NatureScot
Scotland's Nature Agency

**NatureScot**

**SCIENTIFIC ADVISORY COMMITTEE**

**DISCUSSION PAPER**

# BIODIVERSITY METRICS

## Purpose

1. The paper seeks the Committee’s advice on developing biodiversity metrics.

## Action

1. The Committee is asked to comment upon our proposed approach to biodiversity metrics, in particular:
   1. Are there shortfalls or gaps in the proposed approach?
   2. Are there alternative metrics that might be more useful in Scotland?
   3. Does the Committee support the use of a small number (up to five) of high-level metrics or can they suggest a single high-level metric that adequately represents biodiversity in Scotland?
   4. Is there capacity to form an SAC subgroup to advise on metrics, along the lines of that formed to guide Scotland’s reporting against the ‘Aichi targets’?

## Preparation

1. The paper was written by David O’Brien, Simon Brooks and Des Thompson. It is sponsored by Eileen Stuart.

## Background

1. The development of the [draft Scottish Biodiversity Strategy](https://www.gov.scot/publications/scottish-biodiversity-strategy-2045-tackling-nature-emergency-scotland/) (SBS) has taken place at a time of unprecedented public and governmental concern. It also coincides with a new iteration of the Convention on Biological Diversity (CBD) Global Biodiversity Framework and a proposed European Nature Restoration law. The SBS and Scotland’s nascent [Natural Environment Bill](https://www.gov.scot/publications/scottish-government-and-scottish-green-party-shared-policy-programme/pages/our-natural-environment/) both recognise the need for metrics to allow the tracking of progress and to help manage delivery. Rather than develop separate metrics for each, we propose to develop a common set of indicators and targets. Metrics of Scottish biodiversity, like the biodiversity itself should be considered in their international context. It is therefore advantageous to align ourselves with accepted global standards. This would give us multiple advantages:

* The targets, metrics and indicators will have been subject to high standards of scrutiny and peer review;
* The methods behind them will be transparent;
* Scotland will not have to bear the development costs of a full suite of indicators but will be able to influence globally as it has with genetic diversity and as we aspire to with connectivity; and
* We will be able to compare our performance with other nations, thereby allowing us to share what has worked and also to learn from others to improve continuously.

## Scotland-wide metrics

1. NatureScot publishes a number of metrics that reflect aspects of biodiversity across the country. These include the [Marine and Terrestrial Species Indicators](https://www.nature.scot/doc/official-statistics-marine-and-terrestrial-species-indicators-experimental-statistic), the [Natural Capital Asset Index](https://www.nature.scot/information-hub/official-statistics/natural-capital-asset-index#:~:text=The%20Natural%20Capital%20Asset%20Index%20(NCAI)%20is%20a%20composite%20index,was%20carried%20out%20in%202019).), and the [Proportion of Scotland's Protected Sites in favourable Condition](https://www.nature.scot/doc/proportion-scotlands-protected-sites-favourable-condition-2022) all of which are [National Performance Indicators](https://nationalperformance.gov.scot/measuring-progress/national-indicator-performance). We also publish indicators for [terrestrial breeding birds](https://www.nature.scot/doc/official-statistics-terrestrial-breeding-birds), [wintering waterbirds](https://www.nature.scot/doc/scotlands-indicators-wintering-waterbird-indicator), [seabirds](https://www.nature.scot/doc/scottish-biodiversity-indicator-numbers-and-breeding-success-seabirds-1986-2019), [butterflies](https://www.nature.scot/doc/scotlands-indicators-terrestrial-insect-abundance-butterflies), and [moths](https://www.nature.scot/doc/indicators-and-trends-moths-scotland). In addition, NatureScot produces [landscape indicators](https://www.nature.scot/doc/scotlands-indicators-landscape), comprising local landscape areas, urban greenspace, and vacant and derelict land.

