

Biomass production, uses, flows and related impacts

EU PLATFORM ON FOOD LOSSES AND FOOD WASTE (FLW):SUB-GROUP ON ACTION AND IMPLEMENTATION

25 September 2023, Brussels (hybrid)

Robert M'barek

Unit Economics of the Food System
Directorate for Sustainable Resources
EC-Joint Research Centre



ISSN 1831-9424

JRC SCIENCE FOR POLICY REPORT

Biomass production, supply, uses and flows in the European Union

Integrated assessment

Avitabile V, Baldoni E, Baruth B, Bausano G, Boysen-Urban K, Caldeira C, Carnia A, Cazzaniga N, Ceccherini G, De Laurentiis V, Doerner H, Giuntoli J, Gras M, Guillen García J, Gurria P, Hassegawa M, Jasinevičius G, Jonsson R, Konrad C, Kupschus S, La Notte A, M'barek R, Mannini A, Migliavacca M, Mubareka S, Patani S, Pilli R, Rebours C, Ronchetti G, Ronzon T, Rougjeux P, Sala S, Sánchez López J, Sanye Mengué E, Sinkko T, Sturm V, Van Leeuwen M, Vasilakopoulos P, Verkerk PJ, Virtanen J, Winker H, Zilian G

Editors:

Mubareka S, Migliavacca M, Sánchez López J

2023

Joint
Research
Centre

EUR 31415 EN

Chapter 1	European Biomass supply and use from a cross-sectorial perspective
Chapter 2	Agricultural biomass production
Chapter 3	Agricultural biomass uses
Chapter 4	European and Global Macroalgae production and uses
Chapter 5	Fisheries and aquaculture biomass production, supply, uses and flows
Chapter 6	Forest Biomass Production
Chapter 7	Woody biomass sources, uses, flows and cascade use of wood
Chapter 8	Drivers of wood price volatility following the COVID pandemic
Chapter 9	Waste biomass availability: food waste and other biowaste streams
Chapter 10	Biomass uses in biorefineries

Chapter 11	Innovative wood products
Chapter 12	Environmental impacts of bioeconomy
Chapter 13	Trade volume and value of main traded bio-commodities
Chapter 14	Land use and land cover in the EU: Considerations for biomass production
Chapter 15	Biomass for bio-based chemical value chains in a dynamic global economy (focus arable crops)

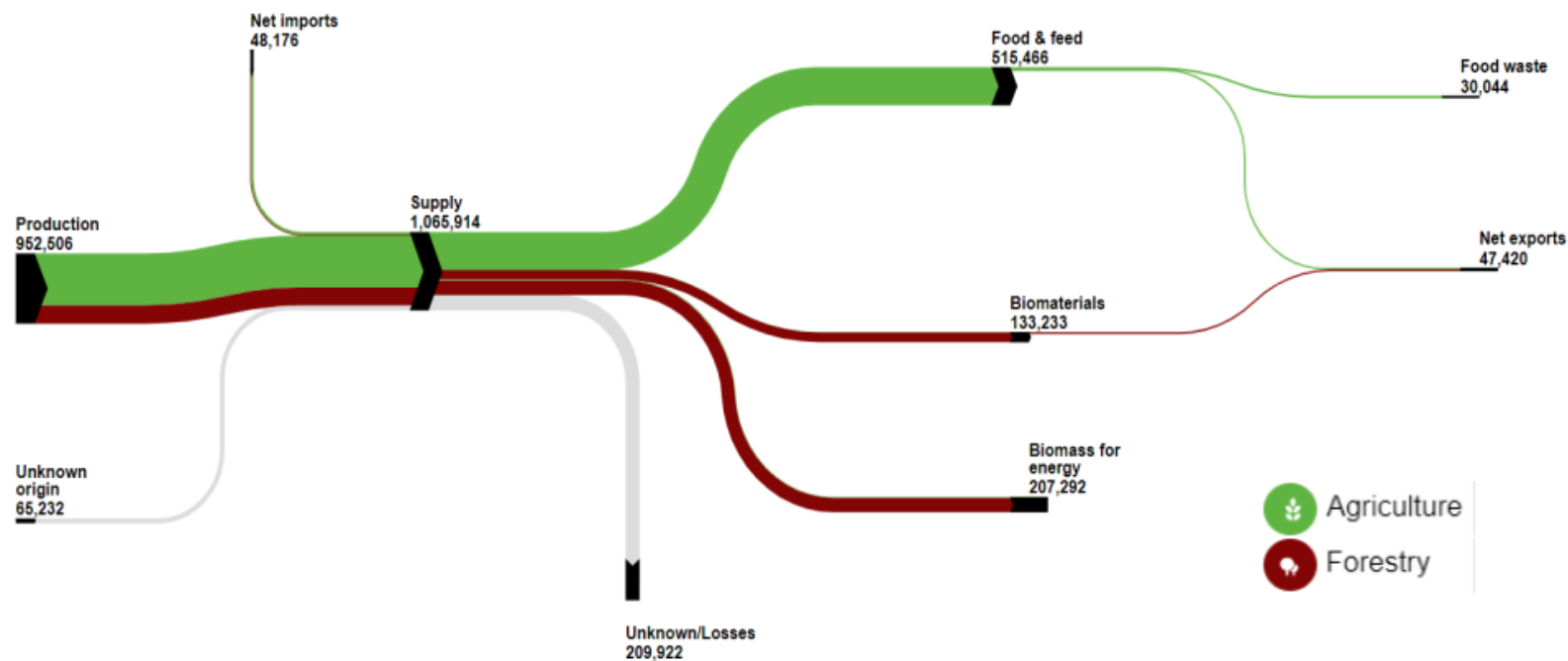
1 European Biomass supply and use from a cross-sectorial perspective

Patricia Gurría & Robert M'barek

Key messages

- The total supply of biomass in the EU-27 adds up to approximately 1 billion tonnes of dry matter of which 90% is produced in the EU²⁴.
- In 2016, the share of biomass used from agricultural sources is overall higher (61.9%) than the share of woody biomass used (37.8%) in the EU, however, shares vary greatly between Member States.
- Harmonisation of biomass flows to common units provides a cross-sectorial perspective, allowing trends in shares of biomass uses to emerge.

