land and seascapes.

³ For further information see: Mace, G.M. & Bateman, I.J. (2011). *Conceptual framework and methodology*. In: *UK national ecosystem assessment technical report* (ed. UK National Ecosystem Assessment). UNEP-WCMC Cambridge, UK, pp. 11-25. <http://uknea.unep-wcmc.org/resources/tabcid/82/default.aspx>

⁴ NERC BESS: <http://www.nerc-bess.net/>

⁵ NERC Valuing Nature: <http://www.nerc.ac.uk/research/funded/programmes/valuingnature/>

Annex 1: a glossary

Benefit – changes in human welfare (or wellbeing) that result from the use or consumption of goods, or from the knowledge that something exists (for example, from knowing that a rare or charismatic species exists even though an individual may never see it). Note that benefits can be both positive and negative (dis-benefits), for example:

- **Food** - plant, animal and fungi consumed by people; both wild and cultivated sources;
- **Fibre** - plant and animal materials used by people for building, clothing and other objects, including timber;
- **Energy** - all sources of energy used by people (fossil fuels, wind, tidal, wave, hydro, biomass and solar);
- **Clean water** - water for human use (for example, drinking, bathing, industrial processes); a combination of quality and quantity;
- **Clean air** - air quality that has no adverse impact upon human health or wellbeing;
- **Recreation** - active enjoyment of the natural environment, for example, walking, fishing, and canoeing;
- **Aesthetics** - passive enjoyment of the natural environment, for example, landscape appreciation and views;
- **Wildlife** - wild species diversity and abundance which has aesthetic and recreational value and has cultural and spiritual significance. Distinct from the natural assets, species and ecological communities, in that these represent the species that are significant to England and that people care about;
- **Protection from hazards** - natural regulation of extreme events such as flooding, drought and landslips;
- **Equable climate** - a comfortable climate that has no adverse impact upon human health or wellbeing. This is the result of both global scale and local scale effects (for example, urban cooling by trees).

Ecosystem services – functions and products from nature that can be turned into benefits with varying degrees of human input.

Major land use category – units of land that encompass areas of land and seas with broadly similar features and use.

Metrics – the means through which changes in assets, goods and benefits can be measured.

Natural Asset – a distinctive component of natural capital as determined by the functions it performs, e.g. soils, freshwater, species. These assets are not mutually exclusive and there is overlap between categories (for example, soils include species, minerals, and water), illustrating the complexity of natural capital:

- **Species** - All living organisms including plants, animals, fungi and micro-organisms; the product of ongoing evolutionary processes;
- **Ecological Communities** - A group of actually or potentially interacting species living in the same place. Groups of interacting species form distinctive assemblages interacting with their physical environment;
- **Soils** - The combination of weathered minerals, organic materials, and living organisms and the interactions between these;
- **Freshwaters** - Freshwater bodies (rivers, lakes, ponds and ground-waters) and wetlands. This includes water, sediments, living organisms and the interactions between these;
- **Land** - The physical surface of the Earth and space for human activity. This includes the various landforms and processes which shape these (weathering and erosion);
- **Atmosphere** - The layer of gases surrounding the Earth including oxygen, carbon dioxide and nitrogen used by all living organisms, and the processes which give rise to climate, weather (wind, precipitation) and temperature regulation;
- **Minerals** - Naturally occurring, non-living substances with a specific chemical composition formed by geologic processes;
- **Sub-soil assets** - Other non-living substances in the Earth's crust including rocks and aggregates as well as non-mineral substances such as fossil fuels;
- **Oceans** - Saline bodies of water that occupy the majority of the Earth's surface. This includes water, sediments, living organisms and the interactions between these;
- **Coasts** - The transitional zone between land and oceans. This includes water, sediments, living organisms and the interactions between these.

Natural capital – the elements of nature that directly or indirectly produce value to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions. When we talk about natural capital, we talk in terms of assets. Any capital asset has the important capacity to produce various goods and services. Natural capital is simply those assets provided by nature which has the capacity to generate goods and services. In fact, natural capital can be regarded as the source of all other types of capital: whether manufactured, financial, human or social.

Safe limit – a target used in management to avoid crossing a point at which the condition of a particular component of natural capital changes dramatically (see threshold).

