



EUROPE'S GLOBAL LAND DEMAND

A study on the actual land embodied in European imports and exports of agricultural and forestry products

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BACKGROUND

Finite natural resources, such as land, are receiving an increasing amount of attention from decision makers and the media. The debate, however, has not focused on the levels of consumption of land globally and how these are linked to the levels of consumption of certain countries.

This study aims to provide a robust picture of the direct and indirect land required to satisfy the final demand for agricultural and forestry products in Europe, also referred to as the land footprint or the actual land demand of countries. With this new research, the objective is to contribute to closing the knowledge gap and start a debate on the global impacts of the consumption levels of certain countries.

The report is divided into two main parts: a methodology section explains how the calculations were carried out and what the weaknesses of the data are; the second section of the report shows the results of the calculations by initially presenting an overview of the results through world maps and, subsequently, further investigating the results and analysing them in the context of a global trade balance.

METHODOLOGY

The study applies multi-regional input-output (MRIO) analysis to calculate the direct and indirect (embodied) land demand of products consumed in Europe. MRIO analysis is a methodology to assess the international environmental consequences of regional consumption activities. It combines economic data (i.e. data on the sectoral structure of economies linked via international trade data) with physical information (e.g. the global land use for the production of different commodities). The model captures the upstream impacts on global land use induced by a country's consumption of goods. This means that the amount of land used for the production of different goods is allocated to the country where the products are finally consumed. In this way, the extent to which a country's lifestyle is dependent on foreign land resources can be assessed, as can whether a reduction of domestic land use is merely a consequence of outsourcing production processes.

Data sources

SERI's global MRIO model is a multi-directional one, which includes all trade relations between the countries and regions in the model¹, extended by land use data. For constructing MRIO-based environmental accounting models, global harmonised sets of input-output (IO) tables and bilateral trade data are required, which were taken from the Global Trade Analysis Project (GTAP7, see Narayanan

¹ There are also uni-directional MRIO models. These are more appropriate for the analysis of single countries (see Lenzen et al. 2004; Munksgaard et al. 2009).

and Walmsley 2008), a data set covering 57 economic sectors for the years 1997 and 2004, and up to 113 countries and world regions, including all European Union (EU-27) Member States, the Organisation for Economic Co-operation and Development (OECD) countries, the major emerging economies, and a significant number of developing countries in Asia, Africa and Latin America. In GTAP, all countries not represented by a country model are grouped in regions (e.g. Rest of East Asia, Rest of South-East Asia). In line with data availability, the calculations in this study cover the two years 1997 and 2004, distinguishing 66 countries and regions for 1997, and 112 for 2004.

*Land use data
and categories*

This monetary model is then extended by land use data, which are provided by the Statistics Division of the UN Food and Agriculture Organisation (FAOSTAT 2011a). We can differentiate the three main types of land cover at a basic level as (a) arable land, (b) meadows and pastures, and (c) forest area. This model distinguishes ten land use types by further disaggregating type (a) according to the crops cultivated, resulting in the following ten model land use categories: (1) paddy rice; (2) wheat; (3) other cereal grains; (4) vegetables, fruit, nuts; (5) oil seeds; (6) sugar cane, sugar beet; (7) plant-based fibres; (8) other crops; (9) grazing areas; and (10) forestry areas.

For types (a) and (b), land use data for the categories “arable land and permanent crops” and “permanent meadows and pastures” were obtained from FAOSTAT (2011b). Category (a) was then disaggregated according to the land use types (1) to (8) in relation to the harvested areas per crop or group of crops reported by FAOSTAT (2011c), as illustrated in Table 1.

Table 1: Concordance of UN Food and Agriculture Organisation (FAO) and model land use categories

Nr.	Model land use category	FAO land use category
1	Paddy rice	“Rice, paddy”
2	Wheat	“Wheat”
3	Other cereal grains	“Cereals, total” excluding “rice, paddy” and “wheat”
4	Vegetables, fruit, nuts	“Fruit excl melons, total”, “vegetable & melons, total”, “treenuts, total”, “potatoes” and “cassava”
5	Oil seeds	“Oilcrops primary” excluding “seed cotton” (which is included in “fibre crops primary”)
6	Sugar cane, sugar beet	“Sugar cane” and “sugar beet”
7	Plant-based fibres	“Fibre crops primary”
8	Other crops	“Crops primary” minus the sum of categories 1 to 7
9	Grazing areas	“Permanent meadows and pastures”

For type (c), land use data were obtained from the Global Forest Resource Assessment 2005 (FRA2005, see FAO 2005). Data were taken from tables 6 and 7 of the document, describing the total forest area of 229 countries and the respective shares of those areas used for production purposes². Furthermore, in cases where the share of the forest area used for production purposes is unknown, we used regional averages, distinguishing 12 world regions. Finally, we compared the obtained forestry areas and the reported amounts of wood products removed from these areas from table 17 of the FRA2005, and limited the productivity of the global forestry area to a range of 1 to 30 cubic metres per hectare. These corrected forestry areas for the year 2005 were then interpolated for the years 1997 and 2004 – according to the modelling years – using percentages of annual change from table 9 of the FRA2005.

Allocation

Before starting the calculations, each hectare needed to be allocated to the economic sector which makes direct use of it. Land use categories (1) to (8) are assigned to the corresponding economic sectors 1 to 8 of the model (please find a detailed GTAP sector listing in the Annex). Category (9), grazing areas, is split up and allocated to sectors 9, “Cattle”, and 10, “Other Animal Products”, in relation to their economic output. Category (10), forestry areas, is assigned to the economic sector 13, “Forestry”.

Unit of measurement

As productivity is not considered in the calculations, land is accounted for without weighting in actual hectares – a hectare of most fertile arable land equals a hectare of dry lands if reported as pastures. This implies that if a country’s land use per tonne of wheat is ten times higher than that of another country, ten times more land is allocated to the consumer of the wheat from this country. The model thus always represents the real land use occurring in the different countries, without performing any weighting with regard to different productivities, as the Ecological Footprint does.

Technical implementation

The model is based on the IO standard equation, extended by a land use vector

$$F = \hat{E}(I - A)^{-1}Y \quad (1)$$

where \hat{E} is a diagonal vector with each element on the principal diagonal representing the direct land use per unit industry output; A are the inter-industry requirements of globally produced products; Y is a 6384 x 112 matrix of final demand with element y_{ij} representing the final demand of country j for products from sector i (with 57 sectors * 112 countries); and I is the identity matrix. This approach is described in various publications (see, for example, Turner et al. 2007). The result, F , is a matrix of land consumption where each element f_{ij} represents a country’s direct and indirect consumption of land originating from sector i .

Total direct and indirect consumption of land in country c is thus

² Many forest areas have the primary function of protection, conservation or social services. These areas were excluded from this investigation.

$$f_c^{ALD} = \sum_{i=1}^{S \times C} f_{ic} \quad (2)$$

where S is the number of economic sectors and C is the number of countries and regions distinguished by the model (57 and 112, resp.). In other words, the sum of each column vector of the matrix F represents the actual land demand (ALD) of a country. Land embodied in exports of country c is defined as

$$f_c^e = \sum_{i=S*(c-1)+1}^{S*c} \sum_{j=1, j \neq c}^{112} f_{ij} \quad (3)$$

where j is unequal to c , as column c represents the domestically consumed land. The total land embodied in imports (LEI) of country c is defined as the difference of ALD deducting the portion of embodied land with domestic origin.

$$f_c^m = f_c^{ALD} - \sum_{i=S*(c-1)+1}^{S*c} f_{ic} \quad (4)$$

The trade balance (TB)

$$f_c^{TB} = f_c^m - f_c^e \quad (5)$$

is defined as the difference of imports minus exports and represents the net trade flows (net-imports or net-exports) of a country.

Model uncertainties

While being able to fully cover direct and indirect production requirements for an infinite number of upstream production stages, environmentally extended IO analysis suffers from uncertainties arising from the following sources: (1) reporting and sampling errors of basic data – both main data sources, GTAP and FAO, are subject to uncertainties of possibly substantial magnitude; (2) the proportionality assumption – monetary and physical flows originating from a sector are always in exactly the same proportion; (3) the aggregation of IO data over different regions – yields across a country's regions are assumed to be equal; and (4) the aggregation of IO data over different products (homogeneity assumption) – price-land use ratios across different crops supplied by one sector are assumed to be equal, while they may vary substantially.

However, it was shown that the overall uncertainties of IO-based assessments are usually lower than truncation errors in extensive process analyses up to the third order (Lenzen 2001).

Land use data uncertainties

Probably the most important source of uncertainties in this study arises from expected inconsistencies in the sampling and reporting of the underlying land use data. The FAO provides one of the most comprehensive sets of global land use data. These are collected in various ways: through (a) annual questionnaires; (b) electronic data transfers; (c) national/international publications; and (d) information gathered during country visits or provided by the local FAO representatives. However, the FAO acknowledges several shortcomings of the data it receives. Notably, these are incompletely reported variables, incomplete regional coverage, questionable reliability and inconsistent definitions (George and Nachtergaele 2002). The Statistics Division of the FAO endeavours to overcome these shortcomings. In order to perform an assessment of global land

footprints that satisfies the required degree of reliability, though, further efforts need to be made in order to examine and improve the underlying data. The present study needs to be considered against this background. However, most uncertainties are expected for some developing countries (see George and Nachtergaele 2002), while for developed countries the overall picture can be regarded as reliable.

Finally, it needs to be noted that if agriculture is practised in a non-commercial way, especially for self-subsistence, this is often not reflected by standard economic accounts. Such non-commercial agricultural land use – insofar as reported to the FAO – will not be attributed to the actual non-paying consumer, but rather to the customers of the statistically recorded commercial agricultural system. In other words, if farmers are primarily producing foodstuffs for feeding their families and are selling only a fraction of their overall production, the full land input of these self-sufficiency farms is allocated to the purchasers of their produce, not to the farmers that might consume most of the land themselves. Again, this may particularly affect developing countries with high rates of self-subsistence agriculture.

RESULTS

This section presents the key results from the model calculations. We start with two world maps showing the actual land demand (absolute and per capita) for all 112 countries and regions analysed. We then present rankings of the countries with the highest and lowest land demand (absolute and per capita), and compare consumption levels of land and biomass. This is followed by graphs focusing on the issue of international trade of embodied land, illustrating the net-trade flows from and to the EU-27, and highlighting the main importers and exporters of embodied land. Finally, we present selected data at the country level for Brazil, the USA and the UK.

