European Commission

JRC SCIENTIFIC INFORMATION SYSTEMS AND DATABASES REPORT

EU Bioeconomy Monitoring System dashboards: extended with trade-related indicators

Status and technical description as of December 2022

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Contents

Abstract

This document describes the progress made in 2022 for the development of the EU Bioeconomy Monitoring System. It contains an overview of the purpose of the system, its current status and future outlook for 2023. Technical details of the back-end and front-end are also provided. This is the third of an annual reporting scheme to document and inform the public of the progress in building the EU Bioeconomy Monitoring System.

Acknowledgements

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We would like to give particular thanks to the Knowledge Centre for Bioeconomy Coordination Team for their technical support in the implementation of the EU Bioeconomy Monitoring System within the Knowledge Centre for Bioeconomy pages.

We acknowledge all the contributors to the content of the EU Bioeconomy Monitoring System.

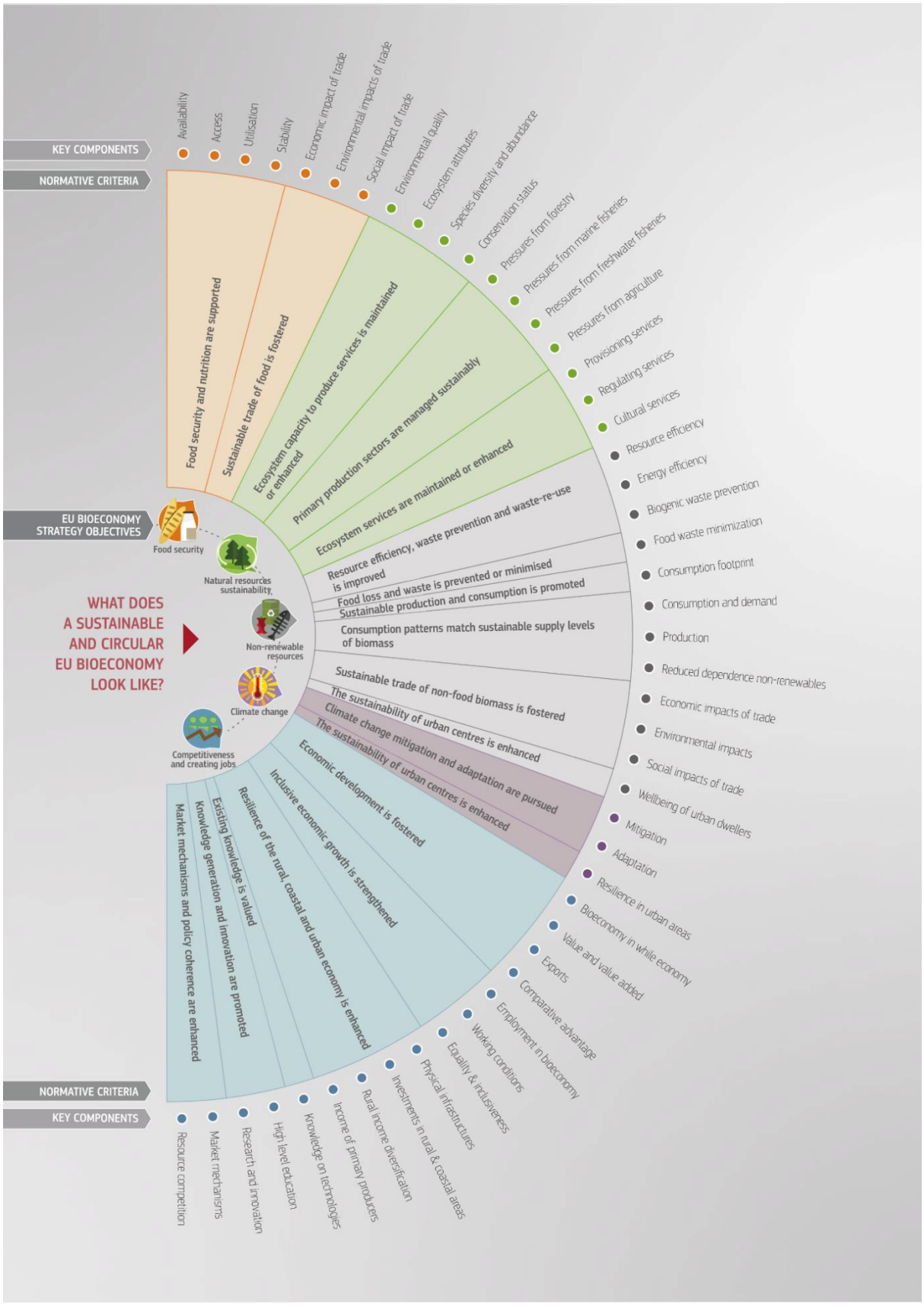
The EU Bioeconomy Monitoring System: summary of progress

The development of the EU Bioeconomy Monitoring System (BMS) is pursuant to the Action 3.3.2 of the EU Bioeconomy Strategy (COM/2018/673). It addresses the need for a comprehensive monitoring system by establishing a mechanism to measure the progress of the EU bioeconomy towards the five strategic objectives it tackles. It defines and implements a comprehensive monitoring framework for the EU bioeconomy and relates to the overarching Sustainable Development Goals (SDGs) context.

The BMS was officially launched in November 2020. This document describes the back-end and front-end system design as well as the content of the BMS dashboards embedded in the Knowledge Centre for Bioeconomy (KCB) at the location https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring. It reports on the status as of December 2022 and the progress of development through the number of indicators published with respect to the number of planned indicators within the BMS framework.

The conceptual framework of BMS consists of four levels. As shown in Figure 1, the highest level is that of the EU Bioeconomy Strategy objectives themselves. Each of these is broken down into normative criteria, which in turn are broken down into key components. The indicators are then assigned to the level of the key components. This hierarchical design allows for a logical aggregation of indicators for higher-level indicators to be developed.

Figure 1. Conceptual framework of the EU Bioeconomy Monitoring System



7 new indicators have been added to the BMS dashboards in 2022. These indicators are related to objectives 1 (ensuring food and nutrition security), 2 (managing natural resources sustainably), 3 (reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad) and 5 (strengthening European competitiveness and creating jobs), closing 3 gaps at the level of key components and 2 at the level of normative criteria. A new indicator related to objective 4 (mitigating and adapting to climate change) has not been added in 2022.

At the end of 2022, roughly 64% of the indicators that were already included at the end of the previous year have been updated and published with the latest available data. The dashboards show almost 30% of the indicators to be eventually included in the platform, covering 67% of all normative criteria and 52% of all key components.

Table 1 reports indicators that have been added or updated in 2022, including the date they have been added or from which their latest version is available on the platform.

Table 1. New and updated indicators of 2022

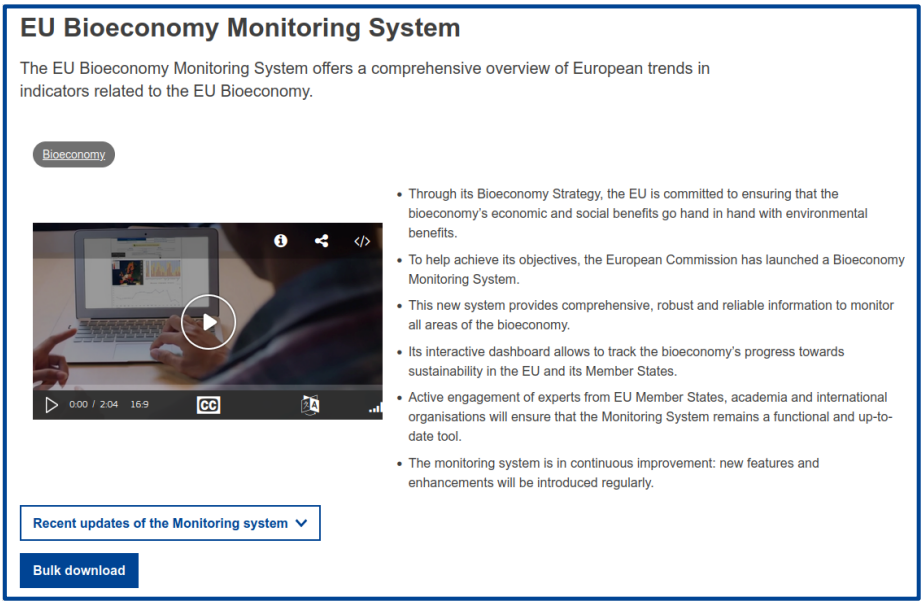
Indicator id	Indicator	Added	Updated	Latest version
1.1.a.1	Agricultural factor income per annual work unit (AWU)		X	16/02/2022
1.1.a.4	Total biomass supply for food purposes, including inputs		X	17/10/2022
1.1.a.5	Biomass directly consumed by EU citizens as food	X		17/10/2022
1.1.b.1	Prevalence of moderate or severe food insecurity in the total population, yearly estimates		X	17/10/2022
1.1.b.3	Food purchasing power	X		24/02/2022
1.1.d.1	Government support to agricultural research and development (by sector)	X		28/02/2022
2.1.b.4	Share of organic farming in utilised agricultural area		X	16/02/2022
2.1.b.5	Livestock density index	X		04/03/2022
2.1.e.1	Surface of marine and terrestrial sites designated under NATURA 2000		X	17/10/2022
2.2.a.1	Ratio of annual fellings (m3/ha/year) to net annual increment (m3/ha/year)		X	23/03/2022
2.3.a.1	Biomass production in EU from primary production systems (agriculture, forests, fisheries)	X		17/10/2022
2.3.a.2	Roundwood removals		X	27/05/2022
3.1.a.1	Domestic Material Consumption (Biomass)		X	01/08/2022
3.1.a.2	Material Footprint (Biomass)		X	17/10/2022
3.1.b.1	Energy productivity		X	16/02/2022
3.1.b.2	Share of renewable energy in gross final energy consumption		X	16/02/2022
3.1.c.1	Cascade use of wood resources		X	14/06/2022
3.1.c.2	Circular material rate		X	16/02/2022
3.1.c.5	Biowaste generated by source		X	20/10/2022
3.1.c.6	Biowaste recovered by source		X	20/10/2022
3.2.a.1	Food waste along supply chain - mass balance approach		X	18/11/2022
3.2.a.2	Food waste by food category - mass balance approach		X	18/11/2022
3.4.a.2	Total biomass consumed for energy		X	17/10/2022
3.4.a.3	Total biomass consumed for materials		X	17/10/2022
3.4.a.4	Share of woody biomass used for energy		X	27/05/2022
3.5.a.1	Economic impact of trade in exporting countries (to EU)	X		22/12/2022
5.1.a.2	Value Added per sector / Bioeconomy value added		X	29/04/2022
5.1.a.5	Gross value added per person employed in bioeconomy		X	31/10/2022
5.1.b.1	Turnover in bioeconomy per sector		X	20/10/2022

5.1.b.2	Value-added per sector		X	20/10/2022
5.2.a.1	Persons employed per bioeconomy sectors		X	29/04/2022
5.6.b.1	Share biomass used by primary sector	X		17/10/2022

Bulk download functionality

New functionality has been added to the main page of the BMS: it is now possible to download the data of all the indicators available on the platform and the associated metadata using a dedicated button (Figure 2). This tool allows further analysis for the users of the platform.

Figure 2. The bulk download button on the main page of the EU Bioeconomy Monitoring System



Trade-related indicators

A trade-related indicator "Economic impact of trade in exporting countries (to EU)" of id 3.5.a.1 was added in 2022. This indicator provides a quantification of how the economies of non-EU countries depend on exports of bioproducts to the EU-27 Member States. It is expressed both in absolute terms, as the monetary trade volume exchanged between a country and the EU-27 and in terms of share, dividing the monetary trade volume by the gross domestic product (GDP) of the exporting country. Values are grouped into 5 categories of bioeconomy products: primary crops, livestock, fish, plants and timber. The total of these categories is also provided.

The calculation of another trade-related indicator "Social condition in exporting countries (to EU)" of id 3.5.c.1 has also been initiated, yet its development is not complete yet.

New headline indicators page

A new headline indicators page has been developed. The page has five sections for which one or more headline indicators are defined. These five sections are ecosystem condition, primary production systems, secondary production systems, waste and circularity and trade. The purpose of developing this new page is to represent all components of the EU bioeconomy through headline indicators, which are derived from the indicators defined in the conceptual framework of the BMS. The related indicators are provided as a list next to the visualization of the headline indicator. Each related indicator can be clicked on to navigate to its detailed dashboard.

1 Introduction

This document describes primarily the user interface of the EU Bioeconomy Monitoring System (BMS) as it is nested within the Knowledge Centre for Bioeconomy (KCB) at the address https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en. A list of indicators that are published in the BMS dashboards in 2022, as well as the full list of indicators to be included in the coming years, are also described in this document. The conceptual framework and methodology are further described elsewhere (Giuntoli et al., 2020; Robert et al., 2020). Furthermore, a description of the methods behind each indicator is published on the data owner's websites.

In the first section of this report, we describe the objectives and scope of BMS. We then walk the reader through the user interface, describing the features developed throughout 2022, followed by a description of the back-end and front-end technologies. The metadata of the indicators presently published in the BMS are given in the annexes.

Action 3.3.2 in the 2018 EU Bioeconomy Strategy related to the development of an EU bioeconomy monitoring system as described in COM/2018/673, states the need to increase observation, measurement, monitoring and reporting capabilities and build an EU-wide, internationally-coherent monitoring system to track economic, environmental and social progress towards a sustainable bioeconomy, which addresses the need for a comprehensive mechanism by which to measure the progress of the EU bioeconomy towards it's five strategic objectives. A comprehensive monitoring framework for the EU bioeconomy should, according to the description in this action, address economic, environmental and social dimensions of sustainability and relate to the overarching Sustainable Development Goals (SDGs) context. The development and the implementation of the monitoring framework are based on a set of indicators that were selected in a participatory process to provide information on the condition, performance and trajectory of the bioeconomy as a whole—including ecosystems and their services, primary production sectors (forestry, agriculture, aquaculture and fisheries) and bio-based industries—at different levels (systemic and sectorial). See, for example, KCB (2019) and KCB (2020).

Since the time of its release, the BMS provides information on trends and changes over time at the EU-27 (not including the UK), EU-28 (including the UK) and Member State levels for a subset of selected indicators. These do not necessarily provide an explanation for the trends or changes, nor do they imply causal links, however they are the first step in a monitoring system. The full list of indicators planned to be included in the BMS dashboards is given in Annex 3.

In 2023, the JRC will continue to add indicators (currently shown as gaps in Annex 3), for which data are available. Furthermore, there will be a focus on headline indicators in order to provide a comprehensive view of the EU's progress towards a sustainable bioeconomy. In parallel with these activities, the scientific team will publish a report on the trends of the bioeconomy, highlighting a need to refresh the current conceptual framework. A special focus will be made on the global impact of the EU bioeconomy, through the finalisation of the indicators that are related to trade.

The consistency, stability and availability of the BMS dashboards will be guaranteed by the KCB and will be reviewed periodically.

1.1 Objectives of the BMS

The objectives of the BMS are to:

- provide robust indicators whose numbers can be trusted as a reference for bioeconomy-related policy formulation, assessment and evaluation;
- ensure a flexible monitoring system that is conducive to modifications as new data and information become available;
- coordinate with other monitoring frameworks, in the Member States and international organisations (e.g., FAO, OECD);
- identify relevant indicators to gauge the progress and sustainability of the EU bioeconomy both within and outside of the EU;
- minimise reporting burdens on all data providers;
- improve data collection exercises in order to close identified gaps;
- review the framework periodically to ensure it is fit for purpose;

- disseminate the information in a user-friendly way, through dashboards and other dynamic visualisations in the KCB and
- provide underlying data and assumptions behind the indicators, ensuring reproducibility to the best extent possible.

1.2 Expected impacts/outcomes of the BMS

- The design of this framework to monitor the sustainability of the EU bioeconomy in a holistic way could serve as an example for other regions.
- The BMS offers a single entry point for harmonised indicators that are relevant to the EU bioeconomy.
- The action, while monitoring the support of the EU bioeconomy to the five objectives of the EU Bioeconomy Strategy, will indirectly support the preparation and evaluation of the mentioned related EU policies/legislations/instruments that also contribute to addressing similar or shared objectives.
- Monitoring the progress of the EU bioeconomy in a consistent way across the EU will enable better coordination and cooperation at different policy levels, including regional and local scales. Thus, the impact of the monitoring framework may be an improved and consistent basis for better policy decisions at different policy levels.
- Dissemination of the information provided by the monitoring framework will better inform policy and public debates.

2 General description

The BMS is a series of dashboards showing trends in indicators that were selected based on their relevance to the overall EU bioeconomy monitoring conceptual framework, as described in Giuntoli et al. (2020) and Robert et al. (2020), in collaboration with external partners, including experts from the Member States and international organisations through the Community of Practice on Bioeconomy (managed by the KCB) via workshops and online discussions (KCB, 2019; KCB, 2020). This document is the third of an annual reporting scheme to document and inform the public of the progress in building the BMS. See Kilsedar et al. (2021) to access the first two reports.

So far, the indicators that are translated to dashboards are there to highlight temporal trends and comparisons between the Member States and regional averages. They measure the state or condition of sectors and systems that rely on biological resources, their functions and principles and the pressures that might exist on them (so-called output indicators). They consist of a set of indicators to show trends in specific themes that are noteworthy. This layer of indicators includes basic indicators (measurements and indicators from other sources), processed indicators (e.g., special treatment of bio-based sectors within NACE processed by the JRC) and system-level indicators (e.g., LCA, footprint processed by the JRC).

2.1 Editorial committee

The responsible person for the content in the BMS is Sarah Mubareka, JRC D.1. The KCB oversees the overall quality of the content. Any new content of the BMS must be pushed through, and therefore approved by the editorial team of the KCB.

2.2 URL

The EC hosts a permanent URL for the KCB. The BMS is embedded in that at https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en. The breadcrumb is European Commission > Knowledge for policy > Bioeconomy > EU Bioeconomy Monitoring System.

2.3 Security

The JRC Local Informatics Security Officer (LISO) has performed a series of security controls to ensure that the level of security of the data service of the dashboards complies with the EC security policies. Risks and impact assessment for this information system has been successfully passed at the beginning of 2021. A new assessment that involves the entire infrastructure is planned for the next year, following particularly the developments of 2022. A weekly assessment of the security of the servers is automatically performed by the

LISO and issues are solved by JRC Directorare D ICT support. This is further described in the Section Back-end technologies.

2.4 Content

Several actors approved the content before it was put online. The main actors are the JRC webmaster and Directorate-General for Communication (DG COMM). The controllers have given a first opinion of the BMS components within the KCB and the changes they have recommended have been implemented.