Target – a set level of benefit or status for natural capital determined by society.

Threshold – a discontinuity in a relationship whereby a small change in a pressure or driver can lead to a large change in the state of natural capital with consequences for the benefits it provides. Some of the best known examples are from water quality changes in shallow lakes.

Value – a measure of the change in human wellbeing that results from the consumption of goods. This may be expressed in monetary terms though this is not always possible.

Wellbeing – is used instead of the economic term ‘social welfare’ which is what economists typically use to describe the sum of individual utility from the consumption of goods. Wellbeing is generated from a mix of market and non-market goods and services, including those derived from natural capital.

Annex 2: understanding where you are starting from

Before making decisions about how to proceed, it is important to understand the starting point - the baseline position of the various assets as well as their benefits and beneficiaries. It is also important to pull together and understand all the environmentally related action plans currently in place, together with information about any other activities that could have an impact (good or bad) on the environment. The synthesis of this information will provide the basis for goal setting, developing plans and implementing them successfully. It will also help make a persuasive and evidenced case for funding, support or change.

Scope - identifying the area

The area covered by the plan is an important consideration. Changing the area can affect the decisions made. Issues to be considered include:

- *What is the relevant geographic area?* What makes most sense as a decision making unit from a biophysical point of view? This could be a river catchment, an ecosystem type, or a physical unit such as an island or an area that shares common natural capital features. If only a part of this geographic area (for example, the boundary of a privately owned farm or estate) is considered, important interdependencies may be missed. For example the quality of a river estuary may well be dependent on actions further upstream. However, it is also important not to be overambitious and draw the boundary of the relevant geographic area too broadly in terms of what can be reasonably influenced by the interested parties;
- *What is the practical institutional area?* This addresses the governance structures. This could be a county, a National Park, a city, town or village, an estate or a single farm. An institutional area may have a number of groups that have common interests and responsibilities, and have effective agency over the whole area;
- *What is the relevant benefits area?* This is anywhere or anyone who is affected by the costs and benefits provided by the natural capital and ecosystem services under consideration. At one extreme the conservation of globally rare and endangered species might generate benefits internationally, even though the species themselves are confined to small geographic areas. Likewise, tourists from around the world travel to and value the UK's National Parks. However, other natural capital generates benefits which are almost entirely confined to a local area. For example, a coastal wetland might well reduce the flood risk to local properties in addition to the habitat created. Given the interconnectedness of benefit value chains, this can get complicated. Our suggestion is to use a proportionate approach.

These areas are unlikely to overlap completely, so it is important to consider what may be missing when choosing the focus for a plan. It is helpful at this stage to map this information along with major land-use classes, significant natural areas such as protected sites and key infrastructure, as well as an indication of owners and those assets which are overseen by people and institutions

involved in the plan. If there are major assets that do not feature in the plan, or if there are major land managers not involved, it might be appropriate to include them.

Scope - identifying the groups of people involved

It will be important to establish the governance arrangements for the development, consultation, delivery and oversight of the plan. There will be a variety of individuals, groups and organisations operating within any area, all of whom have some influence over natural capital. Some of these may be having beneficial or adverse impacts on the environment, and some may be spending significant sums.

As part of establishing the plan it is important to identify the partners, interested parties and agents who can contribute. This can include:

- Those who will benefit from the protection and improvement of the natural capital in relation to human health and wellbeing, such as local health care providers, community groups and NGOs with a wellbeing focus;
- Those who will bear the costs of the protection and improvement of natural capital: notably the local or national public and taxpayers;
- Local nature organisations;
- Organisations representing those who use ecosystem services provided by natural capital – water companies, tourist boards, farmers, walking groups;
- Businesses: for example developers, those with an interest in tourism, or flood risk reduction of their farm or buildings, or in sales of products such as timber;
- Those who have influence over how land is used and managed: for example, landowners and managers, organisations running nature reserves, farmers, and public bodies such as the local council, Environment Agency, Natural England;
- Those who may have an impact on natural capital as a consequence of their activities, some of whom may have a corresponding duty or interest to compensate, including major infrastructure bodies such as Highways England and Network Rail;
- Existing authorities and partnerships that may help to coordinate interests: for example, flood partnerships, Local Nature Partnerships, Local Enterprise Partnerships and National Parks;
- Those who have expertise or information that may be helpful: accountants, economists, or subject specialists such as ecologists.

