European Commission

Biomass flows in the European Union

EU Biomass Flows tool, version 2020

P. Gurría, H. González, T. Ronzon, S. Tamosiunas, R. López, S. García Condado, G. Ronchetti, J. Guillén, M. Banja, G. Fiore, R. M'Barek

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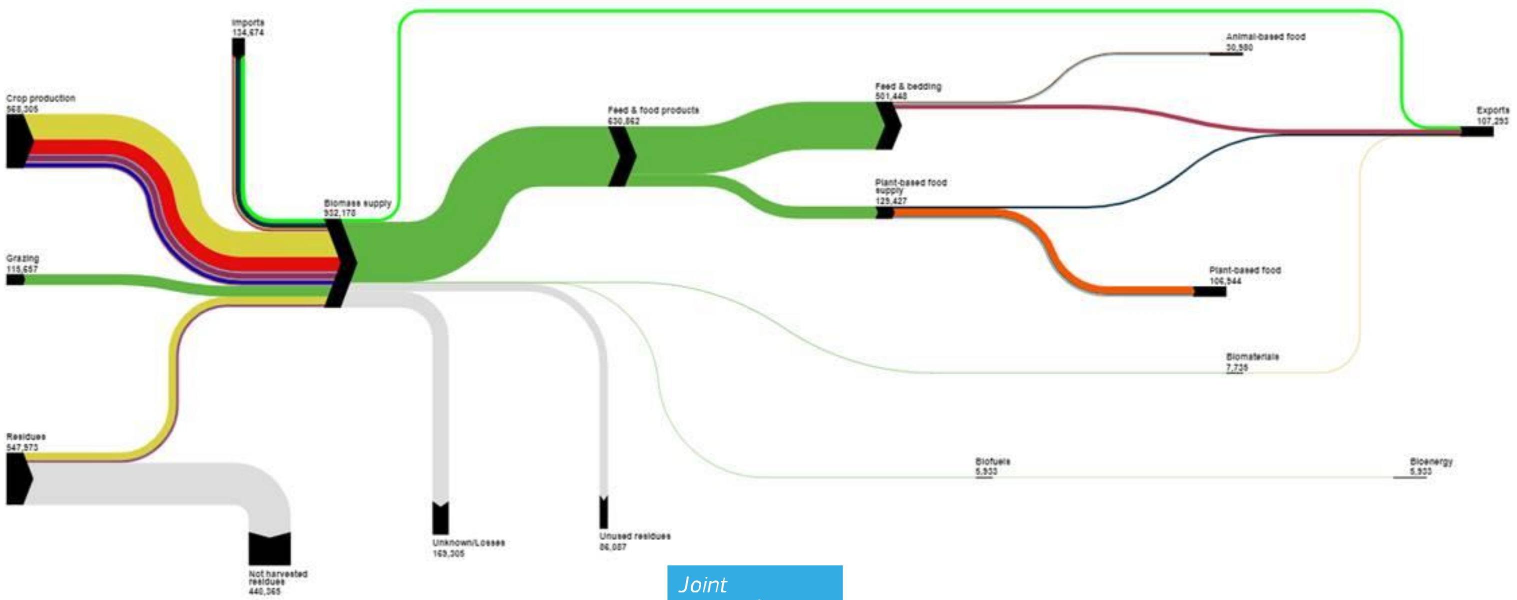

Joint Research Centre

EUR 30454 EN

Contact information
Name: Robert M'Barek
Address: Edificio Expo. C/Inca Garcilaso, 3. 41092 Sevilla (Spain)
Email: jrc-d4-secretariat@ec.europa.eu
Tel.: +34 9544 88 252

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[1] https://ec.europa.eu/knowledge4policy/projects-activities/jrc-biomass-study_en

Authors

Section	Contributors	JRC Directorate	JRC Unit
Agricultural biomass	P. Gurría, T. Ronzon, S. Tamosiunas, R. M'Barek, R. López, S. García Condado, G. Ronchetti	D – Sustainable Resources	D4 – Economics of Agriculture D5 – Food Security
Fishery biomass	J. Guillén, G. Fiore	D – Sustainable Resources	D2 – Water & Marine Resources
Biomass supply for transport	M. Banja	C - Energy, Transport and Climate	C5 – Air and Climate
Eu Biomass Flows tool and database	H. González, P. Gurria, R. M'Barek	D – Sustainable Resources	D4 – Economics of Agriculture
Overall coordination	R. M'Barek and P. Gurria	D – Sustainable Resources	D4 – Economics of Agriculture

Woody biomass data provisioned by: N. E. Cazzaniga, R. Jonsson, A. Camia (JRC D1 – Bio-Economy).

Abstract

The **EU Biomass Flows** tool provides a representation of harmonised data from the various Joint Research Centre (JRC) units contributing to the BIOMASS Assessment study of the JRC[2]. It represents the flows of biomass for each sector of the bioeconomy, from supply to uses including trade. The diagram enables deeper analysis and comparison of the different countries and sectors across a defined time series.

The former EU Biomass Flows tool was released in 2017 and has been used in multiple research activities and publications. Since its publication, the flexibility, analysis capabilities and user experience of the interactive tool have been improved. The new EU Biomass Flows tool was created based on the Energy Flows tool from Eurostat. The EU Biomass Flows tool displays biomass flows in Sankey diagrams and it relies on the methodology to extract and integrate data developed for the former EU Biomass Flows tool.

The new tool offers also an increased granularity of data for some biomass types: crop and residue production can now be shown in crop categories, animal- and plant-based food can be disaggregated into their nutrients. It has also significantly improved the visualisation of the data in charts and graphs, as well as enabling visibility of the evolution over time. Finally, users can download the full or a partial set of data.

In this document, we summarise the sources and data transformation steps to create the database used to represent these biomass flows, as well as the main data gaps and challenges encountered. We also briefly discuss the main features and functionalities of the new EU Biomass Flows tool. Finally, we present some insights based on the represented data and potential future research opportunities.

[2] https://ec.europa.eu/knowledge4policy/projects-activities/jrc-biomass-study_en; see also Ronzon et al. (2017).

1 Introduction

The European Green Deal (European Commission, 2019) sets the overall goal of Europe's trajectory towards 2050 to decouple economic growth from resource use. With global consumption of materials, including biomass, expected to double in the next forty years (CEAP), various strategies within the Green Deal refer to the Assessment of the EU and global biomass supply and demand, carried out by the EC's Joint Research Centre.

The Biodiversity Strategy (EC, 2020) states "To better understand and monitor the potential climate and biodiversity risks, the Commission is assessing the EU and global biomass supply and demand and related sustainability".

The recent communication to "Stepping up Europe's 2030 climate ambition" (EC, 2020b), stresses that "biomass for energy use in the EU should be produced sustainably, and environmental impacts should be minimised", while referring to the Commission's assessment of the EU and global biomass supply and demand.

Other strategies such as the Farm to Fork Strategy (EC, 2020c) refer to the "largely untapped potential of the circular bio-based economy for farmers and their cooperatives. For example, advanced bio-refineries that produce bio-fertilisers, protein feed, bioenergy, and bio-chemicals offer opportunities for the transition to a climate-neutral European economy and the creation of new jobs in primary production."

In this context, the present technical report "Biomass flows in the European Union – The EU Biomass Flows tool, version 2020" provides a methodology for quantification of the current and past biomass supply and demand (or use) in the European Union. It does not provide insights on sustainability of the biomass production, uses or trade.

More than a comprehensive analysis, which is due in 2022[3], it offers a brief summary of insights from the data and diagrams, an explanation of how the numbers have been calculated and an overview of the interactive EU Biomass Flows tool. The tool is hosted in the JRC DataM Portal[4], in the Bioeconomy visualisation area[5]. It can be accessed directly using the following link:
https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/index.html#

It is also part of the visualisations of the JRC Knowledge Centre for Bioeconomy[6].

Both supply and demand/use data can be continuously improved and extended. In the last chapter of this report further avenues of research will be proposed.

[3] See Camia et al. (2018)

[4] https://data.jrc.ec.europa.eu/dataset/34178536-7fd1-4d5e-b0d4-116be8e4b124

[5] https://datam.jrc.ec.europa.eu/datam/area/BIOECONOMY; see also initial work by Ronzon, Santini and M'barek (2015b)

[6] https://ec.europa.eu/knowledge4policy/visualisation/biomass-flows_en

2 Insights

A first analysis of the aggregated data of the European Union shows the relative weight of the different sectors in the bioeconomy. While supply has been split in the traditional sectors (agriculture, forestry and fishery), the uses have been distributed in different categories because their sources are diverse (e.g. biomaterials is sourced from both forestry and agriculture). We have considered the net trade figures for this analysis as using the gross trade values would not allow for comparison across sectors.

2.1 Biomass supply

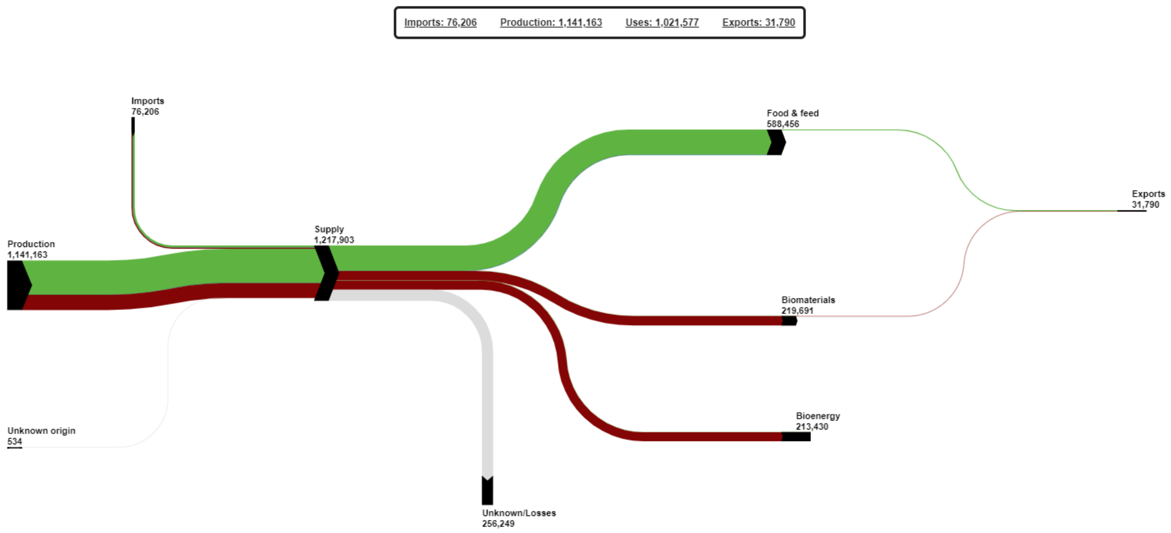
2.1.1 Overview

In 2015, the total supply of biomass in the EU27+UK amounted to more than 1.1 billion tonnes of dry matter (tdm), mostly originating in the land-based sectors. Of the biomass of identifiable origin, 95% was sourced domestically, with 5% imported biomass.

In the EU27+UK, agriculture is the biggest supply sector with a relative weight of approximately 68% (from 17% in Finland to over 90% in Greece, Malta, The Netherlands and Cyprus), followed by forestry with 32% of the dry matter content (from 8% in Cyprus and Malta to 83% in Finland). While the relative weight of the fishery sector is quite small (less than 1%), it is more important when considering economic or nutritional values.

Using the latest available complete set of data (2017 for agriculture, 2015 for forestry) and considering net trade of products, we can analyse the major sources of biomass for each sector. In agriculture, crop production represents almost 67% of the biomass supply with grazed biomass (14%) and collected crop residues (13%) being closer in weight but representing much smaller portions. The dominant known source of forestry biomass is primary woody biomass. As for the fisheries and aquaculture sector, the biggest source of biomass is imported fish and seafood (34%), followed by captured fish[7] (33%). 14% of the supply of aquatic biomass required to match the demand is of an origin that cannot be identified accurately.

Figure 1. Biomass flows by sector, EU27+UK, net trade, latest available data (1000 tdm).



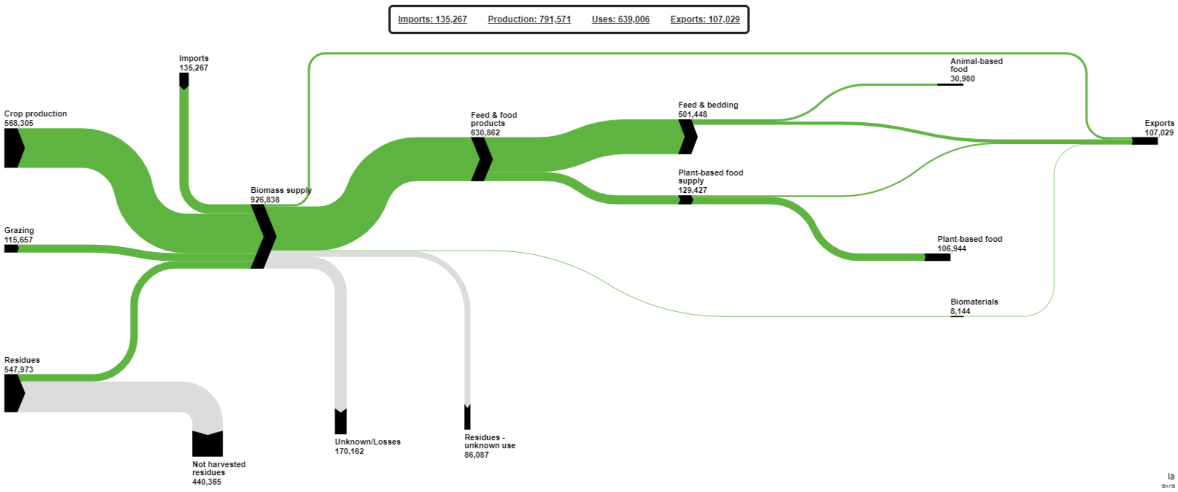
Source: JRC EU Biomass Flows

[7] Imported fish and seafood is a separate category because we currently have no data of whether its origin is capture fisheries or aquaculture.

2.1.2 Agriculture

In 2017, the EU27+UK agricultural biomass total supply (in gross trade figures) amounted to approximately 927 million tonnes of dry vegetal biomass equivalents.

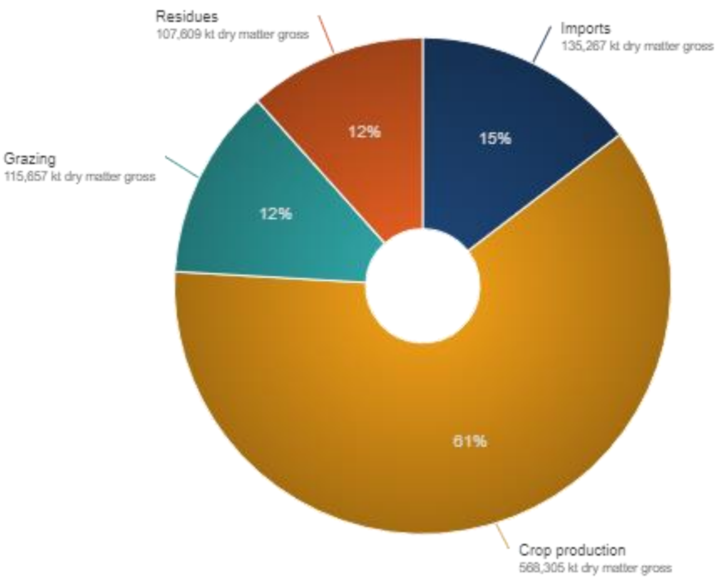
Figure 2. Biomass flows for agriculture, EU27+UK, gross trade, 2017 (1000 tdm).



Source: JRC EU Biomass Flows

This biomass is sourced as harvested crops, collected crop residues, grazed biomass and imports of agricultural products. The imports include live plants and animals, animal- and plant-based food items and other process products of agricultural origin (e.g. leather products).

Figure 3. Sources of agricultural biomass, EU27+UK, gross trade, 2017.

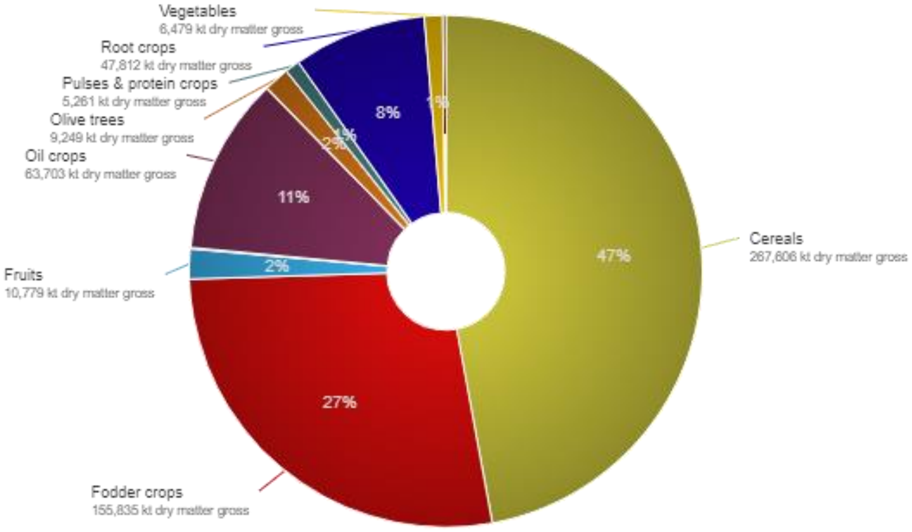


Source: JRC EU Biomass Flows

The crop production is estimated at 568 million tonnes of dry biomass in the EU27+UK. Collected crop residues provide an additional 108 million tdm of biomass. It should be noted that of these collected residues, only an estimated 33% (36 million tdm) are used for feed. The remaining two thirds are used for other purposes (biomaterials or energy), lost or discarded but the quantity of biomass that is used for each purpose cannot be estimated at this point. 116 million tonnes of biomass are grazed in pastures and meadows.

Almost 50% of the crop dry matter produced in the EU27+UK in 2017 were cereals, with only fodder crops (27%) and oil crops (11%) being the other crop types with a higher than 10% share of the total crop production.

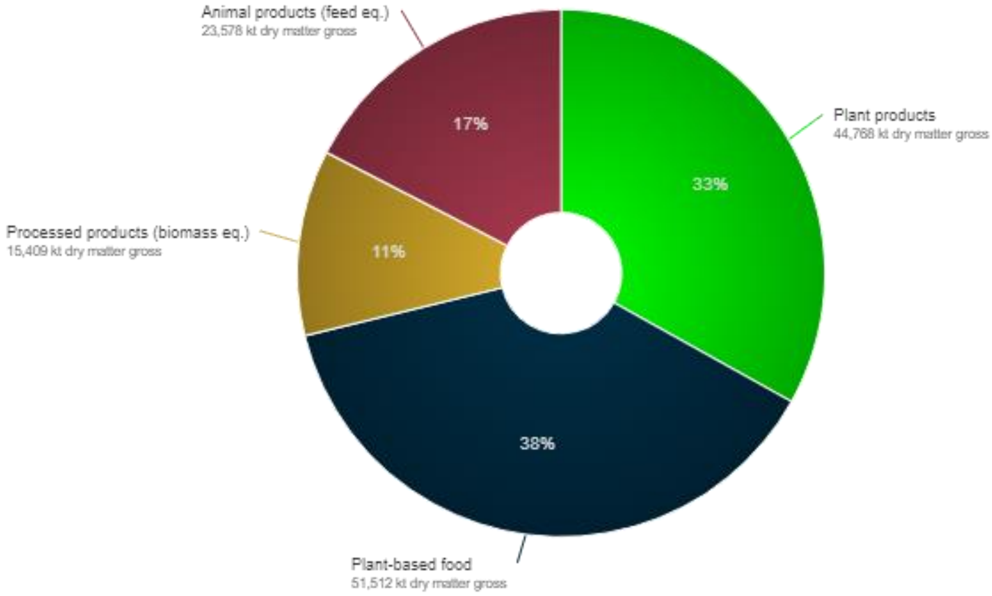
Figure 4. Crop production, EU27+UK, gross trade, 2017.



Source: JRC EU Biomass Flows

Aproximately 135 million tdm of vegetal biomass equivalents are imported, of which the biggest categories are plant-based food and plant products (live plants and vegetal raw material). Animal products (live animals and animal-based food) and processed products (biomaterials of agricultural origin, such as leather products) account for less that 30% of the imports.

Figure 5. Agricultural imports, EU27+UK, gross trade, 2017.



Source: JRC EU Biomass Flows

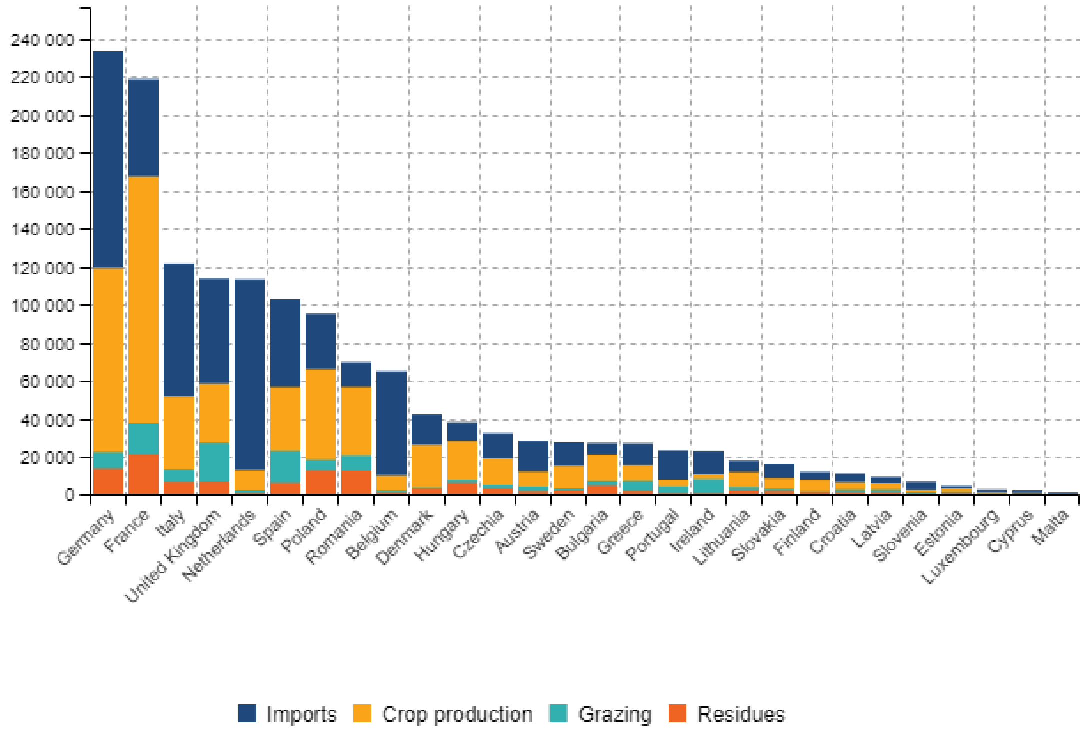
Figure 6 shows the total agricultural biomass supply (including crop and residue production, grazed biomass and imports). It has increased by more than 10% since 2012, mainly due to a 15% increase in crop production.

Figure 6. Biomass supply from agriculture, EU27+UK, gross trade (1000 tdm).

Source: JRC EU Biomass Flows

Germany and France have the biggest supply of biomass available. Germany however, together with The Netherlands, are the biggest importers of agricultural biomass.

Figure 7. Biomass supply from agriculture, gross trade, 2017 (1000 tdm).

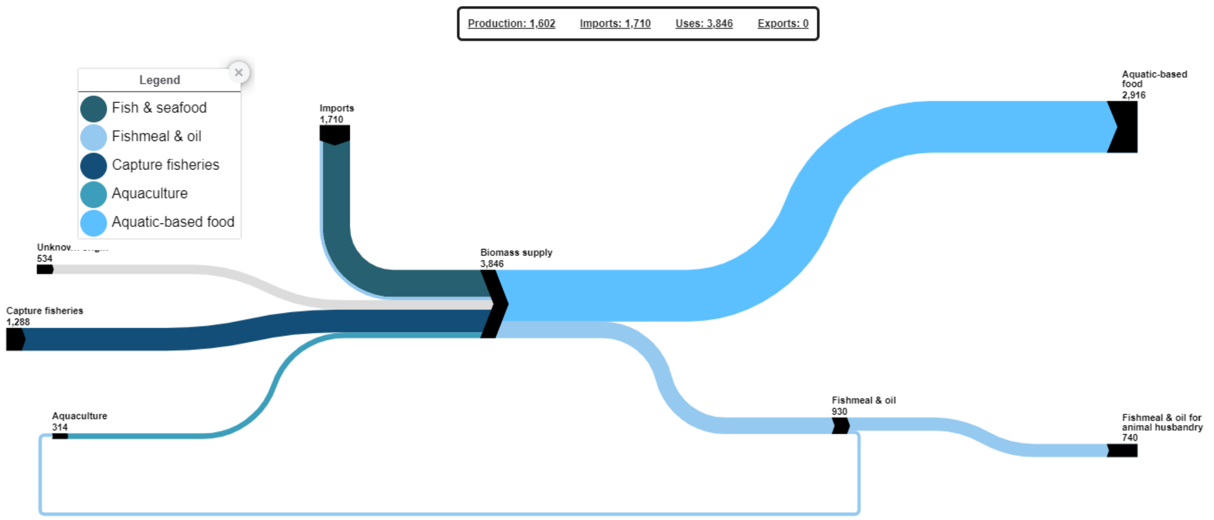


Source: JRC EU Biomass Flows

2.1.3 Fisheries and aquaculture

EU production of seafood by capture fisheries and aquaculture was 6.4 million live weight tonnes in 2011 (i.e. approx. 1.6 million tdm), with 5.2 million tonnes LWE originating from capture fisheries (i.e. approx. 1.3 million tdm) and 1.3 million tonnes LWE from aquaculture (i.e. approx. 0.3 million tdm) (FAO, 2016). EU net imports of seafood products in 2011 amounted to 6.1 million tonnes expressed in live weight equivalents. (1.7 million tdm).

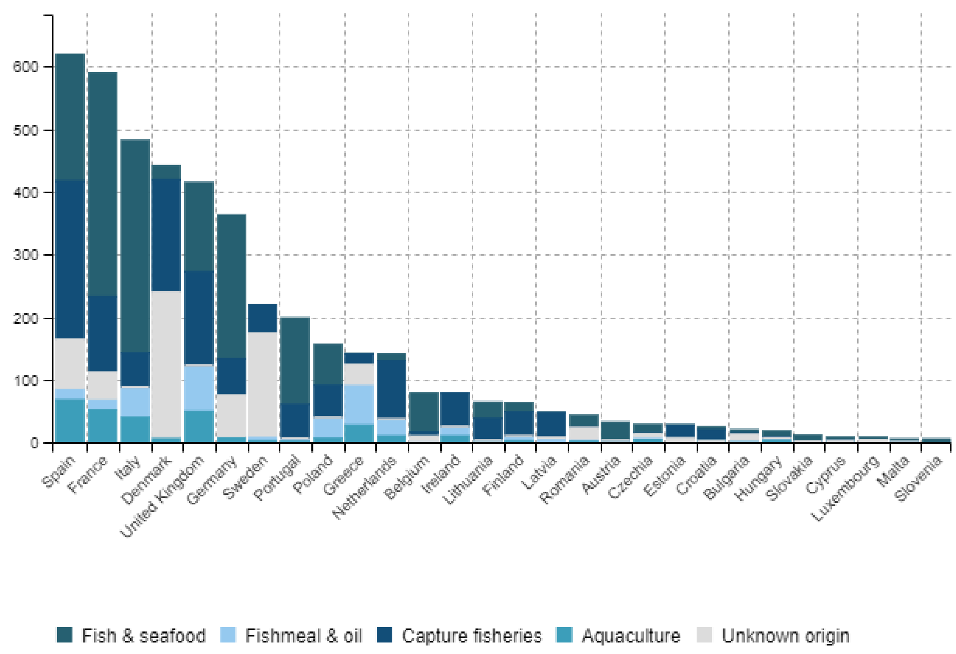
Figure 8. Biomass flows for fisheries and aquaculture, EU27+UK, net trade, 2011 (1000 tdm).



Source: JRC EU Biomass Flows

If we consider only domestic supply of fisheries and aquaculture biomass (in terms of landings and location of aquaculture facilities) of known origin, Spain and France are the biggest suppliers, each producing 15% of the EU27+UK biomass. Italy (13%) and the UK (11%) also supply more than 10% of the EU27+UK aquatic biomass. These 4 countries, together with Germany, supply more than 60% of the total EU27+UK biomass of aquatic origin.

Figure 9. Aquatic biomass supply by type and Member State, net trade, 2011 (1000 tdm).

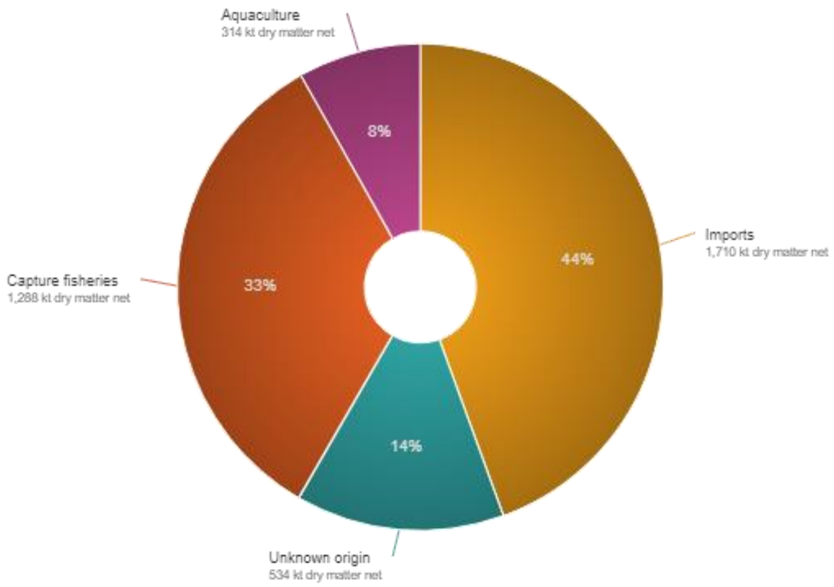


Source: JRC EU Biomass Flows

The aquatic biomass category "Unknown origin" represents the excess use of biomass for a specific Member State that can't be matched by the reported supply of biomass, whether domestic or imported. The causes of this category can be diverse: accounting or reporting errors, lack of data from some Member States or quantities of fish, seafood or aquatic product biomass that cannot be matched with a specific origin. Some Member States have very little biomass in this category (for example, Italy does not report any use of aquatic biomass in excess of the total supply), while it is the biggest category for other Member States, such as Sweden, Denmark or Bulgaria.

In the EU27+UK, 44% of the total supply of fisheries and aquaculture are net imports.

Figure 10. Aquatic biomass supply by origin UE27+UK, net trade, 2011.



Source: JRC EU Biomass Flows

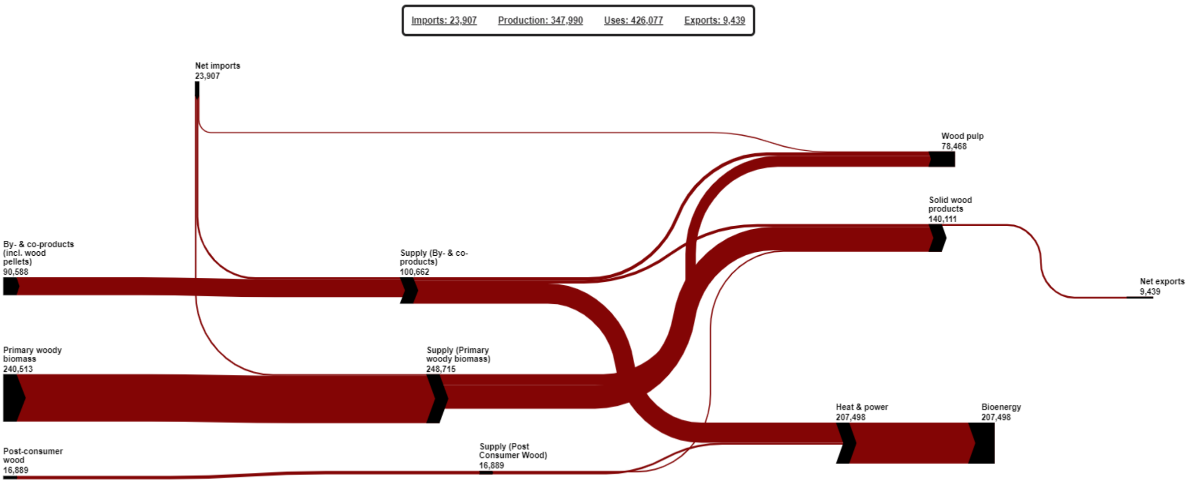
Note that:

- Increases of seafood production, and consequently of seafood biomass production, could be obtained if fish stocks were managed to produce the Maximum Sustainable Yield. The status of fish stocks has been improving in the Northeast Atlantic and Baltic waters over the period 2003-2014, where most fish in the EU is caught (STECF, 2016). Nevertheless, in 2014, the number of overfished stocks (i.e., fishing pressure levels above Maximum Sustainable Yield) in these waters is about 50% of the total number of stocks which were assessed (STECF, 2016). In the Mediterranean and Black Sea, the trend of overfishing is opposite to that in the northern seas of Europe since it has been rising since 2003-2005 for those stocks that were assessed (STECF, 2016). The current situation of Mediterranean and Black Sea's stocks is considered critical with more than 90% of the assessed stocks being overexploited (STECF, 2016).
- Nellemann et al. (2009) reported worldwide discards to be about 30 million tonnes, accounting for 23% of the world-wide catches. The establishment of landing obligation (discard ban) is one of the main aspects in the new EU Common Fisheries Policy (CFP), which aims for a gradual elimination of discards of commercially exploited stocks on a case-by-case basis (EU, 2013). In fact, the extended practice of discarding has been identified as one of the reasons for the failure of the past CFP. Discarding has prevented several fish stock from recovering, despite of the low quotas (EC, 2009). Moreover, the obligation to land all catches and a better use of marine resources are in line with the EU's Europe 2020 Strategy objective of a more resource efficient economy (EC, 2010).
- In the Multiannual National Strategic Plans (European Commission, 2016a) for the promotion of sustainable aquaculture, EU Member States quantify objectives (e.g. production growth) for their domestic aquaculture sector based on addressing the strategic priorities and the EMFF funds received. According to the figures presented in MS' Strategic Plans, the estimated projection for aquaculture production in 2020 is an increase of over 300,000 tonnes (25%) to a total of more than 1.5 million tonnes (European Commission, 2016b).

2.1.4 Woody biomass

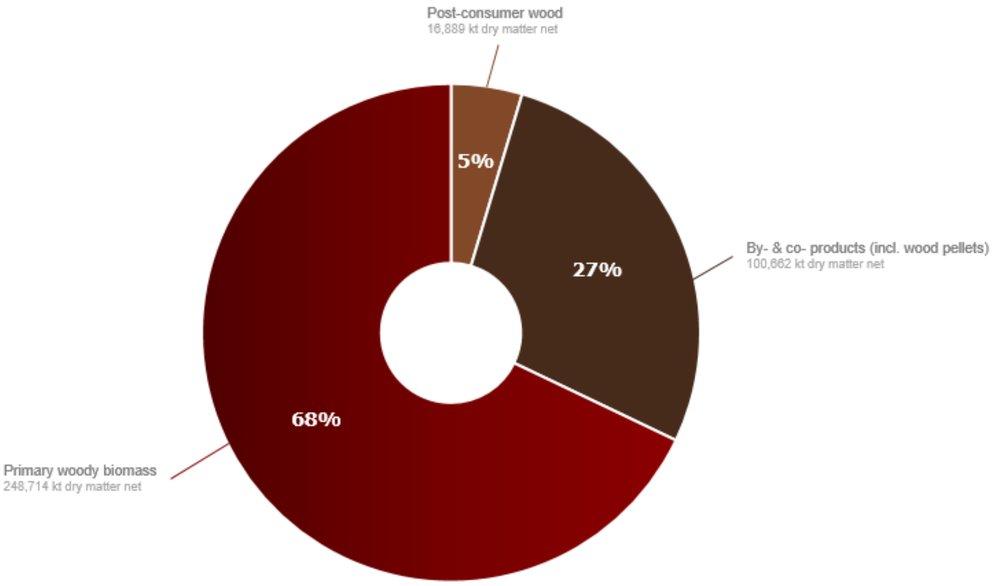
EU27+UK supply[8] of woody biomass from reported data is estimated in total at almost 370 million tdm in 2015. This includes primary and secondary sources of woody biomass. Primary woody biomass is wood removed from forest and other wooded land. Secondary woody biomass is all the woody biomass resulting from a previous processing in at least one industry, it includes solid residues, like chips and particles, other residues, like black liquor, bark and post-consumer wood. The total reported removals of primary woody biomass in EU27+UK add up to 240 million tdm, while the net-import of primary woody biomass is estimated to be about 8 million tdm. The ratio of annual forest fellings in the EU27+UK to net annual increment (NAI) of forest available for wood supply is 78.5% for 2015[9].

Figure 11. Woody biomass flows in the-forest based sector, EU27+UK, net trade, 2015 (1000 tdm).



Source: JRC EU Biomass Flows

Figure 12. Reported sources of woody biomass, EU27+UK, net trade, 2015.

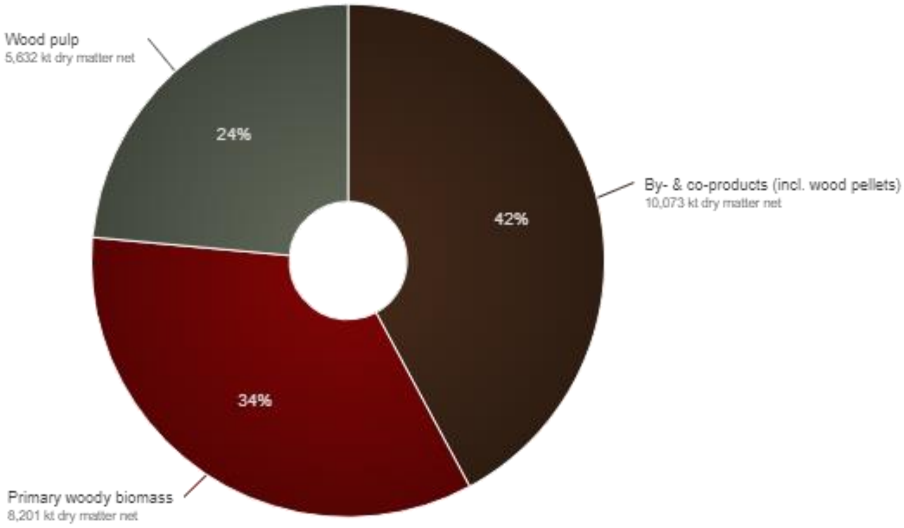


Source: JRC EU Biomass Flows

[8] Supply includes also cascade uses of the same biomass. This results in some “double accounting” of the same biomass.
[9] The ratio of annual fellings to annual net annual increment on FAWS is a commonly used indicator of the intensity of forestry. As a rule of thumb, values lower than 100% indicate harvest levels that can be sustained in the long term, as they entail an increasing growing stock. The opposite holds if the ratio is higher than 100%.

Net-imports of by- and co- products (incl. wood pellets) are about 10 million tonnes dry matter, while net imports of primary woody biomass are 8.2 million tdm and net-imports of wood pulp are 5.6 million tdm.

