

# Natural Capital Committee

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Economic valuation and its applications in natural capital management and the Government's 25 Year Environment Plan

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## Background

The Natural Capital Committee (NCC) defines natural capital as “those elements of the natural environment which provide valuable goods and services to people, such as the stock of forests, water, land, minerals and oceans”.

Value therefore lies at the heart of the natural capital concept. Accordingly, assessing the value of changes in our natural capital and the services it provides<sup>1</sup> is fundamental to deciding how and where funds should be spent to restore, maintain and manage the natural environment.

Yet there are many different interpretations of what valuation means and how to apply valuation evidence in practical decision making contexts.

In this note, the NCC lays out the types of decisions for which natural capital values might be useful and some principles to guide the choice of approaches to valuation.

The intention is to guide and encourage coherence across decision making contexts, particularly relevant for the public sector, and especially for projects related to the development and implementation of the Government’s 25 Year Environment Plan (25 YEP). The principles set out here could also be used to guide relevant decisions in the private sector.

## Why valuing changes in natural capital services is essential

Many of the goods and services that people obtain (either wholly or in part) from natural capital are not supplied by private firms through markets (e.g. clean air, flood control, woodland walks). Some of these ‘public goods’ lack market prices, while the value of others is only poorly reflected in prices<sup>2</sup>. The lack of meaningful or observable prices results in the value of natural capital benefits being frequently overlooked or ignored in decision making.

For example, the market price of timber affects private firms’ decisions about whether to plant new woodlands. However recent figures from the ONS suggest that in the UK, the carbon,

<sup>1</sup> As discussed subsequently in this document, many decisions look at how changes (such as new investments or increased extraction) will alter the flow and value of services from natural capital. Other situations require us to look at changes in the stocks of natural capital. Occasionally decisions concern changes in the flow of services which may in turn significantly alter natural capital stocks and hence future service levels. A more detailed overview of these issues is provided in Bateman, I.J., Mace, G.M., Fezzi, C., Atkinson, G. and Turner, R.K. (2011) *Economic analysis for ecosystem service assessments, Environmental and Resource Economics*, 48(2): 177-218: <http://link.springer.com/article/10.1007/s10640-010-9418-x>

<sup>2</sup> While this document focuses upon improving decisions, there is a wider context. In the absence of market prices, businesses, governments and individuals have a tendency to overuse and under supply environmental public goods; e.g. air quality may be poor if people do not pay when they pollute it, or outdoor recreation may be under supplied because it is difficult for land owners to earn a return from its provision. Sometimes even those goods that are provided by publicly regulated private firms may face prices that only poorly reflect the full value of the goods concerned. For example, the regulated price of water supply and treatment services may be only weakly related to the value of those services. Valuation methods may be needed to provide information to allow policy makers to make decisions or regulate prices in situations such as this.

recreation and air quality benefits of woodlands (which accrue to many different groups of people across the country), may be considerably greater<sup>3</sup> than market revenues for timber (which accrue to the woodland owner). Making investment decisions based on market prices is entirely reasonable for private institutions. However, decisions about natural capital that are guided by market prices alone may not provide the best outcome for society.

The common problem here is that the value of natural capital and the services it provides are often not well incorporated into decision making processes which rely solely on market prices. As a result, there is too little investment in natural capital overall and its wider benefits are not appreciated. This note provides a valuation framework for directly addressing this problem, but only in so far as the decision maker is interested in both private and social benefits. Where this is not the case, Government has a role to play in ensuring social values are considered either through regulation or by providing incentives.

## The decision making context and valuation

The NCC has identified three general decision contexts for which information on the value of natural capital and its services is useful. The approach to valuation depends upon the relevant context. They are:

- (1) Determining priorities for investments in natural capital;
- (2) Determining actions affecting natural capital to (i) achieve target improvements; (ii) avoid deterioration; or (iii) compensate for losses;
- (3) Determining overall progress with objectives to protect and improve natural capital (including at the aggregate level).

Each of these is discussed in more detail below.

### (1) Determining priorities for investments in natural capital

Here the decisions are likely to be about investments in natural capital assets that have the potential to deliver on the goal of the Government's 25 YEP<sup>4</sup>. The purpose of the valuation is to prioritise amongst a suite of different potential projects.