Scope - identifying existing work programmes and activities

The partners involved in taking forward a natural capital and ecosystem services based approach in an agreed geography are likely to be already involved in a range of environmental protection and improvement programmes. It could be useful to collate the following information to form the basis of future plans:

- The planned outcomes of existing work programmes with timings;
- The benefits these will provide for natural capital assets;
- The increase in benefits that could be achieved if an integrated approach is taken together with the pooling of resources where appropriate.

Annex 3: building the evidence base

Having determined the area of interest, the next step is to understand the extent and condition of the natural capital within it, the associated benefits, goods and ecosystem services it provides, and the ways of protecting and improving them. Opportunities for investing in other types of natural capital that are not currently present should also be explored.

It is important to develop a practical, implementable and prioritised action plan. The right balance has to be struck between cataloguing and planning and making a practical difference in protecting and improving the environment.

To do this requires measuring and understanding several things:

- The range of economic and social benefits provided by the natural assets and their associated ecosystem services;
- The way in which these benefits depend upon the various assets and services;
- The state/condition of natural assets in relation to the benefits derived from them.

Benefits are affected by the quantity, quality or location of the underpinning asset and people's ability to access it. For example, for outdoor recreation, the location of recreation areas such as woodlands in proximity to people is a key determinant of how much they will be used and therefore the benefits derived from them. However, the contribution of woodland to an equitable climate, via carbon sequestration, is mostly unaffected by its location and will instead be determined largely by its size and to some extent by species composition.

Developing an *asset register* of the natural capital assets and services in an area

An asset register is an inventory of the natural assets in an area, and their condition. For example, woodland could be defined by its type (plantation, mixed, deciduous), its area, quality (e.g. age, rotation, wildlife species and population, quality of run-off waters) and distribution. For wildlife sites the condition may be measured by the ecosystem type (e.g. wetland, mixed woodland) and should record the number of species present, perhaps focusing on key types such as fungi, plants, insects, birds.

It is important that the asset register is fit for purpose. It does not need to be comprehensive before any action is taken. It can be added to as the work progresses.

The following data (in the form of maps and GIS layers where appropriate) should be included in the asset register:

- The boundary, extent and type of land cover (woodland, farmland, heathland, etc.);
- Significant land managers in the area (e.g. farmers, water companies);

- Major land use types (e.g. residential, transport, agricultural, forestry, recreational, industrial). Equivalent systems will need to be developed for marine areas);
- Who owns which assets;
- The ecosystem services that it provides and its state/condition as measured by quantity (extent, volume or amount), quality and location (spatial) metrics;
- What the asset is being managed for (e.g. wildlife, food, timber, recreation).

Other important information to record about the properties of both natural assets and benefits include: major dependencies (for example on other natural assets or on activities outside the area); potential thresholds or tipping points, if known, for assets and benefits; particular assets people value in this area; and any assets of particular importance, including nationally.

Develop a natural capital *risk register*

As the initial asset and services register is being compiled it is important to assess the current and future risks to the natural capital. By risk, we mean in this context the probability of changes in the delivery of benefits. The risk register needs to consider both the **likelihood** of such a change and the scale of its impact. This helps identify the priority to attach to managing or addressing particular risks. For example, if farmland is not going to be capable of sustaining the same amount of food production as it has previously, due to severe soil degradation, then this needs to be recorded as a potential risk, and taken into account in the prioritisation of actions within a plan.

The Natural Capital Committee has developed a natural capital risk register that highlights where the benefits from natural assets are at risk⁶. While this was not comprehensive and was aimed primarily at the national level, it provides a methodological starting point that could be adapted and used by others in different situations.

Develop a set of *natural capital accounts*

Many of the units used to quantify assets within the asset register cannot be easily compared: for example milligrams per litre of water pollution with tonnes of carbon equivalent greenhouse gases or the number of toads. Environmental accounts help address the challenges of comparability by expressing the value of assets in monetary terms.