2.5 Target user audience

The primary users of the BMS are policymakers at the EU level. This category of users might benefit from the information that is aggregated and interpreted using the scientific knowledge and familiarity with EU policy at the JRC. We also target policymakers at national and regional levels. Other users are EU agencies, researchers and the bio-based industry. The BMS should also cater to EU citizens by providing useful information for curious consumers.

2.6 Description of pages

The main menu items are the following: Headline Indicators, EU Bioeconomy Objectives, Bioeconomy and SDGs and Bioeconomy and Green Deal. The main menu of the BMS dashboards is always present as the KCB frames it.

2.6.1 Headline Indicators

This menu option leads to the main page of the BMS dashboards. The users are presented with an image that has a scenery at the centre surrounded by circles that can be clicked on. The circles represent the headline indicators. Clicking on a circle leads to the display of the chart for the corresponding headline indicator. All the headline indicators belong to a section. In total, there are five sections, which are ecosystem condition, primary production systems, secondary production systems, waste and circularity and trade. The headline indicators each section covers are visually separated from each other by blue lines.

The headline indicators cover all facets of the EU bioeconomy. This page is meant as an entry point to the more detailed datasets in the BMS. It is designed to encourage users with different interests in the targeted audience group (see the Section Target user audience) to go deeper into the indicators of the BMS. This page shows a variety of numbers, sometimes combined so that the users can see the related indicators next to one another.

Next to each headline indicator visualization, a list of one or more related indicators, of which a subset is used to derive the corresponding headline indicator, is placed. Clicking on an indicator in this list leads the user to the dashboard of the clicked indicator, which enables the user to obtain more information on the facet of the EU bioeconomy represented by the headline indicator. See Figure 3, Figure 4, Figure 5 and Annex 2 for more details on the headline indicators.

Figure 3. Landing page of the EU Bioeconomy Monitoring System dashboards

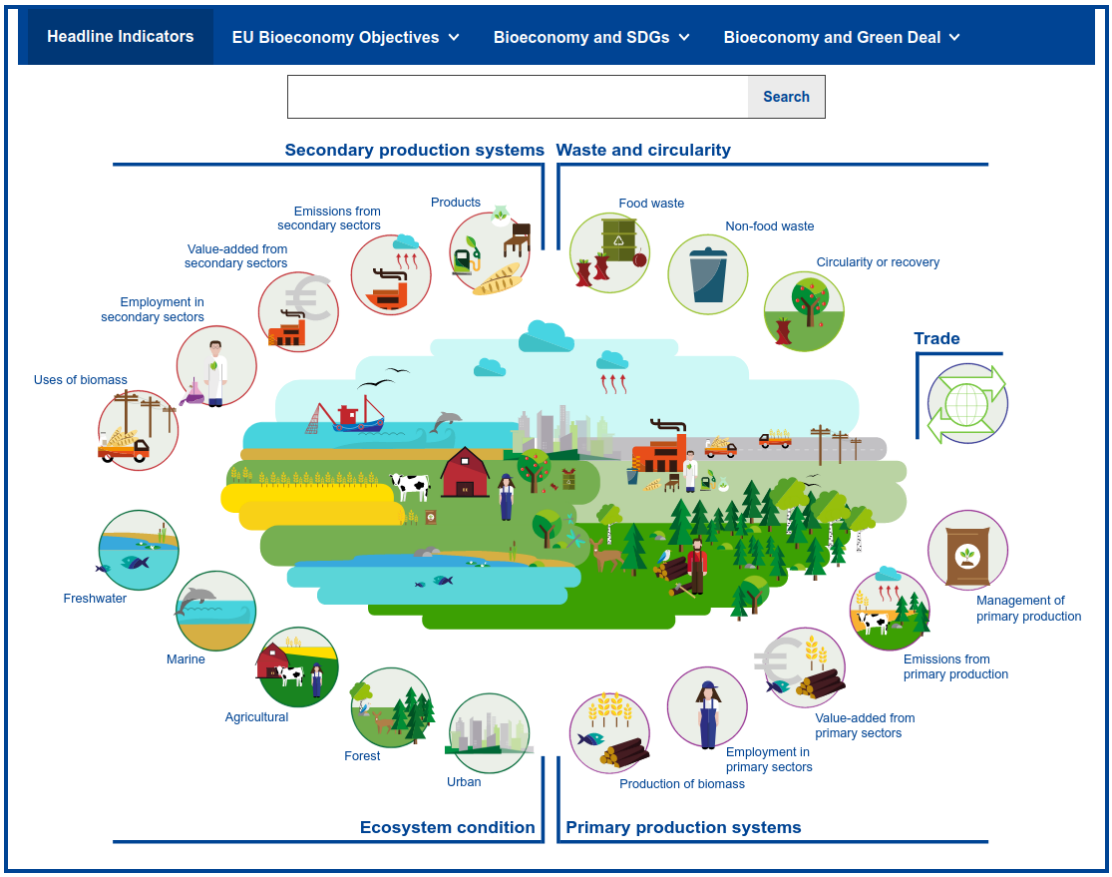


Figure 4. Visualization of employment in primary sectors headline indicator, a part of the primary production systems section

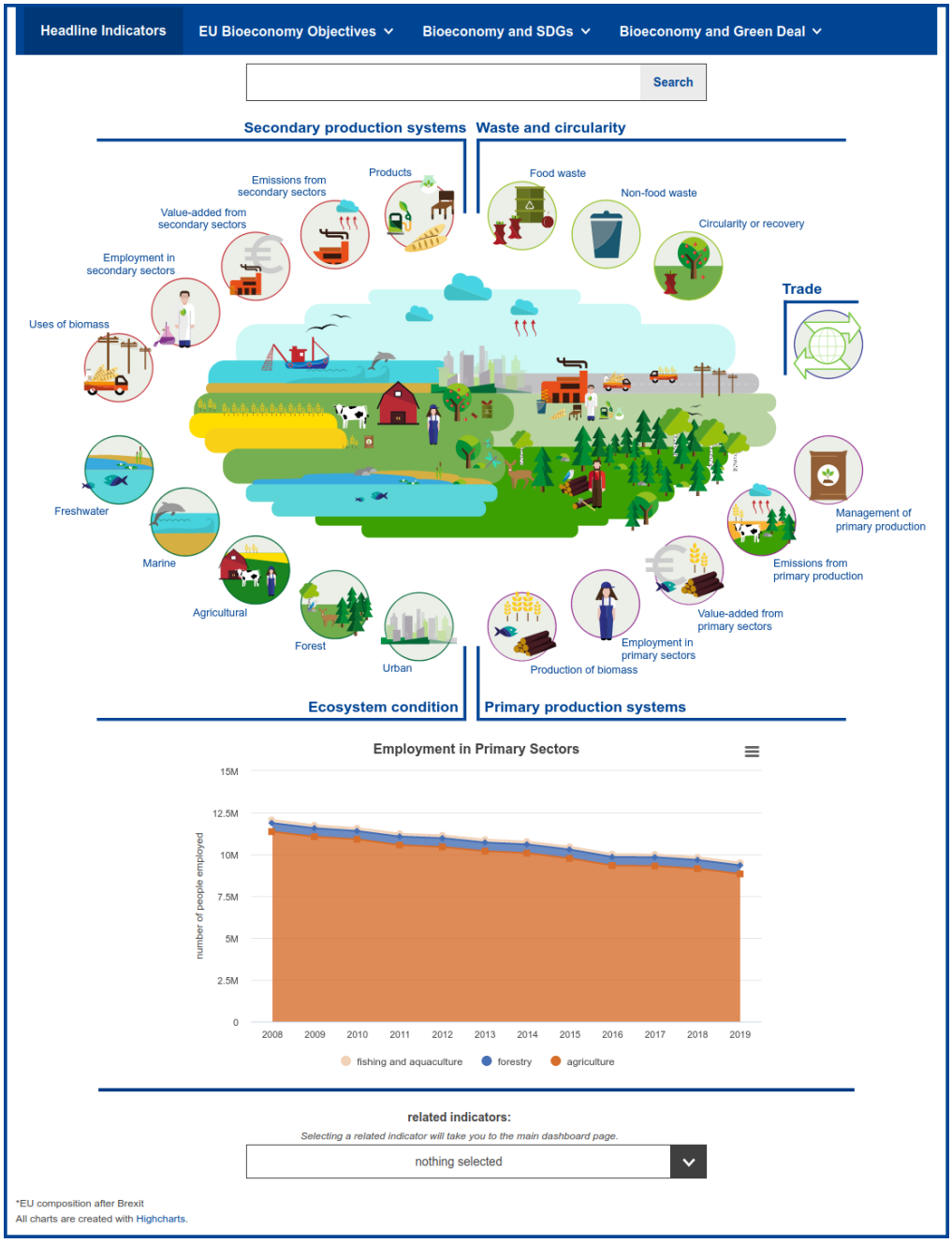
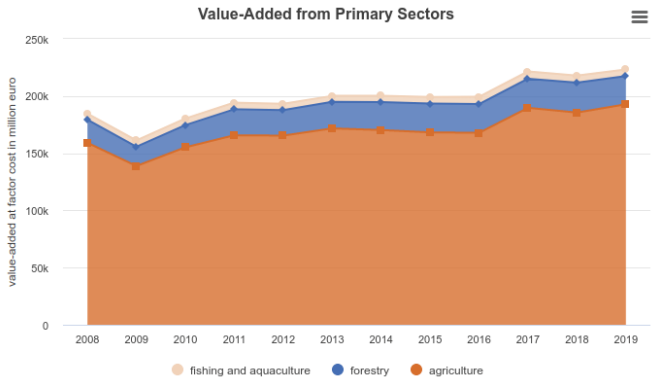
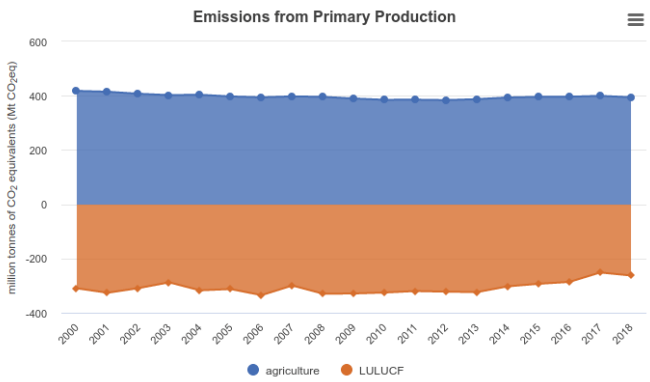


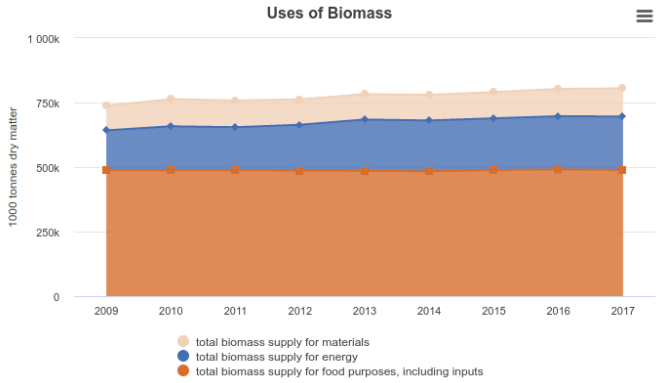
Figure 5. Visualization of the headline indicators that have been developed



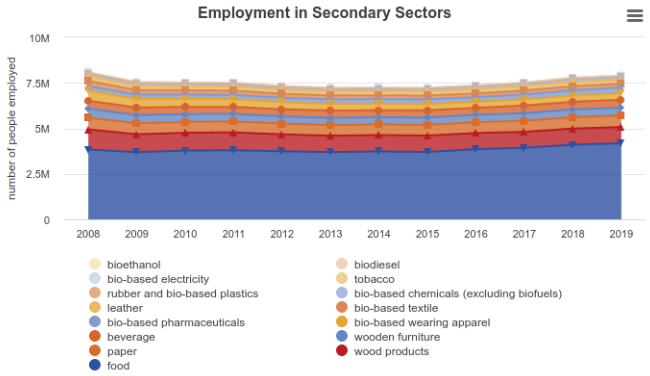
(a) Visualization of value-added from primary sectors headline indicator, a part of the primary production systems section



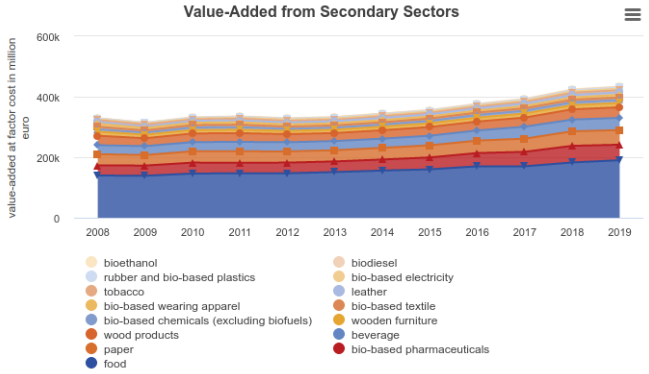
(b) Visualization of emissions from primary production headline indicator, a part of the primary production systems section



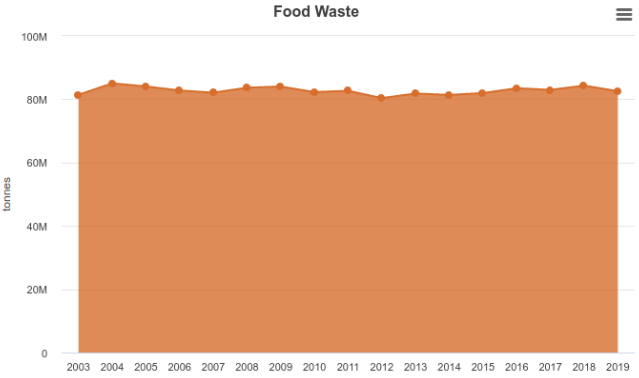
(c) Visualization of uses of biomass headline indicator, a part of the secondary production systems section



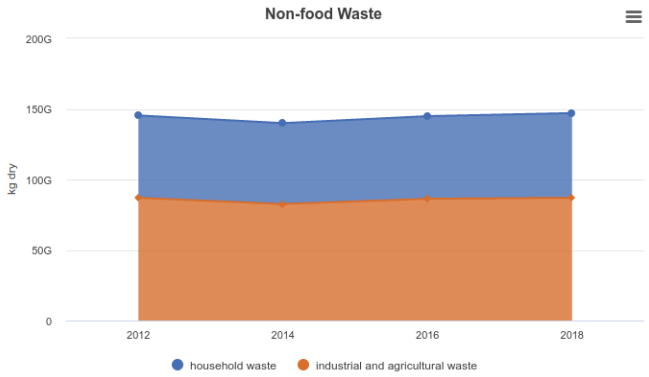
(d) Visualization of employment in secondary sectors headline indicator, a part of the secondary production systems section



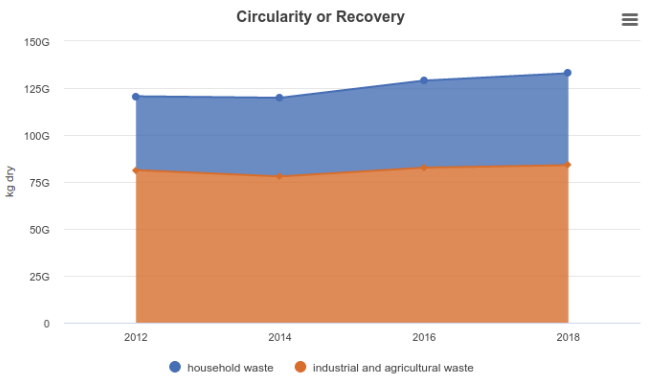
(e) Visualization of value-added from secondary sectors headline indicator, a part of the secondary production systems section



(f) Visualization of food waste headline indicator, a part of the waste and circularity section



(g) Visualization of non-food waste headline indicator, a part of the waste and circularity section



(h) Visualization of circularity or recovery headline indicator, a part of the waste and circularity section

2.6.2 EU Bioeconomy Objectives

The Bioeconomy Strategy objectives are shown in five hexagons representing each of the objectives (Figure 6). The hexagons contain the icons produced for this purpose by the JRC Communications Unit. When the user hovers over a hexagon, the icon is transformed into the EU bioeconomy objective text. The following summarizes the expected sequence of actions a user takes:

1. User clicks on an objective. Then, they are taken to a subpage where all the indicators related to the selected objective are listed.
2. A filter composed of two steps is presented on the page. The first step is the selection of a (a) normative criterion, (b) key component, (c) value chain step or (d) primary production sector.
3. When the user makes a selection, the second step of the filter is activated. The second step provides the user with a list of items that are related to the first selection and the selected objective. Once the user completes the second step of the filtering, the list of indicators is updated.
4. When the user selects an indicator, a dashboard appears in three panes. Pane 1 is a clickable choropleth map showing the relative differences among the Member States based on the quantile classification method. Pane 2 is a column chart showing the same information as in the map but in a column chart in order to facilitate comparability among the Member States. Pane 3 is a line chart showing the trend of the indicator over time. By default, the line chart shows the data for EU-27. Below the line chart, there is a list of clickable Member States so the user may overlay the Member States of interest. The choropleth map and the line chart are linked; if a Member State is selected on the map, it is also shown in the line chart. Only in the case of intensive indicators, the Member States are compared with EU-27 and EU-28 in pane 2, whereas they are always compared with EU-27 and EU-28 in pane 3 if data are available. Some indicators also contain shares, in which case these are represented in all the panes. All three panes are equipped with a mouse-over feature, whereby the exact numbers are shown for the point of interest (i.e., where the mouse is located). For the first two panes, there is a timeline slider; the user may visualise the map and column chart for any point in time along the timeline. The default is the latest year in the available data (Figure 7). Furthermore, some of the metadata of the selected indicator can be accessed by clicking on the information button next to the indicator's name (Figure 8).

