The Cambridge Biodiversity Metric

A method of quantifying biodiversity on the University of Cambridge estate

S U M M A R Y

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1   Introduction

1.1   The Cambridge Biodiversity Metric (CBM) is a modified version of Natural England's Biodiversity Metric 2.0 (NEBM) for use by the University of Cambridge in quantifying biodiversity changes on its estate, developed via consultation with the University's Ecological Advisory Panel and the Wildlife Trust for Bedfordshire, Cambridgeshire & Northamptonshire (WTBCN). Due to the timing of the University's Biodiversity Action Plan, the CBM is based on the Beta test version of the NEBM rather than the finalised version due for release in December 2020.

1.2   The CBM is a simplified proxy measure of biodiversity. It incorporates proxies of habitats' biodiversity value (where habitats are defined largely by their vascular plant composition and structure) as well as actual biodiversity value (e.g. species richness) of vascular plants. The CBM is designed such that it can be carried out by a competent botanist.

1.3   Compared to the NEBM, the CBM aims to be fairer to land managers wishing to enhance existing habitats without an onus to compensate losses elsewhere, whilst going beyond the NEBM in terms of ambition for improving habitat quality. (The NEBM will continue to be used by the University for offsetting purposes to comply with regulation, although the CBM can also be used for offsetting.) The CBM addresses and (it is hoped) improves on the following limitations of the NEBM:

- it is geared towards offsetting and less towards enhancing existing habitats in a non-compensatory manner;

- it is 'lenient' in many places, which limits how much biodiversity increase the University can demonstrate numerically. E.g. a hedgerow is classed as the maximum Condition tier 'Good' in the NEBM even if it fails two of the ten Condition criteria;

- it struggles to deal with relatively irreplaceable sites of LWS (or SSSI) standard;

- it does not deal with certain features of high value for biodiversity, such as veteran trees;

- it has a number of other ecological and technical flaws (some of these flaws may be corrected in the final version of the NEBM).

1.4   Although the CBM could potentially be adapted for other landowners to use, its primary purpose is to serve the University of Cambridge Biodiversity Action Plan on the University's estate.

1.5   For quick reference, the calculation of the CBM is as follows (the individual components are explained in detail below):

CBM = habitat size x (Distinctiveness + Standard) x Condition x Connectivity x Strategic Significance

2   Components of the CBM

2.1   The CBM follows the basic framework of the NEBM but is modified in a number of ways. See Appendix VII for information about Data Certainty and risk factors.

Distinctiveness

2.2   'Distinctiveness' is a measure of how 'significant' the habitat type is for biodiversity in a national context because of its rarity or other priority. Distinctiveness has the following tiers in the CBM:

Distinctiveness tier	Associated score
Very High	8
High	6
Medium	4
Low	2
Very Low	1
Negligible	0

2.3   The CBM's habitat categorisation largely follows the slightly modified UK Habitat Classification (UKHab) system (UK Habitat Classification Working Group 2018) used in the NEBM. Deviations from UKHab are described in detail in the CBM documentation, but surveyors are otherwise assumed to be able to identify UKHab habitats.

2.4   The CBM covers area-based habitats (e.g. grassland and woodland) and linear habitats (e.g. hedgerows, lines of trees and watercourses). A separate assessment has been designed for added point features (APFs) such as bird boxes, log piles and bug hotels, and these are not covered by the CBM. Species data other than vascular plants are also dealt with separately from the habitat component of the CBM (an exception being fish-stocking in standing waterbodies).

Standard

2.5   'Standard' adds detail (especially county-level distinctiveness) to the habitat's Distinctiveness. It is calculated for each broad habitat type using the Condition criteria in the survey sheets (see Appendix I).

2.6   Standard includes criteria which relate to plant species richness, detailed plant communities and abundance of notable features (e.g. veteran trees), borrowed largely from the Cambridgeshire and Peterborough CWS selection guidelines (CPCWSP 2014), hereby referred to as the 'CWS selection guidelines', and the Cambridge city CiWS selection guidelines (WTBCN & Cambridge City Council 2005), hereby referred to as the 'CiWS selection guidelines'.

2.7   CWSs are generally designated from higher biodiversity thresholds than CiWSs. Note that CiWSs are strictly speaking only within and immediately around Cambridge city, but they are nonetheless used in the CBM as a useful established benchmark for biodiversity value.

2.8   Similar approaches to the CBM elsewhere in the UK could make use of their local Wildlife Trust's LWS selection criteria. Scores from any Standard criteria met are added to the habitat's Distinctiveness score.