A good set of accounts is not just a static stocktake of the assets in an area, but rather a means to capture and understand changes over time. Used properly, it is a powerful management tool for understanding what is happening over time to the natural assets in an area; whether the condition and quantity is increasing or decreasing. Natural capital accounts can be produced at any level of

⁶ For further information see the NCC's second state of natural capital report (2014): <https://www.gov.uk/government/publications/natural-capital-committees-second-state-of-natural-capital-report> and Mace, G. et al. *Towards a risk register for natural capital*, *Journal of Applied Ecology* (2015): <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12431/full>

aggregation necessary, for example national and corporate levels. They can equally be produced at the level of an urban conurbation, county, community, asset holder or landowner. Annex 6 to this workbook highlights useful sources of information for such assessments.

Approaching natural capital accounting (NCA) for the first time may be daunting. The NCC has developed both an accounting methodology and guidance to support practitioners. The aim of NCA is to establish a framework within which organisations can account for natural capital, documenting assets and liabilities in a balance sheet format that extends traditional financial reporting while staying compatible with it. The focus here is on decisions about whether to maintain or restore the current assets which that organisation affects either directly or indirectly. However, when making choices about spending and investments, decision makers also need to consider the alternative investments that they could make. This is considered in Step 4.

The NCA framework reports both the private value that an organisation earns from its current natural capital (and for which it will often already account) and the external benefits and costs that affect society⁷. While the private values can be obtained by looking at market prices, the external social costs and benefits it generates need to be estimated using a range of economic valuation methods. These include ‘revealed preference’ methods (looking at people’s behaviour), ‘stated preference’ methods (looking at people’s statements in response to surveys) and ‘production function’ approaches (examining changes in the output of goods)⁸.

This approach provides a workable, consistent and practical method for producing natural capital balance sheets for organisations to use, based on a natural capital asset register. These can be used by owners/managers of natural capital assets to record and value changes in assets, costs and benefits, providing evidence for risk management and maintenance decisions. This approach provides a way to document the management costs of maintenance and its social value. Those maintenance costs also provide an important input to the assessment of different options for investment (described in Step 4).

This methodology can sit alongside traditional financial and management accounts and should be seen as a complement to them. It enables organisations to gather natural capital information in a coherent and comparable format to aid decision making about the management of natural assets,

⁷ Just as for the entire Workbook, this section applies to both public sector decision makers and private organisations. A valid question concerns why a private firm might be interested in the social value (positive and negative) generated by its decisions. While it is true that many firms quite understandably focus on the private value they deliver, others might have philanthropic concerns or be interested in the added value or kudos which socially beneficial modes of production can bring to their company or the reputational risks that high external costs might generate.

⁸ More discussion of this issue is given in the NCC (2017) *Economic valuation and its applications in natural capital management and the Government’s 25 Year Environment Plan*, NCC, Defra:
<https://www.gov.uk/government/collections/natural-capital-committee-documents>

There are a variety of texts providing overviews of economic valuation methods, see for example: Champ, P., Boyle, K. and Brown, T. (eds.) (2017) *A Primer on Non-market Valuation, The Economics of Non-Market Goods and Services: Volume 3*, Springer, ISBN 978-94-007-7104-8.

to the benefit of both the organisation and society. Specifically, the NCA approach helps with determining:

- The private value to an organisation of the natural assets that it currently owns and/or manages;
- The cost to the organisation of maintaining those assets;
- Changes in their condition over time;
- The risks (potential costs) and benefits to the organisation of either depleting or maintaining those assets;
- The costs and benefits to society of either depleting or maintaining those assets.

For more detail on natural capital accounting see the ONS natural capital accounts⁹ and the NCC corporate natural capital accounting advice¹⁰.

⁹ ONS's natural capital accounts:

<https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/methodologies/naturalcapital>

¹⁰ NCC's corporate natural capital accounting: <https://www.gov.uk/government/publications/natural-capital-committee-research-corporate-natural-capital-accounting>

Annex 4: identifying and weighing up your options

The previous sections in this manual outlined how to gather information on current natural capital assets and the services they provide; and how to understand trends in those assets in quantity, quality and accounting terms. The next step is to consider the options for action, intervention and investment. This is where spatial data, environmental and economic modelling and valuation, and environmental management come together to form the basis for a plan. The potential prize this approach can deliver is a set of outcomes that is more than the sum of the existing approaches, creating new value and opportunities.

