**Measuring the Global Environmental Impacts of Consumption: a global indicator of the biodiversity loss, scarcity-weighted water use and deforestation associated with the consumption of agricultural commodities**

UK [**Joint Nature Conservation Committee**](https://jncc.gov.uk/) **(JNCC) &** [**Stockholm Environment Institute**](https://www.sei.org/centres/york/) **(SEI)**

**Indicator summary**

An indicator is outlined that estimates the total environmental impact (including biodiversity loss, scarcity-weighted water use and deforestation) caused by countries’ or territories’ consumption of commodities. Results can also be broken down by the producer countries/territories in which the impact is taking place and by the commodities driving any impact. The indicator is being developed by JNCC and SEI under contract to Defra, with additional support from Trase and the Global UKRI Challenges Research Fund Trade and the Environment Hub.

**Key elements of the Global Environmental Impacts of Consumption Indicator**

* Links consumption to environmental impacts using modelled global trade flows
* Commodity specific (impacts for a given consumer country/territory can be broken down by how much each commodity contributes the total)
* Spatially explicit (impacts for a given consumer country/territory can be broken down by how much each producer country/territory contributes to the total)
* Goes beyond *pressures* (e.g., tonnes of material, hectares of land use) to also estimate associated *impacts* (e.g., hectares of tropical/subtropical deforestation, predicted species loss, scarcity weighted water use)
* Useful for directing action
* Free, practical, and easy-to-use interactive dashboard

**Key links**

Data can be downloaded and viewed through an interactive dashboard at: <https://commodityfootprints.earth/>. Technical documentation detailing the methods behind the production of the data can be found at: <https://hub.jncc.gov.uk/assets/91efc19d-f675-426f-9333-ed0195cc729d>.

Metadata are provided in Annex 1.

**Relevance to the Convention on Biological Diversity (CBD)**

Unsustainable overconsumption of food and other materials is linked to significant production-related environmental impacts, such as deforestation, land use change, biodiversity loss and water stress. Consumers are often far removed from these impacts, at the other end of supply chains which may span many different countries. This makes it difficult for individuals, businesses, governments and other actors to make responsible choices and to have access to relevant information about the environmental impacts of their consumption. By providing information on the global environmental impacts of consumption, the indicator supports **Target 16** of the first draft of the post-2020 global biodiversity framework (REF#) *(“Target 16: Ensure that people are encouraged and enabled to make responsible choices and have access to relevant information and alternatives, taking into account cultural preferences, to reduce by at least half the waste and, where relevant the overconsumption, of food and other materials.”[[1]](#footnote-1)).*

The expert workshop on the monitoring framework for the post-2020 global biodiversity framework convened by the CBD Secretariat (Bonn, Germany, 30 June – 1 July 2022) identified the Global Environmental Impacts of Consumption Indicator as a potential headline indicator[[2]](#footnote-2). In the technical assessment of indicators, the workshop rated the indicator ‘2’ out of ‘5’ , as an option alongside the Ecological Footprint, which means, according to the scoring system, “Support for inclusion as a headline indicator, but does not currently meet all the assessment criteria and further development necessary (i.e., less relevant when nationally disaggregated, lack of agreement on the methodology, lack of national capacity to monitor the indicator, lack of data in some countries, etc.)”. Only 23 indicators of the 245 assessed received a score of ‘1’ or ‘2’. The indicator is the subject of active ongoing research and development as outlined below. In addition to Target 16, the workshop identified that the indicator could be relevant to **Targets 8 and 15**, and **Goals B and D**.

**Development timeline**

Initial results from the indicator were published in October 2021 by the JNCC as a UK [experimental statistic](https://jncc.gov.uk/our-work/ukbi-a4-global-biodiversity-impact/) (a statistic that is published officially by government but that is continuing to undergo further development) alongside an internationally relevant [interactive dashboard](https://www.commodityfootprints.earth/). It will be updated annually by the JNCC and SEI, with data freely available online. A 2022 update will take place on the 27th October 2022, with 2018 data being added to the time series. Development work to continue improving the indicator (expanding the commodity, country and impact metric scope; integrating finer resolution production data; updating the methods behind the biodiversity metric) is planned to at least 2024. Improvements made through this development work will be incorporated into subsequent updates. For example, the 2023 update will expand the indicator to encompass at least 120 countries and territories from a consumption perspective, instead of the current 44.

