

ENVIRONMENTAL- ECONOMIC ACCOUNTING

**Land use of food products of animal origin
2008 – 2015**



2018

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Abbreviations

BLE	=	Bundesanstalt für Landwirtschaft und Ernährung/ Federal Agency of Agriculture and Food
BMEL	=	Bundesministerium für Ernährung und Landwirtschaft/ Federal Ministry of Food and Agriculture
FAO	=	Food and Agriculture Organization of the United Nations
incl.	=	inclusive

Measures/Signs and Symbols

ha	=	hectares
t	=	tonnes
mn	=	million
%	=	per cent
%-pts.	=	percentage points
–	=	no figures or magnitude zero

Introduction

The livestock farming in Germany requires large areas of land at home and abroad for growing feed. Domestically, the cultivation of feed is competing with the cultivation of energy crops. Also often agricultural areas are converted into human settlements. The cultivation of other agricultural plants must be guaranteed for vegetable-based nutrition. Agricultural land is thus increasingly becoming a scarce resource.

In addition to the domestic use of land for growing feed land abroad is also used for imported feed, food products and primary agricultural products for the food industry. In this report, results are presented for total land use of domestic livestock farming and for domestic consumption of food products of animal origin for the period 2008 to 2015. This report is a revised version of the publication in 2017 due to an update of input data.

1 Calculation method

The calculation of land use for food products of animal origin is done in several steps, in which a variety of base data is used. In the first step the extent of the feed of domestic livestock is determined. The information on domestic production of feed was taken from the Statistical Yearbook of Food, Agriculture and Forestry of the Federal Ministry of Food and Agriculture (BMEL). The import and export of feed was determined on basis of information provided by the foreign trade statistics of the Federal Statistical Office (DESTATIS). The land use of domestic feed was calculated by using yield data from the agricultural statistics (harvest statistics). When calculating land use of imported feed, data were taken from the FAO database on harvest and planting area of agricultural commodities.

In a second step the calculated feed volume is attributed to the different types of animals. The information – feed use per animal species – was provided by the BMEL in the 2002 yearbook. This information has been updated, taking into account the changes of livestock and changing feed rations. The land use for the different types of livestock was determined by linking the volume of feed with land use coefficients for the national territory and the countries abroad.

Within the calculations there was made a distinction between the different types of land used – cropland or grassland. This distinction makes sense in view of the different scarcity of certain agricultural land and the different impacts of land used for cropland or grassland.

To analyse the land use of individual food products, in addition to the calculation of the annual land use of domestic livestock a calculation for products of animal origin was made. Within this calculation the land use of livestock was determined over its entire life span and allocated to the quantities of manufactured food products (meat, sausages, milk, cheese, eggs). Data on the quantities of meat and the production of milk and eggs were taken from the agricultural statistics and the production statistics of DESTATIS.

Land use coefficients for domestic production on the product level have been used in the calculation of land use of domestic consumption of food. Land use of imported products is added to land use of domestic production and land use of exported food is subtracted. While for exports domestic land use coefficients were applied, for imports from non-European countries, for example for meat imports from Argentina, coefficients from other sources were used. These are taking into account the specific conditions of local livestock. For imports of food from European countries, domestic coefficients were applied, due to a lack of special knowledge of local animal husbandry and feeding.

2 Results

2.1 Feed consumption of domestic livestock

In 2015, 131.8 million tonnes of feed was fed in domestic livestock farming. Of this, some 120 million tonnes or 91.3 % were of domestic cultivation and domestic production, 11.5 million tonnes (8.7 %) of imports. Compared to 2008, the total volume of feed has dropped by 3.7 %. Feed from domestic sources and from imports showed a completely different trend: while imports increased by 9.9 %, feed from domestic production on the other hand fell by 4.8 %.

