February 2019

Risky Business:

The risk of corruption and forest loss in Belgium's imports of commodities

Dr Steve Jennings & Lyra Schweizer

Executive Summary

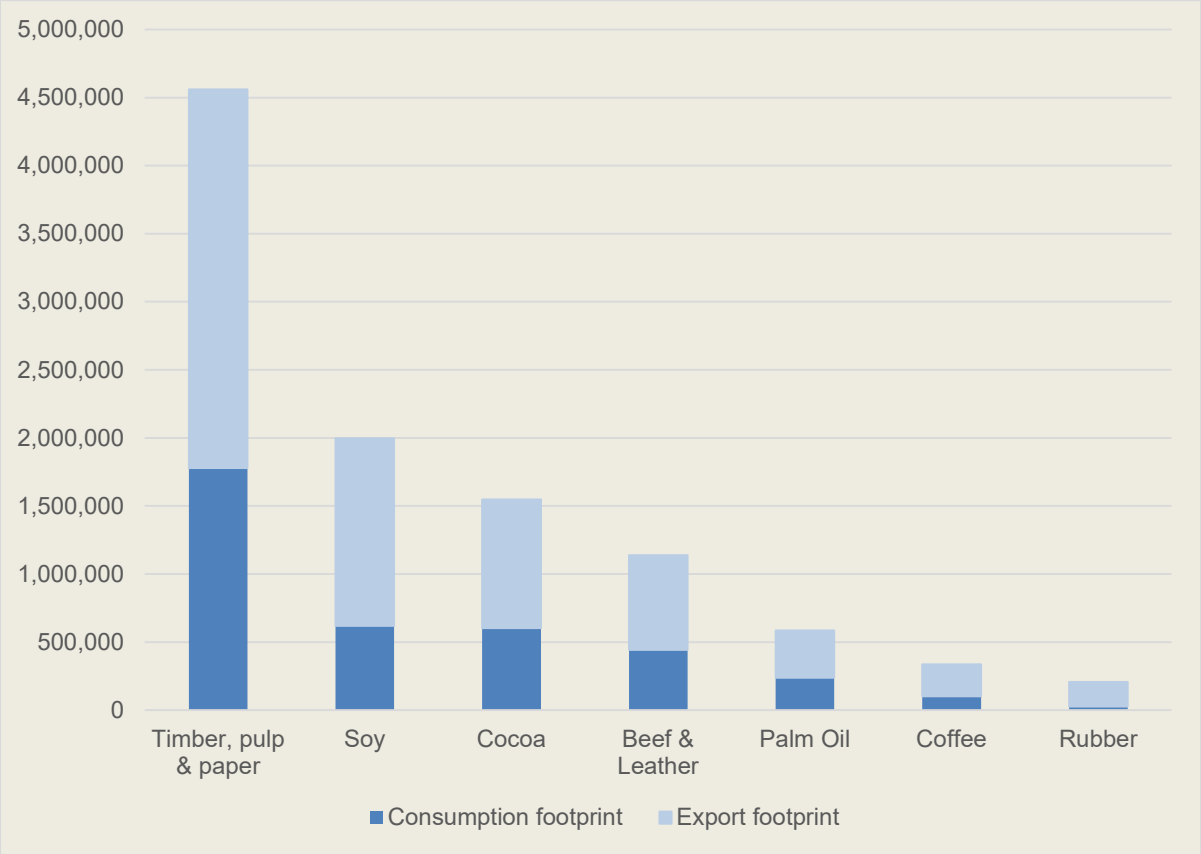
Between 1990 and 2015, the world lost 129 million hectares of forest. Deforestation, forest degradation and the conversion of natural habitats are, in the tropics at least, largely driven by commercial agriculture and forestry. The production of agricultural and forest commodities can also be associated with serious social issues and abuses, including appropriation of land from communities and indigenous groups, forced and child labour.

Belgium imports significant quantities of agricultural and forest commodities – both consuming them and trading them on to other countries – and therefore puts people, forests and other natural habitats at risk. This study estimates the quantities of beef and leather, cocoa, coffee, natural rubber, palm oil, pulp and paper, soy, timber that are imported, their provenance, and the land footprint associated with their production.

The research presented here estimates that the total land area that was required to supply Belgium's demand for these commodities was on average over 10.4 million hectares each year between 2013-17. This is equivalent to a land area more than three times the size of Belgium.

Timber, pulp and paper has the highest land footprint, at over 4.5 million hectares, followed by soy (2 million hectares) and cocoa (1.5 million hectares), reflecting the large quantities of these commodities that are imported by Belgium (Figure A).

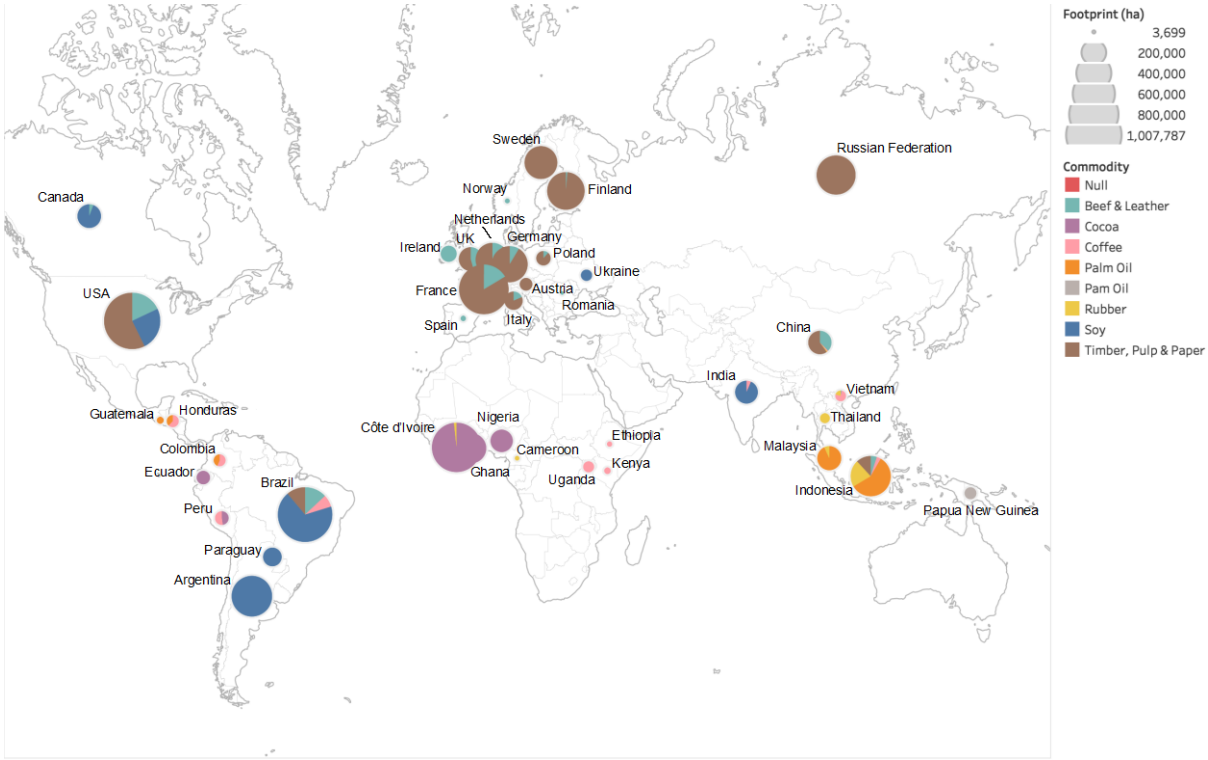
Figure A: Land area required to supply Belgium with commodities (average 2013-17, hectares)



The estimated consumption of these commodities by Belgium averages 33% of imports (or imports plus domestic production, in the case of beef and leather, timber pulp and paper). Separating the import footprint into consumption and export components leaves an estimated consumption footprint of 3.8 million hectares (1.2 times the size of Belgium, or five times the area of Belgium's forest) and a footprint of 6.6 million hectares for commodities that Belgium trades to other countries.

Belgium has land footprints that are over half a million hectares in six countries. The largest is in the USA at just over one million hectares, largely due to imports of timber, pulp and paper, soy, and beef and leather (Figure B). Belgium's footprint in Brazil is of a similar size, at 949,000 hectares, due to imports of coffee, timber, pulp and paper, soy, and beef and leather. France (785,000 hectares, timber, pulp and paper, beef and leather), Côte d'Ivoire (776,000 hectares, mostly cocoa), Argentina (525,000, soy) and Indonesia (517,000 hectares, coffee, palm oil, timber, pulp and paper, natural rubber, and beef and leather) comprise the other countries where Belgium has footprints greater than half a million hectares.

Figure B: Country footprints for all commodities (hectares)

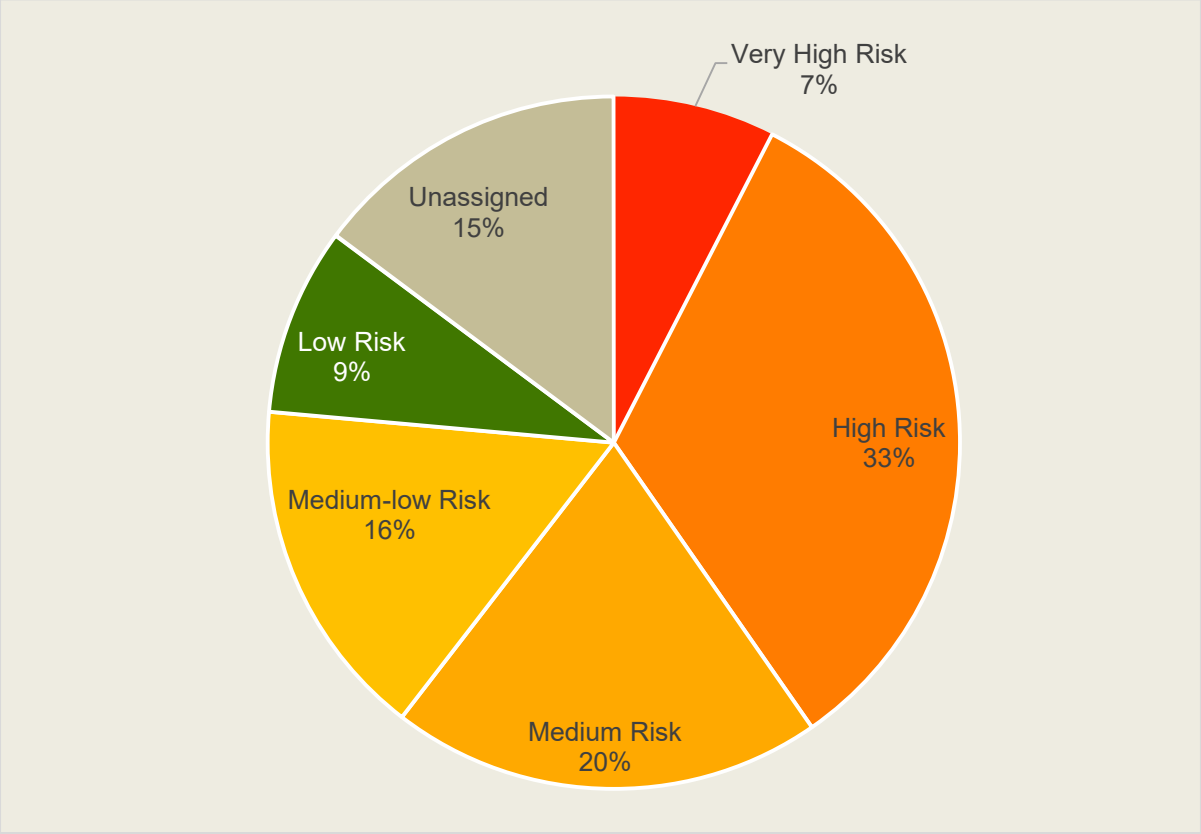


Commodity imports are rarely traceable back to individual farms or plantations, and so the exact contribution of Belgium – via its imports – to deforestation, forest degradation, habitat conversion and social problems is unknown. It remains, however, a very real risk.

We estimate this risk by rating major exporting countries according to the rate and extent of deforestation, the perceived level of corruption, and the labour rights conditions within those countries. The land footprint of Belgium's commodity imports was then allocated to these risk ratings. Forty per cent of the import footprint (4.2 million hectares) is in high and very high risk countries, a land area equivalent to 1.6

times Belgium's own land area (Figure C). Just one quarter of the area (2.6 million hectares, 25%) came from countries with low and medium-low risk ratings.

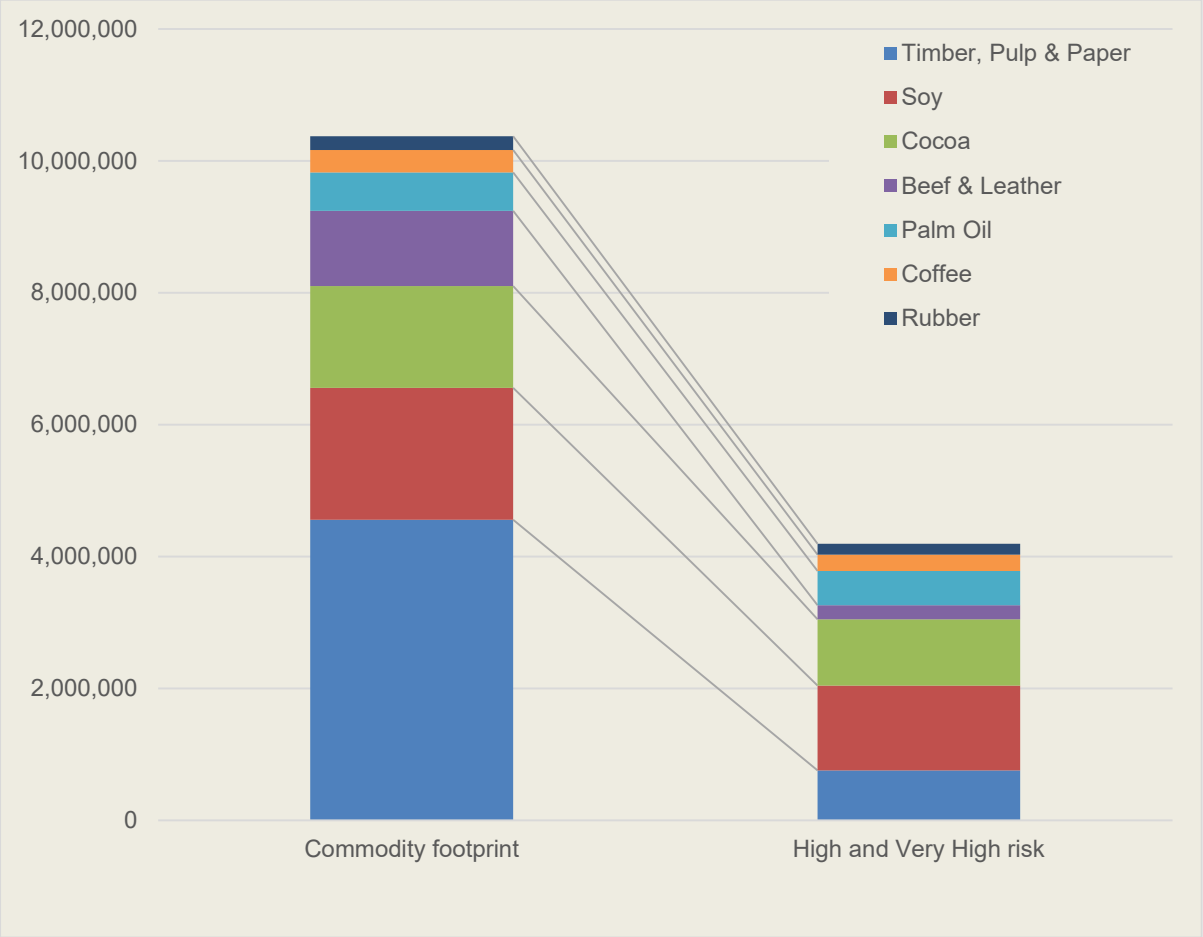
Figure C: Distribution of Belgium's land footprint for imported commodities amongst risk categories



Over half of the land footprint of Belgium's imports of palm oil (89%), natural rubber (80%), coffee (73%), cocoa (65%) and soy (64%) was from countries rated as high risk or very high risk. Timber, pulp and paper, and beef and leather, which are largely supplied from within the EU, have a much lower proportion of their footprints in high and very-high risk countries. However, even within these commodities, there are pockets of high risk, deriving from countries such as China, the Russian Federation and Brazil.

Soy contributes 19% (2 million hectares) to the overall footprint, but is responsible for 31% of the footprint from high and very high risk countries (Figure D). Cocoa also makes a disproportionate contribution to the high and very high risk footprint, being responsible for 15% of the overall footprint but 24% of the high and very high risk footprint.

