EMBODIED ECOLOGICAL IMPACTS – MATERIALS IMPACT SCORECARDS

Background information

The Impact scorecards were designed to raise organizations' awareness of the negative impact that the early stages of the discussed construction materials (stages A1 to A4 of the materials life cycle) have on Biodiversity, Climate (emissions), Land, Freshwater, and Ocean, as defined by the Science-based Targets for Nature (SBTN). Additionally, a measure of negative impact on Human has been integrated as a sixth category.

The methodology section below outlines the process for calculating the impact scores.

Methodology

Data and the decisions taken to calculate each one of the aspects of nature (Biodiversity, Climate (emissions), Land, Freshwater, Ocean, and Human) were informed and collected from a large range of open-source content, such as including LCA reports, environmental research charities (see details in the table below), government (e.g. regulations, data.gov.uk), LCA platforms and academic research. For this stage of the Embodied Ecological Impact project, data collected considered the life cycle stages A1-A4 (material extraction, manufacturing, and transport). The selection of these stages was largely informed by the appropriateness of the information with regard to the discussion as well as its availability.

The scorecards have five possible Impact scores:

0: no impact
1: Low (L)
2: Moderate (M)
3: High (H)
4: Very High (VH)

These were calculated based on the maximum values found for each one of the metrics, per material, in their own units. For example, for Embodied Carbon (GWP), the maximum value found among a wide range of construction materials was 17.5 kgCO2e across the world. Therefore, 17.5 kgCO2e was considered the top-end impact value or 4 (VH), and the rest of the scores (0-3) were calculated simply by dividing the maximum in equal parts. Moreover, when one metric was calculated using more than one type of metric or impact factor (e.g. impact on Freshwater, which accounts for water use and eutrophication due to the material during stages A1-A4), the result represents averages of the metric.

The table below summarises the characteristics of all metrics used for the scorecards, the units for each aspect of nature, calculations performed and sources of data for each one of the aspects of nature.

Aspects of Nature	Metric description	Data source & Method for Estimating Impact	Impact scores (0 - 4) & units
Biodiversity	Biodiversity considers the type of biodiversity hosted in the original type (Bio veg) of habitat where extraction occurs, as well as its national and international level of protection assigned (bio-protected), related to each country from where the material is extracted.	Data source by type: Bio veg: Original vegetation defined based on national vegetation maps, supported by information from ENCORE Bio protected: Classification of protection defined based on "areas of assignation" and also, of the IUCN classification, where: Assignation score + IUCN score = bio-protected. Data was obtained from IBAT Final Biodiversity score is: (bio veg + bio protected area)	There are no units associated with this metric. Score Bio Veg: 2: forest; 1: shrubland or steppe Score Bio protected: i) Scores areas of assignation: national, Natura 200, World Heritage, MAB, Ramsar = 1 ii) Scores IUCN assignation: 0: No vegetation, no animals. Naturally barren land. High altitude, high desert or ice-covered landscape (> 5,000 in tropics, and >4,000 in high latitude) Ia, Ib: 2 II, III:1.5 IV, VI:1 V:0.5
Climate (emissions)	This metric considers the emissions in Global Warming Potential (GWP) during and including stages A1-A4 for each	Metrics are represented by generic, and UK-UK-contextualised data was kindly provided by One Click LCA based on Ecoinvent. We	Data Climate emission final GWP (fossil + bio) in kilograms of carbon dioxide equivalent (kg CO2e) emissions per unit of material.

	material. This considers both emissions related to bio and fossil. Reporting Climate emissions on GWP follows the EN15804+A2 update. "GWP fossil" typically refers to the Global Warming Potential (GWP) associated with the combustion of fossil fuels. "GWP fossil," often refers to the emissions of greenhouse gases that result from burning fossil fuels such as coal, oil, and natural gas. "GWP bio" typically refers to the Global Warming Potential (GWP) associated with the use of biofuels or other biogenic sources of carbon.	expanded our selection of materials by including all those listed in ICE to determine the highest GWP value. We then assigned the maximum score (4: VH) based on the fuller list of materials. Following this, we assessed our five chosen materials using the data provided by One Click LCA Final Climate (emissions) impacts score: GWP (fossil + bio)	Scores are: 0: 0 1: 0.00001- 4.3 2: 4.4 - 8.7 3: 8.8 - 13.1 4: 13.2-17.5
Land	This metric considers LULUC or Land use and Land Change and it is expressed in GWP, following the EN15804+A2 update. The calculation of Land Use, Land Use Change, and Forestry (LULUCF) emissions or removals, including their Global Warming Potential (GWP), is a complex process that involves a combination of data collection, modelling, and accounting methods. This metric considers how much the land has been changed in order to extract materials (e.g. if a forest has been removed, where the impact is large, and therefore has larger GWP). More information about Land Use and Land Change can be found here 2030 Climate Target Plan: review of Land Use, Land Use Change and Forestry (LULUCF) Regulation.	Metrics are represented by generic, and UK-contextualized data kindly provided by One Click LCA based on Ecoinvent. We expanded our selection of materials by including all those listed in ICE to determine the highest LULUC (Land Use, Land Use Change) values. We then assigned the maximum score (4: VH) based on the fuller list of materials. Following this, we assessed our five chosen materials using the data provided by One Click LCA. Final Land impact score: GWP LULUC for each material calibrated to the UK	The unit for LULUC is in Kg CO2e Scores are as follows: 0: none 1: 0.00000001-0.05 2: 0.06 - 0.11 3: 0.12-0.17 4: 0.18- 0.23
Freshwater	This metric considers Freshwater use (Fresh use) and eutrophication (Fresh	Metrics for Freshwater use and eutrophication are represented by generic, and UK-	The units used were: Fresh use m3 of water used / kg material extracted