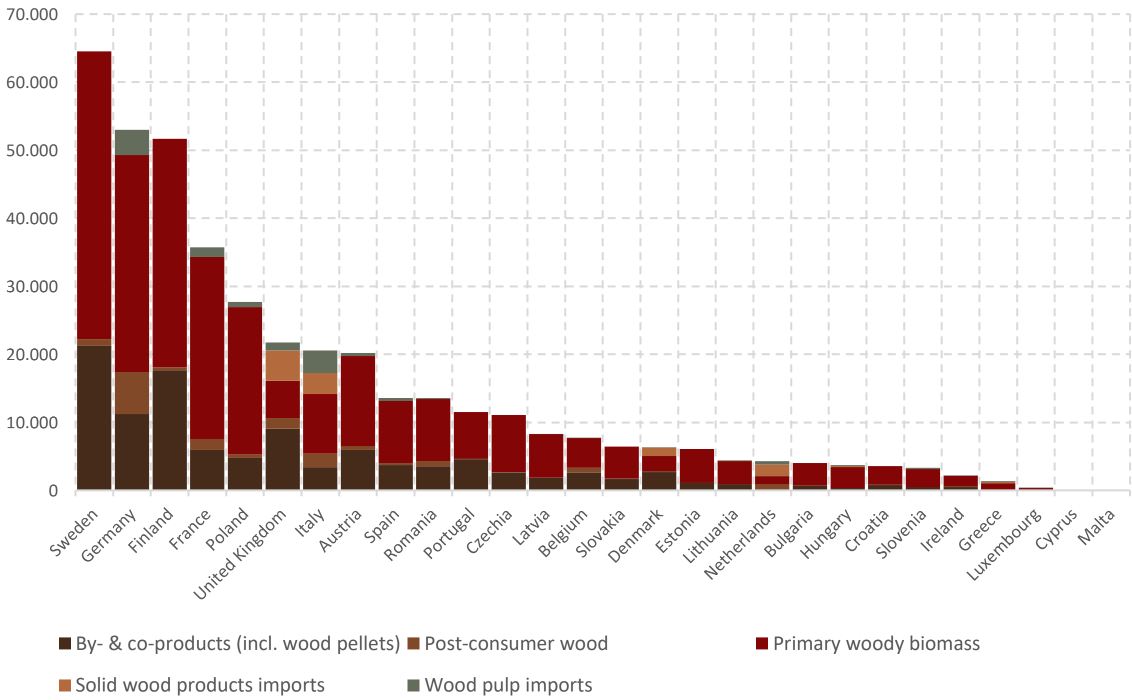
Figure 13. Net-imports of woody biomass, EU27+UK, net trade, 2015.



Source: JRC EU Biomass Flows

In the European Union, the biggest producer of woody biomass is Sweden, followed by Germany and Finland.

Figure 14. Reported woody biomass supply by type and Member State, net trade, 2015 (1000 tdm).



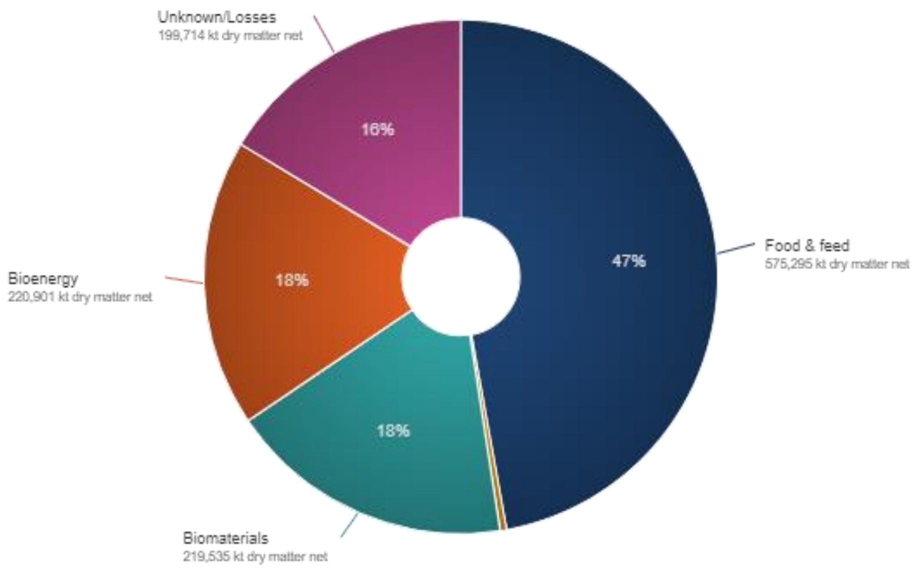
Source: JRC EU Biomass Flows

2.2 Biomass uses

2.2.1 Overview

Feed and food is the most important category in terms of biomass use, adding up to approximately 47% of the biomass. However, due to large data gaps in terms of biomaterial and bioenergy uses of agricultural biomass, those two categories of uses are clearly under-estimated in this document. It is important to note that biogas and bioelectricity have not been considered for this study.

Figure 15. Composition of the EU27+UK biomass uses, net trade, 2015.



Source: JRC EU Biomass Flows

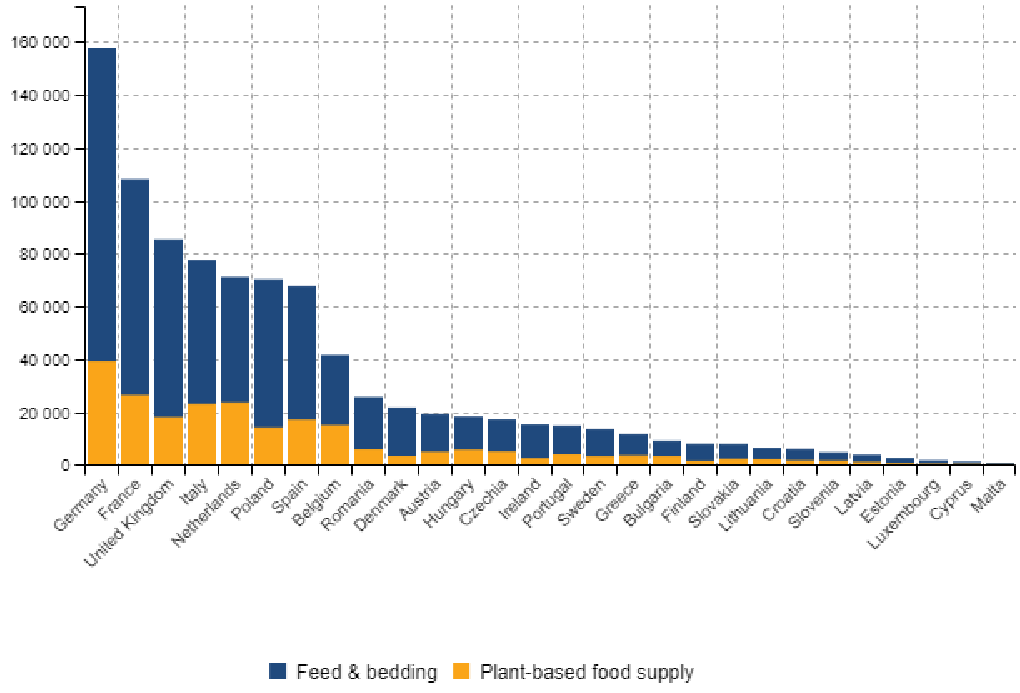
If losses or biomass for which a specific use cannot be estimated are not considered, almost 60% of the available biomass is used for food and feed, with biomaterials and bioenergy accounting for 22% and 21% of the identified biomass uses respectively.

2.2.1 Food and feed

The biomass used for feed and food products is almost entirely of agricultural origin. 68% of the total agricultural biomass supply (gross trade, expressed in dry matter) was used as food and feed in 2017. On average, the share of biomass that is used as animal feed & bedding for the production of animal-based food (either for domestic consumption or for export) is 75% of the total biomass for food and feed uses, while the rest was directly consumed as plant-based food. One third of the collected crop residues is used for feed and bedding and horticulture purposes, while the other two thirds are discarded or used in downstream sectors. How these two thirds are split into bio-materials and bioenergy uses cannot be quantified at this point.

Within the EU27+UK, Germany (157 million tdm) and France (108 million tdm) were the biggest producers of food and feed. Figure 16 and Table 1 show the proportion of biomass dedicated to producing animal- or plant-based food in each country. Member States with a higher share are either bigger exporters of animal-based food and animal food products or consume higher quantities of meat and animal products.

Figure 16. Food and feed uses, gross trade, 2017 (1000 tdm).



Source: JRC EU Biomass Flows

Table 1. Biomass used for food purposes, gross trade, 2017 (1000 tdm).

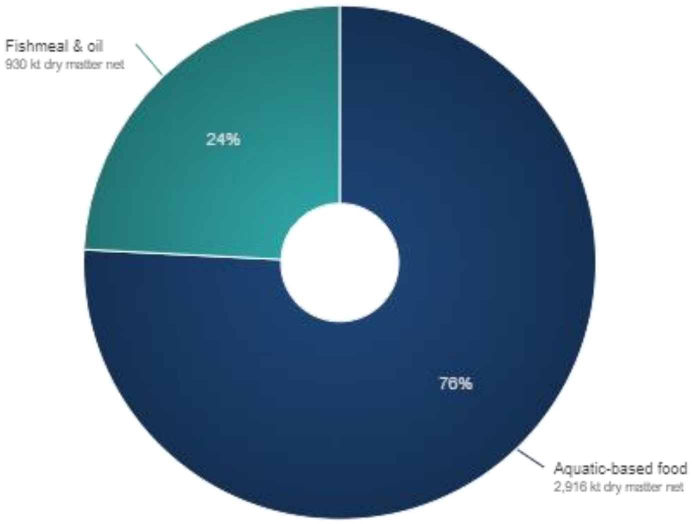
Country	**Feed & bedding**		**Plant-based food supply**	
Germany	118,476	75%	38,974	25%
France	81,788	76%	26,158	24%
United Kingdom	67,242	79%	17,921	21%
Italy	54,502	70%	22,829	30%
Netherlands	47,431	67%	23,441	33%
Poland	56,110	80%	13,982	20%
Spain	50,667	75%	16,819	25%
Belgium	26,469	64%	14,802	36%
Romania	19,867	78%	5,628	22%
Denmark	18,348	85%	3,123	15%
Austria	14,223	75%	4,776	25%
Hungary	12,611	70%	5,484	30%
Czechia	12,040	71%	4,872	29%
Ireland	12,671	84%	2,339	16%
Portugal	10,851	74%	3,741	26%
Sweden	10,253	77%	3,048	23%
Greece	8,056	70%	3,376	30%
Bulgaria	5,808	65%	3,098	35%
Finland	6,439	83%	1,311	17%
Slovakia	5,605	73%	2,094	27%
Lithuania	4,267	69%	1,939	31%
Croatia	4,340	74%	1,496	26%
Slovenia	3,176	69%	1,425	31%
Latvia	2,591	73%	969	27%
Estonia	1,924	80%	477	20%
Luxembourg	1,193	79%	317	21%
Cyprus	777	77%	232	23%
Malta	407	79%	111	21%

Source: JRC EU Biomass Flows

The EU Biomass Flows tool also offers visibility on the nutrient share of the food consumed. This has been estimated following the methodology described by in section 3.1.1.

0.5% of the biomass dry matter that is used for feed and food is of aquatic origin although most of the biomass supply (70%) is consumed as food. As explained in the previous section, aquaculture and capture fisheries growth may not be able to meet the increasing demand so that imports will need to increase, further increasing the dependency of Europe on the rest of the world for its seafood products (Failler, 2007).

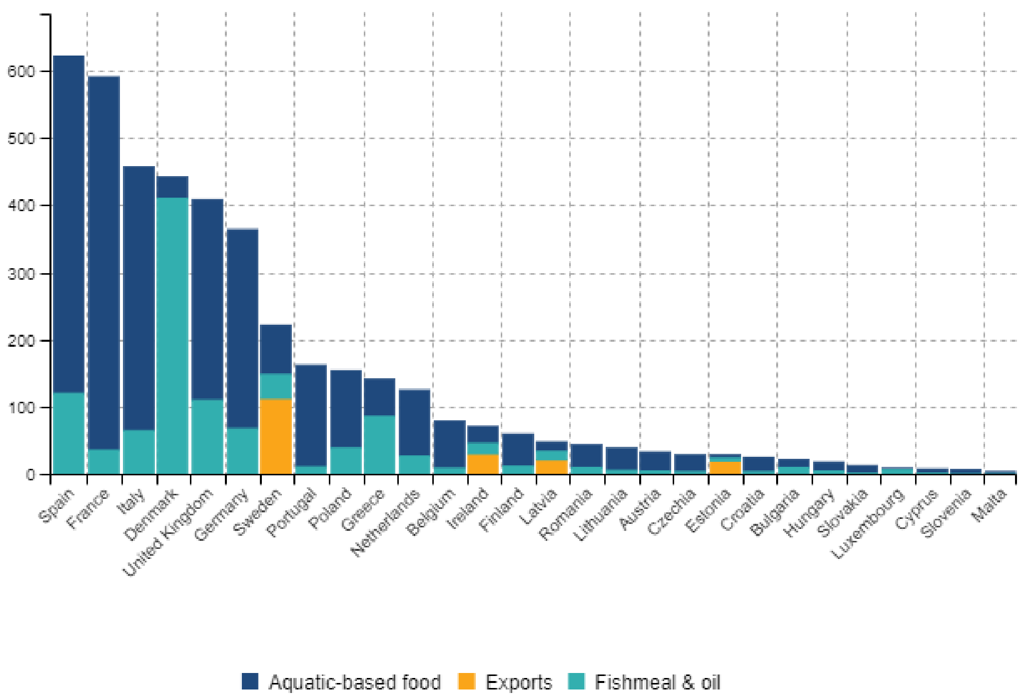
Figure 17. Aquatic biomass uses in the UE27+UK, net trade, 2011.



Source: JRC EU Biomass Flows

Spain and France are the biggest producers of aquatic-based food, summing up 36% of the total. Denmark, on the other hand, is the biggest manufacturer of fishmeal and oil with 37% of the total in the EU27+UK.

Figure 18. Aquatic biomass use by type and Member State, net trade, 2011 (1000 tdm).



Source: JRC EU Biomass Flows

2.2.2 Biofuels and biomaterials

First generation biofuels still play a very minor role in the total European Union bioenergy sector, although in some countries they have a bigger weight.
Most of the biomass used as biofuels is woody biomass. In 2015, 207 million tdm of directly or indirectly[10] gathered woody biomass were estimated to have been used for energy.
A forthcoming JRC report (Camia et al., 2020) will provide a detailed analysis on the use of woody biomass for energy production in the EU.
Biofuels use in the EU27+UK transport sector in 2015 totalled 12381 ktoe in energy terms. Common arable crops including wheat, barley, sugar beet, maize, sugar cane, sunflower and soya cover nearly 95% of biomass supplied in transport sector in 2015. Based on the available data[11], the volume of domestic common arable crops supplied to the transport sector in 2015 is estimated at nearly 13.5 million tdm[12]. Germany was the main supplier with 6715 million tdm followed by Hungary (1590 million tdm) and Romania (475 million tdm).
It is important to note that, due to lack of data that can be integrated with the sources used for this anlysis, many bioenergy pathways are not included in this analysis (e.g. biogas production from biowaste) at this point.
Almost all of the biomaterials also have an origin in forestry activities with the biggest component being solid wood products. In 2015, almost 220 million tdm of wood were used for bio-materials. EU27+UK is also a net exporter (10 million tdm) of solid wood products.

[10] From processed wood or as by- or co-product of industrial roundwood processing.
[11] Since not all EU Member States reported on biomass supply for transport, this amount does not represent the total amount of biomass that has been supplied in the EU transport sector in this year (see Table 5). The contribution of this volume of common arable crops in energy terms in year 2015 was equal to nearly 7318 ktoe. To calculate the overall contribution of common arable crops in energy terms in the EU transport sector the conversion ratio between crops and biofuels use in transport sector is assumed equal to 1 in cases when only the energetic value is reported.
[12] The conversion ratio between crops and biofuels use in transport sector is assumed equal to 1.

3 Data

The base data of the diagram has been extracted from multiple sources using different methods, and each source reports data in different units. A common unit was needed to integrate biomass quantities across sectors. We have selected to present the data in **dry matter** weight to enable comparison of biomass values of different origin (e.g. vegetal vs. animal; woody vs. agricultural biomass).
For this purpose, all data were converted to dry matter weight by applying conversion coefficients to the fresh matter values where necessary. The different conversion coefficients used for the different biomass commodities are detailed later in this document.
Some of the components of the diagram will be missing for a certain country and/or year if the corresponding data has been reported as 0. Consequently, not all countries and years show all identified biomass categories.
It is also important to note that the time series of data available for a biomass commodity or indeed a sector is not always the same. To enable comparison with the latest available year of data for each sector, we have created a data point called "latest available data" that shows the latest year of complete available data for each sector. These are 2017 for agriculture, 2015 for forestry and 2011 ofr fisheries and aquaculture and biofuels.
Most of the data structure has not been changed in regards to the previous EU Biomass Flows tool. However, there have been some changes in data sources and adjustments to coefficients. Some data have also been refreshed or new years have been added to the time series.
Additionally, and because of the functionalities available in the new tool, we have been able to introduce some new data to reflect circular flows between biomass categories.
In this chapter, we will summarise the data sources and transformation that were described in the previous report and highlight any changes that might have been implemented.

3.1 Agriculture

3.1.1 Methodology, data sources and transformation of data

The methodologies used to calculate, estimate and describe agricultural biomass flows differ on the supply and the use side. On the supply side, agricultural biomass is calculated using economic crop production[13] and total crop residues data compiled by the JRC D5 unit, as well as trade and estimated grazing data elaborated by the JRC D4 unit. On the use side, food and feed type and nutrients are estimated by the JRC D4 units based on the diet of the population of each Member State.
Statistics on agricultural biomass supply and uses are usually reported separately in different datasets. The different datasets are integrated to represent the biomass content of each side of the diagram. More details on the data sources can be found in Table 4.
Agricultural biomass **supply** has three components:

— **Economic crop production** (biomass produced in form of grains, fruits, roots or tubers) is assessed using EUROSTAT official production statistics both at national and regional level (tables apro_cpsh1[14] and apro_cpshr[15]) within the period 1998-2017. In addition, data from the national statistical offices are integrated and harmonized with EUROSTAT datasets. To avoid data gaps and inconsistencies in the integrated diagram, the time series shown in the diagram has been limited to 2008-2017. Economic crop production data are sourced at standard humidity, and then converted to dry matter as follows:

$$Y_0 = Y_m * (1 - m)$$

[13] "Total economic crop production", mentioned as "Crop production" on the EU Biomass Flows tool, refers to the crop quantity harvested from the field. Therefore, it excludes post-harvest collected crop residue.
[14] https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=apro_cpsh1&lang=en
[15] https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=apro_cpshr&lang=en

where Y_0 is dry-matter economic yield (or production) and Y_m is economic yield (or production) statistics at moisture content m. The values used for m are shown in Annex 1, coming from EUROSTAT reference values given in EUROSTAT Handbook on Annual crop statistics (Eurostat, 2017) and several scientific studies consulted. In the case of fodder crops and pulses, the moisture content at which Member States report production data to EUROSTAT differ substantially and, therefore, for those countries reporting m that value was used. If m is not reported, then the reference value is used as default.

— **Crop residue production** (biomass produced in form of straw, chaff, husks, etc.) is estimated from economic production for crops from the following groups: cereals, oil-bearing crops, sugar and starchy crops, pulses, industrial crops, and permanent crops. Estimations are based on crop-specific empirical models and transformation coefficients relating crop economic production with residues. Annex 2 lists the approaches used for each of the crops covered. For cereals, oilseeds, and sugar and starchy crops, new empirical models were developed in the original project, assuming that a relationship exists between crop economic yield at 0% moisture content (Y_0) and the harvest index (HI), or directly with the dry matter residue yield (R). Once Y_o and HI are known, R (in tonnes/ha) is calculated as:

$$R = \frac{Y_0}{HI} - Y_0$$

The computation of HI from economic yield is performed at regional (NUTS3) level, as the empirical equations are non-linear for many crops and may lead to important inconsistencies when applied at higher administrative levels. Once that HI is obtained at NUTS3 level, residue values are computed at the same level and then aggregated at higher administrative levels, including national. The regionalisation perocedure is described in Cerrani, I. and López Lozano, R. (2017).

A full explanation of the fundamentals of these new models is given in van der Velde (Ed.) (2016) and Garcia-Condado et al. (2019).

For the remaining crops, existing empirical models or fixed values for HI found in scientific literature were used (see Annex 2). For fodder crops, vegetables and energy crops, residue yields were not estimated, and thus all plant biomass is considered as economic production.

Not all residues are collected and transported from the fields. To estimate the biomass from crop residues that is actually collected and therefore has the potential to be utilised for animal feed or other purposes, a coefficient has been applied to the crop residues production of each crop type. The coefficients applied are presented in Annex 3.

Finally, not all biomass collected from crop production residues is utilised. Another coefficient is applied to the residues collected from the fields to estimate the portion of residues that flow from supply to economic uses.

Both residues left in the field and unused residues are shown in the biomass flows diagram. Some of this biomass could potentially be used, increasing the efficiency of agricultural biomass production.

— **Biomass from grazing** is biomass produced in grasslands that is not harvested, but used only for grazing. The quantity of biomass grazed is considered as proportional to pasture and meadows land area reported in FAOSTAT[16] Land Use (1.8 tdm/Ha).

All estimates for crop and residue production are compiled in the JRC - Biomass supply and potentials database[17].
As a new feature, both agricultural crop and residue production can be disaggregated in 10 crop categories: cereals, oilcrops, root crops, fodder crops, fiber crops, fuits, nuts and grapes, other industrial crops, olive trees, pulses and vegetables.

[16] http://www.fao.org/faostat/en/#data/RL
[17] The JRC Biomass supply and potentials is a database that compiles the data provided for the Biomass project by all participating JRC units (D1, D2, D4, D5 and C2). This database has different sources, including EUROSTAT and FAOSTAT.

Agricultural biomass can be **used** for different purposes:

- **Food (both of plant and animal origin) and feed and bedding** from agricultural biomass are calculated based on food supply for the population of each Member State from FAOSTAT Food Balance Sheets[18]. Factors from the scientific literature have been applied in the case of the flows from crop residues to feed and bedding and to bio-material uses.

  Feed and food uses are split in the EU Biomass Flows tool into: (i) aquatic food, (ii) plant-based food, (iii) animal-based food) and (iv) animal feed and bedding. The estimation of aquatic food uses is made separately using fisheries data (see section 3.2.1). The quantification of plant-based, animal-based and feed and bedding uses is derived from the "Total Food Supply" reported in the FAOSTAT Food Balance Sheets.

  Calculation steps:

1. The total food supply (FS) expressed in kcal/capita/day is converted into kcal/year using population data from the same source (i.e. FAO Food Balance Sheets).

   i.e. $\mathrm{FS\ (kcal)}_{\mathrm{i,j}} = \mathrm{FS}_{i,j} \times \mathrm{Population}_{\ i,j} \times 365$

   where FS is the food supply in kcal/cap/d of the country *i* and for the year *j*.

2. The food supply (kcal) is split into its 3 main nutrients: proteins, fats and carbohydrates considering that the shares of nutrients $\%N_k$ given by Piotrowski et. al (2015b):

Table 2. Proportion of Carbohydrates, fats and proteins in total food supply.

Nutrient *k*	**Share of nutrient ($\%N_k$)**[19]
Carbohydrates	0.50
Fats	0.38
Proteins	0.12

Thus the nutrient supply is calculated as follows:

$$\mathrm{NS\ (kcal)}_{\mathrm{i,j,k}} = \mathrm{FS\ (kcal)}_{i,j} \times \%\mathrm{N}_k$$

where %N is the share of nutrient *k* in the total food supply of the country *i* and for the year *j*.

3. Plant-based food uses and animal-based food uses are estimated by splitting Nutrient Supply: $\mathrm{NS\ (kcal)}_{\mathrm{i,j,k}}$ into the 3 biomass sources of food supply: vegetal, animal (excl. aquatic) and aquatic.

   Table 3 shows the conversion factors used. It is considered that 1 kcal = 0.004187MJ

[18] http://www.fao.org/faostat/en/#data/FBSH, http://www.fao.org/faostat/en/#data/FBS for data until and after 2013 respectively.
[19] Note: calculated for the EU27 in 2011 by Piotrowski (2014) from FAO Food Balance Sheets.

Table 3. Factors used in the conversion of nutrient supplies from kcal to kg (dry matter).

Nutrient *k*	**Conversion factor (MJ/kg)**	**Share of biomass from plant origin**	**Share of biomass from aquatic origin**	**Share of biomass from animal origin (excl. aquatic)**
Carbohydrates	16.7	0.95	0.0005	0.0495
Fats	37.7	$Plant_{i,j,k}/FS_{i,j,k}$	$Aqua_{i,j,k}/ FS_{i,j,k}$	$(1- Plant_{i,j,k}- Aqua_{i,j,k})/ FS_{i,j,k}$
Proteins	16.7	$Plant_{i,j,k}/ FS_{i,j,k}$	$Aqua_{i,j,k}/ FS_{i,j,k}$	$1- Plant_{i,j,k}- Aqua_{i,j,k})/ FS_{i,j,k}$
Other	non-nutritional food components (minerals, dietary fibres) account for an additional 10% of total food supply			

Note: Fixed factors are taken from Piotrowski (2014)

$Plant_{i,j,k}$ is the supply in vegetal products in nutrient *k* of the country i and for the year *j* (source: FAO Food Balance Sheets)

$Aqua_{i,j,k}$ is the supply in aquatic products in nutrient *k* of the country *i* and for the year *j* (source: FAO Food Balance Sheets)

$FS_{i,j,k}$ is the supply in animal products (excluding aquatic products) in nutrient *k* of the country *i* and for the year *j* (source: FAO Food Balance Sheets)

i.e.

$$\textbf{Plant}-\textbf{based food uses}\ (\textbf{1000 Tdm})_{\textbf{i,j}} =$$

$$\text{FS (kcal)}_{i,j} \times 0.004187 \times 1.1 \times (16.7 \times 0.95 + 37.7 \times \frac{\text{Plant}_{i,j,k=fats}}{FS_{i,j,k=fats}} + 16.7 \times \frac{\text{Plant}_{i,j,k=proteins}}{FS_{i,j,k=s}})$$

And

$$\textbf{Animal}-\textbf{based food uses}\ (\textbf{1000 Tdm})_{\textbf{I,j}} =$$

$$\text{FS (kcal)}_{i,j} \times 0.004187 \times 1.1 \times (16.7 \times 0.0495 + 37.7 \times \frac{(1-\text{Plant}_{i,j,k=fats} - \text{Aqua}_{i,j,k=fats})}{FS_{i,j,k=fats}} + 16.7 \times \frac{(1-\text{Plant}_{i,j,k=fats} - \text{Aqua}_{i,j,k=fats})}{FS_{i,j,k=fats}})$$

4. Feed and bedding uses

Animal-based food uses are converted in feed equivalents using the efficiency conversion coefficient of 6.8% from Piotrowski et al. (2015a).

i.e.

$$\textbf{Animal feed and bedding uses}\ (\textbf{1000 Tdm})_{\textbf{i,j}} = \frac{\text{Animal}-\text{based food uses (1000 tdm)}_{\text{I,j}}}{0.068}$$

Please note that, although not of agricultural origin, fishmeal used to feed livestock has been included in the agricultural flows as it is not possible to identify how much animal-based food has been produced using only fishmeal.

— **Biomaterials** data are difficult to retrieve or estimate. Much of the agricultural matter that is originally processed into biomaterials is ultimately used to feed farm animals. A rough estimation of

the biomaterials of agricultural origin based on production statistics would include biomass for feed that has potentially already been considered in the feed and bedding estimation. We have therefore only reported agricultural biomass that is not suitable for food, feed or energy production (fibre crops) in this category, as well as the biomass needed to produce exports of leather and leather related products.

- **Biofuels** is also an area where data that can be integrated are scarce. Data from the EU Member States biennial reporting under the Renewable Energy Directive[20] have been used. The EU Biomass Flows tool makes use of data on biomass supply for transport for the years 2011, 2013 and 2015. Data are sourced from Table 4 of the EU Member States progress reports template[21], in which data on sustainable biofuels[22] for transport are available as: (i) common arable crops for biofuels; (ii) Energy crops (grasses etc.) and short rotation trees for biofuels; (iii) other (liquid waste and by-products). The data reported by Member States on biomass supply for transport include both domestic and imported raw material (from the EU and outside the EU). Reporting of the EU Member States on biomass supply for transport for the selected years is done with respect to the Article 17 of the Directive 2009/28/EC[23] on 'sustainability criteria for biofuels and bioliquids' and also with respect to Article 18 'Verification of compliance with the sustainability criteria for biofuels and bioliquids'. The progress reports template requires Member States to report on forestry in m^3 while Agriculture and Waste are reported in tonnes. Despite this, the EU Member States reporting on biomass supply for transport is not uniform. It is sometimes difficult to define the measurement units because there are not even reported by MS. When the data are reported in tonnes, we assume it is dry matter. Some Member States report on biomass supplied for transport in litres (e.g. rapeseed oil). In this case the conversion from litres to tonnes is performed using the density of oil that can be found in the literature[24].

EUROSTAT Comext is used for the quantification of biomass **trade** data, following the process described by Ronzon et al. (2015). Data for the following categories are considered:

- Plant-based food: Plant-based products (vegetal portion of CPA C10), beverages (CPA C11) and tobacco products (CPA C12).
- Plant products: Vegetal raw material (vegetal portion of CPA A01).
- Processed products (biomass eq.): Leather and related products (biomass estimated in CPA C13, C14, C20, C21, C22, C29). Estimations are done using biobased shares developed by the JRC and nova.
- Animal products: Animal based food (from CPA A01) and live animals (CPA C10).

Coefficients were applied to take into account the production process of manufactured products (e.g. the manufacture of one tonne of bread makes use of 1.3 tonnes of cereals) and all data were converted into dry matter. All data resulting from this conversion steps is therefore an estimation of traded biomass of agricultural origin in dry matter tonnes of vegetal biomass equivalent.
More details on data sources and transformation are given in Figure 19 and Figure 20 as well as in Table 4.

[20] Directive 2009//EC http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=en
[21] https://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports
[22] MS are requested to report only on biofuels that fulfil the criteria of sustainability as specified in Article 29 (10) of the Directive 2018/2001/EU (Renewable Energy Directive recast REDII).
[23] In the Renewable Energy Directive recast (Directive 2018/2001/EU) the obligations are set at Article 29 on 'Sustainability criteria for biofuels, bioliquids and biomass fuels' and Article 30 on 'Verification of compliance with the sustainability criteria for biofuels, bioliquids and biomass fuels'.
[24] Physical properties of fats and oils http://www.dgfett.de/material/physikalische_eigenschaften.pdf

Figure 19. Data sourcing and transformation for agricultural biomass supply in the EU Biomass Flows tool.

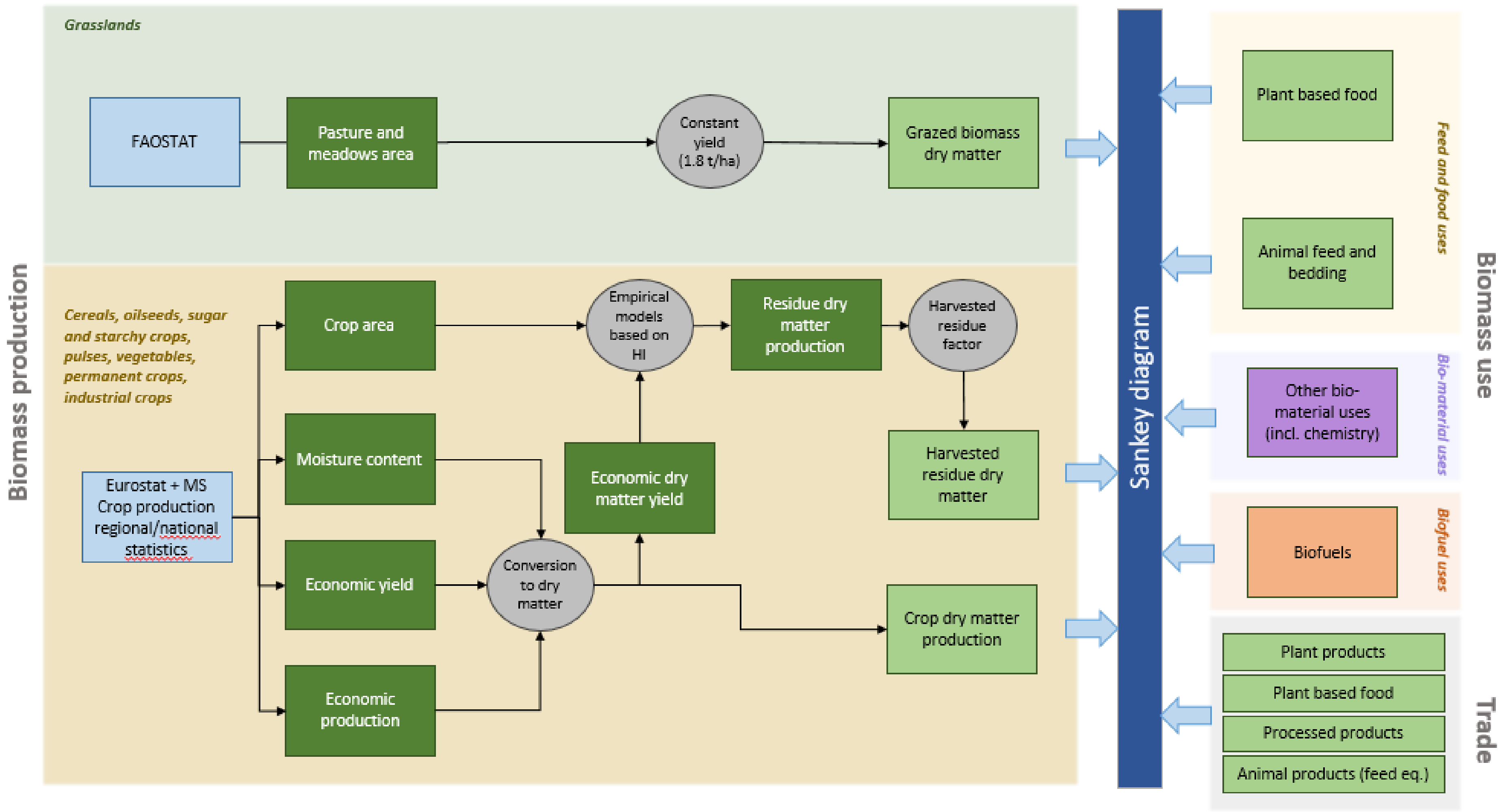


Figure 20. Data sourcing and transformation for agricultural biomass uses and trade in the EU Biomass Flows tool.

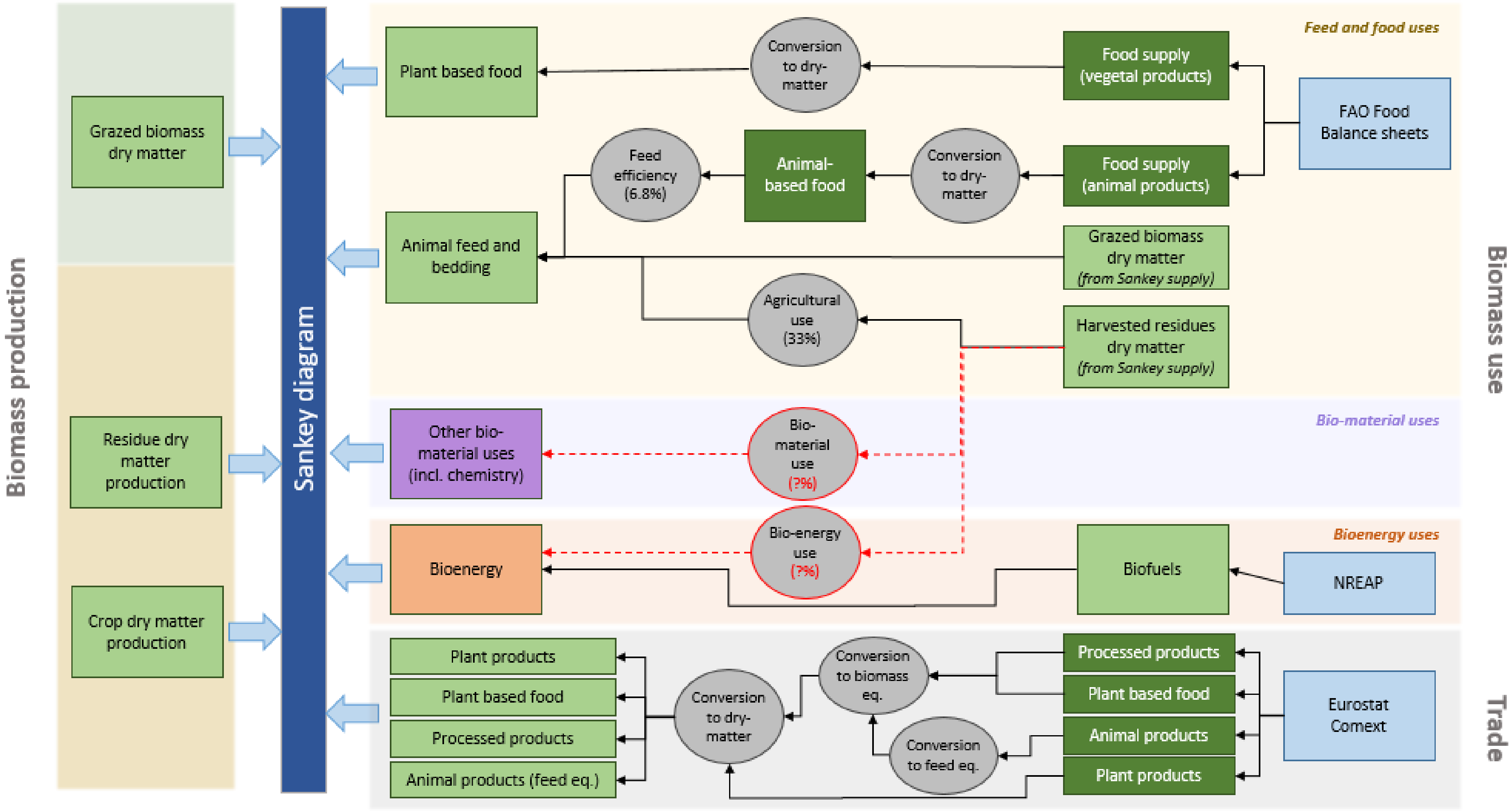


Table 4. Overview of data sources and data transformations integrated in the agricultural biomass balance sheet.