Figure D: Contribution of commodities to Belgium's high and very high risk footprint (hectares)



In all of these sectors, there are companies that produce commodities responsibly, and companies that show diligence in excluding deforestation and social exploitation from their supply chains. The EU, the Belgian Government, businesses, NGOs and the public have taken action to address some of these issues, through initiatives such as the EU Timber Regulation, purchase of sustainably certified timber, and the Consumer Goods Forum zero net deforestation commitments.

Yet the problems of deforestation, forest degradation, habitat conversion and social exploitation remain, and there are opportunities for all stakeholders to act in order to break the link between Belgium's imports of commodities and deforestation and social exploitation.

The research presented in this report is intended to underpin recommendations for policy-makers, businesses, investors, and consumers. These are being developed by WWF Belgium and are available in a separate document.

Table of contents

1 Introduction

1.1 Links between the commodity trade and deforestation

Forests are home to more than 80% of all terrestrial species, deliver ecosystem services such as flood protection and reduction in atmospheric carbon dioxide levels,[1] and provide a livelihood for forest-dependent communities, including the 60 million indigenous people who live in forests. Between 1990 and 2015, the world lost 129 million hectares of forest.[2]

Agricultural and forest commodities, such as beef and leather, cocoa, coffee, palm oil, paper and pulp, soy, natural rubber and timber have been cited as major drivers of deforestation[3] and habitat destruction in some of the most biodiverse and ecologically important places in the world.[4] Whilst the production and trade of commodities provides a livelihood for millions of people, they have also been associated with negative social impacts, including land grabs, forced labour, and terms and conditions of employment that are below international norms.

The EU has recognised its role in deforestation caused by expanding production of these commodities, through consumption and trade, and acknowledges that combatting deforestation is essential to meeting its target of cutting global greenhouse gas emissions by at least 50% below 1990 levels by 2050. In 2008, it proposed a target of halting global forest cover loss by 2030 and reducing gross tropical deforestation by at least 50% by 2020 compared to current levels.[5] European governments and the European Parliament have called on the Commission to develop an action plan on deforestation to deliver this goal, with French, Danish, German, Netherlands and United Kingdom delegations to the Environment Council of March 2018 requesting that the Commission propose *'as soon as possible, of an ambitious Commission strategy to combat imported deforestation'*.[6] The Commission has recently published a feasibility study on options for the EU to combat deforestation,[7] with an accompanying study assessing the social and environmental impacts of palm oil.[8]

---

[1] WWF. 2018. Living Planet Report - 2018: Aiming Higher. Grooten, M. and Almond, R.E.A.(Eds). WWF, Gland, Switzerland

[2] FAO (2016) Global Forest Resource Assessment 2015

[3] We use the FAO's definition of deforestation: 'The conversion of forest to other land use or the permanent reduction of the tree canopy cover below the minimum 10 percent threshold.' FAO (2015). Global Forest Resource Assessment 2015: Terms and Definitions. Rome.

[4] Boucher, D., Elias, P., Lininger, K., May-Tobin, C., Roquemore, S. & Saxon, E. (2010). The root of the problem: what's driving tropical deforestation today? The Union of Concerned Scientists.

[5] Commission of the European Communities (2008). Addressing the challenges of deforestation and forest degradation to tackle climate change and biodiversity loss. Communication from the Commission to the European Parliament, the Council, the European Economic and Social committee and the Committee of the Regions. Brussels, 17.10.2008. Last accessed 28 November 2018: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0645

[6] Council of the European Union (2018). NOTE From: General Secretariat of the Council To: Delegations Subject: Amsterdam Declarations – Combating imported deforestation - Information from the French, Danish, German, Netherlands and United Kingdom delegations. Brussels, 26 February 2018. Last accessed 27 November 2018 http://data.consilium.europa.eu/doc/document/ST-6528-2018-INIT/en/pdf

[7] COWI (2018). Feasibility study on options to step up EU action against deforestation Inventory of existing EU policies, legislation and initiatives addressing the drivers of deforestation and forest degradation. FINAL REPORT. European Union, Luxembourg. ISBN 978-92-79-80498-4 Available at: http://ec.europa.eu/environment/forests/pdf/feasibility_study_deforestation_kh0218321enn_interventions.pdf

[8] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)
http://ec.europa.eu/environment/forests/pdf/palm_oil_study_kh0218208enn_new.pdf

In December 2015, Denmark, France, Germany, the Netherlands and the UK signed the Amsterdam Declaration Towards Eliminating Deforestation from Agricultural Commodity Chains with European Countries.[9] Taking note of related initiatives and global agreements such as the New York Declaration on Forests, the Sustainable Development Goals, and the global climate agreement reached at UNFCCC COP 21 (the Paris Agreement), the Amsterdam Declaration aims to support private sector and public initiatives to halt deforestation from the production of agricultural commodities by no later than 2020. The Declaration was endorsed by Norway in 2016, but Belgium is not yet a signatory.

As a consumer and major trader of agricultural and forest commodities, Belgium has a role to play in ensuring that the future production of these commodities no longer causes deforestation or social exploitation.

Box 1: Imported deforestation

The notion of imported deforestation (or 'embodied deforestation') refers to the deforestation associated with an imported, produced, traded, or consumed product, good, commodity or service. The concept is now widely accepted, and has been enshrined within high level policy commitments such as the Amsterdam Declaration Towards Eliminating Deforestation from Agricultural Commodity Chains with European Countries,[10] and global agreements such as the New York Declaration on Forests, the Sustainable Development Goals, and the global climate agreement reached at UNFCCC COP 21 (the Paris Agreement).

Over the period 1990-2008, the EU28 imported from other regions nine million hectares of deforestation embodied in crop and livestock products. This is almost 36% of the total deforestation that was embodied in crop and livestock products traded globally during that period.[11]

1.2 About this report

The overarching purpose of the research presented here is to inform ongoing efforts to reduce the negative environmental and social impacts of Belgium's imports of commodities. The specific research objectives for this report are:

- To assess the extent to which Belgium's supply chains for timber, pulp and paper, palm oil, soy, cocoa, beef and leather, natural rubber and coffee are sustainable and deforestation-free.
- To generate a risk score that illustrates the risk of deforestation and social problems that Belgium's imports of these commodities may create.

[9] https://www.euandgvc.nl/documents/publications/2015/december/7/declarations
[10] https://www.euandgvc.nl/documents/publications/2015/december/7/declarations
[11] European Union (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation. Technical Report 2013-063.

2 Methods

The general approach to data analysis is outlined in this section. The analysis is based on methods developed for a UK study that was commissioned by WWF UK and RSPB for the UK's imports of deforestation- and conversion-risk commodities.[12] The intent of that study was to develop a robust and transparent approach that could be replicated in other countries, and to provide evidence to guide action.

2.1 Quantifying Belgium's imports

The quantity (net weight) and value (in US$) of Belgium's imports of each commodity were extracted from the UN COMTRADE database for the years 2013-17. The UN COMTRADE database is preferred to national data as it contains comparable data for all countries, which facilitates additional calculations for export countries, and cross-checking of results. Unless otherwise stated, all trade data is derived from this database. The economic value of imported goods was converted from US$ to Euros, using historical annual conversion rates.[13]

We examined three routes by which commodities feature within Belgium's supply chains:

- As **raw materials** (e.g., sawn timber);
- As a **component or ingredient** of imported manufactured goods (e.g., natural rubber in car tyres);
- **Embedded** within the production process of imported goods (e.g., soy used to feed imported chicken)

Many commodities are used in thousands of different products, and so the data captured was confined to those product categories that are cited in the literature as being major uses of the commodity (see Appendices 1, 4, 5, 6, 7, 8 and 9 for a list of the product codes used). The estimates of imports do not include all possible imports of each commodity, and are therefore conservative. However, we are confident that the HS codes used capture the majority of the imported volumes.

2.2 Estimating the provenance of the Belgium's imports

Three general situations are found:

- **A country is a producer and exporter**. Belgium's imports can be assigned the provenance of the exporting country without further analysis (e.g., Brazil's production of soy).
- **A country is an importer and exporter**. For example, the Netherlands imports palm oil and exports it, but does not produce it domestically. Belgium's imports of palm oil from the Netherlands are therefore assigned to the countries from which the Netherlands imports.
- **A country is a producer, importer and exporter**. For example, China produces, imports and exports large quantities of timber. In this situation, the origin of major exporter's imports were analysed, and added to its national production. Exports to

[12] WWF and RSPB (2017). Deforestation and Social Risks in the UK's Commodity Supply Chains. This report, and the summary report 'Risky Business', are available at https://www.wwf.org.uk/riskybusiness

[13] Historic exchange rates from Statista https://www.statista.com/statistics/412794/euro-to-u-s-dollar-annual-average-exchange-rate/

Belgium were then assigned in the same proportion as their relative contributions to the total of the domestic production plus imports. Thus, if Country A produces one million tonnes of a commodity domestically, and imports 0.5 million tonnes from Country B, two thirds of Belgium's imports from Country A would be assigned to Country A, and one third to Country B.

To make this re-assignment feasible, we focused on estimating provenance for countries that are responsible for at least 2% on Belgium's imports, by value (see Section 2.1). Value is used for this cut-off point because – for commodities such as timber – it increases the inclusion of countries that export high value products in relatively small volumes (e.g., tropical hardwoods). For other commodities, the countries that account for at least 2% of Belgium's imports by volume and by value are the same (e.g., soy).

2.3 Estimated Consumption

Belgium is a major trading hub for the trade in international commodities, and both exports and consumes many products that contain deforestation-risk commodities. We provide an estimate of the quantity of each commodity consumed within Belgium to separate Belgium's role as a consumer from its role as a trader.

Consumption is calculated by deducting exports from the sum of imports plus Belgium's domestic production. Domestic production is zero for commodities such as palm oil and cocoa, but is significant in others such as timber, beef and leather.

The quantity of exports is estimated using UN COMTRADE data, utilizing the same HS codes (unless otherwise stated) and conversion factors used to estimate imports. Belgium's production, where relevant, is from FAOSTAT.

The consumption estimate is compared with the FAO's similar 'supply' metric where available. 'Supply' is a somewhat more complex metric, which includes wastage and losses from disasters as well as production, imports and exports, but it provides a means of sense-checking the consumption calculation.

2.4 Estimating the footprint of Belgium's imports of commodities

Deforestation is measured by the area of land that has lost forest cover, and if we are to make meaningful assessments of the risk of deforestation caused by Belgium's imports of commodities, we need to understand the land area required to produce Belgium's imports.

Estimating the land area required to supply Belgium's imports is essentially a two-step process. Firstly, the imported net weight of products needs to be converted into the quantity of harvested commodity that they contain. For raw materials (e.g., whole soy beans) no conversion is required. Where the commodity is a component of the imported goods, or embedded within it, a conversion factor is applied to the imported net weight. Details on conversion factors are given in the Appendices.

The second step is to estimate the land area required to produce the quantity of imported commodity. For most commodities, this is done by applying a yield to the estimated quantity of harvested commodity. FAO yield data,[14] specific to each commodity for each country and year, was used unless otherwise stated.

Finally, some commodities, notably palm oil and soy, are commonly imported in different fractions of the harvested crop. For example, soy is imported as whole soy beans, soy meal, and soy oil (or products containing those fractions). In this case, imported goods are first assigned to the fraction of the commodity they contain, and then yield is assigned to that

[14] FAO STAT. The FAO calculate yield as the national production of the crop divided by area planted each year.

fraction in the same proportion that the fraction is derived from the harvested crop. For example, one tonne of whole soy beans yields 0.82 tonnes of meal and 0.18 tonnes of soy oil[15]. The area required to supply Belgium's imports of whole soy beans (or products containing whole beans or that have whole beans embedded in the production process, once their weights have been converted to soy bean equivalent) is estimated by dividing the quantity of beans by the yield; the area for products using soy meal is estimated by dividing the quantity of meal by the yield * 0.82; and the area for products using soy oil is estimated by dividing the quantity of oil by the yield * 0.18.

The major exceptions to this method are timber, pulp and paper, and beef and leather, for which further details are given below.

2.4.1 Timber, pulp and paper

As trees are an intermittently harvested perennial crop, with hugely variable management systems, there is no straightforward measurement 'yield' that can be used to estimate the land required to produce a given amount of timber in the way that there is for agricultural crops. The approach taken was therefore to use the annual increment, which is the increase in the volume of timber in a forest per hectare per year,[16] and which in effect accounts for the area of forest needed to produce a given amount of timber in a year. For example, if the increment were one cubic metre per hectare per year, it would take ten hectares to produce 10 cubic metres of timber in a year (equally, one hectare would produce the same amount in ten years).[17]

Belgium's timber, pulp and paper imports were converted from tonnes of imports to wood raw material equivalent (WRME). This conversion adjusts for the wood content of manufactured products (e.g., plywood contains both wood and resin) and results in a volume metric that is broadly equivalent to the useable volume of a harvested tree. The conversion factors used were from the UK Forestry Commission (see Appendix 2),[18] and where no conversion factor is available, the closest available estimate was used (e.g., for the import category 'cartons and boxes of paper and paperboard' the conversion factor for 'other paper and paperboard' was applied). The area of forest required to produce this volume of WRME was estimated by dividing the WRME by the exporting country's Net Annual Increment (NAI, see Appendix 3).[19]

---

[15] U.S. Soybean Export Council conversion table, see: https://ussec.org/resources/conversion-table.

[16] Technically, the increment measure used was Net Annual Increment (NAI) which is defined as the average annual volume of gross increment over the given reference period less that of natural losses on all trees, measured to minimum diameters as defined for 'growing stock'. Source: FAO (2012). FRA 2015 Terms and Definitions. FAO, Rome.

[17] Note that due to the large variation in NAI according to forest type and management system, the use of country level NAI could lead to significant over- or under-estimate of land footprint if Belgium's imports from a particular country are highly specific (e.g., a particular species, or from a particular plantation. However, it does provide a reasonable first order estimate.

[18] Conversion to WRME underbark: Tools and Resources: Conversion Factors. UK Forestry Commission https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2016-introduction/sources/timber/conversion-factors/

[19] Net Annual Increment (NAI) data was obtained from FAO (2016) Global Forest Resource Assessment 2015: Desk Reference. Food And Agriculture Organization Of The United Nations, Rome. The FAO does not provide NAI for all of Belgium's major exporters. NAI for Brazil was calculated as the average of estimates given in D. Alder, J.N.M Silva, JOP de Ca Carvalho, J. do C. Lopes, A.R. Ruschel (2012). The cohort-empirical modelling strategy and its application to forest management for Tapajós Forest, Pará, Brazilian Amazon. Bois et Forets Des Tropiques, 314; D. Valle, M. Schilze, E. Vidal, J. Grogan & M. Sales (2006). Identifying bias in stand-level growth and yield estimations: A case study in eastern Brazilian Amazonia. Forest Ecology and Management, Volume 236, Issues 2–3, pp 127–135 (both Amazon); and http://www.fao.org/3/a-ac121e.pdf (Brazilian pine plantations). The average NAI of all major countries was applied to that portion of Belgium's imports that were from countries with less than 1% of imports by value ('Other and unassigned').

2.4.2 Beef and leather

Unlike agricultural crops, we found no publicly available data on cattle pasture productivity for a cross-section of countries (i.e. carcass weight per hectare of pasture). While individual studies exist for some countries, a variety of methods were used in these reports, and so using a mixture of different sources was not feasible. This seems like a significant gap in global agricultural data given the significant land use associated with cattle production. To fill this data gap we adopted method used by de Ruiter *et al.* (2017)[20] that allocates total country pasture to different grazing animals based on the relative feed conversion efficiencies and overall sector production.

Given that beef cattle have two products (meat and leather), we allocated a share of the land footprint to beef and leather co-products on the basis of their mass (the hide being 15% of the mass of a carcass,[21] it was allocated 15% of the land footprint). This was to avoid the potential double-counting of land where beef and leather where sourced from the same country.

There are limitations to this method (explored in detail in de Ruiter *et al., 2017)* – for example we assume similar feed conversion rates and pasture use in all countries. However, given the lack of evidence in this area it was felt to be a reasonable approach to estimating sector-level grazing use for beef cattle.

This calculation showed significant variation between countries – including some countries that appear to be very extensive e.g. Namibia (>5000m^2/kg Carcass Weight Equivalent) and Australia (800m^2/kg Carcass Weight Equivalent). It is also worth noting that India appears to have very high pasture stocking rate, however we suspect this is because cattle often graze waste land, common land, urban areas and on waste by-products (e.g. rice husks). Hence a large cattle population are supported by a relatively small amount of grazing pasture.

2.5 Risk index

The land footprint of a commodity is an estimate of how much land is required to produce imports. However, the likelihood of these imports being associated with deforestation and social exploitation depends on the production systems in the countries in which they were produced. For example, production of a commodity in a country that has strong and well-implemented labour laws is less likely to be associated with labour problems than the same commodity produced in a country with poorly implemented and weaker regulations.