	eu) during stages A1-A4 for each one of the materials. The values can vary significantly depending on the material and location. Here, as with all other metrics, we use data related to the country of extraction and appropriated to the UK.	contextualised data kindly provided by One Click LCA based on Ecoinvent. The data did not need transformation and was used directly to define the scores considering the maximum value found among all construction materials.* *"All construction material" was comprised of the full list of materials found in ICE) <u>Final Freshwater impact score:</u> Average of Fresh use and Fresh eu	Scores Freshwater use: 0: none 1: 0.0000001-25 2: 26 - 51 3: 52 - 77 4: 78- 100 Fresh eu: kg Pe per Kg material Scores eutrophication 0: none 1: 0.0000001- 0.075 2: 0.076-0.151 3: 0.152 - 0.227 4: 0.228 - 0.303
Ocean	This metric considers three components of impact: marine ecosystem eutrophication, marine ecosystem acidification and distance to marine ecosystems during the life cycle A1-A4 for each one of the materials, in the countries/locations from where the material comes to the UK.	Data on Ocean eutrophication (O eu) and Ocean acidification (O acid) was generic and UK-contextualised kindly provided by One Click LCA based on Ecoinvent. Data on direct ocean ecosystem impact due to extraction (O site) was extracted from mining land maps from different sources, including academic publications. <u>Final Ocean impact score is the average of:</u> O eu,O acid and O site	Unit Eutrophication caused aquatic marine: kg N eq. Scores O eu: 0: none 1: 0.001 -0.5 2: 0.6 - 1.1 3: 1.2 - 1.7 4: 1.8 -2 Unit acidification potential: mol H+ eq. Scores O acid: 0: 0 1: 0.000-1 2: 1.1-2 3: 2.1 -3 4: 3.1 – 4 Direct impact in marine ecosystem due to the location of extraction: 0: There is no fixed distance that universally ensures no impact on the ocean 1. Far from 50km 2. Close to coastline (10km) 3. On the coastline 4. Inside the ocean/sea

Human	This metric considers different aspects that may have a negative effect on people. People are considered as those working in material extraction and transportation, as well as the communities living locally in the mining process.	Data was collected from a series of open-source materials, including academic publications, as well as the Environmental Justice Atlas. While this category is extremely complex and largely under-reported publicly, we did in-depth desktop research to define the degree to which people may be: displaced, economically deprived, mentally and/or physically affected by mining.	There are no units associated with this metric. Scores have been assigned based on a comparison between available information and the criteria deemed essential by the UKGBC for Health and Wellbeing, as well as socio-economic equity. These scores will undergo updates as our research in this area progresses. Currently, the scores stand as follows: 0: no impact 1: low degree of impact (e.g. health has been affected, but will recover in the short term and without consequences) 2: moderate impact (e.g. health has been compromised but will recover in the near term, displaced and will be relocated) 3: Large impact (e.g. health has been compromised and will require long-term recovery, displaced and relocated with major challenges) 4: very high impact (e.g. death, severe chronic illness, displaced and not remunerated/relocated)

Notes regarding the data used for the estimation of impact:

     While we have attempted to report the most accurate impact score for each one of the metrics and materials, full data availability via open source is scarce. We were largely supported by One Click LCA, and we are confident with the scores for Climate emissions, Land, and most of the Ocean scores. Nevertheless, there is limited information about the accurate location of mines, for which Biodiversity and Ocean scores depend, and definitely on Human and the impact that the mining has on local communities. Therefore, we will continue to pursue raising awareness regarding the availability of data, and especially advocating for collaboration and open-source reporting from all stakeholders involved in material extraction. We will aim to update this live resource as further collaboration and open information becomes available.

If you have any questions or suggestions for this work, please contact Macarena Cárdenas (macarena.cardenas@ukgbc.org)