WORLD MAPS

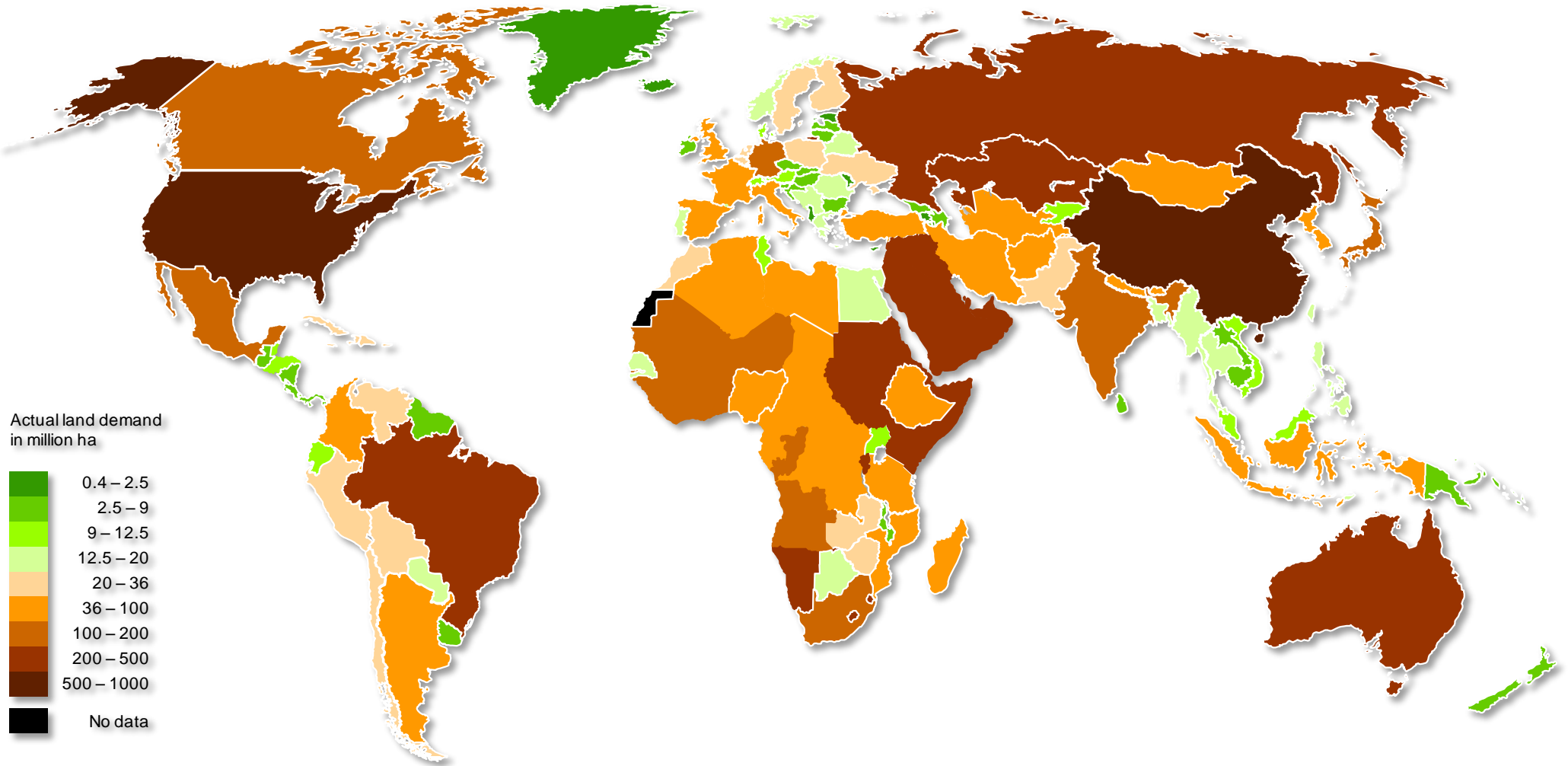
Overview of main results

The following world maps provide an overview of the main results. The actual land demand consists of the total direct and upstream land requirements for the satisfaction of a country's final demand, including domestically harvested land plus land embodied in imports. It describes a country's direct and indirect appropriation of land area all over the world.

First of all, we will examine the actual land demand of countries in 2004 in absolute numbers.

Figure 1 illustrates the actual land demand of the analysed countries and world regions in 2004 in million ha.

Figure 1: Actual land demand of countries and regions; 2004



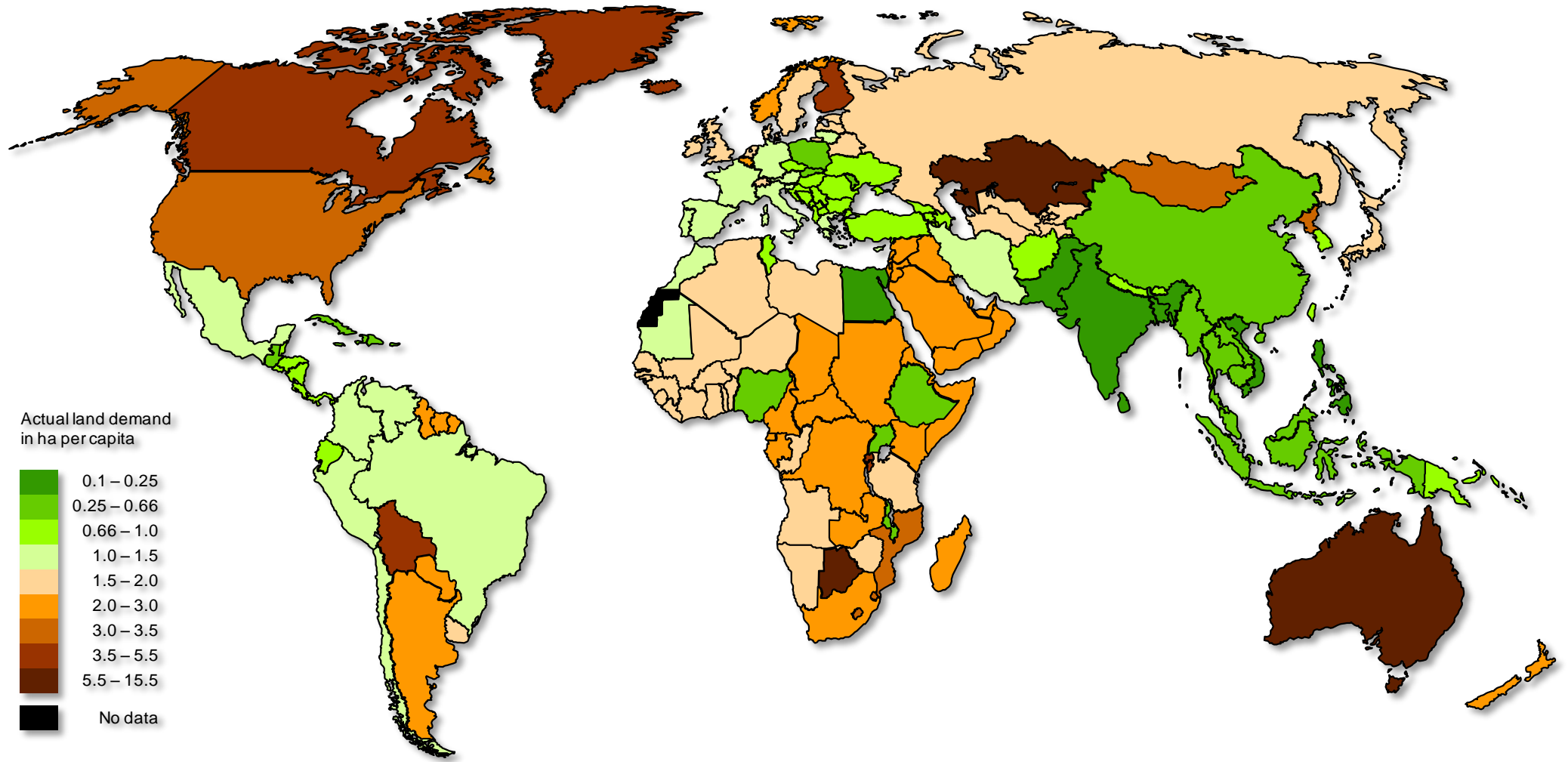
In absolute terms, high actual land demand can be observed not only in countries with high levels of consumption, but also in countries with an elevated population, such as China.

It needs to be highlighted that, due to the country and region classification of the model used, the world map above distinguishes only 93 countries and aggregates the rest of the world into 19 country groups – for example, the Rest of South Central Africa, comprising Angola and the Democratic Republic of the Congo. Therefore, Figure 1 describes the total demand of the respective country *or* region. However, the EU-27 countries are not affected by regional aggregation and are thus all depicted separately. A table that lists all country groups included in the model can be found in the Annex.

The following world map (Figure 2) illustrates the land consumption levels of individuals in 112 countries and regions. This per-capita perspective allows a better understanding of the individual responsibility for the global demand for land. It shows that a person living in China actually has a very low land demand in contrast with the relatively high land footprint of the country.

Figure 2 illustrates the actual land demand per capita in hectares for 2004 for the 112 countries and world regions the model captures.

Figure 2: Actual land demand per capita – world; 2004



High per-capita results, e.g. for Australia and Kazakhstan

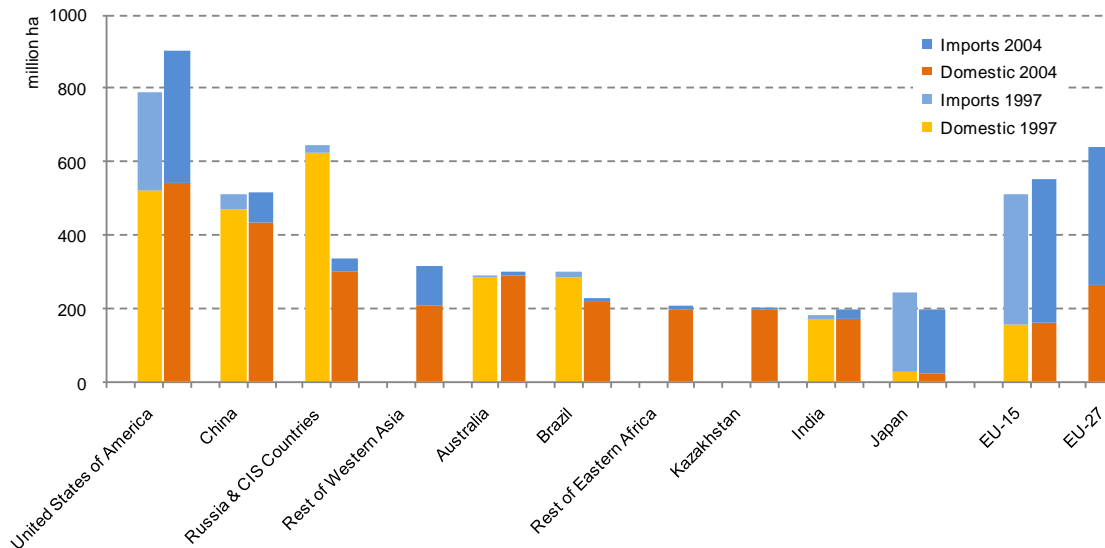
Average per-capita land demand is highest in Australia, Canada, the USA and the Scandinavian countries, but also in many African, Asian and Latin American countries.

It is important to emphasise once more that land area is calculated without considering differences in land use intensities. Therefore, the actual land demand may be higher for countries with very low land use intensities and consequent low land productivities compared to most European countries, where both land use intensities and land productivities are comparably high. Land use, therefore, does not necessarily correlate with the amount of biomass consumed, as will be shown later (see Figure 8).

GLOBAL PERSPECTIVE

To investigate the results further, we will examine some figures that illustrate more details for the countries with the highest actual land demand and for those with the lowest. Figure 3 illustrates the development of the actual land demand in the period from 1997 to 2004 for the ten countries with the highest demand in 2004. For comparison purposes we also include EU-15 and EU-27.