Figure 6. Layout for selection of indicators by EU Bioeconomy Strategy objectives

Figure 7. Example of three panes in the dashboards

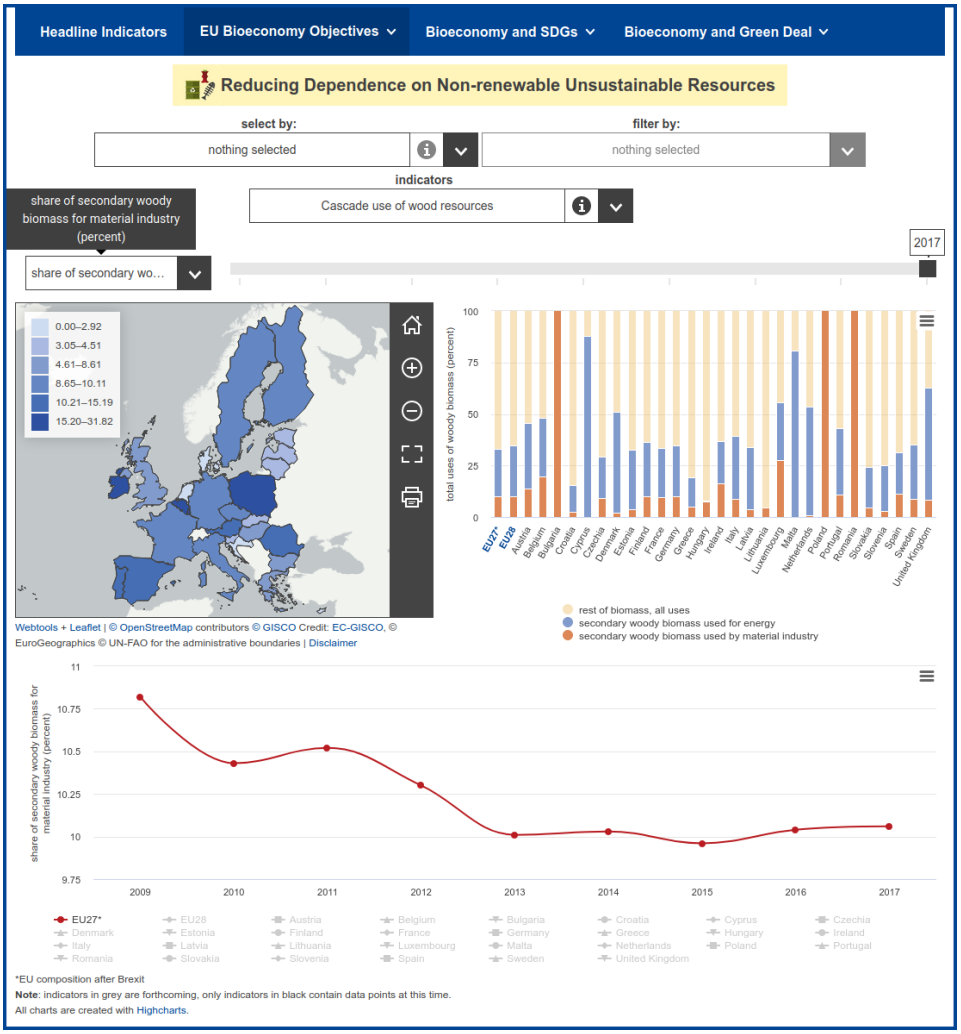
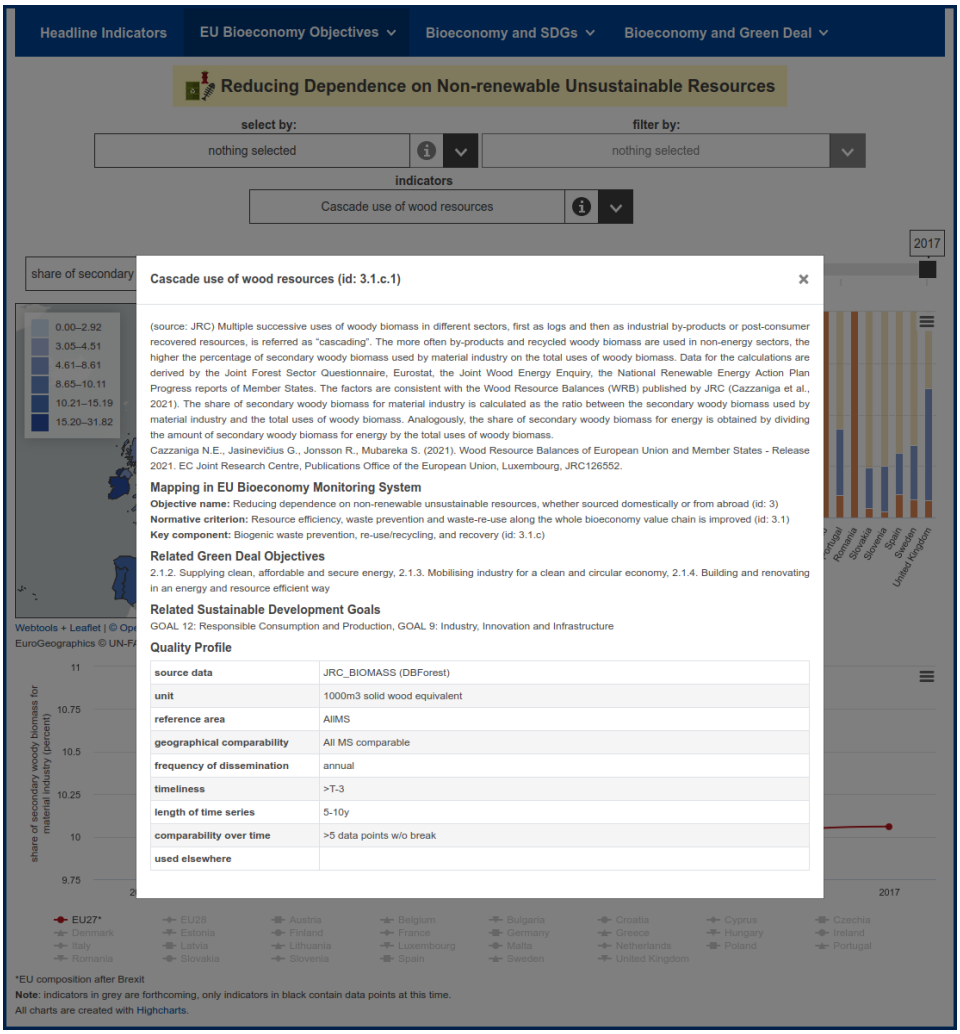


Figure 8. Metadata of an indicator



2.6.3 Bioeconomy and SDGs

This menu item takes the user to a page showing the SDGs in seventeen hexagons representing each of the SDGs (Figure 9). If none of the indicators related to an SDG is added to the dashboards so far or there is not an indicator related to an SDG in the BMS, its corresponding hexagon is greyed out and disabled. As more indicators are added to the dashboards, some of the disabled hexagons will be enabled. When the user clicks on one of the enabled hexagons, they are presented with a list of indicators that are related to that SDG. This option was developed and activated in July 2021. In 2022, SDG 17 has been enabled with the addition of indicator 3.5.a.1.

Figure 9. Layout for selection of indicators by SDGs

2.6.4 Bioeconomy and Green Deal

This menu item takes the user to a page showing the European Green Deal priorities via a structure of hexagons (Figure 10). On this page, only the European Green Deal priorities that currently have related indicators added to the dashboards are displayed. As such, in the future more hexagons representing the rest of the European Green Deal priorities mapped to indicators will be added. When the user clicks on one of the priorities, they are presented with a list of related indicators. This option was developed and activated in July 2021. In 2022, the European Green Deal priority of mobilising research and fostering innovation has been added with the addition of indicators 1.1.d.1 and 5.6.b.1.

Figure 10. Layout for selection of indicators by Green Deal priorities

2.7 Indicator coverage in the conceptual framework

The indicators in the BMS were selected according to whether they could tell us something meaningful about the blueprint we have set out to achieve a sustainable bioeconomy. This blueprint is the conceptual framework of the whole system. The main bounding box is the five EU Bioeconomy Strategy objectives. Each of these objectives is broken down into guiding principles, which we call normative criteria to describe a direction of what we should achieve with a sustainable and circular bioeconomy. The normative criteria are further broken down into key components. This is a manageable categorisation that gives more detail to the broader aspirational normative criteria. With this structure, the indicators are directly relevant to the whole system.

The drawback of such an approach is that there may be no indicator available for a given key component we wish to measure. These are gaps in the system that the JRC is responsible for filling.

Table 2 shows the current status of the BMS. In some cases, there are no indicators published yet for a given key component. These key components are highlighted in grey in the last two columns. In other cases, there are no indicators published yet for all key components within a normative criterion. This is the case where the last four columns are highlighted in grey and occur in two of the five objectives. Key components in bold red show gaps filled in 2022.

Table 2. Summary of coverage of indicators within the conceptual framework

Objective id	Objective name	Normative criterion id	Normative criterion name	Key component id	Key component name
1	Ensuring Food and Nutrition Security	1.1	Food security and nutrition are supported	1.1.a	Availability
1	Ensuring Food and Nutrition Security	1.1	Food security and nutrition are supported	1.1.b	Access
1	Ensuring Food and Nutrition Security	1.1	Food security and nutrition are supported	1.1.c	Utilisation
1	Ensuring Food and Nutrition Security	1.1	Food security and nutrition are supported	**1.1.d**	**Stability**
1	Ensuring Food and Nutrition Security	1.2	Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	1.2.a	Economic impact of trade in exporting countries of food (to EU)
1	Ensuring Food and Nutrition Security	1.2	Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	1.2.b	Environmental footprints in exporting countries of food (to EU)
1	Ensuring Food and Nutrition Security	1.2	Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	1.2.c	Social impact of trade in exporting countries of food (to EU)
2	Managing Natural Resources Sustainably	2.1	Ecosystem capacity to produce services is maintained or enhanced	2.1.a	Environmental quality
2	Managing Natural Resources Sustainably	2.1	Ecosystem capacity to produce services is maintained or enhanced	2.1.b	Structural and functional ecosystem attributes
2	Managing Natural Resources Sustainably	2.1	Ecosystem capacity to produce services is maintained or enhanced	2.1.d	Species diversity and abundance
2	Managing Natural Resources Sustainably	2.1	Ecosystem capacity to produce services is maintained or enhanced	2.1.e	Conservation status of habitats and species

2	Managing Natural Resources Sustainably	2.2	Primary production sectors are managed sustainably	2.2.a	Pressures from Forest Management
2	Managing Natural Resources Sustainably	2.2	Primary production sectors are managed sustainably	2.2.b	Pressures from marine fisheries & aquaculture management
2	Managing Natural Resources Sustainably	2.2	Primary production sectors are managed sustainably	2.2.c	Pressures from freshwater fisheries & aquaculture management
2	Managing Natural Resources Sustainably	2.2	Primary production sectors are managed sustainably	2.2.d	Pressures from agroecosystems
2	Managing Natural Resources Sustainably	2.3	Ecosystem services contribution to human well-being is maintained or enhanced	2.3.a	Provisioning services
2	Managing Natural Resources Sustainably	2.3	Ecosystem services contribution to human well-being is maintained or enhanced	2.3.b	Regulating services
2	Managing Natural Resources Sustainably	2.3	Ecosystem services contribution to human well-being is maintained or enhanced	2.3.c	Cultural services
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.1	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	3.1.a	Resource efficiency (Material footprint)
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.1	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	3.1.b	Energy efficiency
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.1	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	3.1.c	Biogenic waste prevention, re-use/recycling, and recovery
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.2	Food loss and waste is minimised and, when unavoidable, its biomass is reused or recycled	3.2.a	Food loss and waste minimization
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.3	Bioeconomy should promote sustainable production and consumption of biomass and bio-based products (within EU)	3.3.a	Bio-based products environmental impacts
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.4	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	3.4.a	Consumption and demand for biomass and bio-based products

3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.4	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	3.4.b	Production of bio-based products
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.4	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	3.4.c	Reduced dependence on non-renewable resources
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.5	Local economies of countries exporting commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	**3.5.a**	**Economic impact of trade in exporting countries (to EU)**
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.5	Local economies of countries exporting commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	3.5.b	Environmental footprints in exporting countries (to EU)
3	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	3.5	Local economies of countries exporting commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	3.5.c	Social impact of trade in exporting countries (to EU)
4	Mitigating and adapting to climate change	4.1	Climate change mitigation and adaptation are pursued	4.1.a	Climate change mitigation
4	Mitigating and adapting to climate change	4.1	Climate change mitigation and adaptation are pursued	4.1.b	Climate change adaptation
4	Mitigating and adapting to climate change	4.2	The sustainability of urban centres is enhanced	4.2.a	Enhanced resilience/adaptation to climate change for urban areas
5	Strengthening European competitiveness and creating jobs	5.1	Economic development is fostered	5.1.a	Contribution of bioeconomy to economic development
5	Strengthening European competitiveness and creating jobs	5.1	Economic development is fostered	5.1.b	Value of raw and processed biomass, value added in bioeconomy sectors
5	Strengthening European competitiveness and creating jobs	5.1	Economic development is fostered	5.1.c	Exports of EU food and non-food biomass, processed goods and/or related technologies
5	Strengthening European competitiveness and creating jobs	5.1	Economic development is fostered	5.1.d	Comparative advantage

5	Strengthening European competitiveness and creating jobs	5.2	Inclusive economic growth is strengthened	5.2.a	Employment in bioeconomy
5	Strengthening European competitiveness and creating jobs	5.2	Inclusive economic growth is strengthened	5.2.b	Working conditions related to bioeconomy
5	Strengthening European competitiveness and creating jobs	5.2	Inclusive economic growth is strengthened	5.2.c	Equality & inclusiveness in bioeconomy sectors
5	Strengthening European competitiveness and creating jobs	5.3	Resilience of the rural, coastal and urban economy is enhanced	5.3.a	Physical infrastructure (accessibility, services)
5	Strengthening European competitiveness and creating jobs	5.3	Resilience of the rural, coastal and urban economy is enhanced	5.3.b	Bioeconomy investments in rural & coastal areas
5	Strengthening European competitiveness and creating jobs	5.3	Resilience of the rural, coastal and urban economy is enhanced	5.3.c	Rural income diversification
5	Strengthening European competitiveness and creating jobs	5.3	Resilience of the rural, coastal and urban economy is enhanced	5.3.d	Income of primary producers
5	Strengthening European competitiveness and creating jobs	5.4	Existing knowledge is adequately valued and proven sound technologies are fostered	5.4.a	Existing knowledge on bioeconomy technologies
5	Strengthening European competitiveness and creating jobs	5.5	Knowledge generation and innovation are promoted	5.5.a	Knowledge generation/ (high level) education
5	Strengthening European competitiveness and creating jobs	5.5	Knowledge generation and innovation are promoted	5.5.b	Research and innovation
5	Strengthening European competitiveness and creating jobs	5.6	Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced	5.6.a	Market mechanisms (e.g. prices, consumer awareness)
5	Strengthening European competitiveness and creating jobs	5.6	Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced	**5.6.b**	**Resource competition among sectors of the bioeconomy and Biomass demand for new value chains**

2.8 Trade-related indicators

The trade-related indicators implemented in 2022 required a slightly different approach to expressing indicators in the BMS. While the geographical coverage of the other indicators in the dashboards is within the EU boundaries, in this particular set, we report the indicators for countries trading various bio-commodities and -products with the EU.

The trade-related indicators are derived to assess the environmental, social and economic impact of trade with the EU in the trading countries. The indicators for the environmental impact in exporting countries (1.2.b.1 and 3.5.b.1) will be developed using a footprint approach, which has not been fully developed yet so it is omitted from this report. The indicators for the social condition in exporting countries (1.2.c.1 and 3.5.c.1) have been redesigned based on expert opinion that a causal link between EU trade and the social condition of trading countries is not possible to ascertain (Mellim-Mcleod et al., 2021). These indicators are therefore shaped to report on the level of vulnerability in countries whose main trading partner is the EU. The indicators for the economic impact of trade in exporting countries (1.2.a.1 and 3.5.a.1) are the most straightforward and reported as the monetary value of bio-commodities and –products imported to the EU.

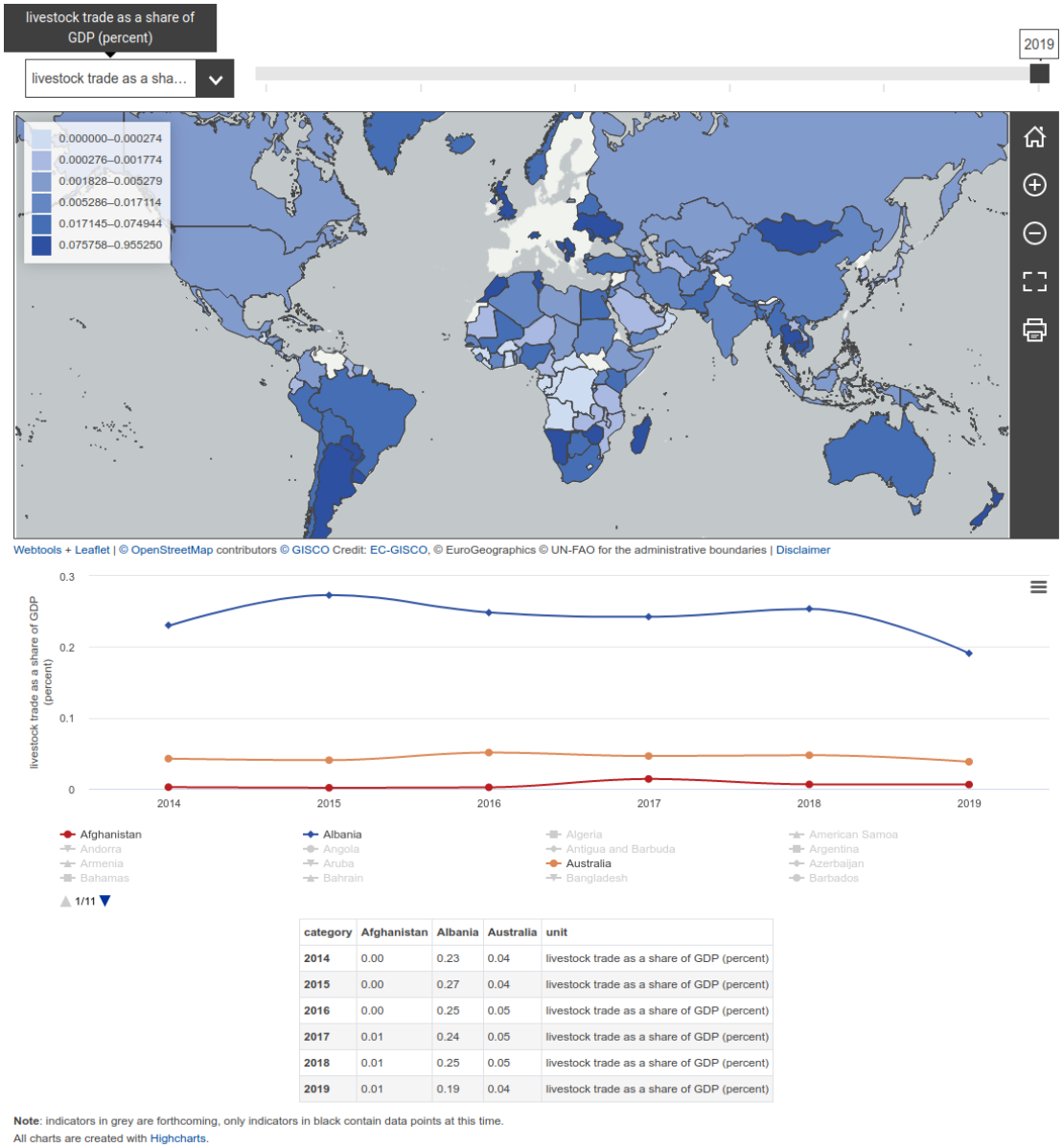
Furthermore, bio-commodities and -products reported via the trade-related indicators in the BMS include both food and non-food. In the conceptual framework, which is ultimately governed by the EU Bioeconomy Strategy's five objectives, indicators related to food are separated from indicators related to non-food. In the case of the trade-related indicators, some commodities are both food and non-food (e.g., soya). Separating the share of food and non-food for some commodities, as a result, entails a high level of uncertainty and several assumptions. In 2022, therefore, we will report these indicators under objective 3 (reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad) without distinguishing between food and non-food, rather than splitting the indicators into the food-related indicators under objective 1 (ensuring food and nutrition security) and non-food-related indicators under objective 3.