**Scope**

**Impact metrics**

The initial results (published October 2021) provided data on:

* Two separate biodiversity risk metrics (predicted regional species loss and species proximity to production activities)
* Water consumption and scarcity-weighted water footprint
* Deforestation and GHG emissions related to this deforestation (currently only available for deforestation taking place in tropical and subtropical regions – whereas all other metrics provide global data)
* Cropland area harvested
* Material consumption (tonnes of biomass production)

Future work will consider how to incorporate the following into the indicator suite:

* Deforestation in all regions (not just tropical/subtropical regions)
* Nitrogen and phosphorous pollution
* Additional/enhanced biodiversity metrics

**Commodities**

The initial results provided data on agricultural crop commodities. For tropical and subtropical deforestation, and the GHG emissions related to tropical and subtropical deforestation, cattle-related commodities and timber were also included. Future work plans to scope out the potential for addition of metals / minerals and marine commodities to the dataset.

**Geographic**

The dataset provides globally relevant results. Any country (and several territories) worldwide can view results from a *production* perspective, to understand impacts taking place in their own country (or territory) that are driven by the consumption of other countries, regions or territories (although for the deforestation metric this is currently restricted to countries/territories containing tropical/subtropical forest). It is also currently possible to view results from a *consumption* perspective for 44 countries/territories, to identify the impacts that their consumption is driving within each producer country/territory. Other countries are currently grouped into five ‘rest of world’ regions due to limited data availability. Work is underway – with results expected to be available for a 2023 data release - to expand this indicator to encompass at least 120 countries and territories from a consumption perspective. On the dashboard, there is a drop-down menu where it is possible to select any country/territory for which there are data, to visualise results.

**Temporal**

Data are currently available annually for 2005-2017. Data for 2018 will become available in late 2022. It will be updated annually.

**Methodology and data sources**

Full technical information providing all relevant details about how the indicator is calculated is available from the indicator’s [technical documentation](https://hub.jncc.gov.uk/assets/91efc19d-f675-426f-9333-ed0195cc729d).

In brief, the indicator is based on a modified form of MRIO (multi regional input-output) modelling, which is used to model global trade flows representing the monetary inputs and outputs across different countries/territories and their commercial sectors (e.g., oilseeds, cattle farming, paddy rice, etc.). The MRIO data used for this indicator were from [Exiobase](https://www.exiobase.eu/) (although the addition of other MRIO datasets is being explored for the work aiming to expand consumption country/territory coverage). The MRIO data are hybridised with [physical production and trade data](https://www.fao.org/faostat/en/) (tonnes of each commodity) from the Food and Agricultural Organisation, using the Stockholm Environment Institute’s IOTA (Input Output Trade Analysis) modelling framework ([Croft *et al*., 2018](https://doi.org/10.1016/j.jclepro.2018.08.267)). The modelling framework allows for an estimation of the producer country/territory of a commodity, accounting for cases where commodities are embedded within other products as an ingredient or input, and cases where commodities are re-exported through multiple countries before the point of consumption. The main advantages of the hybridisation process are that it provides greater regional and commodity specificity and resolution to the modelling framework than standard MRIO approaches, and full supply chain coverage compared to typical bilateral trade data allow, which are critical for understanding consumption-driven environmental impacts that are highly product and place specific.

These data are then combined with datasets linking commodity production to environmental impacts within relevant production countries/territories. For biodiversity loss, these are data from [Chaudhary and Kastner (2016)](https://www.sciencedirect.com/science/article/abs/pii/S0959378016300346) for one metric (species loss) and, for the other metric (species proximity to production, a.k.a. ‘species hectares’), data from [MAPSPAM](https://www.mapspam.info/), [Birdlife International](http://datazone.birdlife.org/species/requestdis), and the [International Union for the Conservation of Nature](https://www.iucnredlist.org/). For scarcity weighted water use, datasets from the [Water Footprint Network](https://waterfootprint.org/en/) and [Boulay *et al*. (2018)](https://link.springer.com/article/10.1007/s11367-017-1333-8) are used. Subsequent updates may rely on updated underlying datasets where relevant. For tropical deforestation, this was the [Pendrill *et al*., 2020](https://doi.org/10.5281/zenodo.4250532) dataset in the initial release (which will update to the Pendrill *et al*., 2022 dataset for the 2022 release, and may be combined with other datasets after this point to enable reporting on all forest types, not just tropical deforestation). Each of these datasets has been internationally peer reviewed (further information is provided in the indicator’s full [technical documentation](https://hub.jncc.gov.uk/assets/91efc19d-f675-426f-9333-ed0195cc729d)).