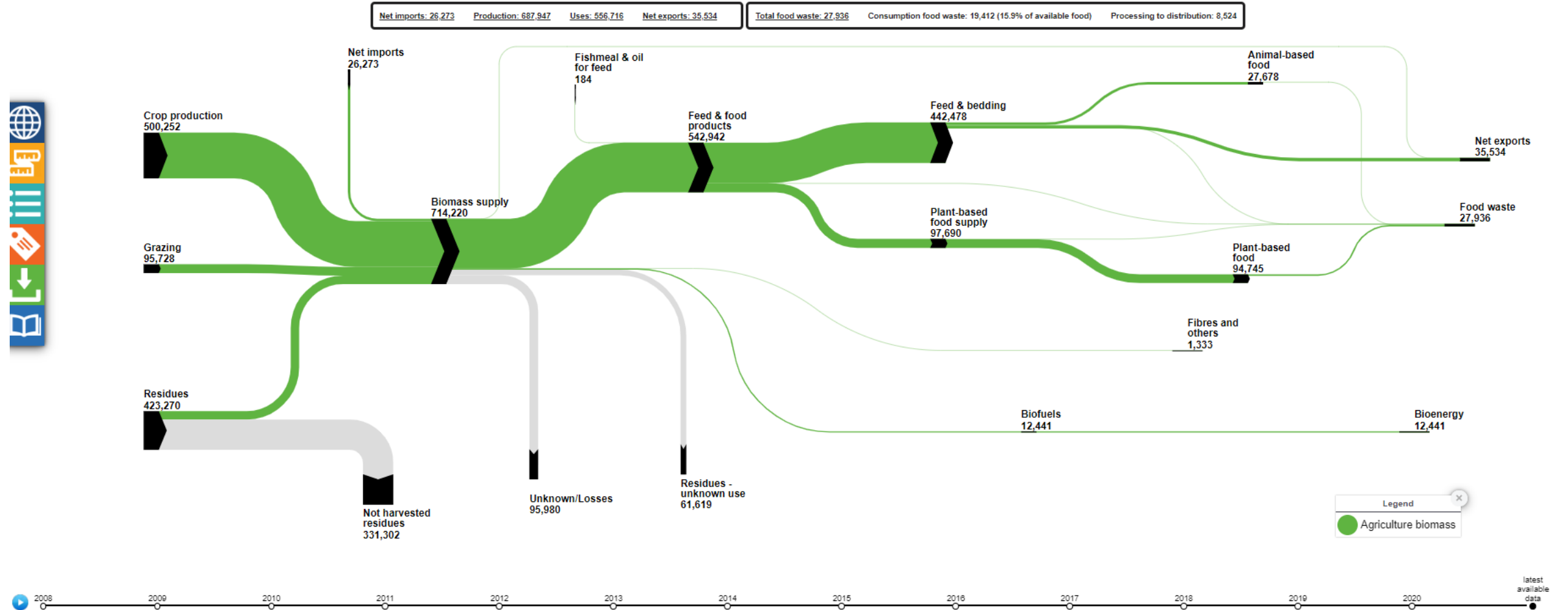
Figure 1. Biomass flows by sector, EU-27, net trade, 2017 (1000 tdm).



online visualisation https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/

Biomass flows

Biomass flows in 1000 T of dry matter (net trade) for European Union (27 countries), latest available data



Source: data from the BIOMASS project, European Commission – Joint Research Centre.
 Please note: Supply and use figures might not match due to estimation errors, stock changes, waste and/or loss of biomass or differences in the data sources used.
 Gaps derive from missing or incorrectly reported data, data not assigned to a specific category or data that cannot be estimated.
 The data point "Latest available data" corresponds to the latest data available from each sector: 2020 for agriculture, 2016 for fisheries and aquaculture and 2017 for forestry.