There are many natural capital project investments that could be undertaken, but both public and private resources are limited. From a social perspective, it is necessary to use the limited public resources available to the greatest effect and to invest in those initiatives that generate the

<sup>3</sup> Initial estimates from the Office for National Statistics suggest the carbon, recreation and air quality benefits may be around 30 times greater than timber values. See:

<https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/ukenvironmentalaccounts/2016>

<sup>4</sup> To be "the first generation to leave the natural environment of England in a better state than that in which we found it". See: <https://www.gov.uk/government/publications/the-natural-choice-securing-the-value-of-nature>

greatest net benefits for society. A risk register can also be useful to highlight natural capital assets and benefits at risk, indicating potential priorities for investment<sup>5</sup>.

An economic approach based on cost-benefit analysis should provide a robust evidence base to support the appraisal of natural capital investment decisions. However, this needs to consider the full suite of environmental costs and benefits as well as the system properties of the environment (see previous NCC advice in this area on the Green Book)<sup>6</sup>. For example, there is currently good evidence for interventions such as woodland planting, upland peatland restoration and wetland creation. However more evidence is required in areas such as improving and expanding urban greenspace or improving the environmental performance of farming. More information is provided in the NCC Third State of Natural Capital Report<sup>7</sup>.

Various methods have been developed for estimating the economic value of natural capital benefits. These approaches include:

- a) 'Revealed preference' methods which examine people's behaviour (e.g. looking at the additional costs people are prepared to incur to visit higher quality recreational areas or the price premiums people pay to live in quieter areas);
- b) 'Stated preference' methods (e.g. asking households how much extra they are prepared to pay in water bills to fund cleaner rivers);
- c) 'Production function' approaches (e.g. using the reductions in output which farmers suffer due to water shortages as a means of valuing that aspect of the security of water supply).

There are a number of guides to such methods<sup>8</sup> and considerable research has been undertaken to provide estimates of the economic value of environmental costs and benefits. For example,

<sup>5</sup> The NCC's second State of Natural Capital Report goes into further detail on risks to natural capital: <https://www.gov.uk/government/publications/natural-capital-committees-second-state-of-natural-capital-report>

<sup>6</sup> Maddison, D. and Day, B. (2014) *Improving Cost Benefit Analysis Guidance, A Report to the Natural Capital Committee*, NCC, Defra. This previous advice recommends a number of revisions to conventional practice. In particular we highlight the importance of recognising potential natural capital thresholds beyond which we risk abrupt changes in the state of assets and the benefits they can supply. For example, with a large stock of fish one can assume that the social value (benefits minus costs) of catching each fish stays constant. However if we expand fishing effort to the point where we threaten the reproductive capacity of the population then the costs of catching additional fish (in terms of foregone future catches) begins to rise and the social value of additional fishing starts to fall. Because of this risk, natural capital decision making requires that, instead of using fixed unit values we should use value functions which reflect changes in natural capital stocks (Bateman et al., 2011, *ibid.*, discusses options for addressing this issue). This approach enables a better sense of the potential 'deprivation value' which may arise when large losses of natural capital arise. <https://www.gov.uk/government/publications/natural-capital-committee-research-improving-cost-benefit-analysis-guidance>

<sup>7</sup> See in particular pages 36-49 of 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>

<sup>8</sup> 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. High quality guides also discuss the limitations of such methods. For

Government has developed valuation estimates and appraisal guidelines for the storage and emission of greenhouse gases, air quality, water quality and peace and quiet. Outdoor recreation values are also well understood thanks to modelling initiatives and tools such as ORVal<sup>9</sup>. Combining these values with assessments of the impacts of changes where market prices are available (e.g. changes in food production, timber, etc.) enables valuation of most of the consequences of alternative uses of resources. There are currently attempts to combine this research into single integrated models, (such as Exeter's TIM), which will enhance the usefulness of this data to decision making.

Economic analysis techniques have improved over recent years although, as in any discipline, examples of poor practice remain. A key requirement is that any analysis recognises the limitations imposed by the systems nature of the natural environment. In cases where very major ('non-marginal') changes are threatened and if adjustments for a potential shift in systems cannot be made, then standard analyses may be inappropriate. Furthermore, while many of the benefits and costs of changes in natural capital can be robustly valued, this is not always straightforward. For example, the value of changes to biodiversity is particularly difficult to assess, as are other components of natural capital for which non-use values<sup>10</sup> are potentially dominant.

