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DataM – Biomass estimates (v3): a new database to quantify biomass availability in the European Union

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Abstract

The bioeconomy observatory (BISO) aims at compiling qualitative and quantitative data of relevance for the monitorimg of the bioeconomy. Considering that biomass is the raw material of the bioeconomy, JRC-IPTS together with the Nova-Institute has elaborated in the BISO framework a new database that quantifies the production and residues of biomass: DataM – Biomass estimates. Compared to existing databases like Eurostat-MFA (env_ac_mfa) and SERI Global material flows, this new database presents a higher level of disaggregation at the geographical and commodity level. Moreover, it allows gathering data either into fresh or dry matter. A quantification of the European trade and biomass uses in biomass equivalent is foreseen in next versions, together with the integration of woody and aquatic product.

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Abstract

In 2012, the Communication of the European Commission "Innovating for Sustainable Growth: A Bioeconomy for Europe" (COM(2012)60) has put the development of the Bioeconomy at the forefront, as a way of reconciling economic growth and the green economy. But current official statistics fall short in providing relevant data to document this new concept. The establishment of the bioeconomy observatory (BISO) aims at filling this gap, compiling qualitative and quantitative data of relevance for policy makers. Considering that biomass is the raw material of the bioeconomy, JRC-IPTS together with the Nova-Institute[1] has elaborated in the BISO framework a new database that quantifies the production and residues of biomass: DataM – Biomass estimates. Compared to existing databases like Eurostat-MFA (env_ac_mfa) and SERI Global material flows, this new database presents a higher level of disaggregation at the geographical and commodity level. Moreover, it allows gathering data either into fresh or dry matter.

DataM – Biomass estimates shows that 1,604 million tonnes of crops (fresh matter) were harvested in EU-28 in 2013 and over the 611 million tonnes of residues only 31% were used. Half of the extraction used of crop biomass (including fodder crops) in the EU-28 DEU comes from Germany, France and Spain. The average agricultural biomass productivity in Europe is about 6 T of dry matter per Ha (including fodder crops), ranging from less than 3T/Ha to more than 9 T/Ha at member state level. The domestic extraction used of crop biomass is constituted by more than 50% of fodder crops and 25% of cereals (in fresh matter, vs. 30% in dry matter). Unused residues (in dry matter) are composed by 71% of cereal residues, 16% of oilseeds residues, 6% of fruits and vegetable residues, and some remaining other categories of crops.

This database is stored in DataM, a JRC data management tool, and is accessible via two applications: the full version in datamintracomm for all European commission staff, and a public light version online, datamweb. Apart from offering a quantification of crop biomass and residues at European level, these two applications also allows browsing data at member state and commodity level. A quantification of the European trade and biomass uses in biomass equivalents is foreseen in next versions, together with the integration of woody and aquatic products.

[1] www.nova-Institue.eu and www.bio-based.eu

1. Introduction

In February 2012, the European Commission published the Communication "Innovating for Sustainable Growth: A Bioeconomy for Europe" (COM(2012)60)[2] officially recognizing the pivotal role of the bioeconomy in the Europe 2020 Strategy. As a transition towards a more resource efficient economy, the development of the bioeconomy in Europe is conceptually a key element for smart and green growth. It is defined in the communication as encompassing "the production of renewable biological resources and the conversion of these resources and waste streams into value-added products such as food, feed, bio-based products and bioenergy".

On the operational side, the communication foresaw the establishment of "a Bioeconomy Observatory in close collaboration with existing information systems that allows the Commission to regularly assess the progress and impact of the bioeconomy and develop forward-looking and modelling tools". The bioeconomy observatory hereafter referred to as BISO, aims at compiling both quantitative and qualitative data dealing with the three pillars of the bioeconomy: Research, Policy and Markets. More specifically, JRC-IPTS is committed under the Grant Agreement 2007-2013-(BISO) 341300[3] to provide quantitative data on the market pillar, including statistics and modelling outputs. Among other activities, JRC-IPTS has investigated the way of quantifying the European biomass. Indeed, biomass being the raw material of the bioeconomy, the first step towards the European bioeconomy monitoring is to quantify how much biomass is domestically produced, how much of it feeds the bioeconomy and how much remains unused. In this perspective, JRC-IPTS with the help of Nova-Institute[4] has elaborated a new database, DataM – Biomass estimates (v3), quantifying the harvested agricultural biomass produced in the EU-28 and European member states as well as the agricultural biomass residues (used and unused). This data is a starting point for further quantification of biomass trade and uses. It is noteworthy that the quantification refers to a technical potential of biomass, meaning the biomass available under the current infrastructure conditions and with the current technological possibilities.

In DataM – Biomass estimates, the methodology for "material flow accounts" has been followed for the quantification of biomass and related residues using DataM as a tool for data storage and management. Both the methodology and quantitative tool are described in section 2. Section 3 presents the structure of the resulting database. Section 4 shows preliminary results and section 5 is dedicated to the limitations of our methodology and further areas of research.

[2] The communication has been co-signed by five commissioners from the following DGs: Research, Industry, Agriculture, Fisheries, Environment.
[3] Grant Agreement 2007-2013-(BISO) 341300 – BISO, Support to policies – Set up of a bioeconomy observatory (BISO project: Bioeconomy Information System and Observatory).
[4] www.nova-Institue.eu and www.bio-based.eu

2. The material flow account (MFA) methodology and DataM tool

1.1. Rationale for the elaboration of DataM – Biomass estimates

As aforementioned, biomass is the raw material of the bioeconomy. As such, data availability and data quality on biomass domestic extraction is of foremost importance for the monitoring of the European bioeconomy. But the concept of the bioeconomy is also focus rooted in the efficient use of natural resources. In this perspective, the extracted but unused amount of biomass ought to be estimated as an indication of the level of biomass use efficiency.

Eurostat already releases official statistics on the domestic extraction used (DEU, see definition in section 3) at EU-28 and member states level in the "Material flow accounts" database (env_ac_mfa[5]). Data is available for the time period 2000 – 2013 at aggregated level (total biomass) and for the main commodity aggregates[6]. Although the Eurostat material flow account database is already a very valuable tool, it presents two main limitations in the framework of the European biomass observatory:

- By reporting on the DEU, it reports on the amount of biomass used in the economy but not on the amount of unused residues.
- Data are only available at commodity aggregates level

The Austrian research institute SERI releases a "global material flows" database online[7] which reports both on DEU and "domestic extraction non-used" at the global and country levels for the years 1980 – 2011. Nevertheless, these data cannot fully complement env_ac_mfa data since they are far less disaggregated. Estimations are proposed for only five biomass sub-groups: animals, feed, food, forestry and other biomass.

"Eurostat-Material flow accounts" and "SERI – Global material flows" rely on the Economy Wide Material Flow Account (EW-MFA) methodology described in two main publications: a technical paper from SERI Institute (Lutter et al. 2014) and the Eurostat's EW-MFA compilation guide (Eurostat 2013).

Then, the objective of the elaboration of the "DataM – Biomass estimates" database was to complement these two databases using their common methodology. We put major emphasis on estimating the agricultural biomass domestic extraction and the amount of used and non-used residues, disaggregating data at commodity level.