**Caveats, limitations and uncertainties**

For appropriate interpretation of the results presented within this indicator, it is necessary to understand the following caveats:

* Data to trace all commodities back to their precise producer country/territory are not publicly available. Whilst based on empirical statistics, the outputs produced by this indicator are derived from modelling so should be considered as providing estimates of producer countries/territories rather than exact information.
* Only the producer country/territory, and not the exact location of the production, can be obtained from the current version of the indicator as only national scale data were used. This means impacts are currently based on average production practices per country, not the actual impacts at the exact location the product came from. The development team are exploring options to improve this by using sub-national data (where available) in future iterations of the indicator.
* Data lags in the underlying data sets mean that data are only available in the current release up to 2017 (with 2018 due for release in October 2022). Care should also be taken in analysing trends over time which can reflect complex changes in production volume, trade distributions, estimated inter-sectoral demands and final consumption expenditure.

Work is underway to understand the extent to which use of different MRIOs as the underlying dataset (for example, [GTAP](https://www.gtap.agecon.purdue.edu/) rather than [Exiobase](https://www.exiobase.eu/index.php%22%20%5Ct%20%22_blank%22%20%5Co%20%22External%20link%3A%20Exiobase)) could lead to differences in results, due to factors including geographic and sectoral resolution, temporal coverage and lag. Work is also underway to compare results from using different MRIO models within the IOTA framework, which can help to understand how perceived impacts/risks might change based on model assumptions (e.g., to provide ‘envelopes’ of risk exposure).

**Data providers and funders**

* The indicator is being developed by the [Stockholm Environment Institute (University of York)](https://www.sei.org/centres/york/) and the [Joint Nature Conservation Committee](https://jncc.gov.uk/).
* Work is being funded by the [UK’s Department for Environment, Food and Rural Affairs (Defra)](https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs).
* Additional resource to further improve the dashboard have also been provided by the Global UKRI Challenges Research Fund [Trade Hub](https://tradehub.earth/) and [Trase](https://trase.earth/). The planned work to produce additional/enhanced biodiversity metrics will also build on work being undertaken by the Trade Hub.

**Comparison with other indicators**

The Ecological Footprint and Material Footprint have also been proposed as potential indicators for Target 16. The indicator described in this document estimates specific impacts such as biodiversity and deforestation, through a complex trade model that allows for a detailed breakdown of commodities and producer countries/territories associated with each consumer country/territory’s impact, which is useful for informing action. Meanwhile, the Ecological Footprint focuses on the land use required to support consumption and regeneration potential, providing a simple but powerful communication tool, but accounting for trade in a simpler way that does not allow for the information to be broken down by commodity or producer country. The Material Footprint estimates the volume of consumption but does not estimate the impacts this consumption is associated with (which may differ in type and severity depending on the type and location of material extraction).

Please see Section 9 of Annex 1 for a more detailed comparison to these other methodologies.

## *Annex 1 – Global Environmental Impacts of Consumption Indicator: metadata sheet*

This metadata sheet has been produced by the Joint Nature Conservation Committee (JNCC) in the style of the metadata sheets prepared by the Secretariat for proposed headline indicators for the post-2020 global biodiversity framework.

***Indicator metadata sheet v2.0***

1. **Indicator name**

Global Environmental Impacts of Consumption <https://www.commodityfootprints.earth/>