It is important to keep an open mind regarding the choice of investment and management options. In some instances it might be best to restore a degraded asset (for which the maintenance costs estimated in the natural capital accounts provide important information). In other cases it might be better to invest in the development of alternative natural capital assets. There is also an opportunity to explore with partners, and anyone potentially affected, whether the original vision remains valid or requires revision¹¹. These decisions should be taken in the context of the Government's overall aim of being the first generation to leave the natural environment in a better state than that in which they found it¹². This suggests two simple guidelines for natural capital investments:

- (1) Decision makers should consider the benefits of alternative options for using the resources available to them;
- (2) The overall stock of natural assets should be improved.

Taking these two rules together can help ensure both good value for money for taxpayers who fund public investments and contribute to the overall vision for environmental improvement that underpins the Government's 25 Year Environment Plan (25YEP).

It can be difficult to compare the positive and negative effects of investments in different types of natural capital if they are measured in diverse units such as quality, quantity, carbon, visitor numbers, etc. There are clear advantages in trying to put the various benefits and costs of environmental investments into common units, specifically in terms of economic value. In particular:

¹¹ There are a number of sources for support here. For example the Ecosystems Knowledge Network has excellent resources to help with this challenge: <http://ecosystemsknowledge.net/about/themes/mapping>

¹² This implies that the stock and quality of natural capital will have to increase. In order to ensure that this does not prevent all growth and development (indeed improving the stock of natural capital itself requires change) we have to allow the use of natural capital, including some losses in certain areas, but ensure that the aggregate natural capital stock increases. Because this is very difficult to leave to a local level (e.g. losses in one area might best be compensated for by gains elsewhere), a national plan becomes essential. The developing 25YEP provides the ideal basis for such a plan.

- This allows us to compare the trade-offs that almost all changes to the natural environment entail;
- We can compare the different values alternative investment options could provide;
- We can identify the value environmental improvements can generate, and use this to justify further investment.

There has been much research into the economic valuation of the benefits of environmental investments. The methods are the same as those employed in natural capital accounting to assess social (as opposed to private) values and has resulted in a considerable literature to refer to (Step 3). Recent work commissioned by the UK Government and its agencies has aimed to bring this information together¹³. However, there are some caveats. First, while most of the benefits and costs of a change can be robustly valued (including recreation, flood risk reductions, greenhouse gas emissions, noise reductions, etc.), at present there are some exceptions. In particular some of the values of conserving biodiversity are difficult to assess and have been discussed at length in other NCC guidance¹⁴. Second, there could be other factors that a decision maker might want to take into account when choosing a course of action. For example, there might be reasons for allowing some stocks to decline if others improve. For example, if stocks of an asset are nationally high then it might be regarded as more important to make investments in other types of assets.

Overall, the evaluation of options should be carefully considered and discussed by the plan participants. Consideration of the benefits and costs of alternative investments and their overall impacts on natural capital should provide a key input to the decision making process.

Details of pilot projects on evaluation and prioritisation which show how this plays out in real life are outlined in “The economic case for investment in natural capital in England¹⁵” and we recommend you review these when considering your own priorities.

¹³ Examples include *Valuing Environmental Impacts: Practical Guidelines for the Use of Value Transfer in Policy and Project Appraisal* (2010): <https://www.gov.uk/government/publications/valuing-environmental-impacts-guidelines-for-the-use-of-value-transfer>. Defra have also funded work to provide further decision support and valuations specific to different areas of the country. These decision support tools include the ORVAL system for assessing and valuing the recreational benefits of environmental investments (<http://leep.exeter.ac.uk/orval/>). Defra have recently commissioned a more general decision support system (the Natural Environment Valuation Online tool) although this will take some time to develop.

¹⁴ This is discussed further in the Natural Capital Committee report *Economic valuation and its applications in natural capital management and the Government’s 25 Year Environment Plan*: <https://www.gov.uk/government/collections/natural-capital-committee-documents>. Put simply this advises the valuation of those benefits that can be robustly assessed. For benefits that cannot be robustly valued simple rules should be applied. For example ‘no-loss’ regulations would ensure that investments that damage biodiversity are ruled out unless more than equivalent improvements to the species concerned are also implemented.