Function	Sector	Domestic/Trade	Measure	Data source	Data transformation
Supplies	Agriculture	Imports	Plant products	Eurostat Comext	Conversion to dry matter (See Annex 1)
			Plant based food		Conversion to biomass equivalent and dry matter[(e)]
			Processed products		Conversion to biomass equivalent and dry matter (tdm)[(f)]
			Animal products (feed eq.)		Conversion to feed equivalent (tdm) and dry matter: 3.69%[(f)]
		Domestic production	Crops	JRC - Biomass supply and potentials (DataM)[(a)]	Dataset Attribute: Agriculture Economic Production Dry Matter
			Residues		Dataset Attribute: Agriculture Residue Production Dry Matter
					Application of a share of collected residues (See Annex 3)
			Grazed biomass	FAOSTAT Inputs (Land)[(b)]	Application of a grazed biomass yield: 1.8 tdm/Ha of meadows and pastures[(f)]
Uses	Feed, food & plant products	Animal feed and bedding (calculated as feed demand for animal-based food)	from harvested crops	FAOSTAT Food balance sheets[(c)]	Conversion animal food supply to feed equivalent (tdm) and dry matter
			from grazed biomass	Equal to grazed biomass supplies	-
			from crop residues	Harvested and used crop residues (see supplies)	Application to collected residues of a share of used residues used for feed and bedding: 33%[(g)]
		Plant-based food	Plant based food	FAOSTAT Food balance sheets[(c)]	Conversion vegetal food supply to tdm
		Exports	Plant products	Eurostat Comext	Conversion to dry matter (See Annex 1)
			Plant-based food		Conversion to biomass equivalent and dry matter[(e)]
			Processed products		Conversion to biomass equivalent and dry matter (tdm)[(f)]
			Animal products (feed eq.)		Conversion to feed equivalent (tdm) and dry matter: 8.34%[(f)]
	Biomaterials	Fibre crops	from crops	JRC - Biomass supply and potentials (DataM)(a)	-
		Exports	Processed products	JRC - Biomass aggregates (DataM)[(a)]	Conversion to biomass equivalent (tdm)[(f)]
	Biofuels	Biofuels consumption	Liquid biofuels 1st generation	NREAP database[(d)]	-

(a) Accessible with restricted access at: https://datam.jrc.ec.europa.eu/datam/public/pages/datasets.xhtml
(b) Accessible at: http://www.fao.org/faostat/en/#data/RL
(c) Accessible at: http://www.fao.org/faostat/en/#data/FBSH, http://www.fao.org/faostat/en/#data/FBS for data until and after 2013 respectively.
(d) Accessible at: https://visualise.jrc.ec.europa.eu/t/NREAPs/views/All_NREAPs_REData/SeeAllNREAPs-AllREData?%3Aembed=y&%3Adisplay_count=no&%3AshowVizHome=no
(e) The conversion from tonnes of final products to vegetal biomass equivalents is based on the coefficients published by the EC DG Agriculture and Rural Development 2015, Agricultural Trade Statistics, Annex I, available at: https://ec.europa.eu/agriculture/sites/agriculture/files/statistics/trade/2016/products-description.pdf
(f) Same methodology as the one presented in Piotrowski et al. 2015.
(g) Based on Scarlat, Martinov et al. (2010), Piotrowski et al. (2015), Bentsen et al. (2014) and Ericsson and Nilsson (2006).

3.1.2 Data availability and limitations

- The EU Biomass Flows tool displays agriculture data for the time series 2008 – 2017. Data are available from 2000, but it is not shown in order to maintain the integration across sectors.
- Estimates of crop biomass production rely on EUROSTAT crop production statistics (apro_acs), which sometimes presents some data gaps within the period considered for some minor crops.
- Agricultural production data is available for all EU27+UK Member States and EU27+UK total.
- Both total and net trade values are available for all EU27+UK Member States and EU27+UK total. Therefore both the net and total trade views are available for the agriculture categories.
- As stated in previous chapters, the statistics available for biomaterials of agricultural origin are very limited. Estimations of some categories with the available data are not very reliable because of multiple potential causes:
- Biomaterial data is often reported in units of different than mass (e.g. pieces). Conversion factors are available for some products, but some cannot be estimated.
- Dry matter content is also often not available.
- For products that are composed of bio- and non-bio-based components, it is often difficult to estimate the bio-based content.
- Some chemicals can be produced from bio-based or non-biobased feedstock. Estimating which portion of the production has been produced using bio'based feedstock is challenging at the least.
- In some cases, agricultural matter is used to manufacture products that can be considered biomaterials (e.g. starch). These biomaterials are however ultimately used for feeding purposes, and are thereafore already considered in the food and feed category estimation. To avoid double counting, further investigation of these categories is required.
- In the case of biofuels, there are recent data but not complete[25] or easily comparable across countries due to the difficulty of defining the reported units (tonnes, litres etc.). Some Member States report data using the above-mentioned table in the progress reports template, whereas some other Member States use only the description on biomass supply. The EU Member States reporting under the Renewable Energy Directive do not provide data on crop mix used for biofuels.

[25] Only 17 EU MS have reported on biomass supply in transport sector in their 2017 progress reports.

Table 5. Availability of common arable crops data for transport, 2011, 2013 and 2015.

Member State	2011	2013	2015
Austria	+	+	+
Belgium	+	+	+
Bulgaria[26]	+	N/A	+
Croatia	+	+	+
Cyprus	+	+	N/A
Czech Republic	+	+	+
Denmark	N/A	N/A	N/A
Estonia	N/A	N/A	N/A
Finland	N/A	N/A	N/A
France	N/A	N/A	N/A
Germany	+	+	+
Greece	N/A	N/A	+
Hungary	N/A	N/A	+
Ireland	N/A	+	+
Italy	+	+	+
Latvia	N/A	N/A	+
Lithuania	N/A	+	+
Luxembourg	N/A	N/A	N/A
Malta	N/A	N/A	N/A
Netherlands	N/A	N/A	N/A
Poland	N/A	N/A	+
Portugal[27]	+	N/A	N/A
Romania	+	+	+
Slovakia	+	+	+
Slovenia	N/A	N/A	N/A
Spain	+	+	N/A
Sweden	N/A	N/A	N/A
United Kingdom[28]	N/A	+	+

[26] The increase of common arable crops used in Bulgaria to produce biofuels was by 56% in 2015 comparing with 2014. The calculation uses a factor 1 to convert from quantity of biofuels to quantity of arable crops (129 million tdm in 2014). Source 2015 and 2017 Bulgarian Progress Reports.

[27] Quantity of maize used in Poland in the production of bioethanol.

[28] United Kingdom data are sourced from the reference provided in the UK Progress Report 2017 in relation to the area of arable crops used to produce biofuels. According to these data the volume of wheat and sugar beet used in UK to produce biofuels (bioethanol) was in 2015 respectively 594 000 tonnes (60 million litres of bioethanol) and 368 000 tonnes (134.9 million litres of bioethanol).

3.2 Fisheries and aquaculture

3.2.1 Methodology, data sources and transformation of data

Fisheries biomass balance sheets have been elaborated by the JRC D2 unit using a Multi Region Input-Output (MRIO) model based on seafood production[29], trade and use data.

The biomass flows within the seafood supply chain are estimated using a MRIO model (Leontief & Strout, 1963; Lenzen et al., 2004; Wiedmann, 2009). This model extends the Leontief's input-output analysis (I/O) used in macroeconomics and in national accounting to represent inter-industry relations by accounting for relations between different national economies as determined by international trade.

The data used to populate the model and calculate the technical coefficients were obtained from the FAO commodity balance sheets, aquaculture and capture fisheries statistics, seafood commodities production statistics, EUROSTAT - COMTRADE trade statistics and technical coefficients on the use of fishmeal in aquaculture and in the feed industry reported in the literature (see Table 6).

Table 6. Overview of data sources and data transformations integrated in the fishery biomass balance sheet.

Data	**Data source**
Aquaculture production	FAO - FishstatJ
Catches from fisheries	FAO - FishstatJ
Production of fish meal	FAO - FishstatJ
Production of processed fish commodities	FAO - FishstatJ
Trade of fish commodities	EUROSTAT - COMTRADE
Apparent consumption of fish	FAO - Food balance sheets
Coefficient for the conversion of fish commodities into live weight	EUMOFA
Livestock (pigs and chicken)	FAOSTAT
Ratio of aquaculture production on aquafeed and economic feed conversion ratio and ratio of fishmeal and fish oil in aquafeed	Tacon & Metian, 2015; Shepherd & Jackson, 2013
Proportion of fish for reduction into fishmeal	Tacon & Metian, 2015; Alder et al., 2008

Some transformations are needed to integrate fisheries and aquaculture data with biomass from other sectors.

- Use of live weight. At a first stage, the seafood balance sheets are expressed in live weight equivalents because most seafood statistics are reported in live weight equivalents. Moreover, the use of live weight equivalents allows full comparability with production and seafood availability (i.e. stock assessments) estimates used in fisheries science. In order to do so, trade statistics have been converted from tonnes of processed products to live weight equivalents using the EUMOFA conversion factors, and the fishmeal statistics in fishmeal equivalents have also been converted to live weight equivalents.
- Conversion to dry matter. Once all fishery data has been aggregated and classified, live weight equivalents are converted into dry matter weight. This is necessary to allow comparability with

[29] By seafood, in this study, we refer to fish, molluscs and crustaceans from capture fisheries and aquaculture, both from marine (including brackish water) and freshwater environments. So, no aquatic plants, mammals, amphibians, reptiles and aquatic invertebrates have been considered.

agricultural and forestry biomass. For this conversion, we have considered an average 25% content of dry matter[30].

- Estimation of the final fish demand. The final demand for fish was taken directly from the FAO food balance sheets.
- Estimation of fishmeal production. The total amount of fishmeal produced is obtained by converting the catches of the industrial species (e.g. fish species such as sandeels and Norway pout) into fishmeal. The live weight equivalents are converted into fishmeal equivalents using the coefficient of 4.8[31].
- Estimation of fishmeal used by the aquaculture sector. The amount of fishmeal used by the aquaculture sector is estimated, following Tacon & Metian (2015) and Shepherd & Jackson (2013), by multiplying the aquaculture production, by the feed conversion ratio, by the percentage of production using feed and by the level of inclusion of fishmeal in this feed.
- Estimation of fishmeal used by the livestock sector. The demand for fishmeal by the livestock sector and pet industry was calculated in proportion to the number of livestock in each country using a fixed allocation of 25% of fishmeal supply to pigs, 5% to chicken and 2% to other uses (Shepherd & Jackson, 2013).

3.2.2 Data availability and limitations

The database contains fisheries and aquaculture production data for the time period 2000-2014. Trade data, intra- and extra-EU imports and exports, are however only available for 2011, the year for which the MRIO model was calibrated. Therefore, only 2011 shows a complete flow of biomass.

With globalisation, international trade of seafood products has become very complex and seafood products can come from different sources, having often passed through various stations in the production and supply chain (Anderson and Fong 1997; Guillotreau and Peridy 2000; Guillotreau 2004). This poses many challenges to the already difficult monitoring activities in the whole fisheries sector.

The main gaps in the current analysis are:

- The absence of any differentiation in origin (capture fisheries or aquaculture) of commodity flows in the trade and consumption statistics. The absence of such differentiation represents the main limitation in understanding the relative importance of capture fisheries, aquaculture and trade for satisfying the EU's demand for fish.
- The flows related to the use of trash fish, trimmings and landings of fish unfit for human consumption in the fish meal industry cannot be explicitly modelled due to the lack of reliable data.
- Trade data are sometimes detailed by species and product type (e.g. frozen fillets); however, for other species, trade data may be aggregated by species groups or families. Moreover, trade between sites of the same company may not always be precisely reported.
- Data on final consumption is often very approximate and not disaggregated by species.
- Data on the use of fishmeal and fish oil for aquaculture are not generally available and need to be estimated from the aquaculture production. Considering that it may take some years to grow certain fish species, estimates can only be approximate figures.
- Data on fishmeal and fish oil for other uses (i.e., animal husbandry) are not available and can only be approximated from the husbandry production.

[30] We have considered an average value of 75% content of water in fish flesh for all species as, for the time being, calculations are not done on a species level. This average has been estimated from Table 1 in *J. Murray and J. R. Burt, The composition of fish*, 2001. http://www.fao.org/3/x5916e00.htm

[31] The conversion factor estimate of 4.8 comes from the calibration of the MRIO model. A conversion of 4.4 is often used for the conversion of whole fish to fishmeal. However, our estimate apart from the conversion of whole fish to fishmeal, it also incorporates the direct use of fish in aquaculture and the use of trimmings from the processing sector.

- Estimates on seafood waste along the market chain are not available, except for very approximate global assessments or in very particular cases.
- Data omissions from official statistics, issues related to the technical coefficients used as parameters in the MRIO model which are not able to capture country specificities or to inconsistencies between demand, trade and primary production across the different statistical data sources.
- Finally, it should be noted that while measures in dry matter were used for the sake of harmonisation with agriculture and forestry biomass, they are hardly used for fisheries and aquaculture, where the main interest is related to food production. Moreover, the use of a general conversion applicable to all fisheries and aquaculture is a significant limitation, considering that depending on the fish species and stock the composition in terms of fat, protein and water can be substantially different. These differences are much more relevant when we consider shellfish, which accounts for an important share of all fisheries and aquaculture production.

3.3 Woody biomass

3.3.1 Methodology, data sources and transformation of data

The Sankey diagrams elaborated by the JRC D1 unit for the Forestry sector build on the integration of a number of different data sets: production and trade of wood-based products and roundwood, conversion factors, and input/output coefficients for material and energy uses of wood (see Table 7). They are consistent with the Wood Resource Balance sheets published in the Knowledge Centre for Bioeconomy (Cazzaniga et al. (2019)).

Table 7. Data sources used for the woody biomass flow diagrams.

Data source	Organization	Data
Joint Forest Sector Questionnaire (JFSQ), release August 2017[32]	Eurostat/FAO/ITTO/UNECE	Production, imports and exports of forest products and removals
Eurostat	EC	Wood pellets production and trade for 2009-2011
Resource shares	Infro (Mantau 2016)	input/output coefficients for wood products industry
Forest product conversion factors for the UNECE region[33]	UNECE, FAO	Bark correction factor
Joint Wood Energy Enquiry (JWEE)[34]	UNECE/FAO Forestry and Timber Section, IEA, EUROSTAT	Energy use of wood, conversion factors
National Renewable Energy Action Plan Progress Reports (NREAP)[35]	EC	Woody biomass supply for energy

Sankey diagrams are based on production and trade statistics, supplemented by sector-specific analysis. They consider all the most important sources and uses for the years 2009-2015. For material uses—coniferous and non-coniferous sawnwood; veneer sheets and plywood; chemical wood pulp; semi-chemical wood pulp; mechanical wood pulp; dissolving wood pulp; fibreboard; particle board; wood pellets—JFSQ is the source, while, for energy production, the main source is the JWEE. For some Member States and years, JWEE data are missing. To fill the gaps, data from the National Renewable Energy Action Plan Progress Reports have been used, as described in Cazzaniga et al. (2019) Jonsson et al. (2020) and Camia et al. (forthcoming in 2020).
Sources of woody biomass comprise:

- primary woody biomass (PWB): coniferous wood in the rough over bark, non-coniferous wood in the rough over bark, including wood harvested from main stems, branches and other parts of trees;
- by-products (BCP): bark as by-product from industry processes, sawmill by-products, other industrial residues, black liquor. This category includes wood pellets import (or net-import, depending on the visualisation;
- post-consumer wood (PCW): wood and wood products made available for re-use or recycling.

JFSQ values do not consider bark (values are reported under bark, u.b.). The source amount of bark has been estimated applying an over bark coefficient to the domestic supply of roundwood u.b.
By-products quantities are obtained by multiplying production data (from JFSQ) for the different wood-based commodities with corresponding output coefficients (from Infro).
As for PCW, the amount used for particle board production, obtained by multiplying its production with the corresponding input coefficient from Infro, is - when available - complemented with the amount used for energy.
Roundwood equivalents under bark are calculated for every item, based on product-and country-specific conversion factors (from Infro), so that all quantities are expressed in the same unit; cubic meter solid wood. These values are subsequently converted to tonnes of dry matter.

[32] http://www.unece.org/forests/fpm/onlinedata.html
[33] http://www.unece.org/fileadmin/DAM/timber/publications/DP-49.pdf
[34] http://www.unece.org/forests/jwee.html
[35] https://ec.europa.eu/energy/topics/renewable-energy/progress-reports_en

3.3.2 Data availability and limitations

As discussed in Jonsson et al. (2020), the data show evident inconsistencies, resulting in notable mismatches between sources and uses. For the majority of Member States, the differences highlighted by the Wood Resource Balances indicate that reported sources are not enough to cover the overall declared uses. These differences are clearly visible in the EU Biomass Flows tool and have not been corrected.

The present visualisation aims to show the sources versus the uses of woody biomass. However, this does not coincide with the overall flow of woody biomass, because of the high circularity of the sector that results from cascade uses. This is an important aspect to consider when reading the graphs.
Total trade values are not available for some biomass categories for the EU27+UK. As a result, the gross trade diagram for the EU27+UK shows no data.

4 The new EU Biomass Flows tool

4.1.1 Functionalities

The former EU Biomass Flows tool was released in 2017 and has been used in multiple research activities and publications. However, the way the flows were represented lacked flexibility (both in the design and the visualisation) and did not offer many functionalities that would have enabled easier analysis.

We still consider Sankey diagrams one of the most useful visualisation of biomass flows. Because the amount of material in each portion of the diagram is represented by the width of the stream, Sankey diagrams visually emphasise the major transfers or flows within a system. They are helpful in locating dominant contributions to an overall flow by comparing the weight of the different flows. Therefore, we decided to search for new software that would allow us to continue and improve the presentation of biomass flows in Sankey diagrams.

The new EU Biomass Flows tool has been developed on the basis of the **Eurostat Energy flow Sankey**[36]. It is a more user friendly and flexible tool that is easier to update, enables higher granularity for the flows, offers more options for analysis and presents the flows in a clearer way. The major features are:

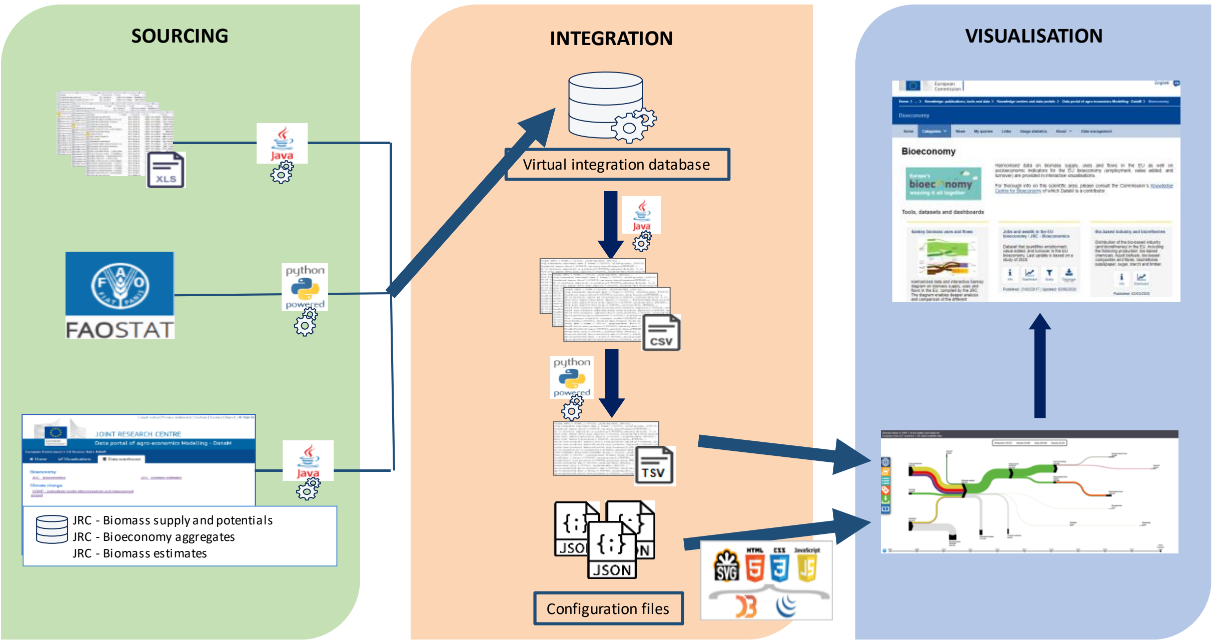
- The diagrams display a series of nodes connected by biomass flows. The black nodes represent biomass activities (e.g. imports, food and feed, etc.), while the coloured flows indicate the inputs and outputs of biomass commodity types (e.g. animal-based food). The width of each flow represents the amount of biomass in the flow.
- In order to represent the biomass flows, the Sankey diagrams in the EU Biomass Flows tool are split in two differenced parts. The first one is formed by the flows that represent the production and the import of the selected setor. The final target for all these flows is the node Supply, which represents the total income of biomass for the sector. The second part of the diagram are the uses and exports of the biomass for the sector. The node where all uses originate for all these flows is the Supply node.
- The EU Biomass Flows tool is interactive, with different selection options and menus. The distribution and size of each component of the biomass flow diagram will change according to the filters selected by the user (geography, trade type, time).
- The user can navigate between different diagrams, each increasing the level of granularity of the flows presented. For example, the starting diagram shows only the flows of aggregated biomass, regardless of origin. From this diagram, the user can step into a second diagram that splits the aggregated biomass into different sectors (agriculture, fisheries and aquaculture and forestry).
- Biomass flows for a specific sector can also be shown as aggregated biomass of that specific origin (e.g. agricultural biomass) or disaggregated into biomass types (e.g. crop production, residues) or even their components (cereals, fodder crops, etc.).
- Graphs and charts based on the user's selections can be created and downloaded directly from the tool.
- The user can download either the full dataset or the dataset corresponding to the selections on screen.
- To visualise evolution through time, the tool offers an animation that will show how the different biomass categories change through time.

[36] https://ec.europa.eu/eurostat/web/energy/energy-flow-diagrams

4.1.2 Tool structure

The EU Biomass Flows tool has been developed using javascript technology. Among others, the tool uses D3 and jQuery javascript libraries.
The category nodes and weighted links required to create the diagram are provided in a TSV file. The data for all countries, years and sectors are in this file. The tool uses some additional configuration files in JSON format which describe the nodes and flows and matches them with the source data file.
There are data that is integrated in the EU Biomass Flows database can be provided in multiple ways and formats. Fisheries and aquaculture and forestry data come in Excel files. Agricultural data is compiled from several JRC datasets in DataM and from FAO using FAOData APIs. Specific data sources have been described in previous chapters.
All source data is compiled in one single database, harmonized, transformed and aggregated by applying calculations. It is then exported in form of multiple CSV files (one per country and year). A second process combines these files to create the TSV file with the complete data. This TSV file has to be harmonised with the configuration files to use the same references for nodes and flows. The process is executed using Python.
The data processing process is illustrated in the following figure.

Figure 21. Schematic representation of the EU Biomass Flows tool structure and interfaces.



5 Planned improvements and future research opportunities

The widespread use of the EU and individual Member State biomass flow diagrams, as well as the recurrent mention of the biomass supply and demand assessment study in key EU policy documents, give evidence of the usefulness of this pioneer work as described also in Camia et al. (2018).

Since the first publication and provision of the biomass flow diagram (Gurria et al., 2017), many improvements have been implemented. However, data gaps in the time series, further break-down of biomass uses, full inclusion of circularity aspects and other desirable enhancements remain pertinent.

The following improvements are planned for the years 2021/22:

- Database update: the available data series are still very heterogenous, ranging for the latest available year from 2011 to 2017.
- Circular flows: through the inclusion of waste, a better understanding of the current and potentially future contribution of biomass recycling in the Circular Economy could be gained.
- Other biomass categories: the inclusion of additional sources of biomass, such as algae, and uses not yet considered in the biomass flow, such as biogas, bioelectricity, other biomaterial etc.
- Future-oriented biomass flows: the inclusion of projections for the future biomass supply and use could help identify sustainability challenges and inform policy makers.
- New indicators: there are several potential indicators related to biomass to be included in a Sankey context, such as nutrition, wet weight, carbon, GHG emissions and monetary flows.
- As a further objective, coherence with other mass flow diagrams including biomass in a much higher disaggregation level should be looked at.

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List of abbreviations and definitions

dm	Dry matter
EMFF	European Maritime and Fisheries Fund
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
IEA	International Energy Agency
JRC	Joint Research Centre
JRC C2	Joint Research Centre Unit C.2. Energy Efficiency & Renewables
JRC D1	Joint Research Centre Unit D.1. Bio-Economy
JRC D2	Joint Research Centre Unit D.2. Water & Marine Resources
JRC D4	Joint Research Centre Unit D.4. Economics of Agriculture
JRC D5	Joint Research Centre Unit D.5. Food Security
JWEE	Joint Wood Energy Enquiry
ktoe	kilo tonnes of oil equivalent
m3	Cubic metres
MS	(EU) Member State
NFI	National Forest Inventory
NREAP	National Renewable Energy Action Plan
SWE	Solid wood equivalents
tdm	Tonnes of dry matter
UNECE	United Nations Economic Commission for Europe
WRB	Wood Resource Balance

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Annex 1. Reference moisture content (m) values to calculate dry-matter economic yield and production.

Crop	% moisture	Source
Apples	0.80	Eurostat Handbook
Artichokes	0.90	Eurostat Handbook
Asparagus	0.90	Eurostat Handbook
Barley	0.14	Eurostat Handbook
Beetroot	0.90	Eurostat Handbook
Berries (exluding strawberries)	0.80	Eurostat Handbook
Broad and field beans	0.14	Eurostat Handbook
Brussels sprouts	0.90	Eurostat Handbook
Cabbages	0.90	Eurostat Handbook
Carrots	0.90	Eurostat Handbook
Cauliflower and broccoli	0.90	Eurostat Handbook
Celeriac	0.90	Eurostat Handbook
Celery	0.90	Eurostat Handbook
Chicory	0.90	Eurostat Handbook
Citrus fruits	0.80	Eurostat Handbook
Cotton fibre	0.05	Ronzon et al. (2015)
Cotton seed	0.09	Eurostat Handbook
Courgettes and marrows	0.90	Eurostat Handbook
Cucumbers	0.90	Eurostat Handbook
Eggplants	0.90	Eurostat Handbook
Endives	0.90	Eurostat Handbook
Energy crops	0.09	Duong et al. (2013)
Fibre flax	0.05	Ronzon et al. (2015)
Field peas	0.14	Eurostat Handbook
Fresh beans	0.90	Eurostat Handbook
Fresh peas	0.90	Eurostat Handbook
Garlic	0.90	Eurostat Handbook
Gherkins	0.90	Eurostat Handbook
Gourds and pumpkins	0.90	Eurostat Handbook
Grain maize	0.14	Eurostat Handbook
Green maize	0.65	Eurostat Handbook
Hemp	0.05	Ronzon et al. (2015)
Hops	0.05	Ronzon et al. (2015)
Leeks	0.90	Eurostat Handbook
Lettuces	0.90	Eurostat Handbook
Lucerne	0.65	Eurostat Handbook
Muskmelons	0.90	Eurostat Handbook
Nuts	0.80	Eurostat Handbook
Oats	0.14	Eurostat Handbook

Crop	% moisture	Source
Olives	0.16	Ronzon et al. (2015)
Onions	0.90	Eurostat Handbook
Other brassicas n.e.c	0.90	Eurostat Handbook
Other cereals	0.14	Eurostat Handbook
Other cereals harvested green (excluding green maize)	0.65	Eurostat Handbook
Other dry pulses and protein crops n.e.c.	0.14	Eurostat Handbook
Other fibre crops n.e.c.	0.05	Ronzon et al. (2015)
Other fresh pulses n.e.c.	0.90	Eurostat Handbook
Other fruits from fruit trees	0.80	Eurostat Handbook
Other leafy or stalked vegetables n.e.c.	0.90	Eurostat Handbook
Other leguminous plants harvested green n.e.c.	0.65	Eurostat Handbook
Other plants harvested green from arable land n.e.c.	0.65	Eurostat Handbook
Other root, tuber and bulb vegetables n.e.c.	0.90	Eurostat Handbook
Other vegetables cultivated for fruit n.e.c.	0.90	Eurostat Handbook
Pears	0.80	Eurostat Handbook
Peppers (capsicum)	0.90	Eurostat Handbook
Potatoes	0.78	Deblonde et al. (1999)
Radishes	0.90	Eurostat Handbook
Rape and turnip rape	0.09	Eurostat Handbook
Rice	0.13	Eurostat Handbook
Rye	0.14	Eurostat Handbook
Shallots	0.90	Eurostat Handbook
Sorghum	0.14	Eurostat Handbook
Soya	0.14	Eurostat Handbook
Spinach	0.90	Eurostat Handbook
Stone fruits	0.80	Eurostat Handbook
Strawberries	0.90	Eurostat Handbook
Sugar beet	0.76	Draycott (2006)
Sunflower	0.09	Eurostat Handbook
Sweet lupins	0.14	Eurostat Handbook
Temporary grasses and grazings	0.65	Eurostat Handbook
Tobacco	0.10	Ronzon et al. (2015)
Tomatoes	0.90	Eurostat Handbook
Triticale	0.14	Eurostat Handbook
Vineyards	0.80	Eurostat Handbook
Watermelons	0.90	Eurostat Handbook
Wheat	0.14	Eurostat Handbook
Cereal straw and husks	0.12	Ronzon et al. (2015)
Coffee, tea, maté and spices	0.10	Ronzon et al. (2015)
Copra	0.22	Ronzon et al. (2015)
Dried vegetables	0.10	Ronzon et al. (2015)

Crop	% moisture	Source
Groundnuts	0.22	Ronzon et al. (2015)
Live animals	0.70	Ronzon et al. (2015)
Live trees and other plants	0.50	Ronzon et al. (2015)
Other oil seeds and oleaginous fruits	0.22	Eurostat Handbook
Peel of citrus fruit or melons	0.50	Ronzon et al. (2015)
Plants used in perfumery, pharmacy or similar purposes	0.71	Ronzon et al. (2015)
Products of animal origin n.e.s	0.60	Ronzon et al. (2015)
Seaweeds and other algae	0.71	Ronzon et al. (2015)
Seeds	0.71	Ronzon et al. (2015)
Sugar cane	0.69	Ronzon et al. (2015)

Annex 2. Summary of methods followed to compute crop residues yield R from dry-matter economic yield Y_0 and the harvest index HI.

Crop	Method of assessment	Source	Model assumptions	Coefficients/ HI modelling
Cereals				
Barley	Empirical model for barley	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y) ●HI predicted from average $\bar{Y}_0$ over the period 1998-2015 ●HI varies from region to region (climate) ● HI is stable from year to year	$HI = f(\bar{Y}_0) \pm CI$
Grain maize	Empirical model for grain maize	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y_0) ●HI predicted from Y ●HI varies from region to region (climate) ● HI varies from year to year	$HI = f(Y_0) \pm CI$
Oats	Empirical model for wheat	Same as wheat		
Other cereals	Empirical model for wheat	Same as wheat		
Rice	Empirical model for rice	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y_0) ●HI predicted from Y_0 ●HI varies from region to region (climate) ● HI varies from year to year	$HI = f(Y_0) \pm CI$
Rye	Empirical model for wheat	Same as wheat		
Sorghum	Empirical model for sorghum	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y) ●HI predicted from Y ●HI varies from region to region (climate) ● HI varies from year to year	$HI = f(Y_0) \pm CI$
Soybean	Empirical model for soybean	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y_0) ●HI predicted from Y_0 ●HI varies from region to region (climate) ● HI varies from year to year	$HI = f(Y_0) \pm CI$
Triticale	Empirical model for wheat	Same as wheat		

Crop	Method of assessment	Source	Model assumptions	Coefficients/ HI modelling
Wheat	Empirical model for wheat	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y_0) ●HI predicted from average $\overline{Y}_0$ over the period 1998-2015 ●HI varies from region to region (climate) ● HI is stable from year to year	$HI = f(\overline{Y}_0) \pm CI$
Energy crops n.e.c.	–		Not estimated	
Fibre crops	Constant HI	Ronzon et al., 2015	●R derived from constant HI	HI =0.83
Fodder crops	–		Not estimated	
Oilseeds				
Cotton seed	Constant HI	Gemtos and Tsiricoglou (1999)	●Residues production includes stalks+ branches biomass ●$HI = 0{,}173$	$R = \frac{Y_0}{HI_{pruning}} - Y_0$
Rapeseed	Empirical model for rapeseed	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y_0) ●HI predicted from average $\overline{Y}_0$ over the period 1998-2015 ●HI varies from region to region (climate) ● HI is stable from year to year	$HI_m = f(\overline{Y}_0) \pm CI$
Sunflower	Empirical model for sunflower	van der Velde (Ed.) (2016)	●R derived from predicted HI (heteroscedasticity between R and Y_0) ●HI predicted from Y_0 ●HI varies from region to region (climate) ● HI varies from year to year	$HI = f(Y_0) \pm CI$
Other crops				
Fruit trees	Constant HI	Di Blasi, Tanzi, and Lanzetta (1997)	●HI calculated from a fixed RPR accounting for pruning residues) for wet biomass ●$RPR_{pruning} = 0{,}91$	$HI_{pruning} = \frac{1}{1 + RPR_{pruning}}$
Tobacco	Constant HI	Ronzon et al., 2015	●R derived from constant HI	HI =0.5
Olives	Constant R	Spinelli and Picchi (2010)	●Constant pruning residues (stems+leaves)	$R = 3.44\ t/ha$
Potato	Empirical model for potato	van der Velde (Ed.) (2016)	●R predicted from Y_0	$R = f(Y_0) \pm CI$
Sugar beet	Empirical model for sugar beet	van der Velde (Ed.) (2016)	●R predicted from Y	$R = f(Y_0) \pm CI$
Tobacco	Constant HI	Ronzon et al., 2015	●R derived from constant HI	HI =0.5

Crop	Method of assessment	Source	Model assumptions	Coefficients/ HI modelling
Vineyards	Constant HI	Manzone et al. (2016)	●Residues production: pruning (sarmenta) ●$HI_{pruning} = 0{,}76\ and\ m = 0$	$R = \frac{Y_0}{HI_{pruning}} - Y_0$
Pulses	Empirical model for pulses	New model from experimental data	●R derived from predicted HI ●Field peas, a=3.644 ● Beans, lupins and other dry pulses, a =3.232	$HI = \frac{1}{a * e^{-0.3*Y_0} + 1}$
Vegetables	–		Not estimated	

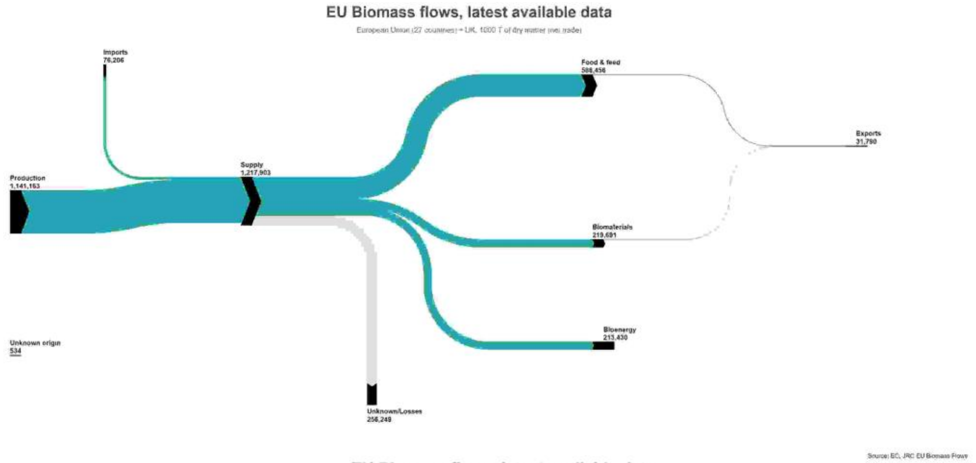
Annex 3. Share of used residues of agricultural commodities.

COMMODITIES:	Share of used residues
Cereals	25%
Fruit trees and berry plantations	10%
Vineyards	10%
Cotton fibre	0%
Fibre flax	0%
Hemp	0%
Other fibre crops n.e.c.	0%
Hops	10%
Tobacco	10%
Olive trees	10%
Oil-bearing crops	10%
Pulses	0%
Potatoes	10%
Nuts	10%
Vegetables, melons and strawberries	10%
Plants harvested green	0%
Sugar beet	50%

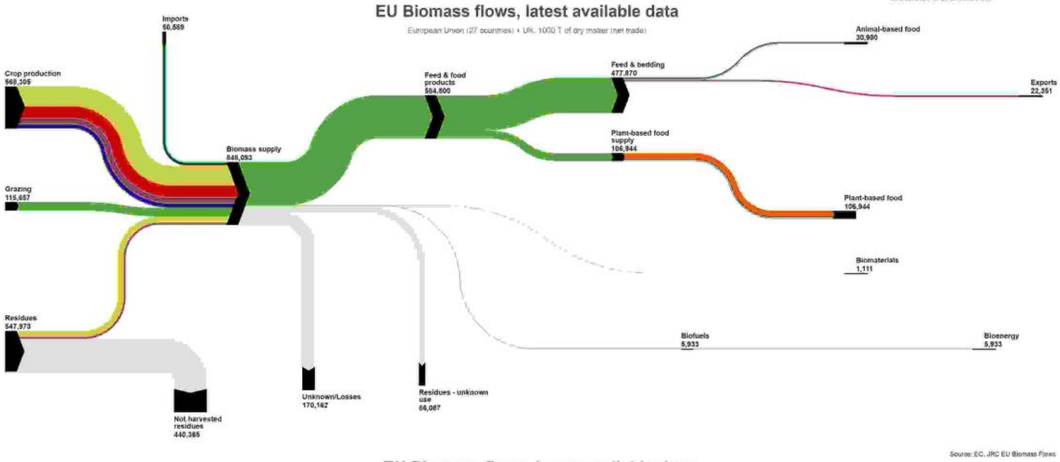
Annex 4. Screenshots of the EU Biomass Flows tool.

To offer a full cross-sector overview, these screenshots are created with the latest available data for each sector. In general, this is 2017 for agriculture, 2015 for woody biomass and biofuels, and 2011 for fisheries and aquaculture.

