Mapping the soy supply chain in Europe

A research paper prepared for WNF

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Summary

Most consumers and even some companies are not aware of how much soy is embedded in products they sell and consume, WWF wants to raise awareness of the soy issue with both companies and consumers in Europe. This research aims to provide the necessary underlying data, including basic data on soy production and trade worldwide, as well as detailed data on soy use in the EU-28 in 2013.

The global soybean harvest reached a volume of 284 million tonnes in the harvest season 2013/2014. This corresponds with a total area of 113 million hectares. Over 80% of all soy produced globally originates from the United States, Brazil and Argentina combined. Global exports of soybeans, soybean meal and soy oil amounted to 182 million tonnes in 2013/2014. Largest exporting countries are Brazil, the United States and Argentina. Global imports of soybeans, soybean meal and soy oil amounted to 178 million tonnes in 2013/2014. Largest importing countries/regions are China, the EU-28 and the other Asian countries.

The total net soy consumption worldwide amounted to 280 million tonnes in the harvest season 2013/2014. The EU-28 countries consumed 31.6 million tonnes of soy in the harvest season 2013/2014. Net consumption of soy in the season 2013/2014 was highest in Germany, Spain and France. Together these countries consume 39% of the total net soy consumption in the EU-28.

The estimated EU-28 feedstock consumption volume in 2013 amounted to 245.4 million tonnes. The total use of soy in livestock feed amounted to 31 million tonnes, composed of 28.7 tonnes of soy meal, 1.2 million tonnes of soy oil and 1.1 million tonnes of soybeans.

The soy content per kilogram of livestock product (in retail weight) is highest for broilers (1,089 grams per kg), farmed fish (738 grams per kg), pork (508 grams per kg) and beef (456 grams per kg).

An average EU-28-citizen roughly consumes 53 kg of pork, poultry and beef (in retail weight), 214 eggs, 134 kg of dairy products and 3 kg of farmed fish (in retail weight) per year. This corresponds to a daily intake of about 146 grams of meat, half an egg, 367 grams of dairy products and 8 grams of farmed fish.

The embedded soy consumption in the EU-28 amounts to 30.7 million tonnes of soy products. This is equivalent to 26.6 million tonnes of soybean equivalent (sbe) and required 10 million hectares of farm land. This area is roughly equivalent to the surface area of Iceland. The total soy use per capita amounts to 60.6 kg of soy products. This is equivalent to 53 kg of soybeans (sbe) and required 197 m^2 of farm land. This equals the size of a tennis court.

Embedded soy consumption is largest for chicken breast. Other iconic products containing a high amount of embedded soy are hamburgers, pork chops and salmon steaks.

Introduction

Most consumers and even some companies are not aware of how much soy is embedded in products they sell and consume, WWF wants to raise awareness of the soy issue among both companies and consumers in Europe. This will be done by publishing an infographic illustrating the soy footprint of the average European consumer that impacts on some of the world's most valuable forests and other habitats in South America. This research aims to provide the necessary underlying data, including basic data on soy production and trade worldwide, as well as detailed data on soy use in the EU-28 in 2013.

A summary of the findings of this report can be found on the first pages of this report.

Chapter 1 Soy production and consumption

1.1 Global production and consumption

The global soybean harvest reached a volume of 284 million tonnes in the harvest season 2013/2014 (see Table 1). This corresponds with a total area of 113 million hectares. Over 80% of all soy produced globally originates from the United States, Brazil and Argentina combined. The EU-28 countries produced 1.2 million tonnes in the harvest season 2013/2014.[1]

Table 1 Soy production per country/region in 2013/2014

Producing country / region	Harvest (1,000 tonnes)	Area used (1,000 hectares)
Brazil	86,700	30,100
Argentina	54,000	19,800
Paraguay	8,200	3,200
Bolivia	2,400	1,000
Rest of Latin America	4,013	1,700
United States	91,389	30,859
Canada	5,359	1,860
EU-28	1,229	469
Ukraine	2,774	1,351
Russia	1,636	1,202
India	9,500	12,200
China	12,200	6,850
Indonesia	650	450
Japan	198	127
Vietnam	168	117
South Korea	154	80
Thailand	64	40
Rest of Asia	746	401
Africa	1,884	1,265
Other countries	524	202
Total	**283,788**	**113,273**

Source: *USDA Foreign Agriculture Service*, "Production, supply and distribution online", Website USDA Foreign Agriculture Service (apps.fas.usda.gov/psdonline/psdQuery.aspx), viewed in April 2015.

Table 2 provides an overview of the soy production volume and area used in the 20 years from season 1993/94 until season 2013/14. During this period of time, a production increase of 141% can be observed, while the surface area required increased by 88%. Besides a massive increase in soy production over this period of time, this also illustrates a significant increase in productivity.[2]

Table 2 Development of production volume and area, 1993/94 until 2013/14

	1,000 tonnes	1,000 hectares
1993/94	117,582	60,258
1998/99	159,826	71,299
2003/04	186,776	88,583
2008/09	211,884	96,533
2013/14	283,788	113,273
Increase 1993/94 until 2013/14	**141%**	**88%**

Source: USDA Foreign Agriculture Service, "Production, supply and distribution online", *Website USDA Foreign Agriculture Service (apps.fas.usda.gov/psdonline/psdQuery.aspx)*, viewed in April 2015.