1. **Date of metadata update**

September 2022

1. **Goals and Targets addressed**

**3.a Goals**

**Principal Goal addressed: Goal A.**

**Other Goals addressed: Goal B & Goal D.**

**3.b Target**

**Principle Target addressed: Target 16.**

**Other Targets addressed: Target 8, Target 14 &Target 15.**

1. **Rationale**

This indicator is directly relevant to Target 16. Unsustainable overconsumption of food and other materials is linked to significant production-related environmental impacts, such as deforestation, land use change, biodiversity loss and water stress. Consumers are often far removed from these impacts, at the other end of supply chains which may span many different countries. This makes it difficult for individuals, companies, Governments and other actors to make responsible choices and have access to relevant information about the environmental impacts of their consumption. Furthermore, impacts may differ in their severity depending on the type and location of material extraction and/or resource use, meaning that quantifying material dependencies (i.e., Material Footprint indicators) is insufficient to understand sustainability-linked impacts linked to consumption activities. This indicator provides information on the estimated tropical and subtropical deforestation, biodiversity loss and scarcity-weighted water use associated with a country’s consumption of agricultural commodities. Results can be broken down by the commodity associated with the impact, and by the country in which production of the commodity is taking place. The tropical deforestation and biodiversity loss aspects of the indicator also support assessing progress towards Goal A, and the possibility of using it to identify hotspots of risk to potentially direct overseas support/intervention could also be of use to Goal D. The indicator also supports: Target 8 through inclusion of data on greenhouse gas emissions relating to land use and land-use change (LULUC) impacts of consumption; Target 14 through the assessment of environmental impacts at all levels of government and across a range of sectors of the economy; Target 15 through its ability to triage/support activities at private sector level.

1. **Definitions, concepts and classifications**

**5.a Definition:**

**Biodiversity loss:** Data are currently available for two separate biodiversity metrics that were published as part of the initial data release (October 2021). Work is ongoing to identify the most appropriate biodiversity metric for use in this context, and future updates may use updated methodologies (i.e., additional or different metrics to the current two). One of the two metrics for which data are currently available uses crop- and country-specific characterisation factors, provided by Chaudhary and Kastner (2016), which are used to estimate the impact per tonne of production for 152 crops/crop groups in 171 territories. **Unit:** *Number of species per ecoregion committed to extinction.* The other method uses MAPSPAM data alongside species richness information from the International Union for the Conservation of Nature (IUCN) and BirdLife International to estimate ‘species richness-weighted extent of crop production’. This represents the hectares of crop production scaled by the number of species present in that hectare, and therefore where there is overlap between production and areas of biodiversity importance. **Unit:** *Species-weighted hectares.*

**Scarcity weighted water use:** Water footprints were estimated from the Water Footprint Network baseline data, which is annualised to account for changes in crop yields over time. To account for water scarcity in regions of production, blue (irrigated) water consumption was then scaled by water availability in a region after human and aquatic ecosystem demand has been met, using conversion factors sourced from Boulay *et al.* (2018). **Unit:** *Cubic metres.*

**Tropical and subtropical deforestation:** Deforestation data from the Pendrill *et al.*, 2020 dataset are used to proportionally attribute a consumption country’s deforestation impacts based on the volumes of each commodity the country consumes from each production country. The Pendrill deforestation definition is based on observed forest loss, from remote sensing data (from GLAD/Hansen - at 30m resolution, with a threshold of 25% canopy cover used to define forest, and complete loss per pixel defined as ‘forest loss’). A land balance model (described in Pendrill *et al.*, 2019, a, b) is used to attribute deforestation to commodity production. Updated versions of the Pendrill dataset will be used in the annual indicator updates. The project team are also scoping out the possibility of combining this with other data sources in future, in order to provide data for deforestation beyond just tropical and subtropical deforestation. **Unit:** *Hectares.*

**Note:** The indicator also presents data on mass (tonnes), land use (hectares), water use (m3), GHG emissions associated with tropical deforestation (tCO2), but a shortened, simplified set is presented here for use as a headline indicator for monitoring progress towards the post-2020 global biodiversity framework. Further information on these other impact types is available from the [dashboard](https://commodityfootprints.earth/) and the [technical documentation](https://hub.jncc.gov.uk/assets/91efc19d-f675-426f-9333-ed0195cc729d).

**5.b Method of computation**

Full technical information providing all relevant details about how the indicator is calculated is available: <https://hub.jncc.gov.uk/assets/91efc19d-f675-426f-9333-ed0195cc729d>

In brief, the indicator is based on a modified form of MRIO (multi regional input-output) modelling, which is used to model global trade flows representing the monetary inputs and outputs across different countries/territories and their commercial sectors (e.g., oilseeds, cattle farming, paddy rice, etc.). The MRIO data used for this indicator were from [Exiobase](https://www.exiobase.eu/) (although the addition of other MRIO datasets is being explored for the work aiming to expand consumption country/territory coverage). The MRIO data are hybridised with [physical production and trade data](https://www.fao.org/faostat/en/) (tonnes of each commodity) from the Food and Agricultural Organisation, using the Stockholm Environment Institute’s IOTA (Input Output Trade Analysis) modelling framework ([Croft *et al*., 2018](https://doi.org/10.1016/j.jclepro.2018.08.267)). The modelling framework allows for an estimation of the producer country/territory of a commodity, accounting for cases where commodities are embedded within other products as an ingredient or input, and cases where commodities are re-exported through multiple countries before the point of consumption. The main advantages of the hybridisation process are that it provides greater regional and commodity specificity and resolution to the modelling framework than standard MRIO approaches, and full supply chain coverage compared to typical bilateral trade data allow, which are critical for understanding consumption-driven environmental impacts that are highly product and place specific.