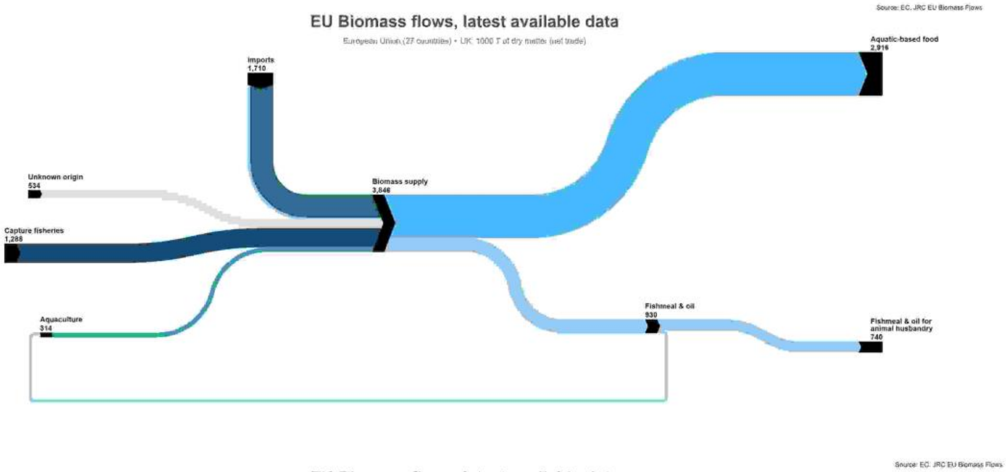
EU27+UK



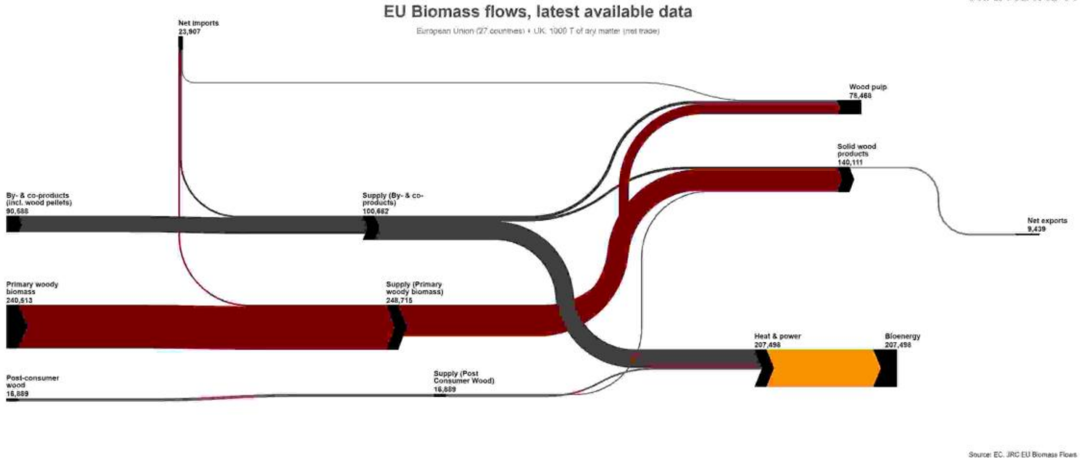
EU Biomass flows, latest available data
European Union (27 countries) + UK, 1000 T of dry matter (net trade)
Imports
76,206
Production
1,141,163
Supply
1,217,903
Food & feed
588,456
Exports
31,790
Biomaterials
219,691
Bioenergy
213,430
Unknown origin
534
Unknown/Losses
256,249
Source: EC, JRC EU Biomass Flows



EU Biomass flows, latest available data
European Union (27 countries) + UK, 1000 T of dry matter (net trade)
Imports
50,589
Crop production
568,305
Grazing
115,657
Residues
547,973
Biomass supply
848,093
Feed & food products
584,800
Feed & bedding
477,870
Animal-based food
30,980
Exports
22,351
Plant-based food supply
106,944
Plant-based food
106,944
Biomaterials
1,111
Biofuels
5,933
Bioenergy
5,933
Not harvested residues
440,365
Unknown/Losses
170,162
Residues - unknown use
86,087
Source: EC, JRC EU Biomass Flows

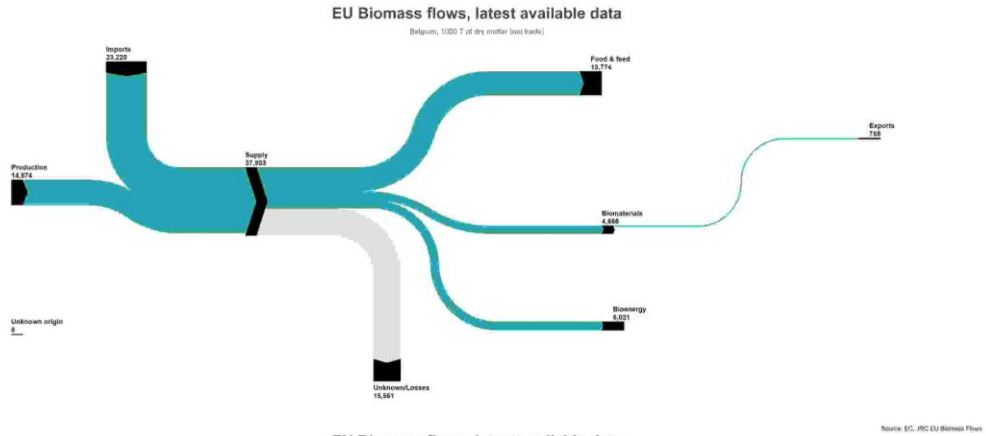


EU Biomass flows, latest available data
European Union (27 countries) + UK, 1000 T of dry matter (net trade)
Imports
1,710
Unknown origin
534
Capture fisheries
1,288
Aquaculture
314
Biomass supply
3,846
Aquatic-based food
2,916
Fishmeal & oil
930
Fishmeal & oil for animal husbandry
740
Source: EC, JRC EU Biomass Flows

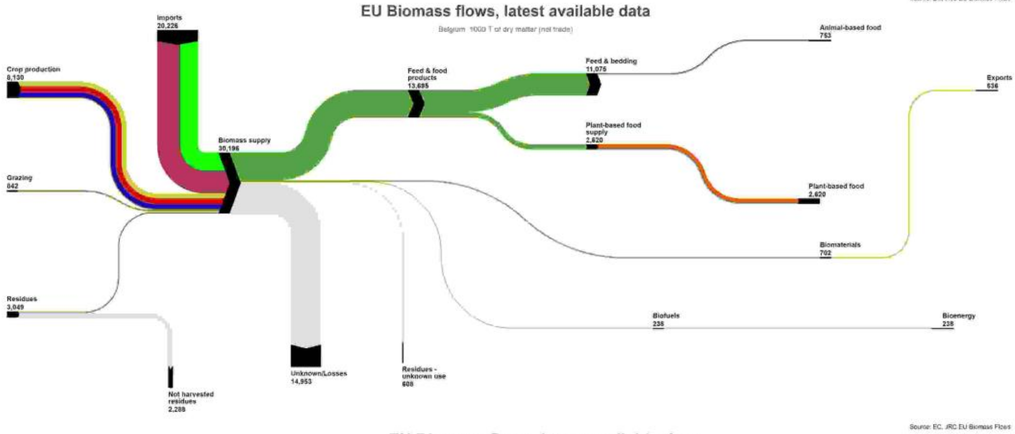


EU Biomass flows, latest available data
European Union (27 countries) + UK, 1000 T of dry matter (net trade)
Net imports
23,907
By- & co-products (incl. wood pellets)
90,588
Supply (By- & co-products)
100,662
Primary woody biomass
240,513
Supply (Primary woody biomass)
248,715
Post-consumer wood
16,889
Supply (Post Consumer Wood)
16,889
Wood pulp
78,468
Solid wood products
140,111
Net exports
9,439
Heat & power
207,498
Bioenergy
207,498
Source: EC, JRC EU Biomass Flows

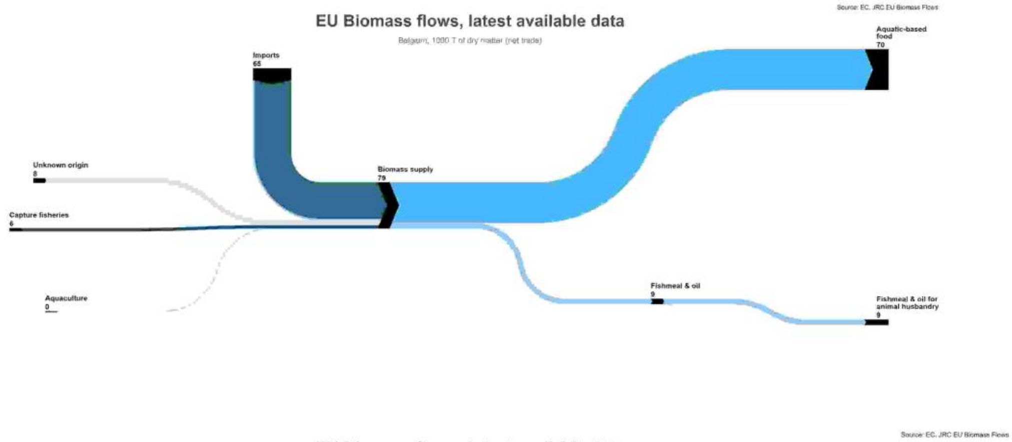
Belgium



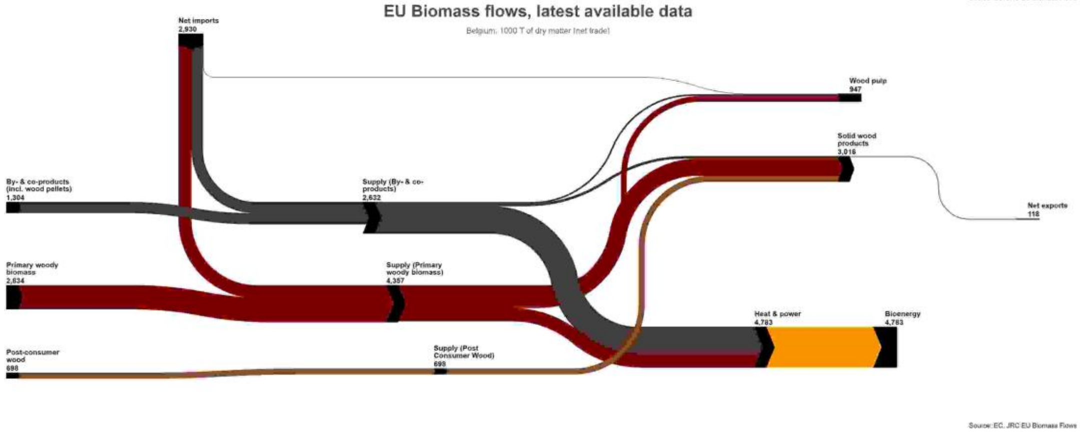
EU Biomass flows, latest available data
Belgium, 1000 T of dry matter (net trade)
Imports
23,220
Food & feed
13,774
Exports
755
Production
14,574
Supply
37,803
Biomaterials
4,666
Bioenergy
6,021
Unknown origin
8
Unknown/Losses
15,561
Source: EC, JRC EU Biomass Flows



EU Biomass flows, latest available data
Belgium 1000 T of dry matter (net trade)
Imports
20,226
Animal-based food
753
Crop production
8,130
Feed & food products
13,685
Feed & bedding
11,075
Exports
636
Plant-based food supply
2,620
Biomass supply
30,196
Grazing
842
Plant-based food
2,620
Biomaterials
702
Residues
3,049
Biofuels
238
Bioenergy
238
Unknown/Losses
14,953
Residues - unknown use
608
Not harvested residues
2,288
Source: EC, JRC EU Biomass Flows

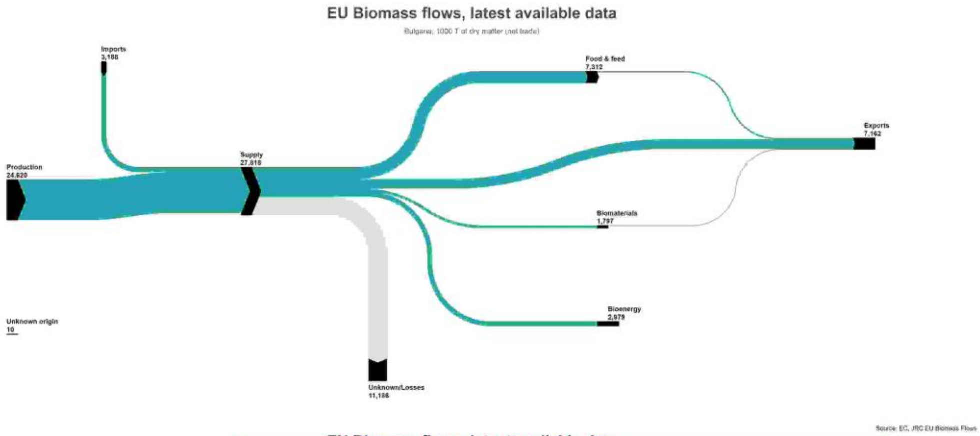


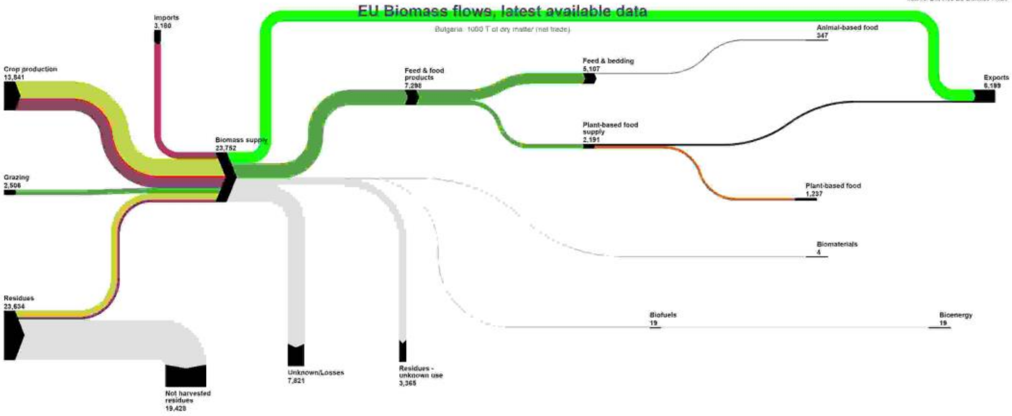
EU Biomass flows, latest available data
Belgium, 1000 T of dry matter (net trade)
Aquatic-based food
70
Imports
65
Unknown origin
8
Biomass supply
79
Capture fisheries
6
Aquaculture
0
Fishmeal & oil
9
Fishmeal & oil for animal husbandry
9
Source: EC, JRC EU Biomass Flows

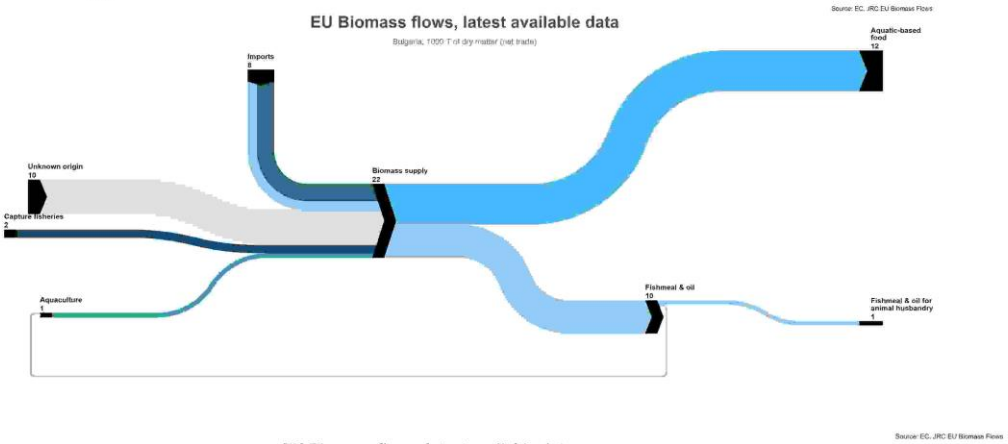


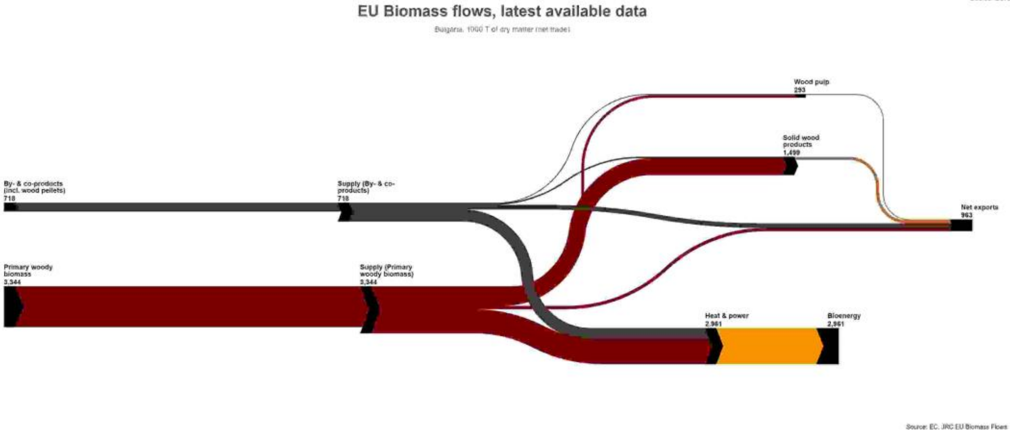
EU Biomass flows, latest available data
Belgium, 1000 T of dry matter (net trade)
Net imports
2,930
Wood pulp
947
Solid wood products
3,016
By- & co-products (incl. wood pellets)
1,304
Supply (By- & co-products)
2,632
Net exports
118
Primary woody biomass
2,834
Supply (Primary woody biomass)
4,357
Heat & power
4,783
Bioenergy
4,783
Post-consumer wood
698
Supply (Post Consumer Wood)
698
Source: EC, JRC EU Biomass Flows

Bulgaria

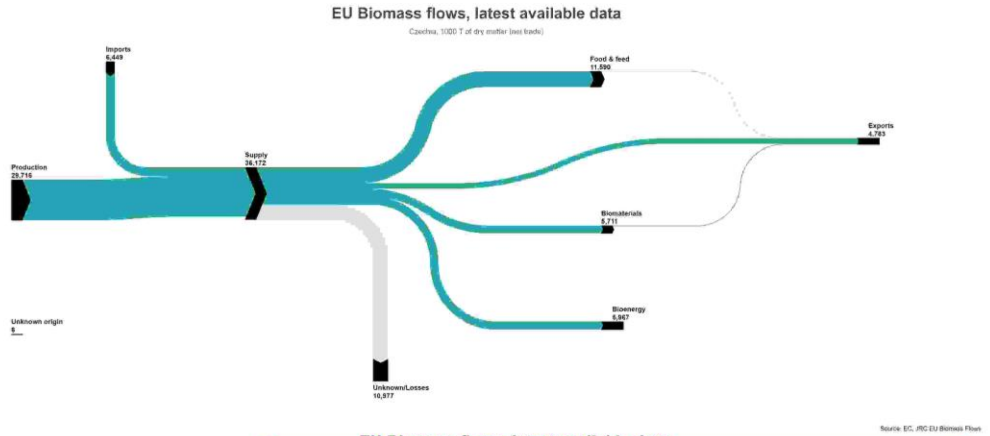

EU Biomass flows, latest available data
Bulgaria, 1000 T of dry matter (net trade)
Imports 3,188
Production 24,620
Supply 27,818
Food & feed 7,312
Exports 7,162
Biomaterials 1,797
Bioenergy 2,979
Unknown origin 10
Unknown/Losses 11,186
Source: EC, JRC EU Biomass Flows

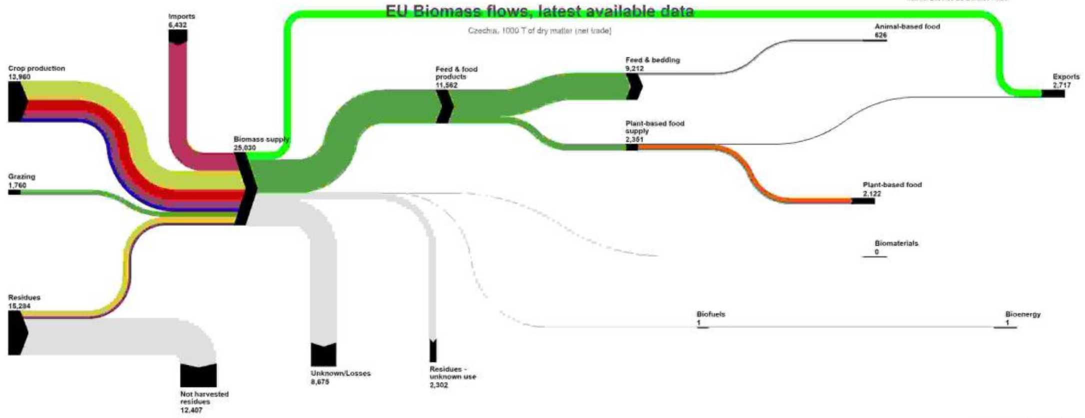

EU Biomass flows, latest available data
Bulgaria, 1000 T of dry matter (net trade)
Imports 3,180
Crop production 13,841
Biomass supply 23,752
Feed & food products 7,298
Feed & bedding 5,107
Animal-based food 347
Exports 6,199
Plant-based food supply 2,191
Plant-based food 1,237
Grazing 2,506
Biomaterials 4
Residues 23,634
Biofuels 19
Bioenergy 19
Not harvested residues 19,428
Unknown/Losses 7,821
Residues - unknown use 3,365
Source: EC, JRC EU Biomass Flows

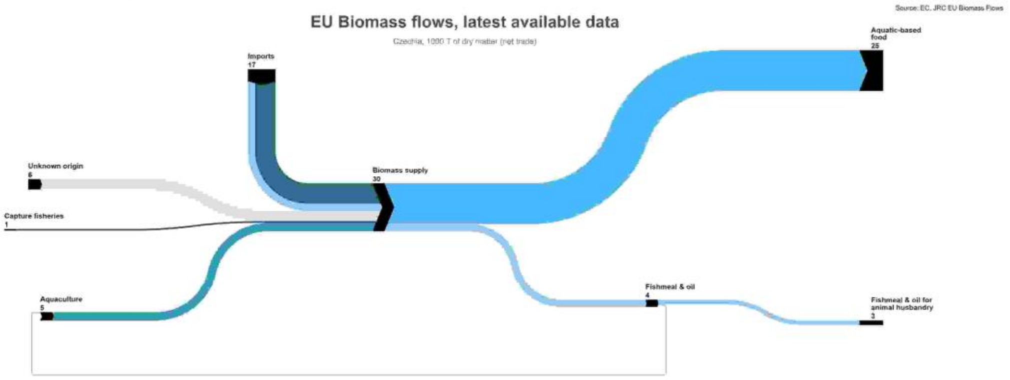

EU Biomass flows, latest available data
Bulgaria, 1000 T of dry matter (net trade)
Aquatic-based food 12
Imports 8
Unknown origin 10
Biomass supply 22
Capture fisheries 2
Aquaculture 1
Fishmeal & oil 10
Fishmeal & oil for animal husbandry 1
Source: EC, JRC EU Biomass Flows

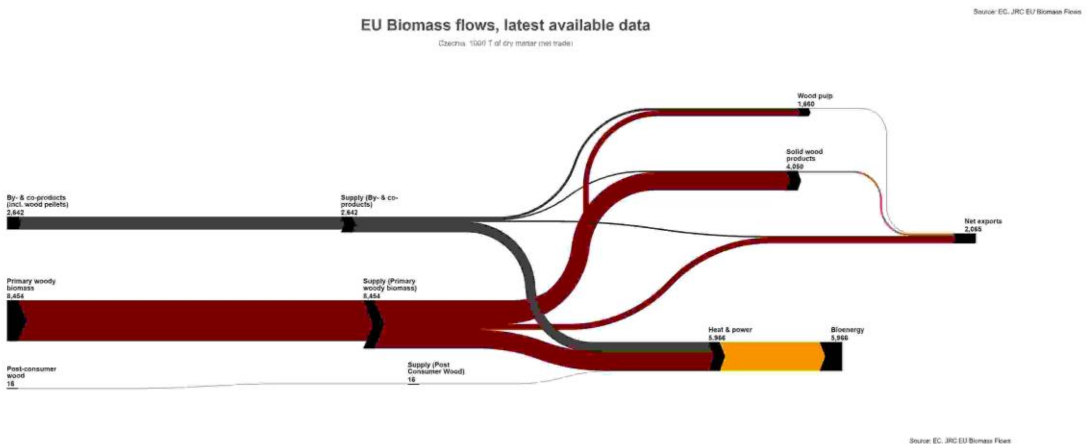

EU Biomass flows, latest available data
Bulgaria, 1000 T of dry matter (net trade)
Wood pulp 293
Solid wood products 1,499
By- & co-products (incl. wood pellets) 718
Supply (By- & co-products) 718
Net exports 963
Primary woody biomass 3,344
Supply (Primary woody biomass) 3,344
Heat & power 2,961
Bioenergy 2,961
Source: EC, JRC EU Biomass Flows

Czechia

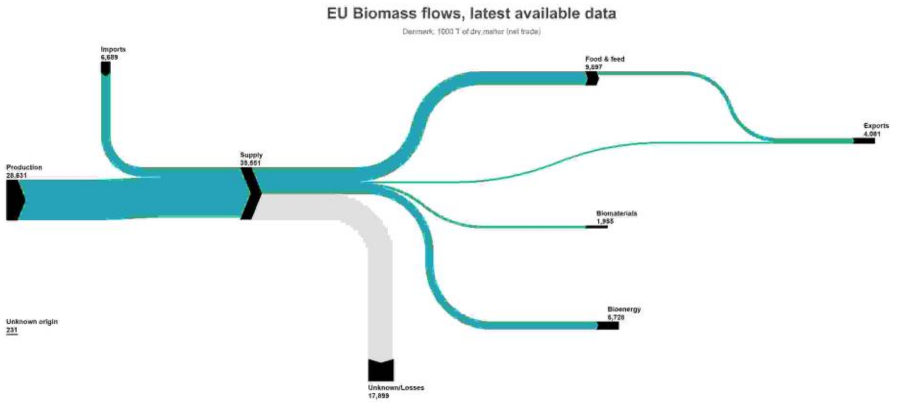

EU Biomass flows, latest available data
Czechia, 1000 T of dry matter (net trade)
Imports
6,449
Production
29,716
Supply
36,172
Food & feed
11,590
Exports
4,783
Biomaterials
5,711
Bioenergy
6,967
Unknown origin
6
Unknown/Losses
10,977
Source: EC, JRC EU Biomass Flows

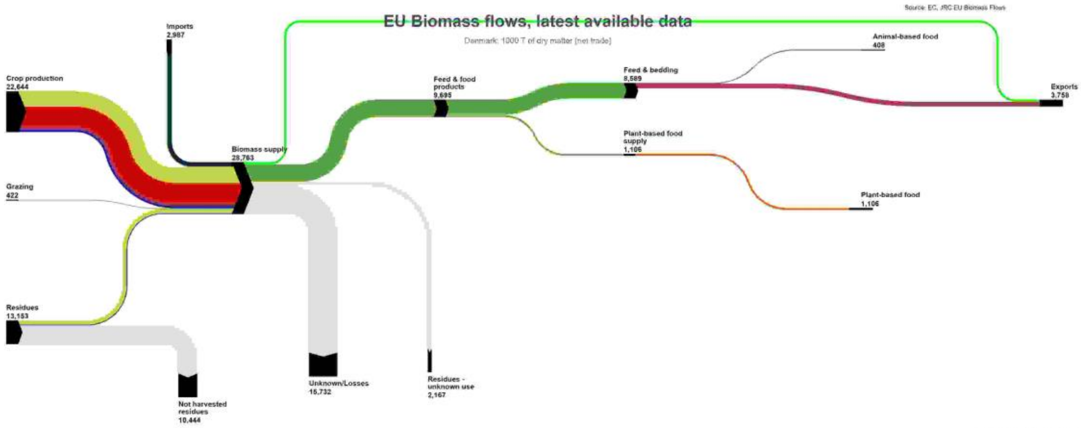

EU Biomass flows, latest available data
Czechia, 1000 T of dry matter (net trade)
Imports
6,432
Crop production
13,960
Grazing
1,760
Residues
15,284
Biomass supply
25,030
Feed & food products
11,562
Feed & bedding
9,212
Animal-based food
626
Exports
2,717
Plant-based food supply
2,351
Plant-based food
2,122
Biomaterials
0
Biofuels
1
Bioenergy
1
Not harvested residues
12,407
Unknown/Losses
8,675
Residues - unknown use
2,302
Source: EC, JRC EU Biomass Flows

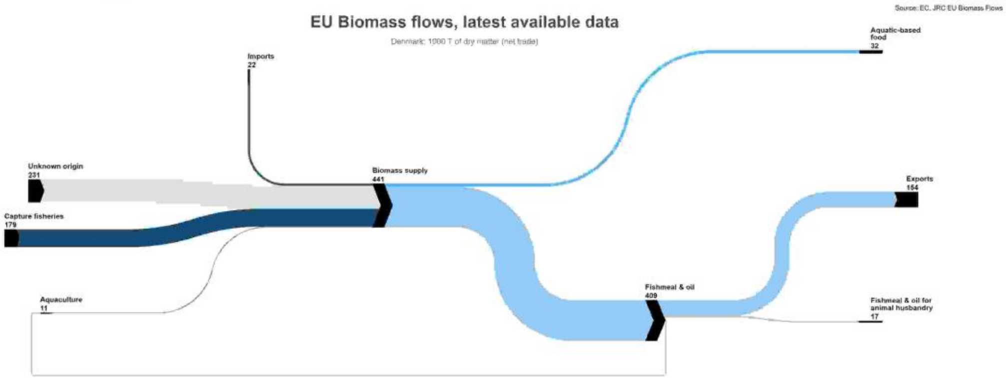

EU Biomass flows, latest available data
Czechia, 1000 T of dry matter (net trade)
Imports
17
Unknown origin
6
Capture fisheries
1
Aquaculture
5
Biomass supply
30
Aquatic-based food
25
Fishmeal & oil
4
Fishmeal & oil for animal husbandry
3
Source: EC, JRC EU Biomass Flows

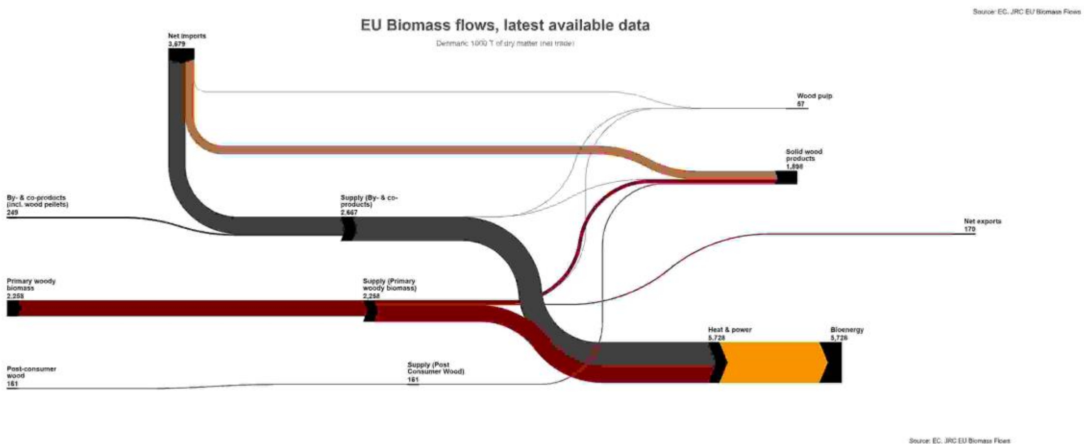

EU Biomass flows, latest available data
Czechia, 1000 T of dry matter (net trade)
By- & co-products (incl. wood pellets)
2,642
Supply (By- & co-products)
2,642
Primary woody biomass
8,454
Supply (Primary woody biomass)
8,454
Post-consumer wood
16
Supply (Post Consumer Wood)
16
Wood pulp
1,660
Solid wood products
4,050
Net exports
2,065
Heat & power
5,966
Bioenergy
5,966
Source: EC, JRC EU Biomass Flows

Denmark

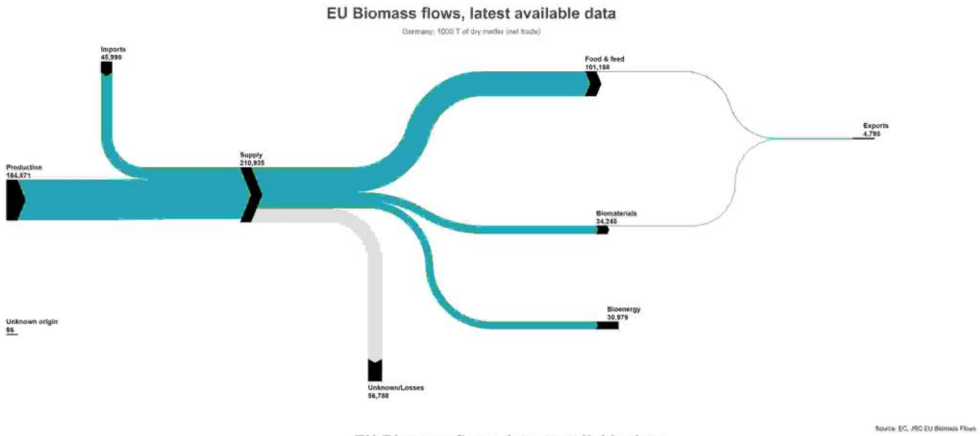

EU Biomass flows, latest available data
Denmark; 1000 T of dry matter (net trade)
Imports
6,689
Production
28,631
Supply
35,551
Food & feed
9,097
Exports
4,081
Biomaterials
1,985
Bioenergy
5,728
Unknown origin
231
Unknown/Losses
17,899
Source: EC, JRC EU Biomass Flows

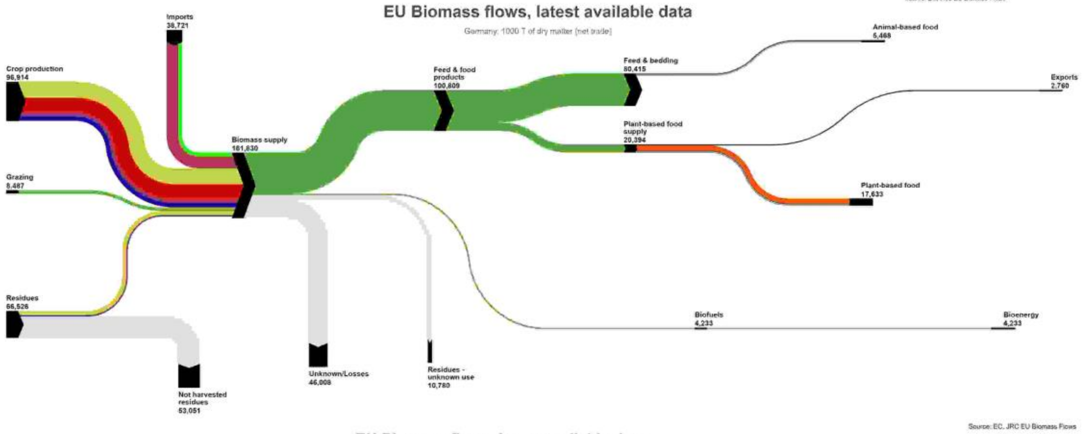

EU Biomass flows, latest available data
Denmark; 1000 T of dry matter (net trade)
Imports
2,987
Crop production
22,644
Grazing
422
Residues
13,183
Biomass supply
28,763
Feed & food products
9,695
Feed & bedding
8,589
Animal-based food
408
Exports
3,758
Plant-based food supply
1,106
Plant-based food
1,106
Unknown/Losses
15,732
Residues - unknown use
2,167
Not harvested residues
10,444
Source: EC, JRC EU Biomass Flows

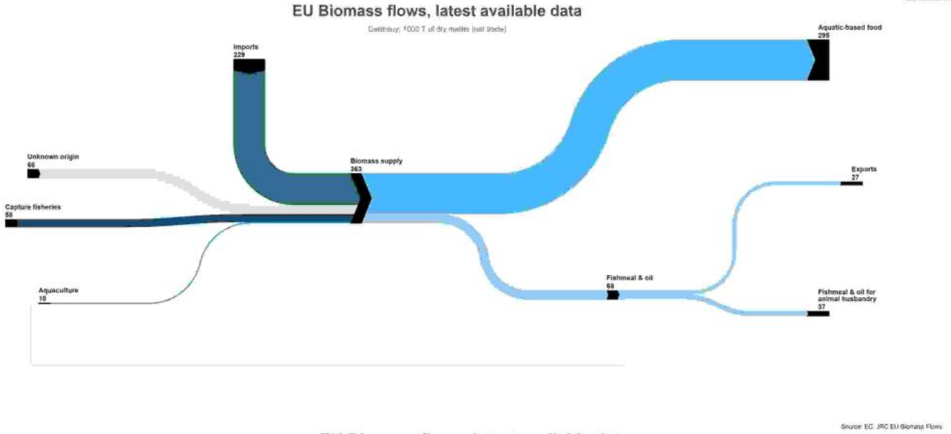

EU Biomass flows, latest available data
Denmark; 1000 T of dry matter (net trade)
Imports
22
Aquatic-based food
32
Unknown origin
231
Biomass supply
441
Capture fisheries
179
Exports
154
Aquaculture
11
Fishmeal & oil
409
Fishmeal & oil for animal husbandry
17
Source: EC, JRC EU Biomass Flows

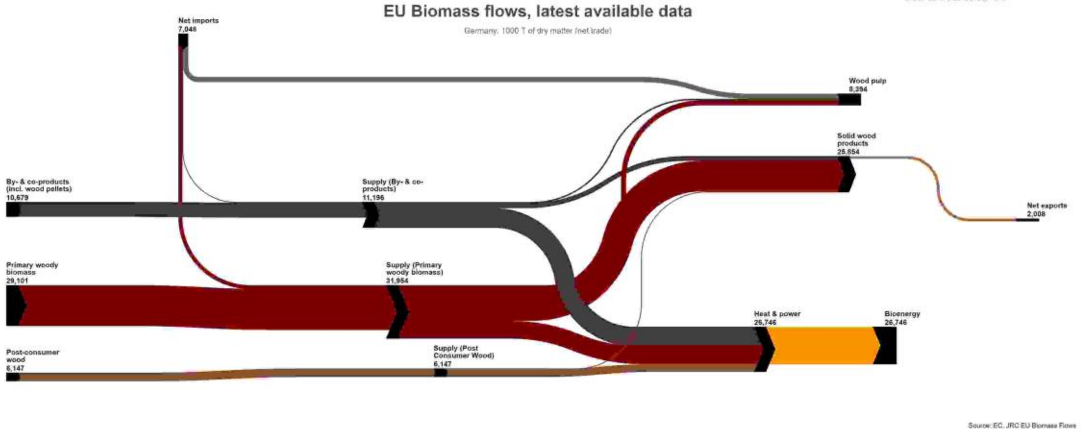

EU Biomass flows, latest available data
Denmark; 1000 T of dry matter (net trade)
Net imports
3,679
Wood pulp
87
Solid wood products
1,890
By- & co-products (excl. wood pellets)
249
Supply (By- & co-products)
2,667
Net exports
170
Primary woody biomass
2,258
Supply (Primary woody biomass)
2,258
Heat & power
5,728
Bioenergy
5,728
Post-consumer wood
161
Supply (Post Consumer Wood)
161
Source: EC, JRC EU Biomass Flows

Germany

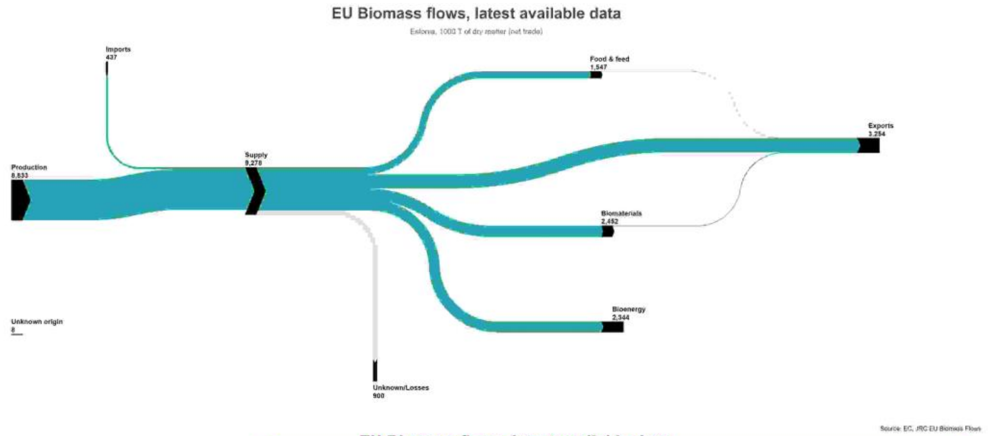

EU Biomass flows, latest available data
Germany; 1000 T of dry matter (net trade)
Imports 45,998
Production 164,871
Supply 210,935
Food & feed 101,168
Exports 4,795
Biomaterials 34,248
Bioenergy 30,979
Unknown origin 66
Unknown/Losses 56,788
Source: EC, JRC EU Biomass Flows