A risk-based approach is used to illustrate the potential association of Belgium's commodity imports with social problems and deforestation. A risk-based approach is favoured because there are two over-arching challenges when assessing the environmental and social risks of the global trade in commodities:

- **Deforestation processes are varied**. In some instances, natural forest may be directly converted to plantations or farms. However, the process is often non-linear, and making attribution of conversion to a single commodity difficult. For example, deforestation may progress via degradation caused by logging, with farmers then using logging tracks to claim land and farm, consolidation of these settlements into larger landholdings with additional deforestation (e.g., for cattle ranching), and then further change into a 'final' commodity production (e.g., soy production). Assigning

[20] de Ruiter, H., Macdiarmid, J.I., Matthews, R.B., Kastner, T., Lynd, L.R. and Smith, P. (2017) Total global agricultural land footprint associated with UK food supply 1986–2011. Global Environmental Change 43 (2017) 72–81

[21] Agriculture and Horticulture Development Board (2014). AHDB Beef Yield Guide. AHDB, Kenilworth, Warwickshire, UK. http://www.qsmbeefandlamb.co.uk/books/beef-yield-guide/files/assets/common/downloads/beef-yield-guide.pdf

deforestation to a specific commodity in such a chain of events is thus somewhat arbitrary.

- **Traceability**. It is rarely possible to know which forest or plantation a particular end-product comes from, and hence whether its production has occurred directly on recently deforested land or not. Although advanced modelling and remote sensing are beginning to provide greater insight, these approaches are not available in all producer countries or for most commodities.

2.5.1 Overview of method

We developed a risk index by assigning a risk rating to each exporting country according to indicators of deforestation and social risk. The inclusion of indictors for both deforestation and social exploitation reflects the focus and commitments of many actors (private sector and NGOs) to make supply chains free from deforestation and exploitation.

Four factors were used to indicate deforestation and social risk in producer countries:

- **Tree cover loss**. This provides an indication of the total extent of the deforestation problem in producer countries. The data used is the area of land with > 10% forest cover lost between 2012-16.[22] Using the low threshold of land with > 10% forest cover[23] means that this indicator takes into account loss of tree-savannah type vegetation, such as the Brazilian *Cerrado*, as well as high forest.
- **Rate of deforestation**. This is a measure of the proportion of change in net natural forest area (excluding plantations) in each producer country between 2010-15. Use of this second deforestation indicator helps to balance out the bias towards large countries of the previous indicator, whereas countries that are losing a large proportion of their small remaining area of natural forest score highly on this indicator.[24]
- **Perception of corruption.** No single global data set is available that captures the range of social problems that have been associated with the production of commodities. These issues include land grabs, forced labour, child labour, and terms and conditions of labour below international norms. Transparency International's Corruption Perception Index is used as a proxy for the likelihood of the range of social and governance issues within an exporting country.[25]
- **Labour standards.** The International Trade Union Confederation (ITUC) documents violations of internationally recognised labour rights by governments and employers and uses these records to score countries, providing a measure of the likelihood of serious workers' rights violations, including forced labour, violence, and the denial of the right to free association.[26]

The value of each indicator in each country was scored on a three-point scale (high = 3 to low =1) according to the thresholds described in Table 1. These thresholds were selected according to the data range of producer countries that export to Belgium to clearly distinguish between high and low impact. For example, Brazil lost 17.5 million hectares of

[22] Global Forest Watch. http://data.globalforestwatch.org/
[23] Readers interested in interrogating patterns of tree cover loss can use Global Forest Watch's interactive mapping tool at http://data.globalforestwatch.org/
[24] FAO FLUDE data
[25] Transparency International (2017). Corruption Perceptions Index 2017. https://www.transparency.org/news/feature/corruption_perceptions_index_2017
[26] ITUC (2016). Global rights index: the world's worst countries for workers. International Trade Union Confederation, https://www.ituc-csi.org/IMG/pdf/survey_ra_2016_eng.pdf

forest with >10% tree cover between 2013-17 compared with the Netherland's 5,200 hectares. These countries score 'high' and 'low' respectively.

Table 1: Indicators and scoring used to indicate risk of deforestation and social issues with Belgium's imports of commodities

Indicator	Description	Scoring		
		High risk	**Medium risk**	**Low risk**
Tree cover loss	Global Forest Watch assessment of the area of forest cover loss 2012-16	≥1M ha	500K to 1 M ha,	<500K ha
Deforestation rate	Percentage change in natural forest 2010-15 (FAO)	≤-1%	-1% to 0%	>0%
Labour Standards	ITUC Labour Standards score 2017 based on reported violations of labour rights published in 2017	≤5	3 to 4	≥2
Corruption Perception	Index of the perceived levels of public sector corruption published in 2017 (Transparency International)	≤36	37-72	>72

An overall country risk rating was calculated by summing the scores for the individual indicators. This score was used to develop five risk categories, which are colour coded to aid visual inspection of the results (see Table 15).

Belgium's import footprint is then apportioned to risk categories based on which partners they trade with, to illustrate the deforestation and social risks of the commodities that are the focus of this study.

2.6 Data challenges

There are significant challenges and constraints inherent in assessing commodity data and the link between production and deforestation. Our analysis focuses on capturing the majority of the trade in the selected commodities, not the whole, and makes conservative assumptions throughout. If anything, the results are likely to be underestimates.

Specific challenges within the constraints of this study are:

- **The diversity of products**. Many commodities have thousands of end uses. For example, the uses of timber, pulp and paper include construction, electricity generation, furniture, and stationery. The approach taken was to focus only on the major uses of each commodity.
- **Poor data on typical commodity use in products**. Commodities are combined with other components in many imported items. For example, natural rubber is combined with metal, chemicals, plastics (etc) in many vulcanised rubber products. The proportions vary depending on the specific product. The conversion factors used to estimate the commodity content of manufactured goods are therefore only first order approximations.
- **Complex/long supply chains**. There are often multiple stages of processing and manufacturing, and export can occur after any of these. This means that there is – at the level of individual items – little traceability on which country, let alone forest or

farm, a particular product has come from. The estimation of provenance (see above) is for some products no more than a first order estimate.

- **Need to cover multiple jurisdictions**. Sub-national patterns in production, export and deforestation are not detected in this analysis because of the need to cover multiple jurisdictions, which in turn means that the analysis of provenance is only practical at a national level. This could lead to overestimations of risk if, for example, deforestation is occurring in a different part of the country from that in which a commodity is produced. Equally, risk could be underestimated if a production of particular commodity was closely associated with deforestation.
- **Variability in productivity**. As described above, we have used national productivity (yield) assumptions. However it is conceivable that some of Belgium's imports are sourced from a niche system with a productivity different from the country average.
- **The lack of readily available data on the Belgium's imports of certified commodities**. Credible certification is one of the major ways of reducing the risk that an imported item has been associated with deforestation, poor social practices, or illegality. However, there is limited data available on the proportion of Belgium's imports that are certified.

This report provides a useful guide on the overall need for action, relative levels of risk for commodities coming from different countries, and an indication of where the Belgian government, businesses and civil society might target their efforts in order to have most impact in reducing the deforestation risk of Belgium's overseas commodity footprint. There are uncertainties in the specific figures calculated using this methodology, but the index approach allows for an interpretation of the figures that is intended to be simple, transparent, and adequate to drive action.

3 Wood products

This chapter is a summary of an earlier technical report produced on behalf of WWF Belgium,[27] which was used as the basis for a public-facing synthesis report in French and Dutch.[28] The analysis from these reports has been adjusted to report the same years (2013-17) and the same threshold for exporter country inclusion (2%) as the other commodities in this report.

3.1 Production, uses and sustainability of timber, pulp and paper

3.1.1 Production systems

There are two major production systems for wood: plantations and natural forest. The bulk of the world's forest is natural, with an estimated 3.7 billion hectares in 2015. Around 31% of the world's forests, almost 1.2 billion hectares, are designated as production forest, with a further 28% (over 1 billion hectares) designated as multiple use, i.e., serving multiple functions including timber production.[29] The area of planted forest has increased by over 105 million hectares since 1990, and now there is an estimated 291 million hectares of plantations, which vary in the intensity of production.

Belgium's forest area was estimated at 683,000 hectares in 2015,[30] and produced over four million cubic metres of timber (including fuel wood, saw wood logs and veneer logs) in 2016, with an additional 1.4 million cubic metres of pulpwood. Belgium has one of the smallest annual timber harvests of any country within the EU, and is net importer of timber, pulp and paper products, with a trade deficit in excess of € 700 million per year for major wood products.[31]

3.1.2 End uses

The key product types within the timber sector are sawnwood, plywood, particleboard, furniture, fuelwood and pulp and paper, collectively 'timber, pulp and paper'. Wood is extremely versatile and has a wide variety of end uses, including:

- **Fuel:** Globally, 49% of harvested wood is used for fuel,[32] with fuel being a major use of timber in developing countries and increasingly in some EU countries also.[33]
- **Construction:** Timber is widely used as a construction material in house frames, flooring (solid wood; laminate or parquet blocks), window frames, doors and doorframes, skirting, decking, garden buildings, telegraph poles, fencing, boat building, railway sleepers, etc.

[27] Steve Jennings & Béatrice Wedeux (2018). The risk of corruption and forest loss in Belgium's timber and paper imports. 3Keel and WWF Belgium. Available at: https://wwf.be/fr/lutter-contre-le-bois-illegal/
[28] Available at https://wwf.be/fr/lutter-contre-le-bois-illegal/
[29] FAO (2016) Global Forest Resource Assessment 2015: How are the world's forests changing? Food And Agriculture Organization Of The United Nations, Rome.
[30] FAO (2016). Global Forest Resource Assessment 2015: Desk Reference. Food And Agriculture Organization Of The United Nations, Rome
[31] OEWB (2017). PanoraBois Wallonie. Édition 2017. Office économique Wallon du Bois. Marche-en-Famenne, Belgium
[32] FAO (2016) Global Forest Resource Assessment 2015: How are the world's forests changing? Food And Agriculture Organization Of The United Nations, Rome.
[33] For example, the UK (see https://www.wwf.org.uk/riskybusiness) and France (https://www.wwf.fr/deforestation-importee).

- **Furniture:** Varying from softwood furniture (e.g. pine) and plywood/laminate flat pack furniture, to luxury hardwood (e.g., mahogany, teak).
- **Various:** Musical instruments, tool handles, decorative items, packaging (e.g. pallets), etc.
- **Industrial processes**: Wood is used in electricity generation, principally in the form of wood pellets, and in food processing (smoking), etc.
- **Paper and paperboard:** are used in magazines, books, stationery, office paper, boxes, packaging, tissues, and labels. It can be coated with a wide variety of materials for specific uses such as printing photographs, pressure sensitive papers, or heat sensitive papers. Pulp and paper are made predominantly from cellulose fibres present in trees in developed countries, with agricultural residues more widely used in some developing nations. The cellulose fibres are derived directly from pulp grade logs, from wood chips, wood reclaimed from other manufacturing processes (e.g. furniture making), and from recycled paper.

3.1.3 Environmental and social issues associated with wood production

Unsustainable harvesting of timber has been cited as a major driver of deforestation,[34] forest degradation, habitat destruction, and species loss in some of the most biodiverse and ecologically important places in the world.[35] Other reported negative environmental impacts include increased vulnerability to natural disasters such as erosion, siltation, landslides, flooding and forest fires. Whilst the production of commercial timber provides a livelihood for millions of people, it has also been associated with negative social outcomes, including land grabs, forced labour, working conditions that are below international norms, and corruption, with knock-on effects for social infrastructure and human well-being in the countries concerned.

The illegal timber trade was estimated to be worth between US$ 30 and US$ 100 billion, or 10–30% of global wood trade.[36] This illegal trade loses governments revenue through the non-payment of taxes, revenue that could contribute to poverty reduction, health care or education. It is estimated that 62–86% of all suspected illegal tropical wood entering the EU and US arrives in the form of paper, pulp or wood chips.[37]

Globally, there has been a shift in recent decades away from using hardwood pulp sourced from natural forests towards ‘fastwood’ plantations, especially eucalyptus and acacia. The creation of pulpwood plantations has sometimes been at the expense of natural forest and other natural habitats. This can have a significant impact on biodiversity, and for this reason the main certification schemes, FSC and PEFC, essentially exclude plantations (for pulp and other end uses) that have replaced natural forest on areas converted from natural forest after November 1994 and 2010 respectively.

---

[34] We use the FAO’s definition of deforestation throughout this report: ‘The conversion of forest to other land use or the permanent reduction of the tree canopy cover below the minimum 10 percent threshold.’ FAO (2015). Global Forest Resource Assessment 2015: Terms and Definitions. Rome.

[35] Boucher, D., Elias, P., Lininger, K., May-Tobin, C., Roquemore, S. & Saxon, E. (2010). The root of the problem: what’s driving tropical deforestation today? The Union of Concerned Scientists.

[36] Nellemann, C., INTERPOL Environmental Crime Programme (eds). 2012. Green Carbon, Black Trade: Illegal Logging, Tax Fraud and Laundering in the Worlds Tropical Forests. A Rapid Response Assessment. United Nations Environment Programme, GRIDArendal. www.grida.no ISBN: 978-82-7701-102-8

[37] Nellemann, C., Henriksen, R., Raxter, P., Ash, N., Mrema, E. (Eds). 2014. The Environmental Crime Crisis – Threats to Sustainable Development from Illegal Exploitation and Trade in Wildlife and Forest Resources. A UNEP Rapid Response Assessment. United Nations Environment Programme and GRID-Arendal, Nairobi and Arendal, www.grida.no ISBN: 978-82-7701-132-5

3.1.4 Certification

Trees are a renewable resource, and there are alternatives to unsustainable and illegal timber. Responsible forest management can maintain the ecological and social benefits that forests provide, whilst achieving economically viability and contributing to the national economy of producer countries. There are two internationally recognised systems for the certification of sustainable forestry management and its supply chain – the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). FSC has 196 million hectares certified globally (of which 94.4 million hectares are in Europe), and the PEFC 304.2 million hectares (95.8 million hectares in Europe).[38]

Both the FSC and PEFC systems include similar basic components:

- Forest management and chain of custody standards that include requirements for sustainable forest management and the tracking of certified materials from forest to end product/sale.
- The use of a trademark (scheme logo) in conjunction with information on the certification process (e.g. a certificate number) at point of sale to provide assurance to buyers/consumers.
- Independent third party certification audits conducted by accredited certification bodies to ensure that the requirements of these standards are being met.
- Independent accreditation of certification bodies to ensure that they have the right systems, processes, skills, expertise and local knowledge to conduct an audit effectively.

Both schemes are working towards the implementation of sustainable forest management practices around the world, and both provide purchasers with assurance against some of the worst excesses of the timber trade, including illegality. However, they have chosen different routes and approaches to get there:

- The FSC continues to enjoy support from major environmental NGOs, including WWF.
- The limited evidence from independent, direct comparisons suggest that the FSC certification system is stronger, more transparent and more consistently applied than the PEFC system.
- The FSC standard is considered to possess stricter safeguards on aspects such as biodiversity conservation and workers' rights.

One significant technical difference is that the FSC has more stringent controls on the origins of the non-certified portion of products that contain both certified and non-certified material. The requirements of the PEFC chain of custody standard mean that such 'mixed' products could contain wood from areas where traditional and civil rights are violated, or where poor forest management threatens areas of high conservation value. However, even the 'FSC mix' is open to criticism, as shown by recent Greenpeace campaign against Essity (the producer of Lotus toilet tissue).[39]

[38] Sources: FSC Facts & Figures: https://ic.fsc.org/en/facts-and-figures, PEFC Facts and Figures: https://www.pefc.org/about-pefc/who-we-are/facts-a-figures and PEFC – Global Statistics – SFM and CoC Certification – Data (Sept 2017): https://www.pefc.org/images/documents/PEFC_Global_Certificates_-_Sep_2017.pdf

[39] https://www.greenpeace.org.uk/velvets-claim-protecting-forests-flushed-away/

Certification is well advanced in Belgium, with 686 Belgian enterprises holding FSC Chain of Custody certificates in 2017, and 471 having the equivalent PEFC certificates.[40] The market penetration of certification varies significantly according to products. Sawn wood and board material from verified FSC and PEFC sources represented 40.5% of the market in 2012, increasing to 59.5% in 2016.[41] However, only 29.5% of the sawn tropical hardwood and 17.8% of temperate hardwoods were certified, whereas 71.6% of the sawn softwood and 53.7% of the panels available on the market were certified. Encouragingly, 78.9% of the paper and paperboard available on the Belgian market was estimated to be certified.

