APPENDIX

I. Form to identify priority ecosystem services in projects

Selection of priority ecosystem services

Project Name: Levern River Restorarion
Location: Barrhead- East Renfrewshire
Date: 13/07/2022

Ecosystem Services (ES)	Biodiversity Metric 3.1	NATURE	EBN	ES priorities for the project	Comments
Biodiversity	x	x		x	principle objective
Cultural & Health					
Mental health		x		x	significant health inequalities in project data zone
Physical Health		x		x	significant health inequalities in project data zone
Aesthetical Values		x	x	x	project site was derelict
Education & Knowledge		x	x	x	school involvement part of programme
Interaction with Nature		x	x	x	principle objective
Recreation		x	x	x	informal: walking, sitting, playing in river
Sense of Place		x	x	x	principle objective
Regulating & Supporting					
Air Quality		x	x		
Carbon Storage		x	x		
Cooling and Shading		x	x		
Erosion Protection		x	x		
Flood Regulation		x	x	x	project has positive impact
Water Quality Regulation		x	x	x	principle objective
Pest Control		x	x		
Pollination		x	x	x	pollinator habitat large part of landscaping
Noise reduction			x		
Provisioning					
Food & Fish-Commercial		x	x		
Food & Fish Community		x			
Water Availability		x	x		
Wood Production		x	x		
Abiotic Services					
Photovoltaic Carbon Impact		x			

The table helps to find the Priority ES of a project, but also includes the ES assessed by each tool. This will also help to select the most suitable tool to assess the project's targets.

II. Data sources for EBN

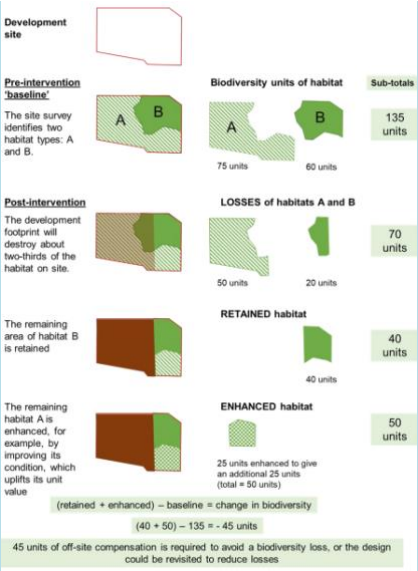
N	Data set	Entity	Data source for Scotland	Comments
1	Agricultural Land Class	Scotland's environment web map	https://map.environment.gov.scot/sewebmap/	
2	Surface water availability			
3	Ground water availability	Scotland's environment web map	https://map.environment.gov.scot/sewebmap/	Layer: groundwater classification
4	Natural Flood management priority	SEPA	https://map.sepa.org.uk/floodmaps/FloodRisk/PostCode https://map.sepa.org.uk/floodmap/map.htm	Post code Check: Potentially Vulnerable Areas
5	Woodland for flood risk			
6	WWNP target zone			Identify potential locations for Working with Natural Processes (WWNP).
7	Water quality: WFD status	SEPA	https://map.environment.gov.scot/sewebmap/	Layer: River classification
8	Water quality management area	SEPA	https://www.farmingandwaterscotland.org/funding-grants-and-resources/scotlands-water-scotlands-priority-catchments/	Priority catchments
9	Rainfall	Met Office	https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gfj1d6wgf	
10	Slope		https://en-gb.topographic-map.com/maps/0a/Dundee/	
11	Soil drainage		https://map.environment.gov.scot/Soil_maps/?layer=1	
12	Soil erodability			
13	Soil compaction		Requires Site survey	
14	Soil management		Local knowledge	
15	Peat quality		Site survey	
16	Soil depth disturbed			
17	Canopy cover		Aerial photo	
18	Tree size		Site Survey (non-expert)	
19	Ground cover		Site Survey (non-expert)	
20	Tall or tussocky grasses		Site Survey (non-expert)	
21	Shrub layer		Site Survey (non-expert)	
22	Flowers		Site Survey (expert)	
23	Invertebrate nest sites		Site Survey (non-expert)	
24	Resources for local species		Site Survey or local knowledge	
25	Position for water quality regulation		Site Survey or local knowledge, GIS, online map	
26	Position for erosion prevention		Site Survey or local knowledge, GIS, online map	
27	Air pollution barrier		Site Survey (non-expert)	
28	Shading ability		Site Survey (non-expert)	
29	Noise barrier		Site Survey (non-expert)	
30	Population density	National records of Scotland	https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/small-area-population-estimates-2011-data-zone-based/mid-2021	
31	Nature designation	NatureScot	https://map.environment.gov.scot/sewebmap/	Layer: local natural reserves, national nature reserves,
32	Ancient habitat	NatureScot	https://map.environment.gov.scot/sewebmap/	Layer: ancient woodland inventory scotland
33	Cultural or historic importance	NatureScot	https://map.environment.gov.scot/sewebmap/	Layer: LUS Cultural (historic environment, landscape)
34	Special recreation value	NatureScot	https://map.environment.gov.scot/sewebmap/	Layer: LUS Cultural (historic environment, landscape)
35	Public access		Site Survey (non-expert)	
36	Educational use		Local authority / Local knowledge	
37	Managed for nature		Local knowledge	
38	Local distinctiveness		Local knowledge and local authority	
39	Landscape diversity		Site plans	
40	Fish barriers		Site survey (non-expert)	
41	Water body naturalness		Site survey	