## Local metric

1. NatureScot and partners including JHI, SEPA and Forest Research developed a suite of Ecosystem Health Indicators, which can be disaggregated to regional level (i.e. SEPA’s 10 river catchment-based regions). These include [habitat connectivity](https://www.environment.gov.scot/our-environment/state-of-the-environment/ecosystem-health-indicators/function-indicators/indicator-8-connectivity/), [soil sealing](https://www.environment.gov.scot/our-environment/state-of-the-environment/ecosystem-health-indicators/resilience-indicators/indicator-13-soil-sealing/), [bryophytes sensitive to nitrogen pollution](https://www.environment.gov.scot/our-environment/state-of-the-environment/ecosystem-health-indicators/resilience-indicators/indicator-14a-bryophyte-nitrogen/) and [bryophyte response to summer temperatures](https://www.environment.gov.scot/our-environment/state-of-the-environment/ecosystem-health-indicators/resilience-indicators/indicator-14b-bryophyte-summer-temperatures/).[[1]](#footnote-1) These four indicators will be updated this spring. Colleagues in the protected areas team are also developing Ecosystems Health Indicators suitable for use at site level.

## Other approaches

1. There is clear demand for metrics of biodiversity management as a public good and in the emerging natural capital market. These will sit alongside or be part of the carbon market, however, unlike the carbon market’s trading of a ton of carbon, what ‘unit’ of biodiversity might be traded (and how this is calculated) is intrinsically more difficult. Such metrics include measurements of actions and outcomes of offsetting, conservation planning or ecological research. These metrics have become an important concept in both research and policy but have been used inconsistently and in some cases inappropriately[[2]](#footnote-2). There are noticeable differences between the frequency of approaches used for each purpose: offsetting metrics tend to focus on habitats and area; conservation planning metrics including both of these along with species richness, distribution, landscape and connectivity, and ecological research on species abundance, species richness, habitats, diversity and landscape.[[3]](#footnote-3) It is worth noting the comparative narrowness in range of approaches in offsetting metrics relative to those with other purposes. Thus offsetting reporting may be failing to account for ecological processes, functions, resilience, with species factors being less commonly considered and genetic diversity ignored. However, new metrics are being developed and some natural capital tools take a wider ecosystem approach, including using a basket of individual metrics that can be adapted and selected to reflect the biome and use to which it is being applied.
2. Defra’s [biodiversity metric to calculate the biodiversity net gain of a project or development](https://www.gov.uk/guidance/biodiversity-metric-calculate-the-biodiversity-net-gain-of-a-project-or-development) is an example of a habitat-based approach to metrics. It focuses on habitat condition and distinctiveness, though an earlier version also included connectivity. It is thus relatively simple to use and has a transparent methodology, making it a practical tool. This relative simplicity is also a source of weakness[[4]](#footnote-4). It has been criticised for taking insufficient account of factors beyond habitat[[5]](#footnote-5), for being too subjective [[6]](#footnote-6) , for ignoring the value of transitional habitats (e.g. early succession scrub before maturing to mixed woodland)[[7]](#footnote-7) and for having no relationship with species of conservation concern[[8]](#footnote-8). Despite these issues, the Defra metric is being increasingly used in England and to some extent in Scotland. Other metrics are in development for example, at ETH Zurich and the [Wallacea Trust Biodiversity Credit](https://www.replanet.org.uk/what-are-biodiversity-credits/). These appear to have more comprehensive scope but will need to both gain ‘market share’ and demonstrate economic viability, as well as ecological validity.
3. SRUC are currently finalising a review for Scottish Government of approaches for establishing a Scottish biodiversity metric, and whether a single or common framework could be applied across a range of policy areas (including agricultural support, investment in natural capital, planning and development and biodiversity conservation and monitoring). The work has reviewed around 30 existing approaches to measuring biodiversity, for a range of purposes, and will include a detailed examination of the Defra metric in particular. The findings and recommendations will be presented at the end of March, and a potential next step for Scottish Government will be the development of a common approach.

