No consistent relationship found between habitat scores determined using the Biodiversity Metric and presence of species of conservation priority

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Summary

The extent to which the DEFRA Biodiversity Metric can be considered a genuine reflection of overall biodiversity is key to the success of Biodiversity Net Gain: a legal requirement for developers by late 2023.

We conducted a preliminary study to explore relationships between Metric scores and other biodiversity data, comparing Metric scores for 110 individual habitats with records of species of conservation concern. We found no consistent relationship between a habitat's distinctiveness or condition score, and the number of conservation priority species. We also demonstrated the value of consultancy site visits, as these data are additional to existing Records Centre data on protected species.

Our study highlights that further research is required to evaluate the relationship between Metric outcomes and wider biodiversity, ensuring that the Metric can be relied upon to deliver genuine BNG and that its general application will not have negative unintended consequences on species of conservation value.

Introduction

Reconciling ambitious national development objectives with efforts to reverse ecological declines presents a huge challenge. England now has world-leading ecological policy goals (including the goal of halting wildlife declines by 2030), whilst also seeking rapid expansion of the nation's infrastructure stocks. This includes a commitment to build 300,000 new homes per year by mid-decade, and >200 major infrastructure projects are in the pipeline (listed on the National Infrastructure Planning website as of 30/8/22). Addressing these potential contradictory ambitions should be a national policy priority (zu Ermgassen et al. 2022).

A key policy for integrating these objectives is the introduction of mandatory Biodiversity Net Gain (BNG) in late 2023. From then, all terrestrial developments requiring planning permission will have to demonstrate they will achieve a minimum 10% gain in "biodiversity units" relative to the baseline state, determined using the Biodiversity Metric (at time of writing version 3.1). This will also apply to Nationally Significant Infrastructure Developments from 2025.

The importance of the Biodiversity Metric

To calculate the type and level of enhancement needed to compensate for biodiversity losses, and achieve a 10% net gain, use of a consistent replicable method or metric is needed. Twelve years ago in *In Practice*, Treweek et al. (2010) proposed a method for measuring biodiversity losses and gains, in which the area, distinctiveness and condition of UK habitat types acted as a proxy for overall biodiversity. Iterative changes over the subsequent decade led by DEFRA and Natural England in coordination with professional ecologists, planning authorities, and consultancies, have led to today's Metric.

The importance of the Metric to the outcomes of BNG cannot be overstated. Developing suitable metrics to support No Net Loss or Net Gain policies always presents challenges in terms of practicality of use versus ecological robustness, but it is important to establish the extent of potential error. In a review of the ecological outcomes of biodiversity compensation systems around the world, zu Ermgassen et al. (2019) identified that the specific choice of metric was one of the key determinants of whether these systems apparently succeeded or failed to deliver on their stated policy aim of no net loss of biodiversity. This is a finding that is replicated in detailed case studies testing the effect of using different metrics (e.g. Bull et al. 2014). In the first evaluation of the reported outcomes of BNG, zu Ermgassen et al. (2021) found that the developments in their sample reported achieving a 20% increase in biodiversity according to the Biodiversity Metric. However, this translated into a 34% loss of non-urban open greenspace, with the vast majority of compensatory biodiversity gains coming from grasslands and shrublands promised on-site and in the future. So, the sample achieved net gain according to the Metric, but resulted in a substantial loss in terms of non-urban habitat area. . It will only be possible to observe the detailed, real-world effects of development on biodiversity once developments are complete and habitat restoration/creation has been delivered: this could be many decades into the future. However, it is evident that if the metric used had been area of greenspace, the outcome would have been very different from that reported by the Biodiversity Metric, illustrating that choice of metric will have a profound effect on the overall ecological outcome.

To understand whether a metric is a good indicator of biodiversity outcomes, it needs to be compared against expected outcomes (Nicholson et al. 2012). One approach is to compare it to another indicator based on empirical datasets and see whether the two are congruent. It is essential to consider whether use of a habitat-proxy can be relied upon to deliver benefits for biodiversity in all its dimensions, or whether explicit consideration of other measures of biodiversity is needed, such as the status of species populations or implications for genetic diversity across taxa.