III. NC Tools additional information

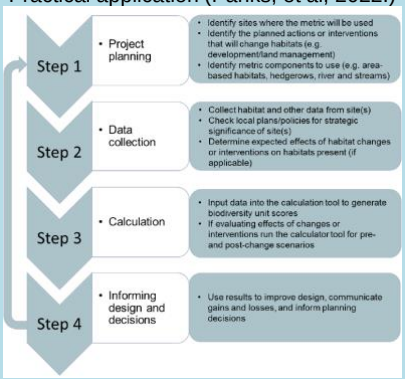
Biodiversity Metric 3.1

Tool's name	Biodiversity Metrics 3.1		
Developer	Natural England	Logo	No Logo
First version/ Latest Version	Biodiversity Metrics 3.1 (2022)	Physical Assessment	Yes
Free?	Yes	Monetary Assessment	No
Characteristics	• It is a habitat based approach which calculates how a development, or a change in land management, will variate the biodiversity value of a site. • It demonstrates biodiversity net gains or losses in a consistent way • It measures and accounts for direct impacts on biodiversity • The tools does not present indirect impacts, but the user is encourage to acknowledge them in as a parallel step. • It allows including on-site and off-site intervention • It considers the proximity of an off-site intervention to the site of the losses. • Calculates the values as 'biodiversity units', which are obtained using the size of the habitat, its quality and location. • It incorporates separate calculations for linear habitats (e.g. hedgerows, lines of trees, rivers and streams and urban trees.) • It accounts for some of the risks associated to the creation of new habitat or existing habitat is enhanced. • The change in biodiversity is obtained by subtracting post-intervention and pre-intervention biodiversity units • The quality and reliability of outputs will depend on the quality of the inputs. • It has been designed for application to UK terrestrial and intertidal habitats • The model apply the "mitigation hierarchy", which means retaining habitats in situ and avoiding or minimising habitat damage so far as possible, before looking to enhance or recreate habitats. • "Small Sites Metric": is a simplified version for small residential developments (less than 0.5 ha), it is still in a beta version.		
Data	• Habitat types • Area/length of habitats • Habitat condition • Strategic significance of each habitat • Area to be retained/enhanced • Whether bespoke compensation has been agreed (when applicable) • Timing of habitat creation (i.e. in advance of habitat loss or delayed)		
Outputs	• Biodiversity units on-site and offsite baseline and post intervention, and net% change • Detailed results of habitat group/hedgerows/Rivers • Trading summary according to distinctiveness.		
Habitat Classification	• Biodiversity metric 3.1 uses a combination of these: UKHab for the majority of area habitats, EUNIS for intertidal habitats and WFD lakes typologies for lakes.		
Useful links	Biodiversity Metric 3.1 Website / The Small Sites Metric Website		

Figures



Practical application (Panks, et al, 2022.)



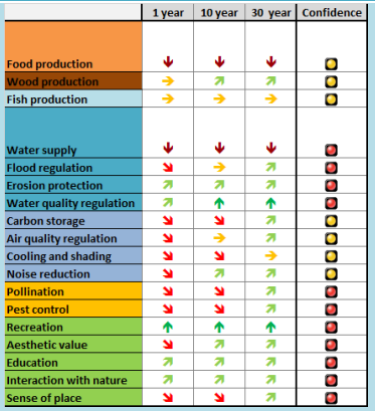
The 4 key steps to using biodiversity 3.1 (Panks, et al, 2022.)

Environmental Benefits from Nature

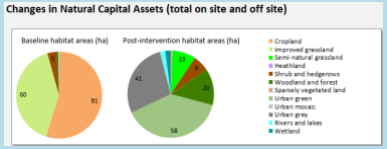
Tool's name	Environmental benefits from Nature (EBN)			Figures
Developer	Natural England and University of Oxford in partnership with Defra, the Forestry Commission and the Environment Agency	Logo	No logo	
Latest Version – Year	EBN Tool Beta V1.0 (2021)	Physical Assessment	Yes	
Free?	Yes	Monetary Assessment	No	
Characteristics	• Works with Microsoft Excel • Previously called Eco-metric • Voluntary decision-support tool, developed to support Government's commitment to expand net gain approaches • Is designed to be used in conjunction with Biodiversity Metric 3.0. While the latter demonstrates biodiversity net gain, EBN identifies opportunities to enhance ecosystem service provision and to avoid or minimise negative impacts. • Is based on scores (on a scale of 0-10) for the ability of different types of land cover to deliver 18 ecosystem services • The scores are obtained by applying multipliers based on 40 indicators (Basic, Standard and Advanced) of habitat condition and spatial location, and then multiplied by the area of habitats and values that reflect delivery risk and the time taken for new habitats to reach their target condition. • Calculations are made to compare the baseline with up to 3 post-development scenarios. • Stakeholders should decide in parallel the ecosystem services priorities in the project. • It is not designed to capture subtle changes in projects. • For calculations, sealed surfaces (e.g. roads and buildings) can always be aggregated because they have a score of zero. • Simplification of results, e.g. initial carbon losses due to soil disturbance are not included when calculating changes over time			

Data	• Biodiversity Metric 3 assessment
	• Baseline type and areas of habitats or length and width for linear habitats (On-site and off-site relevant to the project)
	• Type of change in the intervention (Create, enhance, retain)
	• For housing development, it is possible to do a fast comparison with a "typical suburban mosaic".
	• Target conditions that will be achieved after 30 years, except for trees ("saplings").
	• Check Data Catalogue for data sources
	• Process differs in small and large areas, especially in the habitat section
	  • For small and simple developments, enter a separate row for every parcel of habitat.
	  • For large and complex developments with multiple parcels, group parcels with similar characteristics (habitat parcels, conditions, and spatial indicators) and enter each group on a single row.
	  • For all but the smallest projects, use of a Geographic Information System (GIS)			

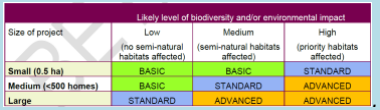
Outputs	• Results are presented in arrows indicating the direction and magnitude of change in the total score for ALL ecosystem services at three points in time (1, 10 and 30 years after the project). • Pie charts show the natural capital asset extent (i.e. the habitat areas, for the baseline and post-development.) • Charts to interpret ES scores in terms of habitats. • Biodiversity net gain check • Allow reviewing the whole site or just the habitats that present changes.			
Habitat Classification	Phase 1, UKHab, Biodiversity Metric habitats			
Useful links	Download tool / User guide / Data checklist / Website			



Results by Ecosystem service (Smith A. et al, 2021)



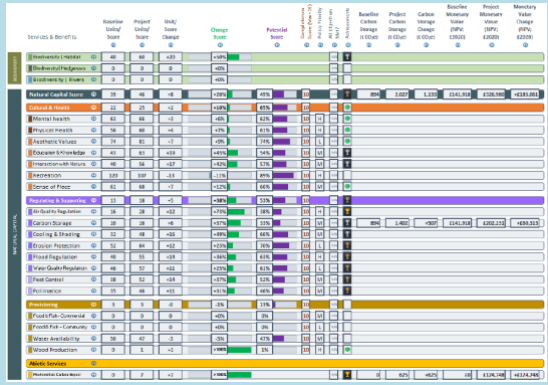
Results of Changes in NC assets (Smith A.C. et al, 2021)