## Challenges in selecting and developing suitable metrics

1. The Defra biodiversity metric highlights many of the potential issues with any metric. There is a fine balance between over simplification[[9]](#footnote-9) and over complexity: finding the sweet spot depends on a degree of subjectivity and on the planned use of the metric. There does not appear to be a single metric that combines all relevant factors. Metrics commonly ignore socially important species, red list status and genetic diversity. In some cases this may be the result of vague policy imperatives leading to vague targets and poorly defined metric. At a local level it will therefore be difficult if not impossible to test whether mitigation or intervention is effective. In turn leading to the continued use of ineffective actions without a sound evidence base.

## Proposed approach

1. Whilst we are not aware of any metrics that can fully capture the status of biodiversity, there are several suites of metrics that can be applied. Rather than develop new approaches, NatureScot are first looking at existing metrics and some in development, both within the UK and globally.
2. Given the congruence of Scotland’s, the EU’s and global ambitions, it would seem best that Scotland’s targets are aligned with both. The Biodiversity Team is therefore looking at both CBD and potential European indicators as we design our indicator suite. NatureScot took an active role in advising Scottish Government’s input to the UK’s negotiating position at COP15 of the CBD. Overall, the goals, targets and indicators agreed at COP15 align well with Scotland’s ambitions for biodiversity. NatureScot staff took an active role in the development of the indicators of genetic diversity[[10]](#footnote-10),[[11]](#footnote-11). The approach is described in detail in Annex 1.
3. The Natural Environment Bill is also highly likely to have statutory targets, either within the Bill itself or in secondary legislation. Scottish Government is working with NatureScot on the development of metrics for the Bill and aims for the targets to be:
   1. Specific
   2. Measurable
   3. Achievable
   4. Relevant
   5. Time-bound
   6. Efficient – using existing indicators, where these fulfil the requirements of the suite of targets, or develop a limited number of new indicators to fill any gaps
   7. Transparent and publicly available
4. The indicator suite will provides clarity on progress made toward overall strategic vison and outcomes outlined in SBS. It will likely include species abundance, occupancy (distribution), within species diversity and extinction risk, and habitat quality and extent. The suite will also show Scotland’s adherence to International obligations and maintain SGs commitment for broad alignment with, or exceedance of, EU environmental standards. It will align with existing Scottish Legislation and SG Policy. In particular it will reflect the strong interconnectedness of biodiversity and climate change.
5. NatureScot and SG have drafted high-level areas that indicators could cover and have also begun an analysis of candidate indicators from around the world, focussing on the CBD and proposed European Indicators. SG plan to hold a public consultation on the Natural Environment Bill indicators and targets in autumn 2023. The targets will be assessed using a matrix with transparent scoring of the various options. We propose that the selected indicators should be used as high-level indicators for both the SBS and the Natural Environment Bill.

## Next steps

1. The guidance of SAC is sought to assess:
   1. Are there shortfalls or gaps in the proposed approach? For example, are there other suites that might be more effective at identifying short- and medium-term change, and hence evaluate the effectiveness of interventions at a local or Scotland-wide level?
   2. Are SAC members aware of alternative metrics that might be more useful in Scotland? The CBD indicators are by definition suitable for any country, but it may be that Scotland would benefit from a more tailored approach.
   3. Does SAC support the use of a small number (3-5) of high-level metrics or can they suggest a single high-level metric that adequately represents biodiversity in Scotland? The idea of a single metric, akin to equivalent tonnes of CO2 for climate change is attractive. There have been attempts to produce a single indicator but these have either been complex ‘black box’ combined indicators or have attempted to use a single indicator and extrapolate it to cover other facets of biodiversity.
   4. Is there capacity to form an SAC subgroup to advise on metrics, along the lines of that formed to guide Scotland’s reporting against the ‘Aichi targets’?
2. The process of developing biodiversity metrics is one of continuous improvement, and we wish to continue to draw on the expertise of the SAC throughout.