3.1.5 The EU and Belgium's response to illegal and unsustainable timber

Illegality within the international trade in timber, pulp and paper trade has received significant attention within the EU. The EU's Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan was established in 2003. The Action Plan sets out a range of measures available to the EU and its member states to tackle illegal logging in the world's forests. The measures include supporting timber-producing countries, promoting trade in legal timber, promoting environmentally and socially beneficial public procurement policies, supporting private-sector initiatives, financing and investment safeguards, using existing or new legislation (the EUTR), and addressing the problem of conflict timber. A key aspect of the Action Plan is the creation of Voluntary Partnership Agreements (VPAs) between the EU and timber-producing countries. A VPA aims to improve forest governance and, ultimately, provide a guarantee that timber and timber products exported to the EU are legal. Cameroon, Central African Republic, Ghana, Indonesia, Liberia and Republic of Congo are currently listed as implementing VPAs with the EU.[42]

The EU Timber Regulation (EUTR) came into effect in all countries in the EU on 3 March 2013. The Regulation prohibits the placing of illegally harvested timber (i.e., violating the laws of the country of harvest) on the European market, and covers both imported and domestically produced timber and timber products. The scope of the regulation includes solid wood products, flooring, plywood, pulp and paper (the complete list is given in the Annex of EUTR[43]), but does not include all wood products. For example, those products that have completed their lifecycle, and would otherwise be disposed of as waste are excluded, as are some specific import categories, such as upholstered seats and kitchenware. Timber or timber products that carry a valid FLEGT licence or Convention on Illegal Trade in Endangered Species (CITES) permit are automatically considered to comply with the requirements of the Regulation. VPA and CITES are the only licenses that are recognised in this way by the EUTR; e.g. certified timber cannot be used on its own as evidence of compliance.

EU Member States are obliged to determine penalties for non-compliance with the EUTR, establish authorities that will be able to check for compliance of the design and implementation of an operator's (the actor placing wood products on the EU market) Due Diligence System (DDS), recognize a monitoring organisation (in Belgium, this is FPS Public Health, Food Chain Safety and Environment), check for their compliance with the EUTR, and provide assistance to operators in implementing the EUTR.

---

[40] OEWB (2017). PanoraBois Wallonie. Édition 2017. Office économique Wallon du Bois. Marche-en-Famenne, Belgium

[41] Dries Van der Heyden, Bert De Somviele, Mark van Benthem, Jan Oldenburger, & Jasprina Kremers (2018). Valentijn BilsenBois certifié sur le marché belge en 2016 : Etude de marché, perspectives et recommandations pour une révision de l'Accord Sectoriel. BOS+, Belgium

[42] http://www.flegtlicence.org/vpa-countries

[43] http://ec.europa.eu/environment/forests/timber_regulation.htm

Legality is, of course, no guarantee of sustainable production, and certification is the pre-eminent market-based mechanism for guaranteeing that production is economically, socially and environmentally responsible within the sector. In 2011, a sectoral agreement was signed between the wood sector and the Climate and Energy Minister, aiming at broadening the availability of sustainably produces wood products and at raising awareness of customers on the importance of sustainable wood.

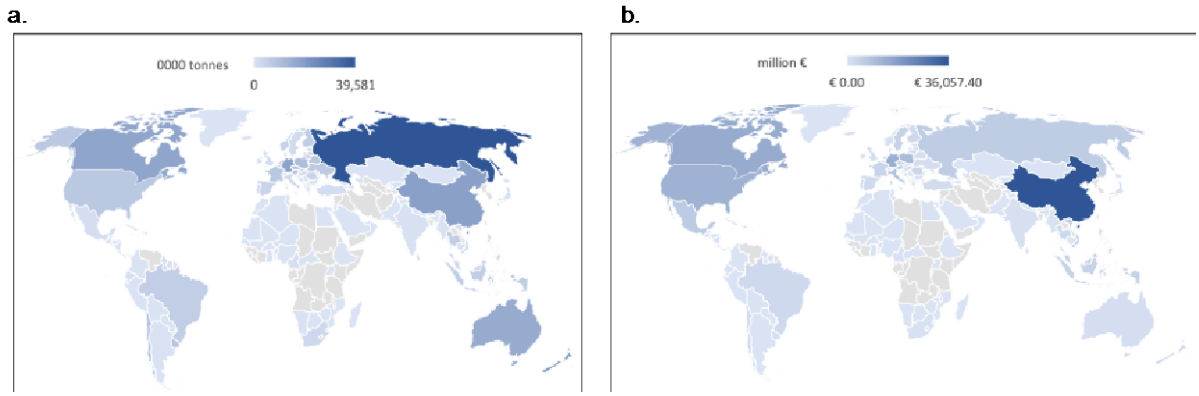
3.2 Trade in wood products

3.2.1 Global trade

A total of € 350 billion of timber, pulp and paper were exported globally in 2016. Of this, timber products accounted for € 198 billion (56%), including raw timber, manufactured products such as plywood, and finished wooden articles (e.g., wooden furniture). Over the past decade the largest increase in demand for forest products has been in pulp and paper. Current demand in Asia is so high that even though production within the region is growing, it is still a net importer. There has also been a steep rise in the use of recovered and recycled paper in recent decades. However, it is important to note that paper is not infinitely recyclable, and that fibre from tree species with specific technical characteristics is required for some types of product.

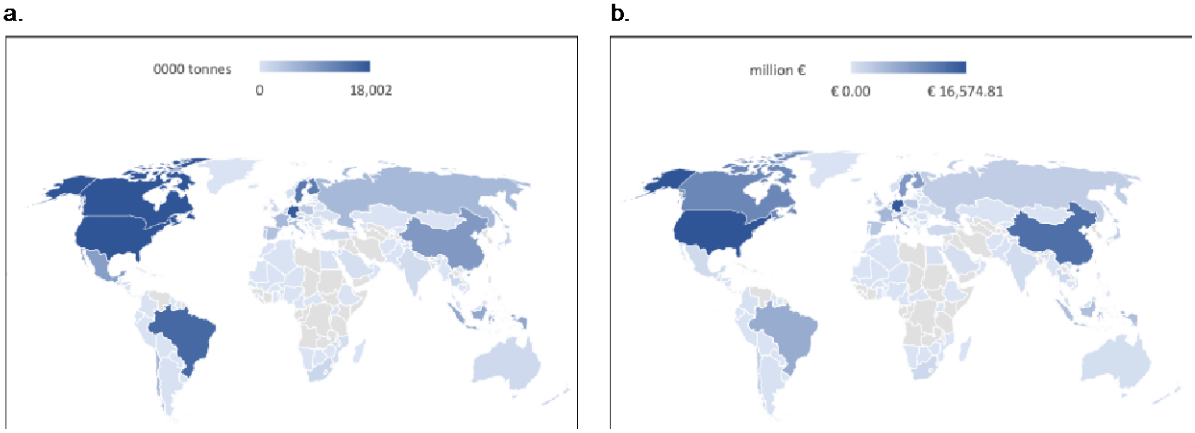
The Russian Federation has the largest share of world exports of timber by quantity, accounting for 12% of the tonnage in 2016 (Figure 1a). However, by value, the Russian Federation ranked only eighth, with China (€ 36 billion, 18% of global trade), Canada (€ 14 billion, 7%), Germany (€ 14 billion, 7%), USA (€ 12 billion, 6%), and Poland (€ 10 billion, 5%) being the top five ranked countries (Figure 1b). The disparity between China's leading position in value and its lower proportion of the quantity of timber exports reflects the degree of value addition that China gains on timber products through manufacturing.

Figure 1: Global exports of timber products in 2016: a. quantity (thousand tonnes), and b. value (million Euro)



The value of pulp and paper products traded globally in 2016 was € 153 billion (44% of the value of all exported timber, pulp and paper products). The USA is the top-ranked country in terms of both quantity (Figure 2 a) and value (Figure 2 b) of pulp and paper products exported, accounting for € 16.6 billion in 2016 (11% of global pulp and paper exports). Germany (€ 16.1 billion, 11%), China (€ 13.6 billion, 9%), Canada (€ 10.7 billion, 7%) and Sweden (€$ 8.9 billion, 6%) make up the rest of top five exporters of pulp and paper products.

Figure 2: Global exports of pulp and paper products in 2016: a. quantity (thousand tonnes), and b. value (million Euros)



3.2.2 The EU and Belgium

The EU is a major producer of timber, and is also one of the world's major importers of wood products, importing over € 29.7 billion of timber, pulp and paper in 2016.[44] An estimated 16-19% of this is from countries with a high risk of illegality,[45] and a proportion of these imports drive deforestation overseas.

Belgium ranked seventeenth globally in terms of value of timber exports in 2016, with € 2.9 billion of timber exports, and twenty-ninth in terms of quantity (3.6 million tonnes). Belgium was the thirteenth largest exporter of pulp and paper products in terms of value (€ 3.8 billion) and fifteenth in quantity (4.9 million tonnes). Belgium takes on a leading trading role within the EU as the largest re-exporter of sawnwood, veneer and industrial roundwood and the second largest exporter of plywood after France[46]. This makes Belgium an important trade point of tropical timber, re-exporting to Germany, the Netherlands, France and Italy in particular. More specifically, the Port of Antwerp handles an annual volume of 1.05 million tonnes forest products,[47] and is recognized as an important distribution hub within Europe.[48] Little information is available on the balance of legal and illegal timber handled by the port, however, reports that Antwerp handles illegal timber continue to surface.[49]

Belgium ranks fourth within the EU for consumption of tropical timber, behind only France, the Netherlands and the UK, and accounting for 12.5% of the EU's consumption of tropical timber in 2016.[50]

With its roles as both a major trader and a significant consumer of timber, pulp and paper, Belgium has a part to play in ensuring that the future production of these commodities no longer causes degradation of forest ecosystems, deforestation or social exploitation.

---

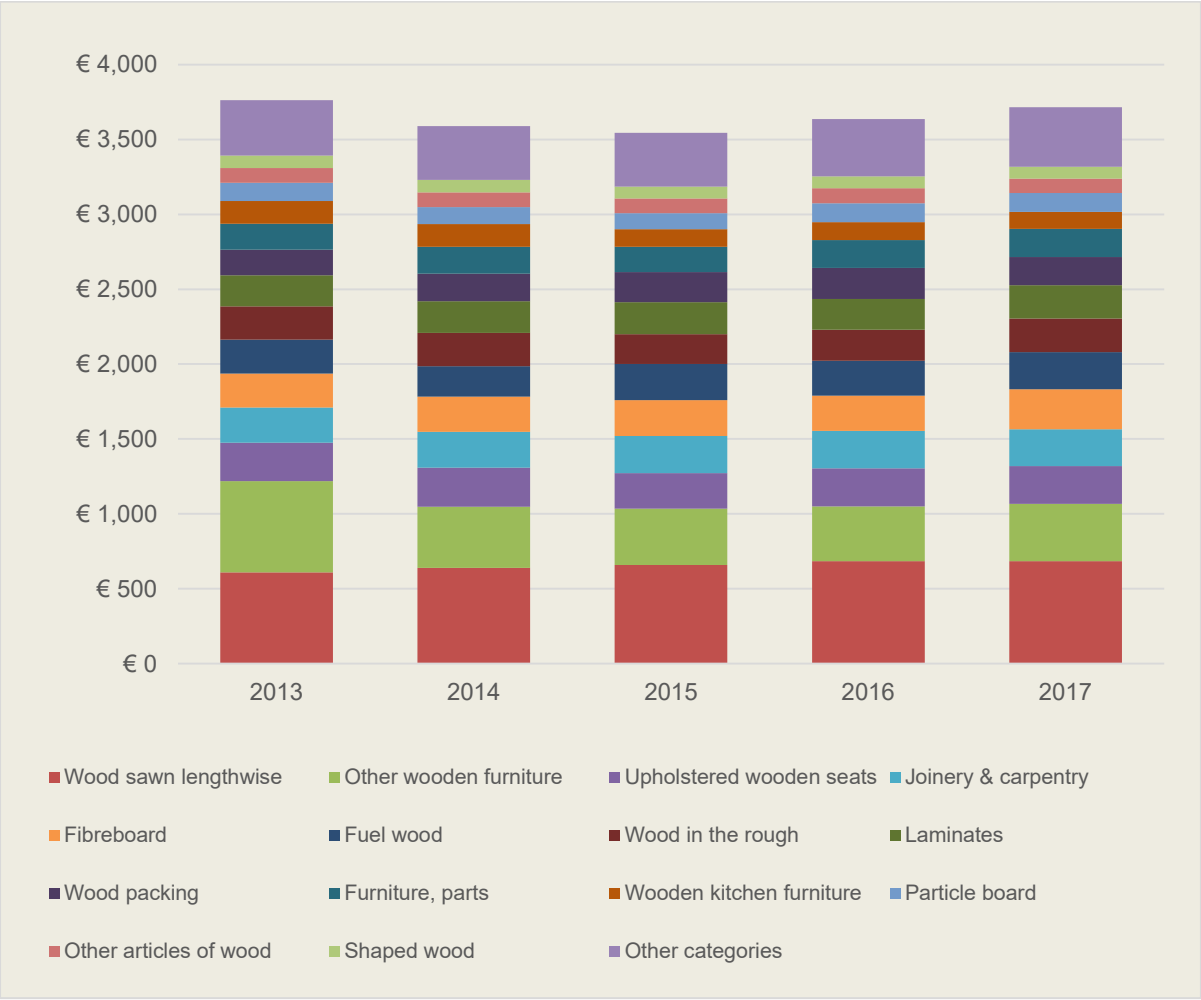
[44] Source: UN COMTRADE https://comtrade.un.org/data/
[45] European Commission, *Assessment of the Impact of Potential Further Measures to Prevent the Importation or Placing on the Market of Illegally Harvested Timber or Products Derived from Such Timber* (Helsinki: European Commission – DG Environment, Indufor, European Forest Institute, Nepcon, Markku Kiikeri Ky, 2008).
[46] Ibid
[47] http://www.portofantwerp.com/en/forest-products
[48] Bisschop, L. (2012) Out of the woods: the illegal trade in tropical timber and a European trade hub. Global Crime, 13:3, 191-212, DOI: 10.1080/17440572.2012.701836
[49] Greenpeace (2016). Importing timber from the Democratic Republic of Congo:
A high-risk business for Europe. Case study III: DRC Afrormosia from La Forestière exported to Belgium; Greenpeace Africa (2015). Trading Chaos: The impact at home and abroad of illegal logging in the DRC.
[50] Mark van Benthem, Jasprina Kremers, Jan Oldenburger, Nienke Stam, Nienke Sleurink (2018). How sustainable ARE Europe's tropical timber imports? Estimating the market share of verified sustainable tropical timber on the European market. IDH.

3.3 Belgium's imports of wood products

Belgium imported an average of € 8.2 billion of timber, pulp and paper products each year between 2013-17. The value of pulp and paper products (average € 4.5 billion per year) exceeded that of timber and timber products (€ 3.6 billion per year).