Figure 3: Actual land demand, top ten countries; 1997/2004



High import rates for the USA, Japan and the EU

Countries with very low land productivity dominated by grassy landscapes and savannahs which are often being farmed very extensively rank among the ten countries with the highest actual land demand. The United States of America, Japan and the EU stand out because of their high import rates – a common picture within highly industrialised countries tightly interconnected through international trade. Among the top ten countries, significant differences in the results can be observed: for instance, the USA uses 4.5 times more land than Japan. The EU-27 and the EU-15 rank between the USA and China. China and India are among the ten countries with the highest actual land demand in absolute numbers, whereas according

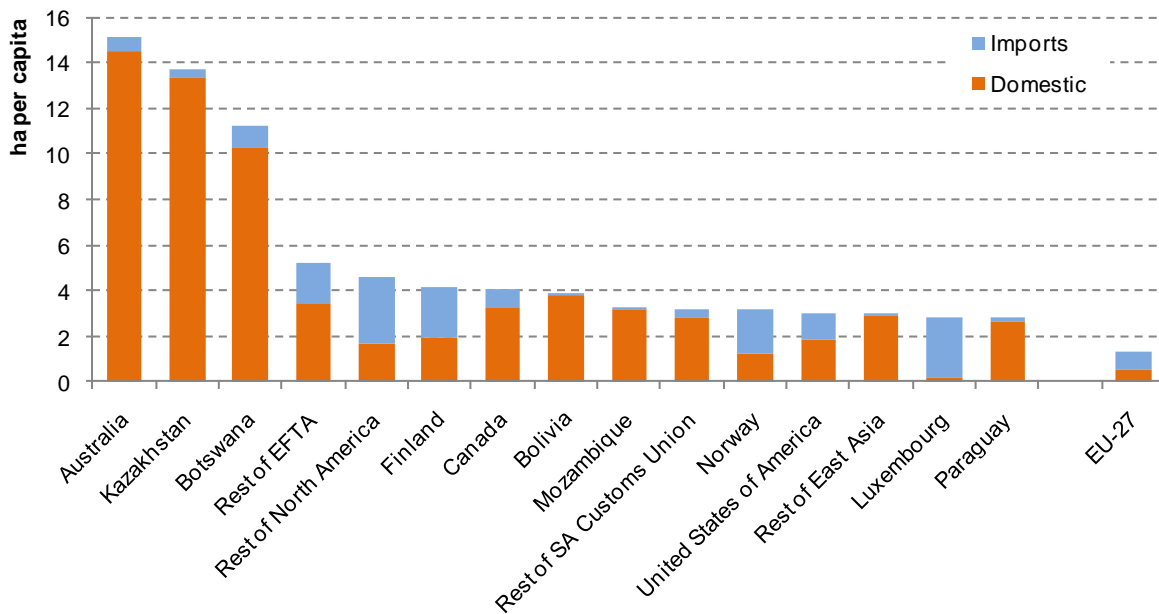
to a per-capita perspective they rank among the 11 lowest of all 112 countries and regions considered in the model (see Figure 5).

The USA: large increase in land demand from 1997 to 2004

The development of actual land demand from 1997 to 2004 is very diverse. A significant rise in absolute land demand can only be observed for the USA and the EU, whilst Russia and Commonwealth of Independent States (CIS) countries, Brazil and Japan show a marked decline. This can, in some cases, be the result of ongoing productivity increases of the domestic agricultural production systems.

Changing the perspective from the land footprints of countries to individual land footprints, as presented in Figure 4, it can be seen that the USA slips from 1st to 12th place.

Figure 4: Actual land demand per capita, top 15 countries; 2004



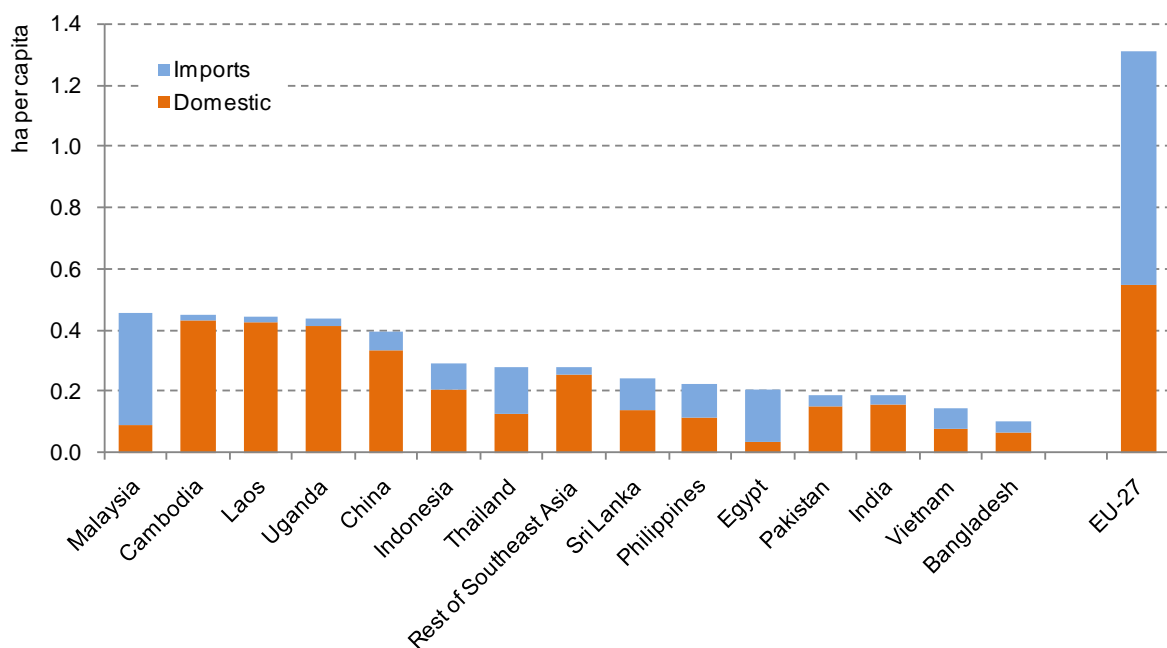
Countries with very low land productivity rank highest

Figure 4 shows the actual land demand per capita in hectares for the 15 countries with the highest results in 2004 and, for comparison, the result for EU-27. The bars are split into the consumption of domestic and imported land. Interestingly, it is not the countries with the highest consumption of agricultural products that rank highest, but rather countries with very low land productivity dominated by grassy landscapes and savannahs, often being farmed very extensively. However, especially in the case of developing countries, uncertainties regarding the quality of the land use data may influence the results. Significant differences can be observed among the top-consuming countries. The per-capita actual land demand of Australia is five times that of the USA. Again, this is mainly explained by the very low land productivities of Australian pastures compared to those of the USA and many of its countries of importation. The EU-27 shows a high import rate whilst not entering the top-15 ranking. Noticeable is the high import rate of Luxembourg, which results from the combination of a very restricted domestic area of arable land and one of the highest

biomass consumption levels. This is the case for many EU countries. However, in addition, the import shares of Finland, Norway and the USA, three western countries with low population density, lie between 40% and 60%. In the case of Finland, imports are dominated by Russian forestry areas; Norwegian imports are mainly composed of Swedish and Russian forestry areas and pastures from all over the world; and the USA imports many forestry areas from Canada and China as well as grazing areas mainly from China and Australia.

The difference between the countries is even more pronounced if we compare the countries with the lowest actual land demand per capita. The consumption activities of an average Australian induce 150 times more land use than those of a Bangladeshi, the country with the lowest actual land demand per capita (see Figure 5). Each bar in Figure 5 is split into domestic land use and land embodied in imports.

Figure 5: Actual land demand per capita, lowest 15; 2004



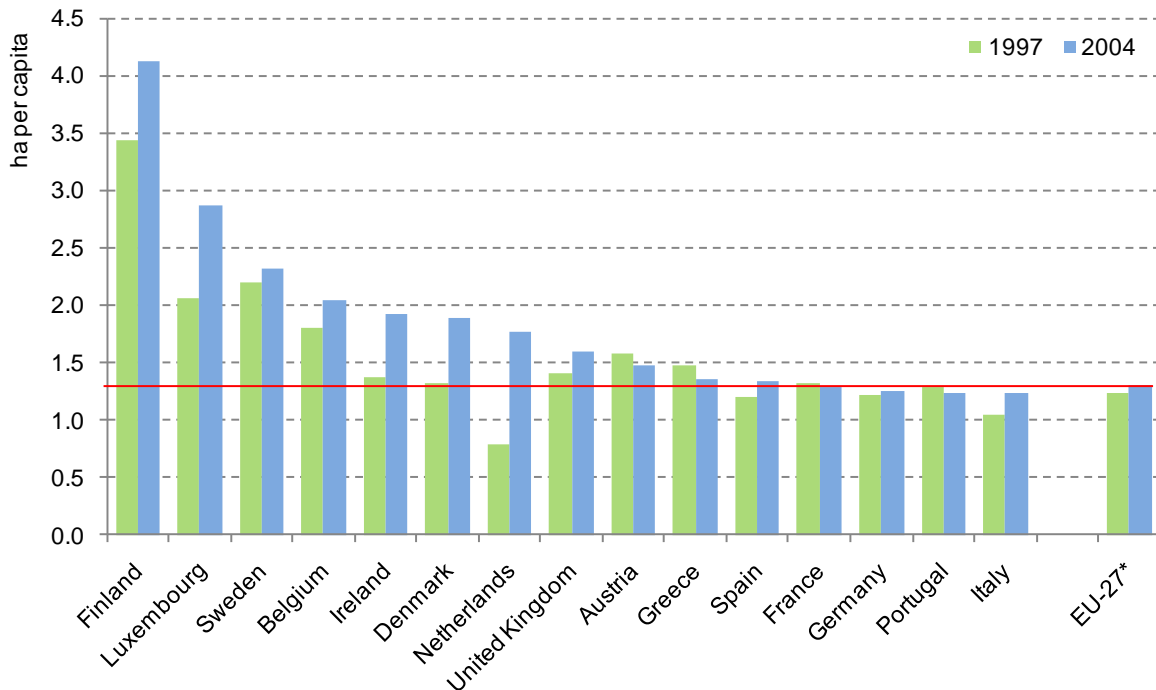
China & India have high absolute but low per-capita results

As expected, the results per capita diverge strongly from the absolute numbers. China and India rank among the ten countries with the highest actual land demand in absolute terms. According to a per-capita perspective, it can be seen that they are among the lowest per-capita land consumers of all 112 countries and regions considered in the model.

Indonesia, the world's greatest palm oil producer, is the tenth lowest-consuming country, whilst around 200 m² per capita are occupied by oil palm plantations, representing nearly 7% of the Indonesian actual land demand. The full picture of European land demand begins to become apparent in this figure. However, as explained in the methodology section, uncertainties surrounding the results for developing countries may be significant for several reasons.

After this investigation at the global level, we now turn to a short analysis of the land demand for the countries of the European Union. Figure 6 shows the actual land demand per capita in hectares for the EU-15 Member States and for the EU-27 as a whole for the years 1997 and 2004.