1.2. The Material Flow Accounts methodology applied in DataM – Biomass estimates (v3)

The sum of domestic extraction used and imports of biomass, minus the biomass exports constitutes the baseline for the calculations according to the "Material Flow Account" (MFA) methodology:

$$Domestic\ use\ of\ Biomass = Domestic\ Extraction\ Used + Import - Export$$

[5] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_ac_mfa&lang=en
[6] Cereals; roots and tubers; sugar crops; pulses; nuts; oil-bearing crops; vegetables; fruits; fibres; other crops n.e.c; grazed biomass; wood; etc.
[7] http://www.materialflows.net/data/datadownload/

However, at this stage the DataM – Biomass estimates database only focuses on the quantification of domestically produced biomass and associated residues. Trade flows will be included at a later stage since the consideration of import and export data deserve much more research to avoid double counting. Also, processed agricultural products have to be converted into biomass equivalent to provide a comprehensive picture of biomass trade flows.

FAO-ProdStat as the data source for the calculations in DataM – Biomass estimates (v3)

Calculations released in DataM – Biomass estimates (v3) derive from the production indicator of the FAO ProdStat database[8]. This indicator reports the harvested agricultural biomass in moisture content at the time of harvest, excluding agricultural residues (straw, leaves etc.).

Other data sources will be integrated in next versions of DataM – Biomass estimates, including historical and projected production data (e. g. Eurostat – Crop production, FAPRI, OECD-FAO Agriculture outlook, USDA projections and potentially projections from in house models).

Scope of the database: DataM – Biomass estimates (v3) restricted to agricultural biomass and residues

Theoretically, total biomass can be grouped into the five following categories:

- **Harvested agricultural biomass**
- **Agricultural residues**
- Grazed biomass
- Woody biomass
- Aquatic biomass

At this stage, the DataM – Biomass estimates database covers the two first categories that are the harvested agricultural biomass and agricultural residues (used and non-used). The woody and aquatic biomass and their respective residues will be integrated in next version. Moreover, as there is no reporting on grazed biomass by member states, this category needs to be estimated using indirect parameters and calculations. A methodology for its estimation is given by SERI and Eurostat in their technical papers afore mentioned, but due to its complexity, the implementation of such methodology will require some more time and research.

Unit of measure: DataM – Biomass estimates duplicates all calculations in fresh and dry matter

While SERI and Eurostat's estimates are released in tonnes of fresh matter, the particularity of DataM – Biomass estimates is to convert all indicators into dry matter according to Wirsenius' coefficients (Wirsenius 2000: pp. 272) for the commodities informed by Wirsenius. For the other commodities, average coefficients (at the level of the commodity group) or coefficient of a similar crop have been applied (see Annex 1).

This double calculation should make data comparable and ease cross-commodity comparisons. Indeed, agricultural biomass embeds different crops with very different moisture contents (e.g. about 12% for cereals vs about 90% for vegetables). Total dry biomass is also considered more informative than fresh biomass when quantifying the potential uses of biomass (particularly for energy and material uses).

[8] http://faostat3.fao.org/download/Q/QC/E

Estimation of crop residues in DataM – Biomass estimates (v3)

Following the MFA methodology, crop residues have been calculated for all crop commodities of DataM – Biomass estimates (v3). The residue-to-crop ratios in use come from Wirsenius (2000: pp. 92). Again, for the commodities not informed by Wirsenius (2000), average coefficients (at the level of the commodity group) or coefficients of a similar crop have been applied (see Annex 1).

Crop residues are informed in DataM – Biomass estimates (v3) under the attribute "**Residues, Total**", expressed both in fresh and dry matter (see definition in section 3).

Estimation of used and unused residues in DataM – Biomass estimates (v3)

According to the MFA methodology, the Domestic Extraction Used of biomass (DEU) is composed of the harvested biomass (given by FAO – ProdStat in fresh matter) and the amount of used residues. In DataM – Biomass estimates, the share of used/unused residues is computed on the basis of recovery rates released by Jölli and Giljum (2005) and on the basis of estimated rates (average/inferred rates) when unavailable in Jölli and Giljum (2005) (see table in Annex 1). The amount of used residues here refers to the amount that is not returned to the field (Jölli and Giljum, 2005: pp. 7).

Used and unused residues are informed in DataM – Biomass estimates (v3) under the attributes "**Residues, Used**" and "**Residues, Non-used**", expressed both in fresh and dry matter (see definition in section 3).

1.3. DataM, the tool for data storage and management of DataM – Biomass estimates (v3)

DataM is a data warehouse on agriculture, trade and models, offering a centralized access point with homogenization of different sources by linking database nomenclatures to a common dictionary. In DataM, datasets are organised by dimensions, a common dimension being the year to reconstitute time series. The three other main dimensions are: (i) Attributes (e.g. harvested biomass, DEU, etc.), (ii) Countries and (iii) Commodities. Additional dimensions have been created according to the specificity of each database (e.g. "Unit" to distinguish between fresh and dry matter in DataM – Biomass estimates (v3)).

Thanks to the mapping of DataM – Biomass estimates elements to a common dictionary, data can be easily compared with other data sources. DataM – BackOffice and DataMweb also offer functionalities for fast visualisations of data including dynamic controls (see Annex 2). Lastly, DataM – Biomass estimates is regularly updated according to the calendar of update of its data source (FAO – ProdStat for DataM – Biomass estimates (v3)) and to calculation developments (most of the time resulting in the release of a new version of DataM – Biomass estimates).

DataM includes three interfaces linked to the central database, with different purposes and targets (see Figure 1):

1. **DataM-BackOffice** which offers a full access for browsing and managing data from DataM – Biomass estimates (v3). Users can access through remote desktop connection after obtaining an account

2. **DataM-IntraComm** for data downloading: open to all European Commission users at http://s-jrcsvqis002d.jrc.es:7011/datamic

3. **DataMweb**, based on data harmonized and combined by thematic areas: for internet audience, at http://www.datamweb.com (public and restricted access)

Figure 1. Schematic representation of DataM structure and interfaces

3. DataM – Biomass estimates (v3) is structured according to five dimensions

DataM – Biomass estimates (v3) includes five dimensions: calendar, country, commodity, attribute and Units.

Calendar

Time series start from 1991 till the last available year (2013 at the time of writing this report).

Country

DataM – Biomass estimates (v3) covers the 28 European Union member states and four calculated aggregates (EU-13, EU-15, EU-27 and EU-28).

Commodity

In DataM – Biomass estimates (v3) only crop commodities are available (see Annex 3).

Attributes

- **Harvested production** (available in 1000 T fresh matter and 1000 T dry matter): The part of the biomass that is harvested. It excludes the parts let in the field (leaves, roots).
- **Residues, Total** (available in 1000 T fresh matter and 1000 T dry matter): The part of the biomass let in the field. Total residues = Used residues + non-used residues
- **Residues, Used** (available in 1000 T fresh matter and 1000 T dry matter): amount of not harvested biomass that is not returned to the field (further used).
- **Residues, Non-Used** (available in 1000 T fresh matter and 1000 T dry matter): amount of not harvested biomass with no further use. Non used residues = Total residues – Used residues
- **Domestic Extraction, Total** (available in 1000 T fresh matter and 1000 T dry matter): Harvested production + Total residues. It refers to the total biomass produced whatever used or not in the economy.
- **Domestic Extraction Used (DEU)** (available in 1000 T fresh matter and 1000 T dry matter): Harvested production + Used residues

  Both Eurostat MFA and SERI use the terminology of "used extraction" instead of "production" in order to underline that only the biomass which is both extracted from the environment and used in the economy is considered.