2.8.1 Economic impact of trade in exporting countries (to EU)

The economic impact of trade in exporting countries (to EU) indicator with id 3.5.a.1 reflects the impact of exporting bio-commodities and related products to the EU on the economy of extra-EU countries. Trade-related data are from UN Comtrade and World Bank sources and elaborated through a Python package developed at the JRC. This indicator is divided into 5 categories related to the classification of bio-products defined in De Laurentiis et al. (2022): primary crops, livestock, fish, plants and timber. Also, the aggregation that encompasses all the listed categories is reported.

We define two sub-indicators: the absolute volume of monetary exchange and the share of it with respect to national GDP. Regarding monetary exchange, it is possible to quantify the bio-commercial fluxes of countries exporting to the EU, establishing the most significant trade relationships. These values are reported in a single currency, dollars, to be comparable among countries. The share of GDP sub-indicator describes the share of EU exports with respect to national GDP and as a result, displays the countries' dependency on EU trade. Here, countries which have a lower population or GDP may have a higher EU trade dependency with respect to the major monetary trade partners. These are reported jointly because the exclusion of one of the two aspects may mislead the users. This framework provides a more complete overview of the economic impact of trade in exporting countries to the EU. We consider the two parts as complementary and essential for potential further analyses, including those related to social aspects.

Figure 11. Dashboard of economic impact of trade in exporting countries (to EU) indicator with id 3.5.a.1



category	Afghanistan	Albania	Australia	unit
2014	0.00	0.23	0.04	livestock trade as a share of GDP (percent)
2015	0.00	0.27	0.04	livestock trade as a share of GDP (percent)
2016	0.00	0.25	0.05	livestock trade as a share of GDP (percent)
2017	0.01	0.24	0.05	livestock trade as a share of GDP (percent)
2018	0.01	0.25	0.05	livestock trade as a share of GDP (percent)
2019	0.01	0.19	0.04	livestock trade as a share of GDP (percent)

Note: indicators in grey are forthcoming, only indicators in black contain data points at this time.
All charts are created with Highcharts.

2.8.2 Social condition in exporting countries (to EU)

The social condition in exporting countries to the EU is reflected in the indicator with id 3.5.c.1. Many indicators exist for assessing social well-being in countries, however, these cannot be directly attributed to the EU's imports since there are many factors influencing the social situation. The JRC is therefore publishing a set of sub-indicators recommended by experts (Melim-Mcleod et al., 2021) to indicate the social vulnerability in countries that trade with the EU related to bioeconomy, without making any direct link to the commodities traded. Eight social sub-indicators will be published covering issues related to labour, health, gender and poverty. However, the set of sub-indicators is not complete, for example, indicators for indigenous peoples' rights are not included at the moment.

Social vulnerability sub-indicators are the following:

Child labour: Child labour is work that children should not be doing because (a) they are too young or (b) the labour is likely to harm their health, safety or morals, due to its nature or the conditions in which it is carried out. The proportion of children in child labour is calculated as the number of children in child labour divided by the total number of children in the population (unit: percentage). For this sub-indicator, children include all persons aged 5–17.

Informal employment: In contexts where social protection coverage is limited, social security benefits (such as unemployment insurance) are insufficient or even non-existent or wages or pensions are low, individuals may have to take up informal employment to ensure their livelihood. Statistics on informality are key to assessing the quality of employment in an economy. This sub-indicator presents the share of employment that is classified as informal employment in the total economy, as well as separately in agriculture and non-agriculture. It is possible to disaggregate the data by sex.

Freedom of association and the effective recognition of the right to collective bargaining: This sub-indicator measures the level of national compliance with fundamental rights at work, specifically freedom of association and collective bargaining. These are rights for all the Member States of the International Labour Organization (ILO)[1] and are proclaimed in the Universal Declaration of Human Rights (1948) as well as other human rights instruments. The unit used for this indicator is trade union density. According the to the data source, a trade union is defined as: "a workers' organization constituted for the purpose of furthering and defending the interests of workers".

Elimination of discrimination in respect of employment and occupation: This indicator is put on hold until further notice.

Poverty rate: Monitoring poverty is important on the global development agenda as well as for many countries. The sub-indicator shows the proportion of the population below the international poverty line which is defined as the percentage of the population living with less than $1.90 a day at 2011 international prices, despite being employed. The sub-indicator includes sex and gender as sub-categories.

Infant mortality rate: Mortality rates among young children are key output indicators for child health and well-being, and more broadly, social and economic development. It is a closely watched public health indicator because it reflects the access of children and communities to basic health interventions such as vaccination, medical treatment of infectious diseases and adequate nutrition. This sub-indicator, the under-five mortality rate, is the probability of a child dying between birth and the age of five, expressed per 1000 live births. The data can be disaggregated by sex and age.

Coverage of essential health services: Coverage of essential health services is defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access. The universal health coverage (UHC) index is used, which is constructed from 14 tracer indicators based on epidemiological and statistical criteria. The index is reported on a unitless scale of 0 to 100, with 100 being the optimal value.

Gender pay gap: Gender equality is a human right and is included in the Universal Declaration of Human Rights (1948). This sub-indicator specifically highlights gender equality related to wages by measuring the relative difference between the average hourly earnings for men and women. Earnings refer to regular remuneration received from employers, in cash and kind. The sub-indicator is computed as the difference between the gross average hourly earnings of male and female employees expressed as a percentage of the gross average hourly earnings of male employees. It is possible to disaggregate the data by different occupations.

3 Back-end technologies

The BMS is supported by the KCB data service, set up in 2021, to store and feed the data shown in the dashboards integrated into the web platform of the KCB. This back-end solution replaced the previous approach of publishing the data in JSON files on the Knowledge4Policy (K4P) platform that was implemented at the launch of the BMS. The data service also supports the editing of the associated metadata through a custom editor.

3.1 Architecture

The KCB data service is a web service (served by Apache web servers) mainly for storing data in a database, developed in Python 3 programming language on top of the Django web framework. It consists of an administrative module named web administrative interface (WAI) and a programmatic module named application programming interface (API).

The WAI module allows authorised users to control the status of the data service, through a graphical user interface. It includes functionalities to administer the user access to the WAI, reserved to users with administrator rights, as well as functionalities to manage the data served through the API for users with editor

[1] https://www.ilo.org/shinyapps/bulkexplorer28/?lang=en&segment=indicator&id=ILR_TUMT_NOC_RT_A

rights. The API module allows machine-to-machine unauthenticated interactions and allows the dashboards to retrieve the data stored in the database for rendering them in the dashboards. The API module is made of read-only endpoints for various sections accessible by URLs. One of the sections is dedicated to the BMS. In 2022, the BMS section was extended with a bulk download functionality. Both the WAI and API have access to the same database, the API in read-only mode.

3.2 Infrastructure

The KCB data service is a project made up of two Django applications, one for each of the two modules, installed in two dedicated environments:

- an external one, called Production, for the API that is exposed to the Internet and can be queried by the dashboards and
- an internal one, called Staging, for the WAI and can be accessed only from the JRC's network.

Both environments host the Python code and the web servers, but not the database server (PostgreSQL) that runs in a shared environment managed by JRC D.1.

3.3 Data publication

The data service stores two types of datasets: geographical datasets and thematic datasets. The thematic datasets are the data shown in charts, while the geographical datasets contain geographical information (e.g., latitude and longitude, ISO 3166-1 alpha-2 country identifiers). The data in every thematic dataset need to be associated with the data in a geographical dataset in order to assign the thematic data to a location and make them visible through maps.

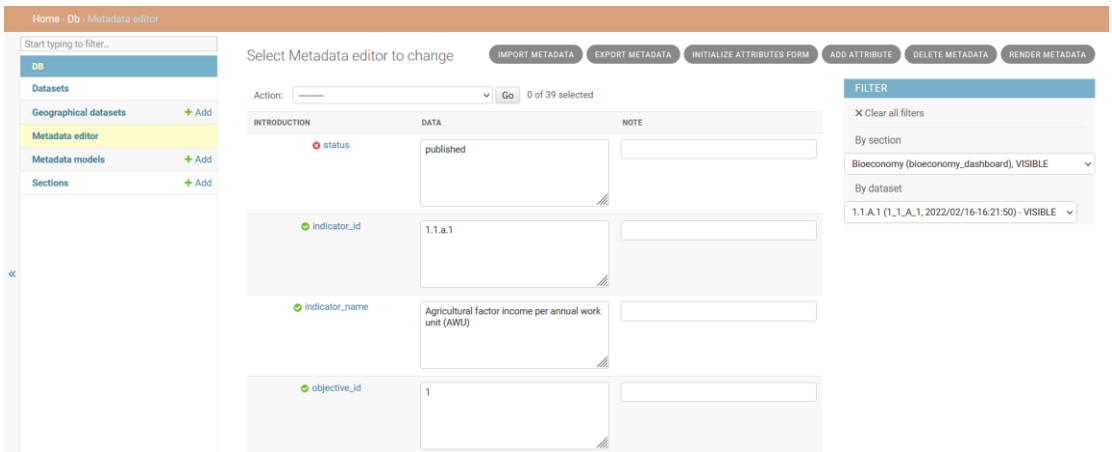
In order to upload data through the WAI module in the data service, the data need to be saved in a spreadsheet, in an XLSX or ODF file format, called KCB DS interchange file format, containing a set of sheets where the information composing a thematic dataset is organized. One of them contains information on how to fill the file.

Geographical datasets can be reused for different thematic datasets that use the same geographic coordinates or identifiers and as the thematic datasets, they can be uploaded into the data service using a specific interchange file format. Thematic datasets are versioned using a timestamp and need to be enabled explicitly in order to be published through the API. The API returns only the latest enabled version of a thematic dataset.

3.4 Metadata editor

This tool is available in the WAI application and allows an administrator to add, modify or delete metadata related to indicators. During 2022, we completed the migration of metadata from a spreadsheet to WAI. In this way, a single database stores the metadata and the metadata editor provides a user-friendly interface to manage the metadata (Figure 12).

Figure 12. Interface of the metadata editor for an indicator



Metadata are exposed from the database to the Internet through the API. This operation is triggered when a user clicks on the bulk download button on the main page of the BMS, in order to retrieve all the metadata stored in the database related to the BMS dashboards.

WAI allows to manage both the values and the data structure behind the metadata, i.e., their model. A specific format, KCB DS interchange file format (in XLSX or ODF format) is used to import/export metadata to/from the data service. It is based on several sheets. The records sheet holds the metadata values for each indicator and the rest is needed to map the metadata structure to the database.

During 2022, metadata editor functionalities have been expanded and now an administrator is also allowed to:

- edit all the metadata of an indicator at once,
- automatically assign a metadata structure while adding a new indicator dataset,
- delete one or more metadata attributes from all the indicators sharing the same metadata model,
- enable or disable specific metadata for the bulk download functionality,
- add a single metadata attribute to a model and to all the indicators that share the model,
- render, in PDF or DOC format, all or a subset of the metadata of an indicator or the entire BMS indicators and
- export all the metadata of the BMS.

3.5 Data of the BMS

The data of the BMS are generated using Python 3. The implemented code is based on both object-oriented and functional programming and is available in an internal JRC Bitbucket repository.

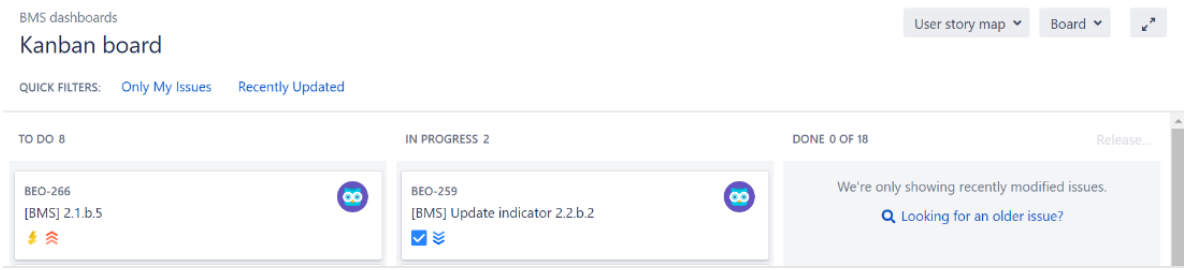
The main goal of the code is to retrieve input data, perform some calculations and finally standardize indicator values in CSV format. Input data sources may be available in a spreadsheet/CSV file or may be requested from an online source. Currently, data are requested from Eurostat servers and DBForest, in the future more sources may be used. As already mentioned, for some indicators, computations are needed before carrying out the structure standardization; group aggregations and calculation of totals and averages are typical operations performed. The standardized CSV files are then converted to XLSX format using a Python script that sets the expected content for the WAI and uploaded to the database by an administrator through the WAI.

During 2022, code improvements have been added to perform automatic consistency checks of data, needed for the format standardization. Most importantly, the following have been implemented:

- filling indicator data with unreported values when missing years for a specific country occur,
- removing countries which do not have data for the entire time series and
- removing unreported values for a specific year whenever all the countries do not have data available.

At the beginning of 2022, we also decided to keep track of indicator updates and changes with the Jira Software. This software is designed to help with the management of a project through the Agile methodology. We created a kanban board (Figure 13) where progress is reported and decisions for indicators are taken via issues. This enables to access the tasks that need to be done, in progress and completed in one place.

Figure 13. Kanban board used in managing the project



3.6 API of the BMS

The front-end makes a request to the API via a URL for each visualization and the API returns the requested data to the client in JSON format. A URL expects the values of three parameters: indicator id, type and visualization type. Initially, the API queries the database and returns the data of the indicator of interest. Then, the data are filtered and reformatted according to the other two parameters. The types of an indicator typically denote the components that make up the whole dataset of an indicator. For instance, the indicator intensification of farming (share of high, medium and low input farms in UAA) with id 2.2.d.5 has three types: low-input farms, medium-input farms and high-input farms. Finally, the visualization types are the line chart, column chart that may be unstacked or stacked and choropleth map. The JSON files are formatted according to the format the visualization libraries expect.

4 Front-end technologies

The platform follows the client-server paradigm. The client is hosted on an Apache HTTP Server during development. It is then transferred to the Drupal content management system (CMS) for enabling global and public access. The front-end is written in HTML, CSS and JavaScript, making use of multiple libraries, which are Highcharts for creating data visualizations (such as line, column and area charts), Webtools that uses Leaflet for creating choropleth maps, jQuery for accelerating the coding process, jQuery UI for adding a search bar with autocomplete, Bootstrap for some visual components and Europa Component Library (ECL) for the rest of the visual components and building responsive dashboards.

Since ECL does not provide all the necessary components, other libraries had to be used in some cases. ECL is used for creating buttons, search bars, icons and messages that are shown as a response to an invalid text search. Moreover, the responsiveness, thus mobile-friendliness was ensured using the grid layout utility of ECL. In this way, the content on the interface gets reorganized and the dashboards can be explored on extra small (phone), small (phone), medium (tablet), large (small laptop) and extra large (laptop and monitor) screens. Finally, the navigation menu that enables site-wide navigation and offers an alternative to the navigation via the structures of hexagons was implemented using ECL.

In 2022, the new headline indicators page has been designed and implemented. The central scenery and the circles that surround it are an SVG image. The code of the parts of this image has been assigned ids to implement the animations and enable user interactions. A new technology has not been introduced for this page; charts are created with Highcharts and the rest of the visual components are created using ECL and Bootstrap.

5 Metadata of indicators

The BMS aims to provide policymakers and other stakeholders with reliable and harmonised data and knowledge about the bioeconomy throughout the years. The indicators were chosen and computed based on the interaction with national and international experts through several workshops and exchanges.

Despite the high number of different data sources and the wide range of technical expertise required, the JRC must provide sound and up-to-date indicators. To ensure the constant update and reproducibility of each indicator, metadata are maintained detailing the meaning of the indicators and the input data used (Annex 4). At the beginning of 2022, we updated the metadata to reflect the last version of indicators' data and in this way inform the users about the version of the data visualized in the platform.

Increasing the transparency on the interpretation, data and methodologies of the basic, processed and system-level indicators will also make the construction and use of composite indicators easier in the future. Disseminating methodological information with numerical results is performed through dashboards and bulk download tool, paving the way to ensure that the indicators are understandable and reproducible or retraceable. It will also set the base for improvements in the future.

6 Dissemination & way forward

In this document, we discuss the technical implementation of the BMS and not the theoretical developments, although the two are clearly related. Whereas the scientific team is responsible for the further development of the concepts behind the BMS, the technical team is responsible for the implementation of the back- and front-end of the system. The following sections discuss the technical aspects only.

6.1 Implementation plan

The JRC relies on an Administrative Agreement with DG RTD to ensure that the development of the system evolves according to the expectations of the Core DG group responsible for the implementation of the EU Bioeconomy Strategy. The BMS, as described as our aspirations and outlined in Giuntoli et al. (2020) and Robert et al. (2020), is now fully in place and operational.

6.1.1 Implementation team

The implementation team is composed of two back-end developers and a front-end developer. One of the back-end developers is also the KCB developer and is responsible for the KCB data service. The other back-end developer generates/updates the data of the indicators using the input data given to her and uploads them to the database. She is also responsible for maintaining the metadata up-to-date. The front-end developer interacts with the scientific team to understand the expectations in data visualisations and implements these visualisations according to the criteria set out by DG COMM for website development. The front-end developer is also responsible for the API and generates the data of the headline indicators using the data generated by the second back-end developer. The fourth member of the team is the team leader who oversees the process. Needless to say, numerous scientific collaborators are producing the data and knowledge used in the specific indicators.

6.1.2 Post-implementation plan

The BMS is fully implemented and may be considered an operational tool. Under normal circumstances, the JRC does not maintain operational tools and perform redundant tasks, however, in this particular case, because of the nesting of the BMS within the KCB and the KCB being under the responsibility of the JRC, the BMS will also likely remain under the responsibility of the JRC. This is desirable because we know that the bioeconomy is evolving very quickly and new research needs will arise. Furthermore, the BMS is an adaptive system that will change as policies evolve, thus, new features and requirements will certainly appear in the coming decade.

6.1.3 Daily management of the system

The JRC has a scientific production mandate with high data management requirements and can therefore guarantee a constant presence of staff with competencies in the web development domain. Furthermore, as a tool embedded in the KCB, so long as the K4P Centres exist, there will be competent staff to maintain them.