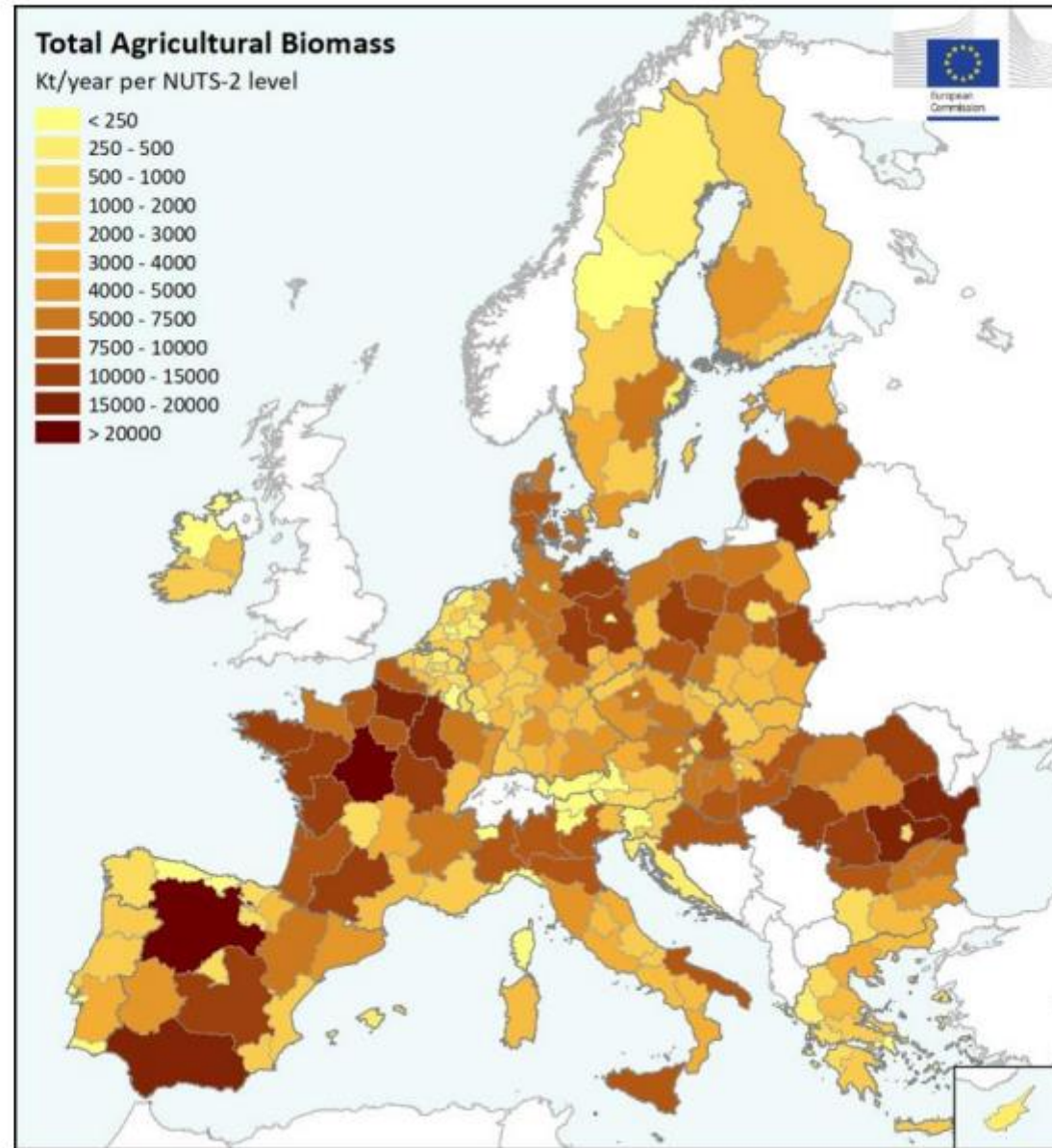
2 Agricultural biomass production

Giulia Ronchetti & Bettina Baruth

Key messages

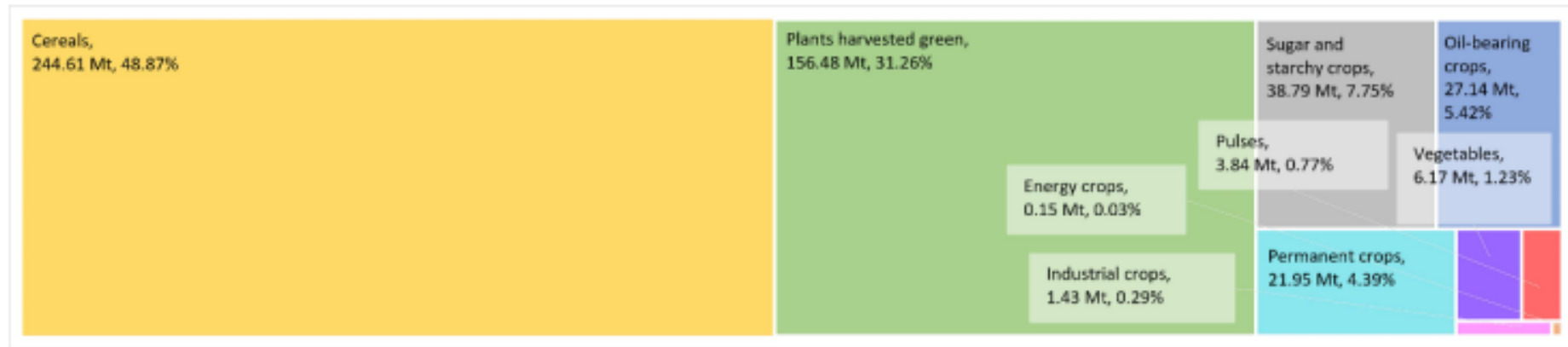
- Agriculture is the primary source of biomass in EU and the total biomass is shared almost equally between economic and residue production.
- Approximately 70% of the agricultural biomass is produced in six Member States, namely France, Germany, Italy, Poland, Spain and Romania.
- Wheat and maize are the major contributors to agricultural biomass. For both crops, residual biomass is higher than the economic part.
- During the last 20 years, the biomass available from agriculture has increased thanks to, depending on the crop and country, changes in the cultivated areas or improvements in agro-management practices which impacted crop yields.
- In the next years, an increase in biomass availability may be expected, but it is influenced by the impacts of climate change on agriculture.

Figure 14. Distribution of agricultural biomass production (in Kt dry matter per year) across the EU (NUTS-2 regions) for the reference period 2016-2020.



Source: JRC 2022 (own calculations).

Figure 11. Economic production (above) and residue production (below) in the EU-27 (expressed in Mt dry matter per year) and the shares for each crop group. Average values over the reference period 2016-2020.