Global exports of soybeans, soybean meal and soy oil amounted to 182 million tonnes in 2013/2014 (Table 3). Largest exporting countries are Brazil, the United States and Argentina. The EU-28 countries exported 1.1 million tonnes of soybeans, soybean meal and soy oil in the harvest season 2013/2014.[3]

Table 3 Soy exports per country/region in 2013/2014

	Export (1,000 tonnes)			
Exporting country / region	Soybeans	Soybean meal	Soy oil	Total
Brazil	46,829	13,948	1,378	62,155
Argentina	7,842	24,972	4,087	36,901
Paraguay	4,800	2,450	630	7,880
Bolivia	120	1,530	315	1,965
Rest of Latin America	3,343	27	45	3,415
United States	44,815	10,478	851	56,144
Canada	3,471	241	92	3,804
EU-28	55	310	771	1,136
Ukraine	1,260	87	118	1,465
Russia	24	491	332	847
India	183	2,742	1	2,926
China	215	2,017	94	2,326
Indonesia	1	0	0	1
Japan	0	0	0	0
Vietnam	0	25	92	117

	Export (1,000 tonnes)			
South Korea	0	179	6	185
Thailand	6	0	43	49
Rest of Asia	30	184	193	407
Africa	9	64	216	289
Other countries	32	277	102	411
Total	**113,035**	**60,022**	**9,366**	**182,423**

Source: USDA Foreign Agriculture Service, "Production, supply and distribution online", *Website USDA Foreign Agriculture Service (apps.fas.usda.gov/psdonline/psdQuery.aspx)*, viewed in April 2015.

Global imports of soybeans, soybean meal and soy oil amounted to 178 million tonnes in 2013/2014 (Table 4).[a] Largest importing countries/regions are China, the EU-28 and other Asian countries. The EU-28 countries imported 31.5 million tonnes of soybeans, soybean meal and soy oil in the harvest season 2013/2014.[4]

Table 4 Soy imports per country/region in 2013/2014

	Import (1,000 tonnes)			
Importing country / region	Soybeans	Soybean meal	Soy oil	Total
Brazil	605	25	0	630
Argentina	1	0	9	10
Paraguay	7	5	5	17
Bolivia	6	0	10	16
Rest of Latin America	5,196	7,807	1,921	14,924
United States	1,951	305	75	2,331
Canada	340	982	31	1,353
EU-28	12,985	18,175	325	31,485
Ukraine	3	3	0	6
Russia	1,931	527	4	2,462
India	4	7	1,830	1,841
China	70,364	20	1,353	71,737
Indonesia	2,241	3,983	25	6,249
Japan	2,894	1,976	16	4,886
Vietnam	1,415	3,342	80	4,837
Thailand	1,798	2,665	6	4,469
South Korea	1,271	1,825	278	3,374

[a] The difference between total global exports and imports of about 4 million tonnes is attributable to slight differences between the volumes reported by importing countries and the volumes reported by exporting countries.

	Import (1,000 tonnes)			
Rest of Asia	5,831	10,519	1,512	17,862
Africa	1,961	3,876	1,824	7,661
Other countries	447	1,800	50	2,297
Total	**111,251**	**57,842**	**9,354**	**178,447**

Source: USDA Foreign Agriculture Service, "Production, supply and distribution online", *Website USDA Foreign Agriculture Service (apps.fas.usda.gov/psdonline/psdQuery.aspx)*, viewed in April 2015.

Table 5 shows the net soy consumption resulting from adding production and import figures from the tables above and subtracting the export figures. Total global soy consumption amounted to 280 million tonnes in the harvest season 2013/2014. The EU-28 countries consumed 31.6 million tonnes of soy in the harvest season 2013/2014.

Table 5 Net soy consumption per country/region in 2013/2014*

Country / region	Consumption (1,000 tonnes)
Brazil	25,175
Argentina	17,109
Paraguay	337
Bolivia	451
Rest of Latin America	15,522
United States	37,576
Canada	2,908
EU-28	31,578
Ukraine	1,315
Russia	3,251
India	8,415
China	81,611
Indonesia	6,898
Japan	5,084
Vietnam	4,888
South Korea	3,343
Thailand	4,484
Rest of Asia	18,201
Africa	9,256
Other countries	2,410
Total	**279,812**

* Net consumption figures include stocks. This may overstate consumption data of the soy producing countries;
Source: Net consumption = total production - total exports + total imports.

1.2 Production and consumption in top-3 soy consuming countries of the EU-28

In this paragraph we focus on the three largest soy consumers among the member states of the EU. Net consumption of soy in the season 2013/2014 was highest in Germany, Spain and France (see Table 9). Together these countries consume 39% of the total net soy consumption in the EU-28.