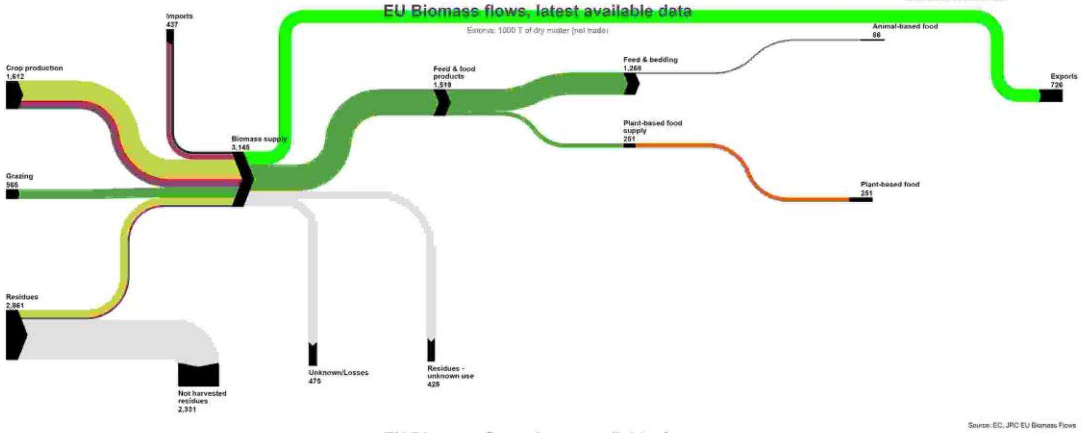

EU Biomass flows, latest available data
Germany; 1000 T of dry matter (net trade)
Imports 38,721
Crop production 96,914
Grazing 8,487
Residues 66,526
Biomass supply 181,830
Feed & food products 100,809
Feed & bedding 80,415
Animal-based food 5,468
Exports 2,760
Plant-based food supply 20,394
Plant-based food 17,633
Biofuels 4,233
Bioenergy 4,233
Not harvested residues 53,051
Unknown/Losses 46,008
Residues - unknown use 10,780
Source: EC, JRC EU Biomass Flows

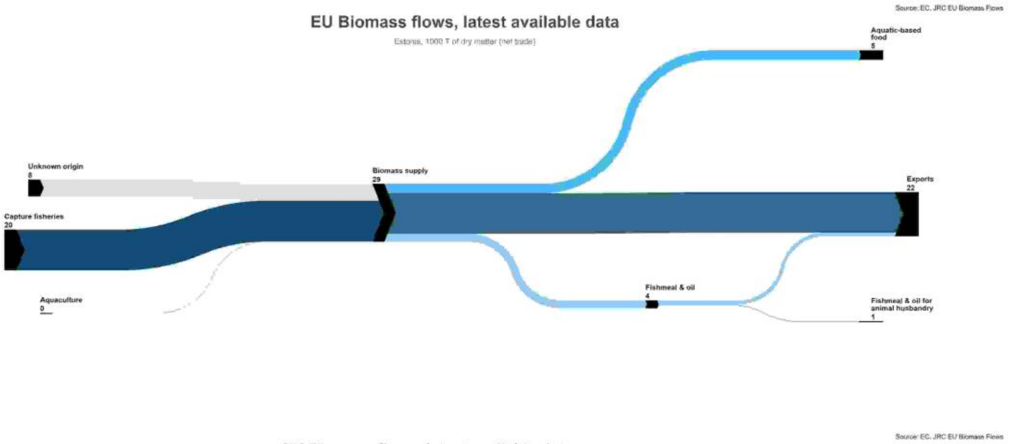

EU Biomass flows, latest available data
Germany; 1000 T of dry matter (net trade)
Imports 229
Unknown origin 66
Capture fisheries 58
Aquaculture 10
Biomass supply 363
Aquatic-based food 295
Exports 27
Fishmeal & oil 68
Fishmeal & oil for animal husbandry 37
Source: EC, JRC EU Biomass Flows

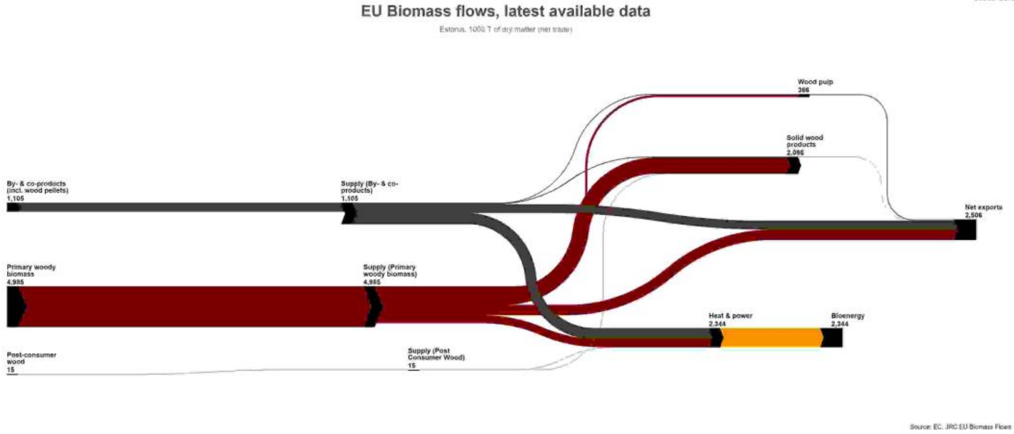

EU Biomass flows, latest available data
Germany; 1000 T of dry matter (net trade)
Net imports 7,048
By- & co-products (incl. wood pellets) 10,679
Supply (By- & co-products) 11,196
Primary woody biomass 29,101
Supply (Primary woody biomass) 31,954
Post-consumer wood 6,147
Supply (Post Consumer Wood) 6,147
Wood pulp 8,394
Solid wood products 25,854
Net exports 2,008
Heat & power 26,746
Bioenergy 26,746
Source: EC, JRC EU Biomass Flows

Estonia

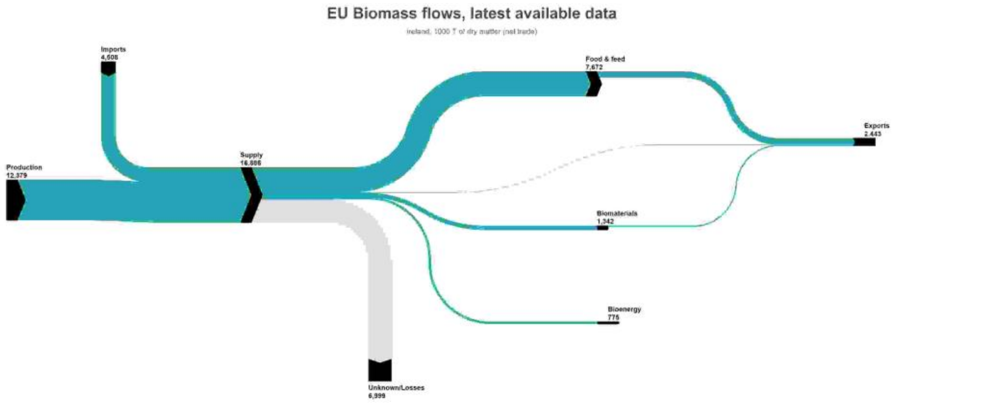

EU Biomass flows, latest available data
Estonia, 1000 T of dry matter (net trade)
Imports
437
Production
8,833
Supply
9,278
Unknown origin
8
Food & feed
1,547
Exports
3,254
Biomaterials
2,452
Bioenergy
2,344
Unknown/Losses
900
Source: EC, JRC EU Biomass Flows

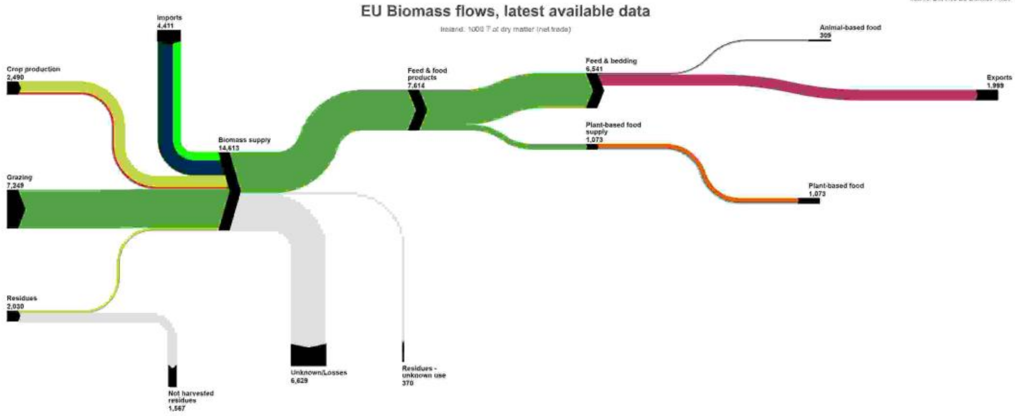

EU Biomass flows, latest available data
Estonia: 1000 T of dry matter (net trade)
Imports
437
Crop production
1,612
Grazing
565
Residues
2,861
Biomass supply
3,145
Feed & food products
1,519
Feed & bedding
1,268
Animal-based food
86
Plant-based food supply
251
Plant-based food
251
Exports
726
Not harvested residues
2,331
Unknown/Losses
475
Residues - unknown use
425
Source: EC, JRC EU Biomass Flows

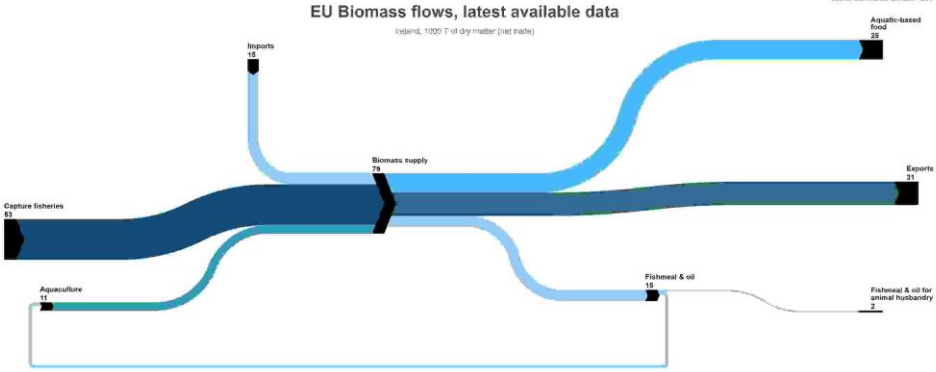

EU Biomass flows, latest available data
Estonia, 1000 T of dry matter (net trade)
Aquatic-based food
5
Unknown origin
8
Biomass supply
29
Exports
22
Capture fisheries
20
Aquaculture
0
Fishmeal & oil
4
Fishmeal & oil for animal husbandry
1
Source: EC, JRC EU Biomass Flows

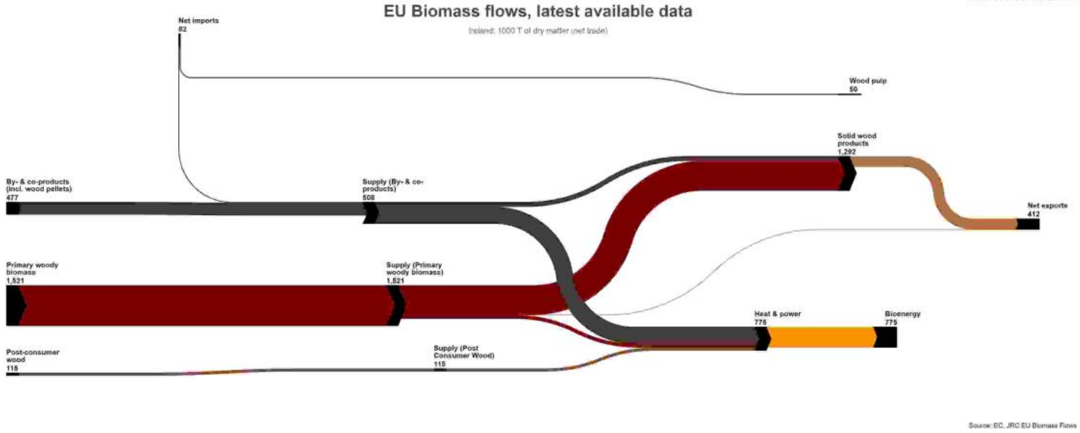

EU Biomass flows, latest available data
Estonia, 1000 T of dry matter (net trade)
Wood pulp
366
Solid wood products
2,086
By- & co-products (incl. wood pellets)
1,105
Supply (By- & co-products)
1,105
Net exports
2,506
Primary woody biomass
4,985
Supply (Primary woody biomass)
4,985
Heat & power
2,344
Bioenergy
2,344
Post-consumer wood
15
Supply (Post Consumer Wood)
15
Source: EC, JRC EU Biomass Flows

Ireland

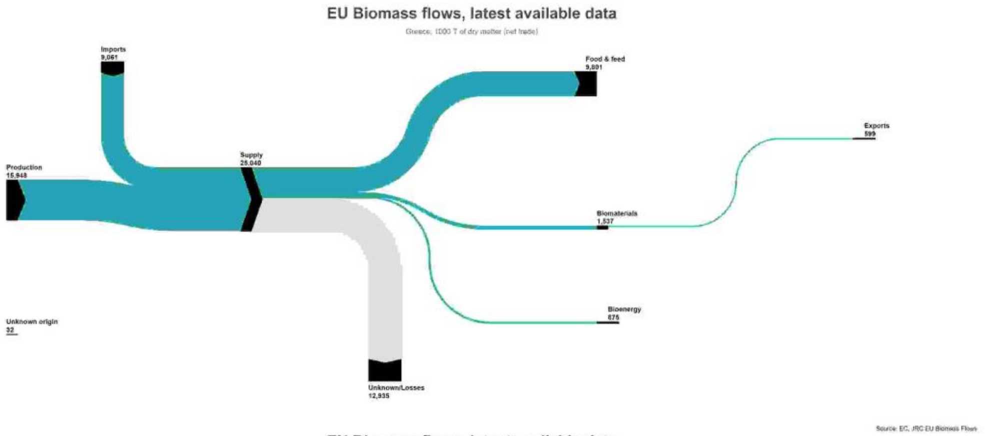

EU Biomass flows, latest available data
Ireland, 1000 T of dry matter (net trade)
Imports 4,608
Production 12,379
Supply 16,886
Food & feed 7,672
Exports 2,443
Biomaterials 1,342
Bioenergy 775
Unknown/Losses 6,999
Source: EC, JRC EU Biomass Flows

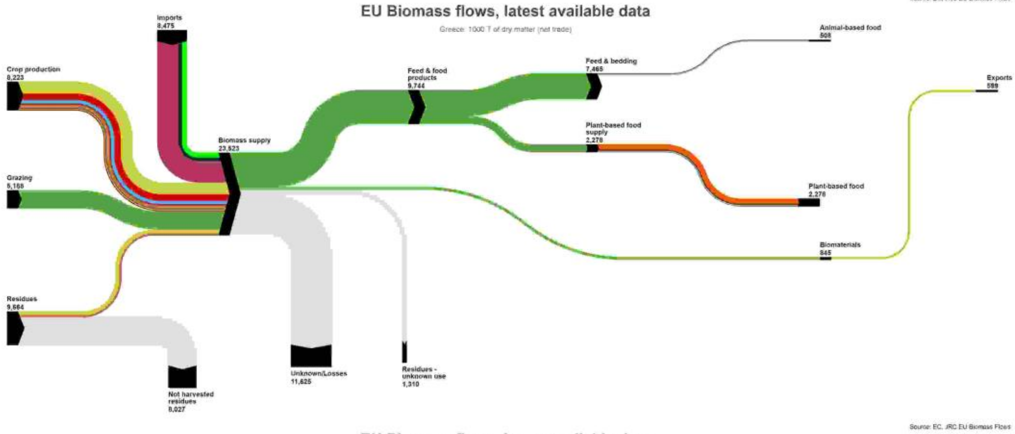

EU Biomass flows, latest available data
Ireland, 1000 T of dry matter (net trade)
Imports 4,411
Crop production 2,490
Grazing 7,249
Residues 2,030
Biomass supply 14,613
Feed & food products 7,614
Feed & bedding 6,541
Animal-based food 309
Exports 1,999
Plant-based food supply 1,073
Plant-based food 1,073
Not harvested residues 1,567
Unknown/Losses 6,629
Residues - unknown use 370
Source: EC, JRC EU Biomass Flows

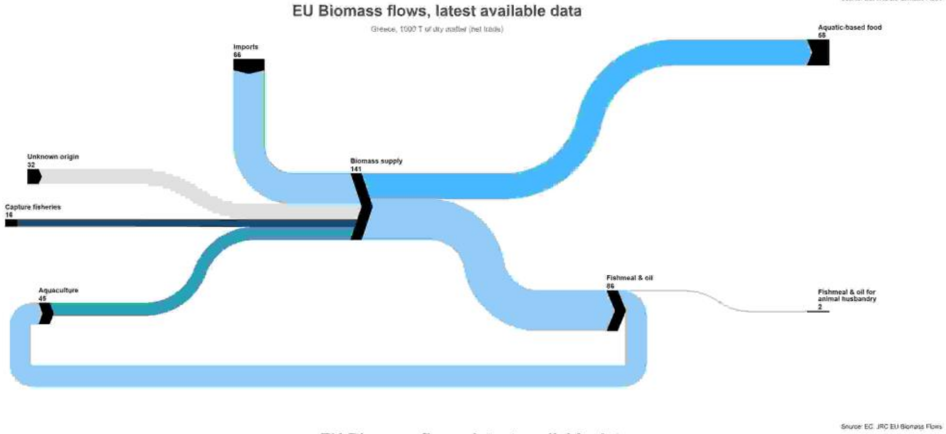

EU Biomass flows, latest available data
Ireland, 1000 T of dry matter (net trade)
Imports 15
Capture fisheries 53
Aquaculture 11
Biomass supply 79
Aquatic-based food 25
Exports 31
Fishmeal & oil 15
Fishmeal & oil for animal husbandry 2

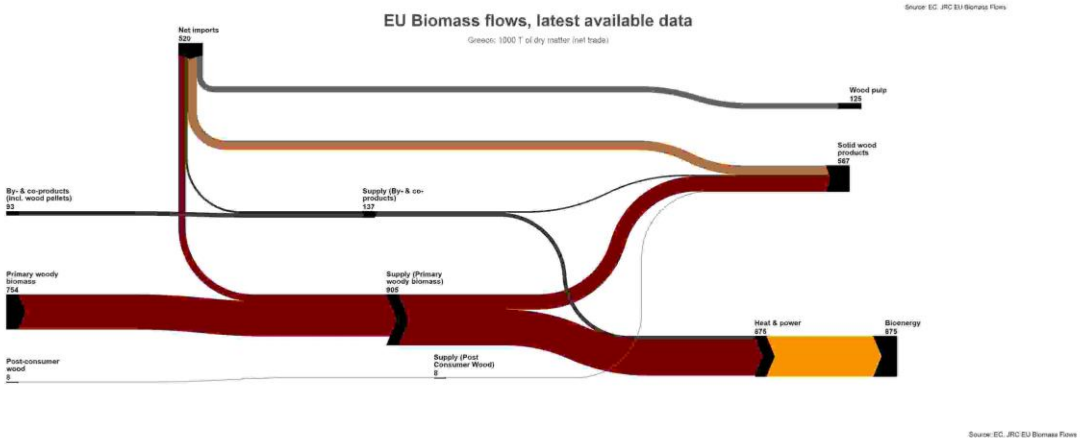

Source: EC, JRC EU Biomass Flows
EU Biomass flows, latest available data
Ireland: 1000 T of dry matter (net trade)
Net imports 82
Wood pulp 50
By- & co-products (incl. wood pellets) 477
Supply (By- & co-products) 508
Solid wood products 1,292
Net exports 412
Primary woody biomass 1,521
Supply (Primary woody biomass) 1,521
Heat & power 775
Bioenergy 775
Post-consumer wood 115
Supply (Post Consumer Wood) 115
Source: EC, JRC EU Biomass Flows

Greece

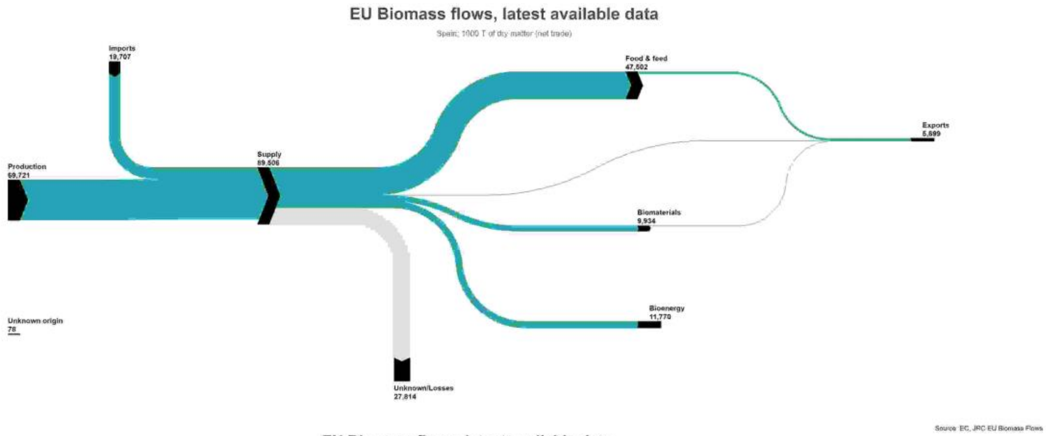

EU Biomass flows, latest available data
Greece, 1000 T of dry matter (net trade)
Imports
9,061
Production
15,948
Supply
25,040
Food & feed
9,801
Exports
599
Biomaterials
1,537
Bioenergy
875
Unknown origin
32
Unknown/Losses
12,935
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Greece: 1000 T of dry matter (net trade)
Imports
8,475
Crop production
8,223
Grazing
5,168
Residues
9,664
Biomass supply
23,523
Feed & food products
9,744
Feed & bedding
7,465
Animal-based food
508
Plant-based food supply
2,278
Plant-based food
2,278
Exports
599
Biomaterials
845
Not harvested residues
8,027
Unknown/Losses
11,625
Residues - unknown use
1,310
Source: EC, JRC EU Biomass Flows

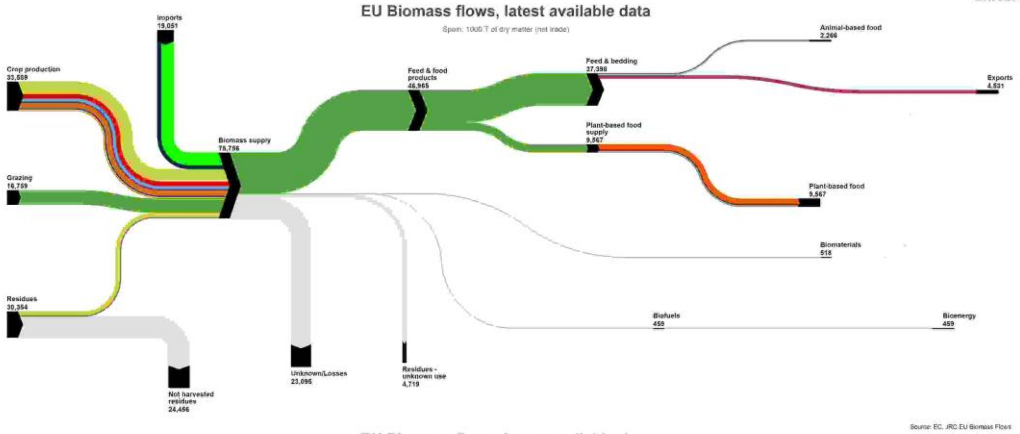

EU Biomass flows, latest available data
Greece, 1000 T of dry matter (net trade)
Imports
66
Aquatic-based food
55
Unknown origin
32
Biomass supply
141
Capture fisheries
16
Aquaculture
45
Fishmeal & oil
86
Fishmeal & oil for animal husbandry
2
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Greece: 1000 T of dry matter (net trade)
Net imports
520
Wood pulp
125
Solid wood products
567
By- & co-products (incl. wood pellets)
93
Supply (By- & co-products)
137
Primary woody biomass
754
Supply (Primary woody biomass)
905
Heat & power
875
Bioenergy
875
Post-consumer wood
8
Supply (Post Consumer Wood)
8
Source: EC, JRC EU Biomass Flows

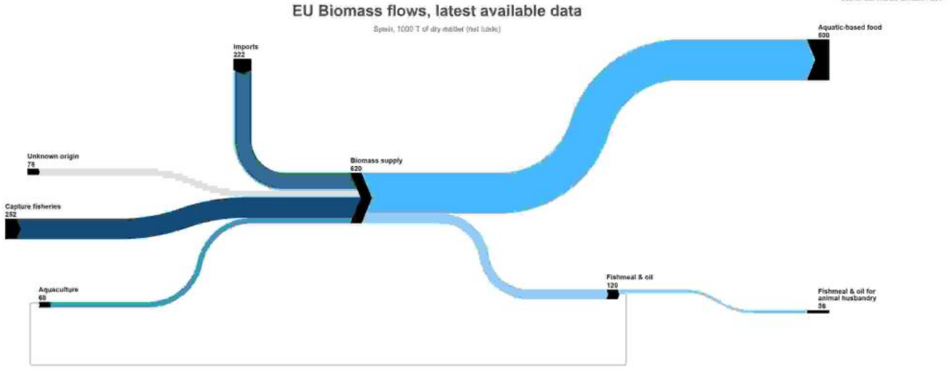
Spain



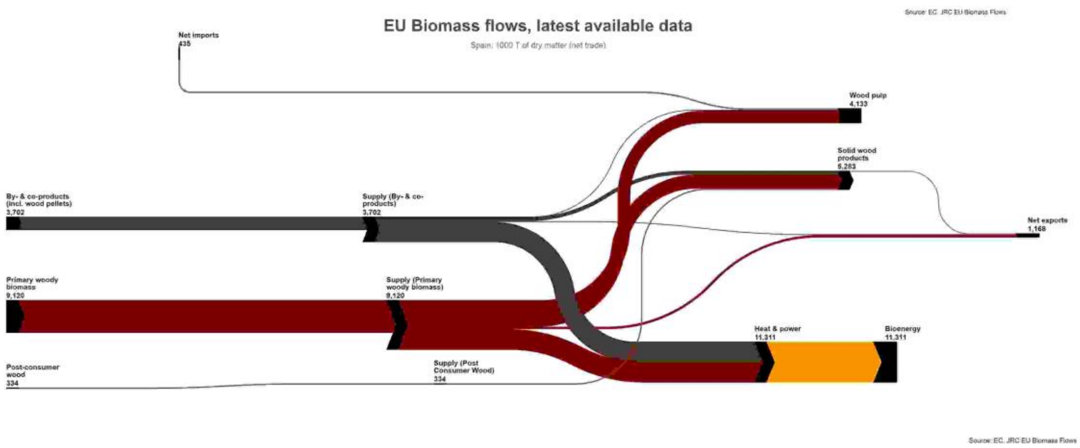
EU Biomass flows, latest available data
Spain; 1000 T of dry matter (net trade)
Imports 19,707
Production 69,721
Supply 89,506
Food & feed 47,502
Exports 5,699
Biomaterials 9,934
Bioenergy 11,770
Unknown origin 78
Unknown/Losses 27,814
Source: EC, JRC EU Biomass Flows



EU Biomass flows, latest available data
Spain; 1000 T of dry matter (net trade)
Imports 19,051
Crop production 33,589
Grazing 16,759
Residues 30,354
Biomass supply 75,756
Feed & food products 46,965
Feed & bedding 37,398
Animal-based food 2,266
Exports 4,531
Plant-based food supply 9,567
Plant-based food 9,567
Biomaterials 518
Biofuels 459
Bioenergy 459
Not harvested residues 24,456
Unknown/Losses 23,096
Residues - unknown use 4,719
Source: EC, JRC EU Biomass Flows

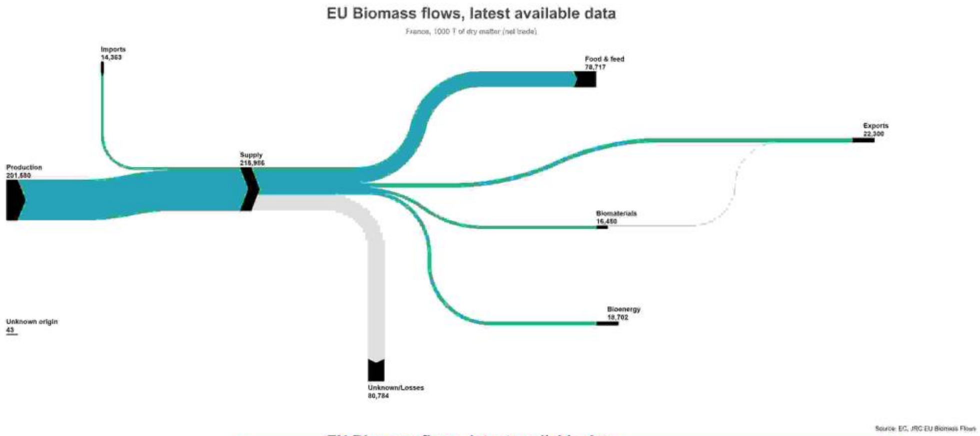


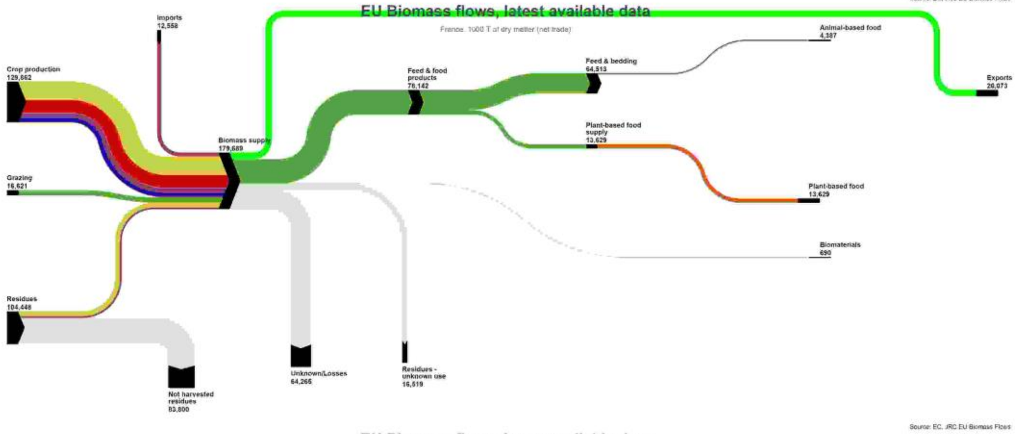
EU Biomass flows, latest available data
Spain; 1000 T of dry matter (net trade)
Imports 222
Unknown origin 78
Capture fisheries 252
Aquaculture 68
Biomass supply 620
Aquatic-based food 500
Fishmeal & oil 120
Fishmeal & oil for animal husbandry 36
Source: EC, JRC EU Biomass Flows

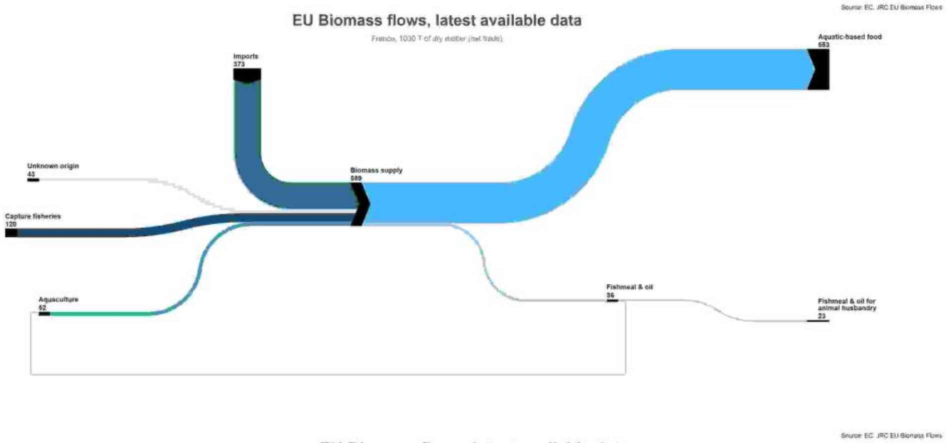


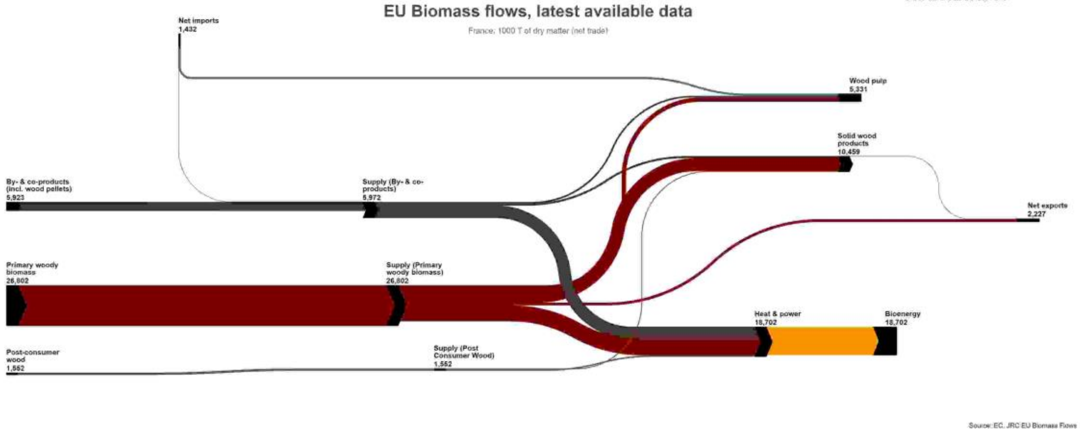
EU Biomass flows, latest available data
Spain; 1000 T of dry matter (net trade)
Net imports 435
By- & co-products (incl. wood pellets) 3,702
Supply (By- & co-products) 3,702
Primary woody biomass 9,120
Supply (Primary woody biomass) 9,120
Post-consumer wood 334
Supply (Post Consumer Wood) 334
Wood pulp 4,133
Solid wood products 5,283
Net exports 1,168
Heat & power 11,311
Bioenergy 11,311
Source: EC, JRC EU Biomass Flows

France

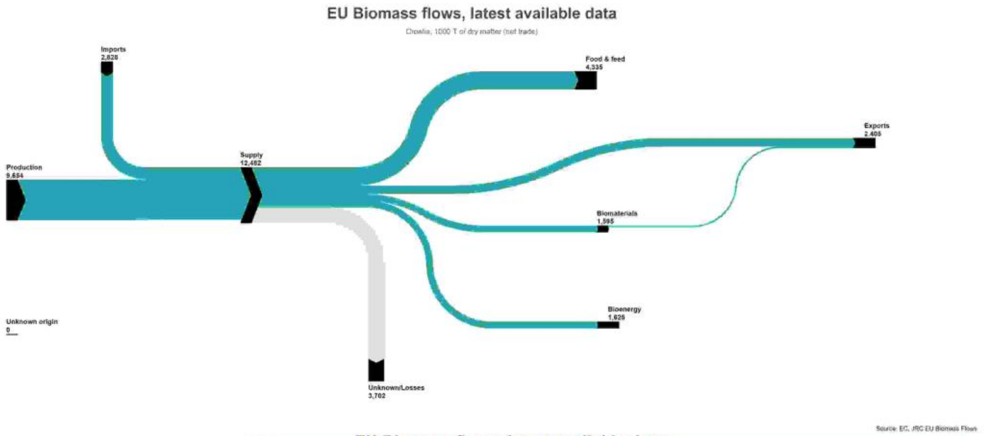

EU Biomass flows, latest available data
France, 1000 T of dry matter (net trade)
Imports 14,363
Production 201,580
Supply 215,986
Food & feed 78,717
Exports 22,300
Biomaterials 16,450
Bioenergy 18,702
Unknown origin 43
Unknown/Losses 80,784
Source: EC, JRC EU Biomass Flows

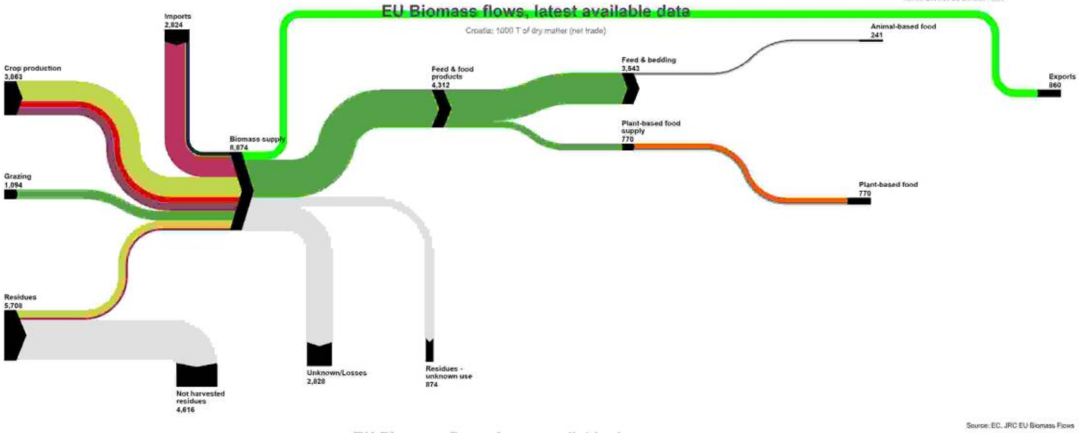

EU Biomass flows, latest available data
France, 1000 T of dry matter (net trade)
Imports 12,558
Crop production 129,862
Grazing 16,621
Residues 104,448
Biomass supply 179,689
Feed & food products 78,142
Feed & bedding 64,513
Animal-based food 4,387
Plant-based food supply 13,629
Plant-based food 13,629
Exports 20,073
Biomaterials 690
Not harvested residues 83,800
Unknown/Losses 64,265
Residues - unknown use 16,519
Source: EC, JRC EU Biomass Flows

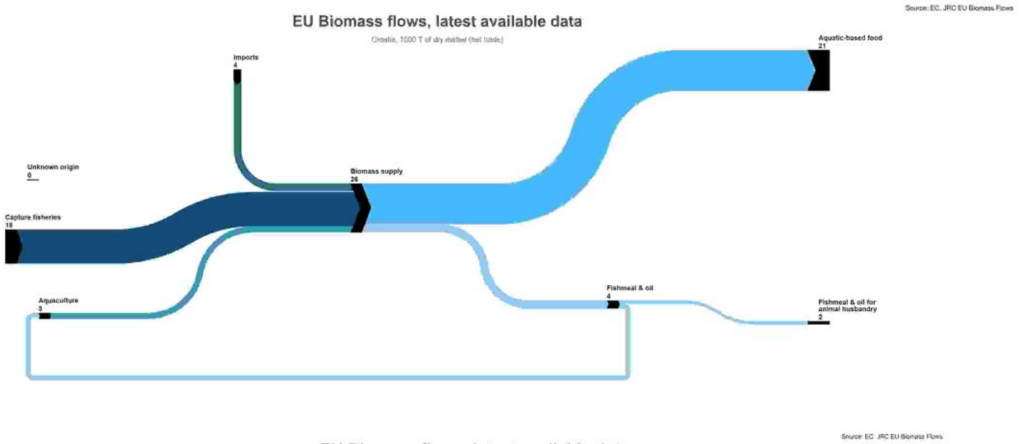

EU Biomass flows, latest available data
France, 1000 T of dry matter (net trade)
Imports 373
Unknown origin 43
Capture fisheries 120
Aquaculture 52
Biomass supply 589
Aquatic-based food 553
Fishmeal & oil 36
Fishmeal & oil for animal husbandry 23
Source: EC, JRC EU Biomass Flows