2.9   Standard has the following tiers:

Standard tier	Score per Standard criterion	Explanation
Above CWS	0.4	Some criteria are set at a higher Standard than even CWSs (e.g. for ditches).
CWS	0.3	Criteria correspond to CWS selection guidelines.
CiWS	0.2	Criteria correspond to CiWS selection guidelines.
Basic	0.1	Criteria include those shifted over from the NEBM Condition assessment.
Poor	Effectively 0	Habitat fails to meet any of the above criteria.

2.10 A habitat's Standard is important to know for the initial valuing of a habitat, and it may change (relatively slowly) over time as a result of changing habitat Condition, or change rapidly if plants are actively introduced to or removed from the habitat parcel. In some cases, Standard may be a relatively static property of the habitat (e.g. the species richness of trees and shrubs in a woodland).

2.11 It is possible that a habitat parcel will meet unrelated Standard criteria from two tiers simultaneously (e.g. some CWS criteria but also some unrelated CiWS criteria). Scores for these criteria are added together. Note that this *only* applies to unrelated criteria: in many cases, each tier has a criterion which 'updates' a related criterion in the tier below. E.g. in the line of trees Standard assessment, the Basic tier includes a criterion 'Groups of 2 or more veteran trees of native species and associated semi-natural habitat', whilst the CiWS tier includes a criterion 'Contains at least 1 veteran or mature pollard of native tree species.' In case, it would be unfair to add together the scores from both the Basic and CiWS tier; only the score from the CiWS tier (the highest tier) is counted.

2.12 If a habitat type has no Standard criteria above Poor that it needs to meet, it is automatically assigned a Standard score of 0.

2.13 The 'Above CWS' tier could include criteria corresponding to SSSI selection criteria where they are set at a higher threshold than CWSs (this is not always the case).

Condition

2.14 'Condition' is a measure of habitat quality that typically relates to how well the habitat is being managed and refers to structural features, such as percentage cover of undesirable species. It is calculated for each broad habitat type using the Condition criteria in the survey sheets (see Appendix I). Condition has the following tiers in the CBM:

Condition tier	Associated score
Good	3
Fairly Good	2.5
Moderate	2
Fairly Poor	1.5
Poor	1

Connectivity

2.15 Connectivity is based on a habitat parcel's nearness to similar habitats (i.e. of the same broad type, e.g. both habitats are types of hedgerow) or related habitats (not necessarily the same type, but complementary habitats that could form a 'dynamic complex', e.g. scrub and

grassland). Connectivity is not currently included in the CBM or the University's 2020 BAP targets (although the aim is to include a measure of Connectivity in future updates). This is because of limitations in the Connectivity calculation of the NEBM Beta version and the need to wait until December 2020, when the final NEBM is due to be published, to assess whether the updated Connectivity calculation is suitable for the University's purpose or whether an alternative Connectivity calculation needs to be designed specially for the CBM (see Appendix III).

Strategic Significance

2.16   Strategic Significance in the CBM depends on whether a habitat parcel falls within a strategic biodiversity area identified in local policy, and has the following tiers:

Strategic Significance tier	Associated score	Criteria
High	1.15	Within strategic biodiversity area formally identified in local policy.
Low	1	Outside any strategic biodiversity area formally identified in local policy.

2.17   In effect, Strategic Significance is akin to a landscape-scale Connectivity score. The only site on the University estate considered to fall within an area of strategic biodiversity significance as identified in local policy is Lord's Bridge, which is located at the edge of the West Cambridgeshire Hundreds Living Landscape.

3   Calculation of the CBM

3.1   The CBM for area-based habitats is calculated as follows:

Area in ha x (Distinctiveness + Standard) x Condition x Connectivity x Strategic Significance

3.2   The CBM for linear habitats is calculated as follows:

Length in km x (Distinctiveness + Standard) x Condition x Connectivity x Strategic Significance

3.3   As in the NEBM, the CBM outputs for area-based and linear habitats are not comparable.

3.4   Note that the CBM calculations in the University's 2020 BAP do not currently incorporate Connectivity.

4 Recommendations for CBM users

Recommendations for CBM surveys

4.1   CBM survey sheets are provided in the following section of this document ('Survey sheets for broad habitat types').

4.2   The CBM has a bespoke survey methodology, albeit similar to the NEBM's. Other survey methodologies (e.g. Phase 1 and the methodology used by the WTBCN to survey LWSs) omit much of the information required to fulfil the requirements of even the NEBM, especially for Condition. The CBM calculation could probably be carried out without too much trouble based on data from a standard NEBM survey, although this is not ideal and some components required by the CBM could be missed in a NEBM survey, decreasing Data Certainty.