Soy imports are shown in Table 6, soy production of the top-3 EU-countries is shown in Table 7 and soy exports are shown in Table 8. Note that Italy, Romania and Croatia are the largest soy producing member states of the EU-28. Italy produced 690,000 tonnes of soybeans harvested in 2013/2014, Romania 151,000 tonnes and Croatia 125,000 tonnes. However, because of the focus on soy consumption rather than production, the production figures of Germany, Spain and France are shown in Table 7.[5]

Table 6 Soy imports of top-3 EU-countries in 2013/2014

	Import (1,000 tonnes)			
Importing country	**Soybeans**	**Soybean meal**	**Soyoil**	**Total**
Germany	3,637	2,965	128	6,730
Spain	3,393	1,416	38	4,847
France	526	3,083	98	3,707
Total	**7,557**	**7,464**	**264**	**15,284**

Source: *Eurostat database*, "EU trade since 1995 by HS6", online: http://ec.europa.eu/eurostat/data/database, viewed on 9 April 2015.

Table 7 Soy production in top-3 EU-countries in 2013/2014

Producing country	**Harvest (1,000 tonnes)**
Germany	2
Spain	1
France	113
Total	**116**

Source: ISTA Mielke (2014, May), *Oil World Annual 2014*, Hamburg: ISTA Mielke.*

* In paragraph 1.1 we used data from the USDA because it provides data in a consistent and transparent way. However, for details on individual EU-member states we have to use data from ISTA Mielke.

Domestic soy production in the major soy consuming countries in the EU only accounts for a minor share of the required soy, accounting 3% in France and less than 0.1% in Germany and Spain. For the EU28, own production accounts for 3.9% of consumption.

Table 8 Soy exports of top-3 EU-countries in 2013/2014

Exporting country	Export (1,000 tonnes)			
	Soybeans	Soybean meal	Soy oil	Total
Germany	23	1,466	322	1,811
Spain	19	461	652	1,132
France	19	103	48	170
Total	**60**	**2,030**	**1,023**	**3,113**

Source: *Eurostat database*, "EU trade since 1995 by HS6", online: http://ec.europa.eu/eurostat/data/database, viewed on 9 April 2015.

Table 9 Net soy consumption in top-3 EU-countries in 2013/2014

Country	Consumption (1,000 tonnes)
Germany	4,921
Spain	3,716
France	3,537
Total	**12,174**

Source: Net consumption = total production - total exports + total imports.

Chapter 2 Direct soy use in the EU-28

2.1 Soy imports in the EU-28 by country of origin

Table 10 shows the soy imports in the EU-28 by country of origin in 2013. Most soy originates from Brazil, Argentina and the United States. The slight difference in overall imports into the EU-28 compared to Table 4 is due to different time tables (calendar year versus marketing year) used by the different statistical sources.[6]

Table 10 Soy imports in the EU-28 by country/region of origin in 2013

Country / region of origin	Import (1,000 tonnes)			
	Soybeans*	Soybean meal	Soy oil	Total
Brazil	5,800	8,784	24	14,608
Argentina	250	8,083	25	8,358
Paraguay	2,000	209	25	2,234
Bolivia	110	22	0	132
Rest of Latin America	620	0	0	620
United States	3,300	1,545	7	4,852
Canada	1,150	62	0	1,212
Ukraine	600	17	44	661
Russia	0	137	90	227
India	0	477	0	477
Other countries	107	312	107	526
Total	**13,937**	**19,648**	**322**	**33,907**

Source: ISTA Mielke (2014, May), *Oil World Annual 2014*, Hamburg: ISTA Mielke.

* Imports of oilseeds based on season September 2013 to August 2014 (forecast).

2.2 Soy exports from the EU-28 by country of destination

Table 11 shows the soy exports from the EU-28 by country of destination in 2013. Most soy exports from the EU-28 are destined for Algeria, South Africa, Morocco and other African countries. Overall it can be observed that the vast majority of soy imported into the EU-28 was also consumed by the member states, only a small share is exported to extra-EU countries.[7]

Table 11 Soy exports from the EU-28 by country/region of destination in 2013

Country / region of destination	Export (1,000 tonnes)			
	Soybeans*	Soybean meal	Soy oil	Total
Switzerland		47	4	51
Russia		72	2	74
Turkey		121	0	121
Iran		0	75	75
Algeria		0	297	297
Morocco		0	141	141
South Africa		0	145	145
Tunisia		0	54	54
Angola		0	45	45
Other countries		175	121	296
Total	**51**	**415**	**884**	**1,350**

Source: ISTA Mielke (2014, May), *Oil World Annual 2014*, Hamburg: ISTA Mielke.

* Exports of soy oilseeds from the EU-28 amount to only 51 tonnes in 2013. This is not differentiated by country of destination.

2.3 Total direct soy use in the EU-28

In total, 33.9 million tonnes of soybeans and -products were imported into the EU-28 in 2013. After crushing part of the beans and exporting of part of the soy-products, 0.7 million tonnes of beans, 30 million tonnes of soy meal and 2.4 million tonnes of oil were available in the EU-28 for further use (see Table 12).[8]

Table 12 Soy available for use in the EU-28 (2013, in 1,000 tonnes)

Soy products (1,000 tonnes)	Import	Crushing	Result of crushing	Export	Losses & changes in stock	Available for use in the EU-28
Beans	13,937	13,226	-	51	-55	660
Meal	19,648	-	10,756	415	-	29,989
Oil	322	-	2,525	884	-484	2,447
Total	**33,907**	**13,226**	**13,281**	**1,350**	**-539**	**33,096**

Source: ISTA Mielke (2014, May), *Oil World Annual 2014*, Hamburg: ISTA Mielke.