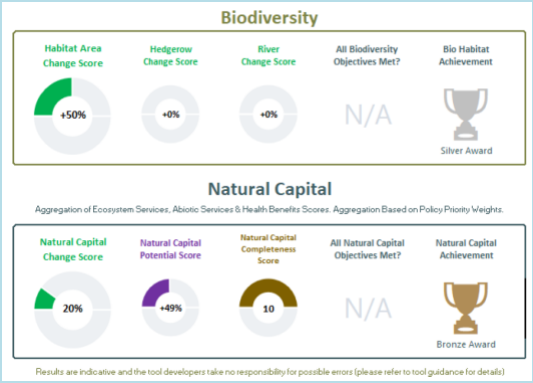


Relationship between project area and level of assessment (Smith A. et al, 2021)

Figure 1: Shows results by ecosystem service after 5, 10 and 30 years respectively, including an indication of the confidence in these results.

NATURE 1.1

Tool's name	NATURE			Figures
Developer	WSP and the Ecosystems Knowledge Network (EKN), in collaboration with Northumbria University	Logo	NATURE TOOL	 *Summary results table (Hölzinger, O. et al, 2022)*
Latest Version – Year	NATURE Tool UK v1.1 BETA (2022)	Physical Assessment	Yes	
Free?	Yes	Monetary Assessment	Yes (Carbon Storage and Photovoltaic carbon impact)	

Characteristics	• Works with Microsoft Excel
	• Assess the impact of land-use and management changes on natural capital performance
	• applicable across the UK and designed for the application by non-specialists without requiring excessive data or time
	• Allows assessing up to 17 ecosystem services plus physical and mental health benefits
	• Biodiversity assessment is optional, and is based on Biodiversity Metric 3.0
	• Allows the selection of objectives that should be reached with natural capital.
	• It has three assessment pillars: asset, service flow and benefits
	• The tool calculates natural capital performance and impact using six key indicators:
	  ◦ Change Score – how will a project impact on the natural capital performance in relation to the baseline (pre-development)?
	  ◦ Potential Score – to what extent has the maximum site potential for natural capital been achieved?
	  ◦ Completeness Score – how complete is the assessment? This is defined as a measure of how detailed the entered habitat categories are and to what extent optional indicators were used.
	  ◦ Policy Priority – the policy priority (high, medium and low) based on national policy or as defined by the objective setter. The policy priorities determine how ecosystem services and benefits are weighted when aggregated to an overall people (project) score.
	  ◦ All Objectives Met? – will the project achieve the natural capital objectives as defined by the objective setter (see below)? Objectives can be defined for the Change Score, Potential Score and Completeness Score.
	• Achievements – does the project achieve Net Gain (NG) and/or even a bronze, silver or gold' excellence standard'? This helps you to highlight and communicate really positive natural capital impact.
				 *Headline Results Example (Hölzinger, O. et al, 2022)*

Data	• A site boundary • Baseline habitat areas (based on an amended JNCC Phase 1 Habitat Classification Framework) • Post-development habitat areas • The level of accessibility of greenspaces for the baseline and post-development			
Outputs	• The Results are summarised in two headline indicators, biodiversity and people. • Summary results table present scores, Change score (%), potential scores, achivements (gold, silver, bronze), T Co2e for carbon storage and monetary value for carbon storage and Photovoltaic carbon impact (£).			
Habitat Classification	Joint Nature Conservation Committee (JNCC) Phase 1 habitat classification, but adapted to the programme (See user guide)			
Useful links	Download tool / Introduction, User guide and Methods / Data checklist / Website			

IV. ES definition and Multipliers in EBN and NATURE

	EBN	NATURE
Biodiversity (Definition)	Biodiversity is the term used to describe the variety of life on earth. It includes everything that is alive on our planet. Habitats are the places in which species live. Species and their habitats form ecosystems, which provide important services to people (Definition extracted from Biodiversity Metric)	Biodiversity is the term used to describe the variety of life on earth. It includes everything that is alive on our planet. Biodiversity | Habitat refers to biodiversity value and impact for habitats that are typically mapped as areas (as opposed to linear features such as hedgerows and rivers which are assessed separately).
Biodiversity (method/ multipliers)	The EBN tool is designed to be used in conjunction with the Biodiversity Metric. Gains in biodiversity are expected to act as the primary driver. Other benefits, identified through EBN tool, are intended to add to, rather than compete with, BNG considerations to offer benefits for both people and nature. The core principle of the approach is that development should achieve biodiversity net gain. Once this has been demonstrated using an approved Biodiversity Metric, such as Biodiversity Metric 3.0, the EBN tool can be used to help explore opportunities to deliver wider natural capital benefits and minimise any negative impacts.	Biodiversity Units are not directly calculated within the NATURE Tool but rather imported from the Defra Biodiversity Metric so that biodiversity and natural capital results can be presented alongside each other. The Change Score, Objectives Met? and Achievements are calculated within the NATURE Tool based on Biodiversity Units calculated within the Biodiversity Metric. Within the Biodiversity Metric 3.1, Biodiversity Units are calculated based on the habitat distinctiveness score which indicate the importance of habitats for biodiversity. This is effectively the habitat base score. • Condition: Biodiversity Units are higher when a habitat is in good ecological condition. • Strategic significance: Biodiversity Units are higher when a habitat forms part of a network that has been identified as significant for nature. • Delivery risk: For created habitats, there is a reduction in Biodiversity Units based on the likelihood of habitat creation to fail which depends on the type of habitat. • Time to target condition: For created habitats, there is a reduction in Biodiversity Units based how long the habitat needs until it reaches target condition. Please note that the Biodiversity Metric is purely habitat-based and does not directly consider the presence/record of species.
Mental health (Definition)		The Mental Health score is an indicative aggregated indicator. It effective aggregates ecosystem services scores based on their indicative contribution to Mental Health. This only indicates the contribution by natural capital and not any other engineered assets such as the presence of a hospital.
Mental health (method/ multipliers)		The Mental Health score is effectively based on a Multi Criteria Decision Analysis (MCDA). A percentage-contribution to Mental Health is allocated to each ecosystem service which adds up to 100% (the Mental Health score): • Aesthetic value • Education & knowledge • Interaction with nature • Recreation • Sense of place The percentage allocation is based on a literature review exploring the links between ecosystem services and Mental Health. To avoid double-counting when aggregating (the already aggregated) Mental Health score to for example the Natural Capital Score, the percentage allocation is deducted from the ecosystem services again when aggregated to the Natural Capital Score. Please refer to the Detailed Results sheet for a full calculation.
Physical health (Definition)		The Physical Health score is an indicative aggregated indicator. It effective aggregates ecosystem services scores based on their indicative contribution to Physical Health. This only indicates the contribution by natural capital and not any other engineered assets such as the presence of a hospital.
Physical health (method/ multipliers)		The Physical Health score is effectively based on a Multi Criteria Decision Analysis (MCDA). A percentage-contribution to Physical Health is allocated to each ecosystem service which adds up to 100% (the Mental Health score). • Aesthetic value • Interaction with nature

