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POLICY BRIEF

A PRICE TO ACCOUNT FOR BIODIVERSITY IN CENTRAL GOVERNMENT GUIDANCE ON PUBLIC SPENDING

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An accounting price for biodiversity: The central government guidance for the analysis of public investment has few values that cut across all departmental appraisals. The social discount rate, the Value of a Preventable Fatality (VPF), the value of time saved (VTS) and the price of carbon are the chief examples. The Dasgupta Review (Dasgupta, 2021) cemented the case for biodiversity to be mainstreamed in government policy and appraisal due to its essential contribution to well-being.

Authored by:

Ben Groom, E.J. Milner-Gulland, Ian Bateman
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University of Exeter Business School

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A price to account for biodiversity in central government guidance on public spending

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Monetary valuations of biodiversity are unreliable: While some benefits from biodiversity (wild living nature in all its variety: genes, individuals, populations, species, ecosystems and functions) can be accurately valued via surrogate market techniques (e.g. revealed preference benefit estimates for recreation, water quality, etc.), the use of surveys to estimate Willingness to Pay for biodiversity produces inconsistent and unreliable value estimates that vary according to the design of studies. A practical alternative, related to current approaches to incorporating greenhouse gases into decision making, is Target and Cost Analysis (TCA).

Target and Cost Analysis (TCA): The value of avoiding climate change is substantial but difficult to assess. However, the Climate Act (2008) legislated the net zero target for 2050 leading to a TCA approach being used to assess the costs of hitting that target. The accounting price for carbon emissions in central guidance is given by the Marginal Abatement Cost (MAC) of reaching this target: the cost of the last unit of carbon abatement that just meets the target in 2050.
The TCA for biodiversity takes the same approach. A target and date are set and the costs of attaining that target can be analysed. For example, the UK Government's 2023 Environment Improvement Plan has an apex goal of halting the decline in biodiversity. The marginal cost curve for reaching that target can be constructed, and the accounting price for biodiversity recovery would be the cost of the last unit of restoration action that just meets the target. This is the relevant accounting price because interventions that decrease or increase biodiversity make the target marginally more or less costly at the margin for society to achieve.

Estimation of the accounting price of biodiversity: In the UK meeting biodiversity targets will require land-use change and changes in agricultural inputs. Both the costs and biodiversity response to interventions vary significantly between locations due both to the biogeography and the feasible conservation options. Therefore, the cost effectiveness of biodiversity recovery needs to be calculated as the increase in biodiversity per pound spent undertaking different land use changes in different locations. An example is mapped in Fig. 1.

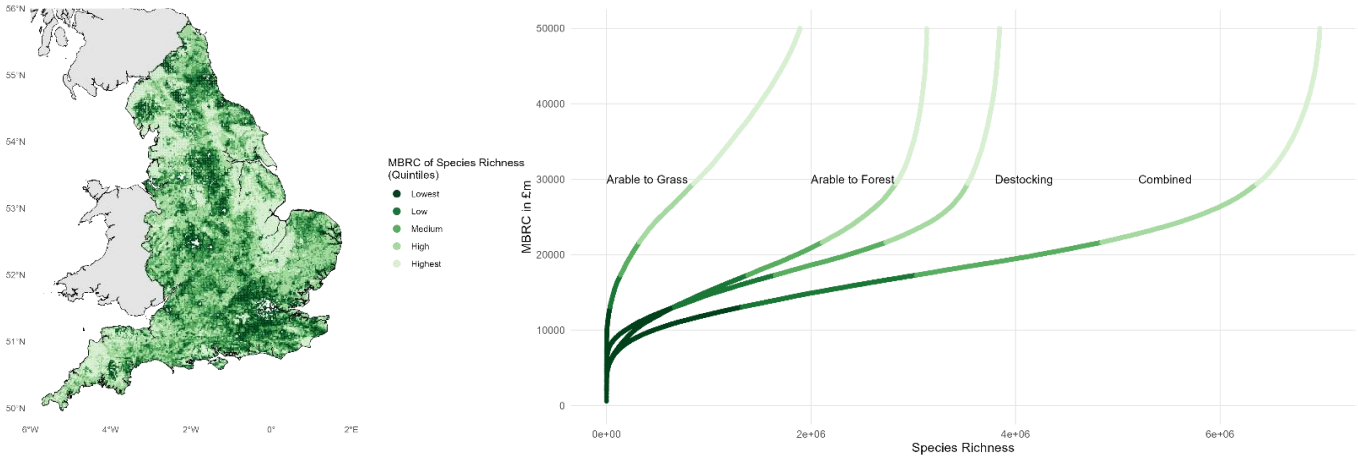

Fig. 1: An empirical Marginal Biodiversity Recovery Cost (MBRC) curve for three approaches ('technologies') to conservation, with an illustrative biodiversity target of increasing the average species richness of a location: Arable to grassland; arable to woodland; and destocking. The map in (a) illustrates spatial heterogeneity of minimum costs for all technologies and is colour-coded to the cost curves in (b). In (b), separate MBRCs for each technology illustrate the heterogeneity of marginal costs (measured as opportunity costs of land). The 'combined' example reflects all three technologies ordered in terms of the cost of a percentage change in average species richness across England measured at the 4km² scale. Costs and biodiversity response calculated using the land use models given by Day et al. (2024) and Binner et al. (2025).