2.4 Total use of soy in livestock feed in the EU-28

According to the European Feed Manufacturers' Federation (FEFAC), the amount of livestock feed produced in the EU-28 reached 155 million tonnes in 2013. The production figures are broken down for different types of compound feed. Due to the fact that not all EU member states report all different types of compound feed, we had to estimate the breakdown across the different types of compound feed based on the figures of individual member states that were available multiplied by total production per group of compound feed.[9]

Since the FEFAC does not provide information about compound feed for farmed fish we had to estimate this figure based on other information. Because of the lack of sound statistical information on fish feed we had to use very rough estimates based on total production of farmed fish. We know that on average 0.3 kg of fish is needed to produce 1 kg of farmed fish.[10] Based on this, we estimated the share of fish in compound feed for farmed fish at 312,000 tonnes. From another source we know that this represents about 27% of total compound feed for farmed fish.[11] Therefore, total compound feed used for farmed fish is estimated at 1.2 million tonnes. The soy content in this compound feed is estimated at 25.4% of soy protein concentrate.[12] One kilogram of soy protein concentrate is equivalent to 1.3 kilograms of soy meal, yielding a soy content in fish feed of 34%.[13] Because of the various assumptions and estimates needed to produce these figures, it is not possible within the scope of this study to further differentiate between different fish species, making the data on fish not generally applicable.

The agro-economic research centre LEI researched average shares of soybeans, -meal and -oil in different livestock feeds in the Netherlands for the years 2011 until 2013 based on a survey among key players in the industry.[14] Applying these average shares of soy products in different compound feeds as well as estimates for additional use of soybean meal as single feedstuff to the EU-28 production volumes of these feeds as reported by FEFAC, this results in an estimated consumption of about 17.9 million tonnes of soy products in the EU-28 compound feed industry in 2013, with soybean meal accounting for 16.6 million tonnes.

However, trade statistics point to a significantly (almost two times) higher consumption of soy products by the livestock industry. As there are no other relevant industries processing soybean meal, it can be assumed that all soybean meal available in the EU-28 is processed into livestock feed.

One possible explanation for the difference could be that extrapolating shares researched for the Netherlands may not correctly reflect the average situation across the EU-28 and soy content may be higher in animal feed in other member states. The figures from the Netherlands had to be used due to a lack of detailed figures on the average feed composition across the various EU-countries. These figures rely on data provided by players in the animal feed industry, which carries the risk that the average amounts of soy used in feeds may be somewhat different when looking at the overall market.
It will not be possible to find a complete explanation for the differences in the resulting amount of soy being consumed in the EU-28 within the scope of this study. However, higher soy contents in animal feed in other member states compared to the Netherlands might not be a problem for this study as long as the *interrelationship* between soy contents of different types of animal feed are comparable to the Netherlands. For example, in the Netherlands soy meal in feed for broilers is about three times higher than in feed for pigs. Assuming these interrelationships also apply to the EU-28 as a whole, it is possible to upscale total compound feed production for the EU-28 to provide a good estimate for amounts of soy in different types of livestock feeds.

This leads to the assumption that the volume of animal feed consumed in the EU-28 is actually higher than is indicated by the FEFAC figures. This would be a plausible explanation why the use of soybean meal for compound feed in the EU-28 is higher than suggested by the average soy percentages of LEI in combination with the EU-28 animal feed production volume. Therefore a multiplication factor for the animal feed production in the EU-28 is used for the purpose of this analysis.

To calculate the multiplication factor it is assumed that 98% of the remaining 13.4 million tonnes of soybean meal available in the EU-28 is processed in livestock feed or as single feedstuffs. With respect to soybeans we assume that 50% is used for livestock feed and 50% is used in food products. This process results in a multiplication factor of 1.73 for the amount of livestock feed consumed in the EU-28 in 2013, and thus an estimated EU-28 feedstock consumption volume in 2013 of 245.4 million tonnes (see Table 13).[15]

The soy content in feed differs between different livestock, depending on the specific needs of the animals. Generally, the soy share is highest in compound feeds for broilers and laying hens and farmed fish. Fluctuations in feed composition between years can, within certain boundaries, be influenced by availability and prices of protein crops like soy and rapeseed. See Table 13 for further information on the soy used in livestock feeds. Hulls used in feed are not being separately considered as their role as a commodity is negligible. In addition to the soy content in compound feeds, the use of soybean meal as single feedstuff has been considered. This is mostly relevant for pigs, dairy cows and laying hens.