		• Recreation • Air quality regulation • Cooling and shading • Flood regulation • Pollination • Food & Fish-Community The percentage allocation is based on a literature review exploring the links between ecosystem services and Physical Health. To avoid double-counting when aggregating (the already aggregated) Physical Health score to for example the Natural Capital Score, the percentage allocation is deducted from the ecosystem services again when aggregated to the Natural Capital Score. Please refer to the Detailed Results sheet for a full calculation.
Aesthetic values (Definition)	Provision of attractive views, beautiful surroundings, and pleasing, calming, or inspiring sights, sounds and smells of nature.	The aesthetic value of nature is highly subjective and therefore difficult to reflect in a habitat-based scoring system which should be acknowledged when interpreting results. Different groups of society have different levels of appreciation for different natural settings and places. However, not valuing aesthetic and other cultural ecosystem services also means that they can be undermined in decision-making. It is important to stress, however, that this is only a **broad indication** of aesthetic value. The Aesthetic Values Score only considers nature/habitats and not the aesthetics of constructed features such as buildings or monuments. The score is **purely habitat-based** and does not take into consideration wider landscape impacts such as the appropriateness of habitats within the landscape setting. Nor does the automatically calculated score consider the preferences of the local community.
Aesthetic values (method/ multipliers)	• Tree size • Flowers • Landscape diversity • Water body naturalness • Spatial factors • Time to target condition • Delivery risk	The Aesthetic Values Score is based on a habitat base score, as well as the following multipliers: • Level of accessibility: The multiplier is higher for sites that have better public access as people are more likely to benefit if they can be physically present. • Nature designations: The multiplier is higher based on whether it has local, national or international nature designations. • Population density/external visitor numbers: The multiplier is higher in areas with higher population density and/or frequently visited which indicates a higher demand/likelihood of exposure. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Education and knowledge (Definition)	Opportunities for formal education (e.g. school trips), scientific research, local knowledge and informal learning (e.g. from information boards or experiences).	Alongside more theoretical environmental education in the classroom, frequent interaction with the natural environment can form a key element of acquiring ecological knowledge. The Education & Knowledge Score only considers informal interaction with/formal educational visits to nature/habitats. It does not consider for example classroom-based ecological education which means that the presence of a school building or education centre would not enhance the score.
Education and knowledge (method/ multipliers)	• Tree size • Pupolation density • Nature designation • Cultural or historic importance • Educational use • Managed for nature • Spatial factors • Time to target condition • Delivery risk	The Education & Knowledge Score is based on a habitat base score, as well as the following multipliers: • Educational use: The multiplier is higher for areas that are specifically designed for educational purposes, areas that are located on primary school grounds and areas regularly visited for organised educational visits. • Level of accessibility: The multiplier is higher for sites that have better public access as people are more likely to benefit if they can be physically present. • Nature designations: The multiplier is higher based on whether it has local, national or international nature designations. • Population density/external visitor numbers: The multiplier is higher in areas with higher population density and/or frequently visited which indicates a higher demand/likelihood of exposure. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Interaction with nature (Definition)	Provision of opportunities for formal or informal nature-related activities, e.g. bird watching, botany, random encounters with wildlife, or feeling 'connected with nature'. There is some overlap with biodiversity, but access by people can have negative impacts on some wildlife habitats. Excludes recreational fishing; hunting /	Interaction with nature refers to observing nature such as bird watching; either formally or informally. It also includes random encounters with wildlife and more generally feeling 'connected to nature'. To distinguish interaction with nature from recreation, for example, amenity grassland or a natural sports pitch may provide great recreational opportunities but it is unlikely to provide many opportunities to interact with nature.

	shooting (not covered); the intrinsic value of nature (covered by the Biodiversity Metric); existence value (from just knowing that nature exists).	The Interaction with Nature Score is purely habitat-based and does not directly consider the presence of species. Nor does it consider species/habitat diversity across a site.
Interaction with nature (method/ multipliers)	• Tree size • Tall or tussocky grasses • Shrub layer • Flowers • Invertebrate nest sites • Resources for local species • Nature designation • Ancient habitat • Public access • Managed for nature • Fish barriers • Water bodies naturalness • Spatial factors • Time to target condition • Delivery risk	The Interaction with Nature Score is based on a habitat base score, as well as the following multipliers: • Level of accessibility: The multiplier is higher for sites that have better public access as people are more likely to benefit if they can be physically present. • Nature designations: The multiplier is higher based on whether it has local, national or international nature designations. • Population density/external visitor numbers: The multiplier is higher in areas with higher population density and/or frequently visited which indicates a higher demand/likelihood of exposure. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Recreation (Definition)	Provision of green and blue spaces that can be used for any recreational activity, e.g. walking, cycling, running, picnicking, camping, boating, playing or just relaxing.	The cultural ecosystem service recreation refers to greenspace that enables enjoyment, recovery from stress and the promotion of health. Accessible greenspace provides opportunities for a range of human activities such as walking, cycling, horse riding, climbing and informal relaxation. Recreational activities are known to increase individual wellbeing.
Recreation (method/ multipliers)	• Population density • Special recreation value • Public access • Spatial factors • Time to target condition • Delivery risk	The Recreation Score is based on a habitat base score, as well as the following multipliers: • Level of accessibility: The multiplier is higher for sites that have better public access as people are more likely to benefit if they can be physically present. The Recreation Score is highly dependent on the level of accessibility and sites without any level of access receive a score of zero. • Population density/external visitor numbers: The multiplier is higher in areas with higher population density and/or frequently visited which indicates a higher demand/likelihood of exposure. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Sense of place (Definition)	The aspects of a place that make it special and distinctive – this could include locally characteristic species, habitats, landscapes, or features; places related to historic and cultural events, or places important to people for spiritual or emotional reasons.	Sense of place refers to the aspects of a place that makes it special and distinctive. This includes historic features, personal reasons, but also natural features such as habitats. The NATURE Tool provides indicative scores for different habitat types. The Sense of Place Score is purely indicative and only captures a proportion of what gives a space sense. Not considered, for example, is how habitats fit into the local setting or interact with other features such as buildings, monuments or the landscape. It also doesn't consider any spiritual or religious meanings of a space to communities.
Sense of place (method/ multipliers)	• Nature designation • Ancient habitat • Cultural or historic importance • Managed for nature • Local distinctiveness • Water body naturalness • Spatial factors • Time to target condition • Delivery risk	The Sense of Place Score is based on a habitat base score, as well as the following multipliers: • Level of accessibility: The multiplier is higher for sites that have better public access as people are more likely to benefit if they can be physically present. • Nature designations: The multiplier is higher based on whether it has local, national or international nature designations. • Population density/external visitor numbers: The multiplier is higher in areas with higher population density and/or frequently visited which indicates a higher demand/likelihood of exposure. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Air quality regulation (Definition)		Complex vegetation and especially trees usually have a positive effect on the regulation of air quality. This applies especially in areas where pollution emissions are comparatively high. Trees and other vegetation absorb, through physical deposition as well as chemical reactions, deleterious pollution such as nitrogen dioxide; but also carbon monoxide, sulphur dioxide, ozone and fine particulates which are responsible for major illnesses such as respiratory ailments, heart disease and cancer. Please note that good design is assumed such as not creating a canopy 'roof' over busy roads which could potentially worsen localised air quality.