Figure 6: Actual land demand per capita for the EU-15 Member States and the EU-27; 1997/2004



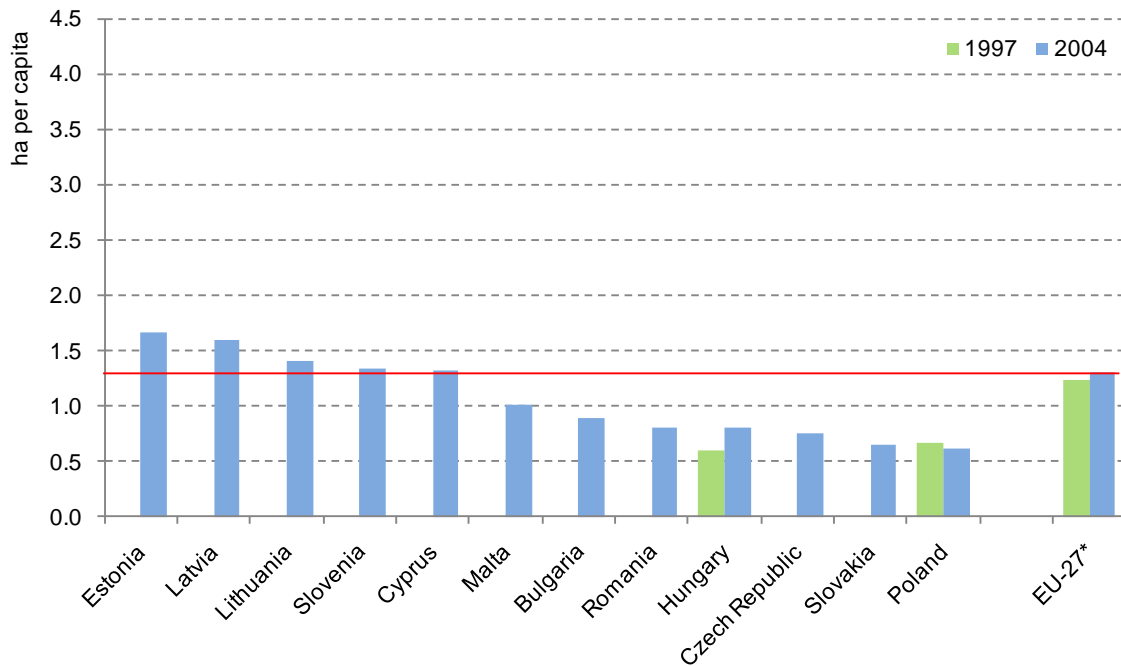
* using 1997 data only for EU-15 plus Poland and Hungary

Almost all EU-15 countries are above EU-27 average

It can be seen that almost all countries have results similar to or above the EU average, which is 1.3 hectares per capita. Except for Austria, Greece, France and Portugal, all EU-15 countries show an increase in the per-capita levels of actual land demand between 1997 and 2004. Compared to the actual land demand per capita of Australia of about 15 hectares, the highest European result of little more than four hectares for Finland is noticeably small. Nevertheless, it is more than double the EU average and four times the world average of exactly one hectare. As we will see in the next figure, a number of countries from the EU-12 (the new Member States) have values below the EU average.

Figure 7 illustrates the actual land demand per capita for the EU-12 Member States and the EU-27 average.

Figure 7: Actual land demand per capita for the EU-12 Member States and the EU-27; 1997/2004

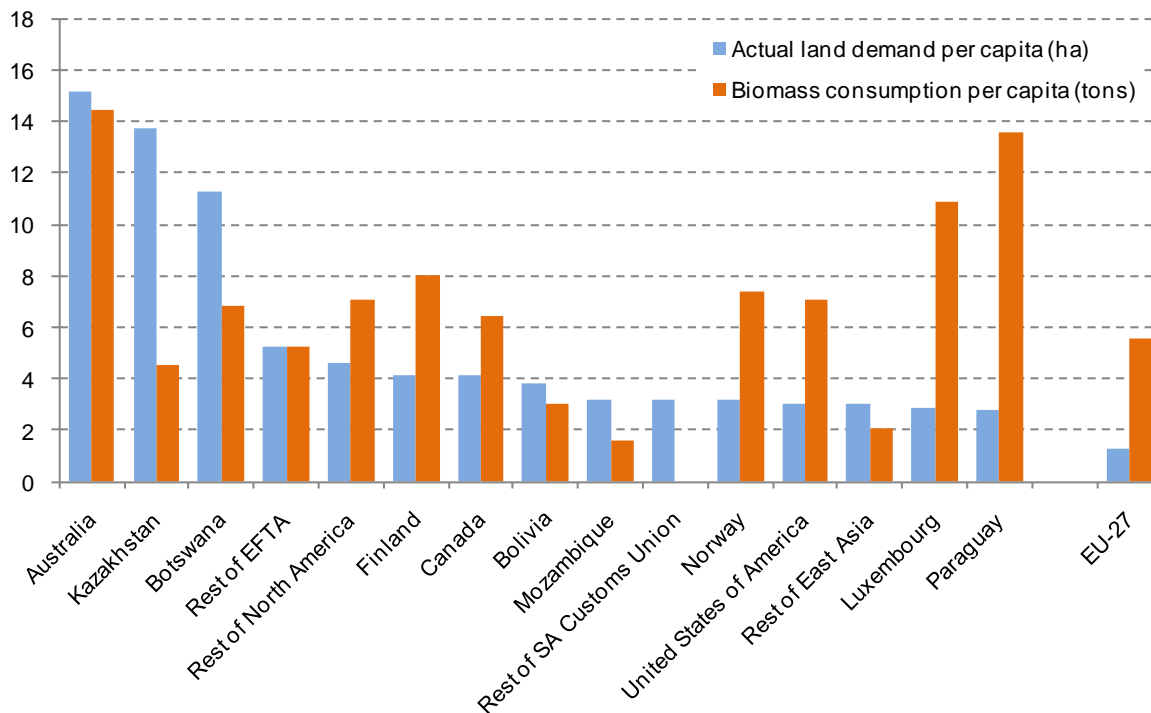


* using 1997 data only for EU-15 plus Poland and Hungary

As mentioned above, almost all countries of the EU-12 have consumption values below the EU-27 average. To allow for further investigation, a table of data for all EU countries is provided in the section on global trade (Table 2).

Actual land demand does not necessarily correlate with biomass consumption (including upstream biomass requirements), as Figure 8 reveals. This is an interesting fact, as it demonstrates that land productivity is having at least as much impact on the levels of land footprints as the amounts of biomass consumed.

Figure 8: Actual land demand per capita and biomass consumption per capita, top 15; 2004



Weak correlation between land footprint and biomass consumption

Figure 8 compares the results from Figure 4 (actual land demand per capita) with the biomass consumption in tons per capita, including food, feed, fibres and wood, for the 15 countries with the highest actual land demand per capita for the year 2004. The result for the EU-27 is added for comparison purposes.

A very diverse picture can be observed. For Australia, nearly a one-to-one ratio can be seen, i.e. a consumption of 14 tons of biomass is provided by 15 hectares of land, which corresponds to a rather low land productivity. For countries like Norway, Luxembourg and Paraguay, the biomass-to-land ratio is much higher – up to five tons of biomass are harvested from one hectare – highlighting a very high productivity of the land consumed by these countries. High land productivity can be a result of favourable soil and climate conditions, and an intensive application of irrigation, fertilisers and pesticides.

On the other hand, for countries like Kazakhstan and Botswana the biomass-to-land ratio is smaller, i.e. one hectare is providing less than one ton of biomass – or as few as 0.35 tons per hectare in the case of Kazakhstan.

It has to be highlighted that the results do not reflect the domestic land productivity of the consuming country, but rather that of the producing countries satisfying a country's final demand. In this way, a country with a highly land-productive agriculture could show low biomass-to-land ratios in this illustration if its consumption is dominated by imports from countries with very unproductive land use. As we already know, Luxembourg has a very high import rate. Its results are very similar to countries with high land productivity and low import rates, showing

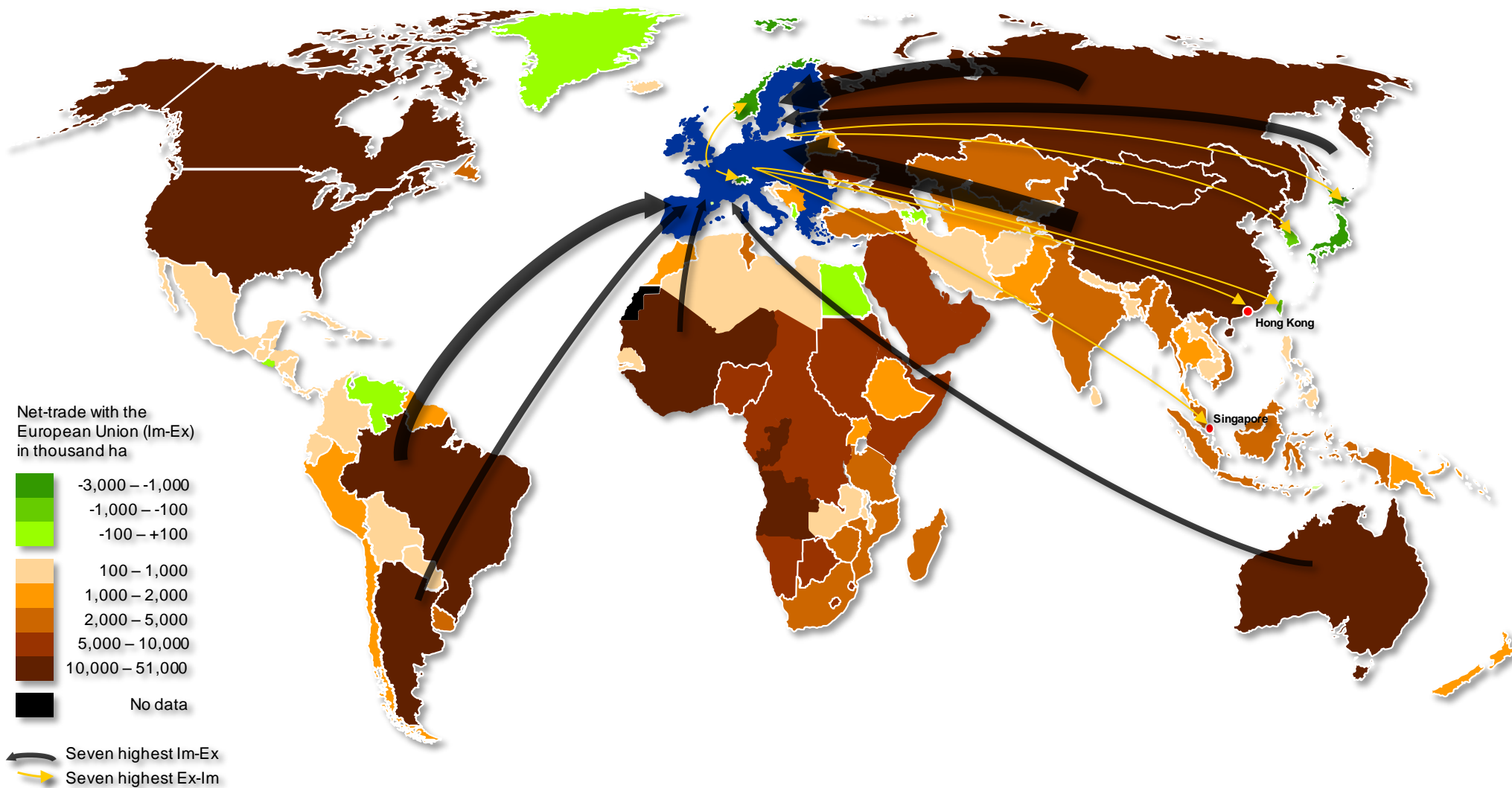
that Luxembourg is mainly importing from countries with high land productivity.

GLOBAL TRADE

The trade balances of the EU-27 with all other countries and world regions can be analysed in the following figure. It shows the differences between the EU-27 imports (Im) from a specific country and the EU-27 exports (Ex) to this country in thousand hectares. Positive results reflect that the EU-27's imports from a country outweigh its exports to it, i.e. the EU-27 is net-importing from this country. If the EU-27's exports to a specific country are higher than the imports from it, then the results are negative, representing net-exports to this country. The black arrows on the world map illustrate the seven biggest net-import flows to the EU-27. The seven biggest net-export flows from the EU-27 are marked by yellow arrows. The size of the arrows is related to the size of the flow.

Figure 9 shows the trade balances of land embodied in imports and exports, also called virtual land, for the EU-27 with the rest of the world in thousand hectares for the year 2004.