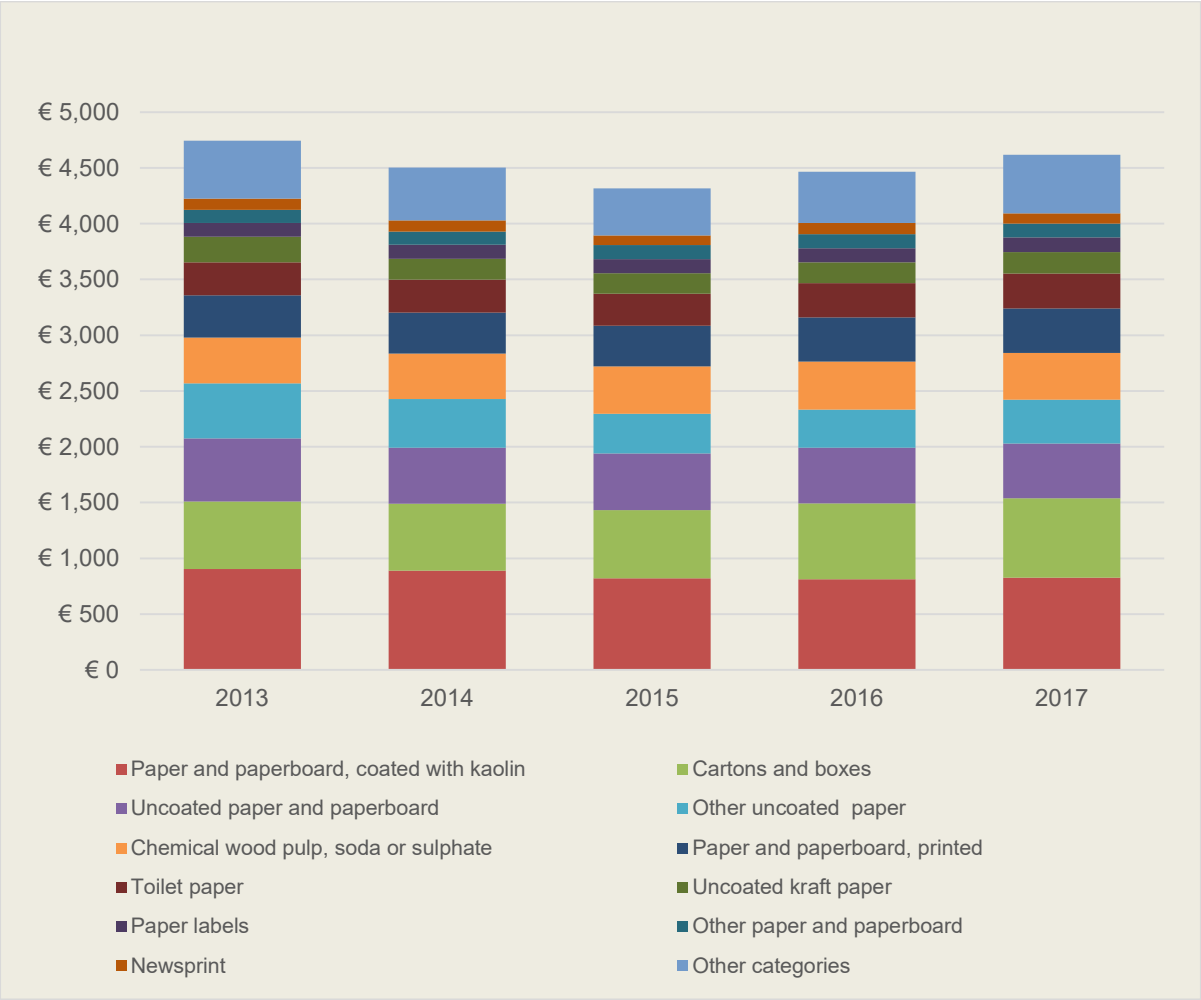
There was little evidence of an overall trend in the value of timber imports over the period assessed over the period (Figure 3). The three largest categories of timber products by value were wood sawn lengthwise, which accounted for 18% of the value of all timber products imported (8% of the value of all timber pulp and paper imports). Wooden furniture accounts for 12% of timber product imports (5% of all timber, pulp and paper imports). Upholstered wooden seats, joinery and carpentry products, fibreboard and fuel wood each account of 7% of the value of timber imports (3% of all timber, pulp and paper imports).

Figure 3: Value of Belgium's imports of timber and timber products from 2013-17 (million Euros)



There was little evidence of a trend in pulp and paper products imports between 2013-17, with the value ranging between €4.7 billion in 2013 to €4.3 in 2015 billion (Figure 4). The most important categories were paper and paperboard, coated with kaolin, which accounted for 19% of the value of imported pulp and paper products (11% of the value of all timber, pulp and paper imports), cartons and boxes (14% and 8%), and uncoated paper and paperboard (12% and 6%).

Figure 4: Value of Belgium's imports of pulp and paper products from 2013-17 (million Euros)



Fuel wood is the largest import of timber and timber products by net weight of imports, accounting for 42% of the net weight of timber product imports (23% of the weight of all imports), with wood sawn lengthwise (16% and 9%) and wood in the rough (12% and 7%) also making significant contributions to the weight of imported timber and timber products (Figure 5). There has been a marked increase in the weight of imported timber, from 5.8 million tonnes in 2013 to 10.4 million tonnes in 2017. This has been driven by increases in most product categories, with particularly dramatic increases in wood in the rough, wood sawn lengthwise, fibreboard, laminates and wooden packing cases.

By contrast, the net weight of pulp and paper has declined slightly over the period (Figure 6), largely due to a decline in printed and surface coated paper and paperboard. The predominant categories by net weight are paper and paperboard coated with kaolin (23% of net weight of pulp and paper imports, 10% of all wood product imports), uncoated paper (19% and 8%), and chemical wood pulp, soda or sulphate (16% and 7%).

Figure 5: Quantity of Belgium's imports of timber and timber products 2013-17 (tonnes)

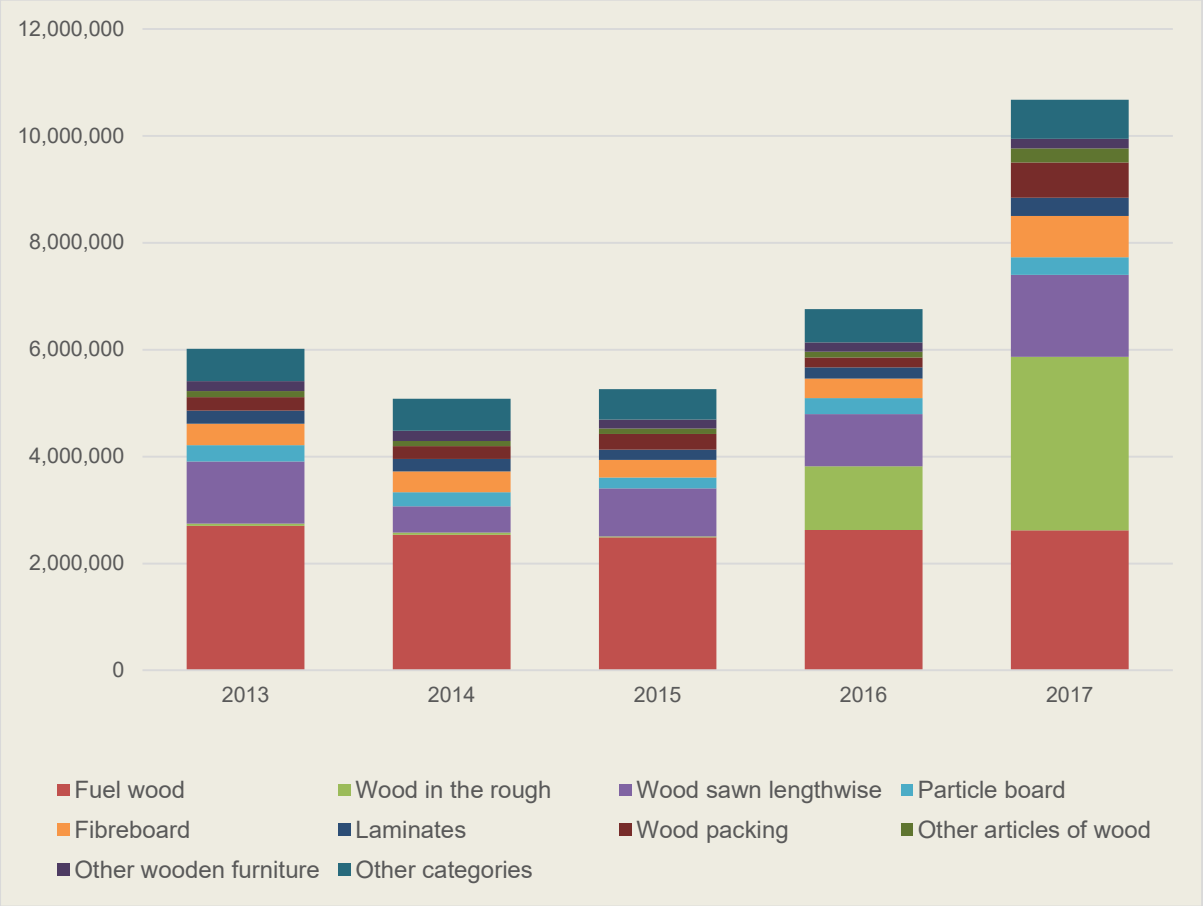
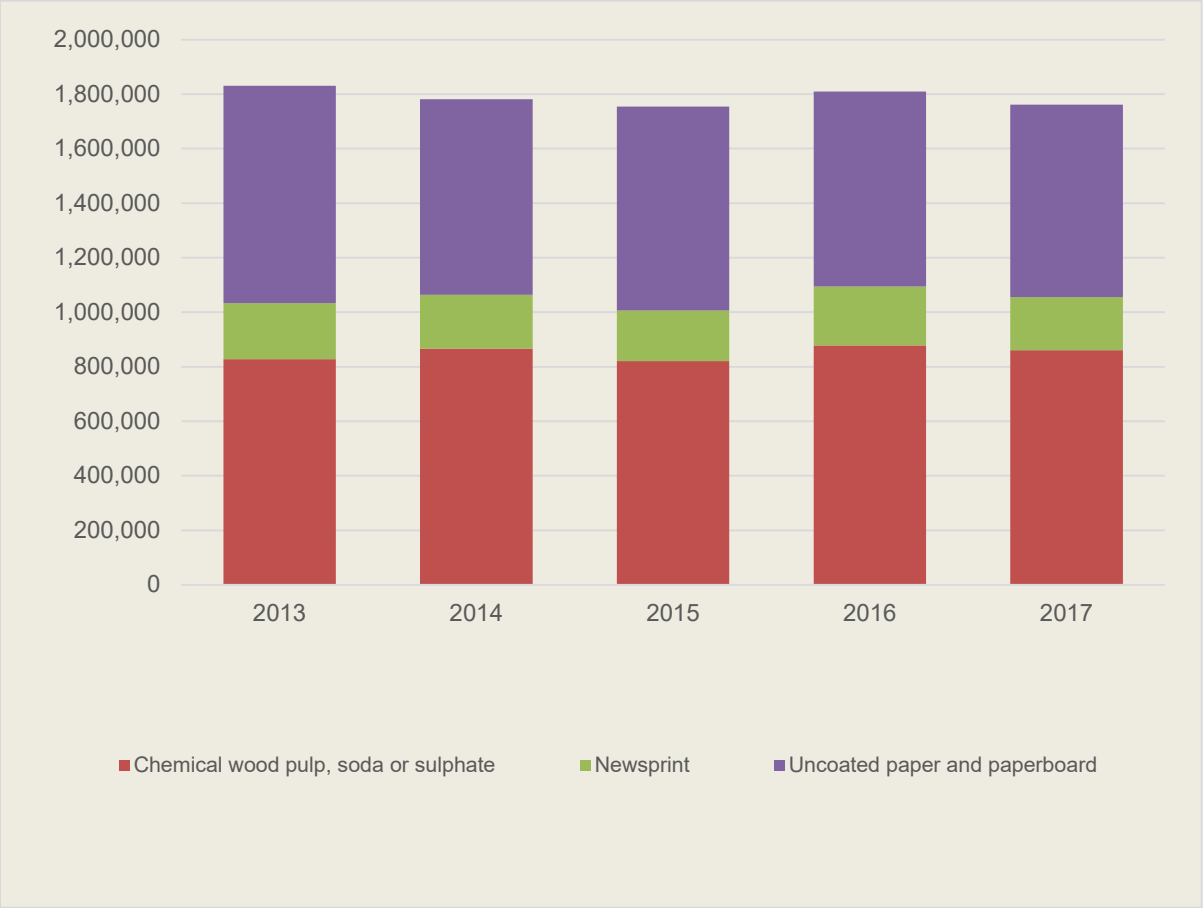


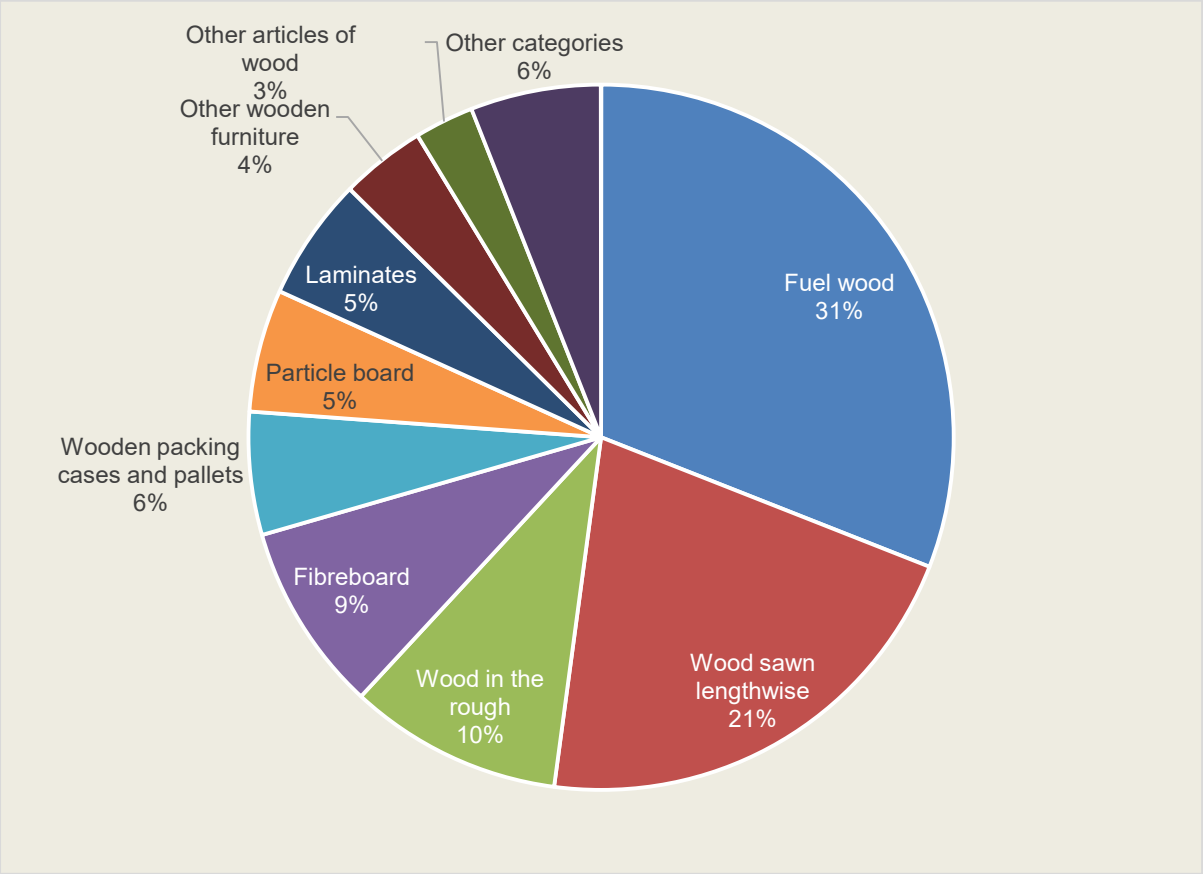
Figure 6: Quantity of Belgium's imports of pulp and paper products 2013-17 (tonnes)



When imports are adjusted for the quantity of wood in them, Belgium imported and average of over 24 million cubic metres of wood per year between 2012-17. Timber and timber products accounted for 43% of this volume (10.6 million cubic metres WRME, Table 2), with pulp and paper products contributing 57% (13.9 million cubic metres, Table 3). Over the whole period, the largest share of volume is in chemical wood pulp – soda or sulphate (15%), fuel wood (13%), paper and paperboard coated with kaolin (12%) and 'other uncoated paper' (10%). Wood in the rough showed a large increase in 2016 and again in 2017, with laminates, wooden packing cases and pallets, and cartons of paper and paperboard also increasing.

Considering timber and timber products, nearly one third of the imported volume (31%) was in fuel wood, with wood sawn lengthwise contributing 21% and wood in the rough 10% (Figure 7).

Figure 7: Imports of timber and timber products by volume, adjusted for wood content (WRME, in m³). Average of 2013-17.



Chemical wood pulp (soda or sulphate) accounted for 26% of the volume of wood imported in pulp and paper products, with paper and paperboard coated with kaolin contributing 21%, 'other' uncoated paper 17% and uncoated paper and paperboard 17% (Figure 8).

Figure 8: Imports of pulp and paper products by volume, adjusted for wood content (WRME, in m3). Average of 2013-17.