Air quality regulation (method/ multipliers)	• Canopy cover • Air pollution barrier • Spatial factors • Time to target condition • Delivery risk	The Air Quality Regulation Score is based on a habitat base score, as well as the following multipliers: • Population density/external visitor numbers: The multiplier is higher in areas with higher population density and/or frequently visited which indicates a higher demand/likelihood of exposure. • Air Quality Management Area (AQMA): The multiplier is higher if a site is located in an area with an AQMA which indicates a higher demand for air quality regulation services. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Carbon storage (Definition)	Carbon stored in vegetation and soil. For a typical development (with complete loss of habitats and often major soil disturbance), this is more relevant than carbon sequestered annually. However, peatland restoration is an exception*. The 'time to reach target condition' reflects the time taken for a new habitat to reach a typical carbon sequestration rate for a mature habitat. *Carbon storage is the total amount of organic carbon stored in soil and vegetation. Carbon sequestration is the amount of carbon absorbed from the atmosphere per year, as vegetation grows through photosynthesis and soil organic carbon increases through the incorporation and decomposition of organic matter such as leaf litter and fine roots. Carbon storage and sequestration are two facets of the same process, as carbon storage is simply the sum of all carbon sequestration over time (minus any emissions). For most types of habitat change we expect the direction and magnitude of changes in carbon storage and carbon sequestration to be very similar. For example, planting a new woodland will result in an increase in both carbon storage and sequestration, while destroying a woodland will result in a large loss of both stored carbon and future sequestered carbon. Therefore, for simplicity, we report only carbon storage in the EBN tool. However thisis not the case for peat, which has an exceptionally high level of carbon storage, but where sequestration can range from a small annual increase for peat in good condition to a large annual emission of carbon for degraded or cultivated peat, such as on moorland that has been drained or burnt, or on lowland fens that have been drained for agriculture. Restoration of degraded peat, either from moorland or arable land, is therefore expected to result in a switch from carbon emissions to carbon sequestration but without a major short-term impact on carbon storage. This type of restoration will play a vital role in meeting climate mitigation targets. We have therefore added a flag to the results page to notify the user of the potential difference in results betweencarbon sequestration and carbon storage in projects that involve peat.	Carbon Storage in this context refers to natural carbon storage in vegetation and corresponding soils which makes an important contribution to mitigating climate change and reaching climate/net-zero targets. The photosynthetic activities of trees and other vegetation sequester carbon dioxide from the atmosphere and therefore act as a net carbon sink, especially when carbon is stored in corresponding soils. This score indicates (the project impact on) average carbon stocks in vegetation and corresponding soils. It is NOT the carbon sequestration as this would not appropriately account for the carbon loss of deforestation, for example. In addition to the scores, Carbon Storage is also assessed in biophysical terms (tonnes of carbon dioxide equivalent; t CO_2e) and in monetary values. Please click on the info notes for respective headers for more information. For woodland, carbon stock (changes) are based on the Woodland Carbon Code (WCC) calculation tool (version 2.1). For other habitats, estimates are based on Natural England's publication Carbon Storage and Sequestration by Habitat 2021. Please note that there is still significant uncertainty particularly around soil carbon stock changes. Please also note that this impact of peatland management/degradation is not implemented yet. However, the development team is intending to implement that in subsequent versions. Not considered in this assessment are for example non-natural carbon impacts such as from building energy use or traffic (except the impacts of photovoltaic installations - see further below).
Carbon storage (method/ multipliers)	• Peat quality • Canopy cover • Tree size • Spatial factors • Time to target condition • Delivery risk	The Carbon Storage Score is based on a habitat base score, as well as the following multipliers: • Grazing & Mowing: The multiplier is slightly higher for non-degraded grassland habitats. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services. • Please refer to the Carbon Storage score calculation sheet (Car Calc) for more detail on how the score is calculated (accessible from the Assessment Status sheet).
Cooling and shading (Definition)	Shade, shelter and cooling effect of vegetation and water, especially urban trees close to buildings, green roofs and green walls, which can reduce heating and cooling costs, or trees	Green vegetation has an influence on the local climate, and particularly so in more urbanised areas. Urban areas are usually warmer than their surroundings. This Urban Heat Island Effect (UHIE) is caused by the built