6.2 Way forward

Two major decisions have been taken regarding indicators:

- 13 indicators initially defined will not be added to the BMS dashboards due to lack of data, no longer updates or minor importance for the BMS (see Annex 3 for details).
- UK and EU28 will be removed from the dashboards.

6.2.1 Next tools

In 2023, the Python project that generates the data of the indicators will be extended for new indicators and the front-end will display the data of these indicators. Furthermore, the data and visualizations of the rest of the headline indicators will be developed. The data of the headline indicators should be in the database of BMS and the data should be retrieved by the front-end through the API; this is planned to be implemented in 2023. In this way, the data of the headline indicators can be included in the bulk downloaded data.

The Python code that generates the data may be improved by including a linter, continuous integration (CI) and a unit test module. These tools, together with a well-documented and -commented code are important ways to ensure good quality of the code. Furthermore, these steps are important for reproducibility; hard-coded parts should be limited as much as possible and optimal code refactoring and automatic checks for the standard structure of the data should be implemented.

Furthermore, the ECL library may be updated to its latest version if the library used in the Drupal platform is updated in 2023. Similarly, if Webtools publishes a new version of the map and charts APIs, the code should be adapted to the latest versions. The rest of the updates of the libraries used on the front-end is optional.

Finally, the scientific team will publish the first report on the interpretation of the indicators drawn from the BMS. In this report, there will also be a discussion on the conceptual framework itself.

6.2.2 Link to Science for Policy report

The JRC will publish the first of a series of Science for Policy reports in February 2023 in a cross-unit collaboration, in which the BMS plays a key role in providing the data behind the report. The reports are planned to go beyond the data in the BMS, offering added intellectual value through the interpretations of the trends, as well as ad hoc studies to go deeper into the drivers behind the indicators, with an expert-based analysis on specific themes that could also be defined by an ad hoc steering committee that should be extended.

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Annexes

Annex 1. Glossary

Indicator	In general terms, an indicator is a quantitative or qualitative measure derived from a series of observed facts that can reveal relative positions in a given area, e.g., a country. When evaluated at regular intervals, an indicator can point out the direction of change across different units and through time. In the context of policy analysis, indicators are useful in identifying trends and drawing attention to particular issues. They can also be helpful in setting policy priorities and in benchmarking or monitoring performance (Nardo et al., 2008).
Headline indicator	Headline indicators are indicators that were chosen to represent all aspects of the EU bioeconomy.
Output indicator	Output indicators measure the state or condition of sectors or systems.
Input indicator	Input indicators correspond to drivers, such as governance.
Basic indicator	Basic indicators are a collection of indicators that are not necessarily harmonised among themselves. Each indicator in this group has its own specific purpose. The basic indicators are often borrowed from European or international reporting systems that are used to gauge EU policy or produced ad hoc to monitor a specific facet of the EU bioeconomy (Giuntoli et al., 2020).
Processed indicator	Processed indicators are more sophisticated than basic indicators in that a certain level of harmonisation, computation and interpretation is made to generate these indicators. These are more useful indicators with respect to basic indicators because although they may be sector-specific, value chain-specific, objective-specific etc., their meaning is interpreted within the context of the EU bioeconomy (Giuntoli et al., 2020).
System-level indicator	System-level indicators are those that require a higher level of judgment with respect to basic and processed indicators in their compilation given a higher level of complexity of the questions the indicators are addressing (Giuntoli et al., 2020).
Composite indicator	A composite indicator is formed when individual indicators are compiled into a single index on the basis of an underlying model. The composite indicator should ideally measure multi-dimensional concepts which cannot be captured by a single indicator (Nardo et al., 2008).
Intensive (indicator type)	An intensive variable does not depend on system size, such as temperature, pressure or density.
Extensive (indicator type)	An extensive variable depends on system size, such as mass or volume.
Positive directionality	An indicator with a positive directionality indicates that an increasing trend is indicative of a desired state or response. E.g., an indicator of the number of employed people has a positive directionality.
Negative directionality	An indicator with a negative directionality indicates that a decreasing trend is indicative of a desired state or response. E.g., an indicator of the number of alien species has a negative directionality.

Annex 2. Headline indicators

There are five sections to which headline indicators belong. These sections are ecosystem condition, primary production systems, secondary production systems, waste and circularity and trade. The sections are defined in a way all aspects of the EU bioeconomy are represented. The headline indicators are derived from the indicators defined in the conceptual framework of BMS and thus already present within the list of the indicators published under the EU Bioeconomy Objectives, Bioeconomy and SDGs and Bioeconomy and Green Deal pages. For each headline indicator, one or more related indicators are defined and a subset of these indicators is used to derive the headline indicator. They enable the users to dive deeper into the topic of the headline indicator. For details on the meaning of each indicator, the reader is referred to Annex 3, where all the indicators to be included in the BMS are listed and Annex 4, where the metadata of all the indicators included in the dashboards are given.

Section	Headline indicator	Related indicators
Ecosystem condition	Freshwater	Not published
	Marine	Not published
	Agricultural	Not published
	Forest	Not published
	Urban	Not published
Primary production systems	Production of biomass	Not published
	Employment in primary sectors	5.2.a.1
	Value-added from primary sectors	5.1.b.2
	Emissions from primary production	4.1.a.3 and 4.1.a.6
	Management of primary production	Not published (2.2.b.2, 2.2.d.5 and 2.3.a.2)
Secondary production systems	Uses of biomass	1.1.a.4, 3.4.a.2 and 3.4.a.3
	Employment in secondary sectors	5.2.a.1
	Value-added from secondary sectors	5.1.b.2
	Emissions from secondary sectors	Not published (4.1.a.2)
	Products	Not published
Waste and circularity	Food waste	3.2.a.1 and 3.2.a.2
	Non-food waste	3.1.c.5 and 3.1.c.6
	Circularity or recovery	3.1.c.5 and 3.1.c.6
Trade	Trade	Not published

Annex 3. All indicators

The full list of indicators and some of their attributes are given below. The column indicator status defines whether indicators are already published, currently being developed (with data that are available, data gap or unknown data source) or to be deleted next year.

Indicator id	Indicator status	Indicator name	Objective name	Normative criterion name	Key component name	Unit
1.1.a.1	published	Agricultural factor income per annual work unit (AWU)	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Availability	index (2010=100)
1.1.a.2	data gap	New food products (by sector)	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Availability	kg
1.1.a.3	data gap	New food value chains (by sector)	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Availability	
1.1.a.4	published	Total biomass supply for food purposes, including inputs	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Availability	1000 tonnes dry matter
1.1.a.5	published	Biomass directly consumed by EU citizens as food	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Availability	1000 tonnes dry matter
1.1.b.1	published	Prevalence of moderate or severe food insecurity in the total population, yearly estimates	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Access	percent
1.1.b.2	data available	Average dietary energy supply adequacy	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Access	percent
1.1.b.3	published	Food purchasing power	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Access	%
1.1.c.1	published	Daily calorie supply per capita by source	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Utilisation	kcal/capita/d and %
1.1.c.2	data gap	Indicator concerning food quality, or food safety	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Utilisation	
1.1.c.3	data gap	Animal welfare	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Utilisation	
1.1.d.1	published	Government support to agricultural research and development (by sector)	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Stability	eur / inhabitant
1.1.d.2	data gap	EU's self-sufficiency rate on protein for feed	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Stability	
1.1.d.3	data gap	Import dependency ratio of food (import/domestic production)	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Stability	

1.1.d.4	data gap	Value of food imports over total merchandise exports	Ensuring Food and Nutrition Security	Food security and nutrition are supported	Stability	
1.2.a.1	developing	Economic impact of trade in exporting countries of food (to EU)	Ensuring Food and Nutrition Security	Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	Economic impact of trade in exporting countries of food (to EU)	
1.2.b.1	data gap	Environmental footprints in exporting countries of food (to EU)	Ensuring Food and Nutrition Security	Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	Environmental footprints in exporting countries of food (to EU)	ha
1.2.c.1	developing	Social condition in exporting countries of food to EU	Ensuring Food and Nutrition Security	Local economies, societies and environmental conditions of countries exporting food to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	Social impact of trade in exporting countries of food (to EU)	no units
2.1.a.1	published	Biochemical oxygen demand in rivers	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	mg 02 per litre
2.1.a.2	published	Phosphate in rivers	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	mg P04/l
2.1.a.3	delete	Phosphorus in lakes	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	mg P/l
2.1.a.4	published	Nitrate in groundwater	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	mg N03/l
2.1.a.5	delete	Nitrate in rivers	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	mg N03-N/l

2.1.a.6	delete	Nutrients in transitional, coastal and marine waters	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	µmol/l
2.1.a.7	data available	Exposure of forest area to ozone	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	µg/m-3/hr
2.1.a.8	unknown	Exceedance of air quality standards in urban areas	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Environmental quality	ug.m-3 03
2.1.b.1	data gap	Percentage area of urban green space (or percentage of natural area within the city boundaries)	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	
2.1.b.2	data gap	Landscape fragmentation Index	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	index
2.1.b.3	data available	Share of High Nature Value farmland in agricultural area	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	percent of UAA
2.1.b.4	published	Share of organic farming in utilised agricultural area	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	percent of UAA
2.1.b.5	published	Livestock density index	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	unit per ha
2.1.b.6	data gap	Forest fragmentation and connectivity index	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	percent
2.1.b.7	data gap	Deadwood	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	m3 per ha
2.1.b.8	data available	Share of forest area	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	percent tot land area
2.1.b.9	published	Forest and other wooded land growing stock	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	1000m3
2.1.b.10	delete	Ecological status of European waters	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	categorical

2.1.b.11	data available	Fish stock biomass in NE Atlantic & Mediterranean	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Structural and functional ecosystem attributes	Fish stock biomass – index 2003 = 100
2.1.d.1	published	Bird and butterfly indices EU aggregate (common farmland bird Index, common forest bird index, grassland butterfly index)	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Species diversity and abundance	index rel to 1990 or 2000
2.1.d.2	data gap	Age and size distribution of commercially-exploited fish species	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Species diversity and abundance	% or number or cm
2.1.e.1	published	Surface of marine and terrestrial sites designated under NATURA 2000	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Conservation status of habitats and species	percent land area
2.1.e.2	data available	Conservation Status of European Habitats	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Conservation status of habitats and species	categorical
2.1.e.3	data available	Conservation status of grassland	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Conservation status of habitats and species	percent of assessments of habitats
2.1.e.4	delete	Threatened tree species in forests	Managing Natural Resources Sustainably	Ecosystem capacity to produce services is maintained or enhanced	Conservation status of habitats and species	
2.2.a.1	published	Ratio of annual fellings (m3/ha/year) to net annual increment (m3/ha/year)	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from Forest Management	fraction
2.2.a.2	data gap	Fraction of primary residues remaining in forest	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from Forest Management	percent
2.2.a.3	delete	Change in ecosystems extent: Forest and woodland	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from Forest Management	ha
2.2.a.4	delete	Land use / land cover type taken over by forest	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from Forest Management	ha
2.2.a.5	data available	Number of annual introductions of invasive alien species in forests	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from Forest Management	number/y
2.2.a.6	data gap	Certified forests	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from Forest Management	
2.2.b.1	data gap	Nutrient discharge from fisheries aquaculture	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from marine fisheries & aquaculture management	

2.2.b.2	published	Fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from marine fisheries & aquaculture management	F/FSMY
2.2.b.3	data gap	Number of annual introductions of invasive alien species in marine waters	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from marine fisheries & aquaculture management	number/a
2.2.c.1	data available	Number of annual introductions of invasive alien species in freshwater	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from freshwater fisheries & aquaculture management	number/a
2.2.c.2	data gap	Size of aquaculture production units	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from freshwater fisheries & aquaculture management	
2.2.c.3	data gap	Number of integrated multi-trophic aquaculture production units	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from freshwater fisheries & aquaculture management	count
2.2.d.1	data available	Ammonia emissions from agriculture	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from agroecosystems	kg/ha
2.2.d.2	data available	Land use / land cover type taken over by agricultural land	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from agroecosystems	ha
2.2.d.3	data available	Change in ecosystems extent: cropland & grassland	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from agroecosystems	ha
2.2.d.4	data gap	Number of annual introductions of invasive alien species in agroecosystems	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from agroecosystems	number/a
2.2.d.5	published	Intensification of farming (share of high, medium and low input farms in UAA)	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from agroecosystems	percent
2.2.d.6	data available	Sales of pesticides	Managing Natural Resources Sustainably	Primary production sectors are managed sustainably	Pressures from agroecosystems	kg of active ingredient
2.3.a.1	published	Biomass production in EU from primary production systems (agriculture, forests, fisheries)	Managing Natural Resources Sustainably	Ecosystem services contribution to human well-being is maintained or enhanced	Provisioning services	tonnes dry matter
2.3.a.2	published	Roundwood removals	Managing Natural Resources Sustainably	Ecosystem services contribution to human well-being is maintained or enhanced	Provisioning services	m3 o.b.
2.3.b.1	data available	Flood regulation (flood control, flow, demand, potential, unment demand, monetary values)	Managing Natural Resources Sustainably	Ecosystem services contribution to human well-being is maintained or enhanced	Regulating services	

2.3.b.2	data available	Air quality	Managing Natural Resources Sustainably	Ecosystem services contribution to human well-being is maintained or enhanced	Regulating services	
2.3.b.3	data available	Net ecosystem productivity	Managing Natural Resources Sustainably	Ecosystem services contribution to human well-being is maintained or enhanced	Regulating services	coefficient 0 to 1
2.3.c.1	data available	Aesthetics considerations of nature	Managing Natural Resources Sustainably	Ecosystem services contribution to human well-being is maintained or enhanced	Cultural services	
2.3.c.2	data available	Recreational services (recreation, flow, demand, potential)	Managing Natural Resources Sustainably	Ecosystem services contribution to human well-being is maintained or enhanced	Cultural services	mln eur/y
3.1.a.1	published	Domestic Material Consumption (Biomass)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Resource efficiency (Material footprint)	%
3.1.a.2	published	Material Footprint (Biomass)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Resource efficiency (Material footprint)	kg per dollar of GDP in USD
3.1.a.3	developing	Land footprint IN EU of EU consumption (for non-food&feed)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Resource efficiency (Material footprint)	
3.1.b.1	published	Energy productivity	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Energy efficiency	eur / kgoe
3.1.b.2	published	Share of renewable energy in gross final energy consumption	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Energy efficiency	%
3.1.b.3	developing	Share of renewable energy in gross final energy consumption of bio based industries or bioenergy industries	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Energy efficiency	
3.1.c.1	published	Cascade use of wood resources	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Biogenic waste prevention, re-use/recycling, and recovery	1000m3 solid wood equivalent

3.1.c.2	published	Circular material rate	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Biogenic waste prevention, re-use/recycling, and recovery	%
3.1.c.3	data available	Total energy supply from municipal waste	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Biogenic waste prevention, re-use/recycling, and recovery	Thousand tonnes of oil equivalent
3.1.c.4	published	Recycling rate of municipal waste	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Biogenic waste prevention, re-use/recycling, and recovery	%
3.1.c.5	published	Biowaste generated by source	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Biogenic waste prevention, re-use/recycling, and recovery	kg dry
3.1.c.6	published	Biowaste recovered by source	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved	Biogenic waste prevention, re-use/recycling, and recovery	kg dry
3.2.a.1	published	Food waste along supply chain - mass balance approach	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Food loss and waste is minimised and, when unavoidable, its biomass is reused or recycled	Food loss and waste minimization	tonnes
3.2.a.2	published	Food waste by food category - mass balance approach	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Food loss and waste is minimised and, when unavoidable, its biomass is reused or recycled	Food loss and waste minimization	tonnes
3.3.a.3	developing	Environmental impacts based on product-based LCA and basket of representative products of the bioeconomy	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Bioeconomy should promote sustainable production and consumption of biomass and bio-based products (within EU)	Bio-based products environmental impacts	
3.4.a.1	data available	Import dependencies for energy (wood,biofuels, bioenergy)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Consumption and demand for biomass and bio-based products	%
3.4.a.2	published	Total biomass consumed for energy	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Consumption and demand for biomass and bio-based products	1000 tonnes dry matter

3.4.a.3	published	Total biomass consumed for materials	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Consumption and demand for biomass and bio-based products	1000 tonnes dry matter
3.4.a.4	published	Share of woody biomass used for energy	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Consumption and demand for biomass and bio-based products	%
3.4.b.1	data available	Liquid biofuels production (bioethanol, pure biogasoline, biodiesel, bio jet kerosene and other liquid biofuels)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Production of bio-based products	1000 tonnes
3.4.b.2	data available	Biogasses (indigenous) production	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Production of bio-based products	TJ
3.4.b.3	data gap	Production of bio-based materials (plastics, textiles, chemicals)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Production of bio-based products	tonnes
3.4.b.4	data gap	Advanced biofuels production	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Production of bio-based products	ktoe
3.4.c.1	published	Share of renewables for transport, electricity and heating & cooling	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Reduced dependence on non-renewable resources	%
3.4.c.2	data available	Total consumption of energy, including fossil-based	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Reduced dependence on non-renewable resources	ktoe
3.4.c.3	data gap	Share of wood-based constructions	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Reduced dependence on non-renewable resources	%
3.4.c.4	data gap	Share of consumption of bio-based plastics, textiles and chemicals	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass	Reduced dependence on non-renewable resources	%

3.5.a.1	published	Economic impact of trade in exporting countries (to EU)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Local economies of countries exporting commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	Economic impact of trade in exporting countries (to EU)	dollars and percentage
3.5.b.1	data gap	Environmental footprints in exporting countries (to EU)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Local economies of countries exporting commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	Environmental footprints in exporting countries (to EU)	
3.5.c.1	developing	Social condition in exporting countries (to EU)	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	Local economies of countries exporting commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies	Social impact of trade in exporting countries (to EU)	
3.6.a.1	delete	Self-assessed satisfaction with recreational and green areas	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	The sustainability of urban centres is enhanced	Enhanced well-being and health of urban dwellers	%
3.6.a.2	delete	Self-assessed satisfaction with living environment	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	The sustainability of urban centres is enhanced	Enhanced well-being and health of urban dwellers	%
3.6.a.3	delete	Self-assessed overall life satisfaction	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad	The sustainability of urban centres is enhanced	Enhanced well-being and health of urban dwellers	%
4.1.a.1	data gap	net GHG emissions (emissions and removals) from bioenergy (absolute and relative vs. total sector emissions)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change mitigation	tCO2e and %
4.1.a.2	data gap	net GHG emissions (emissions and removals) from BBI (absolute and relative vs. total industrial emissions)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change mitigation	tCO2e and %
4.1.a.3	published	net GHG emissions (emissions and removals) from agriculture	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change mitigation	tCO2e