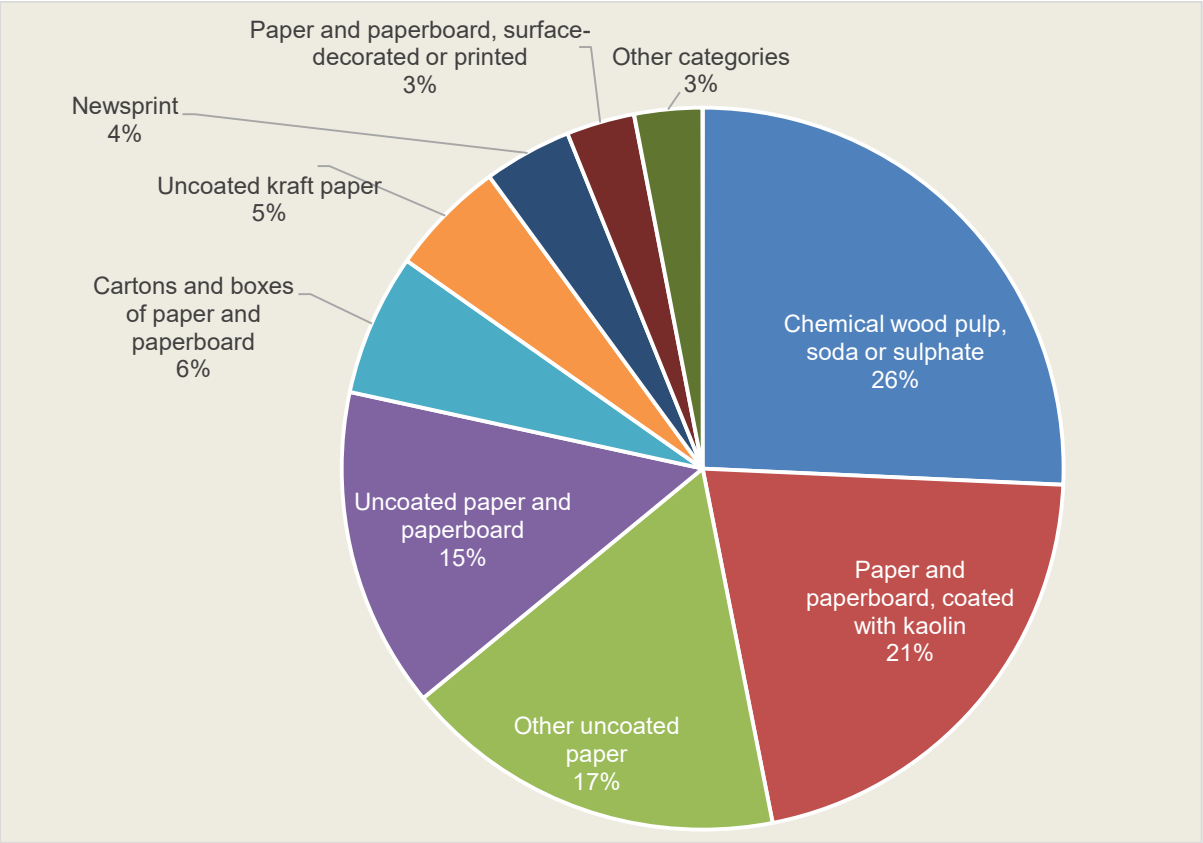


Table 2: Estimated wood raw material equivalent content of Belgium's timber and timber product imports, 2013-17 (m^3)

HS code	Short description	In EUTR	2013	2014	2015	2016	2017	average	%
4401	Fuel wood	Yes	3,248,158	3,044,057	2,985,551	3,152,537	3,146,407	**3,237,429**	**31%**
4407	Wood sawn lengthwise	Yes	2,513,314	1,063,534	1,940,101	2,124,422	3,323,690	**2,210,004**	**21%**
4403	Wood in the rough	Yes	55,889	56,660	27,284	1,592,224	4,348,433	**1,019,280**	**10%**
4411	Fibreboard	Yes	821,671	809,008	668,941	742,808	1,593,293	**902,760**	**9%**
4415	Wooden packing cases and pallets	Yes	481,300	462,482	562,496	346,444	1,260,350	**589,748**	**6%**
4410	Particle board	Yes	643,065	552,199	436,024	637,251	691,612	**587,284**	**6%**
4412	Laminates	Yes	600,686	560,679	473,435	518,647	826,367	**586,341**	**6%**
940360	Other wooden furniture	Yes	423,092	422,009	380,504	385,364	412,393	**406,692**	**4%**
4421	Other articles of wood	No	247,171	209,102	212,614	242,815	559,242	**285,213**	**3%**
	Other categories		602,047	599,076	570,403	621,010	731,806	**624,868**	**6%**
	Total		**9,636,393**	**7,778,805**	**8,257,353**	**10,363,523**	**16,893,593**	**10,585,933**	

Table 3: Estimated wood raw material equivalent content of Belgium's pulp and paper imports 2013-17 (m^3)

HS code	Short description	In EUTR	2013	2014	2015	2016	2017	average	%
4703	Chemical wood pulp, soda or sulphate	Yes	3,538,503	3,706,542	3,510,065	3,755,859	3,680,960	**3,559,514**	**26%**
4810	Paper and paperboard, coated with kaolin	Yes	3,006,315	2,930,845	2,827,136	2,851,976	2,911,030	**2,931,672**	**21%**
4805	Other uncoated paper	Yes	2,919,818	2,538,540	1,991,775	1,977,514	2,106,747	**2,376,475**	**17%**
4802	Uncoated paper and paperboard	Yes	2,120,155	1,907,269	1,989,756	1,900,719	1,876,506	**1,985,975**	**14%**
4819	Cartons and boxes of paper and paperboard	Yes	885,795	880,613	912,431	1,028,783	1,236,116	**878,432**	**6%**
4804	Uncoated kraft paper	Yes	844,091	700,681	674,236	661,441	641,359	**722,548**	**5%**
4801	Newsprint	Yes	546,245	524,682	491,587	573,859	517,846	**544,267**	**4%**
4811	Paper and paperboard, surface-decorated/printed	Yes	434,725	414,900	405,930	431,267	455,112	**422,764**	**3%**
	Other categories	N/A	426,881	386,966	335,032	409,264	551,944	**422,017**	**3%**
	Total		**14,722,528**	**13,991,039**	**13,137,949**	**13,590,683**	**13,977,620**	**13,883,964**	

3.4 Estimated consumption

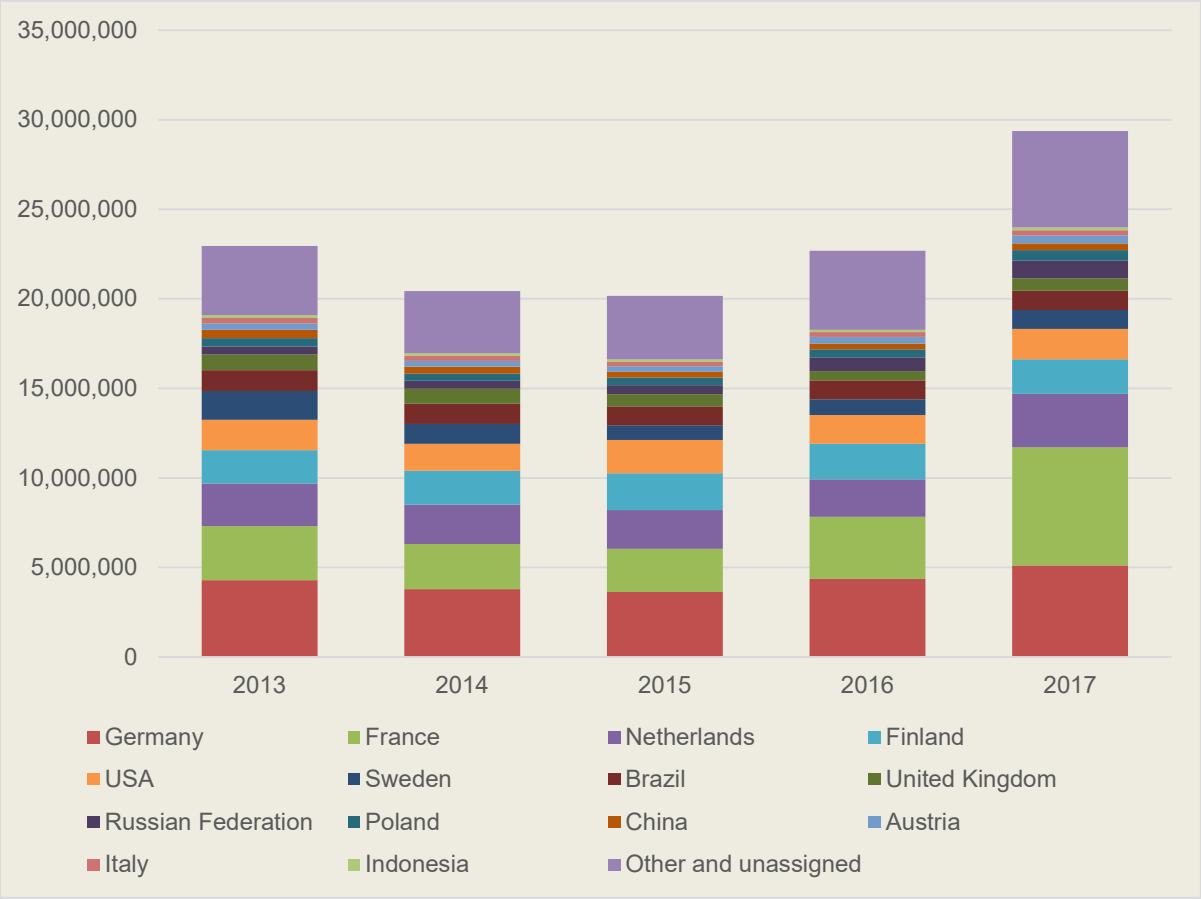
Belgium's consumption of wood products is estimated by subtracting the average quantity of wood products that Belgium exported between 2013-17 after conversion to WRME (18.1 million m^3) from the overall quantity of imported wood (24.3 million m^3) plus Belgium's domestic production (5.4 million m^3). This provides an average consumption figure of 11.6 million m^3 of wood per year between 2013-2017. This represents 39% of Belgium's available stock of timber (production plus imports) during that time period.

3.5 Provenance of Belgium imports of wood products

Between 2013 and 2017, Belgium imported wood products from 165 territories. During that period, 14 countries contributed at least 2% of the value of timber, pulp and paper imports. EU countries dominate Belgium's imports, with the main exporting countries being Germany (23% of total value of timber, pulp and paper imports), the Netherlands (16%), France (15%), Finland (10%) and China (6%). The main tropical countries that directly export to Belgium are Brazil (4%), and Indonesia (2%).

However, as discussed in Section 2.2 (above), most major countries produce and import timber, pulp and paper products, as well as export. The country from which Belgium imports is therefore not necessarily the country in which the timber was harvested. Adjusting for this, the estimated provenance of Belgium's timber shows significant differences from the 'raw' import data. Countries that import large quantities of timber themselves (e.g., China, the Netherlands, the UK) decline in importance, whereas countries that import relatively small amounts but export significant quantities globally (e.g., USA, Sweden) increase their share of Belgium's imports. The main importers are Germany (an average of 4.2 million m^3, 18% of the total) and France (3.6 m^3, 16%, Figure 9).

Figure 9: The estimated provenance of Belgium's timber, pulp and paper imports, adjusted for wood content from 2013-17 (WRME, m^3)



Belgium imports significant quantities of timber from tropical and sub-tropical countries, even though (with the exceptions of Brazil, China and Indonesia) the volumes from each of these countries is below the 2% threshold used for inclusion in the provenance re-assignment. Wood products were imported from a total of 75 tropical and sub-tropical territories between 2013-17, with the an average of 3.6 million cubic meters (WRME) imported by Belgium each year. This is equivalent to 16% of the total wood volume imported by Belgium. The ten largest tropical exporters to Belgium account for 97% of the quantity of tropical wood products imported. Brazil and Indonesia both export significant quantities of pulp and paper to Belgium, however all other tropical countries export predominantly timber and timber products, such as laminates, wood sawn lengthwise, wood in the rough, and furniture (Table 4).

Table 4: Average volume (WRME, in m^3) of wood products imported by Belgium each year (2013-17) from the ten largest tropical and sub-tropical suppliers.

Country	Average imports	Three largest imported products by volume
Brazil	2,082,406	Chemical wood pulp, soda or sulphate, laminates and uncoated paper and paperboard
China	550,617	Laminates, other wooden furniture, joinery and carpentry
Indonesia	210,533	Uncoated paper and paperboard, laminates, other wooden furniture
Nigeria	208,863	Charcoal, fuel wood, wood sawn lengthwise
Cameroon	123,692	Wood sawn lengthwise, shaped wood, wood in the rough
Gabon	97,438	Wood sawn lengthwise, railway sleepers, shaped wood
Malaysia	69,885	Wood sawn lengthwise, joinery and carpentry, other wooden furniture
Vietnam	34,810	Joinery and carpentry, other wooden furniture, non-upholstered wooden seats
Congo	33,596	Wood in the rough, wood sawn lengthwise, veneer
Côte d'Ivoire	32,881	Wood sawn lengthwise, shaped wood, charcoal

3.6 Belgium's timber footprint

The total WRME volume of imports from each country (adjusted for provenance, as above) was divided by the Net Annual Increment (NAI, Appendix 3)[51] to produce an estimate of the area of forest required in each country to supply Belgium's imports each year.

Belgium's imports of timber products required an average of 4.6 million hectares per year between 2013-17. This is equivalent to 1.5 times Belgium's total land area of 3,027,800 hectares, six and a half times Belgium's own forest area (683,400 hectares in 2015), or over fifteen times the area of natural forest in Belgium (289,200 hectares in 2015)[52].

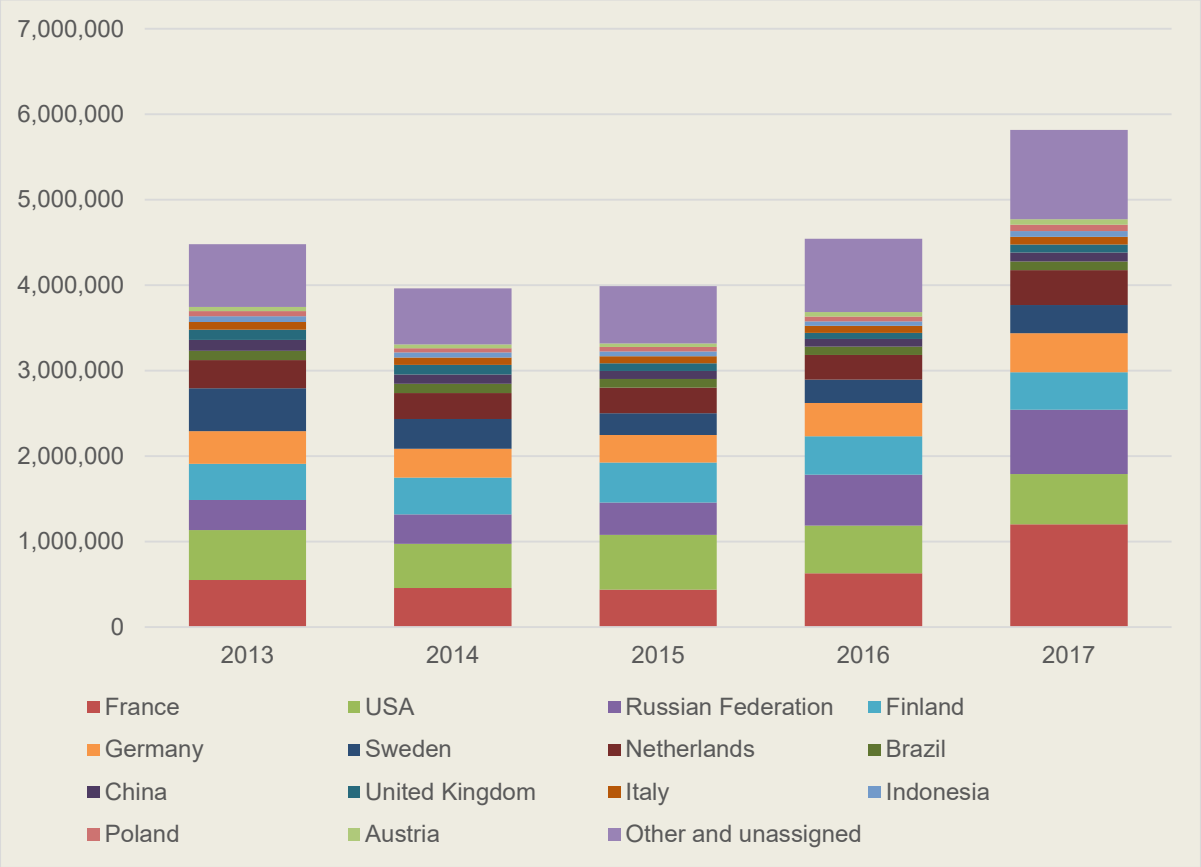
The footprint of Belgium's imported timber, pulp and paper increased significantly in 2017, a 28% increase from 2016 (Figure 10). As described in Section 3.4 above, this is a result of increased imports from France and the Russian Federation in particular. The products

[51] Net Annual Increment (NAI) data was obtained from FAO (2016) Global Forest Resource Assessment 2015: Desk Reference. Food And Agriculture Organization Of The United Nations, Rome. The NAI for the 'Other and Unassigned category was the average of all other NAIs.
[52] Belgium's forest area data is from FAO STAT

driving this increase include wood in the rough, fibreboard, wooden packing cases and paper/paperboard cartons.

The largest footprints fall in France (655,000 ha, 14% of the total), USA (577,000 ha, 13%), the Russian Federation (485,000 ha, 11%) and Finland (442,000 hectares, 10%). Amongst tropical and sub-tropical countries, Brazil contributes 105,000 hectares (2%), China 104,000 hectares (2%), and Indonesia 61,000 hectares (1%).