	in urban parks which can provide shade on hot days.	environment retaining heat, which is released during the night, as well as the concentration of waste heat from warming and cooling. The UHIE will increasingly combine with global warming caused by climate change. Green vegetation and in particular trees have a significant cooling effect on the local climate in cities and towns. The temperature around vegetation is reduced by evapotranspiration. Trees and scrub also provide shading and protection from heat and UV radiation. Therefore, natural capital has the potential to play a vital role in helping urban areas to adapt to climate change. Cooling & Shading only indicates the contribution of natural vegetation. Not considered are for example sunshade sails which also provide shading but are not natural. Also not considered are engineered solutions to reduce waste-heat from buildings, for example.
Cooling and shading (method/ multipliers)	• Canopy cover • Tree size • Shading ability • Spatial factors • Time to target condition • Delivery risk	The Cooling & Shading Score is based on a habitat base score, as well as the following multipliers: • Level of accessibility: The multiplier is slightly higher for sites that have better public access as people are more likely to benefit from shading. • Population density/external visitor numbers: The multiplier is higher in areas with higher population density and/or frequently visited which indicates a higher demand/likelihood of exposure. For Cooling & Shading, the population density is more significant because it also indicates the level of urbanisation/UHIE. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Noise regulation (Definition)	Attenuation of noise by vegetation.	
Noise regulation (method/ multipliers)	• Noise reduction • Spatial factors • Time to target condition • Delivery risk	
Erosion protection (Definition)	The ability of vegetation to stabilise soil against erosion and mass wastage by protecting the soil from the erosive power of rainfall and overland flow, trapping sediment, and binding soil particles together with roots.	Soil erosion happens when wind and water results in the loss of nutrients, minerals and organic compounds. Such loss reduces the fertility of soils and is therefore undesirable. Soil erosion also puts pressure on water bodies through increased sediment runoff. Vegetation cover can protect soils from eroding – especially complex vegetation such as woodlands and vegetation that provides good soil coverage such as grassland habitats. Arable fields where soils are often exposed to water and wind provide lower erosion protection services.
Erosion protection (method/ multipliers)	• Rainfall • Slope • Soil erodibiliity • Soil management • Peat quality • Gound cover • Tall tussocky grasses • Shrub layer • Position for erosion prevention • Spatial factors • Time to target condition • Delivery risk	The Erosion Protection Score is based on a habitat base score, as well as the following multipliers: • Slope steepness: The multiplier is higher for sites with steeper slopes because this makes soil erosion more likely which in turn indicates higher demand for Erosion Protection. • Rainfall: The multiplier is higher in areas that experience more rainfall as heavy rain can contribute to soil erosion. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Flood regulation (Definition)	Reduction of surface runoff, peak flow, flood extent and flood depth through canopy interception, evapotranspiration, soil infiltration and physical slowing of water flow.	Flood Regulation refers to the ability of natural habitats to slow down and store water in case of a flooding event. Woodlands, for example, do this by canopy interception, infiltration and water storage in soils. Please note that the Flood Regulation Score only provides a rough indication of flood regulation. Modelling floods is complex, and this high-level assessment cannot capture the full complexity of flooding events. Not considered, for example, is the reduced level of damage/disruption mitigated flooding events would otherwise cause. Hence, scores are essentially indicative.
Flood regulation (method/ multipliers)	• Natural flood management priority • Woodland for flood risk • Working With Nature Process (WWNP) target zone • Soil compaction • Tall or Tussocky grasses • Shrub layer • Water body naturalness • Spatial factors	The Flood Risk Regulation Score is based on a habitat base score, as well as the following multipliers: • Flood regulation location: The multiplier is higher in locations that are more likely to be flooded as long as water could run off (flow routes). • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential.

	• Time to target condition • Delivery risk	• Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Water quality regulation (Definition)	Direct uptake of pollutants by terrestrial or aquatic vegetation; interception of overland flow and trapping / filtration of pollutants and sediment by vegetation before it reaches watercourses; breakdown of pollutants into harmless forms e.g. by denitrifying bacteria that convert nitrates into nitrogen gas. Also, infiltration into the ground, allowing pollutants to be filtered out by the soil and preventing pollution of watercourses – though pollutants could enter groundwater supplies.	Vegetation can, retain, remove and transform for example nitrate pollution from agricultural habitats or other pollution sources such as from sewage overflows during periods of heavy rainfall. The complexity of vegetation is important because complex vegetation can trap more pollutants when water flows through. Not considered in the score are engineered water quality improvement measures such as chemical water treatment facilities.
Water quality regulation (method/ multipliers)	• Water quality management area • Soil compaction • Soil management • Peat quality • Ground Cover • Tall tussocky grasses • Position for water quality regulation • Water body naturalness • Spatial factors • Time to target condition • Delivery risk	The Water Quality Regulation Score is based on a habitat base score, as well as the following multipliers: • Water status: The multiplier is higher for sites located in areas with generally poorer water quality, indicating a higher demand for the service. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Pest control (Definition)	Predation of crop or tree pests by invertebrates (e.g. beetles, spiders, wasps), birds and bats.	Pest control describes nature's ability to self-regulate pests which are species that compete with humans for provisioning services such as food. Birds and spiders, for example, prey on pests and therefore naturally control pest populations. Chemical pesticides are a threat to natural pest control because natural enemies of pests are often more susceptible than the pests themselves. This is because pests build up resistance to chemical pesticides whilst their predators are more vulnerable and also generally smaller in population. Semi-natural habitats tend to have higher Pest Control Scores than improved grassland or arable fields, for example. Not considered in this score are for example chemical pest treatment or other non-natural measures. Also not considered is the local demand for Pest Control as this would require further context analysis. Arguably, Pest Control is more important in areas with higher volumes of agricultural production, for example.
Pest control (method/ multipliers)	• Flowers • Invertebrate nest sites • Managed for nature • Spatial factors • Time to target condition • Delivery risk	The Pest Control Score is based on a habitat base score, as well as the following multipliers: • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Pollination (Definition)	Pollination of crops (and wild plants, supporting other ES) by wild insects (mainly bees and hoverflies). Excludes pollination by managed honeybees.	Most wild plants and crop species depend on insect pollination. Hence, pollination represents a vital ecosystem service supporting food supply and other ecosystem services such as aesthetic values. Many pollinators in the UK, especially those associated with semi-natural habitats, have become less widespread which may have implications for pollination services. Semi-natural habitats tend to have higher Pollination scores than for example improved grassland. Not considered in this score is the local demand for Pollination as this would require further context analysis. Arguably, Pollination is more important in areas with higher volumes of agricultural production, for example. Also not considered are for example the presence/establishment of bee hives on a site.
Pollination (method/ multipliers/)	• Flowers • Invertebrate nest sites • Managed dor nature • Spatial factors • Time to target condition • Delivery risk	The Pollination Score is based on a habitat base score, as well as the following multipliers: • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Food provision (Definition)	Arable crops, horticulture, livestock, orchards, allotments, urban food, wild food (e.g. gathering berries or mushrooms).	
Food provision (method/ multipliers)	• Agricultural land class • Spatial factors • Time to target condition • Delivery risk	