Table 1 Feed consumption of domestic livestock by fodder categories and by origin

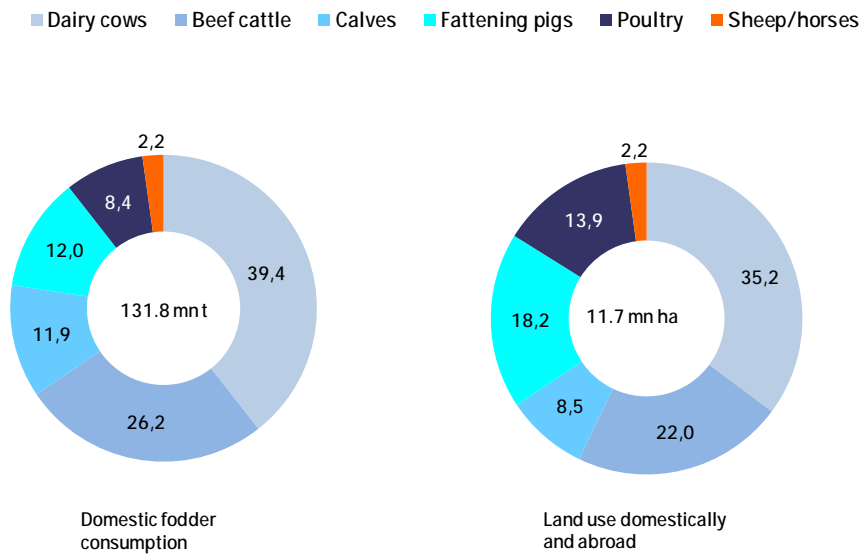
Fodder	2008	2015	2008	2015	2015 to 2008
	1,000 t		%		
Domestic production and imports					
Grain	22,952	24,143	16.8	18.3	5.2
Pulses	220	317	0.2	0.2	44.3
Concentrated feed	14,948	14,727	10.9	11.2	-1.5
Oil cake	7,776	8,166	5.7	6.2	5.0
Others	7,172	6,560	5.2	5.0	-8.5
Root crop	1,424	723	1.0	0.5	-49.2
Green fodder	91,815	86,175	67.1	65.4	-6.1
Maize	52,100	52,000	38.1	39.4	-0.2
Others	39,715	34,175	29.0	25.9	-13.9
Milk, straw	5,513	5,747	4.0	4.4	4.2
Total	136,871	131,831	100	100	-3.7
Thereof					
Domestic production	126,413	120,338	92.4	91.3	-4.8
Imports	10,458	11,493	7.6	8.7	9.9
<i>Thereof</i>					
Domestic production					
Grain	21,449	22,346	17.0	18.6	4.2
Pulses	166	218	0.1	0.2	31.3
Concentrated feed	6,239	5,374	4.9	4.5	-13.5
Root crop	1,424	723	1.1	0.6	-49.2
Green fodder	91,815	86,175	72.6	71.6	-6.1
Maize	52,100	52,000	41.2	43.2	-0.2
Others	39,715	34,175	31.4	28.4	-13.9
Milk, straw	5,320	5,502	4.2	4.6	3.4
Total	126,413	120,338	100	100	-4.8
Imports					
Grain	1,503	1,797	14.4	15.6	19.6
Pulses	54	99	0.5	0.9	84.1
Concentrated feed	8,709	9,352	83.3	81.4	7.4
Oil cake	6,669	6,948	63.8	60.5	4.2
Others	2,040	2,404	19.5	20.9	17.9
Milk	193	245	1.8	2.1	26.9
Total	10,458	11,493	100	100	9.9

2 Results

Besides the changes for pulses high increases were observed for cereals (+ 5.2 %) and oil cake (+ 5.0 %), while the volume of green fodder – that is the feed with the largest share in total feed volume – fell by 6.1 %. In domestic production fodder silage has a share of 43.2 %. Therefore it is the most important feed. In terms of imports, oil cake is the most important with a share of 60.5 %. Concentrated feed from abroad is in particular soybean and rape seed, which are processed domestically to oil cake or are already imported as cakes.