Table 13 Soy in different livestock feeds in the EU-28 (2013)

Livestock feeds	Livestock feed production (1,000 mt)	Soy content (%)[a]			Soy product in livestock feed (1,000 mt)[b]			
		beans	meal	oil	beans	meal	oil	total
Pigs[c]	85,323	0.2	7.6	0.5	45	7,125	412	7,582
Dairy cows	47,698	0.0	9.9	0.2	23	4,794	103	4,920
Cattle[d]	28,021	0.0	7.6	0.1	5	2,130	20	2,155
Broilers	43,051	2.1	22.2	1.2	920	9,578	515	11,013
Laying hens	28,556	0.4	12.9	0.3	107	3,721	97	3,924
Other meat	10,788	0.0	6.2	0.3	0	673	30	704
Farmed fish	1,993	0.0	33.9	0.0	0	675	0	675
Total	**245,429**				**1,099**	**28,696**	**1,177**	**30,972**

[a] based on average shares for the years 2011 to 2013; [b] including soybean meal as single feedstuff; [c] based on relative soy shares in sow, piglet and fattening pigs feed; [d] including milk replacer and part of reported dairy feed attributable to young calves/old cows;

Source: Calculation by Profundo based on: Hoste, R., *LEI,* August 2014; FEFAC, “Industrial compound feed production 1989-2013”, *FEFAC*, June 2014; The Marine Ingredients Organization (n.d.), "How many kilos of feed fish does it take to produce one kilo of farmed fish, via fishmeal and fish oil in feed?", online: http://www.iffo.net/node/463, viewed in April 2015; Skretting Norway (2015, March 16), *Sustainability Report 2014*, p. 14; Belle Vie Global Trading Company (n.d.), "Soy Products", online: http://fi.bellevieglobal.com/our-business/food-ingredient/soy-products, viewed in April 2015.

Chapter 3 Embedded soy use for animal products in the EU-28

Table 14 shows the soy volume used per kilo of livestock product. This provides an estimate of the soy indirectly used for these products. It combines both the soy contents from Table 13 in Chapter 2 and the product volumes from Table 15 in Chapter 4.

Table 14 Soy content in livestock products in the EU-28 (2013)

Livestock product	Production volume	Milk kg per kg product	Soy product per unit				
			beans	meal	oil	Total (in carcass weight)	total (in retail weight)
	1,000 mt	kg	gr/kg	gr/kg	gr/kg	gr/kg	gr/kg
Beef	7,271		1	293	3	296	**456**
Pork	21,940		2	325	19	346	**508**
Broilers	11,494		80	833	45	958	**1,089**
Other meat	754		0	892	40	933	**1,436**
*Eggs**	111,142		1	33	1	35	**35**
Produced and processed milk	147,740		0	32	1	33	**33**
Consumption milk		1	0	32	1	33	**33**
Consumption milk products		1	0	17	0	17	**17**
Cheese		7	1	240	5	246	**246**
Butter		1	0	39	1	40	**40**
Condensed milk		2	0	71	2	73	**73**
Milk powder		9	1	303	7	311	**311**
Other dairy		1	0	32	1	33	**33**
Farmed fish	1,039		0	650	0	650	**738**

Source: see Table 13 and Table 15, own calculations, explained below the table.

* Eggs: production volume is expressed in million eggs, soy product per unit is expressed in grams per egg.

The calculations for meat are for the largest part based on carcass (slaughtering) weight. The difference between carcass and retail weight is important when calculating the amount of soy necessary for the production of a kilo of meat sold in the shop, as the retail weight required the production of a higher slaughtering weight.[b] The ratio depends on various factors such as the breed and the related meat percentage or the age of the animal.

[b] Carcass weight refers to the weight of an animal after being partially butchered, that is after bleeding and removal of intestines, organs, skin, head and inedible parts of tail and legs. Still included are the bones and other body structure. In poultry, skin, stomach, liver, heart and neck are counted in the slaughtered weight. The carcass weight is thus lower than the life weight, but higher than the retail weight, as trimming and deboning leads to a further weight reduction.

The average coefficients that can be applied to convert the carcass weight into retail weight are 0.65 for beef, 0.68 for pig meat and 0.75 for poultry meat cuts (for whole broilers a coefficient of 1 can be applied).[16] Retail weight of poultry is based on a coefficient of 0.88, which is the average of the coefficients of 0.75 for poultry meat cuts and 1 for whole broilers. The retail weight of other meat is based on the coefficient of 0.65 for beef. The consumption of 1 kg of meat purchased by a consumer (retail weight) thus requires the amount of soy used for the production (carcass weight) of 1.54 kilo of beef or veal, 1.47 kilo of pork or 1.33 kilo of poultry. For farmed fish we used a conversion factor of 0.88 from reported weight to edible weight. Because of a lack of sound statistical information on conversion factors for fish, this should be considered a very rough estimate.[17]

Chapter 4 Consumption of animal products and soy in the EU-28

4.1 Consumption of animal products in the EU-28

Table 15 shows the estimated consumption of animal products in the EU-28 based on production and net-export (export minus import) figures.[18]

Table 15 Production, net export and consumption of livestock products in the EU-28 (2013)

Product group	Production	Net-Export	Consumption (total, in slaughtered weight)	Consumption (total, in retail weight)
Cattle and meat (1,000 mt slaughtered weight)				
Cattle & beef	7,271	40	7,231	4,700
Pigs & pork	21,940	3,042	18,898	12,851
Poultry & -meat	11,494	766	10,729	9,441
Other meat	754	-140	894	581
Eggs & egg products (millions)	*111,142*	*2,818*	*108,324*	*108,324*
Dairy products (1,000 mt)				
Consumption milk	31,880	1,616	30,264	30,264
Consumption milk products	21,827	78	21,749	21,749
Cheese	9,240	712	8,528	8,528
Butter & butter oil	2,131	73	2,057	2,057
Condensed milk*	939	251	688	688
Milk powder*	2,037	776	1,261	1,261
Other dairy products	3,358	74	3,284	3,284
Farmed fish (1,000 mt)	*1,039*	*-719*	*1,758*	*1,547*

* Estimates for net exports based on CLAL figures.