Figure 9: Trade balances of virtual land for the EU-27 with the rest of the world; 2004



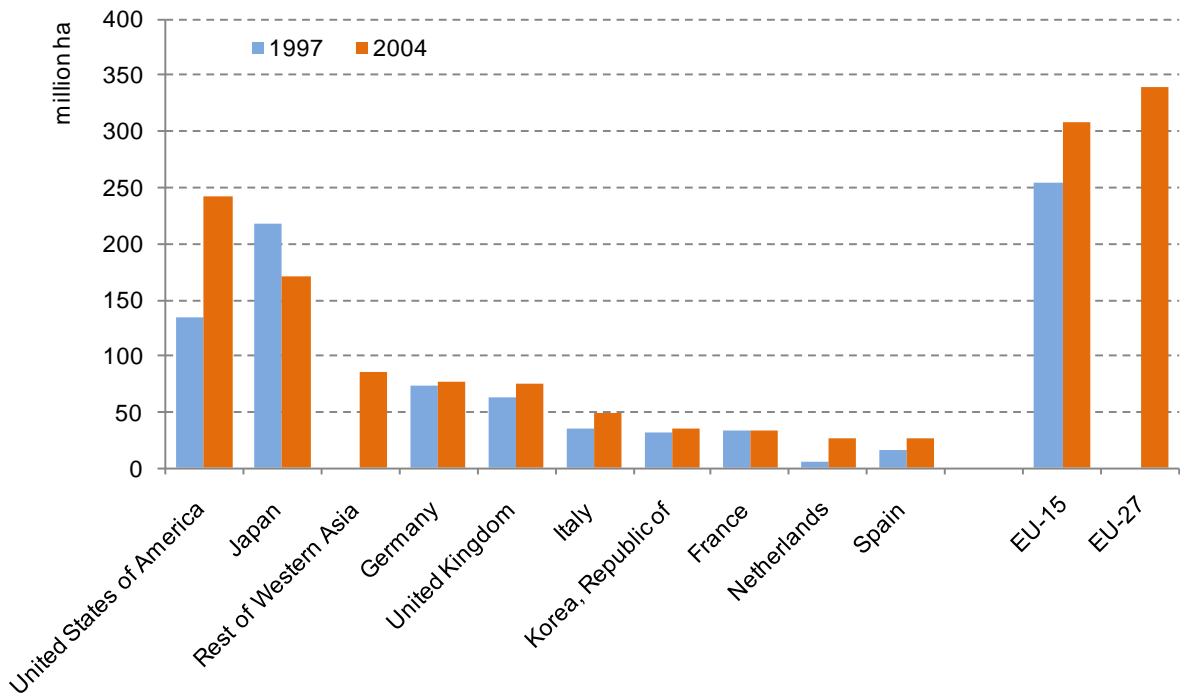
Biggest net-imports to EU-27 from Asia

Figure 9 illustrates that the biggest net-imports to the EU-27 come from Asia (China, Russian Federation and the Rest of East Asia, comprising the Democratic People’s Republic of Korea, Macau and Mongolia) followed by countries from South America (Brazil, Argentina). Australia ranks 6th, the country group Rest of Western Africa 7th, the USA 8th and Canada 9th.

The biggest net-exports from the EU-27 flow to western European and eastern Asian countries (sorted in descending order: Japan, Switzerland, Norway, Republic of Korea, Hong Kong, Singapore and Taiwan). A big difference can be observed between the levels of net-imports and net-exports. Whereas the land use induced by EU-27 net-imports from China accounts for 50 million hectares, the land use induced by EU-27 net-exports to Japan only accounts for 2.5 million hectares.

The ten countries which are the biggest net-importers are illustrated in Figure 10. A country is called a net-importer if it is importing more than exporting. The results are sorted by the net-imports in 2004. Again, the European Union is added for comparison purposes.

Figure 10: Top ten net-importers of virtual land plus EU; 1997/2004



USA: Strong increase in net-imports

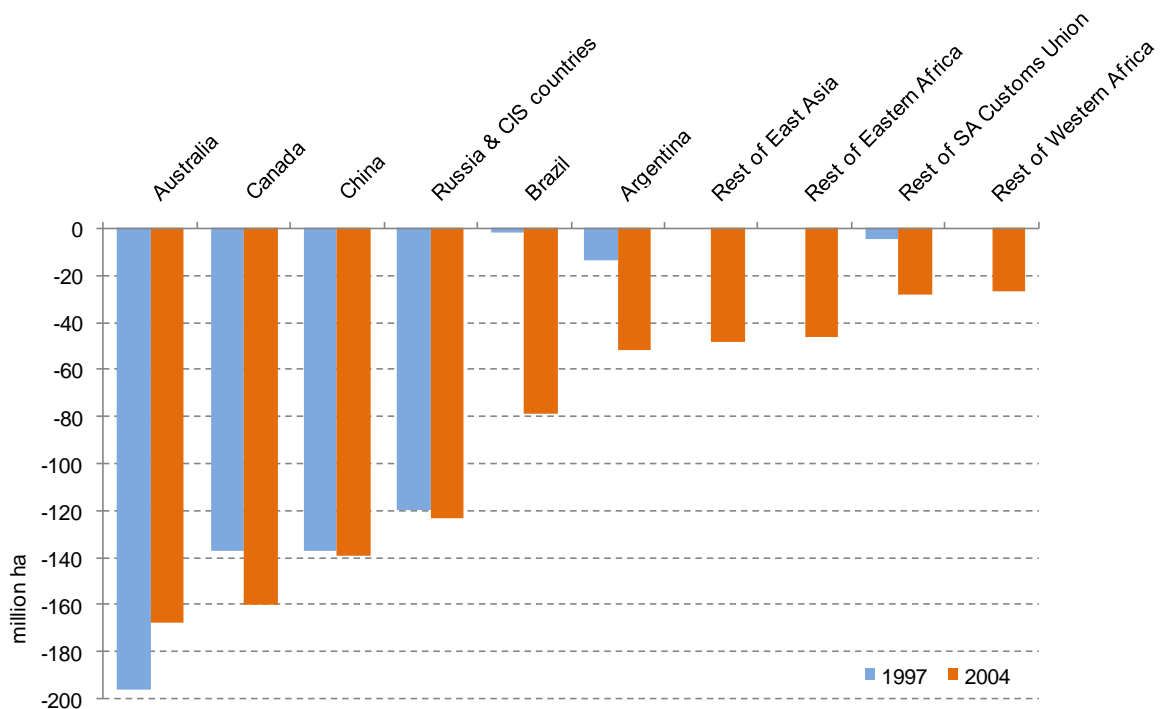
Once more, the United States of America and Japan stand out with their high net-imports. All countries except Japan and France faced an increase from 1997 to 2004, with the strongest increase in absolute terms for the USA. This rise was mainly driven by the land use category of grazing areas, which shows a surge from 70 million hectares in 1997 to 160 million hectares in 2004, revealing a steep rise in imports of leather, milk and meat products from animals such as bovines, sheep and goats. The net-imports of forestry areas

increased from 80 million to 100 million hectares. More details are illustrated in Figure 13. Since a couple of EU Member States rank among the top ten net-importers, it is not surprising that the overall result for the EU-27 is very high, highlighting the comparatively strong dependence of the EU on foreign land resources.

Interestingly, while the EU's land footprint is dominated by grazing and forestry areas, observed changes from 1997 to 2004 do not reinforce this relation. In the case of Germany, we identified a distinct decrease in forestry area imports of 6%, or 1.6 million hectares, whilst imports of grazing areas and land for the cultivation of oil seeds reveal the highest increases in absolute terms, with a growth of 4.5 and 2 million hectares, respectively. For oil seeds, this corresponds to a 45% rise in imports compared to 1997, with a high likelihood of soybeans and palm oil being responsible for most of the increase. These numbers are clear evidence of the continuing increase in the consumption of animal products, as both grass and soybeans are mainly used in animal husbandry.

The countries with higher exports than imports of embodied land are analysed in the following figure. Net-exporters are countries with higher exports than imports. In Figure 11, the ten countries with the biggest net-exports in 2004 can be seen.

Figure 11: Top ten net-exporters of virtual land; 1997/2004



Brazil: Strong increase in net-exports

The result for Brazil in 1997 is about 2 million hectares and is therefore too small to be recognised in Figure 11. Apart from Australia, an increase from 1997 to 2004 can be observed for all countries. Brazil had 40 times more net-exports in 2004 than it did in 1997. Therefore, we will look more closely at Brazil's land exports in Figure 12.

In addition to the analysis of net-exporters and net-importers, it is interesting to examine the absolute values of imports and exports. Therefore, the Annex contains two tables that list the 35 countries with the highest imports and the highest exports in absolute values.

For the EU-27, the following table illustrates total imports and exports, but also net trade flows.

Table 2: Land indicators for the EU-27 Member States (ha); 2004

Table 2 illustrates the different indicators for the EU-27 Member States in the year 2004. The results are sorted by the actual land demand per capita. Dark-blue shading highlights the EU-15 Member States, while light-green shading identifies the EU-12 countries.

2004	Land footprint per capita	Land footprint	Exports (Ex)	Imports (Im)	Net trade (Im-Ex)
Finland	4.1	21,595,964	13,000,534	11,490,170	-1,510,364
Luxembourg	2.9	1,297,590	129,768	1,212,375	1,082,607
Sweden	2.3	20,877,580	13,365,513	10,937,115	-2,428,398
Belgium	2.0	21,282,602	1,479,248	20,701,984	19,222,736
Ireland	1.9	7,851,785	3,257,432	6,201,568	2,944,136
Denmark	1.9	10,200,070	1,874,925	9,043,071	7,168,146
Netherlands	1.8	28,687,716	1,422,782	27,886,307	26,463,526
Estonia	1.7	2,224,852	1,745,024	1,560,291	-184,734
Latvia	1.6	3,723,592	2,145,098	1,903,766	-241,332
United Kingdom	1.6	95,424,188	4,018,351	80,031,011	76,012,660
Austria	1.5	12,117,236	3,178,661	8,798,188	5,619,526
Lithuania	1.4	4,852,844	1,758,676	2,368,226	609,550
Greece	1.4	15,106,184	1,205,185	9,308,735	8,103,550
Spain	1.3	57,227,363	9,789,442	35,975,199	26,185,757
Slovenia	1.3	2,639,291	486,485	1,792,119	1,305,634
Cyprus	1.3	1,094,786	56,725	982,497	925,772
France	1.3	77,765,086	17,190,515	50,275,788	33,085,273
Germany	1.2	103,160,633	10,105,290	86,973,091	76,867,800
Portugal	1.2	12,965,529	2,546,774	8,745,153	6,198,379
Italy	1.2	72,028,162	6,433,182	55,217,619	48,784,437
Malta	1.0	408,358	1,376	399,734	398,358
Bulgaria	0.9	6,947,107	3,592,038	2,172,004	-1,420,033
Romania	0.8	17,556,251	3,710,171	3,869,266	159,095
Hungary	0.8	8,103,818	3,093,059	4,058,612	965,553
Czech Republic	0.8	7,789,451	2,510,485	4,044,039	1,533,554
Slovakia	0.7	3,538,472	1,270,235	1,628,822	358,587
Poland	0.6	23,760,334	6,389,386	7,986,966	1,597,581
EU-15	1.5	557,587,687	88,997,602	422,797,374	333,799,772
EU-12	0.8	82,639,157	26,758,757	32,766,342	6,007,585