4.1.a.4	data gap	net GHG emissions (emissions and removals) from bio-waste (absolute and relative vs. total waste emissions)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change mitigation	tCO2e and %
4.1.a.5	data gap	GHG emissions from fishing and aquaculture	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change mitigation	1000 tCO2e
4.1.a.6	published	net GHG emissions (emissions and removals) from LULUCF	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change mitigation	1000 tCO2e
4.1.a.7	data gap	Financial support to bio-based sectors (climate action)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change mitigation	Euro/pc
4.1.b.1	data available	Annual heating and cooling degree days	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	degree celcius
4.1.b.2	published	Crop yield (3 main crops)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	tonne/ha
4.1.b.3	published	Water exploitation index (WEI)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	%
4.1.b.4	data gap	Soil moisture (seasonal average)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	%
4.1.b.5	data gap	Soil erosion / desertification	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	Tg C/y
4.1.b.6	delete	Soil organic carbon content	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	percent
4.1.b.7	data gap	Adaptation in agriculture, share of farmers with CAP risk management tools (insurance)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	%
4.1.b.8	data gap	Adaptation in agriculture, share of agricultural land under commitments to improve adaptation (ha)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	%
4.1.b.9	data gap	Adaptation in agriculture, unsustainable water use: share of irrigated land under commitments to improve water balance	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	%
4.1.b.10	delete	Adaptation in forest, # fire instances	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	#
4.1.b.11	delete	Adaptation in forest, Burnt area	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	ha
4.1.b.12	data gap	Adaptation in forest, natural disturbance events	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	

4.1.b.13	data gap	Adaptation in fisheries, potential catch	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	tons
4.1.b.14	data gap	MS Preparedeness - Year of adoption of the National Adaptation strategy/Plan (NAS/NAP)	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	#
4.1.b.15	data gap	Adaptation, International Transboundaries effects - loss in GDP	Mitigating and adapting to climate change	Climate change mitigation and adaptation are pursued	Climate change adaptation	%
4.2.a.1	data gap	City preparedness - # cities signatories of COM - Adaptation	Mitigating and adapting to climate change	The sustainability of urban centres is enhanced	Enhanced resilience/adaptation to climate change for urban areas	#
4.2.a.2	data gap	Investments in urban adaptation through nature-based infrastructures or EBA	Mitigating and adapting to climate change	The sustainability of urban centres is enhanced	Enhanced resilience/adaptation to climate change for urban areas	Euro/pc
5.1.a.1	unknown	Contribution of the Bioeconomy to GDP	Strengthening European competitiveness and creating jobs	Economic development is fostered	Contribution of bioeconomy to economic development	%
5.1.a.2	published	Value Added per sector / Bioeconomy value added	Strengthening European competitiveness and creating jobs	Economic development is fostered	Contribution of bioeconomy to economic development	%
5.1.a.3	unknown	GVA to turnover ratio	Strengthening European competitiveness and creating jobs	Economic development is fostered	Contribution of bioeconomy to economic development	ratio
5.1.a.4	data gap	Economic productivity (GVA/unit of biomass)	Strengthening European competitiveness and creating jobs	Economic development is fostered	Contribution of bioeconomy to economic development	GVA/unit biomass / sector
5.1.a.5	published	Gross value added per person employed in bioeconomy	Strengthening European competitiveness and creating jobs	Economic development is fostered	Contribution of bioeconomy to economic development	1000 EUR per worker
5.1.b.1	published	Turnover in bioeconomy per sector	Strengthening European competitiveness and creating jobs	Economic development is fostered	Value of raw and processed biomass, value added in bioeconomy sectors	Million EUR
5.1.b.2	published	Value-added per sector	Strengthening European competitiveness and creating jobs	Economic development is fostered	Value of raw and processed biomass, value added in bioeconomy sectors	Million EUR

5.1.c.1	data gap	Export value	Strengthening European competitiveness and creating jobs	Economic development is fostered	Exports of EU food and non-food biomass, processed goods and/or related technologies	EUR
5.1.c.2	data gap	Trade balance (net export)	Strengthening European competitiveness and creating jobs	Economic development is fostered	Exports of EU food and non-food biomass, processed goods and/or related technologies	EUR
5.1.d.1	data gap	Terms-of-Trade of biomass (export/import)	Strengthening European competitiveness and creating jobs	Economic development is fostered	Comparative advantage	ratio
5.1.d.2	data gap	Revealed comparative advantage of biomass (Balassa index)	Strengthening European competitiveness and creating jobs	Economic development is fostered	Comparative advantage	index
5.1.d.3	data available	Number of enterprises in bioeconomy	Strengthening European competitiveness and creating jobs	Economic development is fostered	Comparative advantage	number
5.1.d.4	data gap	Bioeconomy SME birth & death rates	Strengthening European competitiveness and creating jobs	Economic development is fostered	Comparative advantage	%
5.2.a.1	published	Persons employed per bioeconomy sectors	Strengthening European competitiveness and creating jobs	Inclusive economic growth is strengthened	Employment in bioeconomy	person
5.2.b.1	data gap	Occupation health and safety in bioeconomy sectors	Strengthening European competitiveness and creating jobs	Inclusive economic growth is strengthened	Working conditions related to bioeconomy	
5.2.c.1	data gap	Employment by age in bioeconomy sectors	Strengthening European competitiveness and creating jobs	Inclusive economic growth is strengthened	Equality & inclusiveness in bioeconomy sectors	person
5.2.c.2	data gap	Employment by educational level in bioeconomy sectors	Strengthening European competitiveness and creating jobs	Inclusive economic growth is strengthened	Equality & inclusiveness in bioeconomy sectors	person
5.2.c.3	data gap	Employment by gender in bioeconomy sectors	Strengthening European competitiveness and creating jobs	Inclusive economic growth is strengthened	Equality & inclusiveness in bioeconomy sectors	% female
5.2.c.4	data gap	Income by gender by sector	Strengthening European competitiveness and creating jobs	Inclusive economic growth is strengthened	Equality & inclusiveness in bioeconomy sectors	EUR

5.2.c.5	data gap	Income distribution along bioeconomy value chains	Strengthening European competitiveness and creating jobs	Inclusive economic growth is strengthened	Equality & inclusiveness in bioeconomy sectors	EUR per step in the value chain
5.3.a.1	data gap	Distance to logistics hubs (territorial dimension)	Strengthening European competitiveness and creating jobs	Resilience of the rural, coastal and urban economy is enhanced	Physical infrastructure (accessibility, services)	km
5.3.b.1	data gap	Bioeconomy investments in rural and coastal areas	Strengthening European competitiveness and creating jobs	Resilience of the rural, coastal and urban economy is enhanced	Bioeconomy investments in rural & coastal areas	EUR
5.3.b.2	data gap	Number of bioeconomy businesses developed with policy support	Strengthening European competitiveness and creating jobs	Resilience of the rural, coastal and urban economy is enhanced	Bioeconomy investments in rural & coastal areas	number
5.3.c.1	data gap	Transformation of biomass at farm (or coop) level	Strengthening European competitiveness and creating jobs	Resilience of the rural, coastal and urban economy is enhanced	Rural income diversification	Tonnes??
5.3.c.2	data gap	Income diversification in rural areas, by farmer age for production and transformation at farm or coop level.	Strengthening European competitiveness and creating jobs	Resilience of the rural, coastal and urban economy is enhanced	Rural income diversification	?
5.3.c.3	data gap	Income diversification of rural and coastal biomass producers (other than agriculture)	Strengthening European competitiveness and creating jobs	Resilience of the rural, coastal and urban economy is enhanced	Rural income diversification	?
5.3.d.1	data gap	Income of primary producers (fish & seafood landing income, agriculture households, forest owners)	Strengthening European competitiveness and creating jobs	Resilience of the rural, coastal and urban economy is enhanced	Income of primary producers	EUR
5.4.a.1	data gap	Adoption of new bioeconomy technology by primary producers for both production and transformation levels	Strengthening European competitiveness and creating jobs	Existing knowledge is adequately valued and proven sound technologies are fostered	Existing knowledge on bioeconomy technologies	?
5.4.a.2	data gap	Rolling-out of pilot projects	Strengthening European competitiveness and creating jobs	Existing knowledge is adequately valued and proven sound technologies are fostered	Existing knowledge on bioeconomy technologies	number
5.4.a.3	data gap	Investment in TRL8-9 bio-based products	Strengthening European competitiveness and creating jobs	Existing knowledge is adequately valued and proven sound technologies are fostered	Existing knowledge on bioeconomy technologies	EUR
5.5.a.1	data gap	% persons employed with 3º education in bioeconomy sectors	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Knowledge generation/ (high level) education	%

5.5.a.2	data gap	Changes in University curricula (number)	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Knowledge generation/ (high level) education	number
5.5.a.3	data gap	Investment in higher education related to bioeconomy	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Knowledge generation/ (high level) education	EUR
5.5.b.1	data gap	Number of patents by bioeconomy sectors	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Research and innovation	number
5.5.b.2	data gap	Investment in research and innovation (1000 eur)	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Research and innovation	1000 EUR
5.5.b.3	data gap	Open innovation	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Research and innovation	?
5.5.b.4	data gap	New non-food products produced from primary sources	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Research and innovation	number?
5.5.b.5	data gap	Number of research outputs in the field of bioeconomy	Strengthening European competitiveness and creating jobs	Knowledge generation and innovation are promoted	Research and innovation	number
5.6.a.1	data gap	Market or consumers acceptance	Strengthening European competitiveness and creating jobs	Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced	Market mechanisms (e.g. prices, consumer awareness)	?
5.6.a.2	data gap	Number of labelled or certified bio-based products	Strengthening European competitiveness and creating jobs	Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced	Market mechanisms (e.g. prices, consumer awareness)	number
5.6.b.1	published	Share biomass used by primary sector	Strengthening European competitiveness and creating jobs	Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced	Resource competition among sectors of the bioeconomy and Biomass demand for new value chains	percent
5.6.b.2	data gap	Producer prices per primary production sector	Strengthening European competitiveness and creating jobs	Demand and supply-side market mechanisms and policy coherence between supply and	Resource competition among sectors of the bioeconomy and Biomass demand for new value chains	EUR/tonne?

				demand of food and non-food goods are enhanced		

Annex 4. Metadata of indicators

Agricultural factor income per annual work unit (AWU)

Publication year	2020
Indicator id	1.1.a.1
Objective id	1
Objective name	Ensuring Food and Nutrition Security
Normative criterion id	1.1
Normative criterion name	Food security and nutrition are supported
Key component id	1.1.a
Key component name	Availability
SDGs	GOAL 2: Zero Hunger, GOAL 8: Decent Work and Economic Growth
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) The indicator is a partial labour productivity measure of the agricultural sector. Agricultural factor income measures the income generated by farming, which is used to remunerate borrowed or rented factors of production (capital, wages and land rents) as well as own production factors (own labour, capital and land). Factor income corresponds to the deflated (real) net value added at factor cost of agriculture. The implicit price index of GDP is used as deflator. Annual work units (AWUs) are defined as full-time equivalent employment (corresponding to the number of full-time equivalent jobs), i.e. as total hours worked divided by the average annual number of hours worked in full-time jobs within the economic territory
References	
Unit	index (2010=100)
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/sdg_02_20/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-1
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SDG_02_20
Link used elsewhere	https://ec.europa.eu/eurostat/cache/metadata/en/sdg_02_20_esmsip2.htm
Last update	Feb-22

Total biomass supply for food purposes, including inputs

Publication year	2020
Indicator id	1.1.a.4
Objective id	1
Objective name	Ensuring Food and Nutrition Security
Normative criterion id	1.1
Normative criterion name	Food security and nutrition are supported
Key component id	1.1.a
Key component name	Availability
SDGs	GOAL 2: Zero Hunger
Green Deal priorities	2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: JRC-BIOMASS) The indicator reveals the total primary biomass used annually for food purposes. This includes plant-based food, the total plant biomass and primary fish biomass used to feed and bedding of animals or fish for food consumption.
References	Gurria Albusac, P., Gonzalez Hermoso, H., Ronzon, T., Tamosiunas, S., Lopez Lozano, R., Garcia Condado, S., Ronchetti, G., Guillen Garcia, J., Banja, M., Fiore, G. and M`barek, R., Biomass flows in the European Union, EUR 30454 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-25378-5, doi:10.2760/14342, JRC122379.
Unit	1000 tonnes dry matter
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	JRC EU BIOMASS FLOWS
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS
Geographic coverage	AllMS
Frequency	>triennial
Timeliness	T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Aug-22

Biomass directly consumed by EU citizens as food

Publication year	2022
Indicator id	1.1.a.5
Objective id	1
Objective name	Ensuring Food and Nutrition Security
Normative criterion id	1.1
Normative criterion name	Food security and nutrition are supported
Key component id	1.1.a
Key component name	Availability
SDGs	GOAL 2: Zero Hunger
Green Deal priorities	2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: JRC-BIOMASS) The indicator shows the total biomass of vegetal, animal and fish food consumed annually (summed).
References	Gurría, P., González, H., Ronzon, T., Tamosiunas, S., López, R., García Condado, S., Ronchetti, G., Guillén, J., Banja, M., Fiore, G., M'Barek R., Biomass flows in the European Union: The EU Biomass Flows tool, version 2020, EUR 30454 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-25378-5 (online), doi:10.2760/14342 (online), JRC122379 (forthcoming)
Unit	1000 tonnes dry matter
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	JRC EU BIOMASS FLOWS
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS
Geographic coverage	AllMS
Frequency	>triennial
Timeliness	T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	JRC_BIOMASS
Link used elsewhere	
Last update	Aug-22

Prevalence of moderate or severe food insecurity in the total population, yearly estimates

Publication year	2020
Indicator id	1.1.b.1
Objective id	1
Objective name	Ensuring Food and Nutrition Security
Normative criterion id	1.1
Normative criterion name	Food security and nutrition are supported
Key component id	1.1.b
Key component name	Access
SDGs	GOAL 1: No Poverty, GOAL 2: Zero Hunger
Green Deal priorities	2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	An estimate of the percentage of a country's population that faces difficulties in accessing enough safe and nutritious food for normal growth and development and an active and healthy life. The data is collected through direct interviews by asking people about experiences associated with constrained access to food. For details see http://www.fao.org/hunger/en/
Unit	percent
Unit's description	
Intensive/extensive	intensive
Directionality	neg
Source	FAO
Link	https://unstats.un.org/sdgs/dataportal/database
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	5-10y
Comparability over time	3-5 data points w/o break
Accessibility	most FAIR
Used elsewhere	FAO SDG 2
Link used elsewhere	http://www.fao.org/sustainable-development-goals/indicators/212/en/
Last update	Sep-22

Food purchasing power

Publication year	2022
Indicator id	1.1.b.3
Objective id	1
Objective name	Ensuring Food and Nutrition Security
Normative criterion id	1.1
Normative criterion name	Food security and nutrition are supported
Key component id	1.1.b
Key component name	Access
SDGs	GOAL 1: No Poverty, GOAL 2: Zero Hunger
Green Deal priorities	2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) Nominal expenditure as percentage of GDP. GDP is the monetary value of all the goods and services produced in a country. Nominal differs from real GDP in that it includes changes in prices due to inflation, which reflects the rate of price increases in an economy on, in this case, food and non-alcoholic beverages.
References	
Unit	%
Unit's description	nominal expenditure as % of GDP
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://appsso.eurostat.ec.europa.eu/nui/show.do?query=BOOKMARK_DS-053404_QID_-4A904A2D_UID_-3F171EB0&layout=TIME,C,X,0;GEO,L,Y,0;NA_ITEM,L,Z,0;PPP_CAT,L,Z,1;INDICATORS,C,Z,2;&zSelection=DS-053404INDICATORS,OBS_FLAG;DS-053404PPP_CAT,A010101;DS-053404NA_ITEM,PLI_EU28;&rankName1=PPP-CAT_1_2_-1_2&rankName2=INDICATORS_1_2_-1_2&rankName3=NA-ITEM_1_2_-1_2&rankName4=TIME_1_0_0_0&rankName5=GEO_1_2_0_1&sortC=ASC_-1_FIRST&rStp=&cStp=&rDCh=&cDCh=&rDM=true&cDM=true&footnes=false&empty=false&wai=false&time_mode=ROLLING&time_most_recent=false&lang=EN&cfo=%23%23%23%2C%23%23%23.%23%23%23
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-1
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Feb-22

Daily calorie supply per capita by source

Publication year	2020
Indicator id	1.1.c.1
Objective id	1
Objective name	Ensuring Food and Nutrition Security
Normative criterion id	1.1
Normative criterion name	Food security and nutrition are supported
Key component id	1.1.c
Key component name	Utilisation
SDGs	GOAL 2: Zero Hunger, GOAL 3: Good Health and Well-being
Green Deal priorities	2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) The indicator shows the total daily calorie supply per capita and the split into calories from animal products and vegetal products. It should not be confused with the per capita consumption of those products (calorie consumption) as calorie supply includes also losses through food distribution and mismanagement. The supply data are based on the food balance sheets (FBS) available at FAOSTAT. Data sources are primarily FAO questionnaires, national publications available in the ESS Library and Country visits by statisticians involving discussions with national experts. The food balance sheet shows the availability for human consumption for each food item i.e., each primary commodity, which corresponds to the sources of supply and its utilisation. The total quantity of all foodstuffs produced in a country added to the total quantity imported and adjusted to any change in stocks that may have occurred since the beginning of the reference period, gives the supply available during that period. Data on per capita food supplies are expressed in terms of quantity and by applying appropriate food composition factors for all primary and processed products. The data for this indicator can also be expressed in terms of its energy value.
References	
Unit	kcal/capita/d and %
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	Eurostat
Link	https://ec.europa.eu/eurostat/databrowser/view/t2020_rk100/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Feb-22

Government support to agricultural research and development (by sector)

Publication year	2022
Indicator id	1.1.d.1
Objective id	1
Objective name	Ensuring Food and Nutrition Security
Normative criterion id	1.1
Normative criterion name	Food security and nutrition are supported
Key component id	1.1.d
Key component name	Stability
SDGs	GOAL 2: Zero Hunger, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system 2.2.3. Mobilising research and fostering innovation
Description	(source: Eurostat) Government support to agricultural research and development, reported as part of the EU SDG indicator set for SDG 2. The indicator refers to th elevel of priority governments place on the public funding of R&D for agriculture.
References	
Unit	eur / inhabitant
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sdg_02_30&lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SDG_02_30
Link used elsewhere	https://ec.europa.eu/eurostat/cache/metadata/en/sdg_02_30_esmsip2.htm
Last update	Mar-22