- **Harvested Area** (available in 1000 Ha): land area which has been harvested.
- **Yield, Domestic extraction used (DEU)** (available in T fresh matter/Ha and T dry matter/Ha): DEU / Harvested area.

Unit

DataM – Biomass estimates display data in the following five units: 1000 HA, 1000 T fresh matter, 1000 T dry matter, T/HA fresh matter, and T/HA dry matter. Their correspondence with their respective attributes is indicated in the former paragraph.

4. Preliminary results

According to the calculations presented above, 1,604 million tonnes of crops[9] (fresh matter) were harvested in EU-28 in 2013 and 191 million tonnes of residues were used. 420 million tonnes of residues remained unused. Converted in dry matter, this represents 621 million tonnes of harvested biomass, 144 million tonnes of used residues and 304 million tonnes of unused residues. As a result, **the DEU was 1,795 million tonnes of fresh matter**, that is 765 million tonnes of dry matter.

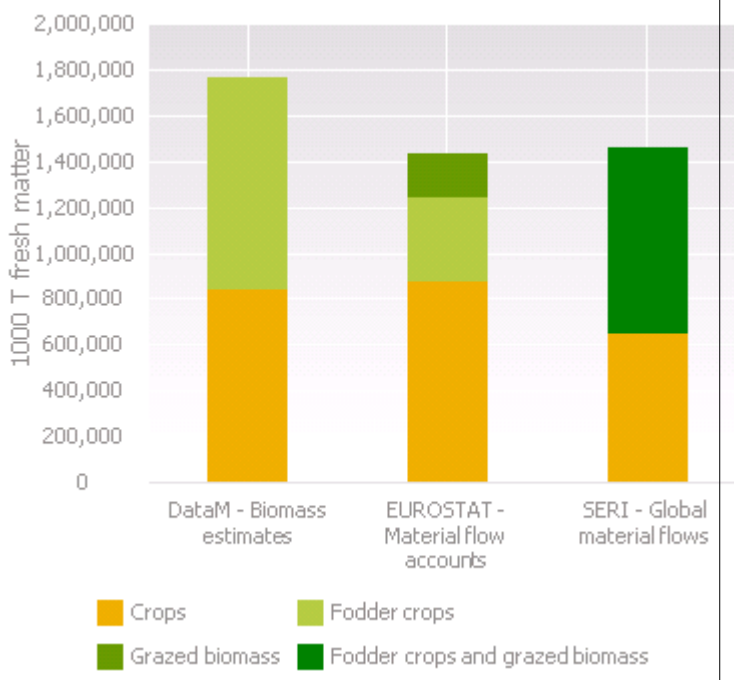
Over the 611 million tonnes of residues (i.e. 304 million T dry matter) **only 31% were used**. According to the scientific literature, 25% to 50% of the residues can be harvested considering sustainability criteria. This share varies according to the crop considered (e.g. 40% for wheat vs 50% for Maize).

Fodder crops and grazed biomass are two concepts not well and consistently reported in official statistics. Thus, they have to be estimated with indirect indicators and their estimation highly varies from one source to another (e.g. the estimation of fodder crops and grazed biomass is nearly 50%

[9] Fodder crops included

higher in SERI-Global material flows than in Eurostat – Material flow accounts for EU-28 in 2011, with 815 and 566 million T fresh matter respectively) (see Figure 2).

Figure 2. DEU for crops, fodder and grazed biomass in EU-27, 2011



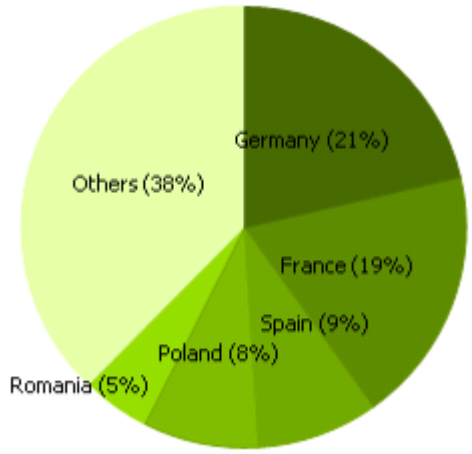
Source: DataM, Elaboration based on original data coming from: DataM – Biomass estimates, EUROSTAT – Material flow accounts and SERI – Global material flows

As a result, estimations for DEU crop biomass excluding fodder and grazed biomass are quite consistent over data sources (respectively 839, 875 and 649 million T fresh matter in DataM – Biomass estimates, EUROSTAT – Material flows and SERI – Global material flows).

When including fodder and grazed biomass, estimations vary from 1,436 to more than 1,772million T fresh matter in the same 3 data sources.

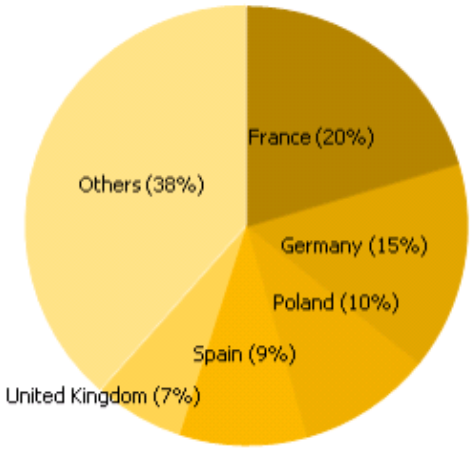
Half of the EU-28 crop biomass (incl. fodder) DEU expressed in dry matter comes from three countries: Germany, France and Spain.

Figure 3. Crop biomass DEU (incl. fodder) among EU-28 member states (2013, dry matter)



Source: DataM, Elaboration based on original data coming from: DataM – Biomass estimates (v3)

Figure 4. Crop biomass DEU (excl. fodder) among EU-28 member states (2013, dry matter)



Source: DataM, Elaboration based on original data coming from: DataM – Biomass estimates (v3)

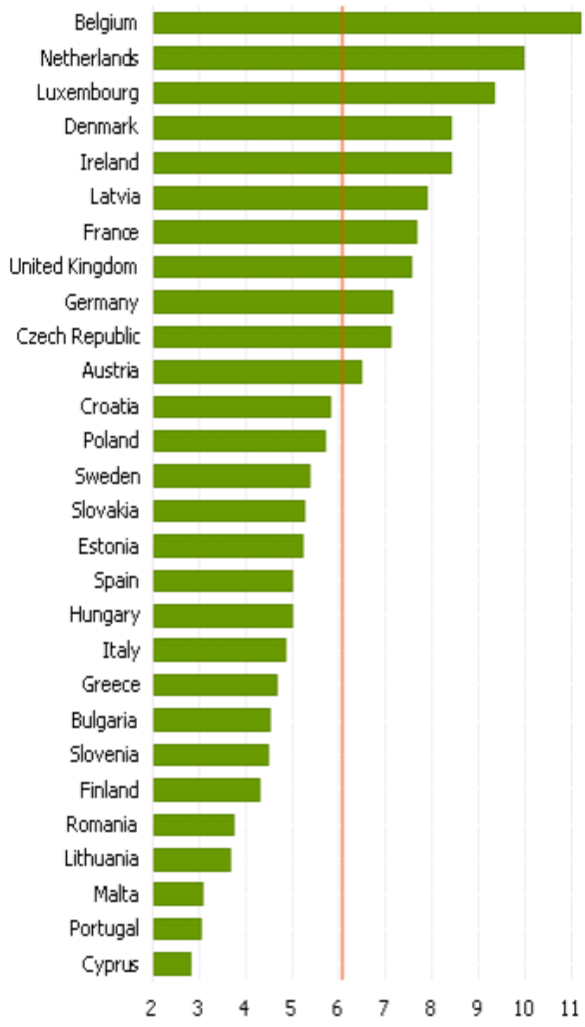
The production of crop biomass and used residues is uneven across member states.