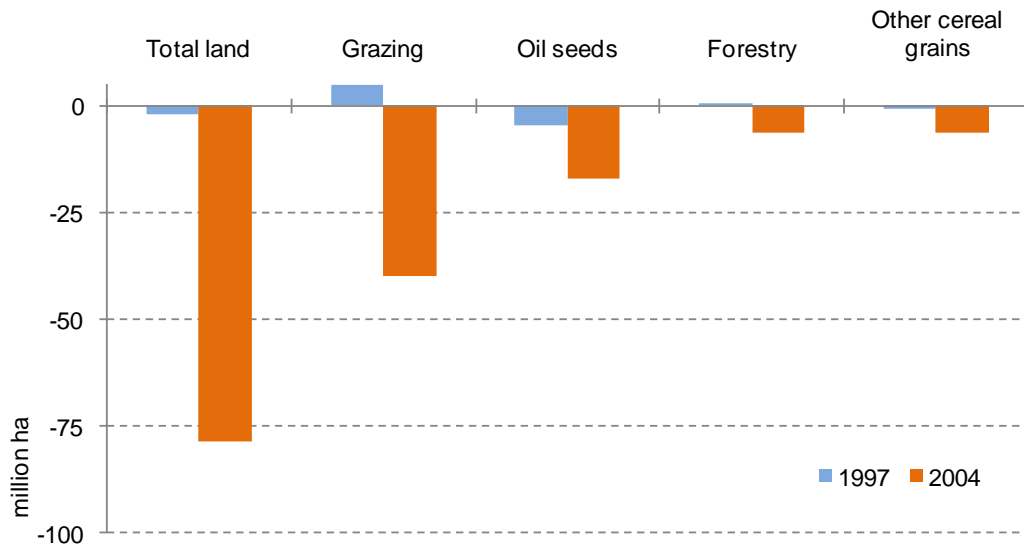
EU-27	1.3	640,226,844	115,756,359	455,563,717	339,807,358
EU-15 extra			45,623,139	389,411,286	343,788,147
EU-12 extra			105,813,895	437,063,102	331,249,207
EU-27 extra			36,921,340	374,440,017	337,518,677

Note: The various EU aggregates include EU intra trade, i.e. trade between EU countries. The sums in the three bottom rows (EU-15 extra, EU-12 extra and EU-27 extra) explicitly exclude intra trade and only add up trade with countries not included in the respective country group. Actual land demand is not included again, as this indicator is not affected by intra trade.

TRENDS IN SELECTED COUNTRIES

We will now investigate selected data at the country level. As already observed, the import rate for the USA and the export rate for Brazil are very high. Below, we will look more closely at the net-exports for the example of Brazil. Figure 12 illustrates the net land exports for Brazil, beginning with two bars for the total net land exports in 1997 and 2004, followed by the four land categories (out of ten) with the highest shares. The results are sorted by the values of 2004.

Figure 12: Net-trade flows – Brazil; 1997/2004



Strongest increase in "grazing" category

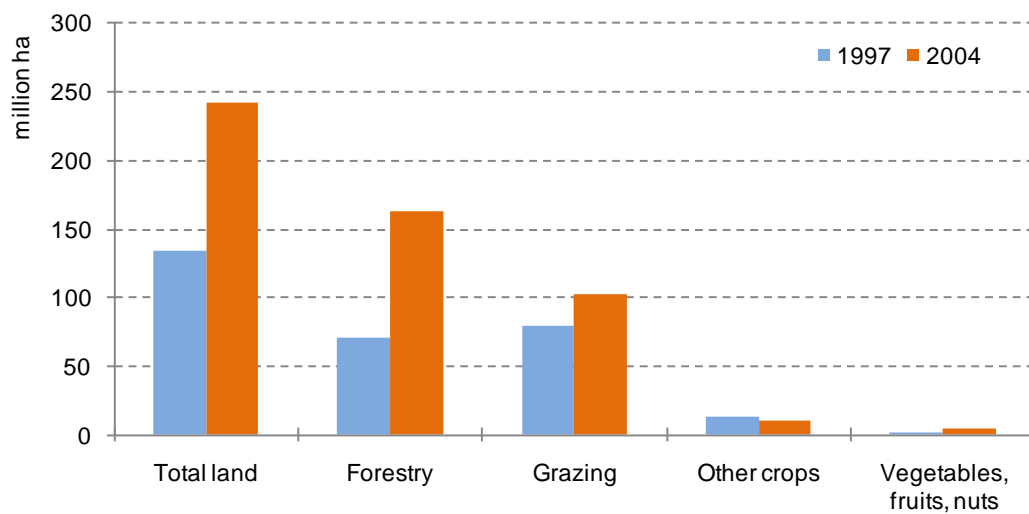
Whereas in 1997 Brazil was a net-importer for some land types, in 2004 all categories showed net-exports. The largest change can be observed for the category "grazing", in which Brazil recorded net-imports of 4 million hectares in 1997 and net-exports of 40 million hectares in 2004. The category "oil seeds" showed an increase in net-exports from 4 million to almost 17 million hectares.

It is important to bear in mind that the productivity of grazing and forestry areas is low, so a large amount of land is used in these categories. For Brazil, the category "oil seeds" almost exclusively consists of soybeans, which are used for animal feed. If we also take

into account the strong increase for the category “grazing”, these rises reveal the surge in worldwide meat consumption, and reflect the results for Germany and the European Union as a whole shown above.

Since the biggest increase in imports was observed for the USA, we will now look more closely at which categories denote the highest increases. In contrast with the illustration above, in Figure 13 we see the net-imports of the USA broken down into total net trade and the four categories with the highest net-imports in 2004.

Figure 13: Net-trade flows – USA; 1997/2004



Strongest increase in “forestry” and “grazing” categories

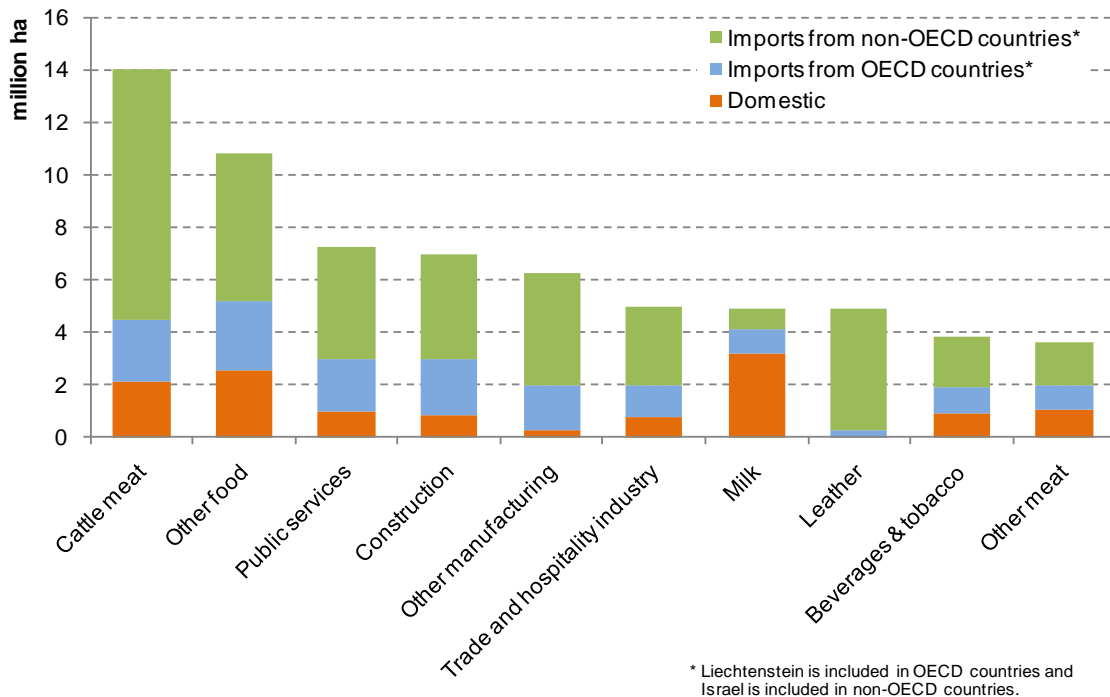
The two land use categories with the highest increase are “forestry” and “grazing”. Again, it must be noted that these two categories have the lowest productivities.

To investigate further, we will examine data at the sectoral level for the UK.

SECTORAL ANALYSIS

The model distinguishes 57 economic sectors. Figure 14 illustrates the ten sectors which led to the highest land demand in the UK in the year 2004. Each bar is divided into domestic land use, land use embodied in imports from OECD countries and land use embodied in imports from non-OECD countries (a list of the OECD and non-OECD countries incorporated in the model can be found in the Annex).

Figure 14: Sectoral actual land demand – top ten sectors – UK; 2004



There is a detailed list of all 57 sectors in the Annex. The ten sectors with the highest results are briefly explained below.

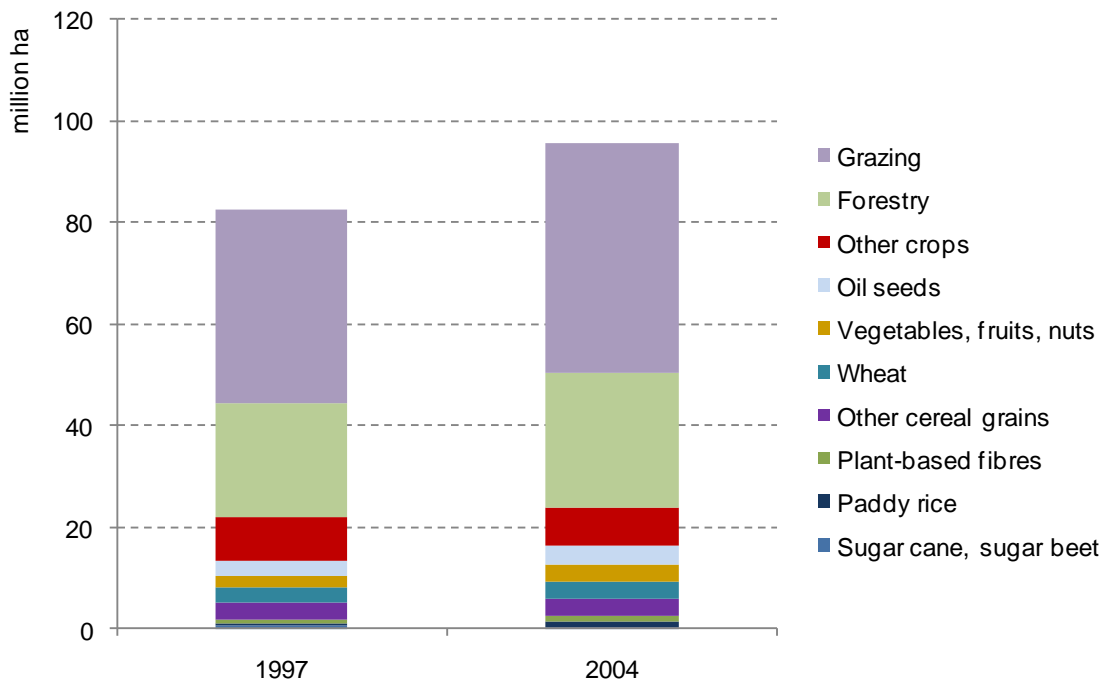
The sector “cattle meat” includes, for example, fresh or chilled meat and edible offal of cattle, sheep and goats, but not pig meat, which is included in the sector “other meat”, in addition to preserves and preparations of meat and further products. “Other food” includes prepared and preserved fish or vegetables, fruit juices and vegetable juices, prepared and preserved fruit and nuts, all cereal grain products, other vegetable flours and meals, as well as a number of other food products. Public administration and defence, compulsory social security, education, health, sanitation and further components are summarised in the sector “public services”. The “construction” sector includes the construction of houses, factories, offices and infrastructure, and “other manufacturing” includes recycling. “Trade and hospitality industry” includes, for example, all retail sales, wholesale trade and commission trade, hotels and restaurants, repairs of motor vehicles, and personal and household goods. The sector “milk” only includes dairy products but not raw milk. The tanning and dressing of leather, luggage, handbags, saddlery, harnesses and

footwear comprise the “leather” sector. Beverages and tobacco products are included in the sector of the same name.