Economic production

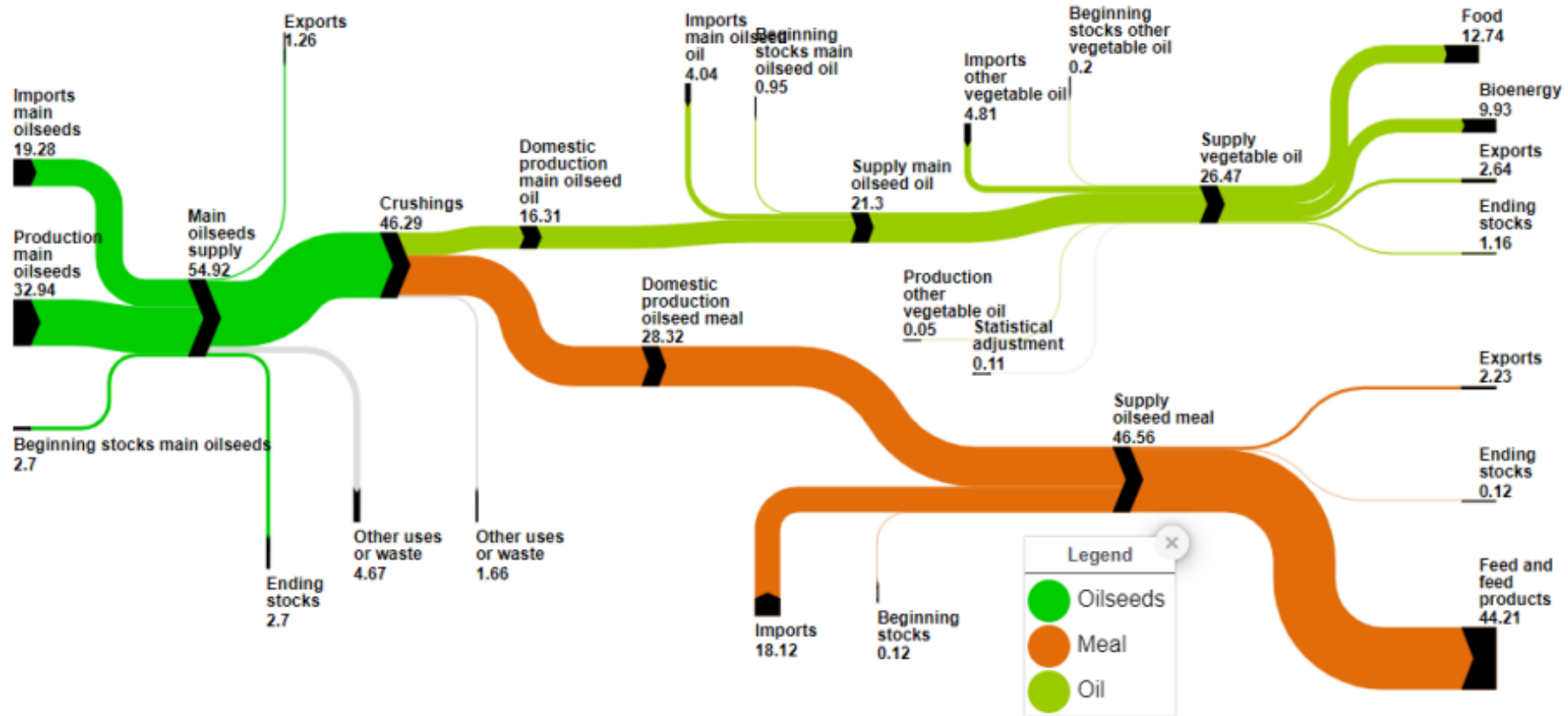


Residue production

Source: JRC 2022 (own calculations).

3 Agricultural biomass uses

Figure 25. Oilseed and product flows in the EU-27 in 2019 (values in million tonnes).



Source: Medium-term Outlook commodity flows (DataM, 2022).

9 Waste biomass availability: food waste and other biowaste streams

Carla Caldeira, Valeria De Laurentiis, Serenella Sala

Key messages

- Around 17 million tonnes wet weight (Mtw) of biomass waste was, on average between 2014-2017, incinerated or landfilled on an annual basis, showing potential for improvements towards a circular economy.
- JRC estimates EU Food waste in 2018 amounts to 84 Mtw, representing roughly 13% of the food produced in the EU is wasted across the whole food supply chain.
- Consumption is the stage of the food supply chain with the highest share of food waste ranging between 56% and 80% in EU countries.
- EU MSs are obliged to report food waste generated and binding reduction targets will be defined towards achieving SDG target 12.3 on food waste.
- The JRC food waste quantification model can be coupled with life cycle-based indicators of environmental impacts in order to assess environmental benefits of food waste reduction by compliance with targets to be defined.
- Food waste reduction strategies focused on food waste prevention and valorisation are key to the achievement of a circular economy.

Updated FW estimates with JRC model, focusing only on **solid** food waste (fresh mass), provided a total value of 75 Mt for the EU for 2020. Data available at:

<https://publications.jrc.ec.europa.eu/repository/handle/JRC133379>

13 Trade volume, deforestation, and forest biomass embodied in traded bio-commodities and products

Mirco Migliavacca, Paul Rougieux, Selene Patani, Guido Ceccherini, Giovanni Bausano, Sarah Mubareka

Key Points:

- The European Union (EU-27) has been identified as an important contributor to tropical deforestation through the consumption and trade of products and commodities.
- The EU-27 plays a major role in the import of coffee and cocoa beans, palm oil, and cake of soybeans.
- On December 2022, the European Parliament, the Council, and the European Commission reached the provisional political agreement on the text of the EU Regulation on deforestation-free supply chains.
- According to our modelling based on land use change and trade flows, the imports of EU-27 between 2014 and 2019 contributed to 74.2% of the deforested area between 2010 and 2015 related to the production of cocoa, 23.7% for coffee, 15.9% for palm oil, 13.6% for soybeans, and less than 1% for cattle. For the deforestation embodied in the EU-27 consumption we also present relevant literature and the results of the impact assessments (SWD(2021) 326).
- The total forest biomass loss in 2010-2015 associated to products traded in 2014-2019 was 48.04 millions tonnes of dry matter

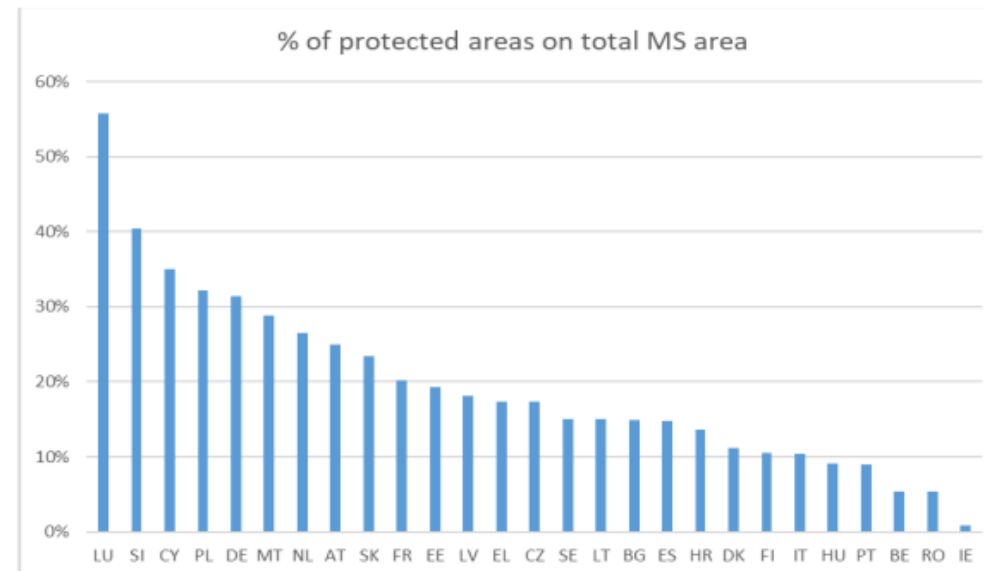
14 Land use and land cover in the EU: considerations for biomass production

Sarah Mubareka, Javier Sánchez López, Grazia Zulian, Noemi E. Cazzaniga, Alessandra La Notte

Key messages

- Land is multi-functional and can offer many services including, but not only, the provision of biomass.
- Biomass is provided by different land systems: in 2017, 704.21 Mtdm were provided from agriculture and 248.06 Mtdm from forests as roundwood removals.
- Alterations to land should consider the pressures that will be put on the land systems, as well as the trade-offs in ecosystem services.
- The multi-functionality of land can be explored by overlaying different layers.
- Marginal lands are not a well-defined concept and should not necessarily be considered as available for production.