Germany and France are ranking firsts by far with respectively 21% and 19% of the EU-28 DEU expressed in dry matter (see Figure 3). They are followed by Spain (9%) and Poland (5%). This ranking can be compared with data for crop biomass excluding fodder in Figure 4.

The same ranking is observed in terms of harvested area and production of residues. Nevertheless, the picture changes when analysing the DEU yields[10].

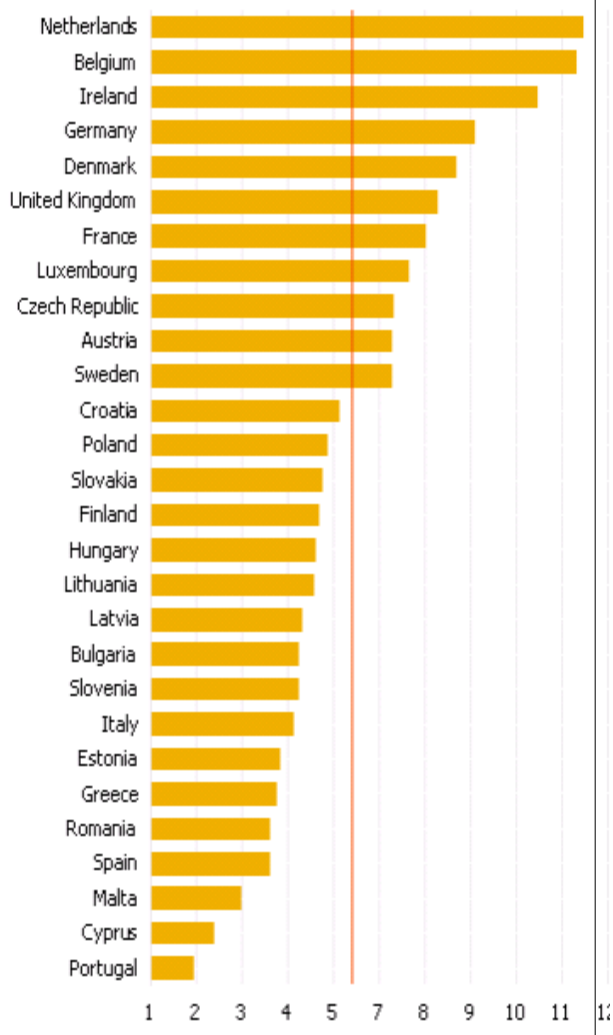
The average agricultural biomass productivity in Europe is about 6 T of dry matter per Ha (including fodder crops), with **Belgium, the Netherlands and Luxembourg producing more 9 T of dry matter per Ha (including fodder crops)** and Cyprus, Portugal and Malta producing 3 T/Ha or less. Eleven member states are over the EU-28 average, distributed among western and eastern European countries (see Figure 5, to be compared with data excluding fodder crops in Figure 6).

Figure 5. DEU yield of total crops (incl. fodder) in the EU-28 (2013, T dry matter/HA)



The red line represents the EU-28 average
Source: DataM, Elaboration based on original data coming from: DataM – Biomass estimates (v3)

Figure 6. DEU yield of total crops (excl. fodder) in the EU-28 (2013, T dry matter/HA)



The red line represents the EU-28 average
Source: DataM, Elaboration based on original data coming from: DataM – Biomass estimates (v3)

[10] Meaning the ratio of the DEU to the harvested area

Looking more closely at the composition of the crop biomass produced in Europe, we can see that fodder crops constitute more than half of the crop biomass extracted and used both in fresh and dry matter. Cereals represent one quarter of the crop biomass in fresh matter, and one third when expressed in dry matter. The remaining crops contribute by 21% to the fresh crop biomass but only by 15% to the dry crop biomass (see Figure 7).

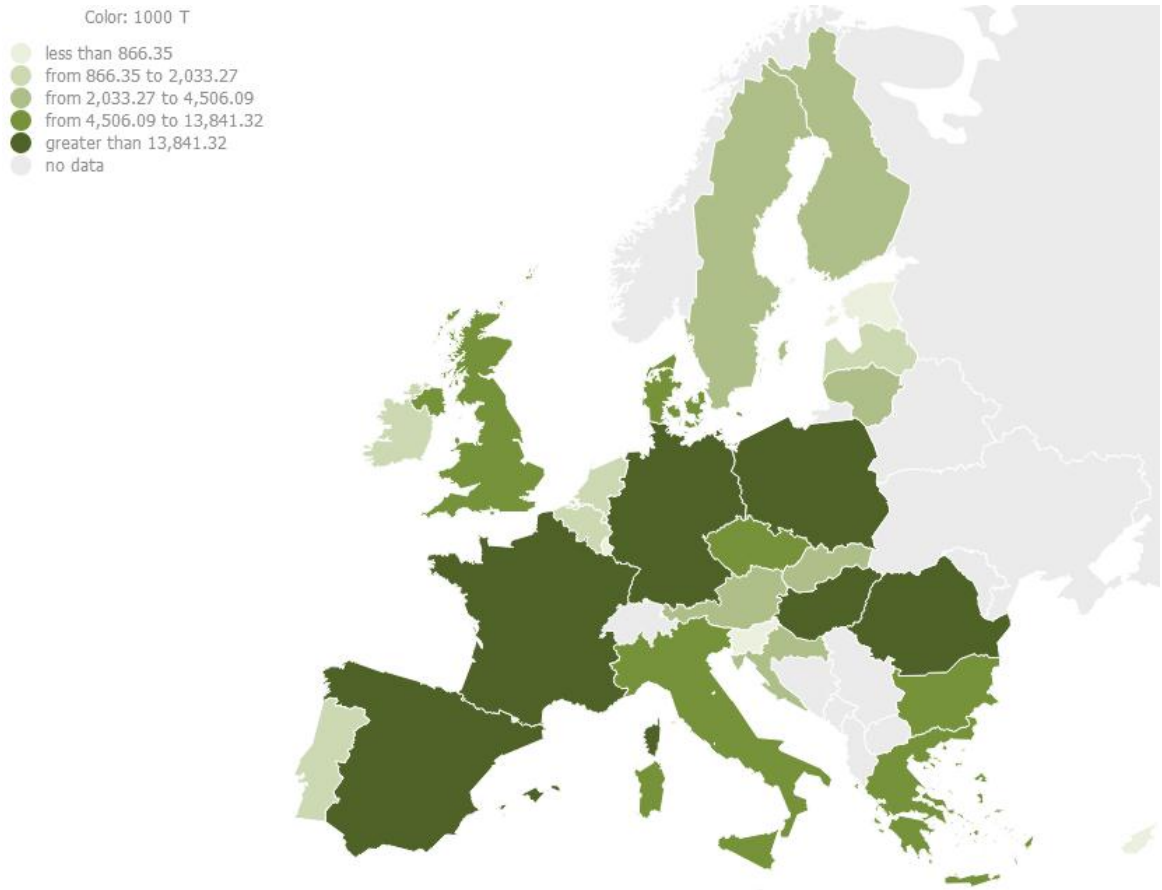
The estimation of unused residues also gives us a quick idea of the type of biomass that usually remains unused. Basically, unused residues (in dry matter) are composed by 71% of cereal residues (see their geographical distribution on Figure 8), 16% of oilseeds residues, 6% of fruits and vegetable residues, and some remaining other categories of crops. It would be worth to assess in what extent we can take advantage of these residues, also taking into account that a part of it needs to remain in the field for soil fertility purposes.