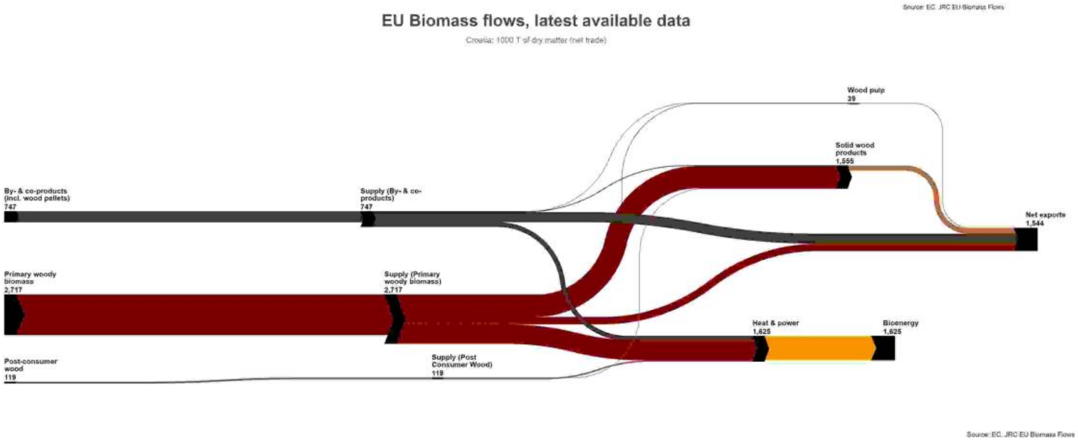

EU Biomass flows, latest available data
France: 1000 T of dry matter (net trade)
Net imports 1,432
By- & co-products (incl. wood pellets) 5,923
Supply (By- & co-products) 5,972
Primary woody biomass 26,802
Supply (Primary woody biomass) 26,802
Post-consumer wood 1,552
Supply (Post Consumer Wood) 1,552
Wood pulp 5,331
Solid wood products 10,459
Net exports 2,227
Heat & power 18,702
Bioenergy 18,702
Source: EC, JRC EU Biomass Flows

Croatia

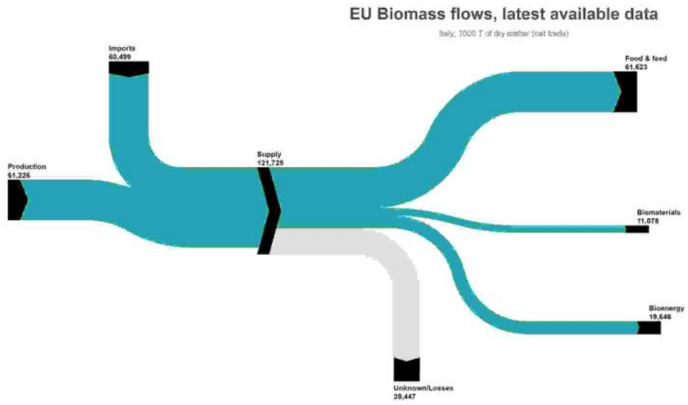

EU Biomass flows, latest available data
Croatia, 1000 T of dry matter (net trade)
Imports
2,828
Food & feed
4,335
Exports
2,405
Production
9,654
Supply
12,482
Biomaterials
1,595
Bioenergy
1,625
Unknown origin
0
Unknown/Losses
3,702
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Croatia: 1000 T of dry matter (net trade)
Imports
2,824
Animal-based food
241
Crop production
3,863
Feed & food products
4,312
Feed & bedding
3,543
Exports
860
Biomass supply
8,874
Plant-based food supply
770
Grazing
1,094
Plant-based food
770
Residues
5,708
Unknown/Losses
2,828
Residues - unknown use
874
Not harvested residues
4,616
Source: EC, JRC EU Biomass Flows

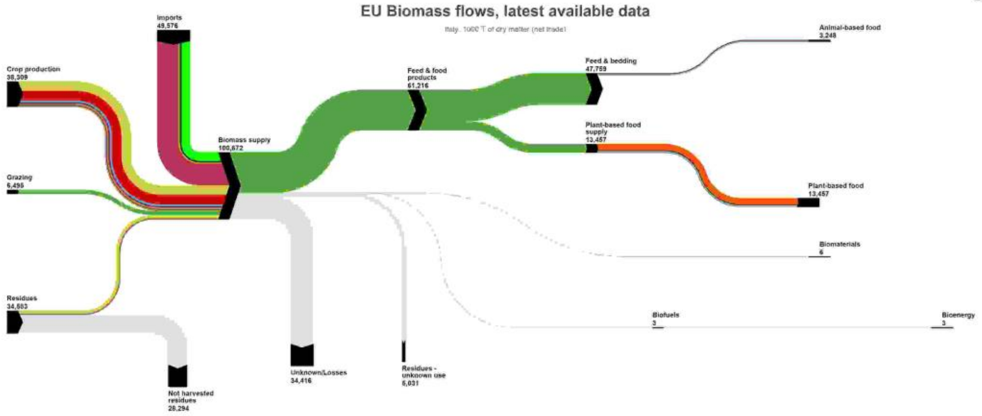

EU Biomass flows, latest available data
Croatia, 1000 T of dry matter (net trade)
Aquatic-based food
21
Imports
4
Unknown origin
0
Biomass supply
26
Capture fisheries
18
Aquaculture
3
Fishmeal & oil
4
Fishmeal & oil for animal husbandry
2
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Croatia: 1000 T of dry matter (net trade)
Wood pulp
39
Solid wood products
1,555
By- & co-products (incl. wood pellets)
747
Supply (By- & co-products)
747
Net exports
1,544
Primary woody biomass
2,717
Supply (Primary woody biomass)
2,717
Heat & power
1,625
Bioenergy
1,625
Post-consumer wood
119
Supply (Post Consumer Wood)
119
Source: EC, JRC EU Biomass Flows

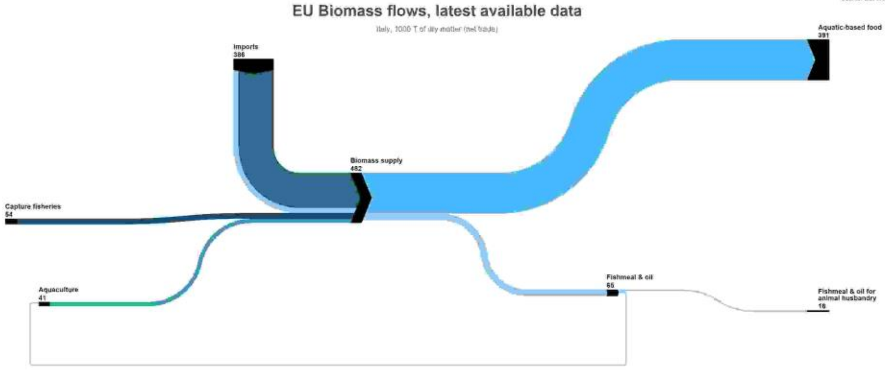
Italy



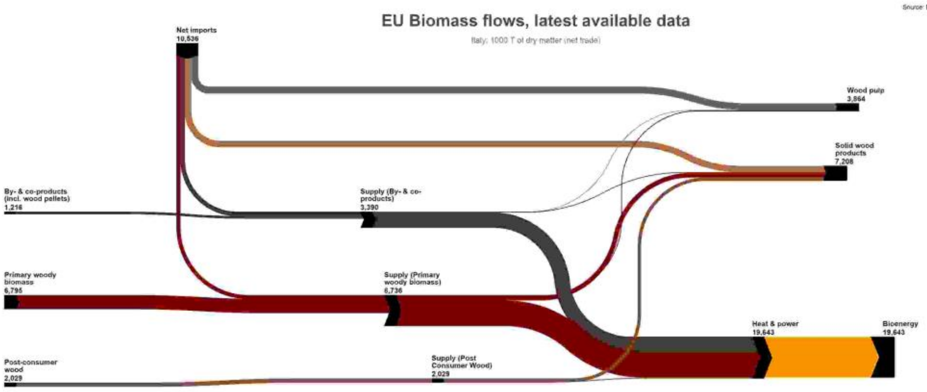
Source: EC, JRC EU Biomass Flows



Source: EC, JRC EU Biomass Flows

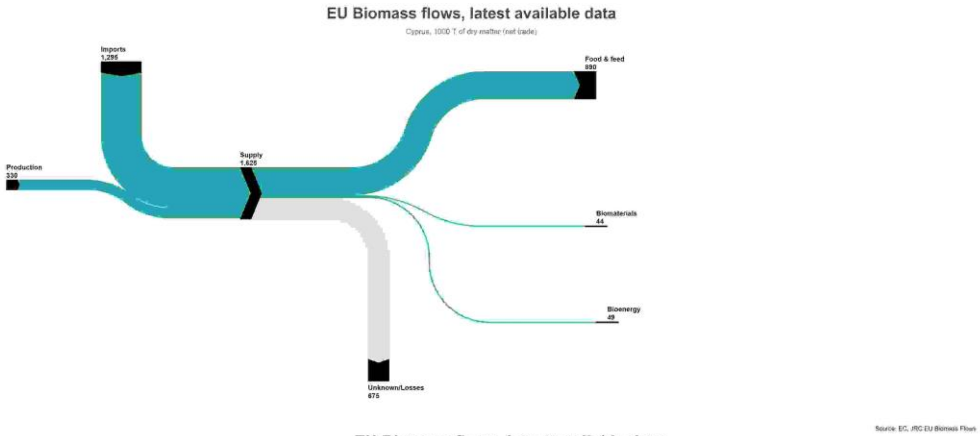


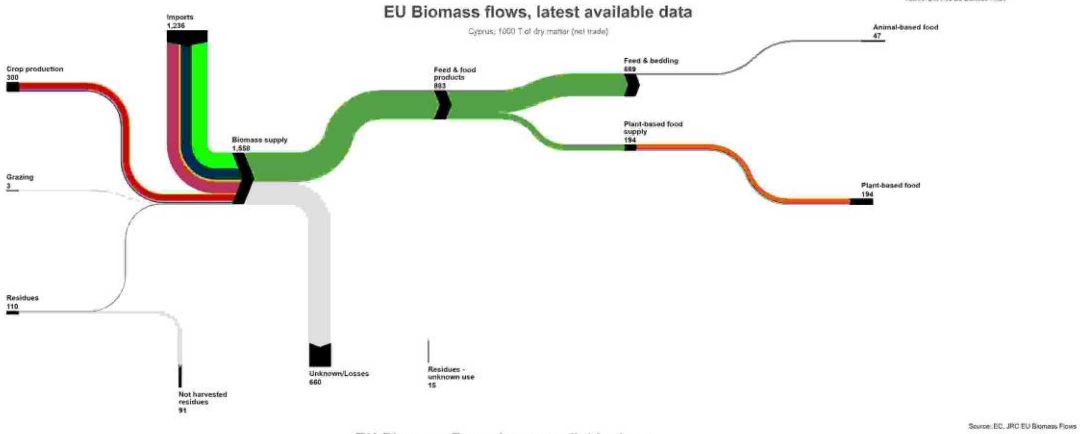
Source: EC, JRC EU Biomass Flows

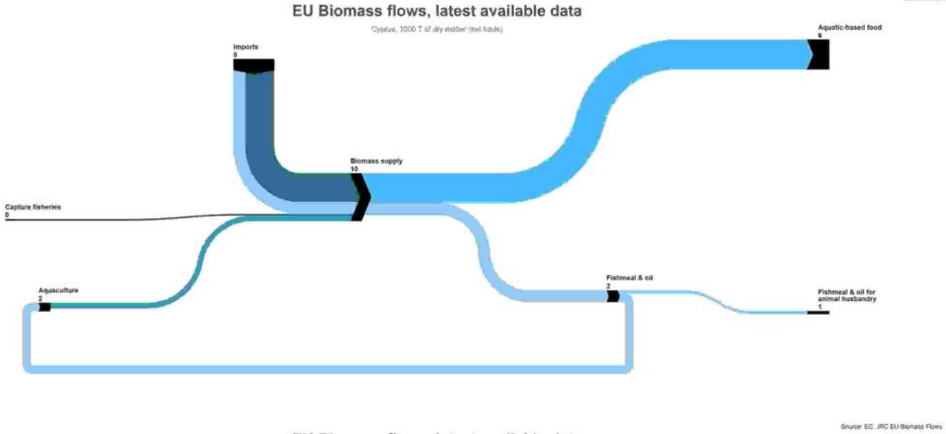


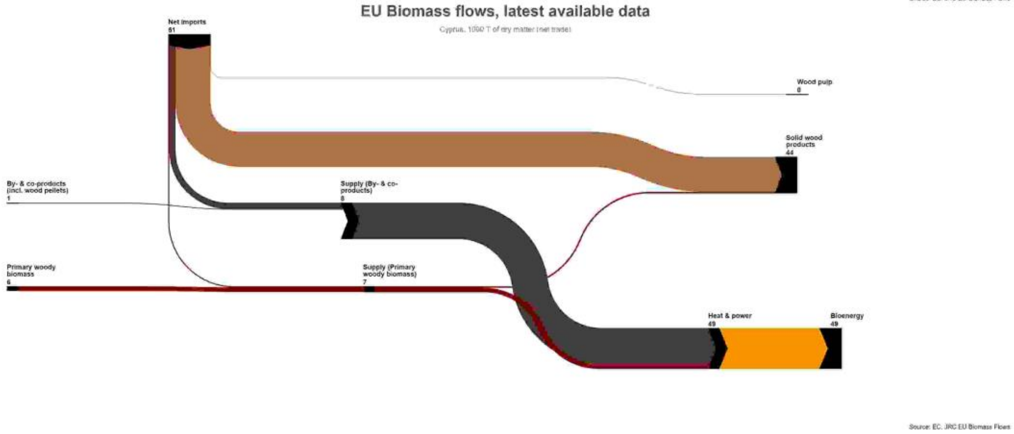
Source: EC, JRC EU Biomass Flows

Cyprus

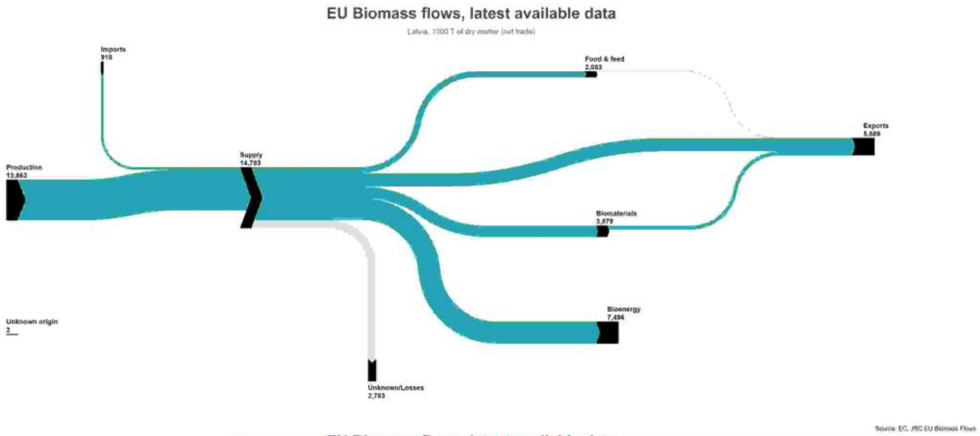

EU Biomass flows, latest available data
Cyprus, 1000 T of dry matter (net trade)
Imports
1,295
Production
330
Supply
1,625
Food & feed
890
Biomaterials
44
Bioenergy
49
Unknown/Losses
675
Source: EC, JRC EU Biomass Flows

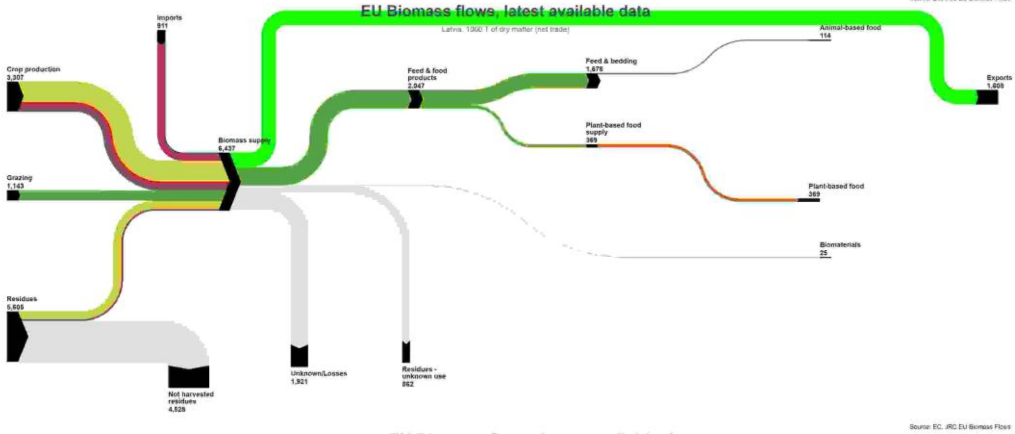

EU Biomass flows, latest available data
Cyprus; 1000 T of dry matter (net trade)
Imports
1,236
Crop production
300
Grazing
3
Residues
110
Biomass supply
1,558
Feed & food products
883
Feed & bedding
689
Animal-based food
47
Plant-based food supply
194
Plant-based food
194
Unknown/Losses
660
Residues - unknown use
15
Not harvested residues
91
Source: EC, JRC EU Biomass Flows

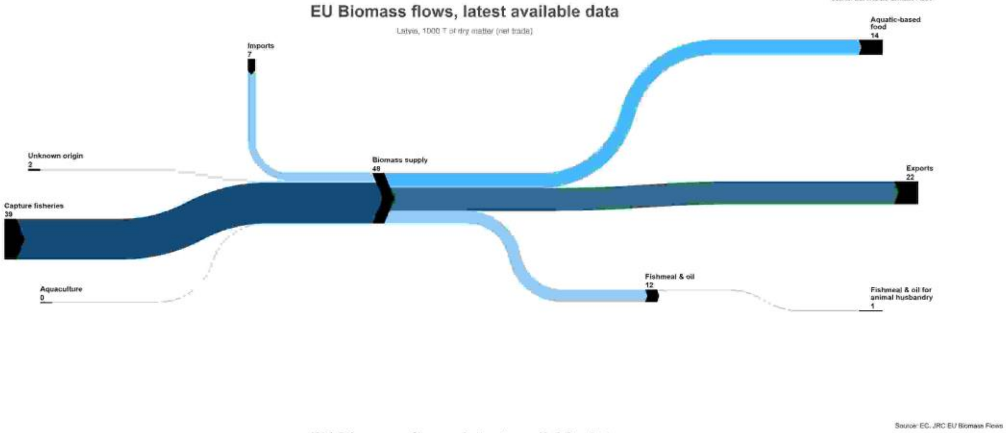

EU Biomass flows, latest available data
Cyprus, 1000 T of dry matter (net trade)
Imports
8
Biomass supply
10
Aquatic-based food
6
Capture fisheries
0
Aquaculture
2
Fishmeal & oil
2
Fishmeal & oil for animal husbandry
1
Source: EC, JRC EU Biomass Flows

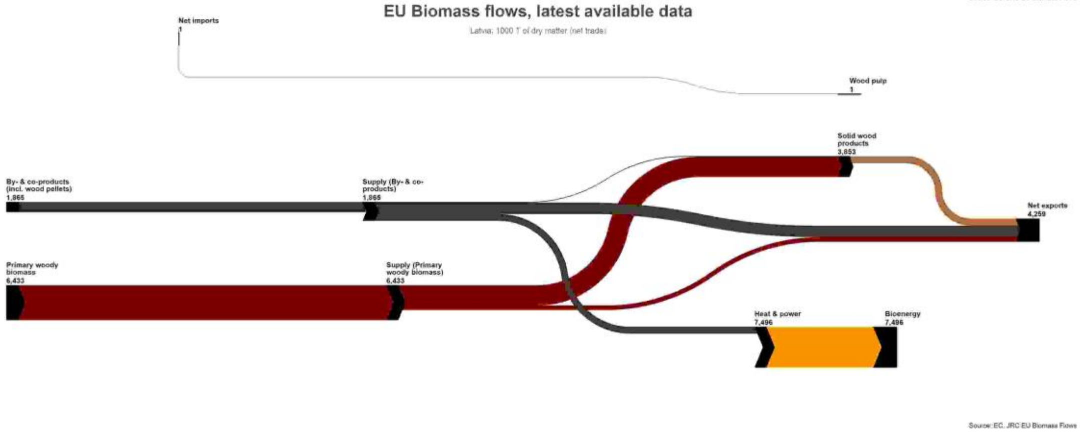

EU Biomass flows, latest available data
Cyprus, 1000 T of dry matter (net trade)
Net imports
51
Wood pulp
0
Solid wood products
44
By- & co-products (incl. wood pellets)
1
Supply (By- & co-products)
8
Primary woody biomass
6
Supply (Primary woody biomass)
7
Heat & power
49
Bioenergy
49
Source: EC, JRC EU Biomass Flows

Latvia

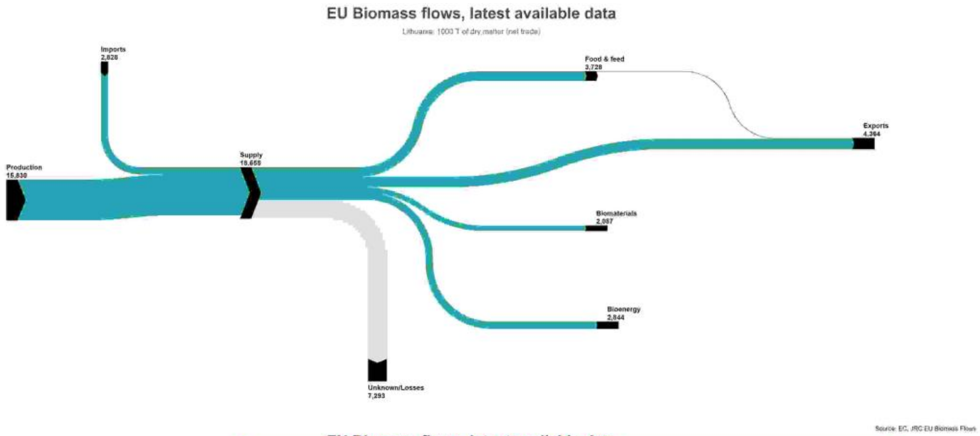

EU Biomass flows, latest available data
Latvia, 1000 T of dry matter (net trade)
Imports
918
Production
13,863
Supply
14,783
Food & feed
2,083
Exports
5,889
Biomaterials
3,879
Bioenergy
7,496
Unknown origin
2
Unknown/Losses
2,783
Source: EC, JRC EU Biomass Flows

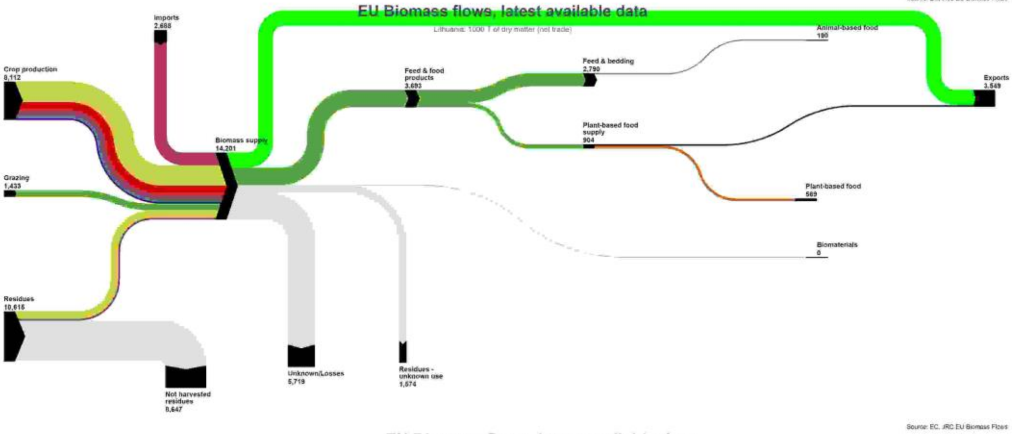

EU Biomass flows, latest available data
Latvia, 1000 T of dry matter (net trade)
Imports
911
Crop production
3,307
Grazing
1,143
Residues
5,605
Biomass supply
6,437
Feed & food products
2,047
Feed & bedding
1,678
Animal-based food
114
Exports
1,608
Plant-based food supply
369
Plant-based food
369
Biomaterials
25
Not harvested residues
4,528
Unknown/Losses
1,921
Residues - unknown use
862
Source: EC, JRC EU Biomass Flows

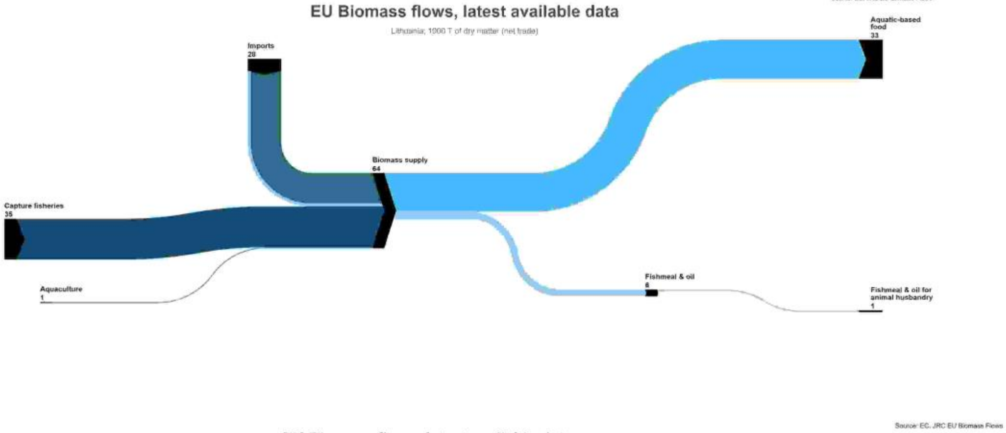

EU Biomass flows, latest available data
Latvia, 1000 T of dry matter (net trade)
Imports
7
Unknown origin
2
Capture fisheries
39
Aquaculture
0
Biomass supply
48
Aquatic-based food
14
Exports
22
Fishmeal & oil
12
Fishmeal & oil for animal husbandry
1
Source: EC, JRC EU Biomass Flows

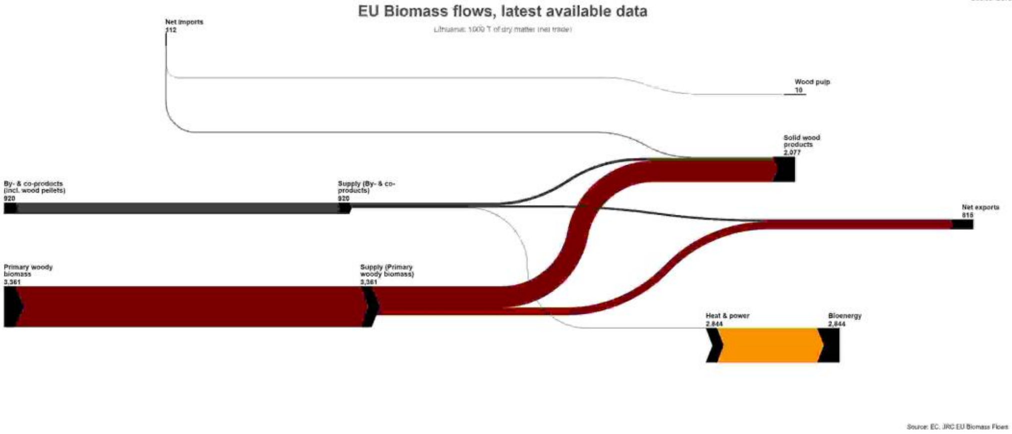

EU Biomass flows, latest available data
Latvia, 1000 T of dry matter (net trade)
Net imports
1
Wood pulp
1
By- & co-products (incl. wood pellets)
1,865
Supply (By- & co-products)
1,865
Primary woody biomass
6,433
Supply (Primary woody biomass)
6,433
Solid wood products
3,853
Net exports
4,259
Heat & power
7,496
Bioenergy
7,496
Source: EC, JRC EU Biomass Flows

Lithuania

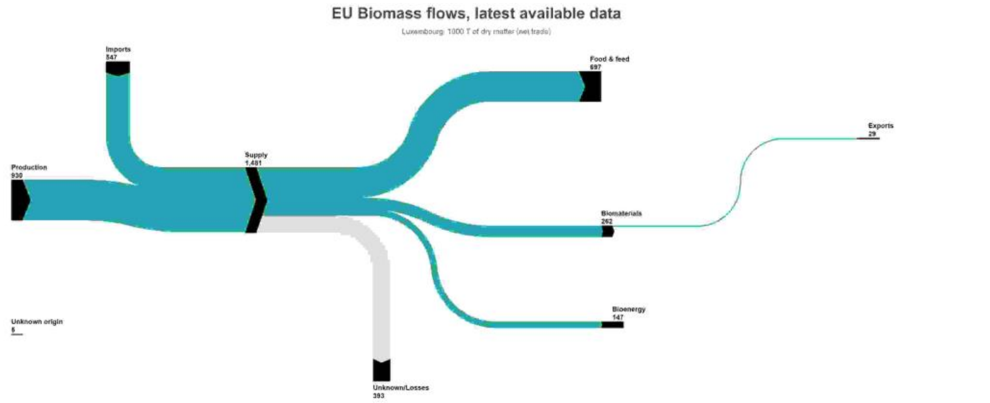

EU Biomass flows, latest available data
Lithuania: 1000 T of dry matter (net trade)
Imports
2,828
Production
15,830
Supply
18,658
Food & feed
3,728
Exports
4,364
Biomaterials
2,087
Bioenergy
2,844
Unknown/Losses
7,293
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Lithuania: 1000 T of dry matter (net trade)
Imports
2,688
Crop production
8,112
Grazing
1,433
Residues
10,616
Biomass supply
14,201
Feed & food products
3,693
Feed & bedding
2,790
Animal-based food
190
Exports
3,549
Plant-based food supply
904
Plant-based food
569
Biomaterials
0
Not harvested residues
8,647
Unknown/Losses
5,719
Residues - unknown use
1,574
Source: EC, JRC EU Biomass Flows

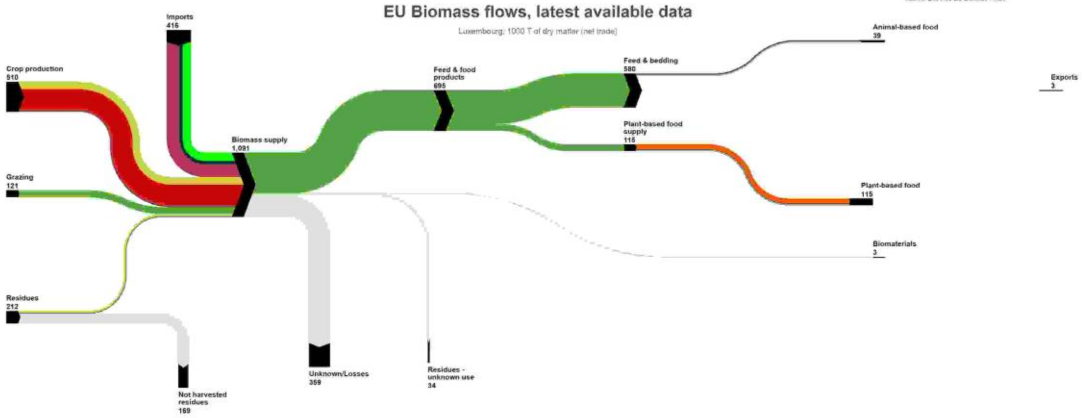

EU Biomass flows, latest available data
Lithuania; 1000 T of dry matter (net trade)
Imports
28
Capture fisheries
35
Aquaculture
1
Biomass supply
64
Aquatic-based food
33
Fishmeal & oil
6
Fishmeal & oil for animal husbandry
1
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Lithuania: 1000 T of dry matter (net trade)
Net imports
112
Wood pulp
10
Solid wood products
2,077
By- & co-products (incl. wood pellets)
920
Supply (By- & co-products)
920
Net exports
816
Primary woody biomass
3,361
Supply (Primary woody biomass)
3,361
Heat & power
2,844
Bioenergy
2,844
Source: EC, JRC EU Biomass Flows

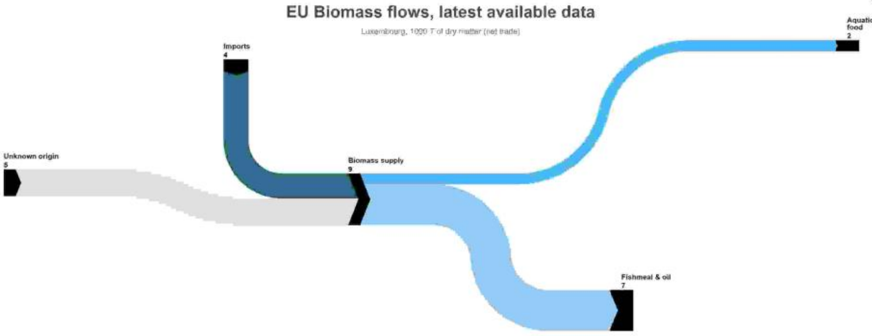
Luxembourg



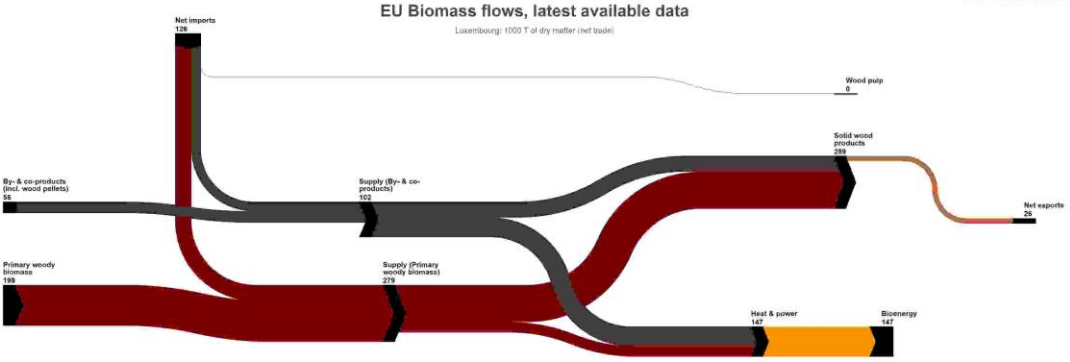
Source: EC, JRC EU Biomass Flows



Source: EC, JRC EU Biomass Flows

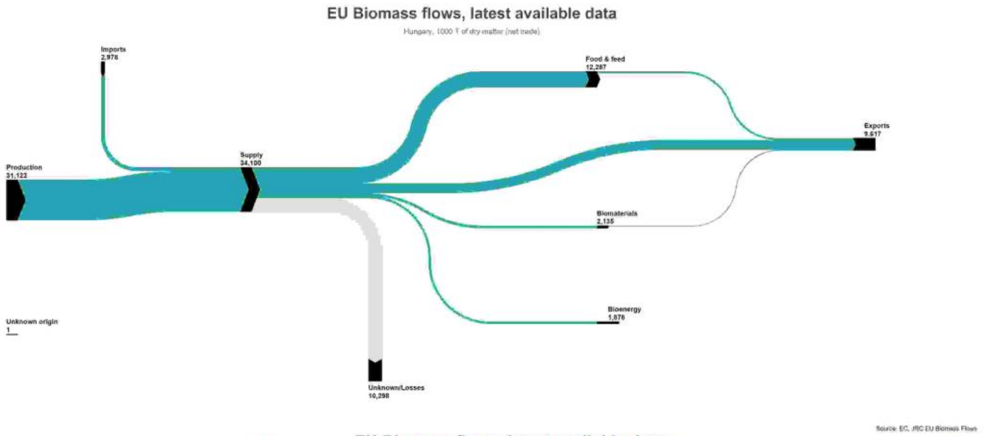


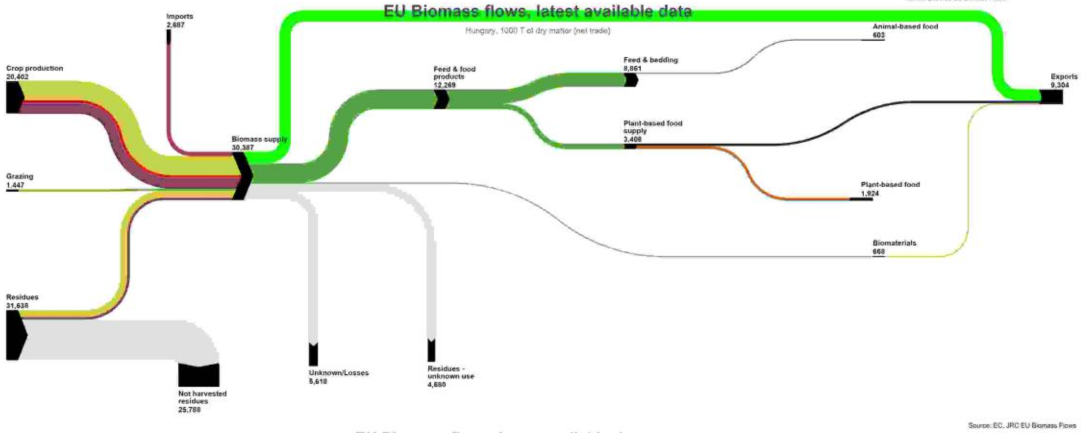
Source: EC, JRC EU Biomass Flows

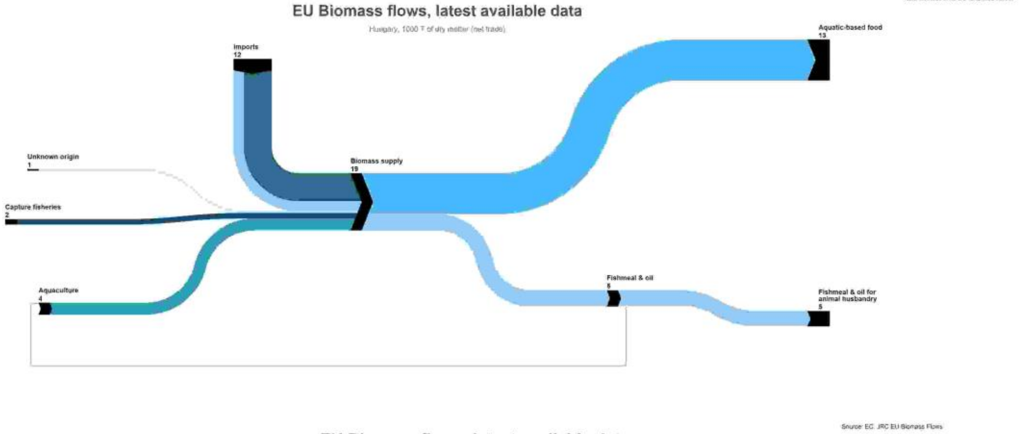


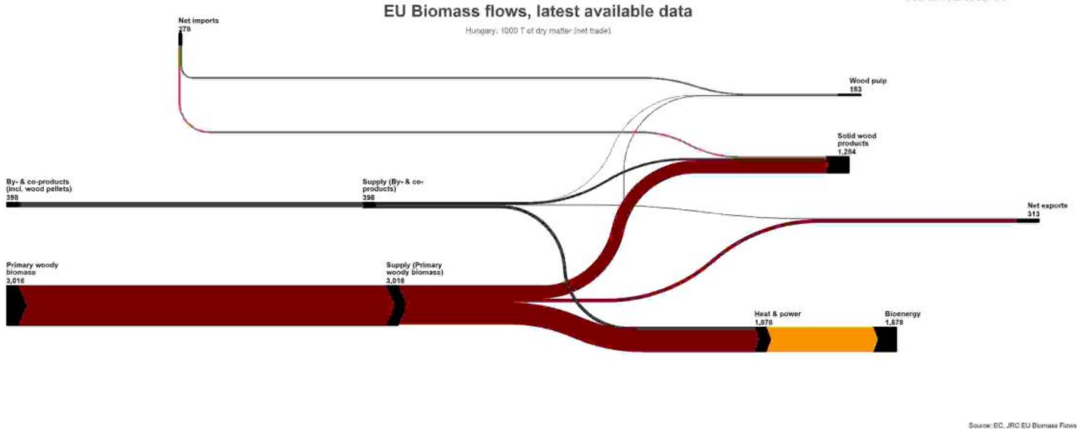
Source: EC, JRC EU Biomass Flows

Hungary

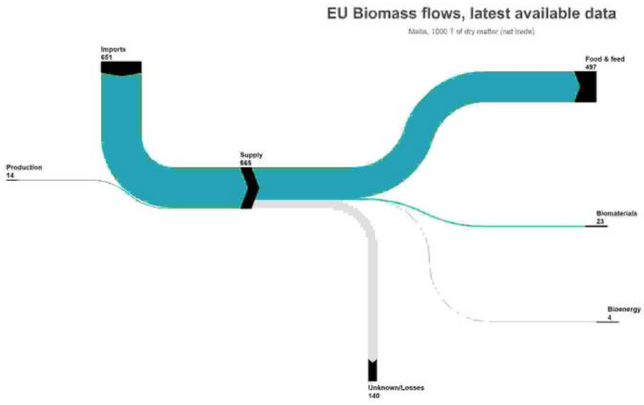

EU Biomass flows, latest available data
Hungary, 1000 T of dry matter (net trade)
Imports
2,978
Food & feed
12,287
Exports
9,617
Production
31,122
Supply
34,100
Biomaterials
2,135
Bioenergy
1,878
Unknown origin
1
Unknown/Losses
10,298
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Hungary, 1000 T of dry matter (net trade)
Imports
2,687
Animal-based food
603
Crop production
20,402
Feed & food products
12,269
Feed & bedding
8,861
Exports
9,304
Plant-based food supply
3,408
Biomass supply
30,387
Grazing
1,447
Plant-based food
1,924
Biomaterials
668
Residues
31,638
Unknown/Losses
5,618
Residues - unknown use
4,680
Not harvested residues
25,788
Source: EC, JRC EU Biomass Flows