Biochemical oxygen demand in rivers

Publication year	
Indicator id	2.1.a.1
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.a
Key component name	Environmental quality
SDGs	GOAL 14: Life Below Water, GOAL 15: Life on Land, GOAL 6: Clean Water and Sanitation
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.8. A zero pollution ambition for a toxic-free environment
Description	(source: Eurostat) An indicator from the EEA. Biochemical oxygen demand (BOD) is used to measure water quality. The cleanest rivers have BOD5 values of less than 1 mg O2/L, moderately and heavily polluted rivers show values ranging from 2 to 8 mg O2/L.
References	
Unit	mg O2 per litre
Unit's description	amount of oxygen required by aerobic microorganisms to decompose organic substances in a water sample over a period of five days in the dark at 20°C. High levels mean organic pollution.
Intensive/extensive	intensive
Directionality	neg
Source	EEA / ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/sdg_06_30/default/table?lang=en
Geographic coverage	50-74%MS
Frequency	annual
Timeliness	T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SDG_06_30
Link used elsewhere	https://ec.europa.eu/eurostat/databrowser/view/sdg_06_30/default/table?lang=en
Last update	Dec-21

Phosphate in rivers

Publication year	
Indicator id	2.1.a.2
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.a
Key component name	Environmental quality
SDGs	GOAL 14: Life Below Water, GOAL 15: Life on Land, GOAL 6: Clean Water and Sanitation
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.8. A zero pollution ambition for a toxic-free environment
Description	(source: Eurostat) An indicator from the EEA. Refers to concentration of phosphate (PO4) in the dissolved phase of water samples. At high levels, phosphate can cause water quality problems, such as eutrophication, by triggering the growth of macrophytes and algae.
References	
Unit	mg PO4/l
Unit's description	concentration of phosphate (PO4) in the dissolved phase of water samples
Intensive/extensive	intensive
Directionality	neg
Source	EEA / ESTAT
Link	https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sdg_06_50&lang=en
Geographic coverage	50-74%MS
Frequency	annual
Timeliness	T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SDG_06_50
Link used elsewhere	https://ec.europa.eu/eurostat/cache/metadata/EN/sdg_06_50_esmsip2.htm
Last update	Dec-21

Nitrate in groundwater

Publication year	
Objective id	2
Indicator id	2.1.a.4
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.a
Key component name	Environmental quality
SDGs	GOAL 14: Life Below Water, GOAL 15: Life on Land, GOAL 6: Clean Water and Sanitation
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.8. A zero pollution ambition for a toxic-free environment
Description	(source: Eurostat) An indicator from the EEA. Indicator refers to concentrations of nitrate (NO3) in groundwater. According to the Drinking Water Directive, a maximum concentration of 50 mg/L of nitrate in groundwater that is used for drinking water is allowed.
References	
Unit	mg NO3/l
Unit's description	concentrations of nitrate (NO3) in groundwater
Intensive/extensive	intensive
Directionality	neg
Source	EEA
Link	http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sdg_06_40&lang=en
Geographic coverage	EUaggr
Frequency	annual
Timeliness	T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	EEA
Link used elsewhere	https://www.eea.europa.eu/data-and-maps/daviz/rivers-nutrient-trend-3#tab-chart_1
Last update	Dec-21

Share of organic farming in utilised agricultural area

Publication year	2020
Indicator id	2.1.b.4
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.b
Key component name	Structural and functional ecosystem attributes
SDGs	GOAL 3: Good Health and Well-being, GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) The indicator measures the share of total utilised agricultural area (UAA) occupied by organic farming (existing organically-farmed areas and areas in process of conversion). Farming is recognised to be organic if it complies with Council Regulation (EC) No 834/2007, which has set up a comprehensive framework for the organic production of crops and livestock and for the labelling, processing and marketing of organic products, as well as for governing imports of organic products into the EU. The detailed rules for the implementation of this Regulation are laid down in Commission Regulation (EC) No 889/2008.
References	
Unit	percent of UAA
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sdg_02_40&lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SDG_02_40
Link used elsewhere	https://ec.europa.eu/eurostat/cache/metadata/en/sdg_02_40_esmsip2.htm
Last update	Feb-22

Livestock density index

Publication year	2022
Indicator id	2.1.b.5
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.b
Key component name	Structural and functional ecosystem attributes
SDGs	GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) Livestock density refers to the number of livestock units per hectare of utilised agricultural area. The livestock species that are aggregated for the purpose of this indicator are equidae, cattle, sheep, goats, pigs, poultry and rabbits.
References	
Unit	unit per ha
Unit's description	number of livestock units per hectare of utilised agricultural area
Intensive/extensive	intensive
Directionality	neg
Source	ESTAT
Link	http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=tai09&lang=en
Geographic coverage	AllMS
Frequency	triennial
Timeliness	>T-3
Length of time series	>10y
Comparability over time	3-5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Mar-22

Forest and other wooded land growing stock

Publication year	2021
Indicator id	2.1.b.9
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.b
Key component name	Structural and functional ecosystem attributes
SDGs	GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity
Description	(source: FAO - FE) Growing stock in forests and on other wooded land. One indicator of Eurostat's 'Forest resources and enviromental functions', where growing stock follows the FAO FRA definition "Volume over bark of all living trees with a minimum diameter of 10 cm at breast height (or above buttress if these are higher). Includes the stem from ground level up to a top diameter of 0 cm, excluding branches".
References	
Unit	1000m3
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	ESTAT
Link	https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=for_vol&lang=en
Geographic coverage	AllMS
Frequency	>triennial
Timeliness	>T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SEBI_017
Link used elsewhere	https://biodiversity.europa.eu/topics/sebi-indicators
Last update	Feb-21

Bird and butterfly indices EU aggregate (common farmland bird Index, common forest bird index, grassland butterfly index)

Publication year	2021
Indicator id	2.1.d.1
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.d
Key component name	Species diversity and abundance
SDGs	GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity
Description	(source: Eurostat) Common bird index by type of species - EU aggregate (source: EBCC). online data code: SDG_15_60. The indicator shows the abundance and diversity of a selection of common bird species and is presented as Index 2000 = 100 and Index 1990 = 100. Three groups of bird species are represented: common farmland species (39 species), common forest species (34 species), all common bird species (167 species) which include the farmland species, the forest species and a further 94 common species (generalists, as opposed to the farmland and forest specialists). Rare species are excluded, although some species common in certain Member States may be considered rare in others. The species covered under the common farmland and common forest indices are deemed to be dependent on that particular kind of habitat for feeding and nesting. Each of the three indices is a composite, multispecies index calculated using Monte Carlo simulations as described in Soldaat et al. (2017) and an R-script developed by Statistics Netherlands. The indices are presented for EU-aggregates only and with smoothed values. The indices draw from data produced by the European Bird Census Council and its Pan-European Common Bird Monitoring Scheme programme. The data source comprises EBCC/RSPB/BirdLife/Czech Society for Ornithology. Data coverage has increased from 9 to 22 EU Member States over the period 1990 to 2010, with 25 countries covered as of the reference year 2011.
References	
Unit	index rel to 1990 or 2000
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/sdg_15_60/default/table?lang=en & https://ec.europa.eu/eurostat/databrowser/view/sdg_15_61/default/table?lang=en
Geographic coverage	EUaggr
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SDG_15_60
Link used elsewhere	https://ec.europa.eu/eurostat/cache/metadata/EN/sdg_15_60_esmsip2.htm
Last update	Feb-21

Surface of marine and terrestrial sites designated under NATURA 2000

Publication year	2021
Indicator id	2.1.e.1
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.1
Normative criterion name	Ecosystem capacity to produce services is maintained or enhanced
Key component id	2.1.e
Key component name	Conservation status of habitats and species
SDGs	GOAL 14: Life Below Water, GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity
Description	(source: DG ENV, EEA) Online data code: SDG_15_20. The indicator measures the surface of terrestrial sites designated under Natura 2000. The Natura 2000 network comprises both marine and terrestrial protected areas designated under the EU Habitats and Birds Directives with the goal to maintain or restore a favourable conservation status for habitat types and species of EU interest. Each country is required to fill in a standard data form where sites designated under the Directives are reported in detail, included the size of the site in km2, the existing habitats and species and their percentage cover of the site. A thorough typology has been developed to support precise reporting.
References	
Unit	percent land area
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_bio1&lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-1
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	SDG_15_20
Link used elsewhere	https://ec.europa.eu/eurostat/cache/metadata/EN/sdg_15_20_esmsip2.htm
Last update	Oct-22

Ratio of annual fellings (m3/ha/year) to net annual increment (m3/ha/year)

Publication year	2022
Indicator id	2.2.a.1
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.2
Normative criterion name	Primary production sectors are managed sustainably
Key component id	2.2.a
Key component name	Pressures from Forest Management
SDGs	GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity
Description	(source: JRC) Total fellings as a fraction of the net annual increment based on JRC's own estimates. Detailed methods and full dataset to be published at end of 2022.
References	https://publications.jrc.ec.europa.eu/repository/handle/JRC122719
Unit	fraction
Unit's description	[annual fellings (m^3/ha/a)/net annual increment (m^3/ha/a)]
Intensive/extensive	intensive
Directionality	neg
Source	JRC_BIOMASS
Link	
Geographic coverage	AllMS
Frequency	>triennial
Timeliness	>T-3
Length of time series	>10y
Comparability over time	3-5 data points w/o break
Accessibility	unFAIR
Used elsewhere	
Link used elsewhere	
Last update	Mar-22

Fishing mortality of commercially exploited fish and shellfish exceeding fishing mortality at maximum sustainable yield

Publication year	2020
Indicator id	2.2.b.2
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.2
Normative criterion name	Primary production sectors are managed sustainably
Key component id	2.1.b
Key component name	Structural and functional ecosystem attributes
SDGs	GOAL 14: Life Below Water
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	
References	Scientific, Technical and Economic Committee for Fisheries (STECF) – Monitoring of the performance of the Common Fisheries Policy (STECF-Adhoc-22-01). EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-51702-3, doi:10.2760/566544, JRC129080
Unit	F/FSMY
Unit's description	
Intensive/extensive	intensive
Directionality	neg
Source	JRC_STECF
Link	https://stecf.jrc.ec.europa.eu
Geographic coverage	all EU
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	unFAIR
Used elsewhere	MSCG_D3C1
Link used elsewhere	https://circabc.europa.eu/sd/a/ac936d86-7a3c-4102-be28-74e155aef3eb/MSCG_22-2018-03_MSFD2018ReportingGuidance_v5.pdf
Last update	Set-22

Intensification of farming (share of high, medium and low input farms in UAA)

Publication year	2020
Indicator id	2.2.d.5
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.2
Normative criterion name	Primary production sectors are managed sustainably
Key component id	2.2.d
Key component name	Pressures from agroecosystems
SDGs	GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system 2.1.8. A zero pollution ambition for a toxic-free environment
Description	(source: FADN) Percentage of utilised agricultural area (UAA) managed by low-, medium- and high-input farms and the number of hectars of UAA per category of farms. Each farm is classified according to the level of input use per hectare, which is calculated on the basis of the spending (in constant euros) on purchased inputs per hectare of UAA. The inputs considered here are purchased fertilisers and soil improvers, pesticides (plant protection products), other means for protection such as traps and baits, bird scarers, anti-hail shells, frost protection and purchased feed. Important details available here https://ec.europa.eu/eurostat/cache/metadata/en/aei_ps_inp_esms.htm
References	
Unit	percent
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=aei_ps_inp&lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	CAP_AEI
Link used elsewhere	https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/cap-indicators-doc-c33_2018_en.pdf
Last update	Nov-20

Biomass production in EU from primary production systems (agriculture, forests, fisheries)

Publication year	2022
Indicator id	2.3.a.1
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.3
Normative criterion name	Ecosystem services contribution to human well-being is maintained or enhanced
Key component id	2.3.a
Key component name	Provisioning services
SDGs	GOAL 14: Life Below Water, GOAL 15: Life on Land, GOAL 2: Zero Hunger
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: JRC-BIOMASS). Production from EU primary production systems.
References	
Unit	tonnes dry matter
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	JRC_BIOMASS
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS (no link for algae)
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	KCB flows diagram
Link used elsewhere	
Last update	Sep-22

Roundwood removals

Publication year	2020
Indicator id	2.3.a.2
Objective id	2
Objective name	Managing Natural Resources Sustainably
Normative criterion id	2.3
Normative criterion name	Ecosystem services contribution to human well-being is maintained or enhanced
Key component id	2.3.a
Key component name	Provisioning services
SDGs	GOAL 15: Life on Land
Green Deal priorities	2.1.7. Preserving and restoring ecosystems and biodiversity
Description	(source: JRC-BIOMASS) Total removals over bark, derived from the last available JFSQ (published August 2019). Conversion to over bark using conversion factors from UNECE/FAO (2010), Forest products conversion factors for the UNECE region.
References	https://publications.jrc.ec.europa.eu/repository/handle/JRC122719
Unit	m3 o.b.
Unit's description	cubic meters over bark. Reported values are actually underbark, the JRC estimates the bark using coefficients.
Intensive/extensive	extensive
Directionality	neg/pos
Source	JRC_BIOMASS
Link	DBForest
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	not very FAIR
Used elsewhere	
Link used elsewhere	
Last update	May-22

Domestic Material Consumption (Biomass)

Publication year	2020
Indicator id	3.1.a.1
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.a
Key component name	Resource efficiency (Material footprint)
SDGs	GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy 2.1.4. Building and renovating in an energy and resource efficient way 2.1.5. Accelerating the shift to sustainable and smart mobility 2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) This indicator quantifies the amount of biomass consumed as a share of the total domestic material consumption. The total is the sum of the biomass, metal ores, non-metallic minerals and fossil energy materials and carriers. This indicator is part of Eurostat's 'Economy-wide material flow accounts (EW-MFA)', which provide an aggregate overview of the material flows into and out of an economy.
References	
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/ENV_AC_MFA__custom_3069846/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-1
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	UN SDG 12.2.2 / 8.4.2
Link used elsewhere	https://unstats.un.org/sdgs/report/2019/goal-12/
Last update	Jul-22

Material Footprint (Biomass)

Publication year	2021
Indicator id	3.1.a.2
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.a
Key component name	Resource efficiency (Material footprint)
SDGs	GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy 2.1.4. Building and renovating in an energy and resource efficient way 2.1.5. Accelerating the shift to sustainable and smart mobility 2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: UN). Total amount of raw materials extracted to meet final consumption demands. It is one indication of the pressures placed on the environment to support economic growth and to satisfy the material needs of people. For more details, see https://unstats.un.org/sdgs/report/2019/goal-12/
References	
Unit	kg per dollar of GDP in USD
Unit's description	
Intensive/extensive	intensive
Directionality	neg
Source	UNEP
Link	https://wesr.unep.org/downloader
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	somewhat FAIR
Used elsewhere	UN SDG 12.2.1 / 8.4.1
Link used elsewhere	https://unstats.un.org/sdgs/report/2019/goal-12/
Last update	Sep-22

Energy productivity

Publication year	2020
Indicator id	3.1.b.1
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.b
Key component name	Energy efficiency
SDGs	GOAL 7: Affordable and Clean Energy
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy
Description	(source: Eurostat) The indicator results from the division of the gross domestic product (GDP) by the gross available energy for a given calendar year. It measures the productivity of energy consumption and provides a picture of the degree of decoupling of energy use from growth in GDP
References	
Unit	eur / kgoe
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=t2020_rd310&lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	UN SDG 7.3.1
Link used elsewhere	https://unstats.un.org/sdgs/report/2019/goal-07/
Last update	Feb-22

Share of renewable energy in gross final energy consumption

Publication year	2020
Indicator id	3.1.b.2
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.b
Key component name	Energy efficiency
SDGs	GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy
Description	(source: Eurostat) The indicator measures the share of renewable energy consumption in gross final energy consumption according to the Renewable Energy Directive (the gross final energy consumption is the energy used by end-consumers -final energy consumption- plus grid losses and self-consumption of power plants)
References	
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/t2020_rd330/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	UN SDG 7.2.1
Link used elsewhere	https://unstats.un.org/sdgs/report/2019/goal-07/
Last update	Feb-22

Cascade use of wood resources

Publication year	2022
Indicator id	3.1.c.1
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.c
Key component name	Biogenic waste prevention, re-use/recycling, and recovery
SDGs	GOAL 12: Responsible Consumption and Production, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy 2.1.3. Mobilising industry for a clean and circular economy 2.1.4. Building and renovating in an energy and resource efficient way
Description	(source: JRC) Multiple successive uses of woody biomass in different sectors, first as logs and then as industrial by-products or post-consumer recovered resources, is referred as "cascading". The more often by-products and recycled woody biomass are used in non-energy sectors, the higher the percentage of secondary woody biomass used by material industry on the total uses of woody biomass. Data for the calculations are derived by the Joint Forest Sector Questionnaire, Eurostat, the Joint Wood Energy Enquiry, the National Renewable Energy Action Plan Progress reports of Member States. The factors are consistent with the Wood Resource Balances (WRB) published by JRC (Cazzaniga et al., 2021). The share of secondary woody biomass for material industry is calculated as the ratio between the secondary woody biomass used by material industry and the total uses of woody biomass. Analogously, the share of secondary woody biomass for energy is obtained by dividing the amount of secondary woody biomass for energy by the total uses of woody biomass.
References	Cazzaniga N.E., Jasinevičius G., Jonsson R., Mubareka S. (2021). Wood Resource Balances of European Union and Member States - Release 2021. EC Joint Research Centre, Publications Office of the European Union, Luxembourg, JRC126552.
Unit	1000m3 solid wood equivalent
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	JRC_BIOMASS
Link	DBForest
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	unFAIR
Used elsewhere	
Link used elsewhere	
Last update	May-22

Circular material rate

Publication year	2020
Indicator id	3.1.c.2
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.c
Key component name	Biogenic waste prevention, re-use/recycling, and recovery
SDGs	GOAL 12: Responsible Consumption and Production, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy 2.1.3. Mobilising industry for a clean and circular economy 2.1.4. Building and renovating in an energy and resource efficient way
Description	(source: Eurostat) The indicator measures the share of material recovered and fed back into the economy - thus saving extraction of primary raw materials - in overall material use. The circular material use, also known as circularity rate is defined as the ratio of the circular use of materials to the overall material use. The overall material use is measured by summing up the aggregate domestic material consumption (DMC) and the circular use of materials. DMC is defined in economy-wide material flow accounts. The circular use of materials is approximated by the amount of waste recycled in domestic recovery plants minus imported waste destined for recovery plus exported waste destined for recovery abroad. Waste recycled in domestic recovery plants comprises the recovery operations R2 to R11 - as defined in the Waste Framework Directive 75/442/EEC. The imports and exports of waste destined for recycling - i.e. the amount of imported and exported waste bound for recovery are approximated from the European statistics on international trade in goods. A higher circularity rate value indicates means that more secondary materials substitute for primary raw materials thus reducing the environmental impacts of extracting primary material.
References	
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	Eurostat
Link	https://ec.europa.eu/eurostat/databrowser/view/cei_srm030/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	sdg_ 12_41
Link used elsewhere	https://ec.europa.eu/eurostat/cache/metadata/EN/sdg_12_41_esmsip2.htm
Last update	Feb-22