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## Annex 1

## Developing targets for the Scottish Biodiversity Strategy

## Background

“Nature includes biodiversity, geodiversity and the natural elements of our landscapes and seascapes. It encompasses all the underpinning features and forces that have continued since the Earth was formed from summit to seabed including rocks, landforms, soils and processes like weather systems, Nature has shaped our history, culture and identity.”

Scottish Biodiversity Strategy

Short for biological diversity, Biodiversity is the diversity of life in all its forms - the diversity of species, of genetic variations within one species, and of ecosystems. Scotland has recognised that we are facing twin crises of biodiversity loss and climate change. Whilst the international community have accepted targets for climate change through the [Paris Agreement](https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement), there is currently no equivalent target for biodiversity. The Convention on Biological Diversity ([CBD](https://www.cbd.int/)) adopted 20 [targets](https://www.cbd.int/sp/targets/) at its meeting in Aichi prefecture, Japan in 2010 but none of these were met at a global level, with few countries hitting half or more. There was some criticism that these targets, whilst of laudable intent, were not well enough worded to prompt or measure real progress. CBD members have recognised that future targets should be specific, measurable, achievable, relevant and time-bound (SMART).

The Natural Environment Bill is a key part of Scotland’s response to the crises. At a national level, the Bill offers an opportunity to develop a world-class monitoring programme with clear, effective targets that meet the needs of stakeholders. Such targets will signal Scotland’s commitment to halting and then reversing the biodiversity crisis. This document has focussed on biodiversity targets, not wider targets such as those related to pollution or climate change.

## Biodiversity targets in their global context

The pressures and opportunities facing Scotland’s biodiversity are not unique: they are shared by other nations around the world. It would therefore be advantageous to align ourselves with the accepted global standards. This would give us multiple advantages:

• The targets, metrics and indicators will have been subject to high standards of scrutiny and peer review;

• The methods behind them will be transparent;

• Scotland will not have to bear the development costs of a full suite of indicators but will be able to influence the global development of targets and metrics as we have with [genetic diversity](https://www.nature.scot/doc/scotlands-biodiversity-progress-2020-aichi-targets-conserving-genetic-diversity-development-national) and as we aspire to with connectivity; and

• We will be able to compare our progress towards the targets with other nations, thereby allowing us to share what has worked and also to learn from others to improve continuously.

The Convention on Biological Diversity parties will be meeting in December 2022 in Montreal, Canada to agree targets from now to 2030. The CBD parties, and in particular the [High Ambition Coalition for Nature and People](https://www.hacfornatureandpeople.org/) (HACNP), have been keen to develop targets that are both challenging and ‘SMART’. NatureScot and Scottish Government have been key partners in the development of the UK’s negotiating position, a position that is well-aligned with the other HACNP members, including the [EU](https://environment.ec.europa.eu/news/biodiversity-european-business-and-nature-summit-push-global-deal-nature-cop15-2022-10-18_en). The CBD working groups have proposed 39 potential headline indicators and these were assessed by a [Workshop](https://www.cbd.int/doc/c/952a/6414/02f1d60f8957fbac5462f04d/id-om-2022-01-02-en.docx) in Bonn. The workshop members concluded that: 10 were broadly supported and met the criteria for headline indicators; 13 were supported but required further development to meet the criteria for headline indicators, in particular in relation to application at the national level; and 16 were identified as key gaps for which methods and data were not established. The UK, with the general support of other HACNP partners has proposed that the list be rationalised to 21 headline indicators. If Scottish Government decides to report on these indicators, it would seem logical for the Natural Environment Bill targets to be aligned with them.