These data are then combined with datasets linking commodity production to environmental impacts within relevant production countries. For biodiversity loss, these are currently data from Chaudhary and Kastner (2016) for the species loss metric, and data from [MAPSPAM](https://www.mapspam.info/), [Birdlife International](http://datazone.birdlife.org/species/requestdis), and the [International Union for the Conservation of Nature](https://www.iucnredlist.org/) for the species weighted hectares metric. For scarcity weighted water use, this is based on data from the [Water Footprint Network](https://waterfootprint.org/en/) and Boulay *et al.* (2018). For tropical deforestation, this is currently the Pendrill *et al*., 2020 dataset (due to be Pendrill *et al*. 2022 for the 2022 update, and may be combined with other datasets after this point to enable reporting on all forest types, not just tropical deforestation).

The IOTA framework is designed to be ‘modular’ so that alternative datasets (e.g. alternative MRIO models, alternative environmental indicators) can be utilised to extend analysis and allow intercomparison across datasets. Importantly, subsets of the data framework can also be interrogated to allow commodity and/or trade-pathway specific analysis of connections between production and consumption.

**5.c Data collection method**

National authorities from countries included in the consumption dataset can use the data to report on their impact directly as provided – free of charge - via <https://commodityfootprints.earth/> which is due to be updated annually in late autumn.

The data is designed to be reported on as several separate metrics (one for each impact type) – they do not combine together to give a single total. We recommend that for CBD purposes, this should include a suite of the ‘Predicted species loss,’ ‘Scarcity-weighted water use’ and ‘Deforestation’ metrics (with ‘Deforestation’ considered an optional indicator while only tropical data is available, but to be included by all if data on all forest types become available). As an optional extra, some authorities may also wish to report against the full range of other metrics possible to select from the drop-down menu of the dashboard.

Select the drop-down menus so that the panel at the top reads “Visualise the [impact type of interest] associated with [your country]’s consumption.” Ensure the filters in the “more filters” section are all left as their default (i.e. no entry in the Producing country/territory or Commodity boxes, the Year can be set to anything and Domestic flows should be set to “Include”). Scroll down to the graph entitled “Total per year” for a visual representation of your national indicator and click on “Data” at the bottom right of this graph to obtain the summary data that make up the headline national indicator results.

After obtaining data for a national indicator, users may also wish to explore the detail of the dashboard in terms of which commodities and geographies are contributing most to the total values, in order to better inform discussions around targeting solutions.

If your country is not on the current list in the consumption country/territory drop-down, you will need to identify which of the ‘rest of world’ regions your country falls into (RoW Africa, RoW Asia and Pacific, RoW America, RoW Europe, RoW Middle East) and use this coarser data as a proxy at this stage. We are continuing to develop the dashboard and plan for the 2023 release to have data for at least 120 countries/territories and 20 rest of world regions.

An example of where these data have already been used in the context of a national indicator can be found at <https://jncc.gov.uk/our-work/ukbi-a4-global-biodiversity-impact/>. If you would like further assistance, or have questions about the development or use of data for national indicator purposes, please contact info@commodityfootprints.earth

**5.d Accessibility of methodology**

The indicator methodology and underlying data are published at: <https://hub.jncc.gov.uk/assets/91efc19d-f675-426f-9333-ed0195cc729d> and <https://commodityfootprints.earth/#data> These were produced following the UK’s Code of Practice for Statistics and the relevant review processes required by this. Croft *et al.,* 2018 provides a peer-reviewed methodological summary of the core techniques used to generate this data. Additional articles linked to indicator development, intended for peer-reviewed publication, are under preparation.

Much of the underlying methodology that is brought together into the overall indicator framework (Croft *et al.,* 2018; Pendrill *et al.*, 2019 a,b; Chaudhary and Kastner, 2016; Boulay *et al.*, 2018) has been published in peer reviewed journals (see references section).