Most of the food was accounted for dairy cows (39.4 %), 26.2 % to beef cattle, 11.9 % to calves and 12.0 % to fattening pigs. Poultry had a share of 8.4 % of the total feed consumption, sheep and horses 2.2 % (see figure 1).

Figure 1 Feed consumption and land use of domestic livestock 2015 in %



2.2 Land used domestically and abroad for the cultivation of feed crops

In 2015 total agricultural land in Germany amounted to 16.7 million ha, which was 0.2 million ha less than in 2008 (16.9 million ha). In 2015, 55.8 % were used for the cultivation of fodder for domestic use. Compared to 2008 (56.7 %), the share declined slightly by 0.9 %. The share of agricultural land used for food purposes fell by 2.3 % from 5.0 million ha (29.6 %) in 2008 to 4.6 million ha (27.3 %) in 2015. This decline is mainly due to the increased cultivation of energy crops. This rose from 1.4 million ha in 2008 to 2.0 million ha in 2015. The share of energy crops on the land used thereby increased from 8.2 % in 2008 to 11.7 % in 2015.

2 Results

Table 2 Domestic agricultural land use by use categories

Use category	2008		2015		2015 to 2008	
	mn ha	%	mn ha	%	mn ha	%-pts.
Agricultural land use, total ¹	16.9	100	16.7	100	-0.2	-
Fodder	9.9	58.5	9.6	57.3	-0.3	-1.2
Domestic use	9.6	56.7	9.3	55.8	-0.3	-0.9
Food products ^{2,3}	5.0	29.6	4.6	27.3	-0.4	-2.3
Field crops	4.7	27.9	4.3	25.7	-0.4	-2.3
Vegetables ¹	0.1	0.7	0.1	0.7	0.0	0.0
Fruit plantations ¹	0.1	0.4	0.1	0.4	0.0	0.0
Vineyards ¹	0.1	0.6	0.1	0.6	0.0	0.0
Home and kitchen gardens ¹	0.0	0.0	0.0	0.0	0.0	0.0
Bio-energy ³	1.4	8.2	2.0	11.7	0.6	3.6
Industrial use	0.3	1.7	0.3	1.6	0.0	-0.2
Other land use ⁴	0.3	2.0	0.4	2.1	0.0	0.1

1 Subject-matter series 3 „Bodennutzung der Betriebe – landwirtschaftlich genutzte Flächen“, Series 3.1.2.

2 Including land for exported agricultural raw materials.

3 Without fuel wood and vegetable residuals.

4 Christmas tree cultures, unused permanent greenland, fallow land, setaside land.

To produce total feed for livestock an area of 11.7 million ha was used, of which 9.3 million ha originated from domestic use and 2.4 million ha from abroad. The land use by type of livestock showed a similar distribution as for the feed consumption. The land use of feed for cattle (cows, beef cattle and calves) is slightly lower compared to the shares in the feed volume. This is due to green fodder for beef cattle which exclusively comes from domestic cultivation. The feed for other animals – such as pigs and poultry – has a higher share of land use as the feed volume, since animal feed for pigs and poultry fodder is composed differently from feed for ruminants with a high share of concentrated feed. Concentrated feed from imports has a relatively high land footprint compared to other feed.

Table 3 Land use domestically and abroad by categories of feed in 1,000 ha

Fodder categories	2015			2008	2015 to 2008
	Inland	Imports	Total		in %
Total	9,331	2,409	11,740	11,806	-0.6
Grain ¹	4,396	391	4,788	4,541	5.4
Concentrated feed	386	2,018	2,404	2,502	-3.9
Green fodder	4,549	0	4,549	4,763	-4.5
Memorandum item:					
2008	9,601	2,205	11,806	-	-
2015 to 2008 in %	-2.8	9.3	-0.6	-	-

1 Inc. maize, pulses.

From total land used for feed (11.7 million ha), in 2015, 4.8 million ha, accounted for grain, 2.4 million ha for concentrated feed and 4.5 million ha for green fodder. In 2015, domestic land use was 9.3 million ha, land use abroad 2.4 million ha.