## Targets within a European Union context

Within the EU, the [Nature Restoration Law](https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en#objectives) proposed in July 2022, will contain “ambitious and binding targets”. It also reiterates the EU’s commitment to the CBD. The [Proposal](https://environment.ec.europa.eu/publications/nature-restoration-law_en) contains detailed targets and definitions, although the implications for each member state are still to be negotiated. These targets cover habitats with existing legislative protection, pollinators, and focuses on forests, urban, agricultural and marine ecosystems, and river connectivity. It appears likely that the EU will provide both standardised methodologies and reporting templates, which could make processes simpler than otherwise would have been the case. Aligning with the Nature Restoration targets could also encourage greater collaboration between Scottish and other European researchers. It should be noted however, that some national governments (e.g. Sweden) within the EU have been hostile to the proposed Restoration Law and others have called for sections to be struck out or highly modified to protect industry (e.g. Ireland for peat, Netherlands for nitrate pollution and Finland for forestry). As such, any legislation is likely to differ markedly from the current proposal before it is passed.

## Targets within a UK context

The biodiversity commitments of the four nations relative to the EU were reviewed in a [report](https://ieep.eu/uploads/articles/attachments/e677ebea-9780-493b-9969-7c760218d490/Divergence%20Project%20report%20-%20comparison%20of%20biodiversity%20targets%20-%20Final.pdf?v=63832272668) by [IEEP](https://ieep.eu/). It suggests that whilst the UK government and the administrations of England and Northern Ireland have high aspirations, they have not committed to SMART targets, which will make it difficult to measure whether they are successful. The targets may also be unrepresentative, for example, England looks likely to use the Living Planet Index (LPI) as a headline indicator. The LPI is based on annual change in vertebrate abundance and is hence highly limited both taxonomically (no plants, no invertebrates) and functionally (e.g. no pollinators). Northern Ireland’s efforts to develop a set of targets has been hampered by the governmental hiatus there, and current proposed targets would be non-binding. The Welsh devolved administration has signalled its intention to set legally binding targets.

## Options

We have discounted the option of developing a suite of targets from scratch. Although such targets would have the advantage of being tailor-made for Scotland, this is the most costly option, and experience in other countries (e.g. Switzerland, Sweden) shows it to be a lengthy process. It would also risk us being out of alignment with our neighbours and potentially make international collaboration harder. However, while developing a full suite is not practical, there will be opportunities to develop individual indicators, as we have for genetic diversity, or to collaborate with other nations in the development of targets.

The UK is already developing a suite of metrics. These are well-suited to many aspects of Scotland’s biodiversity. However, as described above, there are some short-comings in the indicators and they have not been designed with statutory targets in mind. Furthermore, relative to the UK as a whole Scotland has disproportionate amounts of uplands, sea and islands, all of which face their own pressures. Habitat metrics would also have to modified as Scotland uses the European standard EUNIS habitat classification schemes whereas England and Wales use [UKHab](https://ukhab.org/). This modification is perfectly feasible but it would lead to a metric that could not be compared with either the rest of the UK or the rest of Europe.

Given the congruence of Scotland’s, the EU’s and CBD’s global ambitions, it would seem feasible that Scotland’s targets are aligned with both, notwithstanding the likely changes. It would also be logical for the targets to align with the Scottish Biodiversity Strategy.

The targets should be related to the most important pressures, threats and opportunities facing biodiversity. The [2019 IPBES Global Assessment](https://zenodo.org/record/6417333#.Y2Khq3bP02w) on Biodiversity and Ecosystem Services found five main direct drivers of biodiversity loss: changing use of sea and land, direct exploitation of organisms, climate change, pollution and invasive non-native species. The assessment also identified indirect drivers, in particular people’s disconnection with nature and the resulting lack of value placed on the importance of nature.

Whilst having a single simple overarching target is appealing, unlike climate change there is no single indicator that can come close to accurately or usefully tracking biodiversity. Furthermore, it is often useful to base targets on metrics that can be disaggregated to help focus actions at a species, habitat or local level. We therefore propose that we develop a small number of positively-framed targets that will garner support across society and be related to meaningful change. These targets should represent the three strands of biodiversity and the pressures upon them. A target that captures people’s essential relationship with nature and an economic target would complement the biodiversity targets. We are investigating the merits and resource implications metrics that could form the basis of such targets (table 1). This will allow us to hone our search to five targets or fewer (e.g. one from each category).