Recycling rate of municipal waste

Publication year	
Indicator id	3.1.c.4
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.c
Key component name	Biogenic waste prevention, re-use/recycling, and recovery
SDGs	GOAL 12: Responsible Consumption and Production, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy
Description	(source: Eurostat) The share of recycled municipal waste in the total municipal waste generation
References	
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/t2020_rt120/default/table?lang=en
Geographic coverage	75-99%MS
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	ESTAT - Circular Economy
Link used elsewhere	https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework
Last update	Sep-21

Biowaste generated by source

Publication year	2021
Indicator id	3.1.c.5
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.c
Key component name	Biogenic waste prevention, re-use/recycling, and recovery
SDGs	GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy
Description	(source: JRC) Biowaste generated by households and industry. Data on waste generation is collected from EU MS in Waste Statistics Regulation framework and published by Eurostat. This data includes a mix of organic and inorganic wastes generated from various economic activities (including households). JRC has developed a methodology to differentiate the biodegradable component in the different waste categories using empirical evidence. Statistics on waste generation are provided through a matrix which consists of different waste categories and the activities/source of the waste generation. Relevant data on waste categories that contain biodegradable matter and the source of waste generation (NACE activities) were chosen and are reported in the following sections. The calculations were done for agricultural and industrial biowaste and household biowaste. More detailed indicators on food waste are shown in indicators "Food waste along supply chain - mass balance approach"; and "Food waste by food category - mass balance approach".
References	
Unit	kg dry
Unit's description	per waste type
Intensive/extensive	extensive
Directionality	neg
Source	JRC_BIOMASS
Link	https://github.com/xapple/waste_flow/
Geographic coverage	AllMS
Frequency	biennial
Timeliness	>T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Nov-21

Biowaste recovered by source

Publication year	
Indicator id	3.1.c.6
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.1
Normative criterion name	Resource efficiency, waste prevention and waste-re-use along the whole bioeconomy value chain is improved
Key component id	3.1.c
Key component name	Biogenic waste prevention, re-use/recycling, and recovery
SDGs	GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy
Description	(source: JRC) Biowaste recovered from household and industrial biowaste. The amount of each type of biowaste differentiated by waste treatment option is provided in the Eurostat database [env_wastrt].Based on the values reported, coefficients expressing the share of waste going to each destination were determined. The coefficients were then multiplied by the amount of the respective stream of biowaste.
References	
Unit	kg dry
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	JRC_BIOMASS
Link	https://github.com/xapple/waste_flow/
Geographic coverage	AllMS
Frequency	biennial
Timeliness	>T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Nov-21

Food waste along supply chain - mass balance approach

Publication year	
Indicator id	3.2.a.1
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.2
Normative criterion name	Food loss and waste is minimised and, when unavoidable, its biomass is reused or recycled
Key component id	3.2.a
Key component name	Food loss and waste minimization
SDGs	GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: JRC) Food waste generated per year in EU MS by stage of the food supply chain. The model was developed in the JRC and provides results for the years 2000 – 2017 for EU27 MS.
References	De Laurentiis, V., Caldeira, C., Sala, S., Building a balancing system for food waste accounting at National Level, EUR 30685 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-37275-2, doi:10.2760/316306
Unit	tonnes
Unit's description	
Intensive/extensive	extensive
Directionality	neg
Source	JRC
Link	manually retrieved from JRC.D3
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	1y
Comparability over time	no data points w/o break
Accessibility	
Used elsewhere	will be soon used by ESTAT for Waste Framework Directive (2008/98/EC)
Link used elsewhere	
Last update	Mag-22

Food waste by food category - mass balance approach

Publication year	
Indicator id	3.2.a.2
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.2
Normative criterion name	Food loss and waste is minimised and, when unavoidable, its biomass is reused or recycled
Key component id	3.2.a
Key component name	Food loss and waste minimization
SDGs	GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: JRC) Food waste generated per year in EU MS by food type category. The model was developed in the JRC and provides results for the years 2000 – 2017 for EU27 MS.
References	De Laurentiis, V., Caldeira, C., Sala, S., Building a balancing system for food waste accounting at National Level, EUR 30685 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-37275-2, doi:10.2760/316306
Unit	tonnes
Unit's description	
Intensive/extensive	extensive
Directionality	neg
Source	JRC
Link	manually retrieved from JRC.D4
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-4
Length of time series	1y
Comparability over time	no data points w/o break
Accessibility	
Used elsewhere	will be soon used by ESTAT for Waste Framework Directive (2008/98/EC)
Link used elsewhere	
Last update	Mag-22

Total biomass consumed for energy

Publication year	2020
Indicator id	3.4.a.2
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.4
Normative criterion name	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass
Key component id	3.4.a
Key component name	Consumption and demand for biomass and bio-based products
SDGs	GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy 2.1.3. Mobilising industry for a clean and circular economy
Description	(source: JRC-BIOMASS) The indicator shows the total biomass of agricultural and woody origin consumed annually in the production of energy.
References	Gurria Albusac, P., Gonzalez Hermoso, H., Ronzon, T., Tamosiunas, S., Lopez Lozano, R., Garcia Condado, S., Ronchetti, G., Guillen Garcia, J., Banja, M., Fiore, G. and M`barek, R., Biomass flows in the European Union, EUR 30454 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-25378-5, doi:10.2760/14342, JRC122379.
Unit	1000 tonnes dry matter
Unit's description	
Intensive/extensive	extensive
Directionality	descriptive
Source	JRC EU BIOMASS FLOWS
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	don't know
Used elsewhere	
Link used elsewhere	
Last update	Aug-22

Total biomass consumed for materials

Publication year	2020
Indicator id	3.4.a.3
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.4
Normative criterion name	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass
Key component id	3.4.a
Key component name	Consumption and demand for biomass and bio-based products
SDGs	GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.1. Increasing the EU's climate ambition for 2030 and 2050
Description	(source: JRC-BIOMASS) The indicator shows the total biomass of agricultural and woody origin consumed annually in the production of materials.
References	Gurria Albusac, P., Gonzalez Hermoso, H., Ronzon, T., Tamosiunas, S., Lopez Lozano, R., Garcia Condado, S., Ronchetti, G., Guillen Garcia, J., Banja, M., Fiore, G. and M`barek, R., Biomass flows in the European Union, EUR 30454 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-25378-5, doi:10.2760/14342, JRC122379.
Unit	1000 tonnes dry matter
Unit's description	
Intensive/extensive	extensive
Directionality	descriptive
Source	JRC EU BIOMASS FLOWS
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	don't know
Used elsewhere	
Link used elsewhere	
Last update	Aug-22

Share of woody biomass used for energy

Publication year	2021
Indicator id	3.4.a.4
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.4
Normative criterion name	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass
Key component id	3.4.a
Key component name	Consumption and demand for biomass and bio-based products
SDGs	GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy 2.1.3. Mobilising industry for a clean and circular economy
Description	(source: JRC-BIOMASS) The indicator shows the total biomass of agricultural and woody origin consumed annually in the production of energy.
References	https://knowledge4policy.ec.europa.eu/publication/forestry-sankey_en
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	neg
Source	JRC_BIOMASS
Link	DBForest
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	don't know
Used elsewhere	KCB
Link used elsewhere	https://ec.europa.eu/jrc/en/publication/sankey-diagrams-woody-biomass-flows-eu-28
Last update	May-22

Share of renewables for transport, electricity and heating & cooling

Publication year	
Indicator id	3.4.c.1
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.4
Normative criterion name	Consumption patterns of bioeconomy goods match sustainable supply levels of biomass
Key component id	3.4.c
Key component name	Reduced dependence on non-renewable resources
SDGs	GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.2. Supplying clean, affordable and secure energy 2.1.3. Mobilising industry for a clean and circular economy 2.1.5. Accelerating the shift to sustainable and smart mobility
Description	(source: Eurostat) This indicator is based on data collected by Eurostat in the framework of Regulation (EC) No 1099/2008 on energy statistics and complemented by specific supplementary data transmitted by national administrations to Eurostat. More detailed information is available at https://ec.europa.eu/eurostat/cache/metadata/en/nrg_ind_share_esms.htm
References	
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_REN__custom_1260675/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	not very FAIR
Used elsewhere	RED
Link used elsewhere	https://ec.europa.eu/energy/topics/renewable-energy_en
Last update	Sep-21

Economic impact of trade in exporting countries (to EU)

Publication year	2022
Indicator id	3.5.a.1
Objective id	3
Objective name	Reducing dependence on non-renewable unsustainable resources, whether sourced domestically or from abroad
Normative criterion id	3.5
Normative criterion name	Local economies of countries exporting commodities to the EU are not hampered but rather harnessed by the trade of raw and processed biomass and related technologies
Key component id	3.5.a
Key component name	Economic impact of trade in exporting countries (to EU)
SDGs	GOAL 8: Decent Work and Economic Growth, GOAL 12: Responsible Consumption and Production, GOAL 17: Partnerships to achieve the Goal
Green Deal priorities	
Description	The indicator shows the monetary volume from exporter countries to EU related to biocommodities and the share of GDP. It is subdivided into 5 categories: primary crops, livestock, fish, plants, timber. The total is also reported.
References	
Unit	US dollars and percentage
Unit's description	
Intensive/extensive	
Directionality	
Source	
Link	
Geographic coverage	
Frequency	annual
Timeliness	T-3
Length of time series	6y
Comparability over time	
Accessibility	
Used elsewhere	
Link used elsewhere	
Last update	Dec-22

net GHG emissions (emissions and removals) from agriculture

Publication year	2020
Indicator id	4.1.a.3
Objective id	4
Objective name	Mitigating and adapting to climate change
Normative criterion id	4.1
Normative criterion name	Climate change mitigation and adaptation are pursued
Key component id	4.1.a
Key component name	Climate change mitigation
SDGs	GOAL 13: Climate Action
Green Deal priorities	2.1.1. Increasing the EU's climate ambition for 2030 and 2050 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) Agriculture emissions (mostly methane CH4 and nitrous oxide N2O) are mainly related to the management of agricultural soils (e.g. fertiliser and lime application), enteric fermentation by ruminant animals and manure management and , to a lesser extent, to rice cultivation and crop residue burning.
References	
Unit	tCO2e
Unit's description	
Intensive/extensive	extensive
Directionality	neg
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/ENV_AIR_GGE__custom_3120017/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Nov-20

net GHG emissions (emissions and removals) from LULUCF

Publication year	2020
Indicator id	4.1.a.6
Objective id	4
Objective name	Mitigating and adapting to climate change
Normative criterion id	4.1
Normative criterion name	Climate change mitigation and adaptation are pursued
Key component id	4.1.a
Key component name	Climate change mitigation
SDGs	GOAL 13: Climate Action
Green Deal priorities	2.1.1. Increasing the EU's climate ambition for 2030 and 2050 2.1.2. Supplying clean, affordable and secure energy 2.1.4. Building and renovating in an energy and resource efficient way
Description	(source: Eurostat) LULUCF covers emissions and removals (mainly CO2) in "managed lands" (forest land, cropland, grassland, wetlands ,settlements, other lands) from the following pools: Living biomass (above and below-ground values); Dead organic matter (deadwood and litter); Soil organic carbon (mineral and organic). Harvested wood products such as timber used in construction or furniture are reported as an additional pool.
References	
Unit	1000 tCO2e
Unit's description	
Intensive/extensive	extensive
Directionality	neg
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/ENV_AIR_GGE__custom_3120041/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-2
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	eea
Link used elsewhere	https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2019;
Last update	Nov-20

Crop yield (3 main crops)

Publication year	
Indicator id	4.1.b.2
Objective id	4
Objective name	Mitigating and adapting to climate change
Normative criterion id	4.1
Normative criterion name	Climate change mitigation and adaptation are pursued
Key component id	4.1.b
Key component name	Climate change adaptation
SDGs	GOAL 2: Zero Hunger, GOAL 13: Climate Action
Green Deal priorities	2.1.1. Increasing the EU's climate ambition for 2030 and 2050 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: Eurostat) Climate change can measurably affect crop productivity, food security and agriculture competitiveness. Annual productivity (tonnes/ha yr) of three crops that are sensitive to climate change: Winter wheat, summer wheat and corn.
References	
Unit	tonne/ha
Unit's description	Yield in EU standard humidity (tonne/ha)
Intensive/extensive	intensive
Directionality	pos
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/APRO_CPSH1__custom_3120134/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-1
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Aug-21

Water exploitation index (WEI)

Publication year	2021
Indicator id	4.1.b.3
Objective id	4
Objective name	Mitigating and adapting to climate change
Normative criterion id	4.1
Normative criterion name	Climate change mitigation and adaptation are pursued
Key component id	4.1.b
Key component name	Climate change adaptation
SDGs	GOAL 6: Clean Water and Sanitation, GOAL 13: Climate Action
Green Deal priorities	2.1.1. Increasing the EU's climate ambition for 2030 and 2050 2.1.7. Preserving and restoring ecosystems and biodiversity
Description	(source: Eurostat) Climate change can lead to longer and more frequent droughts across the EU, affecting both the demand and availability of water for, e.g., agriculture irrigation. Annual total water use – i.e., the difference between water abstraction and return after use - can be expressed as a percentage of the available renewable freshwater resources (groundwater and surface water) at given time. The higher the percentage, the higher pressure on renewable water resources due to water demand and the more vulnerable the system is. On average, values above 20% indicate situations of water scarcity, while values above 40% point to severe water scarcity and unsustainable use of water resources.
References	
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	neg
Source	ESTAT
Link	https://ec.europa.eu/eurostat/databrowser/view/sdg_06_60/default/table?lang=en
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-3
Length of time series	>10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Jan-21

Value Added per sector / Bioeconomy value added

Publication year	2021
Indicator id	5.1.a.2
Objective id	5
Objective name	Strengthening European competitiveness and creating jobs
Normative criterion id	5.1
Normative criterion name	Economic development is fostered
Key component id	5.1.a
Key component name	Contribution of bioeconomy to economic development
SDGs	GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: DataM) The ratio of the value added of a sector on the total bioeconomy value added reflects the contribution of that sector to bioeconomy wealth generation. Value added refers to the value added at factor costs. It is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. Value adjustments (such as depreciation) are not subtracted.
References	
Unit	%
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	DataM
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	Action plan of the EU Bioeconomy strategy
Link used elsewhere	https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf#view=fit&pagemode=none
Last update	Apr-22

Gross value added per person employed in bioeconomy

Publication year	2021
Indicator id	5.1.a.5
Objective id	5
Objective name	Strengthening European competitiveness and creating jobs
Normative criterion id	5.1
Normative criterion name	Economic development is fostered
Key component id	5.1.a
Key component name	Contribution of bioeconomy to economic development
SDGs	GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	The value added at factor costs divided by the number of persons employed in a given sector measures the "Apparent labour productivity" of that sector.
References	
Unit	1000 EUR per worker
Unit's description	
Intensive/extensive	intensive
Directionality	pos
Source	DataM
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	
Link used elsewhere	
Last update	Apr-22

Turnover in bioeconomy per sector

Publication year	2021
Indicator id	5.1.b.1
Objective id	5
Objective name	Strengthening European competitiveness and creating jobs
Normative criterion id	5.1
Normative criterion name	Economic development is fostered
Key component id	5.1.b
Key component name	Value of raw and processed biomass, value added in bioeconomy sectors
SDGs	GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: DataM) Turnover comprises the totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties.
References	
Unit	Million EUR
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	DataM, JRC.D2 for algae
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	EU Bioeconomy strategy
Link used elsewhere	https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf#view=fit&pagemode=none
Last update	Apr-22

Value-added per sector

Publication year	2020
Indicator id	5.1.b.2
Objective id	5
Objective name	Strengthening European competitiveness and creating jobs
Normative criterion id	5.1
Normative criterion name	Economic development is fostered
Key component id	5.1.b
Key component name	Value of raw and processed biomass, value added in bioeconomy sectors
SDGs	GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: DataM) Value added refers to the value added at factor costs. It is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. Value adjustments (such as depreciation) are not subtracted.
References	Ronzon, T., Piotrowski, S., Tamosiunas, S., Dammer, L., Carus, M., M'barek, R., 2020. Developments of economic growth and employment in bioeconomy sectors across the eu. Sustainability 12, 4507. 10.3390/su12114507. (https://www.mdpi.com/2071-1050/12/11/4507)
Unit	Million EUR
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	DataM
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-3
Length of time series	5-10y
Comparability over time	>5 data points w/o break
Accessibility	most FAIR
Used elsewhere	Action plan of the EU Bioeconomy strategy
Link used elsewhere	https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf#view=fit&pagemode=none
Last update	Apr-22

Persons employed per bioeconomy sectors

Publication year	2020
Indicator id	5.2.a.1
Objective id	5
Objective name	Strengthening European competitiveness and creating jobs
Normative criterion id	5.2
Normative criterion name	Inclusive economic growth is strengthened
Key component id	5.2.a
Key component name	Employment in bioeconomy
SDGs	GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	(source: DataM) The number of persons employed is defined as the total number of persons who work in the observation unit, as well as persons who work outside the unit who belong to it and are paid by it. For Algae: Data collected and curated by JRC.D2 Water and Marine Resources. Note that the employment data under fishing and aquaculture includes also algae gathering
References	Ronzon, T., Piotrowski, S., Tamosiunas, S., Dammer, L., Carus, M., M'barek, R., 2020. Developments of economic growth and employment in bioeconomy sectors across the eu. Sustainability 12, 4507. 10.3390/su12114507. (https://www.mdpi.com/2071-1050/12/11/4507)
Unit	person
Unit's description	
Intensive/extensive	extensive
Directionality	pos
Source	DataM, JRC.D2 for algae
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html
Geographic coverage	AllMS
Frequency	annual
Timeliness	T-3
Length of time series	5-10y
Comparability over time	3-5 data points w/o break
Accessibility	most FAIR
Used elsewhere	Action plan of the EU Bioeconomy strategy
Link used elsewhere	https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf#view=fit&pagemode=none
Last update	Apr-22

Share biomass used by primary sector

Publication year	2022
Indicator id	5.6.b.1
Objective id	5
Objective name	Strengthening European competitiveness and creating jobs
Normative criterion id	5.6
Normative criterion name	Demand and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced
Key component id	5.6.b
Key component name	Resource competition among sectors of the bioeconomy and Biomass demand for new value chains
SDGs	GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure
Green Deal priorities	2.1.3. Mobilising industry for a clean and circular economy 2.2.3. Mobilising research and fostering innovation 2.1.6. From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system
Description	
References	
Unit	percent
Unit's description	
Intensive/extensive	intensive
Directionality	descriptive
Source	JRC EU BIOMASS FLOWS
Link	https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS
Geographic coverage	AllMS
Frequency	annual
Timeliness	>T-3
Length of time series	5-10y
Comparability over time	annual
Accessibility	most FAIR
Used elsewhere	no
Link used elsewhere	
Last update	Sep-22

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