Purpose of our study

In this study we made a first attempt at exploring the relationship between the Metric and alternative measures of biodiversity, by comparing BNG scores for a sample of sites with records of species of conservation concern for these same sites. Two sources of biodiversity data were used; presence of species of conservation priority gathered from Biological Records Centres, and records of species of conservation priority identified by consultants conducting walkover surveys for ecological impact assessments and preliminary ecological appraisals. Therefore we have attempted to establish the extent to which the Metric scores can be expected to reflect implications for species of conservation concern identified from the two methods above. Our expectation was broadly that more species of conservation concern would be likely to be found in sites in better condition, and in more distinctive habitats.

We were also interested to see the extent to which species presence/absence based on consultant walk-overs was consistent with that based on data from Biological Records Centres. This casts light on the reliability of the two data sources for the potential incorporation of priority species into biodiversity assessments.

We used a database of BNG assessments assembled for a set of six early-adopter councils in zu Ermgassen et al. (2021). Using planning applications from five councils (Figure 1) , we obtained a sample of habitats (the individual habitat patches that came from the sample of developments included in our database) associated with Biodiversity Unit scores. The geographical spread of these habitats was limited, as four of the five councils used are within the South of England. Whilst an unavoidable limitation in using the early-adopter councils, future research may benefit from expanding the geographical scope once all councils in England are required to use the Metric. We restricted our analysis to habitats assessed using Metric 2.0, as most of the developments in the database were assessed prior to August 2021. The Metric has since been updated to version 3.1, although the core method the Metric used to estimate the biodiversity value of a site remains the same. Our results for Metric 2.0 may therefore be applicable to version 3.1, but the changes made in updating the Metric means caution should be used in applying these conclusions to Metric 3.1.

We restricted our analysis to the broad habitat types ‘cropland’, ‘grassland’ and ‘woodland’ as we had sufficient sample sizes for these broad habitat types to support valid statistical analysis. We consulted the ecological impact assessments associated with the paired BNG assessments to identify the exact habitat patch within each development to which each Metric score applied.

We created shapefiles of each habitat patch in GIS, which we submitted to the relevant regional Biological/Local Records Centres (Figure 1) to request their data on the species identified within the boundaries of each habitat patch. We cross-referenced these data with species records obtained by consultants during walkover surveys of each habitat patch (reported in the ecological impact assessment or related documentation). This generated a sample of 22 cropland patches, 26 woodland patches, and 62 grassland patches for which we had the Metric score, Biological Records Centre data and records of species found during walkover surveys.

Council	**Biological Records Centre**
South Oxfordshire District Council	Thames Valley Environmental Records Centre
West Oxfordshire District Council	Thames Valley Environmental Records Centre
Vale of White Horse District Council	Thames Valley Environmental Records Centre
Cornwall County Council	The Environmental Records Centre for Cornwall and the Isles of Scilly
Leeds City Council	West Yorkshire Ecological Service

To identify species of conservation concern, we cross-referenced the species list against the JNCC's list of UK conservation designations. Species listed under the UK Biodiversity Action Plan, EU Birds directive, Habitats and Species directive, IUCN Red List, NERC Act Priority species, UK Wildlife and Countryside Act or as a Bird of Conservation Concern were considered species of conservation concern in our analysis.

To analyse the relationship between the number of species of conservation concern present at the site and its distinctiveness and condition scores, we ran multiple regression models. We included other variables in the models which we expected to affect the relationship between these variables, in order to control for them. These were the area of the habitat patch (as larger areas would be expected to harbour more species) and the council from which the BNG assessment came (as a proxy for geographical differences).

Results

There was no significant relationship observed between the number of species of conservation concern within a patch and the overall biodiversity score for the patch, measured using Metric 2.0. (Figure 1) . Using generalised linear models, we found no significant relationship between the number of species of conservation concern within a patch and the Metric distinctiveness category of the patch (p=0.315), figure 2. We found a significant effect of Metric condition category (p= 0.026), however, not in the direction expected, with preliminary evidence for 'fairly poor' patches having the highest number of species of conservation concern (p= 0.101), figure 3. This is shown for the broad habitat types in figure 4.