However, in such situations alternative approaches can be taken<sup>11</sup>. In the case of wildlife, for example, there are existing targets and regulations for the conservation of certain species and habitats in EU and national level designations. The same is true for landscape and heritage features in national parks and Areas of Outstanding Natural Beauty (AONBs). A simple approach to incorporating impacts which cannot be valued robustly is to ensure that proposed investments do not have effects which run counter to those existing targets and regulations, and that instead they secure them or improve their status.

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example stated preference studies are open to critique when applied to goods which survey respondents do not adequately understand or where payment mechanisms are not clear.

<sup>9</sup> ORVal: <http://leep.exeter.ac.uk/orval/>

<sup>10</sup> Use value includes direct use, indirect use and option value. Non-use value comprises of bequest value, altruistic value and existence value. See: <https://www.gov.uk/government/publications/green-book-supplementary-guidance-environment>

<sup>11</sup> Bateman, I.J., Day, B.H., Agarwala, M., Bacon, P., Bad'ura, T., Binner, A., De-Gol, A.J., Ditchburn, B., Dugdale, S., Emmett, B., Ferrini, S., Fezzi, C., Harwood, A., Hillier, J., Hiscock, K., Hulme, M., Jackson, B., Lovett, A., Mackie, E., Matthews, R., Sen, A., Siriwardena, G., Smith, P., Snowdon, P., Sünnerberg, G., Vetter, S. and Vinjili, S. (2014) *Economic value of ecosystem services, Final Report to the UK National Ecosystem Assessment – Follow-On programme*, Defra, London (available at <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx> ).

(2) Determining actions to avoid (or compensate for) the deterioration of, or achieve target improvements in, natural capital

Here the decisions relate to management and maintenance activities for natural capital assets; for example, within the investment projects that might have been identified above in (1) as good prospects for investments.

A common driver for investments is to ensure that there is no deterioration of natural capital and examples of such objectives are reflected in certain current legislation<sup>12</sup>. Indeed in order to fulfil its stated objective for this “to be the first generation to leave the natural environment in a better state than that in which we found it<sup>13</sup>”, the Government will have to go beyond the avoidance of deterioration and deliver overall enhancements of natural capital. The use of valuation in this context is to compare the consequences of alternative ways of delivering those objectives.

One approach to decision making in such situations is to identify the minimum cost route to delivering the desired objective. This ‘cost effectiveness’ approach is not necessarily a trivial undertaking as all reasonable options need to be considered in terms of both their direct costs and the indirect ‘opportunity costs’ of foregone activities. A preferable approach is to supplement cost information with assessments of the benefits provided by alternative ways of allocating available resources to deliver the natural capital target. By considering benefits as well as costs across a range of options it is likely that decision makers can identify superior alternatives for investing the limited resources available.

In assessing investment options the decision maker not only needs to consider the flow of benefits and costs, but also the effects upon the stock of natural capital which determines and sustains the flows into the future. In the NCC ‘How To Do It Workbook’ we suggest that a general rule should be that decisions should *improve the stock of natural capital*. Although this rule sounds straightforward, in reality the inevitable trade-offs which arise whenever changes are made to the environment makes this a challenging undertaking. Win-win outcomes are rare and so valuations can help assess trade-offs in common units.

An issue arises if allowing degradation of a natural capital asset could generate more benefits<sup>14</sup> than maintaining the asset. For example, a loss of natural capital in one area could lead to a more than offsetting gain in natural capital elsewhere. While such an approach raises issues about local versus national losses and gains (and associated institutional issues)<sup>15</sup>, full or net gain

<sup>12</sup> An example of which might be the [Water Framework Directive](#).

<sup>13</sup> H.M. Government (2011) *The Natural Choice: Securing the value of nature* (Natural Environment White Paper), CM 8082, The Stationery Office, London. See: <https://www.gov.uk/government/publications/the-natural-choice-securing-the-value-of-nature>

<sup>14</sup> Benefits generated should be sufficient enough to more than fully compensate for the degradation.

<sup>15</sup> Local Planning Authorities (LPAs) are now required to assure no net loss and, where possible, net-gain of biodiversity during development (DCLG (2012) National Planning Policy Framework. See:

compensation has now been trialled in various countries<sup>16</sup> and has been advanced as a potential route for financing and delivering natural capital enhancements in the UK<sup>17,18</sup>. Key aspects of this special case are:

- a) There must be a net gain in natural capital to sanction such compensation;
- b) While short term payments (e.g. from developers to ecological experts) might help ensure faster, higher quality compensation, within a reasonably short timeframe any degradation must be compensated with restored natural capital rather than money. In economic terms, compensation must be ‘real and actual’ rather than ‘monetary and hypothetical’;
- c) While arguably one could substitute between different forms of natural capital compensation, there would need to be a compelling case to permit such transfers. One possibility might be where losses of one form of relatively common natural capital is compensated by gains in another more at risk capital. However, this approach is fraught with risk and difficulties over agreeing priorities and the replaceability of certain kinds of natural assets;
- d) The distribution of loss and compensation should also be considered. Compensation could maximise the gain for the environment, or the benefit to society across the country, or could just compensate those people affected by the loss. All three rules could lead to different outcomes<sup>19</sup>.