**5.e Data sources**

Initial data are available now from <https://www.commodityfootprints.earth/>. It is planned that the indicator will continue to undergo development over the next two years. This development will include improving understanding of which biodiversity metric(s) and data are most appropriate to combine with the economic data (i.e., the current metrics of species loss and species weighted hectares may change) and further disaggregation of ‘rest of world’ regions to national level data. It will also include exploring the potential to add data from all forest types (to be able to report on deforestation beyond that in tropical areas), further sectors (e.g. metals / mining), further metrics (e.g. N and P pollution) and finer geographic resolution production data (to improve accuracy). There is a time lag in the data due to the underlying economic data, with the latest year available at the point of publishing in 2021 being 2017 (2018 data are due to be made available in the 2022 update). The indicator will be updated annually.

**5.f Availability and release calendar**

A global dataset, providing indicator data for 44 countries/territories and 5 ‘rest of world’ regions (aggregations of remaining countries), is available from <https://commodityfootprints.earth/> Development work to update this to include at least [120 countries/territories and 20 ‘rest of world’](https://www.gtap.agecon.purdue.edu/databases/regions.aspx?version=9.211) regions is underway. Underlying data that feed into this dataset is available from the sources listed in sections 5 a and b of this metadata sheet.

**5.g Time series**

Data are currently available for 2005-2017, with 2018 data due to be published in the 2022 update.

**5.h Data providers**

Data provided at <https://commodityfootprints.earth/> is produced by the [Stockholm Environment Institute at the University of York](https://www.sei.org/centres/york/) and the [Joint Nature Conservation Committee (a UK government agency)](https://jncc.gov.uk/). Development work was funded and commissioned by [Defra](https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs), with additional support given towards the dashboard by the [Trade Hub](https://tradehub.earth/) and [Trase](https://www.trase.earth/).

**5.i Data compilers**

Compilation and reporting at the global level is conducted by the [Stockholm Environment Institute at the University of York](https://www.sei.org/centres/york/) and the [Joint Nature Conservation Committee (a UK public body)](https://jncc.gov.uk/). Relevant national authorities can use the data available at <https://commodityfootprints.earth/> to compile national reports.

**5.j Gaps in data coverage**

**Geographic:** Currently, data are available for 44 countries/territories from a consumption perspective (although all countries/territories as recorded by FAO are available from a production perspective). Data are also available for 5 ‘rest of world’ regions, consisting of aggregates of remaining countries. Development work to update this to include at least 120 countries/territories and 20 ‘rest of world’ regions in the 2023 release is underway.

**Commodity coverage:** For the biodiversity loss and scarcity weighted water use metrics, data are only available forcrop commodities. For the deforestation metric, data are available for crop commodities, timber and cattle related commodities. The potential for adding metals and mineral, and marine commodities is being explored but to date remains a data gap.

**Metric types:** There are many different types of environmental impact from unsustainable consumption that affect biodiversity, beyond deforestation, biodiversity loss and water stress. Data are also available from the dashboard on tonnes of production, land use, water use, and GHG emissions associated with tropical deforestation. However, other impact types, especially those most associated with intensive agriculture, such as nitrogen and phosphorous pollution, are not currently included. Development work to explore adding such metrics in future is planned. Exploration of the addition of data to extend the deforestation metric to include deforestation taking place in non-tropical areas is also planned. A major advantage of the data framework is its retention of commodity-specificity which means that appropriate commodity-level indicators (important to reflect the heterogeneous nature of production processes and impacts across products) can be relatively easily integrated to extend coverage of environmental impacts.

**5.k Treatment of missing values**

For production and trade data, data gaps are left blank. In many cases, this is due to a combination of not knowing if “gaps” are really gaps or whether they genuinely represent zero trade. For production, this means that in such cases, no production/impacts are assigned to a given commodity/country pairing. Within the trade data, there are some cases where no trade data are present, but it is known that, in reality, trade takes place because some countries might not report their trade data fully.

Currently these are just left blank, and the MRIO is used to estimate all trade in these cases. In future, it will be possible to utilise additional trade data and methodologies to “reconcile” the trade data and fill these gaps, e.g., by combining export and import records. This was beyond the scope of the initial release but is an active area of current development.

Whilst not all countries are explicitly covered within the MRIO (44 individual countries are currently represented within EXIOBASE), any remaining countries are represented within one of five “Rest of World” regions, and therefore their supply chains (from a producer, intermediary and consumption perspective) are captured and considered, albeit at reduced geographic resolution.