**Table 1**. Metrics upon which targets can be built. M or T in parenthesis represent metrics not currently available but that can developed without substantial cost. EUNRL is the proposed EU Nature Restoration Law.

| **Metric** | **Possible target** | **Source** | **Marine - M or Terrestrial - T** |
| --- | --- | --- | --- |
| **Ecosystems** |  |  |  |
| Extent of ecosystems by type | 5% increase in area of wetlands, forests, grasslands, river and lakes, heath & scrub by 2030, and connectivity increased by x by 2030 | CBD, EUNRL | M, T |
| [Red List of Ecosystems](https://iucnrle.org/) | Index stable by 2030, increasing by x from baseline thereafter | IUCN | M, T |
| Coverage of protected areas and OECMS, by effectiveness, KBAs & ecosystems | 30% of land and sea covered by protected areas and OECMS by 2030.  Effective management metric to be defined by CBD | CBD | M, T |
| [Biodiversity Intactness Index](https://www.nhm.ac.uk/our-science/data/biodiversity-indicators/biodiversity-intactness-index-data?future-scenario=ssp2_rcp4p5_message_globiom&georegion=001&min-year=1970&max-year=2050&georegion-compare=null&future-scenario-compare=null&show-uncertainty=true&min-biigraph-y-axis=0&max-biigraph-y-axis=100&min-factorgraph-y-axis=0&max-factorgraph-y-axis=100&underlying-factor=crp) | Index stable by 2030, increasing by x from baseline thereafter | NHM | T |
| [Habitat Connectivity Indicator](https://www.nature.scot/doc/naturescot-research-report-887-developing-habitat-connectivity-indicator-scotland) | Connectivity of the four key habitat types (woodland, wetland, heathland, grassland) has increased by x % by 2030. | NatureScot, (Defra have a similar metric) | T |
| River Connectivity Target | Identifying and removing barriers that prevent the connectivity of surface waters, so that at least X km of rivers are restored to a free-flowing state by 2030 | EUNRL (in development) | (T) |
| Marine Ecosystem Target | Restoring marine habitats such as seagrass beds or sediment bottoms that deliver significant benefits, including for climate change mitigation;, and  Restoring the habitats of iconic marine species such as dolphins and porpoises, sharks and seabirds. | EUNRL (in development) | (M) |
| Forest Ecosystem Target | Increasing trend for standing and lying deadwood;  Uneven aged forests;  Forest connectivity;  Abundance of common forest birds ;and  Stock of organic carbon | EUNRL (in development) | (T) |
| Agricultural Ecosystems Target | Increasing grassland butterflies;  Increasing farmland birds;  Stock of organic carbon in cropland mineral soil (tonnes of organic carbon/ha);  The share of agricultural land with high-diversity landscape features; and  Restoring drained peatlands under agricultural use. | EUNRL (in development) | (T) |
| Index of coastal eutrophication potential | Reduction in coastal eutrophication | CBD | M |
| Muirburn | Area of land subject to muirburn regimes | NatureScot | (T) |
| Invasive Alien Species (Invasive Non-Native Species) | Number of invasive alien species introduction events | CBD, OSPAR | M, (T) |
| **Species** |  |  |  |
| [Red List Index](https://www.iucnredlist.org/assessment/red-list-index) | Index stable by 2030, increasing by x from baseline thereafter | IUCN | M, T |
| [Living Planet Index](https://livingplanetindex.org/) | Index stable by 2030, increasing by x from baseline thereafter | WWF, ZSL | M, T |
| [Marine & Terrestrial Species Indicator](https://www.gov.scot/publications/development-combined-marine-terrestrial-biodiversity-indicator-scotland/) | Index stable by 2030, increasing by x from baseline thereafter | SG | M, T |
| [Species Extinction](https://www.science.org/doi/10.1126/science.aba6592) | No new species extinction in Scotland | Rounsevell *et al*. 2020 | M,T |
| Proportion of fish stocks within biologically sustainable levels | All fish stocks within biologically sustainable levels by 2030 and maintained thereafter | CBD | M |
| Pollinator Target | Reversing the decline of pollinator populations by 2030; and  Achieving an increasing trend for pollinator populations, with a methodology for regular monitoring of pollinators. | EUNRL (in development) | (T) |
| **Genetic** |  |  |  |
| [Scottish Genetic Diversity Scorecard](https://www.nature.scot/doc/scotlands-biodiversity-progress-2020-aichi-targets-aichi-target-13-genetic-diversity-maintained) | No loss of genetic diversity in monitored wild spp. by 2030 | SEFARI | (M), T |
| Effective population size, Ne | The proportion of populations within species with an effective population size > 500 | CBD | (M), (T) |
| **People** |  |  |  |
| Average share of the built-up area of cities that is green/blue space for public use for all | X% of built up area in cities is blue and green space accessible to all , with no city falling below y% by 2025 and increasing to Z% by 2030. | CBD target 12 and SDG 11.7.1 | T |
| Urban Ecosystems Target | No net loss of green urban space by 2030; and  Increase in the total area covered by green urban space by 2040 and 2050. | EUNRL (in development) | T |
| Urban blue and green space to be of high biodiversity value | 30% of urban green/blue space to have biodiversity as the primary land management purpose by 2030 | NatureScot | T |
| **Economic** |  |  |  |
| Ecological footprint | Reduce footprint by x % year on year | CBD | (M), T |
| Public and private expenditure | Increase public and private expenditure in line with GDP | CBD | (M), (T) |
| NCAI & Marine NCAI | Increase index relative to baseline by X% each year | NatureScot | (M), T |