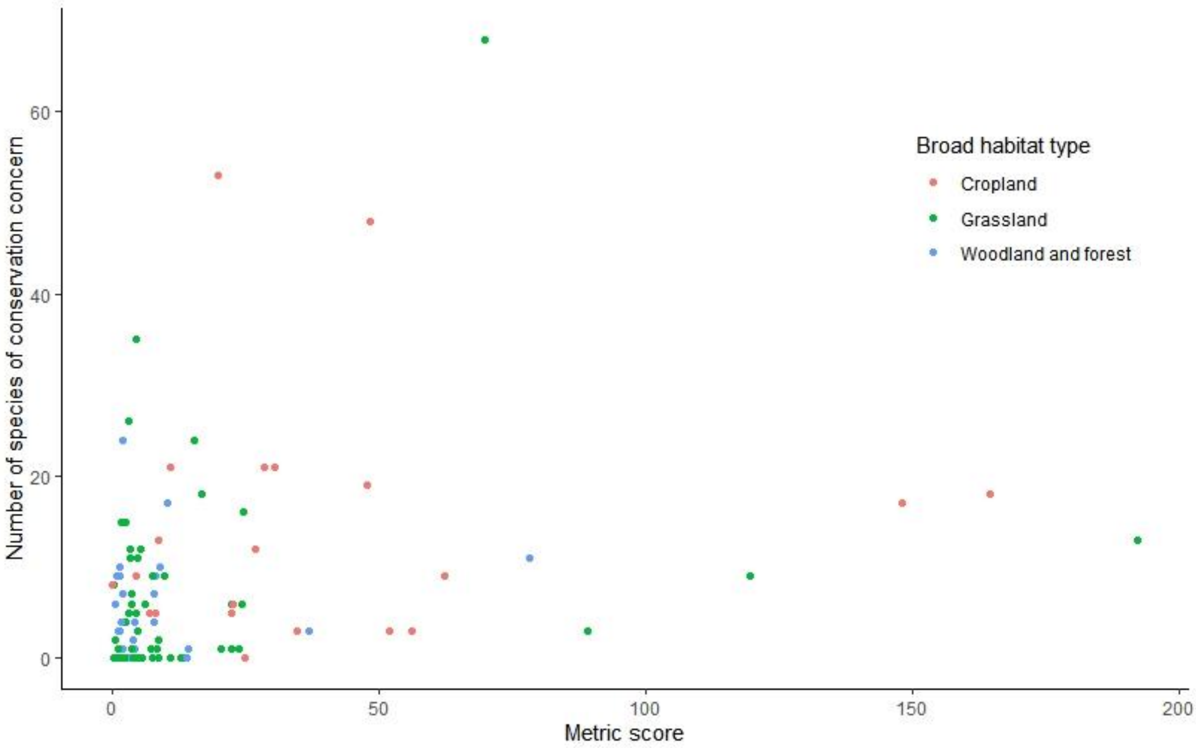

Figure 1 Number of species of conservation concern identified in each habitat, compared to the number of biodiversity units as measured by the Metric 2.0.

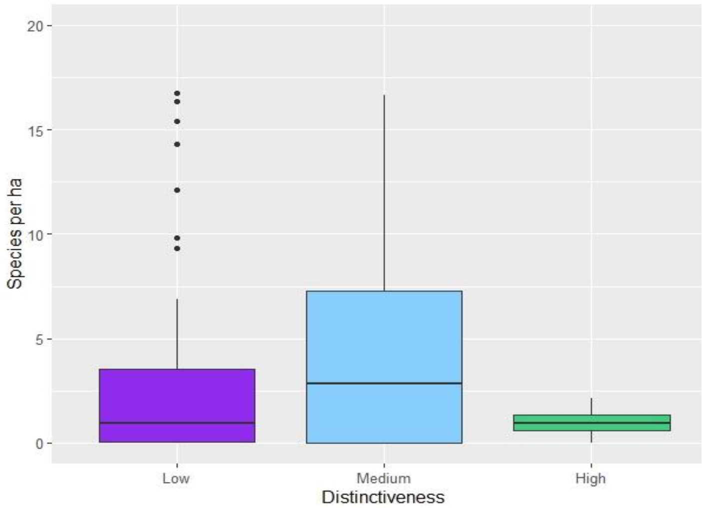

Figure 2 Comparing the median number of species per hectare between habitats of different distinctiveness levels, with extreme outliers removed.