Ranking all conservation options across locations, from the most cost-effective (i.e. largest biodiversity improvement per £) to the least, gives us the Marginal Biodiversity Recovery Cost (MBRC) curve for the specific biodiversity recovery target we are assessing against: the cost per unit of biodiversity improvement. This unit cost rises as we conserve more biodiversity because the most cost-effective places are used first. This is shown in Fig. 1b, which also shows that different approaches to conservation have different unit costs. Combining these approaches further improves cost-effectiveness as we undertake the best conservation approaches in the best locations. The combined MBRC curve shows the lowest possible cost for delivering any level of biodiversity; in the illustrated example the target T gives a biodiversity accounting price (BAP), which can be used in the HM Treasury Green Book or similar guidance.

Implementation: With a policy target set (Target T in a diagram such as Fig 1b), the Biodiversity Accounting Price, BAP, can be read from on the y-axis in Fig 1b. Biodiversity can enter into a CBA appraisal by first measuring the impact of an intervention (project, policy, regulation) on the biodiversity metric, in this example average species richness. Suppose this change in biodiversity is given by D. The entry into the CBA ledger would then be D*BAP, which would be a cost if $D < 0$ and a benefit if $D > 0$.

Metrics: The example given in Fig. 1b uses the widely used 'species richness' measure of biodiversity. However, there are many metrics for biodiversity, which relate to different biodiversity targets. Each will have different MBRC curves. Different metrics for biodiversity could be targeted

and used to construct an MBRC. Implementations of the TCA approach would need to be done at an appropriate spatial and institutional scale; whether for the UK, England, or more locally, depending on the target.

Summary: The TCA approach provides a straightforward way to ensure that biodiversity can be accounted for in central government guidance. Such guidance will help to *mainstream* biodiversity considerations into decision-making across all public sector institutions in a clear and operational way. A central accounting price for biodiversity can be obtained using an agreed target for biodiversity coupled with the appropriate metric(s), and information on the costs of conservation actions to meet that target. This then allows estimation of a combined MBRC curve.

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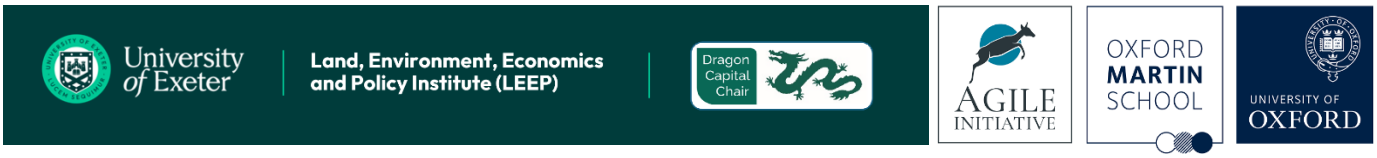

References

Binner, A.R., Addicott, E.T., Balmford, B., Day, B.H., Mancini, M.C., Williamson, D., & Bateman, I.J. (2025). *Using the natural capital framework to integrate biodiversity into sustainable, efficient and equitable environmental-economic decision-making*. PhilTransB: Biological Sciences, 380(1917), 20230215. https://doi.org/10.1098/rstb.2023.0215.

Dasgupta, P. (2021). The Economics of Biodiversity: The Dasgupta Review. HM Treasury.

Day, B., Mancini, M., Bateman, I. J., Binner, A., Cho, F., de Gol, A., ... & Smith, G. (2024). Natural capital approaches for the optimal design of policies for nature recovery. Philosophical Transactions of the Royal Society B, 379(1903), 20220327. https://royalsocietypublishing.org/doi/full/10.1098/rstb.2022.0327

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HM Treasury. (2022). "The Green Book: Central Government Guidance on Appraisal and Evaluation." London: HM Treasury.

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Economic Policy Decision Making for Biodiversity

Dragon Capital Chair
Xfi Building
University of Exeter Business School
Rennes Drive
Exeter
EX4 4PU

www.dragonchair.org.uk
b.d.groom@exeter.ac.uk

University of Exeter Business School

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