### (3) Determining overall progress at the aggregate level on objectives to protect and improve the environment

Whilst approaches (1) and (2) are relevant to decision making at the project level where the focus is upon ensuring that investments deliver value for money, decision context (3) operates at a

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<https://www.gov.uk/government/publications/national-planning-policy-framework--2> ) Public authorities, as listed in Section 40 of the Natural Environment and Rural Communities (NERC) Act 2006, have a duty to conserve biodiversity, including restoring or enhancing species populations or habitats. We are grateful to Guy Duke of The Environment Bank Ltd. for advice regarding the issue of compensation.

<sup>16</sup> BenDor, T., Livengood, A., Lester, W., Davis, A. and Yonavjak, L. (2015). *Defining and evaluating the ecological restoration economy*. *Restoration Ecology* 23 (3), 209–219. <http://onlinelibrary.wiley.com/doi/10.1111/rec.12206/full>

<sup>17</sup> The Ecosystem Markets Task Force (EMTF) estimate this could deliver over £500m p.a. for the creation and restoration of nature. EMTF (2013) *Realising Nature’s Value: The Final Report of the Ecosystem Markets Task Force*. <https://www.gov.uk/government/publications/realising-natures-value-final-report-of-the-ecosystem-markets-task-force>

<sup>18</sup> Duke, G. and ten Kate, K. (2014). *Exploring lessons learned from biodiversity offsetting markets in other countries that could inform appraisal of options for delivering offsets in England*. *Final Report to Defra*. Forest Trends, Washington, D.C. [http://www.forest-trends.org/publication\\_details.php?publicationID=5159](http://www.forest-trends.org/publication_details.php?publicationID=5159)

<sup>19</sup> The NCC is carrying out initial research into the implications of these alternative strategies.



higher, typically aggregate, level. It can help inform the policy process about whether progress is being made over time and help identify broader priority and programme resourcing requirements.

This approach aids the monitoring of the overall state of natural capital within some defined domain (e.g. the entire country, the area defined by a pioneer project, the estate of a significant landowner) or programme (e.g. in order to monitor progress in the 25 YEP).

The state of natural capital over any time period is the product of complex natural processes – some occurring at a global scale (e.g. atmospheric gas concentrations) and others at local scales (e.g. flooding/pollinator availability) – as well as billions of decisions taken by different people every day.

A rigorous and reliable system that records changes in the state of natural capital over time is essential to determining whether high level objectives are being met (e.g. the Government's 25 YEP target to protect and improve the environment).

Accounting approaches can be particularly useful for such purposes. By assembling a register of different natural capital assets, recording changes in those so that a proper balance sheet can be produced, overall progress towards objectives can be measured, both in physical and potentially value terms.

The Office for National Statistics is working towards a set of national natural capital accounts, following emerging international standards, to do exactly this. The intention here is that, over time these accounts will reveal broad, national level trends in natural capital and how different aspects are faring, permitting comparisons with trends in human and produced capital.

Where net declines over time are recorded in the accounts at a national (or possibly subnational) level or for individual asset classes, this will signal the need for action. This in turn links back to approaches (1) and (2) which examine the best ways to deliver the necessary improvements flagged up by approach (3).

Where net gains are recorded over time, the accounts should pick this up, documenting the nature of the improvement and tensioning that against any losses. This information can again signal the opportunity for investment in particularly beneficial projects.

## Conclusion

Delivery of the Government's objective of being the 'first generation to leave the natural environment in a better state than that in which they found it' requires the careful application of valuation and accounting methods.

Natural capital physical<sup>20</sup> and value accounts are required, especially at a national level, for tracking overall progress and identifying broad priorities.

Economic valuations can provide crucial estimates of the net benefits of alternative investments, guiding decisions and spending.

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<sup>20</sup> Physical accounts are also required where specific natural assets have been identified for protection (for example threatened habitats and species).