Figure 135. Proportion of land protected of the land surface of the land on continental European soil per EU-27 Member State.



Source: JRC 2022 (own calculation).

15 Biomass for selected bio-based industrial value chains in a dynamic global economy

Myrna van Leeuwen, Robert M'barek, Kirsten Boysen-Urban, Patricia Gurría, Tevecia Ronzon, Viktoriya Sturm

Key messages

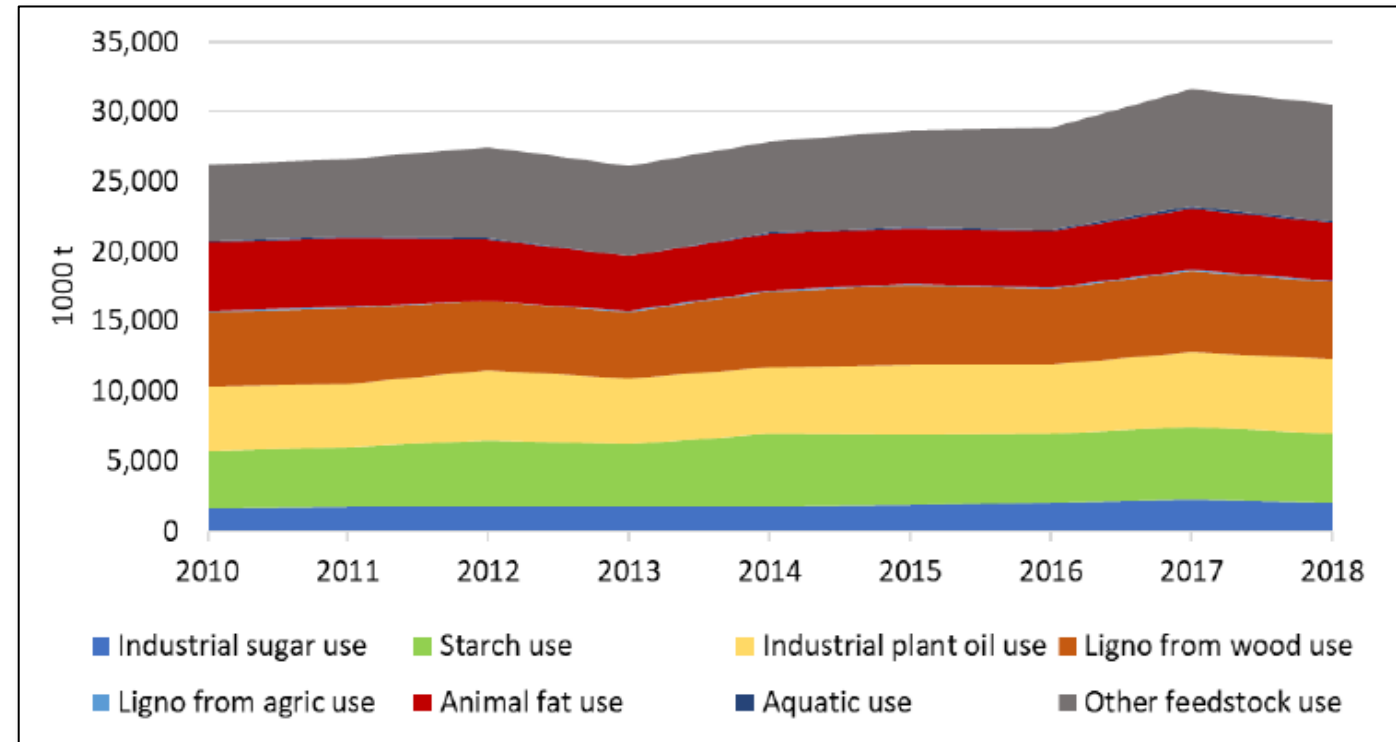
- Europe, Asia and North America have very similar shares in the global bio-based chemical markets of around 30%.
- It is estimated that 13.2% of corn, 7.4% of wheat, and 8.2% of sugar beets in the EU is used for material purposes.
- The main (processed) feedstocks (incl. imports) used for bio-based products are plant oil (30%) and starch (25%).
- In terms of volume, biofuels (42%) is the most important application category within bio-based chemicals, followed by bio-based agrochemicals (21%) and bio-based surfactants (12%).
- Under unchanged policies, the share of arable crops for material use is projected to rise slightly from 8.2% in 2020 to 9.7% in 2050, so the intended growth of bio-based materials may be met with a stronger increase of imported feedstock unless targeted policies and technologies (e.g. upscaling valorisation of unused biomass from waste streams and residues) to increase domestic production are deployed.