Imports from non-OECD countries dominate in all sectors, except for “milk”. The sector “leather” has the smallest share of domestic land use. “Cattle meat” ranks first, which reflects both the elevated level of meat consumption and the high requirements for (grazing) areas for animal husbandry. The high ranking of “public services” may be explained by the fact that food is provided in public institutions such as schools and hospitals.

To reveal another interesting result, we will split up the actual land demand of the UK into the ten land use categories. Figure 15 illustrates the actual land demand of the UK split up into all ten land use categories for 1997 and 2004.

Figure 15: Actual land demand – UK; 1997/2004



“Grazing” and “forestry” have the highest share of total land

In both years, “grazing” accounts for the biggest share, followed by “forestry”. The evident land demand increase from 1997 to 2004 of approximately 13 million hectares, or about 16%, is mostly caused by a rise in “grazing”. This may reveal a steep surge in the consumption of animal products such as bovine meat, milk and leather, or a shift to imports from producing countries with very low pasture productivities.

GLOBAL LAND USE INDUCED BY THE UK

In this final section, we will investigate the global land use that is induced by the final demand of the UK by analysing impact maps for 1997 and 2004.

These impact maps illustrate the land use per capita in different world regions induced by the UK's final demand for seven product groups, these being an aggregation of the 57 sectors of the model. For clarity, the results are presented in units of ten square metres. The cells are coloured in shades of green to yellow to red in ascending order, reflecting the values within them. For the year 1997, the model does not allow the allocation of all countries to a continent – therefore, we include the region “Rest of World” in these illustrations.

Table 3: Impact map of per-capita consumption – UK, in 10 m²; 1997/2004

	Oceania	Asia	North America	Latin America	Europe	Africa	Rest of World	Total	
Crop products	12	55	23	23	111	49	4	278	15
Animal products	67	33	13	18	165	128	2	425	35
Wood products	0	36	11	2	46	16	1	112	1
Clothing	6	70	4	3	6	18	1	109	5
Manufactured products	6	77	22	4	36	18	6	169	7
Construction	1	37	12	2	35	9	1	98	2
Service	16	61	22	10	72	36	3	219	17
Total	109	369	107	62	471	273	18	1410	82
									2004
									19
									9
									49
									146
									107
									80
									340
									26
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									24
									10
									48
									22
									229
									42
									16
									117
									82
									45
									299
									285
									1597

Strong increase in land use in Asia and Africa

We will examine the product category “clothing” as an example: the UK's final demand per capita for clothing induced a land use of 700 m² in Asia in 1997. In 2004, this land use rose to 1,200 m². Surprisingly, the biggest part of the UK's land demand in the clothing sector is not related to the cultivation of cotton, but to the production of leather products and therefore to the land use category of grazing areas. It can be observed that the land use resulting from the demand for animal and wood products declined, whereas land use from the demand for all other product groups rose. The UK's demand for manufactured products, service and clothing had a particularly strong impact on Asia. The land use rise due to demand for crop products mostly occurred in Africa and Latin America.

More examples of such impact maps can be found in the Annex.

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ANNEX

Table A.1 shows the actual land demand, virtual land exports and imports, and virtual land trade balance for the 35 main importing countries.

Table A.1. Top 35 importing countries (in hectares); 2004

	Actual land demand	Exports (Ex)	Imports (Im)	Trade balance (Im-Ex)
1 United States of America	899,890,114	115,501,085	357,991,464	242,490,379
2 Japan	198,101,813	1,899,781	173,163,772	171,263,991
3 Rest of Western Asia	315,964,367	22,112,236	107,361,097	85,248,860
4 Germany	103,160,633	10,105,290	86,973,091	76,867,800
5 China	518,233,975	221,945,930	82,981,705	-138,964,225
6 United Kingdom	95,424,188	4,018,351	80,031,011	76,012,660
7 Italy	72,028,162	6,433,182	55,217,619	48,784,437
8 France	77,765,086	17,190,515	50,275,788	33,085,273
9 Korea, Republic of	41,648,217	568,125	36,287,341	35,719,217
10 Spain	57,227,363	9,789,442	35,975,199	26,185,757
11 Russian Federation	275,711,095	153,914,440	33,681,388	-120,233,052
12 South Africa	126,221,835	12,900,043	31,268,088	18,368,045
13 Netherlands	28,687,716	1,422,782	27,886,307	26,463,526
14 India	199,751,612	12,781,619	27,634,245	14,852,625
15 Canada	131,004,587	186,873,460	26,870,738	-160,002,723
16 Mexico	119,336,505	18,396,477	25,283,652	6,887,176
17 Belgium	21,282,602	1,479,248	20,701,984	19,222,736
18 Indonesia	64,537,376	15,892,061	19,087,240	3,195,180
19 Turkey	58,759,120	6,494,886	16,069,005	9,574,120
20 Hong Kong	15,794,045	823	15,791,483	15,790,659
21 Taiwan	18,923,306	680,470	15,747,168	15,066,698
22 Ukraine	35,716,189	24,200,237	13,976,894	-10,223,343
23 Australia	302,395,731	180,774,201	13,161,952	-167,612,249
24 Rest of North Africa	65,696,676	4,087,925	12,744,302	8,656,377
25 Egypt	14,759,172	940,122	12,187,523	11,247,402
26 Caribbean	22,871,181	2,701,554	11,885,183	9,183,629
27 Finland	21,595,964	13,000,534	11,490,170	-1,510,364
28 Sweden	20,877,580	13,365,513	10,937,115	-2,428,398
29 Iran, Islamic Republic of	73,500,392	3,410,818	9,955,208	6,544,389
30 Thailand	17,832,475	11,581,876	9,809,398	-1,772,479
31 Switzerland	11,406,627	651,915	9,730,528	9,078,613
32 Singapore	9,516,326	1,737	9,516,127	9,514,390
33 Greece	15,106,184	1,205,185	9,308,735	8,103,550
34 Malaysia	11,400,402	21,868,613	9,128,281	-12,740,332
35 Brazil	227,922,099	87,848,108	9,106,761	-78,741,348

Table A.2 shows the actual land demand, virtual land exports and imports, and virtual land trade balance for the 35 main exporting countries.

Table A.2. Top 35 exporting countries (in hectares); 2004

	Actual land demand	Exports (Ex)	Imports (Im)	Trade balance (Im-Ex)
1 China	518,233,975	221,945,930	82,981,705	-138,964,225
2 Canada	131,004,587	186,873,460	26,870,738	-160,002,723
3 Australia	302,395,731	180,774,201	13,161,952	-167,612,249
4 Russian Federation	275,711,095	153,914,440	33,681,388	-120,233,052
5 United States of America	899,890,114	115,501,085	357,991,464	242,490,379
6 Brazil	227,922,099	87,848,108	9,106,761	-78,741,348
7 Argentina	83,095,095	54,249,700	2,609,071	-51,640,628
8 Rest of Eastern Africa	206,453,973	53,600,542	7,169,833	-46,430,709
9 Rest of East Asia	76,099,105	50,691,529	2,655,532	-48,035,997
10 Rest of Western Africa	189,834,094	32,467,436	5,617,958	-26,849,478
11 Rest of SA Customs Union	15,455,917	30,158,939	1,762,272	-28,396,667
12 Rest of Southeast Asia	14,229,261	24,978,372	1,141,741	-23,836,631
13 Rest of South Central Africa	132,164,260	24,271,001	2,843,918	-21,427,082
14 Ukraine	35,716,189	24,200,237	13,976,894	-10,223,343
15 Rest of Western Asia	315,964,367	22,112,236	107,361,097	85,248,860
16 Malaysia	11,400,402	21,868,613	9,128,281	-12,740,332
17 Mexico	119,336,505	18,396,477	25,283,652	6,887,176
18 France	77,765,086	17,190,515	50,275,788	33,085,273
19 Indonesia	64,537,376	15,892,061	19,087,240	3,195,180
20 Rest of Central Africa	93,744,051	13,861,912	2,215,515	-11,646,397
21 Sweden	20,877,580	13,365,513	10,937,115	-2,428,398
22 Nigeria	69,486,498	13,042,196	4,934,732	-8,107,465
23 Finland	21,595,964	13,000,534	11,490,170	-1,510,364
24 South Africa	126,221,835	12,900,043	31,268,088	18,368,045
25 India	199,751,612	12,781,619	27,634,245	14,852,625
26 Kazakhstan	203,388,569	12,679,631	5,838,509	-6,841,122
27 Thailand	17,832,475	11,581,876	9,809,398	-1,772,479
28 Uruguay	6,227,826	10,299,406	865,379	-9,434,026
29 Germany	103,160,633	10,105,290	86,973,091	76,867,800
30 Spain	57,227,363	9,789,442	35,975,199	26,185,757
31 New Zealand	8,974,855	9,345,871	4,598,726	-4,747,145
32 Vietnam	11,797,467	8,821,635	5,576,750	-3,244,885
33 Rest of Oceania	5,896,342	8,743,796	2,541,141	-6,202,655
34 Chile	22,743,410	8,674,659	6,160,558	-2,514,101
35 Botswana	19,913,509	8,565,507	1,768,797	-6,796,710

Impact maps

Impact maps illustrate the land use in six world regions (continents) induced by the consumption of goods, segmented into seven product groups, these being an aggregation of the 57 sectors of the model. For clarity, the results are presented in rounded units of ten square metres per capita. The cells are coloured in shades of green to yellow to red in ascending order, reflecting the values within them. For the year 1997, the model does not allow the allocation of all countries to a continent – therefore, we include the region “Rest of World” in these illustrations.