Figure 7. Extraction of crop biomass by commodity aggregate in EU-28 (2013)

	Harvested production	Residues, Used	Domestic Extraction Used	Residues, Non-Used	Harvested production	Residues, Used	Domestic Extraction Used	Residues, Non-Used
	1000 T fresh matter				1000 T dry matter			
Agricultural crops	**1,603,852**	**190,913**	**1,794,765**	**420,128**	**620,579**	**144,150**	**764,729**	**303,835**
Fodder crops	956,746	0	956,746	0	247,054	0	247,054	0
Total cereals incl. rice	308,380	145,884	454,264	246,641	271,374	128,378	399,752	217,044
Fruits and Vegetables	140,818	4,670	145,488	42,028	31,173	2,184	33,358	19,660
Sugar crops	107,627	29,060	136,686	29,060	25,831	6,974	32,805	6,974
Starchy Roots	53,554	5,355	58,909	48,197	11,414	1,141	12,555	10,272
Total Oilseeds	32,367	5,927	38,294	53,347	29,782	5,457	35,238	49,109
Protein crops	2,989	0	2,989	598	2,690	0	2,690	538
Other crops	836	17	852	150	752	15	767	135
Fibre Crops	536	0	536	107	509	0	509	102

Source: DataM, Elaboration based on original data coming from: DataM – Biomass estimates (v3)

Figure 8. Distribution of unused residues of cereals over EU28 (1000 T, 2013)



Source: DataM, Elaboration based on original data coming from: DataM – Biomass estimates (v3)

5. Further research needs

The 3rd version of DataM – Biomass estimates already provides interesting data on the potential of agricultural biomass available within the European Union, taking into account used and unused residues (see section 4). Nevertheless, this database will be continuously improved with the release of new versions. Next versions will seek to address the current weaknesses and gaps presented in this section.

5.1. Limitations in the coefficients used

Coefficients used are static over time (1991-2012) **and countries**. It is to be considered that DataM – Biomass estimates (v3) releases rough and first estimates of the agricultural biomass. Coefficients used do not reflect the differences due to the variety of farming practices, soil and climate conditions, genetic material, etc., within the European Union.

Moreover, to fill literature gaps missing coefficients for a given commodity were estimated using average coefficients for the corresponding commodity group or inferring the same coefficient as for a similar crop.

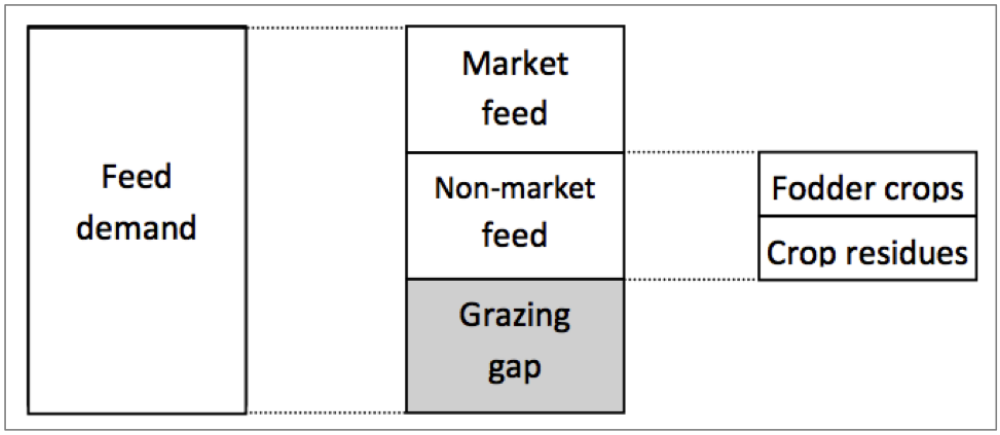
5.2. Weak estimations for fodder crops

As fodder crop data are not systematically reported, they are subject to estimations in FAO ProdStat on which the "DataM – Biomass estimates" database is based (the same applies to Eurostat Crop Production database[11]). For this reason they can be considered as less reliable than crop data.

5.3. The estimation of grazed biomass remains an area for further investigation

No comprehensive official statistics reports the amount of grazed biomass in the European Union member states. It would then require a substantial amount of further investigation to compute it in DataM – Biomass estimates, possibly following the methodology proposed by SERI (Lutter et al. 2014) and Eurostat (Eurostat 2013). "Two main estimation methods are possible, a supply-side approach or a demand-side approach. The supply-side approach attempts at closing gaps in production data for individual fodder crop categories. The demand-side approach takes the annual fodder requirement of the existing livestock as the starting point for estimating the total production of fodder crops. Ideally both approaches should be combined to cross-check the results" (Eurostat 2013: pp. 18). Figure 9 shows a schematic outline of this approach.

Figure 9. General concept of the grazing demand approach



Source: Lutter et al. (2014)

5.4. The integration of woody and aquatic biomass to be integrated in next versions of DataM – Biomass estimates

The woody biomass will be integrated in next version of DataM – Biomass estimates after converting Eurostat data recorded in volume (solid cubic metres) into metric tonnes. Conversion factors are released with the definitions of the Joint Forest Sector Questionnaire (UNECE et al. 2014).

The case of aquatic biomass is far more problematic. In the literature we have processed as of today, we could not find the density factors and recovery rates at the level of disaggregation required for the estimation of aquatic biomass. According to an FAO publication, the water content of fish fillets lies at about 70-80% depending on the species (Huss 1995, Table 4.2). This publication could serve as a first source for conversion of fresh aquatic biomass into dry matter.

[11] Data on fodder crops and grazed biomass can be "voluntarily reported in crop statistics, but in practice many data gaps appear in national as well as in Eurostat's crop production database in particular for grazed biomass" (Eurostat 2013: pp. 18).

5.5. The estimation of agricultural biomass from new data sources is another area of development foreseen (including historical and projected data)

The same methodology as the one applied on FAO – ProdSTAT data could be replicated on agricultural production data from other sources (e. g. Eurostat – Crop production). Thanks to a relevant mapping of countries, attributes and commodities to DataM's common dictionary, this would allow a fast and easy cross-data source comparison.

Particularly, the integration of projected data (at least till 2020) could be welcome for the analysis of the bioeconomy potential in the framework of the Europe 2020 Strategy. FAPRI, OECD-FAO Agriculture outlook, USDA projections and projections from in house models would be relevant databases to work on.

5.6. Development of DataM – Biomass estimates with new attributes: trade and use indicators

Investigation is on-going to integrate imports and exports of processed products in "raw commodity equivalents" and to calculate biomass uses at member state level (Food, Feed, Food manufacture, Non-food industry (of which Energy), Waste and Other).