Feedstock for bio-based chemicals

Insights:

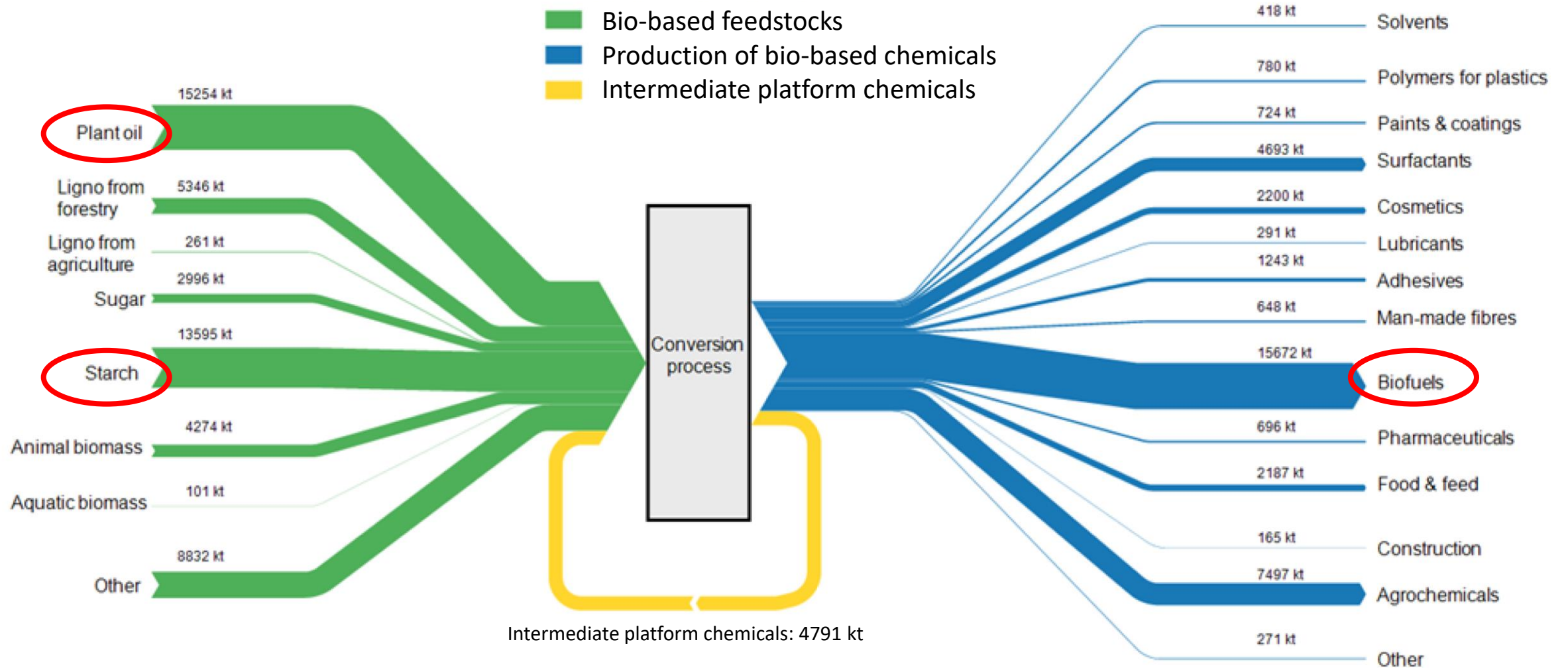
- Share of bio-based products in total organic chemical products (C20): 14%
- Total biological feedstock use by chemical industry in the EU
 - 25 Mio t for biofuels
 - 30 Mio t for non-biofuels
- Dashboard & dataset fully available here: https://datam.jrc.ec.europa.eu/datam/mashup/MARKETS_BB_CHEMICALS/

Development of use of different bio-based feedstocks by the chemical industry (excl. biofuels) in the EU



Source: Sturm et al., 2023, <https://doi.org/10.3390/su15043064>

Use of biological resources for production of bio-based chemicals in the EU in 2018