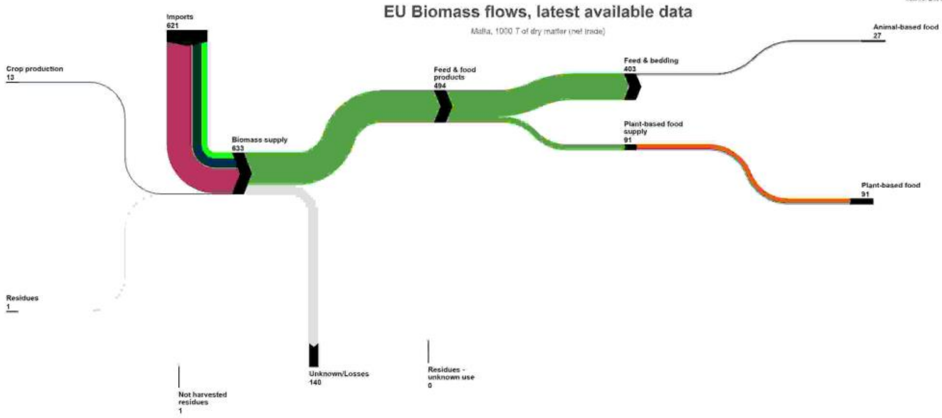

EU Biomass flows, latest available data
Hungary, 1000 T of dry matter (net trade)
Imports
12
Aquatic-based food
13
Unknown origin
1
Biomass supply
19
Capture fisheries
2
Aquaculture
4
Fishmeal & oil
6
Fishmeal & oil for animal husbandry
5
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Hungary, 1000 T of dry matter (net trade)
Net imports
278
Wood pulp
183
Solid wood products
1,284
By- & co-products (incl. wood pellets)
398
Supply (By- & co-products)
398
Net exports
313
Primary woody biomass
3,016
Supply (Primary woody biomass)
3,016
Heat & power
1,878
Bioenergy
1,878
Source: EC, JRC EU Biomass Flows

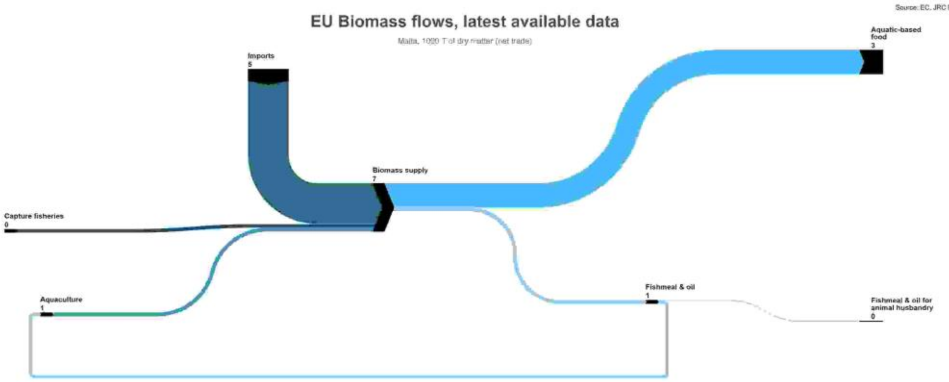
Malta



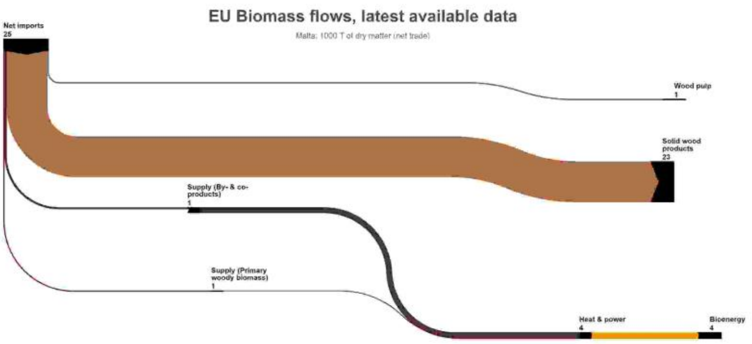
Source: EC, JRC EU Biomass Flows



Source: EC, JRC EU Biomass Flows

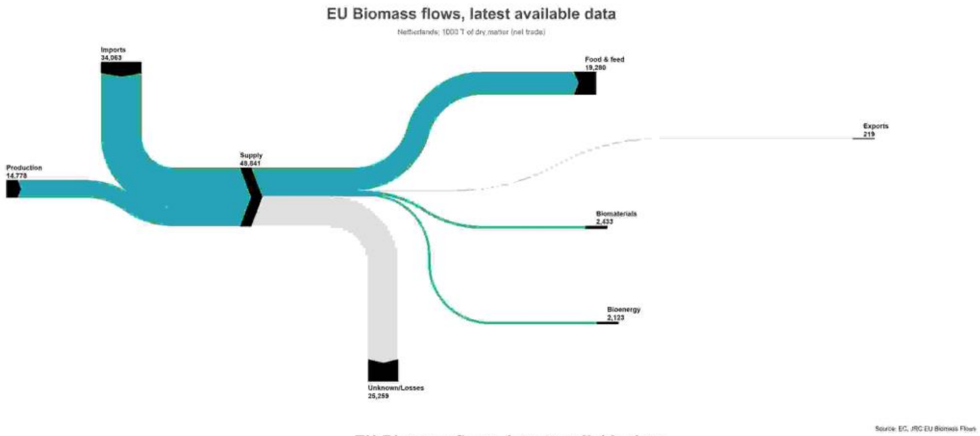


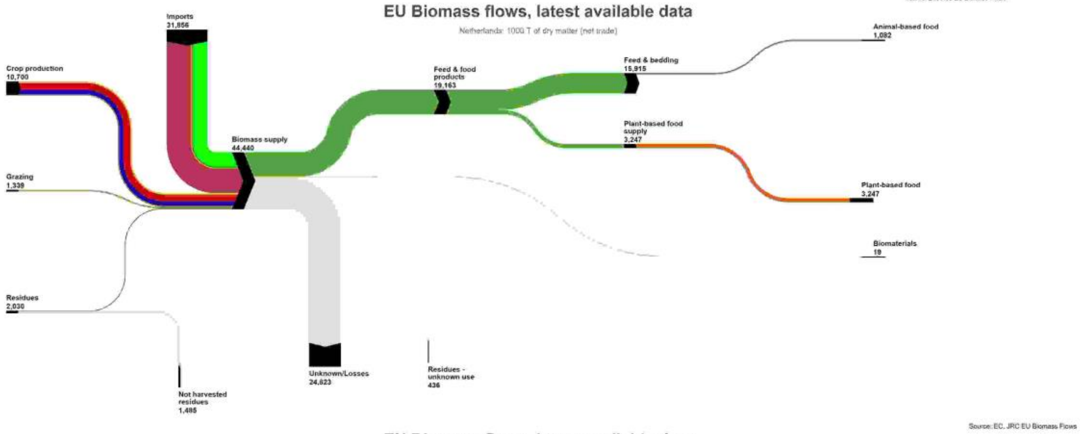
Source: EC, JRC EU Biomass Flows

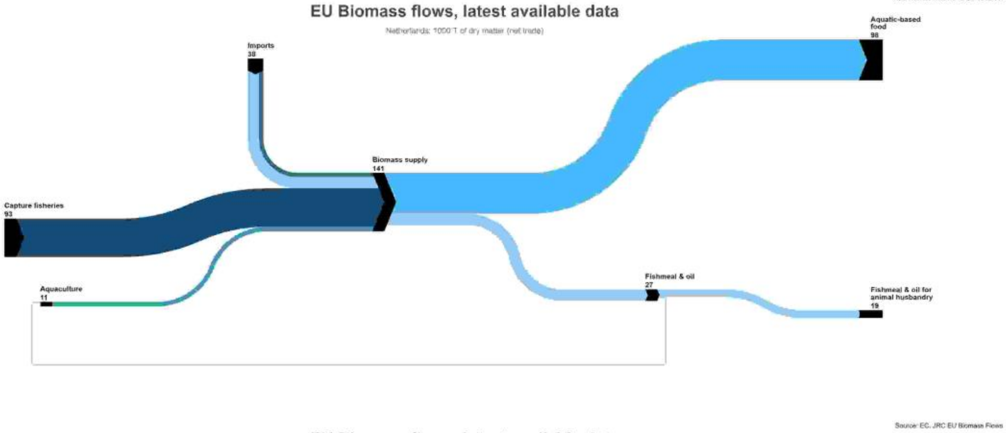


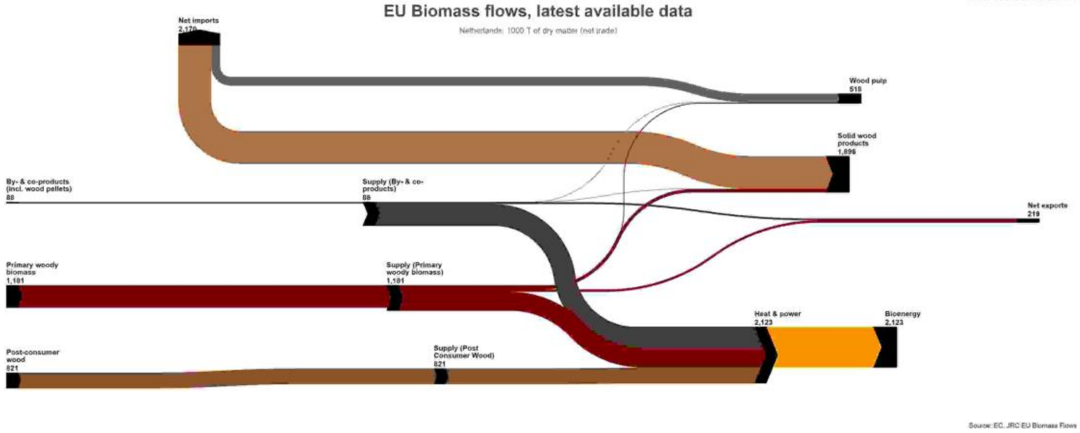
Source: EC, JRC EU Biomass Flows

Netherlands

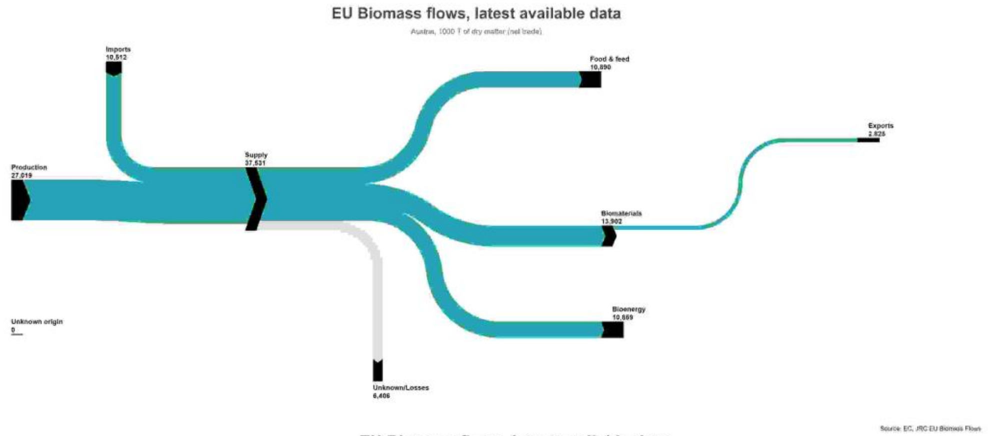

EU Biomass flows, latest available data
Netherlands: 1000 T of dry matter (net trade)
Imports 34,063
Food & feed 19,280
Exports 219
Production 14,778
Supply 48,841
Biomaterials 2,433
Bioenergy 2,123
Unknown/Losses 25,259
Source: EC, JRC EU Biomass Flows

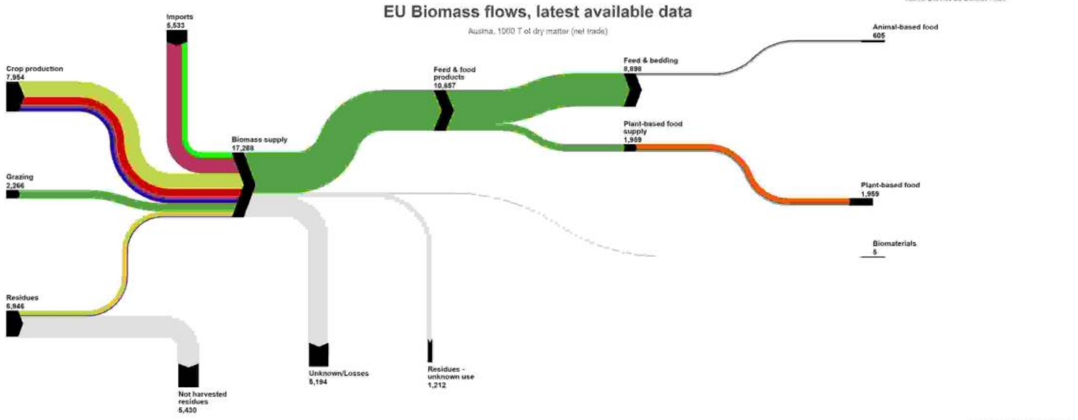

EU Biomass flows, latest available data
Netherlands: 1000 T of dry matter (net trade)
Imports 31,856
Animal-based food 1,082
Crop production 10,700
Feed & food products 19,163
Feed & bedding 15,915
Biomass supply 44,440
Plant-based food supply 3,247
Grazing 1,339
Plant-based food 3,247
Biomaterials 19
Residues 2,030
Unknown/Losses 24,823
Residues - unknown use 436
Not harvested residues 1,485
Source: EC, JRC EU Biomass Flows

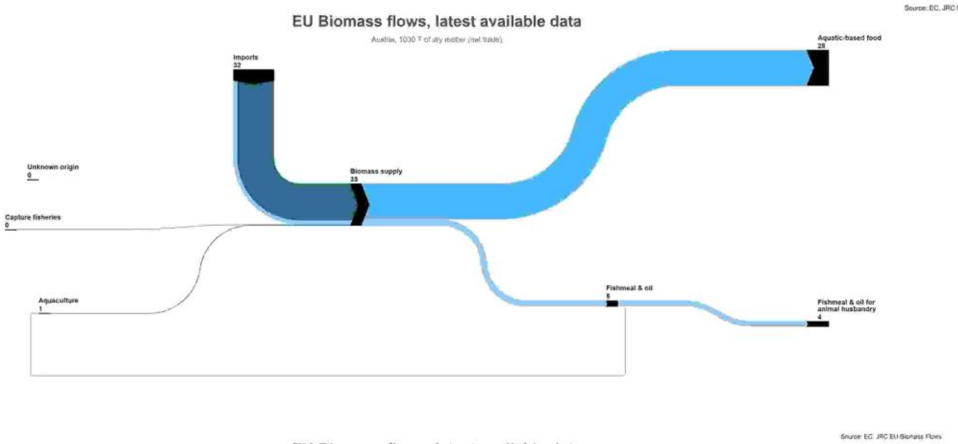

EU Biomass flows, latest available data
Netherlands: 1000 T of dry matter (net trade)
Aquatic-based food 98
Imports 38
Biomass supply 141
Capture fisheries 93
Fishmeal & oil 27
Aquaculture 11
Fishmeal & oil for animal husbandry 19
Source: EC, JRC EU Biomass Flows

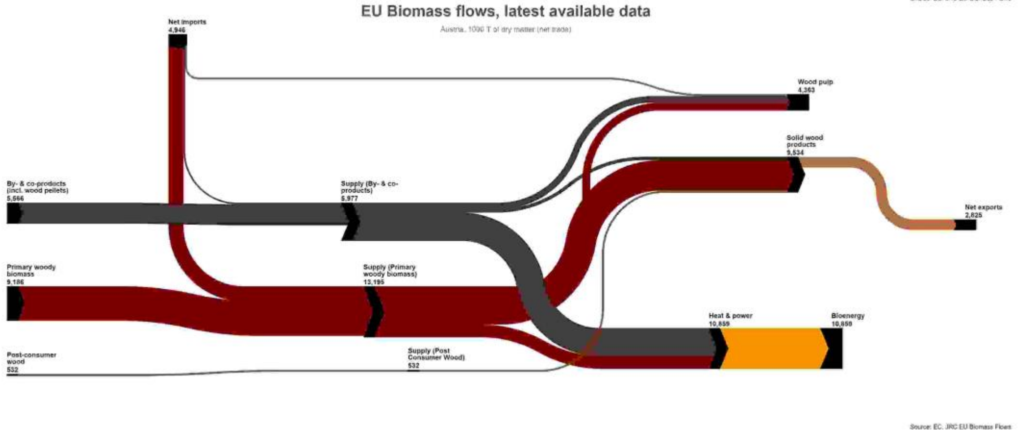

EU Biomass flows, latest available data
Netherlands: 1000 T of dry matter (net trade)
Net imports 2,170
Wood pulp 518
Solid wood products 1,896
By- & co-products (incl. wood pellets) 88
Supply (By- & co-products) 88
Net exports 219
Primary woody biomass 1,181
Supply (Primary woody biomass) 1,181
Heat & power 2,123
Bioenergy 2,123
Post-consumer wood 821
Supply (Post Consumer Wood) 821
Source: EC, JRC EU Biomass Flows

Austria

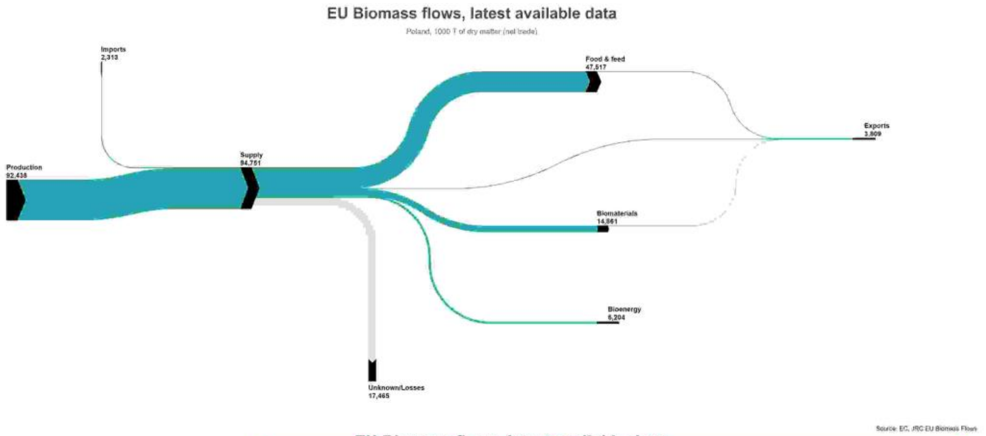

EU Biomass flows, latest available data
Austria, 1000 T of dry matter (net trade)
Imports 10,512
Production 27,019
Supply 37,531
Food & feed 10,890
Exports 2,825
Biomaterials 13,902
Bioenergy 10,859
Unknown origin 0
Unknown/Losses 6,406
Source: EC, JRC EU Biomass Flows

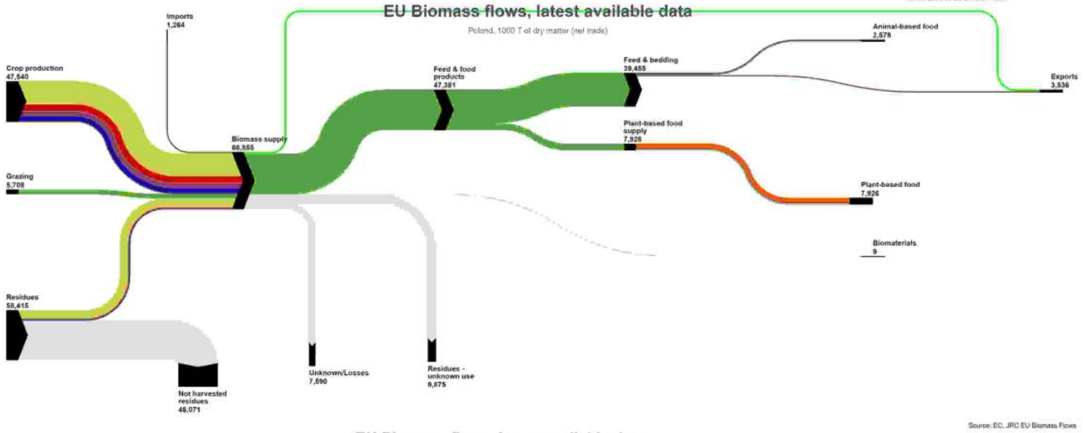

EU Biomass flows, latest available data
Austria, 1000 T of dry matter (net trade)
Imports 5,533
Crop production 7,954
Grazing 2,266
Residues 6,946
Biomass supply 17,288
Feed & food products 10,857
Feed & bedding 8,898
Animal-based food 605
Plant-based food supply 1,959
Plant-based food 1,959
Biomaterials 5
Not harvested residues 5,430
Unknown/Losses 5,194
Residues - unknown use 1,212
Source: EC, JRC EU Biomass Flows

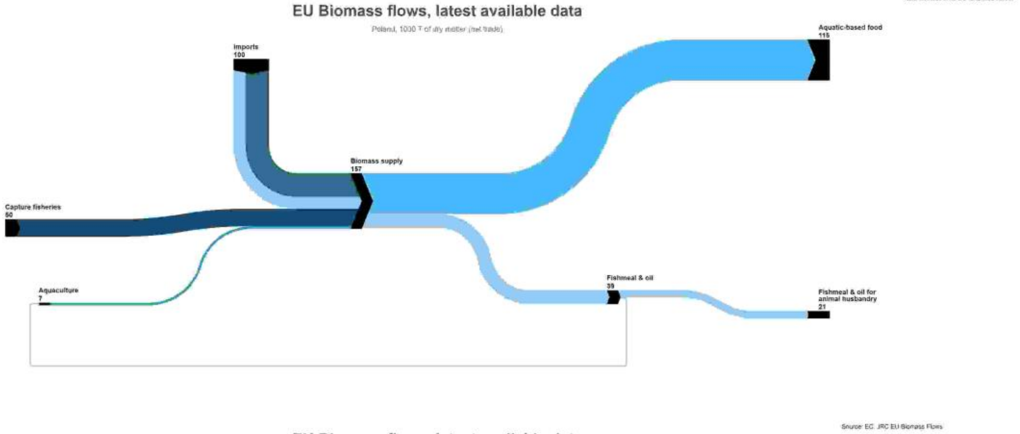

EU Biomass flows, latest available data
Austria, 1000 T of dry matter (net trade)
Imports 32
Aquatic-based food 28
Unknown origin 0
Biomass supply 33
Capture fisheries 0
Aquaculture 1
Fishmeal & oil 5
Fishmeal & oil for animal husbandry 4
Source: EC, JRC EU Biomass Flows

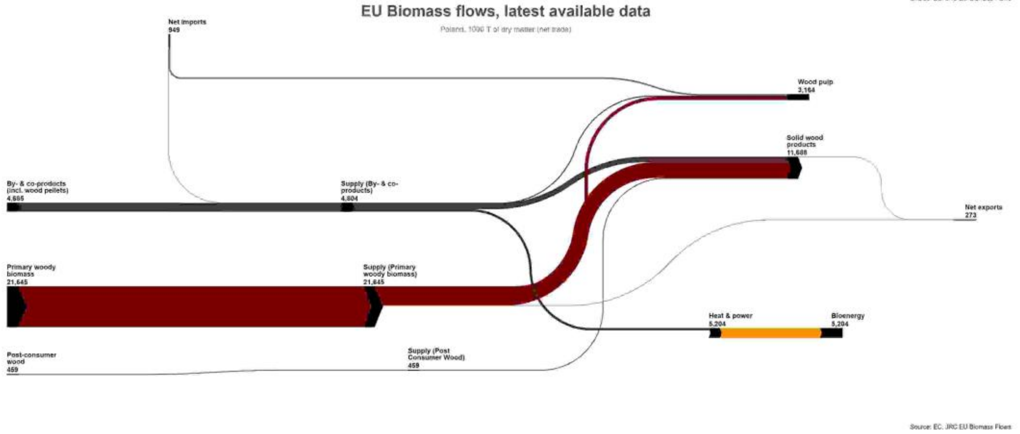

EU Biomass flows, latest available data
Austria, 1000 T of dry matter (net trade)
Net imports 4,946
Wood pulp 4,363
Solid wood products 9,534
By- & co-products (incl. wood pellets) 5,566
Supply (By- & co-products) 5,977
Net exports 2,825
Primary woody biomass 9,186
Supply (Primary woody biomass) 13,195
Heat & power 10,859
Bioenergy 10,859
Post-consumer wood 532
Supply (Post Consumer Wood) 532
Source: EC, JRC EU Biomass Flows

Poland

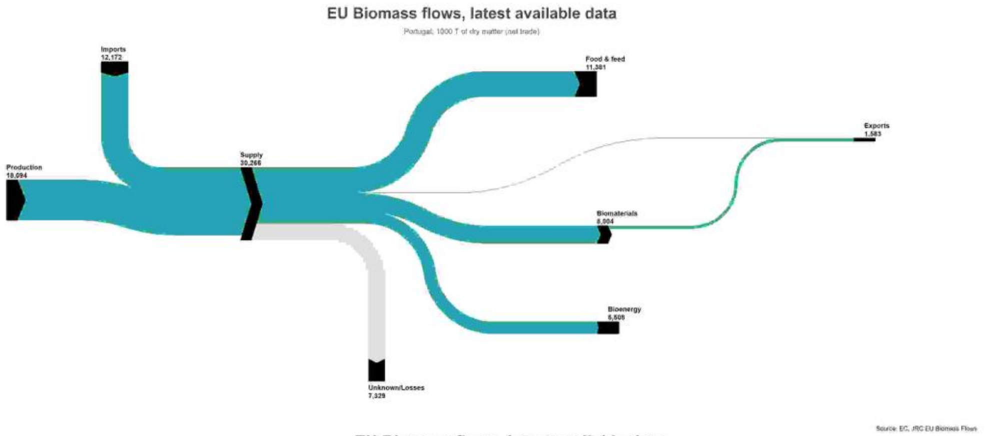

EU Biomass flows, latest available data
Poland, 1000 T of dry matter (net trade)
Imports 2,313
Production 92,438
Supply 94,751
Food & feed 47,517
Exports 3,809
Biomaterials 14,861
Bioenergy 6,204
Unknown/Losses 17,465
Source: EC, JRC EU Biomass Flows

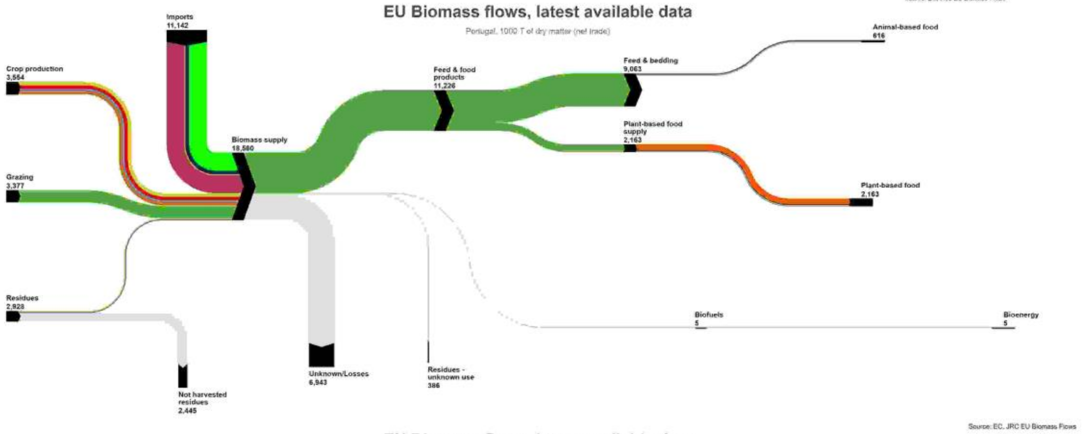

EU Biomass flows, latest available data
Poland, 1000 T of dry matter (net trade)
Imports 1,264
Crop production 47,540
Grazing 5,708
Residues 58,415
Biomass supply 66,855
Feed & food products 47,381
Feed & bedding 39,455
Animal-based food 2,578
Exports 3,536
Plant-based food supply 7,926
Plant-based food 7,926
Biomaterials 9
Not harvested residues 46,071
Unknown/Losses 7,590
Residues - unknown use 9,875
Source: EC, JRC EU Biomass Flows

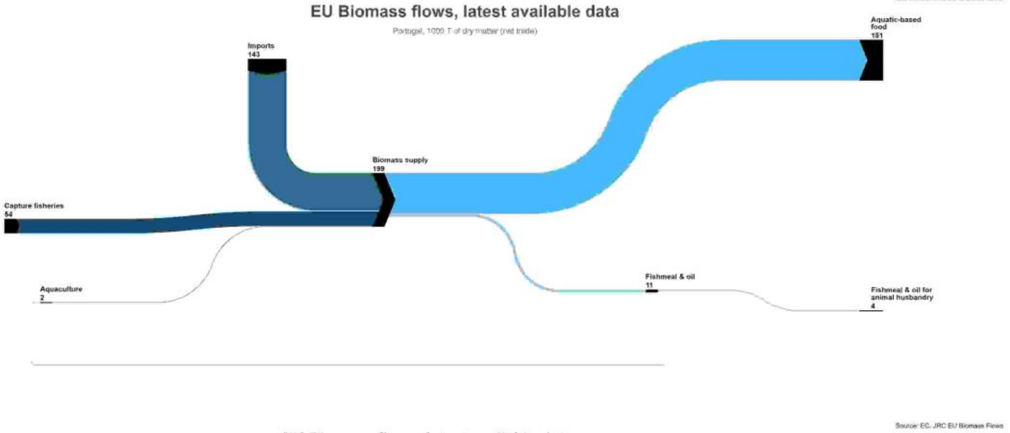

EU Biomass flows, latest available data
Poland, 1000 T of dry matter (net trade)
Imports 100
Aquatic-based food 115
Biomass supply 157
Capture fisheries 50
Aquaculture 7
Fishmeal & oil 39
Fishmeal & oil for animal husbandry 21
Source: EC, JRC EU Biomass Flows

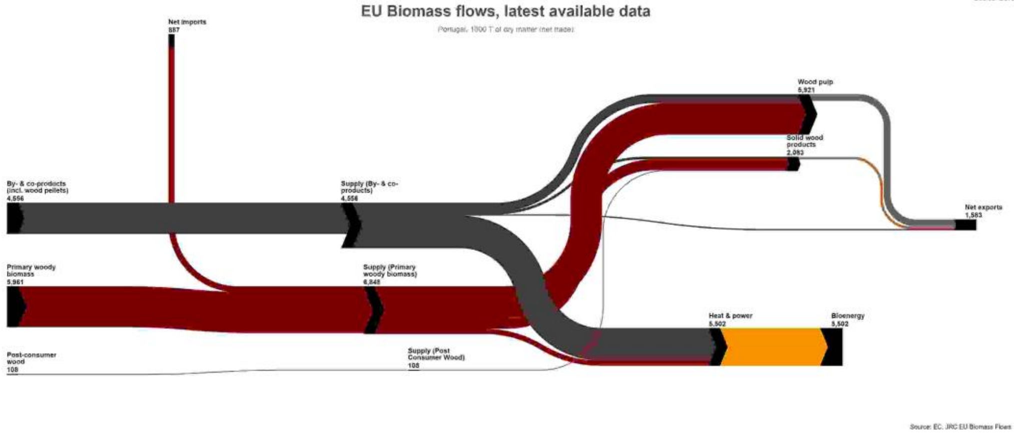

EU Biomass flows, latest available data
Poland, 1000 T of dry matter (net trade)
Net imports 949
Wood pulp 3,164
Solid wood products 11,688
By- & co-products (incl. wood pellets) 4,685
Supply (By- & co-products) 4,804
Net exports 273
Primary woody biomass 21,645
Supply (Primary woody biomass) 21,645
Heat & power 5,204
Bioenergy 5,204
Post-consumer wood 459
Supply (Post Consumer Wood) 459
Source: EC, JRC EU Biomass Flows

Portugal

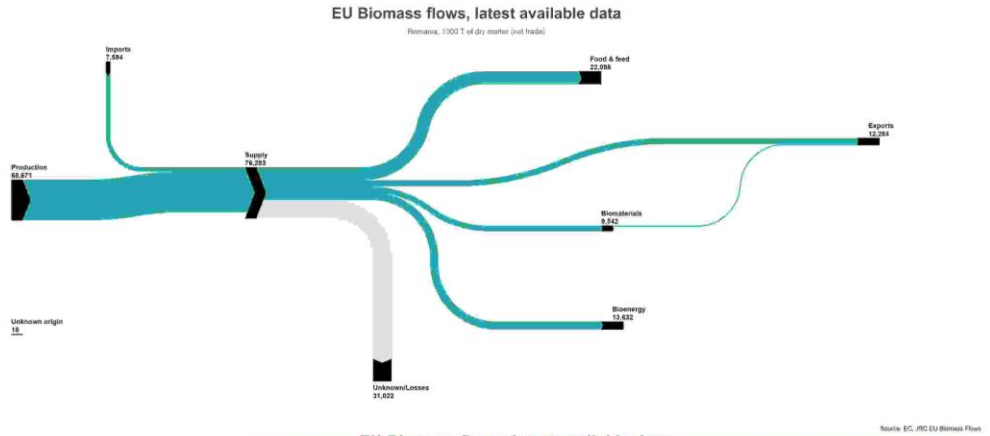

EU Biomass flows, latest available data
Portugal, 1000 T of dry matter (net trade)
Imports 12,172
Production 18,094
Supply 30,266
Food & feed 11,381
Exports 1,583
Biomaterials 8,004
Bioenergy 6,508
Unknown/Losses 7,329
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Portugal, 1000 T of dry matter (net trade)
Imports 11,142
Crop production 3,554
Grazing 3,377
Residues 2,928
Biomass supply 18,580
Feed & food products 11,226
Feed & bedding 9,063
Animal-based food 616
Plant-based food supply 2,163
Plant-based food 2,163
Biofuels 5
Bioenergy 5
Not harvested residues 2,445
Unknown/Losses 6,943
Residues - unknown use 386
Source: EC, JRC EU Biomass Flows

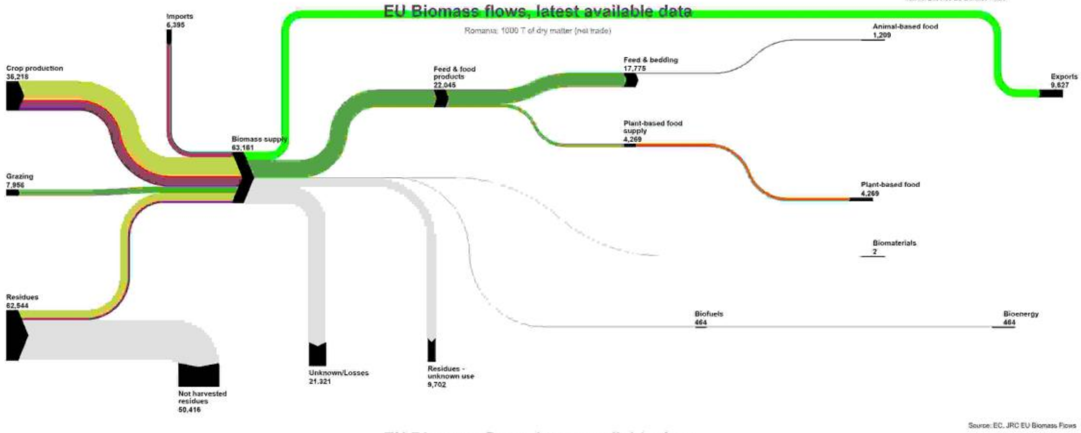

EU Biomass flows, latest available data
Portugal, 1000 T of dry matter (net trade)
Imports 143
Capture fisheries 54
Aquaculture 2
Biomass supply 199
Aquatic-based food 151
Fishmeal & oil 11
Fishmeal & oil for animal husbandry 4
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Portugal, 1000 T of dry matter (net trade)
Net imports 887
By- & co-products (incl. wood pellets) 4,556
Primary woody biomass 5,961
Post-consumer wood 108
Supply (By- & co-products) 4,556
Supply (Primary woody biomass) 6,848
Supply (Post Consumer Wood) 108
Wood pulp 5,921
Solid wood products 2,083
Net exports 1,583
Heat & power 5,502
Bioenergy 5,502
Source: EC, JRC EU Biomass Flows