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Annex 1: List of coefficients used in DataM – Biomass estimates (v3)

	Dry matter content of main product (%)	Residue-to-Product Ratio (East Europe)	Residue-to-Product Ratio (West Europe)	Residue-to-Product Ratio (World)	Share of used residues (%)
Source/comments:	**Wirsenius 2000, S. 272 (Table A1.I)**	**Wirsenius 2000, S. 92 (Table 3.16)**	**Wirsenius 2000, S. 92 (Table 3.16)**	**Wirsenius 2000, S. 92 (Table 3.16)**	**Jölli und Giljum 2005, S. 10ff.**
Cereals:		1.59	1.18	1.88	
Barley	88.0%	1.50	1.22	1.39	50.00%
Buckwheat	88.0%	1.59	1.18	1.88	50.00%
Canary seed	88.0%	1.59	1.18	1.88	50.00%
Cereals, nes	88.0%	1.59	1.18	1.88	50.00%
Fonio	88.0%	1.59	1.18	1.88	50.00%
Grain, mixed	88.0%	1.59	1.18	1.88	50.00%
Maize	88.0%	1.86	1.22	2.24	0.00%
Millet	88.0%	1.59	1.18	1.88	50.00%
Oats	88.0%	1.59	1.18	1.88	50.00%
Popcorn	88.0%	1.59	1.18	1.88	50.00%
Quinoa	88.0%	1.59	1.18	1.88	50.00%
Rice, paddy	88.0%	1.22	1.22	1.33	50.00%
Rye	88.0%	1.59	1.18	1.88	50.00%
Sorghum	88.0%	1.86	1.22	3.01	50.00%
Triticale	88.0%	1.59	1.18	1.88	50.00%
Wheat	88.0%	1.50	1.00	1.43	50.00%
Fibre crops:		0.20	0.20	0.20	
Agave fibres nes	95.0%	0.20	0.20	0.20	0.00%
Bastfibres, other	95.0%	0.20	0.20	0.20	0.00%
Fibre crops nes	95.0%	0.20	0.20	0.20	0.00%
Flax fibre and tow	95.0%	0.20	0.20	0.20	0.00%
Hemp tow waste	95.0%	0.20	0.20	0.20	0.00%
Jute	95.0%	0.20	0.20	0.20	0.00%
Kapok fruit	95.0%	0.20	0.20	0.20	0.00%
Manila fibre (abaca)	95.0%	0.20	0.20	0.20	0.00%
Ramie	95.0%	0.20	0.20	0.20	0.00%
Seed cotton	95.0%	0.20	0.20	0.20	0.00%
Sisal	95.0%	0.20	0.20	0.20	0.00%

Fruits incl. melons:		0.20	0.20	0.20	
Apples	20.0%	0.20	0.20	0.20	10.00%
Apricots	20.0%	0.20	0.20	0.20	10.00%
Avocados	20.0%	0.20	0.20	0.20	10.00%
Bananas	20.0%	0.20	0.20	0.20	10.00%
Berries nes	20.0%	0.20	0.20	0.20	10.00%
Blueberries	20.0%	0.20	0.20	0.20	10.00%
Carobs	20.0%	0.20	0.20	0.20	10.00%
Cashewapple	20.0%	0.20	0.20	0.20	10.00%
Cherries	20.0%	0.20	0.20	0.20	10.00%
Cherries, sour	20.0%	0.20	0.20	0.20	10.00%
Cranberries	20.0%	0.20	0.20	0.20	10.00%
Currants	20.0%	0.20	0.20	0.20	10.00%
Dates	20.0%	0.20	0.20	0.20	10.00%
Figs	20.0%	0.20	0.20	0.20	10.00%
Fruit, citrus nes	20.0%	0.20	0.20	0.20	10.00%
Fruit, fresh nes	20.0%	0.20	0.20	0.20	10.00%
Fruit, pome nes	20.0%	0.20	0.20	0.20	10.00%
Fruit, stone nes	20.0%	0.20	0.20	0.20	10.00%
Fruit, tropical fresh nes	20.0%	0.20	0.20	0.20	10.00%
Gooseberries	20.0%	0.20	0.20	0.20	10.00%
Grapefruit (inc. pomelos)	20.0%	0.20	0.20	0.20	10.00%
Grapes	20.0%	0.20	0.20	0.20	10.00%
Kiwi fruit	20.0%	0.20	0.20	0.20	10.00%
Lemons and limes	20.0%	0.20	0.20	0.20	10.00%
Mangoes, mangosteens, guavas	20.0%	0.20	0.20	0.20	10.00%
Melons, other (inc.cantaloupes)	20.0%	0.20	0.20	0.20	10.00%
Oranges	20.0%	0.20	0.20	0.20	10.00%
Papayas	20.0%	0.20	0.20	0.20	10.00%
Peaches and nectarines	20.0%	0.20	0.20	0.20	10.00%
Pears	20.0%	0.20	0.20	0.20	10.00%
Persimmons	20.0%	0.20	0.20	0.20	10.00%
Pineapples	20.0%	0.20	0.20	0.20	10.00%
Plantains	20.0%	0.20	0.20	0.20	10.00%
Plums and sloes	20.0%	0.20	0.20	0.20	10.00%
Quinces	20.0%	0.20	0.20	0.20	10.00%
Raspberries	20.0%	0.20	0.20	0.20	10.00%
Strawberries	20.0%	0.20	0.20	0.20	10.00%
Tangerines, mandarins, clementines, satsumas	20.0%	0.20	0.20	0.20	10.00%
Watermelons	20.0%	0.20	0.20	0.20	10.00%

Oilcrops primary:		1.59	1.60	1.70	
Castor oil seed	84.2%	1.59	1.60	1.70	10.00%
Coconuts	84.2%	1.59	1.60	1.70	10.00%
Groundnuts, with shell	94.0%	1.22	1.22	1.38	10.00%
Hempseed	84.2%	1.59	1.60	1.70	10.00%
Jojoba seed	84.2%	1.59	1.60	1.70	10.00%
Karite nuts (sheanuts)	84.2%	1.59	1.60	1.70	10.00%
Linseed	84.2%	1.59	1.60	1.70	10.00%
Melonseed	84.2%	1.59	1.60	1.70	10.00%
Mustard seed	84.2%	1.59	1.60	1.70	10.00%
Oil, palm fruit	51.1%	1.50	1.86	1.80	10.00%
Oilseeds nes	84.2%	1.59	1.60	1.70	10.00%
Olives	84.2%	1.59	1.60	1.70	10.00%
Poppy seed	84.2%	1.59	1.60	1.70	10.00%
Rapeseed	92.0%	1.86	1.86	2.00	10.00%
Safflower seed	84.2%	1.59	1.60	1.70	10.00%
Sesame seed	84.2%	1.59	1.60	1.70	10.00%
Soybeans	91.0%	1.50	1.22	1.39	10.00%
Sunflower seed	93.0%	1.86	1.86	1.96	10.00%
Tallowtree seed	84.2%	1.59	1.60	1.70	10.00%
Tung nuts	84.2%	1.59	1.60	1.70	10.00%

Pulses:		0.20	0.20	0.20	
Bambara beans	90.0%	0.20	0.20	0.20	0.00%
Beans, dry	90.0%	0.20	0.20	0.20	0.00%
Broad beans, horse beans, dry	90.0%	0.20	0.20	0.20	0.00%
Chick peas	90.0%	0.20	0.20	0.20	0.00%
Cow peas, dry	90.0%	0.20	0.20	0.20	0.00%
Lentils	90.0%	0.20	0.20	0.20	0.00%
Lupins	90.0%	0.20	0.20	0.20	0.00%
Peas, dry	90.0%	0.20	0.20	0.20	0.00%
Pigeon peas	90.0%	0.20	0.20	0.20	0.00%
Pulses, nes	90.0%	0.20	0.20	0.20	0.00%
Vetches	90.0%	0.20	0.20	0.20	0.00%