From total domestic land use 4.4 million ha accounted for cereals and 4.5 million ha for green fodder. For the cultivation of concentrated feed an area of 0.4 million ha was domestically occupied, in contrast to 2.0 million ha used abroad .

The total area used for feed was – despite lower feed volumes – almost constant. Domestic land use fell by 2.8 %, land use of imports increased by 9.3 %. The reason for this increase is – as described above – the increasing imports of oil cakes with a corresponding land use in the countries of origin. Compared to 2008, the total area under cultivation for fodder grain increased by 5.4 %, the area for concentrated feed decreased by 3.9 % and for green fodder by 4.5 %.

2.3 Land use for exports

Domestic land use is not only influenced by the origin of the feed but also from the volume of production. A higher demand for the products of animal origin has a medium and long term impact on the livestock and thus on the feeding. With regard to the demand it can be observed that for the period 2008 to 2015 exports were a key driver of the entire production of meat, sausage products and dairy products. Between 2008 and 2015 exports of meat rose by 20.3 % (see table 4), that of the sausages by 13.0 % and exports of dairy products increased by around 23.3 %. A high proportion of the amounts of feed and land use – at home and abroad – is therefore linked with export production.

The reported amounts of feed and land use in table 4 are related to the slaughtered animals in the reporting year. The figures reported here are – in the years observed – slightly less than the figures on feeding and livestock farming area of the total livestock.

Between 2008 and 2015 the entire amount of feed has fallen by 5.6 % , however the amount of feed that is attributable to exports has almost been constant (– 0.5 %). The exports affected much stronger the imports of feed than the feed quantities produced domestically: due to the high growth in exports of pork and poultry large quantities of feed had to be imported for their production. In 2015 these imports, linked to exports, increased by 18 %. Already 42.0 % of total feed was applied to the production of export products.

Regarding the land used for the production of feed nearly 5.2 million ha or 44.7 % of total land use are attributed to export production. Land use for exports increased by 4.0 % compared to 2008, while the total land use decreased (– 3.1 %).

2 Results

Table 4 Domestic production and exports of products of animal origin, volumes of feed and land use domestically and abroad

	Domestic production			Thereof exports				
	2008	2015	2015 to 2008	2008	2015	2015 to 2008	2008	2015
			%			%	in % of domestic production	
Domestic production of meat in 1,000 t								
Meat ¹	7,200	8,096	12.4	2,560	3,080	20.3	35.6	38.0
Beef	1,228	1,177	- 4.1	357	266	- 25.4	29.1	22.6
Pork	4,589	5,092	10.9	1,792	2,321	29.5	39.0	45.6
Poultry	1,341	1,796	33.9	405	488	20.4	30.2	27.2
Sheepmeat ...	41	31	- 24.1	6	5	- 19.9	14.2	15.0
Sausages	2,948	2,934	- 0.5	531	600	13.0	18.0	20.4
Dairy products ² ..	1,227	1,339	9.1	451	556	23.3	36.7	41.5
Eggs	730	793	8.6	105	151	43.8	14.4	19.0
Volume of feed in 1,000 t								
Total	133,220	125,767	- 5.6	53,052	52,810	- 0.5	39.8	42.0
Domestic production	122,310	113,964	- 6.8	48,273	47,167	- 2.3	39.5	41.4
Imports	10,910	11,803	8.2	4,779	5,643	18.1	43.8	47.8
in % of total								
Domestic production	91.8	90.6	- 1.2	91.0	89.3	- 1.7	-	-
Imports	8.2	9.4	1.2	9.9	10.7	1.7	-	-
Land use in 1,000 ha								
Total	12,066	11,691	- 3.1	5,027	5,229	4.0	41.7	44.7
Domestic production	9,715	9,161	- 5.7	4,005	4,026	0.5	41.2	43.9
Imports	2,351	2,530	7.6	1,022	1,204	17.8	43.5	47.6
in % of total								
Domestic production	80.5	78.4	- 2.2	79.7	77.0	- 2.7	-	-
Imports	19.5	21.6	2.2	20.3	23.0	2.7	-	-