¹⁵ *The economic case for investment in natural capital in England* (2015): <https://www.gov.uk/government/publications/natural-capital-committee-research-investing-in-natural-capital>

Annex 5: implementation and evaluation

It is important to incorporate the choices made in the preceding steps into a clearly articulated plan. The plan should set out the goals, measures, milestones and actions, together with the relevant accountabilities and responsibilities.

Partners initially are likely to have a range of views on what the goals of the overall work programme should be. There may also be challenges around taking a more integrated approach to considering the issues and pooling resources. However, these are important if the plan is to deliver more than the sum of the existing work programmes in the area. The development of the plan and its acceptance by all partners will require effective leadership and governance arrangements.

The level of detail in the plan should be commensurate with the scope and extent of the work programme – unnecessary bureaucracy should be avoided. However, the discipline of developing a fit for purpose plan will help order participants' thoughts and increase the likelihood of achieving the desired outcomes. It will also be important to ensure that funding is available to take the various actions forward.

Reporting mechanisms and regular meetings should be established to review progress and if necessary to decide what corrective actions should be taken. The plan should also be reviewed and updated from time to time in the light of changing circumstances and opportunities. It will also be appropriate periodically to revisit the prior steps within the NCC model as part of an iterative, ongoing natural capital protection and improvement plan.

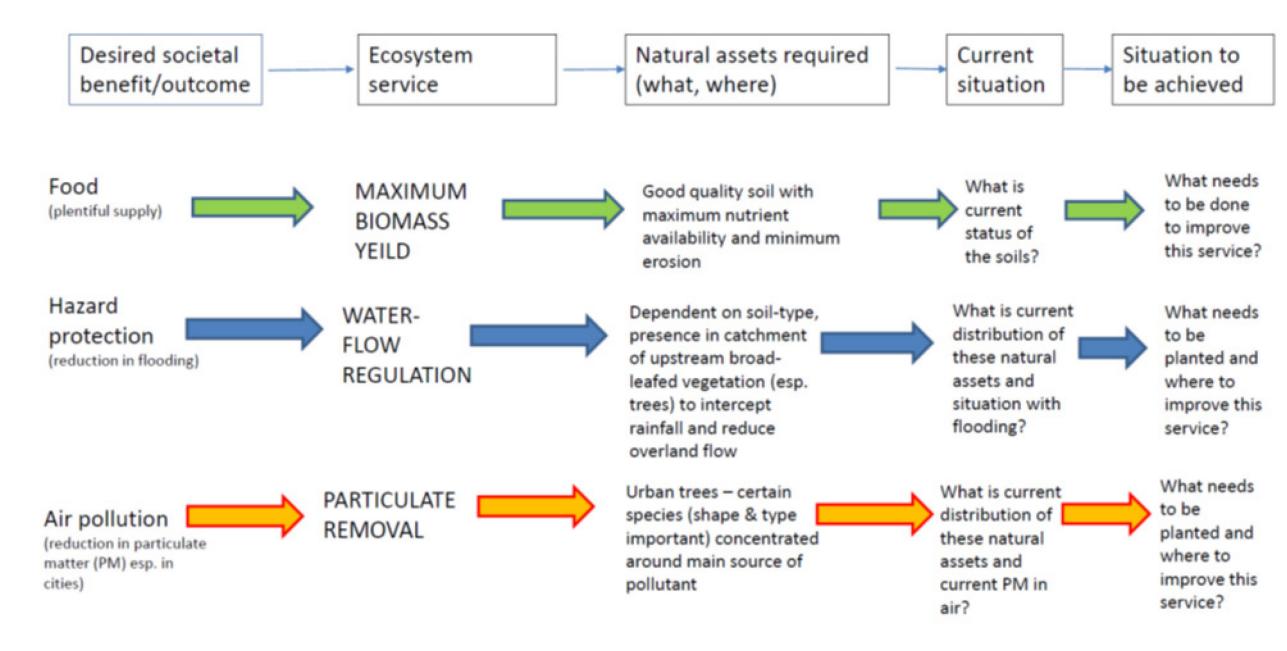
Annex 6: tools, datasets and organisations

Here are some places where you can find currently available tools, datasets and organisations for determining UK natural capital assets and the key ecosystem services that they provide.