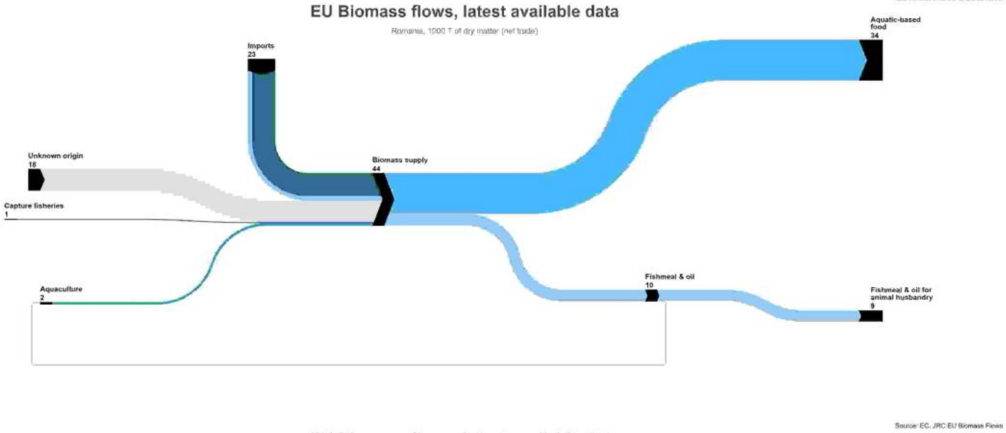
Romania



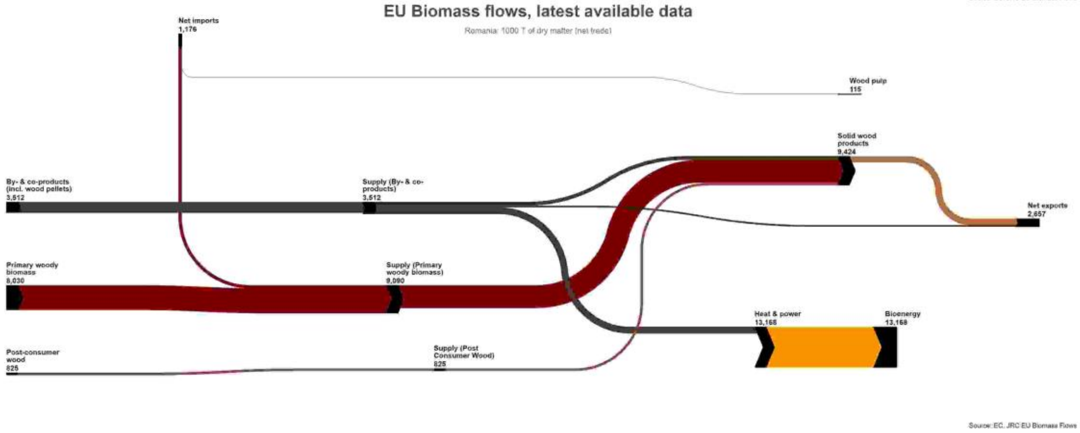
EU Biomass flows, latest available data
Romania, 1000 T of dry matter (net trade)
Imports
7,594
Production
68,671
Supply
76,283
Food & feed
22,088
Exports
12,284
Biomaterials
9,542
Bioenergy
13,632
Unknown origin
18
Unknown/Losses
31,022
Source: EC, JRC EU Biomass Flows



EU Biomass flows, latest available data
Romania: 1000 T of dry matter (net trade)
Imports
6,395
Crop production
36,218
Grazing
7,956
Residues
62,544
Biomass supply
63,161
Feed & food products
22,045
Feed & bedding
17,775
Animal-based food
1,209
Exports
9,627
Plant-based food supply
4,269
Plant-based food
4,269
Biomaterials
2
Biofuels
464
Bioenergy
464
Not harvested residues
50,416
Unknown/Losses
21,321
Residues - unknown use
9,702
Source: EC, JRC EU Biomass Flows

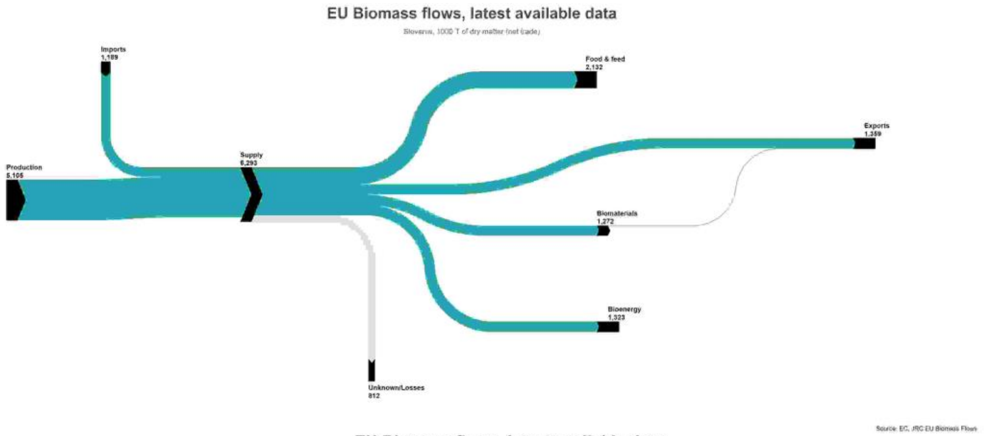


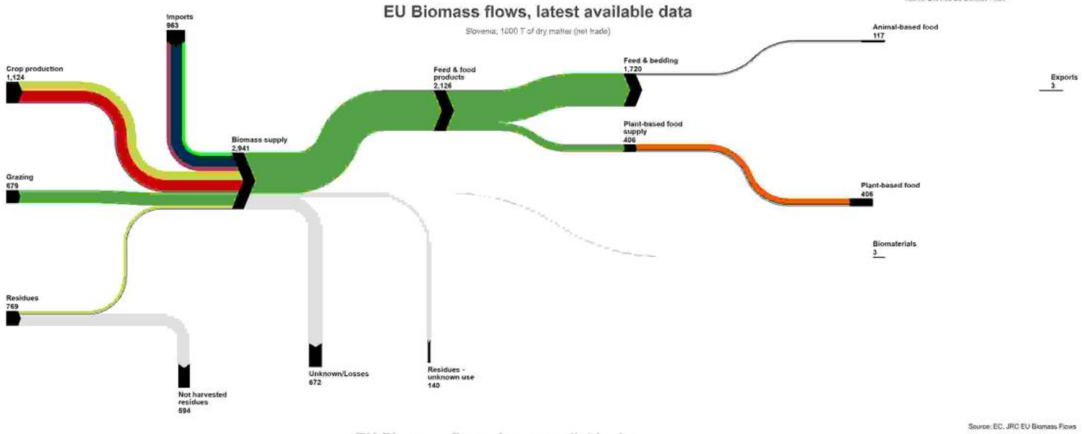
EU Biomass flows, latest available data
Romania, 1000 T of dry matter (net trade)
Imports
23
Aquatic-based food
34
Unknown origin
18
Capture fisheries
1
Biomass supply
44
Aquaculture
2
Fishmeal & oil
10
Fishmeal & oil for animal husbandry
9
Source: EC, JRC EU Biomass Flows

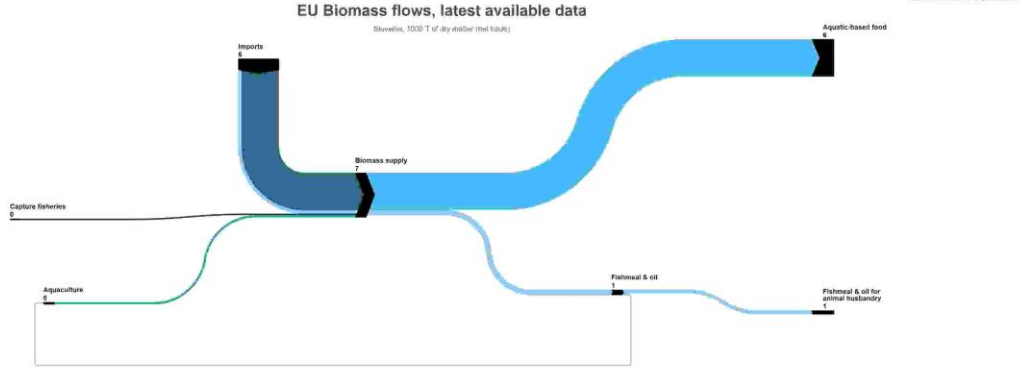


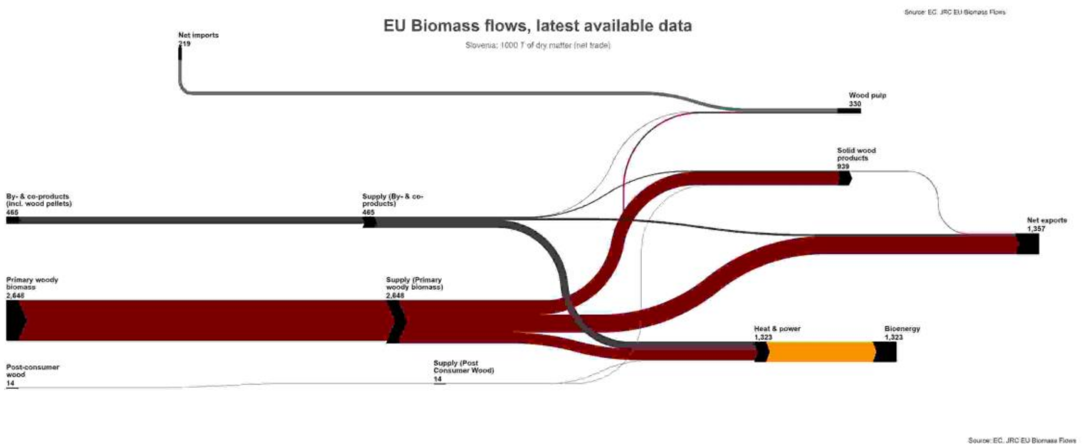
EU Biomass flows, latest available data
Romania: 1000 T of dry matter (net trade)
Net imports
1,176
Wood pulp
115
Solid wood products
9,424
By- & co-products (incl. wood pellets)
3,512
Supply (By- & co-products)
3,512
Net exports
2,657
Primary woody biomass
8,030
Supply (Primary woody biomass)
9,090
Heat & power
13,168
Bioenergy
13,168
Post-consumer wood
825
Supply (Post Consumer Wood)
825
Source: EC, JRC EU Biomass Flows

Slovenia

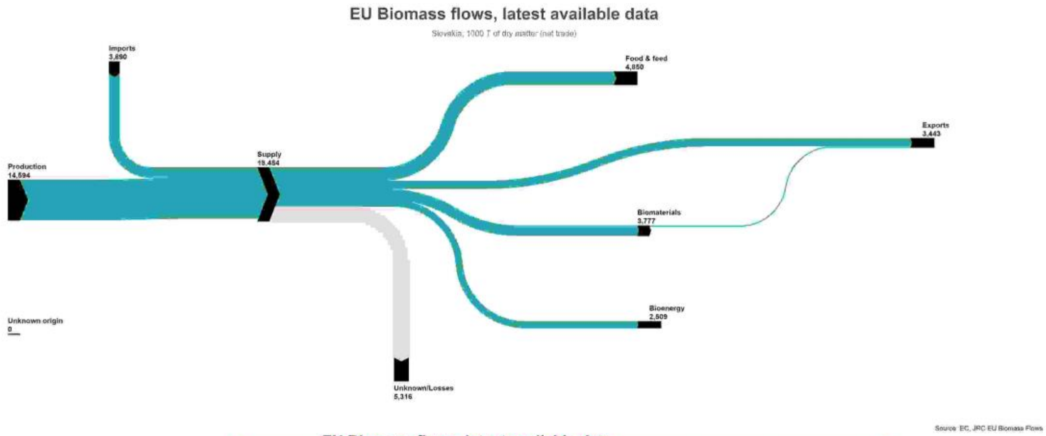

EU Biomass flows, latest available data
Slovenia, 1000 T of dry matter (net trade)
Imports 1,189
Food & feed 2,132
Exports 1,359
Production 5,105
Supply 6,293
Biomaterials 1,272
Bioenergy 1,323
Unknown/Losses 812
Source: EC, JRC EU Biomass Flows

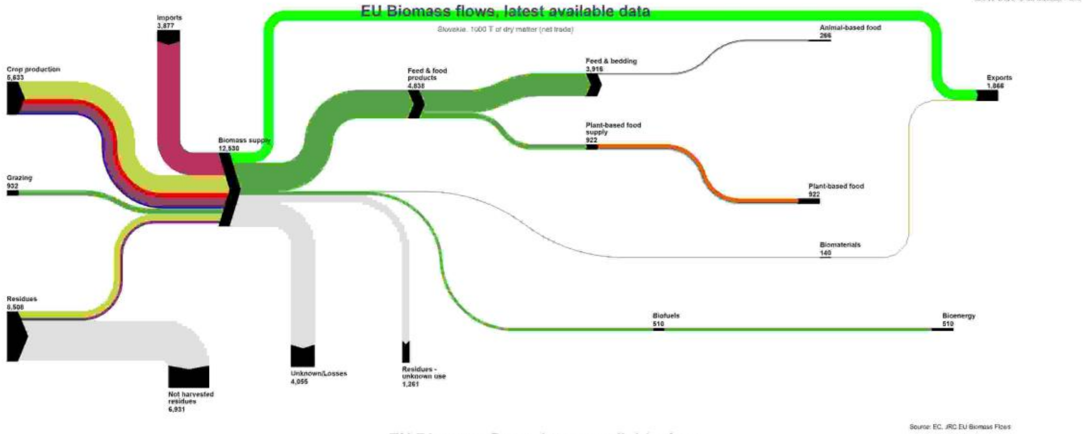

EU Biomass flows, latest available data
Slovenia; 1000 T of dry matter (net trade)
Imports 963
Crop production 1,124
Feed & food products 2,126
Feed & bedding 1,720
Animal-based food 117
Exports 3
Biomass supply 2,941
Plant-based food supply 406
Grazing 679
Plant-based food 406
Biomaterials 3
Residues 769
Unknown/Losses 672
Residues - unknown use 140
Not harvested residues 594
Source: EC, JRC EU Biomass Flows

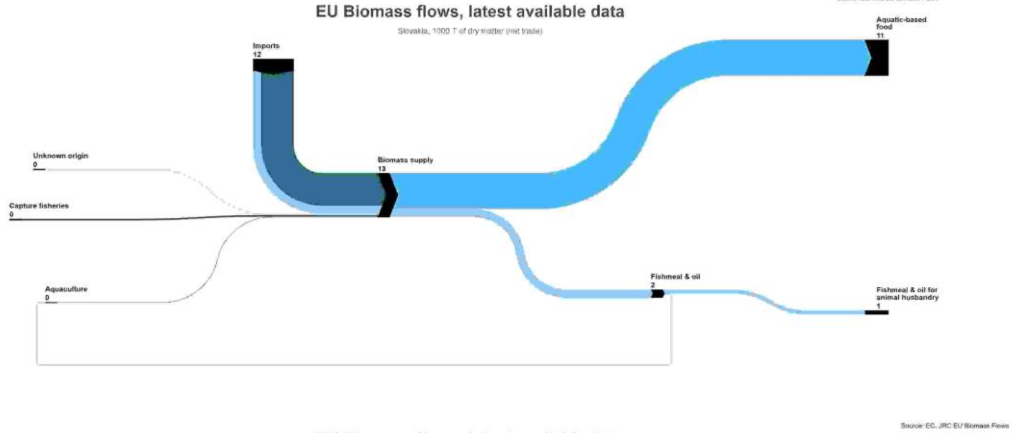

EU Biomass flows, latest available data
Slovenia, 1000 T of dry matter (net trade)
Imports 6
Aquatic-based food 6
Biomass supply 7
Capture fisheries 0
Aquaculture 0
Fishmeal & oil 1
Fishmeal & oil for animal husbandry 1
Source: EC, JRC EU Biomass Flows

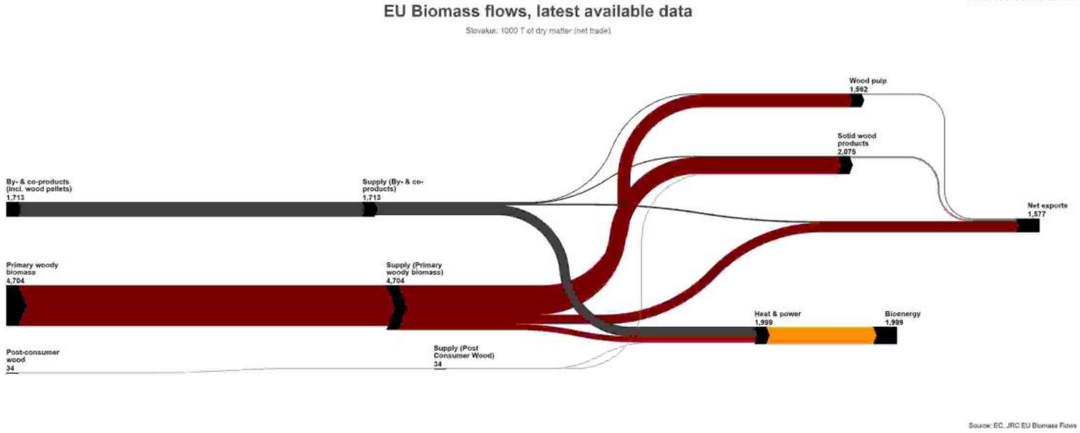

EU Biomass flows, latest available data
Slovenia; 1000 T of dry matter (net trade)
Net imports 219
Wood pulp 330
Solid wood products 939
By- & co-products (incl. wood pellets) 465
Supply (By- & co-products) 465
Net exports 1,357
Primary woody biomass 2,648
Supply (Primary woody biomass) 2,648
Heat & power 1,323
Bioenergy 1,323
Post-consumer wood 14
Supply (Post Consumer Wood) 14
Source: EC, JRC EU Biomass Flows

Slovakia

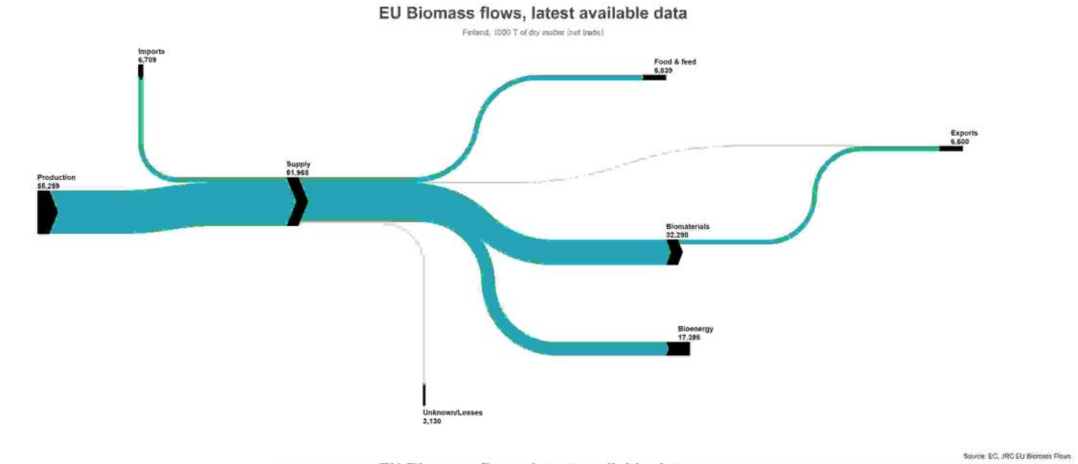

EU Biomass flows, latest available data
Slovakia, 1000 T of dry matter (net trade)
Imports 3,890
Production 14,594
Supply 19,484
Food & feed 4,850
Exports 3,443
Biomaterials 3,777
Bioenergy 2,509
Unknown origin 0
Unknown/Losses 5,316
Source: EC, JRC EU Biomass Flows

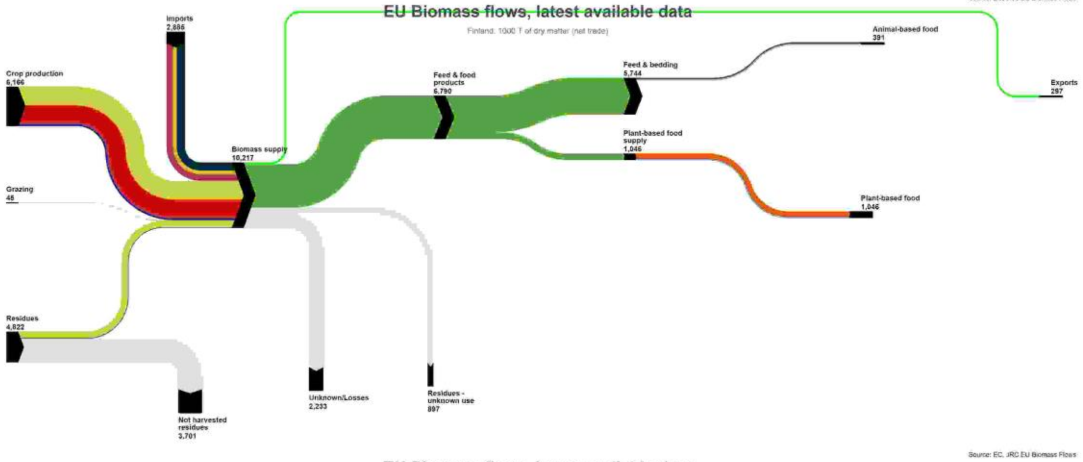

EU Biomass flows, latest available data
Slovakia, 1000 T of dry matter (net trade)
Imports 3,877
Crop production 5,633
Grazing 932
Residues 8,508
Biomass supply 12,530
Feed & food products 4,838
Feed & bedding 3,916
Animal-based food 266
Plant-based food supply 922
Plant-based food 922
Exports 1,866
Biomaterials 140
Biofuels 510
Bioenergy 510
Not harvested residues 6,931
Unknown/Losses 4,055
Residues - unknown use 1,261
Source: EC, JRC EU Biomass Flows

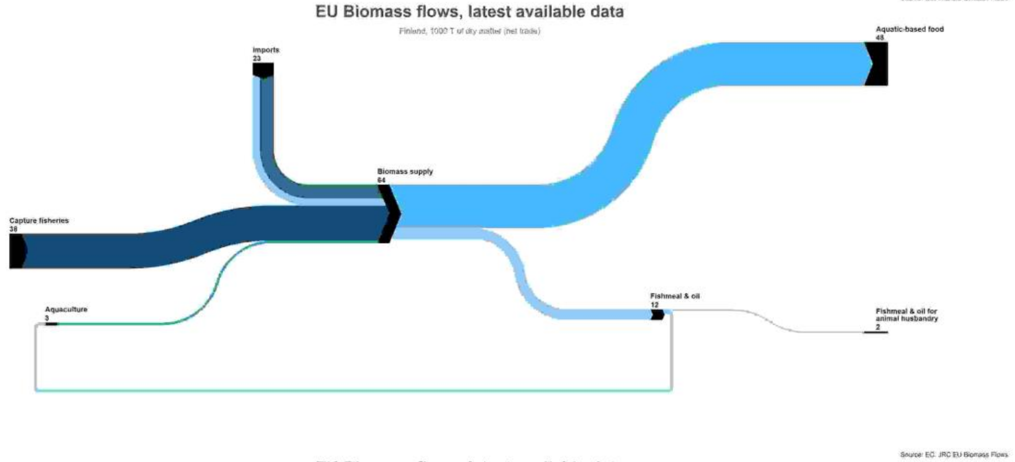

EU Biomass flows, latest available data
Slovakia, 1000 T of dry matter (net trade)
Imports 12
Unknown origin 0
Capture fisheries 0
Aquaculture 0
Biomass supply 13
Aquatic-based food 11
Fishmeal & oil 2
Fishmeal & oil for animal husbandry 1
Source: EC, JRC EU Biomass Flows

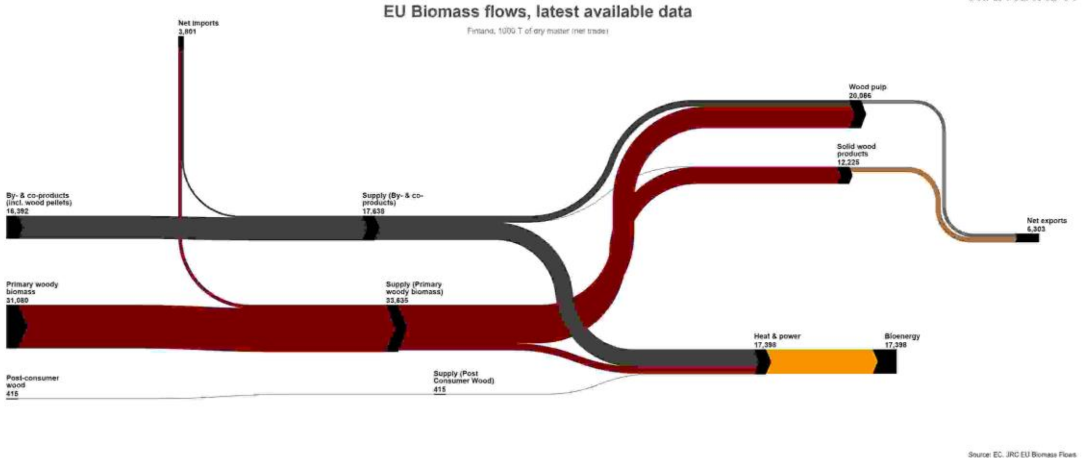

EU Biomass flows, latest available data
Slovakia, 1000 T of dry matter (net trade)
By- & co-products (incl. wood pellets) 1,713
Supply (By- & co-products) 1,713
Primary woody biomass 4,704
Supply (Primary woody biomass) 4,704
Post-consumer wood 34
Supply (Post Consumer Wood) 34
Wood pulp 1,562
Solid wood products 2,075
Net exports 1,577
Heat & power 1,999
Bioenergy 1,999
Source: EC, JRC EU Biomass Flows

Finland

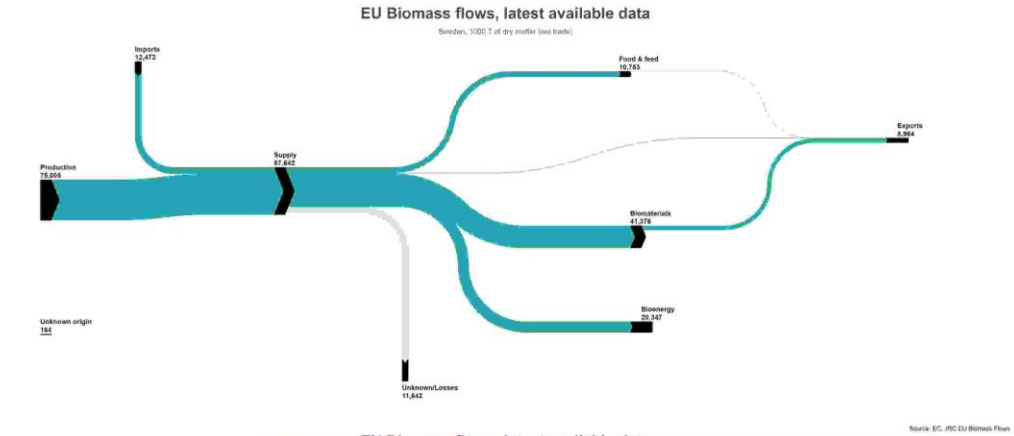

EU Biomass flows, latest available data
Finland, 1000 T of dry matter (net trade)
Imports
6,709
Food & feed
6,839
Exports
6,600
Production
55,259
Supply
61,968
Biomaterials
32,290
Bioenergy
17,398
Unknown/Losses
3,130
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Finland, 1000 T of dry matter (net trade)
Imports
2,886
Animal-based food
391
Crop production
6,166
Feed & food products
6,790
Feed & bedding
5,744
Exports
297
Plant-based food supply
1,046
Biomass supply
10,217
Grazing
48
Plant-based food
1,046
Residues
4,822
Unknown/Losses
2,233
Residues - unknown use
897
Not harvested residues
3,701
Source: EC, JRC EU Biomass Flows

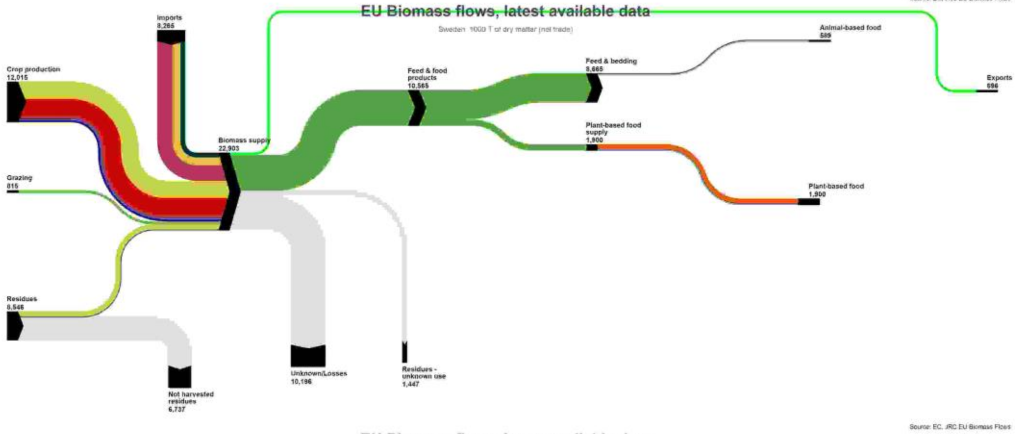

EU Biomass flows, latest available data
Finland, 1000 T of dry matter (net trade)
Imports
23
Aquatic-based food
48
Biomass supply
64
Capture fisheries
38
Aquaculture
3
Fishmeal & oil
12
Fishmeal & oil for animal husbandry
2
Source: EC, JRC EU Biomass Flows


EU Biomass flows, latest available data
Finland, 1000 T of dry matter (net trade)
Net imports
3,801
Wood pulp
20,086
Solid wood products
12,225
By- & co-products (incl. wood pellets)
16,392
Supply (By- & co-products)
17,638
Net exports
6,303
Primary woody biomass
31,080
Supply (Primary woody biomass)
33,635
Heat & power
17,398
Bioenergy
17,398
Post-consumer wood
415
Supply (Post Consumer Wood)
415
Source: EC, JRC EU Biomass Flows

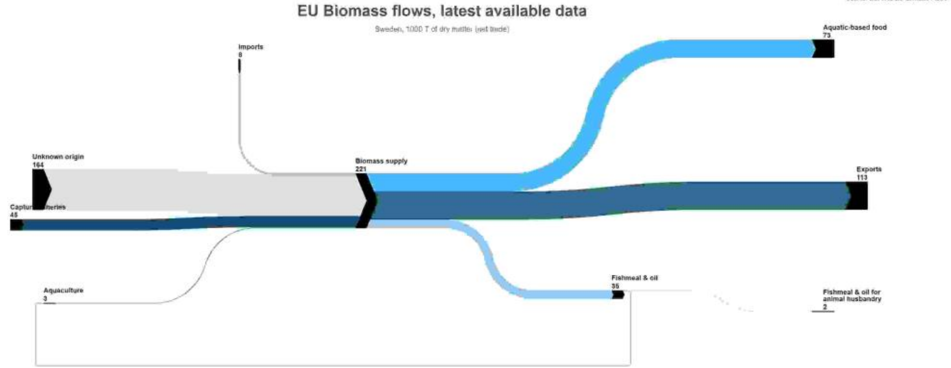
Sweden



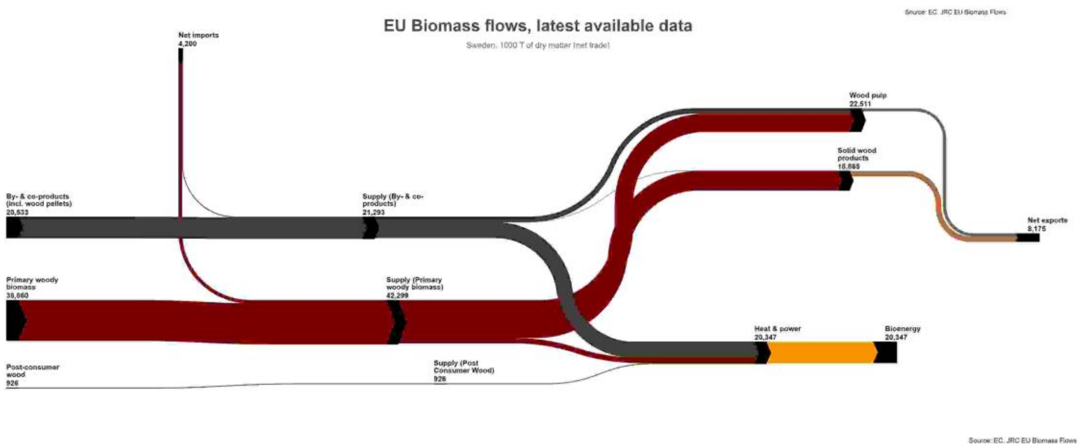
EU Biomass flows, latest available data
Sweden, 1000 T of dry matter (net trade)
Imports
12,472
Food & feed
10,753
Exports
8,984
Production
75,005
Supply
87,642
Biomaterials
41,376
Bioenergy
20,347
Unknown origin
164
Unknown/Losses
11,642
Source: EC, JRC EU Biomass Flows



EU Biomass flows, latest available data
Sweden, 1000 T of dry matter (net trade)
Imports
8,265
Animal-based food
589
Crop production
12,015
Feed & food products
10,565
Feed & bedding
8,665
Exports
696
Biomass supply
22,903
Plant-based food supply
1,900
Grazing
815
Plant-based food
1,900
Residues
8,546
Not harvested residues
6,737
Unknown/Losses
10,196
Residues - unknown use
1,447
Source: EC, JRC EU Biomass Flows

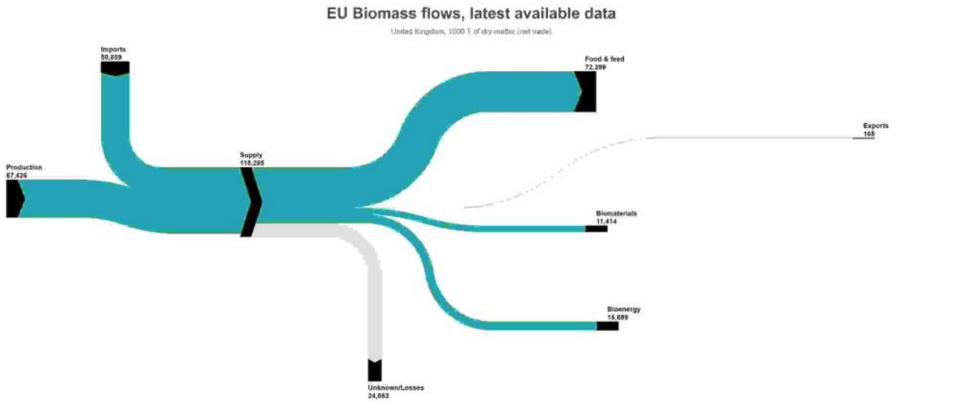


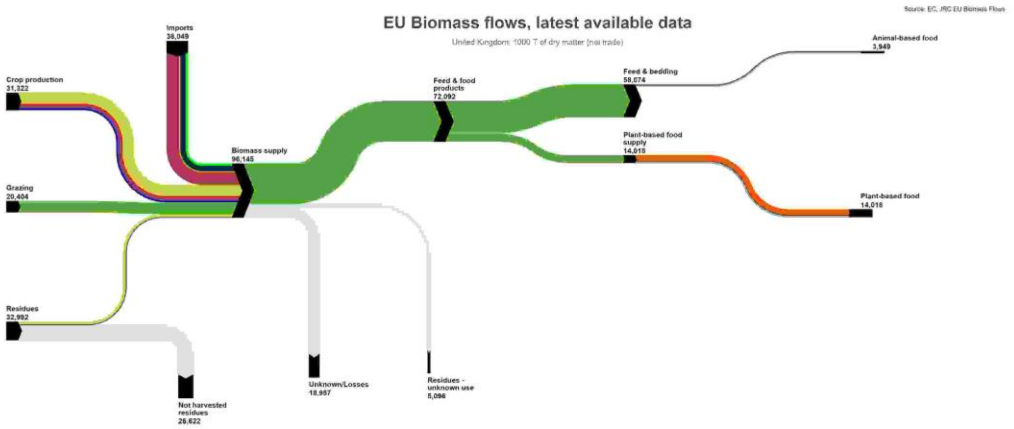
EU Biomass flows, latest available data
Sweden, 1000 T of dry matter (net trade)
Aquatic-based food
73
Imports
8
Unknown origin
164
Biomass supply
221
Exports
113
45
Aquaculture
3
Fishmeal & oil
35
Fishmeal & oil for animal husbandry
2
Source: EC, JRC EU Biomass Flows

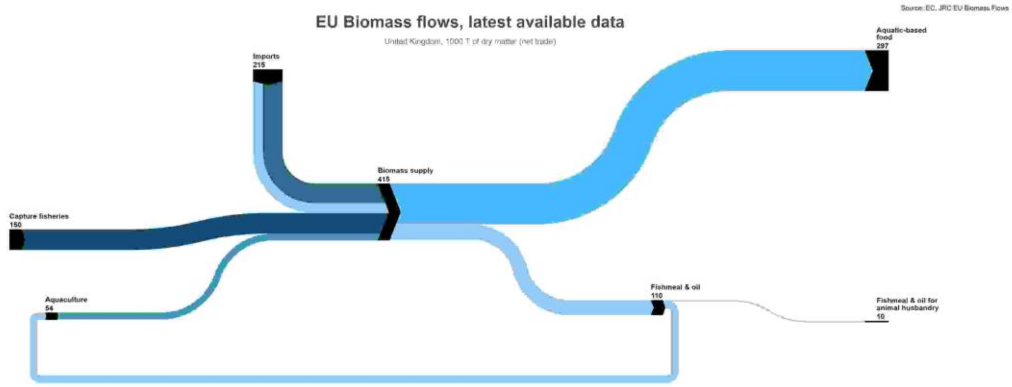


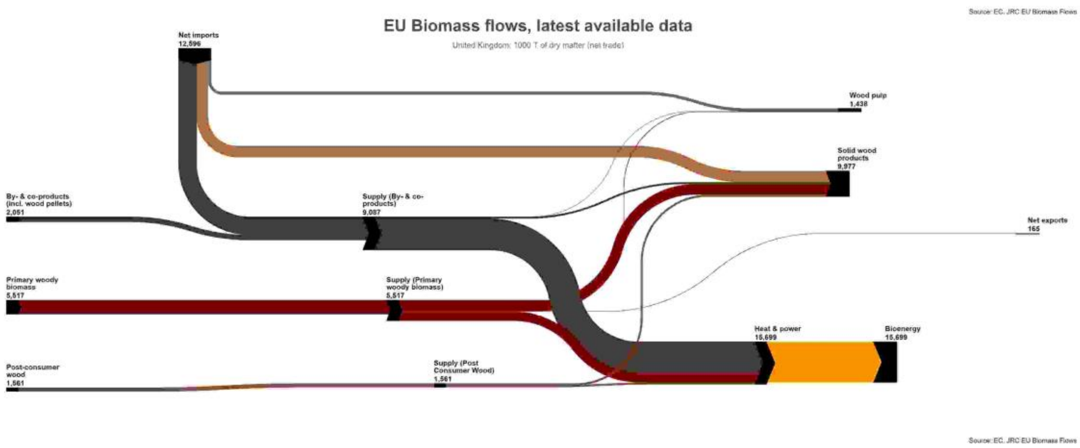
EU Biomass flows, latest available data
Sweden, 1000 T of dry matter (net trade)
Net imports
4,200
Wood pulp
22,511
Solid wood products
18,865
By- & co-products (incl. wood pellets)
20,533
Supply (By- & co-products)
21,293
Net exports
8,175
Primary woody biomass
38,860
Supply (Primary woody biomass)
42,299
Heat & power
20,347
Bioenergy
20,347
Post-consumer wood
926
Supply (Post Consumer Wood)
926
Source: EC, JRC EU Biomass Flows

United Kingdom









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