4.3   The CBM works best with complete or near-complete vascular (especially angiosperm) plant species lists from each habitat parcel, as this is often required to calculate Standard. There may be circumstances where it is appropriate to complete a single species list for multiple parcels of the same habitat type where they form a single 'management unit' even though they would technically be mapped as separate polygons (e.g. two adjacent areas of chalk grassland split by a tarmac path); this would usually be applicable to parcels in close proximity, but some sensible judgement may be required.

4.4   Knowledge of a limited selection of National Vegetation Classification (NVC) communities is required for recording the Standard of certain habitats.

4.5   In addition, an abundance scale is important for some Standard criteria. DAFOR (see Appendix II) is suitable, although technically speaking it is only necessary to know if a plant species is frequent or above, or less than frequent.

4.6   The table below summarises what extra information or knowledge is required for each broad habitat type. Note that the survey for rivers and streams follows a fundamentally different structure to surveys for other habitat types; see the NEBM Technical Supplement (Crosher *et al.* 2019b) for more detail.

Broad habitat type	Plants to include in species list	Importance of species list	NVC required?	DAFOR required?
Hedgerow	Woody species only	Essential	No	No
Line of trees	Trees only	Essential	No	No
Woodland	All vascular plants	Essential	Yes	No
Wood-pasture/parkland	All vascular plants	Essential	Yes	Yes (for grassland component)

Orchard	All vascular plants	Essential	Yes	Yes (for grassland component)
Scrub	All vascular plants	Essential	Yes	Yes (for grassland component)
Grassland	All vascular plants	Essential	Yes	Yes
Cropland	Isolated trees only	Essential	No	No
Urban	All vascular plants	Desirable	No	No
Rock	All vascular plants	Desirable	No	No
Wetland	All vascular plants	Essential	Yes	No
Ditch	All vascular plants	Essential	No	No
Pond	All vascular plants	Essential	No	No
Lake	All vascular plants	Essential	No	No

Recommendations for habitat-mapping

4.7   Habitat information from the University's estate is stored in a 'Biodiversity Map' on ArcGIS Pro. It is hoped that access to this map will be provided for ecological consultants undertaking CBM surveys so that they can input their data directly into it. The Biodiversity Map can also be used to inform consultants which habitats are to be surveyed as distinct 'parcels' (i.e. potentially with their own separate vascular plant species list).

4.8   Habitats should ideally be mapped as the largest possible continuous extent of that habitat type. This makes mapping easier, discourages 'micromanagement' as there will be more complementarity of ecological attributes within larger habitats, and may reduce survey time required (e.g. because fewer separate plant species lists may be needed). There may be circumstances where it is appropriate to map multiple parcels of the same habitat type as a single multi-part feature even though they are separated, e.g. two adjacent areas of chalk grassland split by a tarmac path; this would usually be applicable to parcels in close proximity, but some sensible judgement may be required. If there is a sharp contrast in other habitat attributes within a single habitat type, e.g. Condition or Standard, then it may be appropriate to map separate parcels even if they are the same habitat type. The decision to 'split' or 'lump' habitats may also be determined by differences in management agreements, ownership, access, etc.

Recommendations for others interested in using the CBM on their land

4.9   The basic framework of the CBM would be applicable anywhere in the UK. However, other landowners should note the following:

- Many Standard criteria refer to county-level distinctiveness relevant specifically to Cambridgeshire. Nonetheless, some Standard criteria could be relevant across the UK, and users of the CBM outside of Cambridgeshire could design their own version of the metric incorporating Standard criteria from their LWS selection guidelines.

- The CBM survey sheets currently omit some of the habitat types in the NEBM because they are not relevant to Cambridgeshire; these omitted habitats may be relevant elsewhere in the UK.

- The NEBM is due to be updated following the recent consultation. The CBM was developed because a metric was needed before the NEBM consultation was completed, but other land managers may wish to wait until the final version of the NEBM has been published in December 2020, as this may satisfy their needs.

5   Abbreviations

BAP = Biodiversity Action Plan
CBM = Cambridge Biodiversity Metric
CiWS = City Wildlife Site
CWS = County Wildlife Site
NEBM = Natural England Biodiversity Metric 2.0 (Beta version)
LWS = Local Wildlife Site (includes both CWSs and CiWSs)
NVC = National Vegetation Classification
SSSI = Site of Special Scientific Interest
UKBAP = United Kingdom Biodiversity Action Plan
UKHab = UK Habitat Classification
WTBCN = Wildlife Trust for Bedfordshire, Cambridgeshire & Northamptonshire

6   References

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