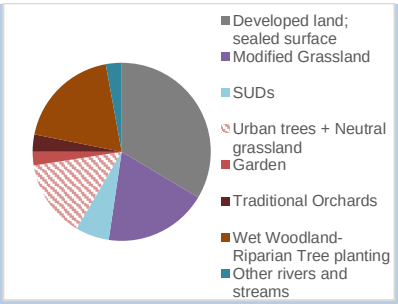
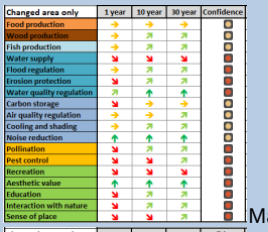
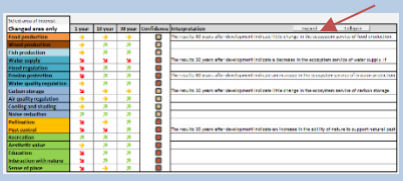
Fish production (Definition)	Aquaculture, commercial fishing, recreational fishing (recreational fishing is also a cultural service, but the habitat conditions match those for fish production).	
Fish production (method/ multipliers)	• WFD (Water Framework Directive) overall ecological and chemical status • Barriers to fish passage • Naturalness of water body • Linear habitat multiplier • Spatial factors • Time to target condition • Delivery risk	
Food & Fish- commercial (Definition)		Commercial food and fish production includes all production/catch that has a commercial purpose – essentially food/fish that is produced/caught to be sold. This is in contrast to community food and fish which is assessed below. The score only captures grown food but does not include for example pig or poultry farms. This is because arguably such food production is not based on an ecosystem service (apart from the food grown to feed animals which is included in the score). It could also lead to double-counting with grown food that this then fed to livestock.
Food & Fish- commercial (method/ multipliers)		The Food & Fish - Commercial Score is based on a habitat base score, as well as the following multipliers: • Commercial food/fishing function: Scores are zero if a habitat is not used for commercial fishing/food production. • Agricultural Land Classification (ALC) grade: The multiplier for food production is higher for sites with better ALC grade. The ALC grade indicates the quality of land for agricultural production. Please note that the ALC grade multiplier only applies to habitat types which typically rely on it. Habitat types that are not connected to ALC classification include woodland which may be used to collect mushrooms. • Water status: The multiplier for fish production is higher for water that has a good status. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Food & Fish- community (Definition)		Community food and fish production refers to non-commercial food production such as gathering berries and mushrooms or managing an allotment for private consumption. This service also includes non-commercial angling where the fish caught can be kept. Not captured within the score is the recreational aspect of, for example, recreational fishing or enjoying gardening in an allotment. The score only indicates the produce, rather than the experience of the process.
Food & Fish- community (method/ multipliers)		The Food & Fish - Community Score is based on a habitat base score, as well as the following multipliers: • Community food/fishing function: Scores are zero if a habitat is not used for community fishing/food production. • Water status: The multiplier for fish production is higher for water that has a good status. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Water supply (Definition)	Impact of soil and vegetation on rainwater runoff and infiltration, and thus on groundwater recharge or surface water flow.	
Water supply (method/ multipliers)	• Surface water availability • Grounwater availability • Slope • Soil drainage • Soil compaction • Spatial factors • Time to target condition • Delivery risk	
Water availability (Definition)		The availability of water is, for example, crucial for ensuring affordable and safe drinking water and sanitation. Habitats such as running and standing water contribute directly to water abstraction whilst other habitats such as

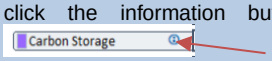
		wetlands and woodlands allow the recharge of groundwater as surface water can impede through soil. This water availability function can be interrupted when surfaces are sealed or compacted, for example. **Water Availability needs to be distinguished from water supply where water is actually abstracted.** This has not been included because information is usually difficult to obtain. Also not considered within the score is the local demand for water availability, for example whether water is/will be in shortage in an area.
Water availability (method/ multipliers)		The Water Availability Score is based on a habitat base score, as well as the following multipliers: • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Wood production (Definition)	Timber, wood production for paper, woody biofuel crops, coppice wood or wood waste used for biofuel.	Wood Production includes harvesting of timber and other woodland products such as wood-based biofuels or firewood. Woodland habitats usually receive the highest scores, but orchards, scattered trees and scrub can also provide some level of woodland products.
Wood production (method/ multipliers)	None (Usually grown on low grade land and can cope with steep slopes, low temperatures, high rainfall and high altitudes).	The Wood Production Score is based on a habitat base score, as well as the following multipliers: • Woodland management: The multiplier is higher if a woodland is primarily managed for wood/timber production. The score is zero for woodlands that are not managed for wood production. • Habitat maturity: The score is usually higher for mature habitats that already have reached their full ecosystem services potential. • Delivery risk: For newly created habitats, a delivery risk penalty may apply where failure of creating the intended habitat is likely to reduce ecosystem services.
Photovoltaic carbon impact (Definition)		Photovoltaic Carbon Impact refers to the abated carbon emissions through the installation of photovoltaic (PV) systems for solar electricity production. This is based on the substitution of electricity from the general electricity generation mix (including coal and gas) by clean PV electricity. Also considered are potential savings to electricity transmission and operation losses which can be avoided if PV electricity is used on-site. Please note that the NATURE Tool also calculates the estimated electricity production in kilowatt hours (kwh) - see Photovoltaic sheet. Please note that the carbon impact only considers carbon abated from electricity generation but not carbon emissions as part of the construction of PV panels, for example.
Photovoltaic carbon impact (method/ multipliers)		Photovoltaic Carbon Impact is calculated based on the location of the PV installation, informed by the PV GIS Tool, as well as standard specifications for PV installations, but with the option to amend. Carbon impact is calculated as a score which represents the abated carbon should new PV be installed. Impacts are also calculated in tonnes of carbon dioxide equivalent (t CO2e) and in monetary terms. The monetary valuation approach follow the Green Book (HM Treasury 2022) in combination with Supplementary Guidance on the Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal (BEIS 2021). Both, discounting future benefits and the increasing value per t CO2e over time has been considered.