Source: *Eurostat database*, "Slaughtering in slaughterhouses - annual data", online: http://ec.europa.eu/eurostat/data/database, viewed on 2 April 2015; *Eurostat database*, "EU trade since 1995 by HS6", online: http://ec.europa.eu/eurostat/data/database, viewed on 4 April 2015; *Eurostat database*, "Milk collection (all milks) and dairy products obtained - annual data", online: http://ec.europa.eu/eurostat/data/database, viewed on 2 April 2015; *Faostat database*, "Production - Livestock Primary - Eggs, hen, in shell (number) (2012)", online: http://faostat.fao.org/site/569/DesktopDefault.aspx?PageID=569#ancor, viewed on 7 April 2015; *Egginfo* (n.d.), "Egg sizes", online: http://www.egginfo.co.uk/egg-facts-and-figures/industry-information/egg-sizes, viewed on 6 April 2015; *Eurostat database*, "Production from aquaculture excluding hatcheries and nurseries (from 2008 onwards)", online: http://ec.europa.eu/eurostat/data/database, viewed on 2 April 2015; CLAL (n.d.), "European Union: Dairy sector", online: http://www.clal.it/en/?section=stat_ue15, viewed in April 2015.

Notes to the table:

- Condensed milk and milk powder are not reported as separate product groups in the trade figures of the Eurostat database. Estimates for EU-28 exports of condensed milk and skimmed and whole milk powder from another source have been used to account for trade in these products.
- Retail weight of poultry is based on a coefficient of 0.88, which is the average of the coefficients of 0.75 for poultry meat cuts and 1 for whole broilers.
- The product group 'Other meat' contains sheep and goat meat.
- Retail weight of the product group 'Other meat' is based on the coefficient of 0.65 for beef.

- Egg imports and exports are converted from tonnes to number of eggs based on average weight of 1 egg of 55 grams. Imports and exports of egg products are converted from tonnes to number of eggs based on average weight of 1 egg without a shell of 47.9 grams.
- Production of farmed fish in the EU-28 is based on figures of 2012. Import and export of farmed fish is estimated based on total imports and exports of all fish times the share of aquaculture in total fish production. As this is a very rough calculation, data for farmed fish are only a rough estimate.

Table 16 shows the estimated consumption per capita of animal products in the EU-28. On average, a EU28-citizen roughly consumes 53 kg of pork, poultry and beef (in retail weight), 214 eggs, 134 kg of dairy products and 3 kg of farmed fish (in retail weight) per year. This corresponds to a daily consumption of about 146 grams of meat, half an egg, 367 grams of dairy products and 8 grams of farmed fish.

Table 16 Per capita consumption of livestock products in the EU-28 (2013)

	Consumption (per capita, in slaughtered weight)	Consumption (per capita, in retail weight)
Cattle and meat (kg slaughtered / retail weight)		
Cattle & beef	14.3	9.3
Pigs & pork	37.3	25.4
Poultry & -meat	21.2	18.6
Other meat	1.8	1.1
Eggs & egg products (number of eggs)		*214*
Dairy products (kg)		
Consumption milk		59.7
Consumption milk products		42.9
Cheese		16.8
Butter & butter oil		4.1
Condensed milk		1.4
Milk powder		2.5
Other dairy products		6.5
Farmed fish (kg)	*3.5*	*3.1*

Source: input from Table 15; *Eurostat database*, "Population on 1 January by age and sex", online: http://ec.europa.eu/eurostat/data/database, viewed on 6 April 2015.

4.2 Consumption of embedded soy in the EU-28

Table 17 presents an overview on the estimated amount of soy needed for the EU-28 consumption of livestock products and other food products, and an indication on the amount of agricultural land needed to produce the soy for the EU-28 consumption. It combines both the soy product per unit from Table 14 in Chapter 3 and the consumption volumes from Table 15 in Chapter 4.

Appendix 1 and Appendix 2 contain more detailed explanations for the calculation of the average yield per hectare and the conversion to soybean equivalent.

Table 17 Embedded soy consumption in the EU-28 and the required land (2013)

Product (group)	Consumption (1,000 mt or million eggs)	Soy volume (1,000 mt)				Soybean equivalent (1,000 mt)	Land (1,000 hectares)
		beans	meal	oil	total		
Cattle and Meat					*19,787*	*16,178*	*6,064*
Beef & veal	7,231	5	2,118	20	2,143	1,646	617
Pork meat	18,898	38	6,137	355	6,530	5,342	2,002
Poultry meat	10,729	859	8,940	481	10,279	8,518	3,193
Other meat	894	0	798	36	834	671	252
Eggs and egg products	*108,324*	*104*	*3,626*	*94*	*3,825*	*3,025*	*1,134*
Dairy products					*4,111*	*3,213*	*1,204*
Consumption milk	30,264	5	982	21	1,008	787	295
Consumption milk-products	21,749	2	363	8	373	291	109
Cheese	8,528	10	2,043	44	2,097	1,638	614
Butter	2,057	0	81	2	83	65	24
Condensed milk	688	0	49	1	50	39	15
Milk powder	1,261	2	382	8	392	306	115
Other dairy	3,284	1	107	2	109	85	32
Farmed fish	*1,758*	*0*	*1,142*	*0*	*1,142*	*865*	*324*
Sub-total animal products		*1,025*	*26,768*	*1,072*	*28,865*	*23,281*	*8,726*
Other products					*1,857*	*3,355*	*1,257*
Food products from soybeans		92	0	0	92	92	34
Food products from soy oil		0	0	950	950	1,756	658
Biodiesel from soy oil		0	0	815	815	1,507	565
Total consumption		**1,117**	**26,768**	**2,837**	**30,722**	**26,635**	**9,984**