In order to determine natural within a defined geographic boundary such as a city or a landscape, a series of steps is required. This involves first mapping the natural capital assets and their quality, second determining the ecosystems services provided by these assets, and third understanding the societal benefits obtained from them. Each requires a different type of information (see Figure 2, Glossary and Kew terms). The process for determining natural capital can also begin the other way around i.e. the end-user determines the societal benefits required and then identifies the quantity and quality of ecosystem services and natural capital assets required to deliver them (Figure 3).

Both approaches are currently being carried out in the UK but the tools and datasets containing the relevant information to undertake either approach, are the similar.

Figure 3: Examples of determination of natural capital required in order to achieve desired societal outcomes.



There are an increasing number of tools and datasets currently available for obtaining the information required to achieve these steps. Below we provide some of the more commonly used tools and datasets but please note this is an interactive list and will be updated as new tools and datasets become available.

Datasets currently available to determine UK Natural Capital assets

Note that some of these datasets contain information on more than one asset type.

Natural capital asset	Datasets	Lead organisation	Access
Species	Biodiversity mixed: This is a repository for all biodiversity datasets for the UK and contains the Environmental Monitoring Dataset Species Data (Natural England), EA rare and protected species records, Non-native species records etc.	National Biodiversity Network (NBN) gateway (soon to become NBN Atlas)	https://data.nbn.org.uk/
Species	Bats	National Bat Monitoring Programme	http://www.bats.org.uk/pages/nbmp.html
Species	Birds	Joint Nature Conservation Committee & British Trust for Ornithology	See C5. Birds of the wider countryside and at sea (JNCC) and British Trust for Ornithology Wetland Bird Survey (WeBS) (BTO)
Species	Invertebrates – see Pantheon database	Natural England/ Centre for Ecology and Hydrology	http://www.brc.ac.uk/pantheon/
Species	Freshwater species: Fish, Invertebrates, diatoms, macrophytes, phytoplankton – freshwater species data/fisheries data, WFD element classifications	Environment Agency	https://data.gov.uk
Species	Insects	Joint Nature Conservation Committee	JNCC - Insects of the wider countryside (butterflies)

Natural capital asset	Datasets	Lead organisation	Access
Landscapes	Land Cover Map 2007	Centre for Ecology and Hydrology	http://www.ceh.ac.uk/services/land-cover-map-2007
Landscapes	MasterMap	Ordnance Survey	https://www.ordnancesurvey.co.uk/business-and-government/products/mastermap-products.html
Landscapes	Phase 1 habitat survey	Joint Nature Conservation Committee	http://jncc.defra.gov.uk/page-2468
Landscapes	Agricultural census data	Defra	https://www.gov.uk/government/collections/structure-of-the-agricultural-industry
Communities	National Forest Inventory	Forestry Commission	http://www.forestry.gov.uk/
Communities	National LiDAR data	Environment Agency	https://data.gov.uk/dataset/lidar-composite-dsm-1m1
Communities	Plant indicators of good habitat condition	Natural England/CEH	GIS compatible layers available to download from Natural Capital — Environmental Information Platform
Communities	Priority Habitats Inventory/Map	Natural England	Available on Magic as three or four individual layers covering the whole country. All the individual habitats are available on MAGIC: http://www.natureonthemap.naturalengland.org.uk/
Communities	SSSI Condition Data	Natural England	Available on MAGIC: http://www.natureonthemap.naturalengland.org.uk/
Soils	Soil carbon, phosphorous, nitrogen, bacteria, invertebrates, pH	Natural England/ Centre for Ecology and Hydrology	GIS compatible layers available to download from Natural Capital — Environmental Information Platform
Soils	Countryside survey	Centre for Ecology and Hydrology	CEH (2007) Countryside Survey: Soils Report from 2007
Soils	Hydrology soil types	Centre for Ecology and Hydrology	http://www.ceh.ac.uk/services/hydrology-soil-types-1km-grid
Water: rivers	WFD water bodies (GIS)	Environment Agency	https://data.gov.uk/