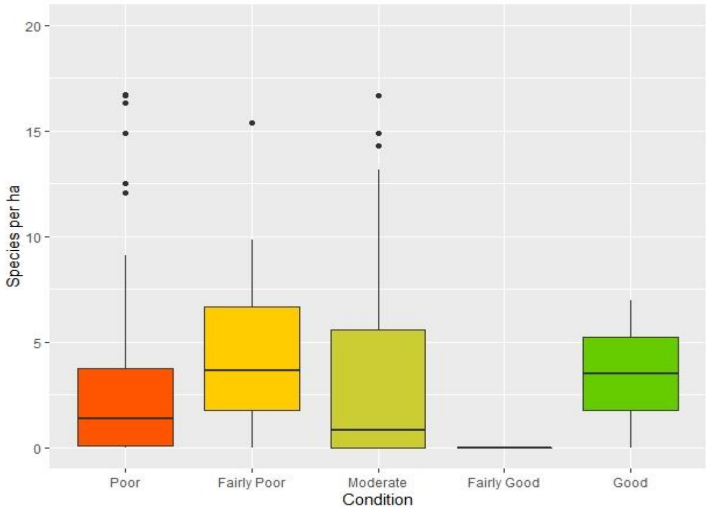

Figure 3 Comparing the median number of species per hectare between habitats of different condition levels, with extreme outliers removed.

Our work also demonstrated the value of site-based surveys to identify the presence of species of conservation concern. We found that it would be an insufficient strategy for developers to simply supplement their metric calculations with an estimate of species found in local record centre databases, rather than carrying out in-person visits to sites. Species surveys conducted by consultancies detected more protected species than were listed for the same site by the Records Centres in 61% of patches, equal numbers to Records Centres in 31% patches, with Records Centres capturing more species than consultancy reports in just 8% of patches (Figure 5). Over the whole dataset, consultancies found 581 protected species, and Records centres, 43. 31 species were recorded by Records Centres datasets which were not found by consultants.

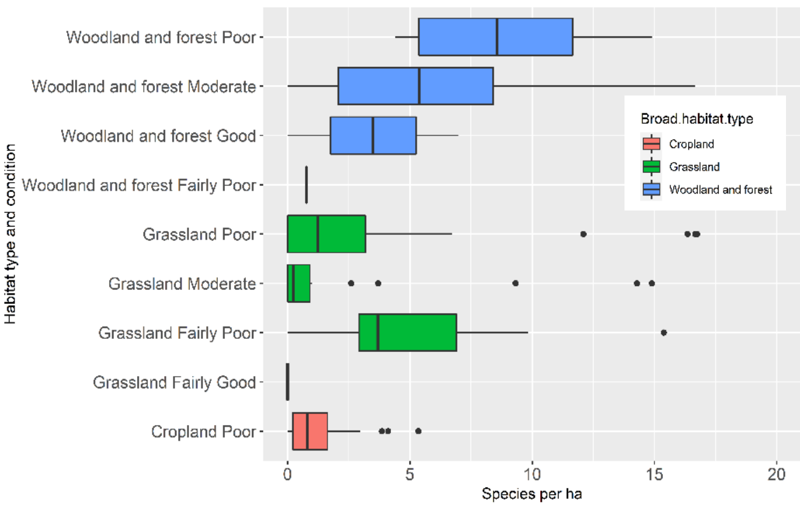

Figure 4 Comparing the median number of species per ha between cropland, grassland and woodland habitats in different condition levels, with extreme outliers removed.

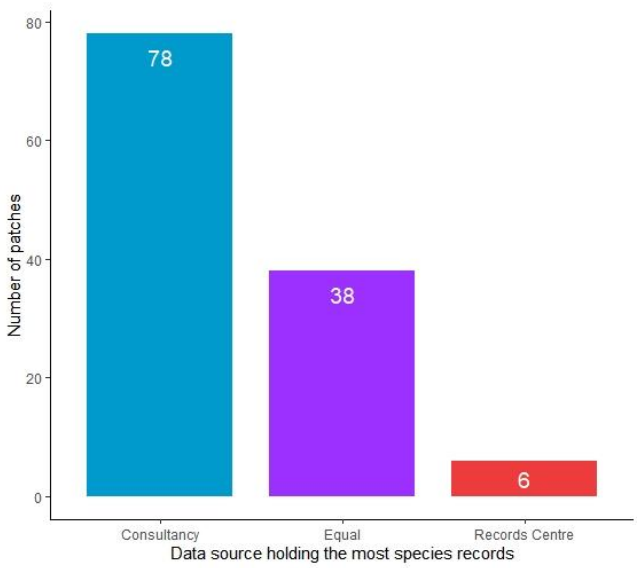

Figure 5 Number of habitat patches in which either consultancies or record centres detect more species.