Source: input from Table 14, Table 15, Appendix 1 and Appendix 2 ; own calculations.

For the EU-28 consumption of livestock feed, food and other products in total 30.7 million tonnes of soy products were required. This is equivalent to 26.6 million tonnes of soybeans and required 10.0 million hectares of farm land.

Table 18 shows the per capita consumption of embedded soy in the EU-28. The total soy use per capita amounts to 60.6 kg of soy products. This is equivalent to 53 kg of soybeans and required 197 m^2 of farm land.[19]

Table 18 Per capita embedded soy consumption in the EU-28 and the required land (2013)

Product (group)	Total soy products (kg per capita, retail weight)	Soybean equivalent (kg per capita)	Land (m^2 per capita)
Cattle and Meat	*39.1*	*31.9*	*119.7*
Beef & veal	4.2	3.2	12.2
Pork meat	12.9	10.5	39.5
Poultry meat	20.3	16.8	63.0
Other meat	1.6	1.3	5.0
Eggs and egg products	*7.5*	*6.0*	*22.4*
Dairy products	*8.1*	*6.3*	*23.8*
Consumption milk	2.0	1.6	5.8
Consumption milk-products	0.7	0.6	2.2
Cheese	4.1	3.2	12.1
Butter	0.2	0.1	0.5
Condensed milk	0.1	0.1	0.3
Milk powder	0.8	0.6	2.3
Other dairy	0.2	0.2	0.6
Farmed fish	*2.3*	*1.7*	*6.4*
Sub-total animal products	*57.0*	*45.9*	*172.2*
Other products	*3.7*	*6.6*	*24.8*
Food products from soybeans	0.2	0.2	0.7
Food products from soy oil	1.9	3.5	13.0
Biodiesel from soy oil	1.6	3.0	11.1
Total consumption	**60.6**	**53.0**	**197.0**

Source: input from Table 17; *Eurostat database*, "Population on 1 January by age and sex", online: http://ec.europa.eu/eurostat/data/database, viewed on 6 April 2015.

4.3 Embedded soy consumption per iconic product

Table 19 shows the embedded soy consumption for several iconic livestock products. Embedded soy consumption is largest for chicken breast. Other iconic products containing a high amount of embedded soy are hamburgers, pork chops and salmon steaks.[20]

The embedded soy consumption for salmon steak is not based on input from Table 14 as is the case for the other iconic products. This is because of the lack of sound statistical data on production, imports and exports of farmed salmon in the EU-28. Instead we have made a rough estimate of soy use per 100 grams salmon steak based on the following calculation. According to Marine Harvest, 57 kg of farmed salmon in retail weight requires 100 kg of feed. Skretting Norway reports a percentage of soy protein concentrate in fish feed of 25.4%. This is equivalent to 33.9% of soy meal. This means that for producing 100 kg of fish feed 34 kg of soy meal is needed. Converting 57 kg of retail weight to a 100 grams salmon steak yields a soy use of 59 grams.[21]

Table 19 Embedded soy consumption per iconic product in the EU-28 (2013)

Product	Soy use per unit (in grams)
Hamburger (100 grams)	46
Pork chop (100 grams)	51
Pork sausage (50 grams)*	17
Chicken breast (100 grams) **	109
Egg (55 grams)	35
Cheese (100 grams)	25
Glass of milk (200 ml)	7
Bowl of yoghurt (200 ml)	3
Salmon steak (100 grams)	59

Source: input from Table 14, except for salmon steak which is based on the calculation as discussed in the accompanying text.

* Assuming a weight of 50 grams for a pork sausage containing 65% of pork meat. Source: Tesco, "Weight Watchers Premium Pork Sausages 400G", online: http://www.tesco.com/groceries/product/details/?id=264339116, viewed in April 2015.

** Based on the weight of an average serving of chicken breast. Source: Weight Loss Resources (n.d.), "9 Portion Size Mistakes That Are Easy to Avoid", online: http://www.weightlossresources.co.uk/calories/calorie_counter/chicken_meat.htm, viewed in April 2015.

Appendix 1 Yield per hectare

For the calculation of the soy cultivation surface that is necessary for the EU-28 imports the figures from Table 20 have been used.[22]

Table 20 Average yield per hectare in the period 2010/11 until 2012/13 in various production countries

Producer country	mt/ha
Canada	2.91
United States	2.81
Argentina*	2.49
Brazil	2.92
Paraguay*	2.30
Uruguay*	2.46
China*	1.79
India	1.03
Ukraine*	1.79
Other countries	1.66
Average productivity (weighted)	**2.67**

*(partly) based on estimates.