Figure 10: Estimated land footprint of Belgium's imports of timber, pulp and paper products 2013-2017 (hectares)



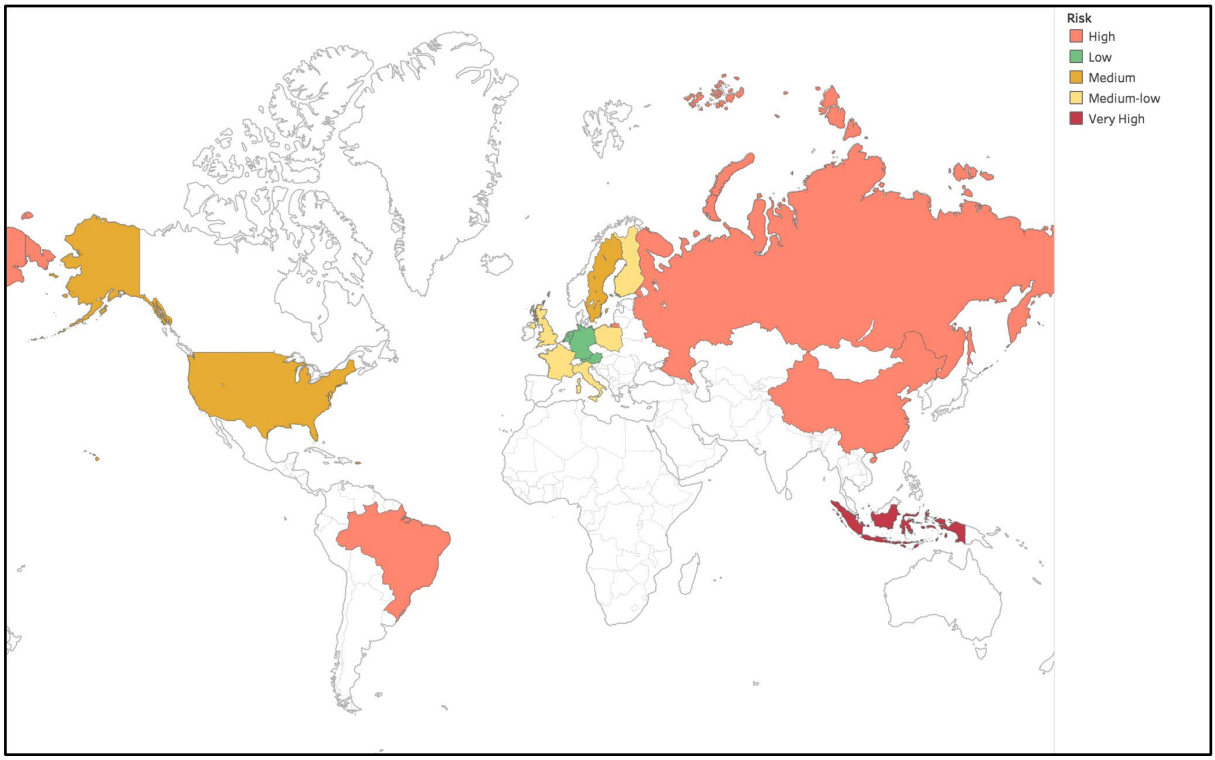
3.7 Belgium's wood product risk profile

Belgium imports most of its timber, pulp and paper products from low and medium-low risk countries, including Austria, Finland, France, and Germany. However, 17% of the footprint is from four high risk countries: Brazil, China, Indonesia and the Russian Federation (Figure 11). These countries have high rates of tree cover loss, and poor labour standards (especially China and Indonesia) and a perception of high levels of corruption (especially the Russian Federation, see Table 15). Both China and the Russian Federation are known as conduits for illegal timber.[53] In addition, several countries that export to Belgium below the two per cent cut-off used in this study are known to have forestry sectors that are associated

[53] For example: Greenpeace (2008). Alternatives to unsustainable plywood in the UK construction industry, Greenpeace, London, UK; and https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/402325/Chinese_Plywood_Research_Report.pdf

with illegal harvesting and unsustainable practices, including Cambodia, Cameroon, Central African Republic, Gabon, Laos PDR and Myanmar.[54]

Figure 11: Belgium's timber, pulp and paper footprint by risk category



Even if the European Union Timber Regulation (EUTR) is successful in excluding illegal wood products from these countries, there is no guarantee that production of these imports has not caused deforestation, forest degradation, or has not been associated with serious social issues such as land grabs and forced labour. There are also a group of products that are outside the scope of the EUTR, which account for six per cent of Belgium's timber, pulp and paper imports and are worth an average of € 490 million per year, and for which companies in Belgium have no legal obligation to ensure that these products are from legal sources.[55]

Finally, there are pulp and paper products that arrive into Belgium as packaging material for other imports. Whilst it is beyond the scope of this study to estimate the quantities and provenance of packaging, it is inevitable that some of this material has been produced at the expense of forests and other natural habitats, and this represents an additional overseas impact of Belgium's imports.

Greater uptake of FSC certification, which has the highest social and deforestation safeguards, would undoubtedly reduce the risk of association of France's imports with deforestation, forest degradation and conversion of natural habitats. In addition, for some product types, greater use of recycled paper would reduce the demand on high risk plantations.

[54] Steve Jennings & Béatrice Wedeux (2018). The risk of corruption and forest loss in Belgium's timber and paper imports. 3Keel and WWF Belgium. Available at: https://wwf.be/fr/lutter-contre-le-bois-illegal/
[55] Steve Jennings & Béatrice Wedeux (2018). *Ibid.*

4 Cocoa

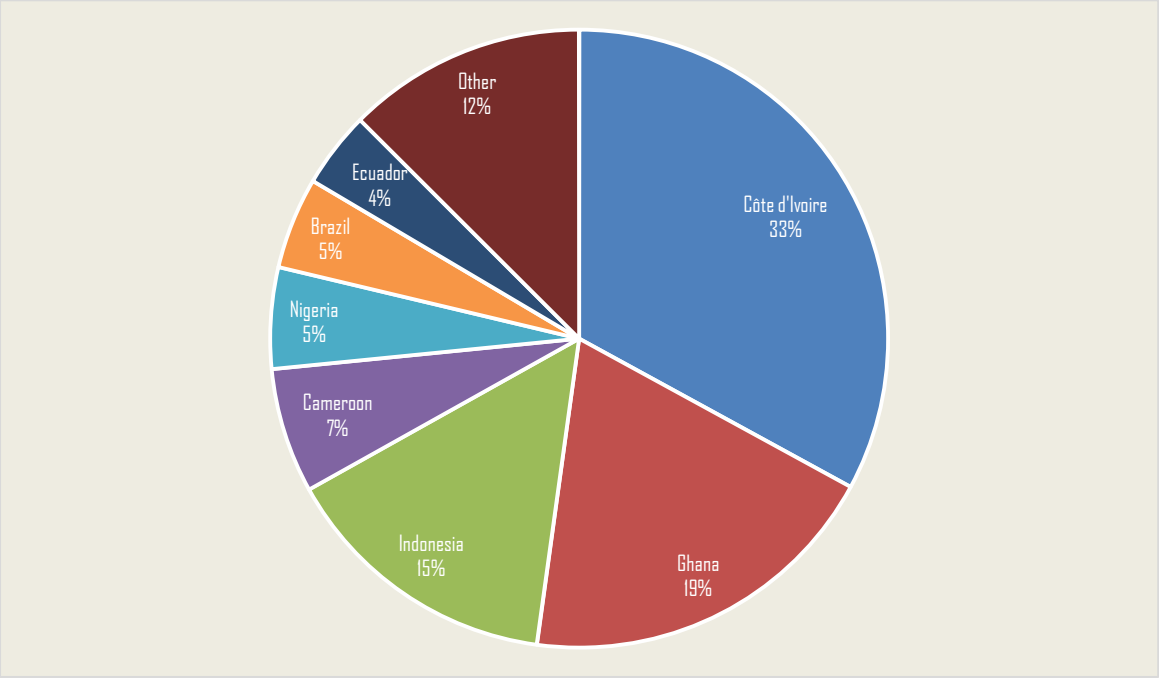
4.1 Production, uses and sustainability of Cocoa

4.1.1 Production systems

Cocoa products are made from cocoa beans, which are the seeds found inside cocoa pods: the fruits of the cocoa tree, *Theobroma cacao*. Cocoa production is labour intensive since the crop is delicate and sensitive to changes in weather and diseases and pests. The cocoa tree flowers through the entire year and pods do not ripen at the same time, so cocoa trees need to be monitored continuously. Once harvested, the pods are split open to retrieve the cocoa beans and cocoa pulp inside. The beans are then fermented in the pulp for several days, and subsequently cleaned, dried, and packed. At this point, the farmer will sell the beans on to intermediaries or traders. Beans may be further processed in the country of origin, or exported elsewhere for processing.

Around 4.5 million tonnes of cocoa beans were produced globally in 2016[56]. Cocoa production is limited to those areas within 20 degrees of the equator because the trees require humid tropical climates for optimal growth. Cocoa is produced in 62 countries worldwide but over 66% of global cocoa production is located in Africa, with the two largest producing countries being Côte d'Ivoire (33%) and Ghana (19%). At 15% of global production, Indonesia is the third largest producing country (Figure 12).

Figure 12: Primary cocoa producing countries in 2016.



The majority of cocoa is produced by smallholders, with more than 90% of global cocoa production originating from farms covering only 2-5 hectares.[57] The majority of these smallholder farmers operate independently and are not part of cooperatives or other organizations.[58]

[56] FAOSTAT http://www.fao.org/faostat/en/#data/FO. Last accessed 23 November 2018.
[57] ICCO https://www.icco.org/component/content/category/9-economy.html. Last accessed 23 November 2018.
[58] Antonie Foundation & Friedel Huetz-Adams (2018). Cocoa Barometer 2018. Available at http://www.cocoabarometer.org/cocoa_barometer/Download_files/2018%20Cocoa%20Barometer%20180420.pdf

4.1.2 End uses

The principal end use of cocoa beans is chocolate and chocolate products which are manufactured from the intermediate products of cocoa beans: cocoa paste (also known as cocoa liquor), cocoa butter and cocoa powder. Small amounts of cocoa butter are also used in cosmetic products.

- **Cocoa paste:** Cocoa paste is the result of roasting and grinding cocoa nibs (the cocoa beans with their outer shell removed), and is either processed straight into chocolate, or pressed to make cocoa butter and cocoa powder.
- **Cocoa butter:** Cocoa butter is extracted through pressing cocoa paste and is usually combined with pure cocoa paste to be made into chocolate, but it can also be used in cosmetics. Typically, cocoa butter destined for cosmetic use is made from diseased pods, or beans that have germinated during drying, and is a relatively small-scale use.
- **Cocoa powder:** Cocoa powder (or 'press cake') is the resulting by-product from pressing cocoa liquor to extract cocoa butter. It is used in baking and the manufacture of other chocolate goods.

Different types of chocolate are created by using varying proportions of cocoa paste, butter and powder. For example, couverture, which is used for coating sweets and cakes, is made by adding higher proportions of cocoa butter to give the chocolate a higher gloss composition.

Besides the main use of cocoa beans, the husks of cocoa pods and the pulp surrounding the beans and the cocoa bean shells can be used[59]. Some examples of these uses are:

- **Cocoa pod husk:** Dried husks can be used in animal feed. However, to be usable, husks must be processed quickly and dried fast, which imposes limitations on production, as processing at this level often happens on farm.[60] Cocoa pods are generally not imported to the EU and cocoa husks are not normally available.
- **Cocoa pulp:** This material (also referred to as sweatings) surrounds the cocoa beans inside the pod. It can be used when fresh to make soft drinks, alcohol, and pectin. These uses are small-scale and local.
- **Cocoa bean shells:** As a first step in the processing of cocoa beans, the cocoa bean shells (also referred to as husks or hulls) that encloses the nibs is removed. Cocoa bean shells are often processed into animal feed or used as fuel or mulch. They are increasingly used also a food ingredient due to their high fibre and antioxidant content.

4.1.3 Environmental and social issues associated with cocoa production

Cocoa production has been linked to the loss of natural habitats, soil degradation, degradation of water quality, poor labour conditions and low farmer incomes.

As a crop that needs shade, cocoa can be produced in agroforestry systems. However, despite the potential for cocoa to be grown in agroforestry systems, cocoa production is actually driving deforestation in major producing countries in West Africa, including Ghana

[59] ICCO https://www.icco.org/faq/52-by-products/115-products-that-can-be-made-from-cocoa.html. Last accessed 22 November 2018.
[60] http://www.new-ag.info/99-2/focuson/focuson6.html

and Côte d'Ivoire, as well as in Latin America and Indonesia.[61] Global forest loss driven by cocoa expansion is estimated to be around 2-3 million hectares from 1998-2008, accounting for roughly 1% of all forest loss during this period[62]. This deforestation is in part because of low investment in farmers (financially, and in terms of skills and management training), and in part because aging trees have lower yields, which means that farmers must expand production by cutting down trees for new cocoa fields. The location of the majority of cocoa production in tropical countries with large areas of rainforest means that such expansion increases the impacts on deforestation.

Cocoa cultivation provides a livelihood for millions of smallholders in countries such as Côte d'Ivoire, Indonesia, Ghana and Nigeria. However, there are high levels of child labour in the cocoa sector, sometimes as a result of human trafficking. The US Department of Labor includes cocoa from six countries on their List of Goods Produced by Child Labor: Cameroon, Côte d'Ivoire, Ghana, Guinea, Nigeria, and Sierra Leone. Côte d'Ivoire and Nigeria are also on the list for forced labour.[63] A US Department of State report in 2011 noted '*It is estimated that some 15,000 Malian children work on Ivoirian cocoa and coffee plantations. Many are under 12 years-of-age, sold into indentured servitude for $140, and work 12-hour days for $135 to $189 per year*'.[64] Child labourers on cocoa farms are typically exposed to hazardous working conditions.[65] This includes strenuous manual labour and long working hours, injuries resulting from the use of sharp equipment (e.g. machetes) to cut down cocoa pods, lack of proper protective equipment or clothing, and exposure to pesticides and other toxins.[66] Child labour is a result of systemic poverty and lack of local infrastructure, so interventions that aim to decrease child labour must also address these larger, underlying issues.

Cocoa farmers receive a small percentage of overall cocoa price – between 3 and 5% of the value of a chocolate bar. Low income combined with difficulties in obtaining high yields (due to small farm size, lack of training and knowledge, and lack of infrastructure or ability to invest in production improvements) mean that cocoa farmers often rely on loans and are unable to save money.[67] Farmers are also susceptible to changes in the world price for cocoa, which directly affects their income. During the global 2016-2017 price decline in cocoa, the value of cocoa fell by over a third and farmers in producing countries such as Côte d'Ivoire saw their income decline by as much as 30-40% from one year to the next.[68] In response, the concept of a 'living income' has gained prominence in discussions over the cocoa supply chain, though there is not yet consensus over how much a living income for cocoa farmers should be. A collaboration between The Global Living Wage Coalition, GIZ and the Sustainable Food Lab is currently working to gather data from Ghana and Côte d'Ivoire and calculate a baseline living income for cocoa farmers in these countries.[69]

---

[61] http://www.euredd.efi.int/cotedivoire; Antonie Foundation & Friedel Huetz-Adams (2018). Cocoa Barometer 2018. Available at http://www.cocoabarometer.org/cocoa_barometer/Download_files/2018%20Cocoa%20Barometer%20180420.pdf

[62] Kroeger, A. et al. (2017) Eliminating Deforestation from the Cocoa Supply Chain. World Bank Group, 2017.

[63] https://www.dol.gov/ilab/reports/child-labor/list-of-goods

[64] http://www.state.gov/j/drl/rls/hrrpt/2000/af/773.htm

[65] ILO (2007). Rooting out Child Labour from Cocoa Farms. Paper No. 2: health and Safety Hazards.

[66] Mull and Kirkhorn (2005). Child Labor in Ghana Cocoa Production: Focus upon Agricultural Tasks, Ergonomic Exposures, and Associated Injuries and Illnesses." Association of Schools of Public Health. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1497785/#__ffn_sectitle.

[67] http://www.fairtrade.org.uk/~/media/fairtradeuk/farmers%20and%20workers/documents/cocoa%20commodity%20briefing_online7.pdf

[68] Antonie Foundation & Friedel Huetz-Adams (2018). Cocoa Barometer 2018. Available at http://www.cocoabarometer.org/cocoa_barometer/Download_files/2018%20Cocoa%20Barometer%20180420.pdf

[69] Antonie Foundation & Friedel Huetz-Adams (2018). Cocoa Barometer 2018.