Roots and Tubers:		0.94	0.94	0.94	
Cassava	35.0%	0.82	0.82	0.82	10.00%
Potatoes	21.3%	1.00	1.00	1.00	10.00%
Roots and tubers, nes	28.6%	0.94	0.94	0.94	10.00%
Sweet potatoes	29.4%	1.00	1.00	1.00	10.00%
Taro (cocoyam)	28.6%	0.94	0.94	0.94	10.00%
Yams	28.6%	0.94	0.94	0.94	10.00%

Roots and Tubers (next)					
Yautia (cocoyam)	28.6%	0.94	0.94	0.94	10.00%

Treenuts:		0.20	0.20	0.20	
Almonds, with shell	90.0%	0.20	0.20	0.20	10.00%
Brazil nuts, with shell	90.0%	0.20	0.20	0.20	10.00%
Cashew nuts, with shell	90.0%	0.20	0.20	0.20	10.00%
Chestnut	90.0%	0.20	0.20	0.20	10.00%
Hazelnuts, with shell	90.0%	0.20	0.20	0.20	10.00%
Nuts, nes	90.0%	0.20	0.20	0.20	10.00%
Pistachios	90.0%	0.20	0.20	0.20	10.00%
Walnuts, with shell	90.0%	0.20	0.20	0.20	10.00%

Vegetables:		0.20	0.20	0.20	
Artichokes	10.0%	0.20	0.20	0.20	10.00%
Asparagus	10.0%	0.20	0.20	0.20	10.00%
Beans, green	10.0%	0.20	0.20	0.20	10.00%
Cabbages and other brassicas	10.0%	0.20	0.20	0.20	10.00%
Carrots and turnips	10.0%	0.20	0.20	0.20	10.00%
Cauliflowers and broccoli	10.0%	0.20	0.20	0.20	10.00%
Chillies and peppers, green	10.0%	0.20	0.20	0.20	10.00%
Cucumbers and gherkins	10.0%	0.20	0.20	0.20	10.00%
Eggplants (aubergines)	10.0%	0.20	0.20	0.20	10.00%
Garlic	10.0%	0.20	0.20	0.20	10.00%
Leeks, other alliaceous vegetables	10.0%	0.20	0.20	0.20	10.00%
Lettuce and chicory	10.0%	0.20	0.20	0.20	10.00%
Maize, green	10.0%	0.20	0.20	0.20	10.00%
Mushrooms and truffles	10.0%	0.20	0.20	0.20	10.00%
Okra	10.0%	0.20	0.20	0.20	10.00%
Onions, dry	10.0%	0.20	0.20	0.20	10.00%
Onions, shallots, green	10.0%	0.20	0.20	0.20	10.00%
Peas, green	10.0%	0.20	0.20	0.20	10.00%
Pumpkins, squash and gourds	10.0%	0.20	0.20	0.20	10.00%
Spinach	10.0%	0.20	0.20	0.20	10.00%
String beans	10.0%	0.20	0.20	0.20	10.00%
Tomatoes	10.0%	0.20	0.20	0.20	10.00%
Vegetables, fresh nes	10.0%	0.20	0.20	0.20	10.00%
Vegetables, leguminous nes	10.0%	0.20	0.20	0.20	10.00%

Spice and luxury food:		0.20	0.20	0.20	
Anise, badian, fennel, coriander	90.0%	0.20	0.20	0.20	10.00%
Areca nuts	90.0%	0.20	0.20	0.20	10.00%

Spice and luxury food (next)					
Chicory roots	90.0%	0.20	0.20	0.20	10.00%
Chillies and peppers, dry	90.0%	0.20	0.20	0.20	10.00%
Cinnamon (canella)	90.0%	0.20	0.20	0.20	10.00%
Cloves	90.0%	0.20	0.20	0.20	10.00%
Cocoa, beans	90.0%	0.20	0.20	0.20	10.00%
Coffee, green	90.0%	0.20	0.20	0.20	10.00%
Ginger	90.0%	0.20	0.20	0.20	10.00%
Hops	90.0%	0.20	0.20	0.20	10.00%
Kola nuts	90.0%	0.20	0.20	0.20	10.00%
Maté	90.0%	0.20	0.20	0.20	10.00%
Nutmeg, mace and cardamoms	90.0%	0.20	0.20	0.20	10.00%
Pepper (piper spp.)	90.0%	0.20	0.20	0.20	10.00%
Peppermint	90.0%	0.20	0.20	0.20	10.00%
Pyrethrum, dried	90.0%	0.20	0.20	0.20	10.00%
Spices, nes	90.0%	0.20	0.20	0.20	10.00%
Tea	90.0%	0.20	0.20	0.20	10.00%
Tea nes	90.0%	0.20	0.20	0.20	10.00%
Tobacco, unmanufactured	90.0%	0.20	0.20	0.20	10.00%
Vanilla	90.0%	0.20	0.20	0.20	10.00%

Fodder crops:		0.00	0.00	0.00	
Beets for fodder	15.0%	0.00	0.00	0.00	100.00%
Cabbage for fodder	15.0%	0.00	0.00	0.00	100.00%
Carrots for fodder	15.0%	0.00	0.00	0.00	100.00%
Forage and silage, alfalfa	30.0%	0.00	0.00	0.00	100.00%
Forage and silage, clover	30.0%	0.00	0.00	0.00	100.00%
Forage and silage, grasses nes	30.0%	0.00	0.00	0.00	100.00%
Forage and silage, green oilseeds	30.0%	0.00	0.00	0.00	100.00%
Forage and silage, legumes	30.0%	0.00	0.00	0.00	100.00%
Forage and silage, maize	30.0%	0.00	0.00	0.00	100.00%
Forage and silage, rye grass	30.0%	0.00	0.00	0.00	100.00%
Forage and silage, sorghum	30.0%	0.00	0.00	0.00	100.00%
Forage products	15.0%	0.00	0.00	0.00	100.00%
Pumpkins for Fodder	15.0%	0.00	0.00	0.00	100.00%
Swedes for fodder	15.0%	0.00	0.00	0.00	100.00%
Turnips for fodder	15.0%	0.00	0.00	0.00	100.00%
Vegetables and roots fodder	15.0%	0.00	0.00	0.00	100.00%

Sugar crops:					
Sugar beet	24.0%	0.54	0.54	0.56	50.00%
Sugar cane	27.0%	0.67	0.67	0.67	50.00%