Figure A.1. Impact map of per-capita consumption – USA, in 10 m²; 1997/2004

	Oceania	Asia	North America	Latin America	Europe	Africa	Rest of World	Total
Crop products	5	26	283	28	3	11	1	356
Animal products	47	6	661	5	2	2	0	724
Wood products	1	12	530	3	3	4	1	554
Clothing	8	150	39	7	1	6	1	212
Manufactured products	6	65	109	4	6	10	1	202
Construction	1	15	250	4	2	3	1	277
Service	18	42	416	13	7	12	2	510
Total	86	316	2288	64	25	48	6	2834

1997

	Oceania	Asia	North America	Latin America	Europe	Africa	Total
Crop products	7	23	214	19	4	9	277
Animal products	60	7	655	13	2	3	742
Wood products	2	51	635	11	5	6	711
Clothing	7	122	30	14	1	6	180
Manufactured products	8	102	110	13	8	14	254
Construction	2	29	256	7	3	4	300
Service	27	67	438	20	8	16	576
Total	113	402	2339	97	32	58	3040

2004

Figure A.2. Impact map of per-capita consumption – Brazil, in 10 m²; 2004

	Oceania	Asia	North America	Latin America	Europe	Africa	Total
Crop products	0	2	1	185	0	1	189
Animal products	0	0	0	711	0	0	712
Wood products	0	0	0	109	0	0	110
Clothing	0	2	1	18	0	1	21
Manufactured products	0	4	1	26	1	1	33
Construction	0	1	0	15	0	0	17
Service	0	3	1	151	1	1	157
Total	1	11	5	1216	2	3	1239

Table A.3. Regions list in GTAP7 (GTAP 2011a)

Rest of Oceania

- American Samoa
- Cook Islands
- Fiji
- French Polynesia
- Guam
- Island of Wallis and Futuna
- Kiribati
- Marshall Islands
- Micronesia, Federated States of
- Nauru
- New Caledonia
- Niue
- Norfolk Island
- Northern Mariana Islands
- Palau
- Papua New Guinea
- Samoa
- Solomon Islands
- Tokelau
- Tonga
- Tuvalu
- Vanuatu

Rest of East Asia

- Korea, Democratic People's Republic of
- Macau
- Mongolia

Rest of Southeast Asia

- Brunei Darussalam
- Timor-Leste

Rest of South Asia

- Afghanistan
- Bhutan
- Maldives
- Nepal

Rest of North America

- Bermuda
- Greenland
- Saint Pierre and Miquelon

Rest of Central America

- Belize
- El Salvador
- Honduras

Caribbean

- Anguilla
- Antigua and Barbuda
- Aruba
- Bahamas
- Barbados
- Cayman Islands
- Cuba
- Dominica
- Dominican Republic
- Grenada
- Guadeloupe
- Haiti
- Jamaica
- Martinique
- Montserrat
- Netherlands Antilles
- Puerto Rico
- Saint Kitts and Nevis
- Saint Lucia
- Saint Vincent and the Grenadines
- Trinidad and Tobago
- Turks and Caicos
- Virgin Islands, British
- Virgin Islands, U.S.

Rest of EFTA

- Iceland
- Liechtenstein

Rest of Eastern Europe

- Moldova, Republic of

Rest of Europe

- Andorra
- Bosnia and Herzegovina
- Faroe Islands
- Gibraltar
- Macedonia, the former Yugoslav Republic of

**Rest of South America**

- Falkland Islands (Malvinas)
- French Guiana
- Guyana
- Suriname

Rest of Former Soviet Union

- Tajikistan
- Turkmenistan
- Uzbekistan

Rest of Western Asia

- Bahrain
- Iraq
- Israel
- Jordan
- Kuwait
- Lebanon
- Oman
- Palestinian Territory, Occupied
- Qatar
- Saudi Arabia
- Syrian Arab Republic
- United Arab Emirates
- Yemen

Rest of North Africa

- Algeria
- Libyan Arab Jamahiriya

Rest of Western Africa

- Benin
- Burkina Faso
- Cape Verde
- Cote d'Ivoire
- Gambia
- Ghana
- Guinea
- Guinea-Bissau
- Liberia
- Mali
- Mauritania
- Niger
- Saint Helena
- Sierra Leone
- Togo

- Monaco
- San Marino
- Serbia and Montenegro

Rest of Central Africa

- Cameroon
- Central African Republic
- Chad
- Congo
- Equatorial Guinea
- Gabon
- Sao Tome and Principe

Rest of South Central Africa

- Angola
- Congo, Democratic Republic of the

Rest of Eastern Africa

- Burundi
- Comoros
- Djibouti
- Eritrea
- Kenya
- Mayotte
- Reunion
- Rwanda
- Seychelles
- Somalia
- Sudan

Rest of South African Customs Union

- Lesotho
- Namibia
- Swaziland

Additional group in this report for illustration purposes:

Russia and CIS Countries

- Rest of Former Soviet Union
- Russian Federation

Table A.4. OECD and non-OECD countries as distinguished in the model

OECD countries	Non-OECD countries	Non-OECD countries (continued)
Australia	Albania	Nigeria
Austria	Argentina	Pakistan
Belgium	Armenia	Panama
Canada	Azerbaijan	Paraguay
Chile	Bangladesh	Peru
Czech Republic	Belarus	Philippines
Denmark	Bolivia	Rest of Central Africa
Estonia	Botswana	Rest of Central America
Finland	Brazil	Rest of East Asia
France	Bulgaria	Rest of Eastern Africa
Germany	Cambodia	Rest of Eastern Europe
Greece	Caribbean	Rest of Europe
Hungary	China	Rest of North Africa
Rest of EFTA	Colombia	Rest of North America
Ireland	Costa Rica	Rest of Oceania
Italy	Croatia	Rest of South African Customs Union
Japan	Cyprus	Rest of South America
Korea, Republic of	Ecuador	Rest of South Asia
Luxembourg	Egypt	Rest of South Central Africa
Mexico	Ethiopia	Rest of Southeast Asia
Netherlands	Former Soviet Union	Rest of Western Africa
New Zealand	Georgia	Rest of Western Asia
Norway	Guatemala	Romania
Poland	Hong Kong	Russian Federation
Portugal	India	Senegal
Slovakia	Indonesia	Singapore
Slovenia	Iran, Islamic Republic of	South Africa
Spain	Kazakhstan	Sri Lanka
Sweden	Kyrgyzstan	Taiwan
Switzerland	Lao People's Democratic Republic	Tanzania, United Republic of
Turkey	Latvia	Thailand
United Kingdom	Lithuania	Tunisia
United States of America	Madagascar	Uganda
	Malawi	Ukraine
	Malaysia	Uruguay
	Malta	Venezuela
	Mauritius	Vietnam
	Morocco	Zambia
	Mozambique	Zimbabwe
	Nicaragua	

Note: Country group “Rest of EFTA” includes Iceland and Liechtenstein. In order not to lose Iceland in the group of OECD countries, Liechtenstein also had to be included. In parallel, Israel is part of the model’s country group “Rest of Western Asia”, which was allocated as a whole to the group of non-OECD countries.

Table A.5. Detailed sectoral list in GTAP7 (GTAP 2011b)

Nr.	Sector name	Sector description
1	Paddy Rice	rice, husked and unhusked
2	Wheat	wheat and maslin
3	Other Grains	maize (corn), barley, rye, oats, other cereals
4	Veg & Fruit	vegetables, fruit vegetables, fruit and nuts, potatoes, cassava, truffles
5	Oil Seeds	oil seeds and oleaginous fruit; soy beans, copra
6	Cane & Beet	sugar cane and sugar beet
7	Plant Fibres	cotton, flax, hemp, sisal and other raw vegetable materials used in textiles
8	Other Crops	live plants; cut flowers and flower buds; flower seeds and fruit seeds; vegetable seeds, beverage and spice crops, unmanufactured tobacco, cereal straw and husks, unprepared, whether or not chopped, ground, pressed or in the form of pellets; swedes, mangolds, fodder roots, hay, lucerne (alfalfa), clover, sainfoin, forage kale, lupines, vetches and similar forage products, whether or not in the form of pellets, plants and parts of plants used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal or similar purposes, sugar beet seed and seeds of forage plants, other raw vegetable materials
9	Cattle	cattle, sheep, goats, horses, asses, mules and hinnies; and semen thereof
10	Other Animal Products	swine, poultry and other live animals; eggs, in shell (fresh or cooked), natural honey, snails (fresh or preserved) except sea snails; frogs' legs, edible products of animal origin n.e.c., hides, skins and furskins, raw, insect waxes and spermaceti, whether or not refined or coloured
11	Raw Milk	raw milk
12	Wool	wool, silk and other raw animal materials used in textiles
13	Forestry	forestry, logging and related service activities
14	Fishing	hunting, trapping and game propagation, including related service activities, fishing, fish farms; service activities incidental to fishing
15	Coal	mining and agglomeration of hard coal, lignite and peat
16	Oil	extraction of crude petroleum (part), service activities incidental to oil extraction excluding surveying (part)
17	Gas	extraction of natural gas (part), service activities incidental to gas extraction excluding surveying (part)
18	Other Mining	mining of metal ores, uranium, gems; other mining and quarrying
19	Cattle Meat	fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules and hinnies; raw fats or grease from any animal or bird
20	Other Meat	pig meat and offal; preserves and preparations of meat, meat offal or blood, flours, meals and pellets of meat or inedible meat offal; greaves
21	Vegetable Oils	crude and refined oils of soya-bean, maize (corn), olive, sesame, ground-nut, olive, sunflower-seed, safflower, cotton-seed, rape, colza and canola, mustard, coconut palm, palm kernel, castor, tung jojoba, babassu and linseed, perhaps partly or wholly hydrogenated, inter-esterified, re-esterified or elaidinised. Also margarine and similar preparations, animal or vegetable waxes, fats and oils and their fractions, cotton linters, oil-cake and other solid residues resulting from the extraction of vegetable fats or oils; flours and meals of oil seeds or oleaginous fruits, except those of mustard; degreas and other residues resulting from the treatment of fatty substances or animal or vegetable waxes
22	Milk	dairy products
23	Processed Rice	rice, semi- or wholly milled
24	Sugar	Sugar
25	Other Food	prepared and preserved fish or vegetables, fruit juices and vegetable juices, prepared and preserved fruit and nuts, all cereal flours, groats, meal and pellets of wheat, cereal groats, meal and pellets n.e.c., other

	cereal grain products (including corn flakes), other vegetable flours and meals, mixes and doughs for the preparation of bakers' wares, starches and starch products; sugars and sugar syrups n.e.c., preparations used in animal feeding, bakery products, cocoa, chocolate and sugar confectionery, macaroni, noodles, couscous and similar farinaceous products, food products n.e.c.
26 Beverages & Tobacco Products	beverages and tobacco products
27 Textiles	textiles and man-made fibres
28 Wearing Apparel	clothing, dressing and dyeing of fur
29 Leather	tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear
30 Lumber	wood and products of wood and cork, except furniture; articles of straw and plaiting materials
31 Paper & Paper Products	includes publishing, printing and reproduction of recorded media
32 Petroleum & Coke	coke oven products, refined petroleum products, processing of nuclear fuel
33 Chemical Rubber Products	basic chemicals, other chemical products, rubber and plastics products
34 Non-Metallic Minerals	cement, plaster, lime, gravel, concrete
35 Iron & Steel	basic production and casting
36 Non-Ferrous Metals	production and casting of copper, aluminium, zinc, lead, gold and silver
37 Fabricated Metal Products	sheet metal products, but not machinery and equipment
38 Motor Vehicles and Parts	cars, lorries, trailers and semi-trailers
39 Other Transport Equipment	manufacture of other transport equipment
40 Electronic Equipment	office, accounting and computing machinery, radio, television and communication equipment and apparatus
41 Other Machinery & Equipment	electrical machinery and apparatus n.e.c., medical, precision and optical instruments, watches and clocks
42 Other Manufacturing	includes recycling
43 Electricity	production, collection and distribution
44 Gas Distribution	distribution of gaseous fuels through mains; steam and hot water supply
45 Water	collection, purification and distribution
46 Construction	building houses, factories, offices and roads
47 Trade	all retail sales; wholesale trade and commission trade; hotels and restaurants; repairs of motor vehicles and personal and household goods; retail sale of automotive fuel
48 Other Transport	road, rail; pipelines, auxiliary transport activities; travel agencies
49 Water Transport	water transport
50 Air Transport	air transport
51 Communications	post and telecommunications
52 Other Financial Intermediation	includes auxiliary activities, but not insurance and pension funding (see next)
53 Insurance	includes pension funding, except compulsory social security
54 Other Business Services	real estate, renting and business activities
55 Recreation & Other Services	recreational, cultural and sporting activities, other service activities; private households with employed persons (servants)
56 Other Services (Government)	public administration and defence; compulsory social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organisations n.e.c., extra-territorial organisations and bodies
57 Dwellings	ownership of dwellings (imputed rents of houses occupied by owners)