Source: ISTA Mielke (2014, May), *Oil World Annual 2014*, Hamburg: ISTA Mielke; own calculations.

In order to account for the fact that the EU is sourcing more than 90% of its soy from just five countries, the average yields in the different producing countries were weighted according to the share that the country has in soy imports to the EU-28. This results in an average soy yield of 2.67 tonnes per hectare.

Appendix 2 Calculation of soybean equivalents

The crushing of soybeans results in oil and meal. Both are traded on the world market and world market prices determine the sales for the grower, trader, crusher and other parties further up in the chain. Soymeal cannot be produced without producing oil at the same time and the other way around. As the income from both products are needed for the cultivation of soybeans to be profitable, a part of the surface on which soybeans are grown needs to be assigned to soymeal and a part to soy oil.

As soybeans are annual crops, soybean growers each year take a decision to grow soybeans or another crop. This decision is largely based on the expected financial yield from the soy crop, which is for 61% determined by the sales of soybean meal and for 39% by the expected sales of soybean oil (= sales volume x price). Therefore, we think the price should be included in the calculation of the agricultural land for soybean meal and soybean oil.

The alternative is to base this calculation solely on the weight of the products, which would mean that 1 tonne soymeal would equal 1 tonne soybeans and also that 1 tonne soy oil equals 1 tonne soybeans. However, this approach neglects the price differences between the two products. The incentive to produce more soybeans mostly is determined by the financial yield, which argues against a neglect of these price differences. The net value of soy production is thus determined by soymeal as well as soy oil, and by combining them according to their relative share in the weight of soybeans. Soybeans for human consumption, which were found to account for about 6% of the value, are unlikely to have an impact on a production decision. Hulls, which account for less than 1% of the value, can be neglected.

Table 21 Conversion to soybean equivalent, 2010/11-2012/13

Crushing	Soybean production (mln mt)	Soybean products (mln mt)	Crushing ratio	Price (in US$, average 2011-2013)	Value (US$ million)	%	Soybean equivalent (mt/mt)
Soybean production	257.2						
of which crushed	226.3						
Soybeans for food consumption		15.3		561	8,576	6.0%	1
Soybean meal		177.6	78.5%	474	84,121	59.5%	0.757
Soybean oil		41.9	18.5%	1,156	48,393	34.2%	1.849
Soybean hulls*		2.3	1.0%	175	396	0.3%	0.280
Total					**142,942**	**100%**	

* price estimate based on U.S. data for June 2014.

Source: USDA Foreign Agriculture Service, 'Production, supply and distribution online", *Website USDA Foreign Agriculture Service* (apps.fas.usda.gov/psdonline/psdQuery.aspx), viewed in June 2014; International Monetary Fund, "IMF Primary Commodity Prices", *Website International Monetary Fund* (www.imf.org/external/np/res/commod/index.aspx), viewed in June 2014; Hoste, R., LEI Wageningen UR, and information by Nicolaj, J. (IDH), July 2014.

Table 21 illustrates that in the years 2011-2013, on average 15.3 million tonnes of soybeans were used for human consumption. 226.3 million tonnes were crushed annually worldwide, resulting in 177.6 million tonnes of soymeal and 41.9 million tonnes of soy oil.[23] The crushing ratios are based on data reported by the USDA Agricultural Service for the key countries of origin of EU imports of soybeans and -meal: Argentina, Brazil, Canada, Paraguay, USA, and other countries. The ratios of these countries are weighted according to their contribution in volume. In addition, 2% losses during the crushing process have been considered. Assuming a division of one-third hi-pro (48% protein meal) and two-third low-pro soybean meal requested by the EU feed industry, the crushing of soybeans on average yields 78.5% soymeal and 18.5% soy oil. The remainders are hulls (1%) and waste.[24] Of the resulting oil, about 81% are destined for food consumption, while 18% are accounted for by industrial uses.[25]

As the market prices achieved for meal and oil are quite different, contribution of soybean meal and soybean oil to the total value of the global soybean industry is also different. 177.6 million tonnes of soybean meal has a value of US$ 84 billion and 42 million tonnes of soybean oil has a value of US$ 48 billion. One can therefore assume that the total value of soybeans for 34% is determined by the soy oil and for 59% by the soymeal produced.

In order to produce 1,000 tonnes of soymeal, 1,274 tonnes of soybeans are required (=1,000/0.785). Of the total value of this amount, 59.5% is determined by soymeal. We assume thus that of these 1,274 tonnes soybeans, 757 tonnes (59.5%) are exclusively used for the production of soymeal. For conversion purposes, 1,000 tonnes of soymeal are thus equal to 757 tonnes of soybeans.

In order to produce 1,000 tonnes of soy oil, 5,405 tonnes of soybeans (=1,000/0.185) are required. Of the total value of this amount, 34.2% is determined by soy oil. We assume thus that of these 5,263 tonnes of soybeans, 1,849 tonnes (34.2%) are exclusively used for the production of soy oil. For conversion purposes, 1,000 tonnes of soy oil are thus equal to 1,849 tonnes of soybeans.

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