1 Gross domestic production (weight of slaughtering acc. BLE, BMEL)

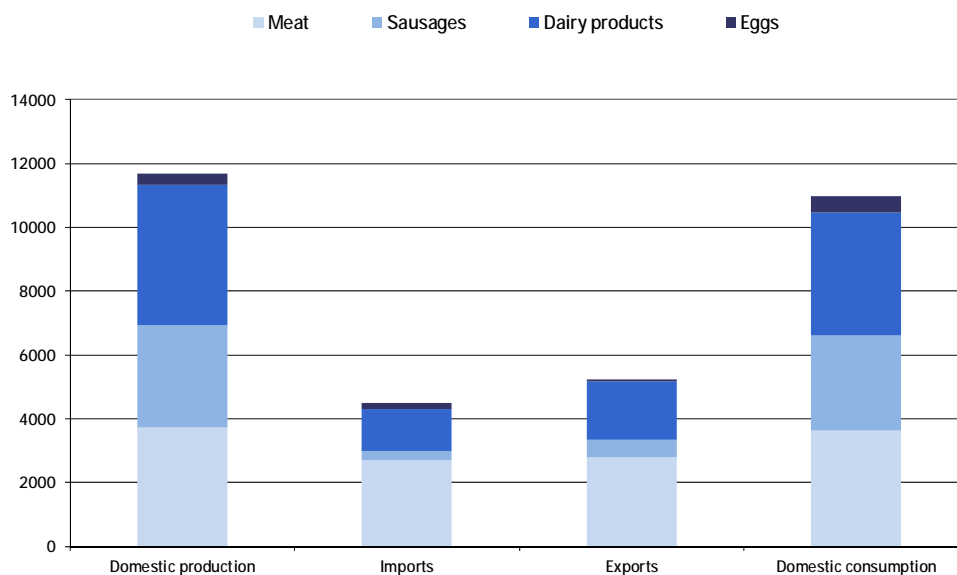
2 In milk fat units.

2.4 Land use of domestic consumption of food products

For determining the land requirements of domestic consumption of food, land use of domestic livestock farming and land required for the production of imported (finished) products abroad has to be considered as well as land use related to exported food products. For determining land use of domestic consumption, land use of imports and land use of domestic production have to be added whereas land use of exports has to be subtracted.

Land use of total domestic consumption amounted to 11.0 million ha in 2015, making it smaller than land use of domestic production. The difference is due to the bigger land use of exports (5.2 million ha) compared to imports (4.5 million ha). The highest proportion of land use of domestic consumption is related to meat and sausages with a share of more than 60 %, followed by dairy products (35.2 %) and eggs (4.7 %).

Figure 2 Land use for products of animal origin 2015
1,000 ha



The calculations allow the determination of land use footprints for individual food products such as beef, pork, milk or cheese. These land use footprints can also be related to nutritional values (caloric content) of the products, thus allowing comparisons between land use of different products of vegetable and animal origin and of different food styles.

2 Results

Table 5 Land use of selected products of vegetable and animal origin

Product	m ² /kg ¹	m ² /10 ³ kcal ²
Beef	30.3	12.5
Pork	6.5	2.8
Chicken	12.0	5.5
Lamb, goat meat	14.3	7.3
Milk	1.3	2.0
Butter	26.2	3.5
Cheese	8.5	2.6
Eggs	4.7	2.9
Potatos	0.2	0.2
Bread	2.4	1.2

1 Average value 2008 to 2015.

2 Conversion in kcal with information from www.kalorientabelle.net.