V. Tips and comments when applying Biodiversity Metric, EBN and NATURE

The following chart provides useful tips when applying the tools used for the study. The recommendations were recovered during the application of the tools in the case studies.

Issue	Tool	Comment	How to solve it?
Habitat classification	• Biodiversity Metric	BM has its own classification, which includes a shortlist of UK Hab. It is possible that the habitat surveys or habitat proposals show habitats that are not in Biodiversity metric. Selecting suitable habitats is vital for a successful study.	The assessor needs to select the most appropriate habitat, consult with biodiversity or ecology experts. Request the habitat surveyor and the landscape architects to use the same classification as Biodiversity Metric in the surveys/maps.
Habitat conditions	• Biodiversity Metric	It is necessary to follow the conditions assessments from Biodiversity Metric 3.1	Make or request a detailed survey including Biodiversity Metric conditions If conditions were not tested in the field, make assumptions but explain them clearly.
Habitat conditions scores	• Biodiversity Metric	The Biodiversity Metric spreadsheet considers Good, Fairly good, Moderate, Fairly poor and Poor for conditions scores. However the conditions scoring just mention Good, Moderate and Poor.	Use your best judgment.
Urban trees	• Biodiversity Metric • EBN	The term “Urban Trees” is not included in the UK hab classification. This creates confusion.	Review the definition of Urban trees and criteria in the Biodiversity Metric guidance before selecting this habitat.
Urban trees area are not accounted in the total area	• Biodiversity Metric • EBN • NATURE	“The canopy of Urban trees is calculated separately to the underlying ground-based habitat. Both the area of ground-based habitat and the area of canopy should be included within the metric.” (Biodiversity Metric User guide) EBN follows the same rule. This creates confusion when doing the survey. Also when checking the total habitat area. NATURE considers the urban tree area (like any other habitat) and not the undelying ground-based habitat.	When processing the data, account the urban trees and the underlying gound-based habitat (e.g. 1 ha Urban tree+Modified grassland) In EBN an Biodiversity metric, select both habitats (e.g. 1 ha Urban tree and 1 ha Modified grassland),a ccount the same area in both. In NATURE, just consider the area as urban trees (e.g. 1 ha Urban tree).
Phase 1 habitat classification	• NATURE	Nature uses Phase 1 habitat classification. Most categories are similar than UK Hab, however in some cases it shows other habitats (e.g. NATURE includes flower beds, while Biodiversity’s closest term is garden)	Use the most appropriate habitat.
River biodiversity units +100% change	• Biodiversity Metric	If a proposal doubles the extent of a river/stream/ditch at a site, the results show +100% in river biodiversity units. Also consider other multipliers like river condition. However, the results can be confusing when the site has a burn that is initially underground and the proposal opens the burn.	Check the river units carefully.
Area Erros when implementing a river	• Biodiversity Metric	Biodiversity Metric considers the river/stream/ditch as linear habitats, therefore the extension is assessed in km. However, in cases like St Mary, when a burn is opened in the post development. The tools shows errors in the habitat areas, because some habitats will reduce its area for the implelemtnation fo the river. This creates confusion	In this case, continue the assessment despite the tool shows an error warning.
River area	• EBN • NATURE	EBN and NATURE accounts the area of the river/stream/ditch, which is not completely compatible with Biodiveristy Metric.	Keep your data organized. Account the area of linear water bodies when processing your habitats.

			
Comparing EBN and NATURE	• EBN • NATURE	As mentioned above, there are multiple differences between both tools. However, during the study it was observed that when considering the evaluation of the 50-year projection in NATURE the results are more similar to those of EBN than when using a 30-year projection. This is mainly due to the habitat maturity methods used in each tool.	Apply a 50-year projection assessment in NATURE when coparing it with EBN.
Use the "Changed area only" to safe time when assessing one intervention in two scales (e.g. St Mary or Foresterhill)	• EBN	When comparing the Macro scale "changed area only" results and the micro scale ones, outcomes were very similar.  Macro  Micro	Instead of developing both assessments, just apply the macro scale.
Data source for Scotland	• EBN	The tool gives instructions for using the MAGIC map and others, but they focus only on the territory of England and Wales. These are not a useful source for Scotland.	Find suitable data sources for Scotland (Appendix II)
Food production for community (e.g. traditional orchards)	• EBN • NATURE	When assessing food production in EBN, it considers a score for the habitats and the main multipier is the Agricultural land classification. In St Mary, results did not mark positive outcomes for food production despite implementing traditional orchards. A question such as "Is community food production considered in this habitat?" could add more value to urban scale projects. NATURE separates the food production for commercial and community purposes, and the users input helps to identify the benefits.	Consider that NATURE is more sensitive than EBN to detect food production at community scale.
Baseline assessment	• NATURE	The tool gives the option of assessing the baseline scores (without the post-development), this can be useful when starting the proposal.	Use NATURE when assessing the baseline's ES.
Recommendations given by the tools	• EBN • NATURE	Both tools provide useful recommendations to improve scores	To display the recommendations: In EBN, press the "Expand" button in the Results table. 

			In NATURE, in the “summary result” spreadsheet, click the information button of each ES 
Accessibility	• EBN • NATURE	In case a place is public but has poor accessibility, instinctively they would be assessed as “Open access”. However, is the post development improves its accessibility and is also assessed as “Open access”, the tools wouldn’t detect an improvement.	In case a place is public but has poor accessibility consider the following: In NATURE, select private/restricted access. “Areas that are not designed/optimised for public access but have 'right to roam' access should also be classified as 'private/restricted access'.” In EBN, select Footpath access.
Water status	• NATURE	The tool requests the water status before and after the project. Intuitively, the project our other factors (a subcatchment restauration programme) could improve the water status. However, NATURE assumes that the water status wouldn’t change due to the project because the data should be based on a public dataset. Additionally, it assumes that habitats that are better at improving water quality are in higher demand/more effective in areas where water quality is poor. Changing the status from poor to good means therefore that the same habitats score lower because they are less needed.	Use the same water status in the baseline, construction and post development, based on a public data source (E.g. SEPA).