Details on how the data are captured, and how some missing values are imputed, in the underlying production and trade datasets from FAO can be found here: <https://fenixservices.fao.org/faostat/static/documents/QCL/QCL_methodology_e.pdf> and <https://fenixservices.fao.org/faostat/static/documents/TM/TM_e.pdf>

Detail on the production of the EXIOBASE MRIO utilised can be found here: <https://onlinelibrary.wiley.com/doi/10.1111/jiec.12715>

For the environmental indicators themselves, different approaches are adopted in the cases of data gaps, as explained below:

* Cropland area harvested: where no data are available, entries are left as zero value.
* Deforestation and associated emissions: where no data are available, entries are left as zero value.
* Water footprint and scarcity:
	+ If annualised data for a country/commodity are missing, a value is adopted from a “nearest neighbour” within ten angular degrees.
	+ If none is available, non-annualised data are adopted for the focal country, and if not available again from a nearest neighbour within ten angular degrees.
	+ If this yields no value, a global average for the crop from the original reference period is adopted.
	+ If no global average is available, the entry is left blank.
	+ Across all of these stages of data substitution, values are only adopted if data are available for both blue and green water.
* Biodiversity – predicted species loss: where no data are available, entries are left as zero value.
* Biodiversity – species richness weighted hectares: where no data are available, entries are left as zero value. However, application of this indicator depends on land use data, so if no land area data are available within FAOSTAT for a given country/commodity/year, an estimate is derived from global average yields.
1. **Scale**

**6.a Scale of use**

Data are provided at national/regional scale, but with global coverage. For 44 countries/territories, data have been disaggregated for national/territorial use, while other countries are aggregated into five ‘rest of world’ regions. Future development should allow for disaggregation for at least 120 countries/territories, and 20 ‘rest of world’ regions in the 2023 data release.

**6.b National/regional indicator production**

The global dataset is presented with national/territorial disaggregation built in already for 44 countries/territories (with further development allowing for expansion to at least 120 countries/territories), and other countries grouped regionally into several ‘rest of world’ regions. These data can be accessed directly from <https://commodityfootprints.earth/>.

The data are already in use as a national indicator for the UK (UK Biodiversity Indicator A4: <https://jncc.gov.uk/our-work/ukbi-a4-global-biodiversity-impact/>).

Work to explore the downscaling of the indicator for potential reporting at subnational scale is also underway.

**6.c Sources of differences between global and national figures**

N/A – the global total would be a sum of the national totals and the ‘rest of world’ region totals.

**6.d Regional and global estimates & data collection for global monitoring**

*6.d.1 Description of the methodology*

*6.d.2 Additional methodological details*

No weighting applied – the global total would simply be produced by summing the national totals and the ‘rest of world’ region totals.

*6.d.3 Description of the mechanism for collecting data from countries*

N/A

N/A

1. **Other MEAs, processes and organisations**

Data are collected by the Stockholm Environment Institute at the University of York and the Joint Nature Conservation Committee (a UK public body) from internationally published data sources as described in sections 5 a and b of this metadata sheet. National authorities can collect the analysed data directly from <https://commodityfootprints.earth/>

**7.a Other MEA and processes**

No

**7.b** **Biodiversity Indicator Partnership**

No

1. **Disaggregation**

**Geographic (consumption perspective):** 44 countries/territories and 5 rest of world regions (with further development work planned to bring the total to at least 120 countries/territories and 20 rest of world regions).

**Geographic (production perspective):** 197 countries/territories for most metrics presented, although currently fewer for the deforestation metric.

**Commodity breakdown:** 162 commodities for the deforestation metric, 160 commodities for the biodiversity loss and scarcity weighted water use metrics.

1. **Related indicators**

The Global Environmental Impacts of Consumption indicator is not the only indicator available relating to the sustainability of consumption. Other indicators that have been proposed as part of the CBD framework include the Material Footprint and the Ecological Footprint. There are two broad needs behind sustainable consumption indicators: estimating the impacts associated with consumption and informing action to try and manage these impacts. Whilst all three indicators meet the first of these needs, the Global Environmental Impacts of Consumption indicator is the only one that is also able to inform detailed action, through provision of a breakdown of total impacts by producer country/territory and by the commodity associated with the environmental risk. This specificity is critical to plotting a route to sustainable production and consumption, as it provides a tangible linkage to supply chain activities and traded commodities. This section outlines key differences between the three indicators.