Natural capital asset	Datasets	Lead organisation	Access
Water: rivers	WFD water body status (Classification) – water quality data for rivers, lakes, canals and ground waters	Environment Agency	http://environment.data.gov.uk/catchment-planning/ also on: https://data.gov.uk/
Water: rivers	River Habitat Survey	Environment Agency	Summary data available on: https://data.gov.uk/
Water: rivers	Flow data	Environment Agency	Some river flow data is also available from the National River Flow Archive (http://nrfa.ceh.ac.uk/) and some peak flow data is available from the Centre of Ecology and Hydrology (http://www.ceh.ac.uk/data).
Water: rivers	WFD water body status (Classification) – water quality data for coastal water bodies	Environment Agency	http://environment.data.gov.uk/catchment-planning/ also on: https://data.gov.uk/
Water: coasts	WFD water body status (Classification) – water quality data for transitional (estuarine) water bodies	Environment Agency	http://environment.data.gov.uk/catchment-planning/ also on: https://data.gov.uk/
Water: coasts	Bathing Water Directive compliance	Environment Agency	http://environment.data.gov.uk/bwq/profiles/
Water: coasts	Commercial shellfisheries – water quality (e-coli)	CEFAS data	CEFAS data is used for the Food Standards Agency hygiene classifications and for the Environment Agency WFD shellfish Protected Area reporting. https://www.cefas.co.uk/cefas-data-hub/
Air	Downscaled meteorological data 1km: 1962 - 2012	Centre for Ecology and Hydrology	CHESS explorer https://eip.ceh.ac.uk/apps/chess/
Air	Air quality – Defra environmental statistics	Defra	https://www.gov.uk/government/collections/air-quality-and-emissions-statistics

Online tools to determine UK ecosystem services

Tool	Access
Ecosystems Knowledge - contains information on 12 tools	http://ecosystemsknowledge.net/resources/tools/tool-assessor Information sheets on each tool can be found at: http://jncc.defra.gov.uk/page-7246
Eco4Biz - Ecosystem services and biodiversity tools to support business decision making	http://www.wbcsd.org/Clusters/Ecosystems-Landscape-Management/Resources/Eco4Biz
Ecosystem Service Mapping Gateway	http://www.nerc-bess.net/ne-ess/
TESSA: a toolkit for rapid assessment of ecosystem services at sites of biodiversity	http://www.sciencedirect.com/science/article/pii/S2212041613000417
NaturEtrade: creating a marketplace for ecosystem services	http://www.naturetrade.ox.ac.uk/

Examples of the societal benefits obtained from natural capital

Benefit type	Access
Natural England ecosystem service maps (food provision; wood provision; water supply; climate regulation; water quality; soil function; air quality regulation; pollination; wild species diversity; cultural ecosystem services) based on expert opinion from UK National Ecosystem Assessment of the importance of broad habitats for the provision of ecosystem services. Report with maps.	Assessing the potential for mapping ecosystem services in England based on existing habitats - NERR056: http://publications.naturalengland.org.uk/publication/5280919459987456
Crops & livestock	https://www.gov.uk/government/collections/agriculture-in-the-united-kingdom
Wood	http://www.forestry.gov.uk/
Fish	http://www.fao.org/fishery/statistics/global-production/en
Climate regulation	http://www.forestry.gov.uk/
Air quality	https://www.gov.uk/government/collections/air-quality-and-emissions-statistics
Hazard protection	https://data.gov.uk/publisher/environment-agency
Recreation	& https://www.gov.uk/government/collections/monitor-of-engagement-with-the-natural-environment-survey-purpose-and-results

Government agencies that can help to provide additional information

Subject	Access
Vegetation	Inventory – National Forestry Inventory Lead authority – Forestry Commission
Vegetation	Designated areas, National Nature reserves, terrestrial ecology, Nature Improvement Areas Lead authority - Natural England
Vegetation	Agri-Environment Schemes Lead authority - Natural England
Air quality	Air Quality Management Area action plans Lead authority - Local Authority
Air quality	Emissions to air from major industrial activities Lead authority - Environment Agency
Air quality	Local air pollution control from designated business activities Lead authority- Local Authority
Water	River Basin Management Plans including catchment level actions Lead authority - Environment Agency
Water	Catchment Flood Risk Management Plans Lead authority – Environment Agency
Water	Local flood risk plans Lead authority - Lead Local Flood Authority
Water	Water Resource Management Plans and Drought Plans Lead authority – Water Companies
Water	Catchment Abstraction Management Plans Lead authority – Environment Agency