Conclusions

Our study finds limited evidence that ecological quality of a site, as estimated using the Biodiversity Metric, is correlated with ecological quality as measured by the presence of species of conservation concern. An implicit assumption of BNG is that the Metric is a good proxy for real-world biodiversity, and therefore, that increases in the number of units delivered by the Biodiversity Metric will translate into real-world improvements in biodiversity (including populations of species of conservation concern). However, the lack of correlation between the Metric and our alternative measure of biodiversity, the richness of species of conservation concern, indicates that such real-world gains for priority species may not be guaranteed. Therefore, our preliminary study highlights the necessity of further work in order to understand the relationship between the Metric and alternative measures of biodiversity, to ensure habitat improvements measured by the Metric do have positive impacts on other aspects of biodiversity.

We recognise the preliminary nature of our study and acknowledge its limitations; many of the species captured in consultancy reports and Records Centres are highly mobile and seasonal, and so further work could look into associations between the Metric and different taxonomic groups to see if the Metric is a better proxy for some than for others. Additionally, our sample size was limited, especially for high distinctiveness habitats. We focus on comparing the Metric to the richness of species of conservation concern, a single proxy measure of biodiversity. Therefore, future work could investigate the relationship between the Metric and other measures of biodiversity, such as species diversity, overall species richness, or functional diversity. However, these preliminary results make the strong case that much more empirical work exploring the ecological robustness of the Metric is needed before we can be confident that achieving BNG's aim of a 10% uplift in biodiversity units (according to the Metric) will actually translate into real-world improvements in species presence and abundance. If this translation does not take place, then BNG as currently measured will not in itself be enough to achieve the government's overarching biodiversity target of halting wildlife declines by 2030. It could even be counterproductive, if habitats designated as poor condition/low distinctiveness are replaced by habitats designated as good condition/high distinctiveness but which harbour fewer species of conservation concern.

An additional implication of this study is that it provides yet more evidence that high-quality ecological expertise is needed in the ecological impact assessment process. Consultancies consistently identify additional species on sites compared to records held by Records centres. Record Centre data is primarily collected to provide a picture of species distributions and trends, however these data can also provide a useful baseline for consultants, to inform the nature of on-site surveys. As consultants consistently identify more species of conservation concern than were recorded in Records Centres, this reinforces the necessity of carrying out on-site surveys in addition to data searches, in accordance with best practice. Effort could therefore also be put into encouraging developers to contribute their consultants' records to BRCs, in order to improve coverage, or resources could be put into extending ecological assessments into areas with apparently lower quality habitats, so that their value is documented.

Whilst the Metric could play a role in increasing certainty about the level of ecological mitigation required by planning proponents and streamlining the planning process, this study provides further evidence that quality ecological assessment is required within the development process alongside Metric calculations. This is not just in order to ground-truth and verify the ecological feasibility of the information reported in BNG assessments, but also to identify and help mitigate threats to threatened species.

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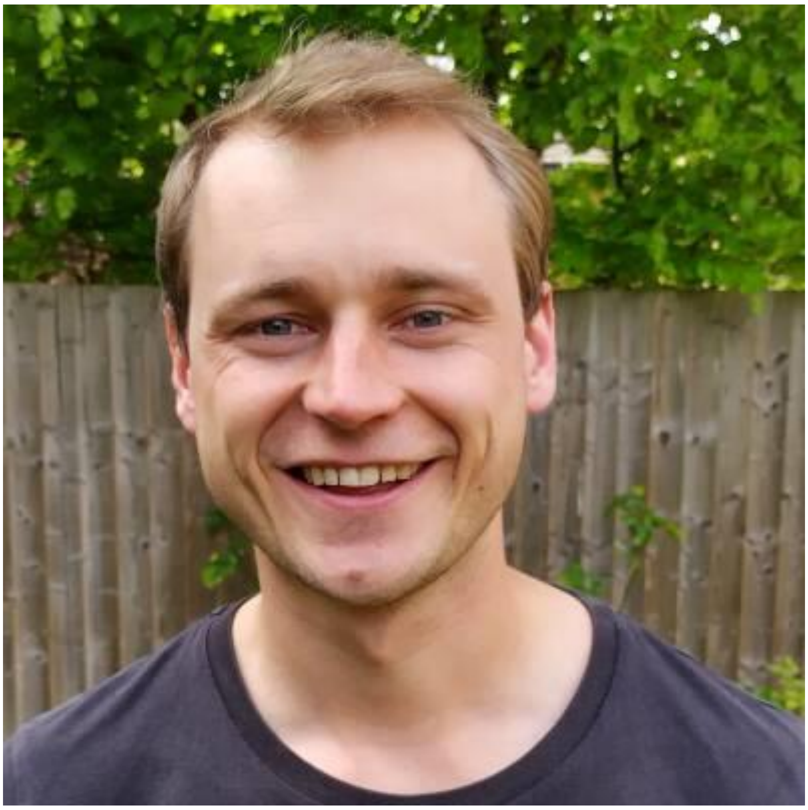
About the authors