*What is each indicator measuring?*

* *Global Environmental Impacts of Consumption indicator:* estimates specific impact types such as biodiversity loss, scarcity-weighted water use and deforestation
* *Material Footprint:* estimates the *volume* of consumption, but does not estimate the *impacts* this consumption is associated with (which may differ in type and severity depending on the type and location of material extraction)
* *Ecological Footprint:* estimates land use required to support consumption and regenerative potential ("the demand on and supply of nature”)

*How easy-to-communicate is each indicator?*

* *Global Environmental Impacts of Consumption indicator:* data is provided on a free, practical, and easy-to-use interactive dashboard. The detail available provides the necessary information for those taking action to manage impacts.
* *Material Footprint:* volume of consumption is a simple concept but does not give the user meaningful insight into the impacts this is associated with. Data provided as one of the Sustainable Development Goal indicators.
* *Ecological Footprint:* Strong communication tool; calculates the number of earths it would take to support humanity’s demand compared to how much the planet is able to renew, which is likely to strongly identify with a broad audience. Data is also provided on a free interactive dashboard.

*How can each indicator be used to inform action?*

* *Global Environmental Impacts of Consumption indicator:* able to break down estimates of total consumption impacts in each consumer country/territory analysed, by how much of this impact takes place within each producer country/territory of the world, and how much of the impact is associated with each type of commodity. This could be used to inform policy levers such as negotiations as part of free trade agreements, and provision of investment spending towards innovation or implementation of sustainable solutions through aid. Such levers would be mutually beneficial, as any two trading partner countries will have an interest in ensuring that their supply from the other is resilient into the future and will not be disrupted due to environmental impacts or lost regenerative potential. The analytical framework used to generate the indicator can also be interrogated to understand the detail of supply chain/trade-linkages.
* *Material Footprint and Ecological Footprint:* Not possible to break the data down beyond a total for each consumer country. Can encourage action around consuming less overall, but not targeted action such as trade and aid.

*How much of the economy does each indicator cover?*

* *Global Environmental Impacts of Consumption indicator:* currently restricted to agricultural crop products (although the deforestation metric also includes cattle related commodities and timber). The current commodity scope allows for the detailed interrogation of impacts on a commodity-by-commodity basis, and further developments may allow for the addition of metals and minerals, marine and other sectors.
* *Ecological Footprint:* covers agriculture, forestry, fisheries and infrastructure.
* *Material Footprint:* covers the whole economy.

**9. Related indicators (continued)**

*How is trade accounted for in each indicator?*

* *Global Environmental Impacts of Consumption indicator:* uses a modified version of MRIO to model global trade flows, which includes additional physical production and trade data. As well as enabling the data to be broken down by producer country as described in the previous paragraph, this improves the accuracy of the indicator given that the impacts it assesses, such as biodiversity loss, vary considerably across geographies. Estimating production location in this manner is essential to effectively link consumption to the impact datasets
* *Material Footprint:* also based on MRIO, but not the modified version that includes additional physical production data (so trade is estimated at a coarser spatial resolution)
* *Ecological Footprint:* simply subtracts total exports from total imports plus total production (although more complex paid-for versions are also available)

What limitations are common to all three indicator*s*?

* Data tracing exact supply chains at a global scale are not publicly available. Any indicator relating to the sustainability of consumption is therefore reliant on modelling and assumptions.
* All three indicators have a data lag, with the most recent data available currently 2017 for the Global Environmental Impacts of Consumption indicator (due to update to 2018 in October 2022), 2018 for the Ecological Footprint as reported on their Open Data Platform, and 2017 for the Material Footprint as reported on the SDG website.

*Conclusions*

Overall, the Global Environmental Impacts of Consumption indicator may be of most use in applications relating to informing actions that governments can take to reduce the impacts associated with their country’s consumption and ensure resource security, and the Ecological Footprint may be of most use in applications relating to communication with the public to illustrate the scale of consumption as a problem.

1. **Data reporter**

**10.a Organisation**

Joint Nature Conservation Committee and Stockholm Environment Institute (University of York)

**10.b Contact person(s)**

Chris West and Simon Croft: info@commodityfootprints.earth

Maddie Harris: ukglobalimpacts@jncc.gov.uk

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Additional references to underlying data are provided within the technical documentation.

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2. [CBD/ID/OM/2022/1/2](https://www.cbd.int/doc/c/3190/c3f4/1d9fe2d2dedc8c8b97023750/id-om-2022-01-02-en.pdf): Report of the expert workshop on the monitoring framework for the Post-2020 Global Biodiversity Framework [↑](#footnote-ref-2)