Sugar crops (next)					
Sugar crops, nes	25.5%	0.61	0.61	0.62	50.00%

Natural rubber:					
Rubber, natural	90.0%	0.20	0.20	0.20	0.00%

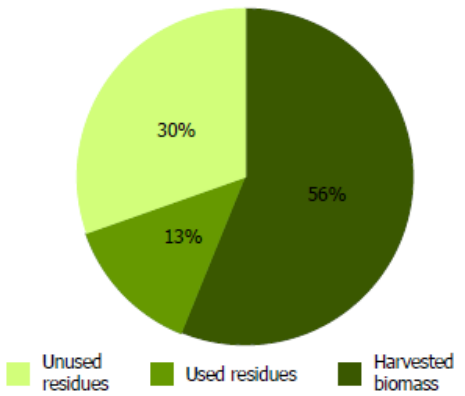
Totals:	5.32

Annex 2: Example of dynamic DataM report on agricultural biomass production

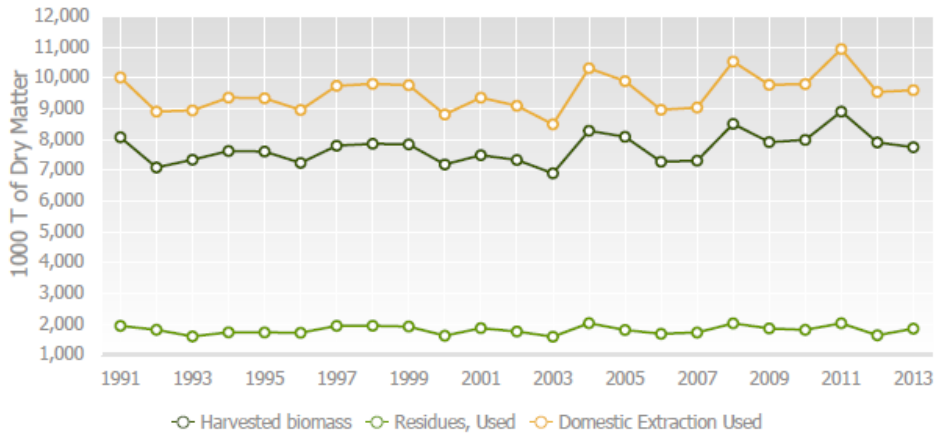
This report is considered dynamic because the user can select the country and year of his choice and the report is automatically regenerated according to this selection

Agricultural biomass production and uses in Austria

Agricultural biomass produced in 2013, in Austria (1000 T dry matter)

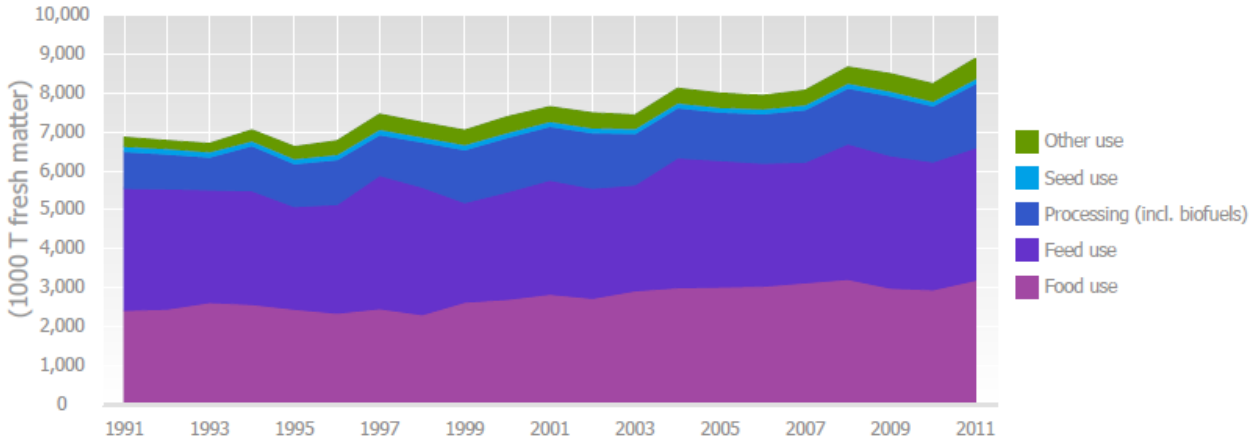


Evolution of the Domestic Extraction Used Biomass in Austria (1000 T dry matter)



Source: DataM, provided by the European Commission /Joint Research Centre. Data accessed on 30/04/2015. Elaboration based on original data coming from: DataM - Biomass Estimates

Agricultural biomass uses in Austria (1991-2011): Food, Feed, Processing, Seed and Other



Source: DataM, provided by the European Commission /Joint Research Centre. Data accessed on 30/04/2015. Elaboration based on original data coming from: FAO Food Balance Sheets

Annex 3: List of commodities covered by DataM – Biomass estimates (v3)

Underlined are the commodities mapped to DataM's common dictionary

Agricultural crops, total

Total cereals incl. rice
- Barley
- Buckwheat
- Canary seed
- Cereals, nes
- Mixed grain
- Maize
- Millet
- Oats
- Rice, paddy
- Rye
- Sorghum
- Triticale
- Wheat

Fibre Crops
- Flax fibre and tow
- Hemp Tow waste
- Lint cotton

Total fruits
- Apples
- Apricots
- Avocados
- Bananas
- Berries Nes
- Blueberries
- Carobs
- Citrus fruit, nes
- Cherries
- Cranberries
- Currants
- Dates
- Fruit Fresh Nes
- Fruit, tropical fresh nes
- Gooseberries
- Grapefruit (inc. pomelos)
- Grapes
- Kiwi fruit
- Lemon and limes
- Oranges
- Peaches and nectarines
- Pears
- Persimmons
- Pineapples
- Plums and sloes
- Quinces
- Raspberries
- Strawberries
- Stone fruit, nes
- Other melons (inc. cantaloupes)
- Tangerines, mandarins, clem.
- Watermelons

Total Oilseeds
- Castor oil seed
- Groundnuts, with shell
- Hempseed
- Linseed
- Melonseed
- Mustard seed
- Oilseeds, Nes
- Poppy seed
- Rapeseeds
- Safflower seed
- Soybeans
- Sunflower seed
- Cotton seed

Olives

Protein crops
- Beans, dry
- Broad beans, horse beans, dry
- Chick peas
- Cow peas, dry
- Lentils
- Lupins
- Peas, dry
- Pulses, nes
- Vetches

Starchy roots
- Potatoes
- Roots and Tubers, nes
- Sweet potatoes
- Taro (cocoyam)
- yams

Treenuts
- Almonds, with shell
- Chestnuts
- Hazelnuts, with shell
- Nuts, nes
- Pistachios
- Walnuts, with shell

Total Vegetables
- Artichokes
- Asparagus
- Beans, green
- Cabbages and other brassicas
- Carrots and turnips
- Cauliflowers and broccoli
- Chillies and peppers, green
- Cucumber and gherkins
- Eggplants (aubergines)
- Garlic
- Leeks, other alliaceous veg
- Leguminous vegetables, nes
- Lettuce and chicory
- Maize, green
- Mushrooms and truffles
- Okra
- Onions (inc. shallots), green
- Onions dry
- Peas, green
- Pumpkins, squash and gourds
- Spinach
- String beans
- Tomatoes
- Vegetables fresh nes

Other crops
- Anise, badian, fennel, corian.
- Chicory roots
- Chillies and peppers, dry
- Coffee, green
- Hops
- Peppermint
- Pyrethrum, dried
- Spices, nes
- Tea
- Tobacco, unmanufactured

Sugar crops
- Sugar beet
- Sugar cane

Fodder crops
- Beets for fodder
- Cabbage for fodder
- Carrots for fodder
- Forage and silage, alfafa
- Forage and silage, clover
- Forage and silage, grasses nes
- Forage and silage, green oilseed
- Forage and silage, legumes
- Forage and silage, maize
- Forage and silage, rye grass
- Forage and silage, sorghum
- Forage products
- Pumpkin for fodder
- Swedes for fodder
- Turnips for fodder
- Vegetables and roots fodder

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