1. Detailed methods in [Pakeman et al. 2019](https://www.sciencedirect.com/science/article/pii/S1470160X19303310) [↑](#footnote-ref-1)
2. Reviewed in [Marshall et al. 2020](https://www.sciencedirect.com/science/article/pii/S0006320719309620?casa_token=jGTQuhSG8P8AAAAA:yPbOpAC-s2hjRs5-fvK4kG7w77diUyyb_sTUe5A6Carosb3kHlW68qR6tWFTWObY0SuUz9Q9LD1e) [↑](#footnote-ref-2)
3. Ibid [↑](#footnote-ref-3)
4. [McVittie & Faccioli 2020](https://www.sciencedirect.com/science/article/pii/S2212041620300875?casa_token=zgKK7-vdu7EAAAAA:_5Sl4uNfCHMrlfQzyi6GCPEbRlTg9xkECEIMpwuPloCgdRAUKFmZMgUqSRInepiKJ5_S7u478hTi) [↑](#footnote-ref-4)
5. ibid [↑](#footnote-ref-5)
6. [zu Ermgassen et al. 2021](https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/conl.12820) [↑](#footnote-ref-6)
7. Glenister 2022 Does the Biodiversity Metric 3.1 discourage the creation of priority habitats. *In Practice* 118; 11-15. [↑](#footnote-ref-7)
8. [Hawkins et al. 2022](https://ora.ox.ac.uk/objects/uuid:d0f359e9-f9f5-4a61-ba1d-f6ba5a8943fb) [↑](#footnote-ref-8)
9. [Magurran 2021](https://www.sciencedirect.com/science/article/pii/S0960982221010393) [↑](#footnote-ref-9)
10. Detailed in <https://www.post-2020indicators.org/> [↑](#footnote-ref-10)
11. [O'Brien et al. 2022](https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.14225) [↑](#footnote-ref-11)