Isobel Hawkins

Isobel is based at the University of Oxford, where she completed her MBiol Project on assessing how well DEFRA's Biodiversity Metric performs as a tool for enabling development to achieve Biodiversity Net Gain. This project compared the Metric to alternate measures of biodiversity. Isobel is currently working as a research assistant at the University of Oxford on the AGILE project "Operationalising Guidance for the Treasury Green Book" project, which supports HM Treasury's Biodiversity Working Group in updating guidance on accounting for and measuring biodiversity. She has previously worked for the Durrell Institute of Conservation and Ecology (DICE) at the University of Kent as a researcher, collecting and processing data on the implementation of Biodiversity Net Gain in early adopter councils.

Dr Sophus zu Ermgassen



Dr Sophus zu Ermgassen is an ecological economist working on topics broadly related to biodiversity finance, biodiversity compensation, and infrastructure sustainability. He is a Postdoctoral researcher at the University of Oxford, a member of Natural England's Biodiversity Metric expert advisory group, and a member of the UK Treasury's Biodiversity Economics Working Group. He is the co-host of the European Society for Ecological Economics podcast "Economics for Rebels", and in 2022 was named on the ENDS Report "Power List" of the 100 most influential environmental professionals in the UK.

Dr Jo Treweek

Dr Treweek has devoted her career to strengthening the ecological basis for planning and decision-making. Her book Ecological Impact Assessment (EcIA) was influential in the UK and internationally, making the case for ecological science to underpin environmental assessment practice. She has been actively involved in development of standards and guidance on EcIA, the mitigation hierarchy, ecosystem services assessments and use of biodiversity offsets in the UK and overseas. She is an author of the 'DEFRA' biodiversity metric being used to support the game-changing new Biodiversity Net Gain policy in the UK, and of the UK Habitat Classification which underpins it. She retains a keen interest in practical applications of ecological evidence to support robust approaches to development and meaningful integration of social and biodiversity considerations in planning and assessment.

Professor E.J. Milner-Gulland

E.J. Milner-Gulland is Tasso Leventis Professor of Biodiversity at the University of Oxford. Previously she was Professor of Conservation Science at Imperial College London, and she has also held lectureships in Resource Economics and Mathematical Ecology. Her PhD, at Imperial College London, was on the wildlife trade, with a focus on ivory, rhino horn and saiga antelopes. Her research group, the Interdisciplinary Centre for Conservation Science, undertakes a wide range of research, outreach and engagement projects, on five continents and in both marine and terrestrial settings. She has launched a number of initiatives which aim to change the real-world conversation around conservation, including the Conservation Hierarchy approach to meeting a global vision of restoring nature and the Conservation Optimism movement. She is the Chair of the UK Government's Darwin Expert Committee and a Trustee of WWF-UK. E.J. is passionate about the conservation ecology of the saiga antelope in Central Asia, and co-founded the Saiga Conservation Alliance in 2006.

Henry Grub

Henry Grub is a PhD student at Imperial College London undertaking research in environmental policy, with his PhD focusing on the control of bovine tuberculosis (bTB) disease in the UK. Henry is generally interested in how people interact with nature, what problems this can cause, and what solutions can be found. His previous work has looked at a range of different stakeholder engagement techniques to reconcile differing points of view when it comes to the use of nature and sustainable development. Henry was the lead researcher of OxPOCH – the Oxford Partnership for Operationalising the Conservation Hierarchy – a project aimed at testing the conservation hierarchy framework at the University of Oxford to increase the institution's sustainability. The main focuses of this project were on increasing the sustainability of the University's food consumption and ensuring that the university's infrastructure projects are managed in a 'biodiversity net gain' way, to mitigate against biodiversity loss.