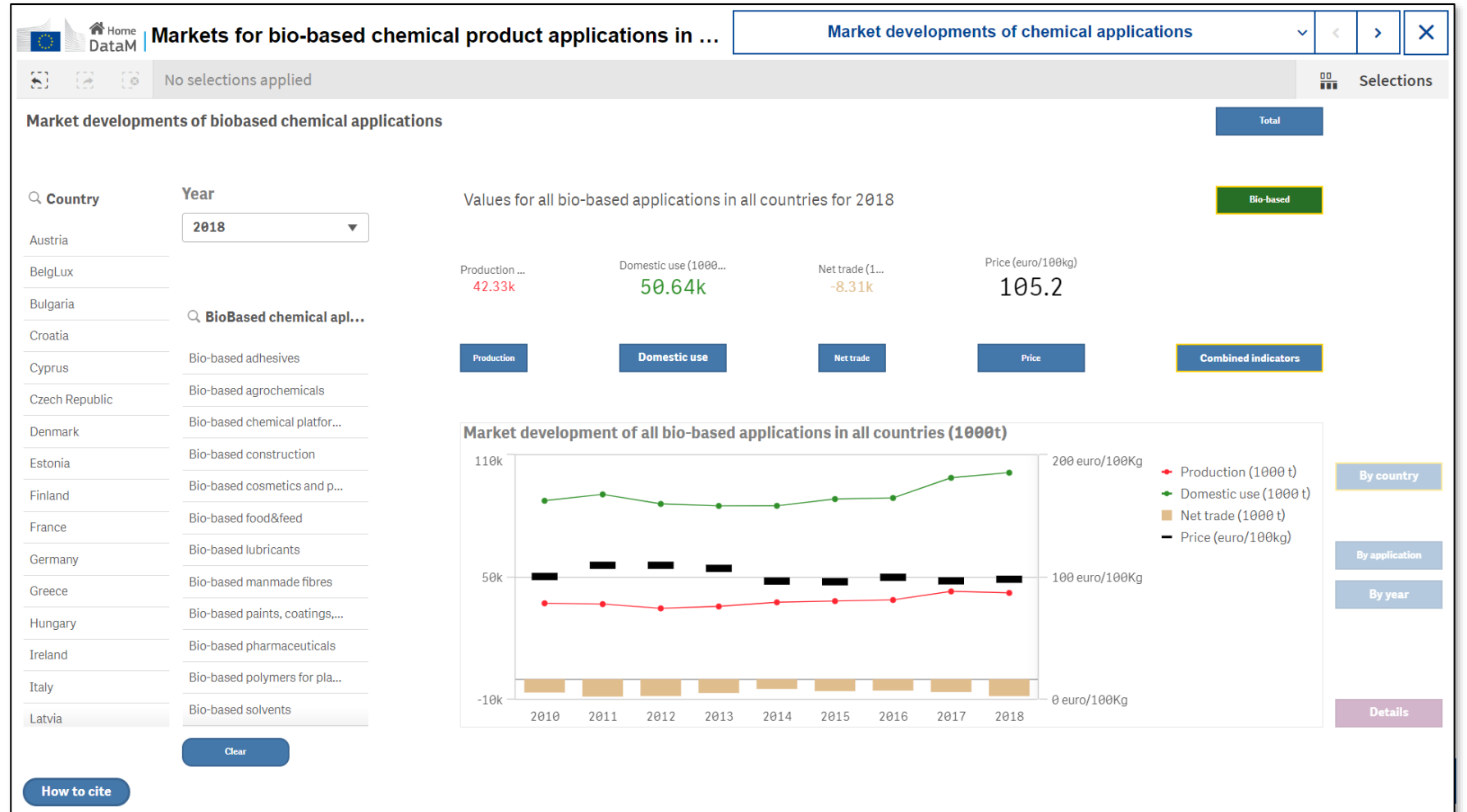


Markets for bio-based chemical product applications in EU member states - Dashboard



Public version
https://datam.jrc.ec.europa.eu/datam/mashup/MARKETS_BB_CHEMICALS/

Soon also on KCB website



Supplies and uses of biomass for all bio-based chemical applications – *Dependency from imports*

Home DataM **Markets for bio-based chemical product applications in EU member states** Biomass uses and bio-based chemical products

No selections applied

Supplies and uses of biomass for all bio-based chemical applications

- Country
- Austria
 - BelgLux
 - Bulgaria
 - Croatia
 - Cyprus
 - Czech Republic
 - Denmark
 - Estonia
 - Finland
 - France
 - Germany
 - Greece
 - Hungary
 - Ireland
 - Italy
 - Latvia

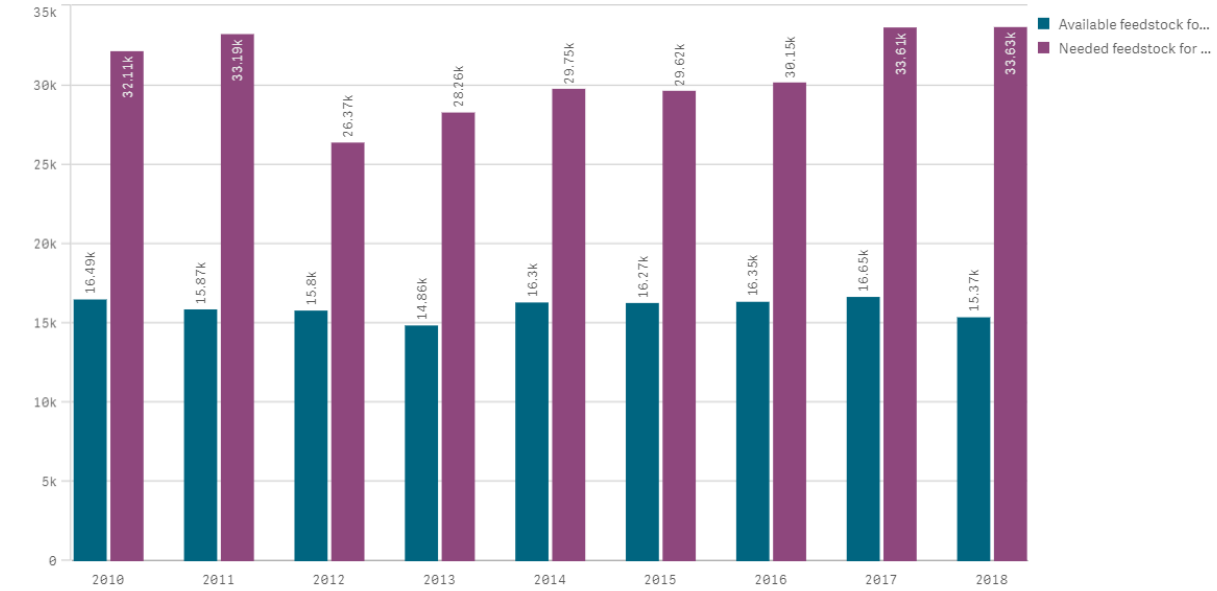
Starch

Industrial sugar

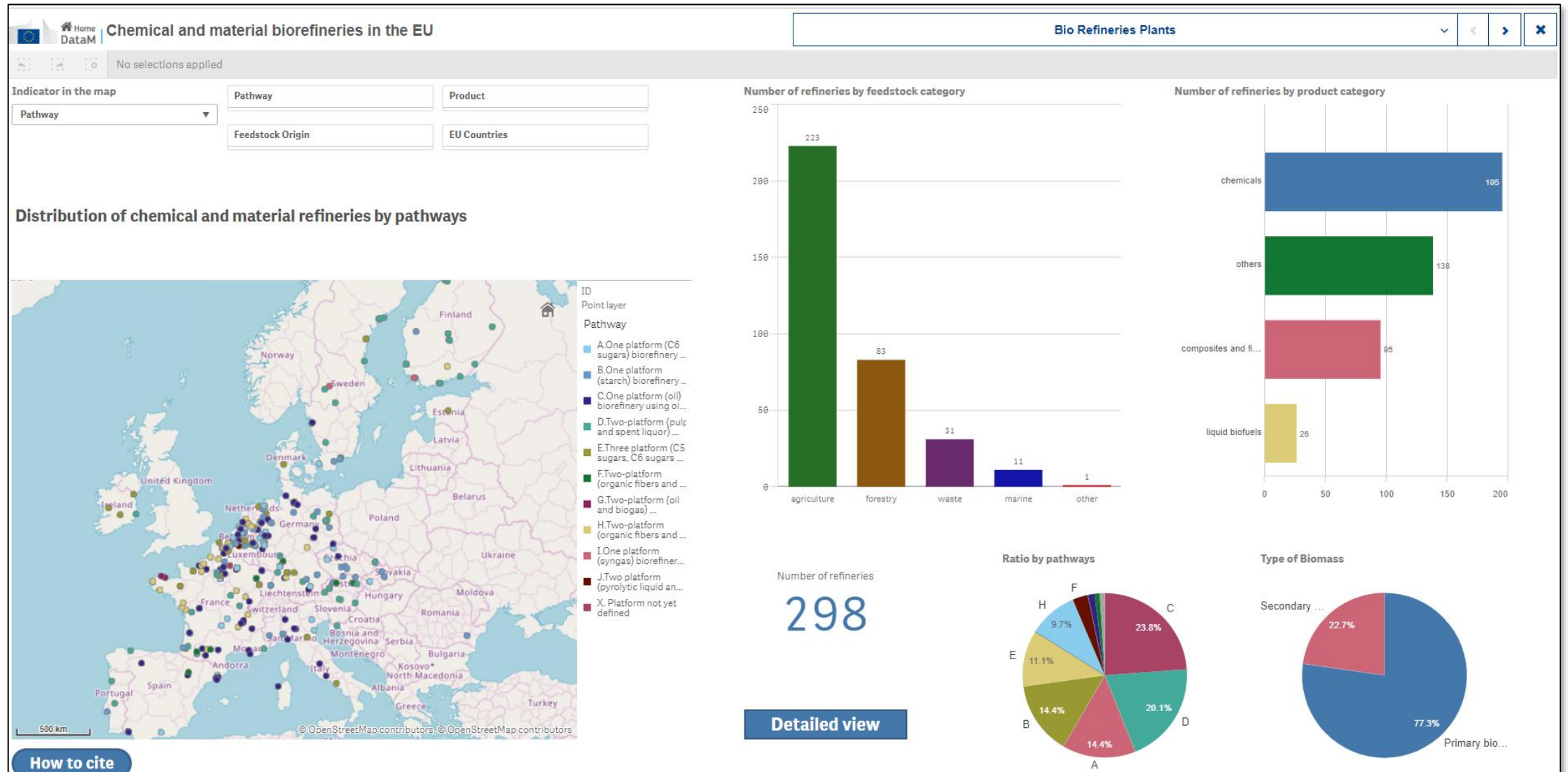
Industrial plants oil

Clear

Available Industrial plants oil for material use in EU versus Industrial plants oil needs in the bio-based chemical industry in all countries (1000t)



Chemical and material driven biorefineries: waste as feedstock still marginal



Thank you

Contact: Robert.M'barek@ec.europa.eu



© European Union 2023

Unless otherwise noted the reuse of this presentation is authorised under the [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) license. For any use or reproduction of elements that are not owned by the EU, permission may need to be sought directly from the respective right holders.

Slide xx: [element concerned](#), source: e.g. [Fotolia.com](#); Slide xx: [element concerned](#), source: e.g. [iStock.com](#)



Comparison between FW estimates from JRC model and reported by MSs

MFA model/reported data

	Primary production	Processing & Manufacturi	Retail & Distribution	Consumption food service	Consumption househ	Total
Austria	↑ 1204%	↗ 112%	↗ 141%	↘ 74%	↘ 87%	↗ 105%
Belgium	↑ 981%	↓ 25%	↑ 214%	↑ 303%	↗ 147%	↘ 86%
Bulgaria	↗ 153%	↘ 65%	↗ 167%	↘ 77%	↗ 114%	↗ 106%
Croatia	↑ 513%	↑ 1515%	↑ 1372%	↑ 510%	↗ 194%	↑ 319%
Cyprus	↓ 47%	↓ 9%	↓ 20%	↘ 73%	↘ 98%	↓ 36%
Czechia	↑ 339%	↘ 98%	↑ 218%	↑ 484%	↗ 116%	↗ 141%
Denmark	↑ 585%	↓ 48%	↘ 82%	↑ 372%	↗ 116%	↗ 119%
Estonia	↗ 141%	↘ 99%	↘ 73%	↗ 158%	↗ 119%	↗ 115%
Finland	↗ 183%	↘ 53%	↗ 110%	↗ 147%	↗ 121%	↗ 110%
France	↘ 89%	↘ 80%	↗ 106%	↘ 79%	↗ 113%	↘ 98%
Germany	↑ 548%	↘ 91%	↗ 142%	↘ 70%	↘ 95%	↗ 101%
Greece	↗ 152%	↗ 115%	↘ 84%	↗ 112%	↘ 80%	↗ 103%
Hungary	↑ 1424%	↘ 95%	↑ 273%	↑ 846%	↗ 103%	↗ 149%
Ireland	↑ 296%	↘ 88%	↘ 97%	↘ 54%	↗ 164%	↗ 120%
Italy	↑ 310%	↑ 466%	↑ 237%	↑ 645%	↘ 71%	↗ 138%
Latvia	↗ 159%	↘ 71%	↗ 159%	↘ 87%	↘ 100%	↗ 104%
Lithuania	↘ 90%	↑ 223%	↗ 142%	↑ 1163%	↗ 103%	↗ 124%
Luxembourg	↓ 32%	↘ 80%	↘ 70%	↗ 104%	↘ 68%	↘ 70%
Malta	↑ 979%	↑ 211%	↘ 90%	↓ 30%	↓ 39%	↘ 58%
Netherlands	↑ 224%	↘ 80%	↗ 119%	↑ 595%	↗ 151%	↗ 148%
Poland	↗ 172%	↘ 99%	↗ 166%	↑ 479%	↗ 165%	↗ 168%
Portugal	↑ 378%	↑ 814%	↘ 79%	↗ 128%	↘ 76%	↗ 123%
Romania						
Slovakia	↘ 56%	↓ 34%	↑ 330%	↑ 962%	↘ 88%	↘ 90%
Slovenia	↑ 36532%	↑ 214%	↗ 146%	↘ 91%	↗ 185%	↗ 179%
Spain	↑ 356%	↗ 137%	↑ 225%	↑ 390%	↑ 328%	↑ 265%
Sweden	↑ 583%	↑ 214%	↘ 75%	↑ 205%	↘ 94%	↗ 122%

Legend

- ↑ JRC value is more than 2 times the reported value
- ↗ JRC value is higher than reported value but less than 2 times
- ↘ JRC value is lower than reported value, but more than half of it
- ↓ JRC value is lower than half of reported value

Updated FW estimates with JRC model, focusing only on **solid** food waste (fresh mass), provided a total value of 75 Mt for the EU for 2020. Data available at:

<https://publications.jrc.ec.europa.eu/repository/handle/JRC133379>

Bio-based industry plants