Many cocoa farmers do not own official land titles, which makes them susceptible to tenure disputes. Land grabs from local communities to create cocoa farms have been reported from South America.[70] Tenure insecurity can also undermine motivation to invest in the land and engage in sustainable agricultural practices.

4.1.4 Certification in cocoa

The main third-party certification systems within the cocoa sector are:[71]

- **UTZ:** Over 2.1 million hectares of cocoa were UTZ-certified in 2016, which represents almost 21% of the global cocoa area. UTZ reported an estimated production volume of almost 1.2 million metric tons or 27% of the global cocoa production volume in 2016. The countries with the largest UTZ-certified cocoa areas are Côte d'Ivoire, Ghana, Nigeria, Indonesia, and Cameroon, together comprising 88% of the total UTZ certified area. UTZ has reported the largest growth in certified area, with a fourfold increase between 2011-2016 and a 37% increase from 2015 to 2016 alone.
- **Rainforest Alliance/SAN:** The Rainforest Alliance (RA) certified more than 692,000 hectares of cocoa farms in 2016, which produced almost 473,500 metric tons of RA cocoa and 10.6% of the global cocoa production volume. The vast majority of RA certified cocoa area (96%) are in Côte d'Ivoire, Ghana, Dominican Republic, Indonesia, and Ecuador. While overall RA certified area increased fourfold between 2011 and 2016, it dropped by 6% from 2015 to 2016.
- **Fairtrade certification:** Fairtrade International certified over 722,000 hectares of cocoa in 2016 (7.1% of the global cocoa area), which produced 292,000 metric tons of Fairtrade cocoa (6.5% of global production). The countries with the largest Fairtrade certified areas are Côte d'Ivoire, Ghana, the Dominican Republic, Peru, and Ecuador. The area of cocoa land under Fairtrade International's certification doubled from 2011 to 2016, and it increased by almost 27% between 2015 and 2016.
- **Organic:** More than 320,100 hectares (3.1% of the global cocoa area), and an estimated 157,275 tonnes of cocoa (almost 3.5% of the world's cocoa production) were organic certified in 2016. The Dominican Republic, the Democratic Republic of Congo, Peru, Sierra Leone, and United Republic of Tanzania are the biggest organic cocoa-producing countries, together representing 77% of the total organic cocoa area. Growth of organic certification has been slower than other schemes: with certified area increased by over 64% between 2011 and 2016 and less than 20% between 2015 and 2016.

Combined, these four schemes certified 2.3-3.8 million hectares in 2016 (the range is provided because many producers are certified by more than one scheme), which represented 22.8-37.6% of the global cocoa area.

The above schemes include criteria on conservation, with varying levels of protection against deforestation.[72] While Fairtrade contains criteria on general biodiversity conservation, which includes the protection of areas of high conservation value (HCV), it

[70] https://news.mongabay.com/2015/04/court-rules-deforestation-of-peruvian-rainforest-for-chocolate-was-legal/
[71] The following data is from Julia Lernoud, Jason Potts, Gregory Sampson, Bernhard Schlatter, Gabriel Huppe, Vivek Voora, Helga Willer, Joseph Wozniak, and Duc Dang (2018), The State of Sustainable Markets – Statistics and Emerging Trends 2018. ITC, Geneva
[72] http://www.standardsmap.org/compare?standards=378,71,62&standard=0&shortlist=378,71,62&product=Cocoa&origin=Any&market=Any&cbi=78:78:756

does not have a specific deforestation criteria.[73] In contrast, the UTZ standard includes a criterion that excludes certification areas that were converted from HCV areas after 2008. The Rainforest Alliance/SAN has a new zero deforestation standard launched in 2017, which will maintain a 2005 cut-off for HCV as well as cut-off date of 2014 for conversion of any natural habitat. With this new standard, Rainforest Alliance/SAN will effectively be zero deforestation, while UTZ and Fairtrade are not.[74]

Fairtrade is the only certification scheme that has a system of price guards: there is a minimum price for cocoa (of US $2,000 per tonne as export price) as well as a fixed premium of US $200 per tonne of cocoa.[75] This helps provide farmers with greater financial security during periods of price volatility and decline on the world market for cocoa.

Note that UTZ and Rainforest Alliance have recently merged (to go into effect mid-2019), but it is too early to understand the possible effects of the merger on cocoa certification.

A 2016 Market study carried out by the Trade for Development Centre (TDC) of the Belgian Development Agency (BTC) surveyed 56 retail outlets in Belgium to estimate the share of certified products and labels being sold in supermarkets. It found that the certification scheme with the greatest supermarket presence was UTZ, followed by Fairtrade, Bio (Organic), and, to a lesser extent, Rainforest Alliance.[76] In total, 29% of all cocoa sold in the surveyed supermarkets were certified by one of these labels. However, the overall amounts of certified cocoa still remain low, especially in comparison to other European countries such as Switzerland or the Netherlands. For example, despite being the second most popular certification scheme, just 1.2% of the chocolate sold in Belgium in 2015 was Fairtrade certified.[77]

4.1.5 The EU and Belgium's responses to environmental and social issues with cocoa

According to CBI, a Dutch government agency performing market research, consumer awareness and demand for sustainable cocoa in Belgium is lower than in other European countries[78]. Though a panel was organized in 2011 to discuss the opportunities to create a more sustainable supply chain for cocoa, the lack of government support impeded significant progress.

In response to international pressure to improve its cocoa supply chain, a growing number of retailers, Belgian chocolate manufacturers, and global chocolate companies operating in Belgium have developed their own initiatives around sustainable cocoa. The "Beyond Chocolate" initiative launched on December 5, 2018 as a partnership between the Belgian chocolate and retail sector, civil society, social impact investors and universities to make Belgium chocolate more sustainable. Signatories include a wide range of actors in the sector: Mondelez, Cargill, Mars Belgium, WWF, Oxfam, Lidl, Aldi, Carrefour, VLIR-UOS, Universiteit Gent, KU Leuven, ACV/CSC and ACLVB/CGSLB trade unions, Incofin, Oikocredit, Rainforest Alliance/Utz, Fairtrade, and the ISEAL Alliance. Partners have committed to eliminate deforestation associated with chocolate produced or traded in

[73] http://www.fairtrade.net/fileadmin/user_upload/content/2009/standards/documents/SPO_EN.pdf
[74] http://sanstandard2017.ag/
[75] Antonie Foundation (2018). Cocoa Barometer 2018. Available at http://www.cocoabarometer.org/cocoa_barometer/Download_files/2018%20Cocoa%20Barometer%20180420.pdf
[76] BTC Trade for Development (2016). Market study on the presence of sustainable products in Belgian supermarkets. Available at http://www.befair.be/drupal_files/public/all-files/brochure/Final%20report%20supermarkets.pdf
[77] BTC Trade for Development (2016). Market study on the presence of sustainable products in Belgian supermarkets.
[78] CBI www.cbi.eu/market-information/cocoa/belgium/. Last accessed 19 November 2018

Belgium originating from Côte d'Ivoire, Ghana, and Colombia by 2025 in accordance with the Cocoa and Forests Initiative. They further commit to eliminate deforestation and provide a living income for cocoa farmers associated with all chocolate produced or traded in Belgium by 2030.

The retailers Lidl International and Aldi North Group[79] have both set commitments that 100% of the cocoa they use in their own brand products will be certified by one of the existing schemes,[80] and a large number of private standards and programs have been created by large traders and manufacturers in the sector (e.g. Olam Livelihoods, Barry Callebaut's Cocoa Horizon, Mondelez Cocoa Life). Premium Belgian chocolate brands, including Jacques and Kwatta, have also committed to the UTZ label. Belgian trade unions, including ACV (Algemeen Christelijk Vakverbond) and ABVV (Algemeen Belgisch Vakverbond) have developed their own action plans for cocoa in response to a lack of action from both consumers and the government.[81]

On an international scale, the World Cocoa Foundation (WCF), and especially its Cocoa and Forests Initiative, is a potentially important development. This initiative has brought together Côte d'Ivoire and Ghana with leading chocolate and cocoa companies who are together developing Frameworks for Action to end deforestation and restore forest areas. Central to the Frameworks are a commitment to no further conversion of any forest land for cocoa production within the two producer countries.

4.2 Trade of Cocoa

4.2.1 Global Trade

The main exporters of cocoa raw materials – cocoa beans, liquor, butter, paste, powder, and shells – include the major producing countries, with the addition of Belgium, which plays a major role in international trade of cocoa raw materials (Table 5).[82]

Table 5: Top 5 exporting countries of raw cocoa materials

Exporting countries	Quantity (tonnes)	% of total exports
Cote d'Ivoire	1,285,988	40%
Ghana	581,375	17%
Cameroon	263,746	8%
Ecuador	227,214	7%
Belgium	187,201	5%

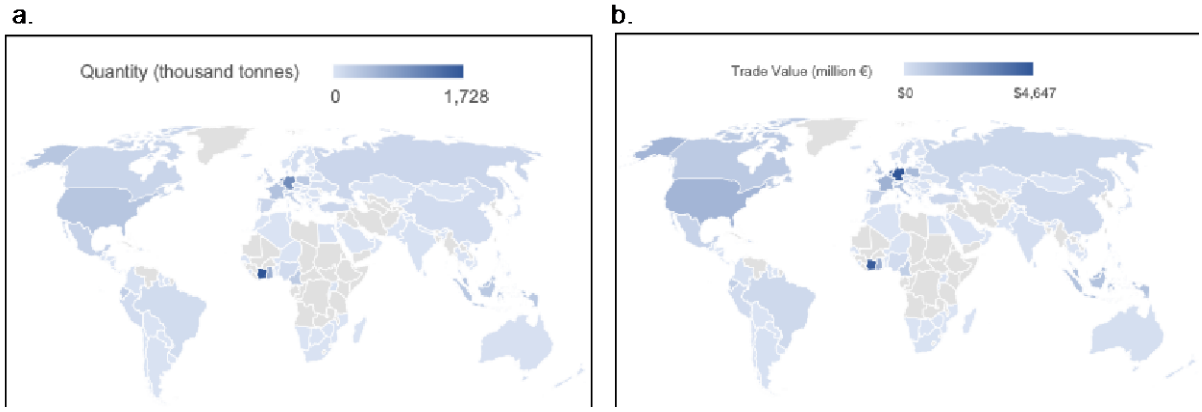
At 60% of global imports, the EU is the main destination of cocoa raw materials globally, with the top three importing countries being the Netherlands (25%), Germany (11%) and Belgium (9%). The EU imported almost 1.7 million tonnes of cocoa beans and almost 0.7 million tonnes of processed cocoa products in 2016.[83] Once these cocoa products arrive in the EU, intra-EU trade occurs, in which the Netherlands, Germany and Belgium play the greatest roles. Belgium in particular exported over 317,000 tonnes of cocoa products, which were

[79] The Aldi North Group includes Belgium, Denmark, Germany, France, Luxembourg, the Netherlands, Poland, Portugal and Spain
[80] BTC Trade for Development (2016). Market study on the presence of sustainable products in Belgian supermarkets
[81] CBI www.cbi.eu/market-information/cocoa/belgium/. Last accessed 19 November 2018
[82] Source: UN COMTRADE https://comtrade.un.org/data/. Last accessed 21 November 2018. Note: for Côte d'Ivoire, 2015 export data has been used since 2016 data was unavailable.
[83] UN COMTRADE https://comtrade.un.org/data/

mainly sold within the EU. Outside of the EU, the USA (12% of global imports) and Malaysia (7%) also play significant roles in the global trade of cocoa beans.

A large amount of further trading occurs within the importing countries, as cocoa beans are processed and manufactured into various intermediate and end products. A total of € 37.4 billion of cocoa products were exported globally in 2016. Of this, cocoa beans account for €8.2 billion, partly or fully processed cocoa products for € 28.3 billion and cocoa bean shells the remainder. Looking at the global trade flows of both cocoa beans and processed cocoa products, the cocoa-producing countries Côte d'Ivoire and Ghana, and the major importer-trader countries (the Netherlands, Germany, Belgium and France) are highly ranked in both the quantity and the value of cocoa exports (Figure 13 a and b). With the exceptions of Côte d'Ivoire and Ghana, the trade role of other cocoa producing countries decreases in this wider picture of trade flows.

Figure 13: Global exports of cocoa products in 2016: a. quantity, in thousand tonnes, and b. value (million Euros)



4.3 Belgium's imports of cocoa[84]

Belgium imported an average of € 2.1 billion of cocoa products per year between 2013-17. By value, cocoa beans are the most important cocoa import, accounting for 34% of the value of all cocoa product imports. Cocoa fats (21%) and 'Other chocolate products' (13%, Figure 14) are other major imports. The value of cocoa imports to Belgium shows an increase since 2013, with a particularly pronounced increase in 2016.

Imports of cocoa products averaged nearly 658,000 tonnes each year between 2013-2017 (Figure 15). Forty-two per cent of the total import quantity of cocoa are cocoa beans, indicating that the majority of Belgium's cocoa imports will either undergo partial or full processing after entering the country or be re-exported to other countries. Other important categories are cocoa fats (13%) and 'Other chocolate products' (11%, Table 6). See Appendix 4 for details of the HS codes used in these calculations.

[84] Unless otherwise stated all data is derived from UN COMTRADE https://comtrade.un.org/data/

Figure 14: The value of Belgium's imports of cocoa beans and cocoa products from 2013-17 (million Euros)

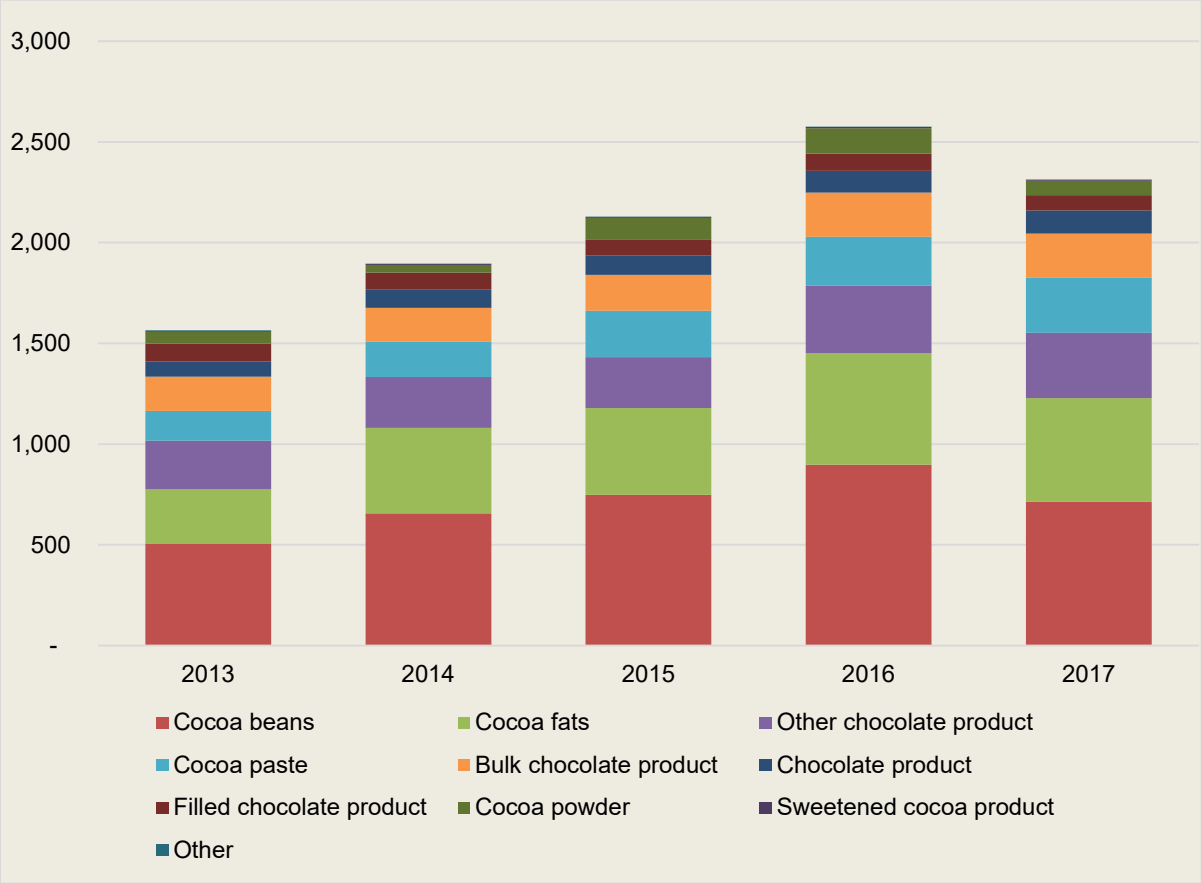


Figure 15: Quantity of cocoa products imported by Belgium between 2013-17, not adjusted for cocoa content (tonnes)

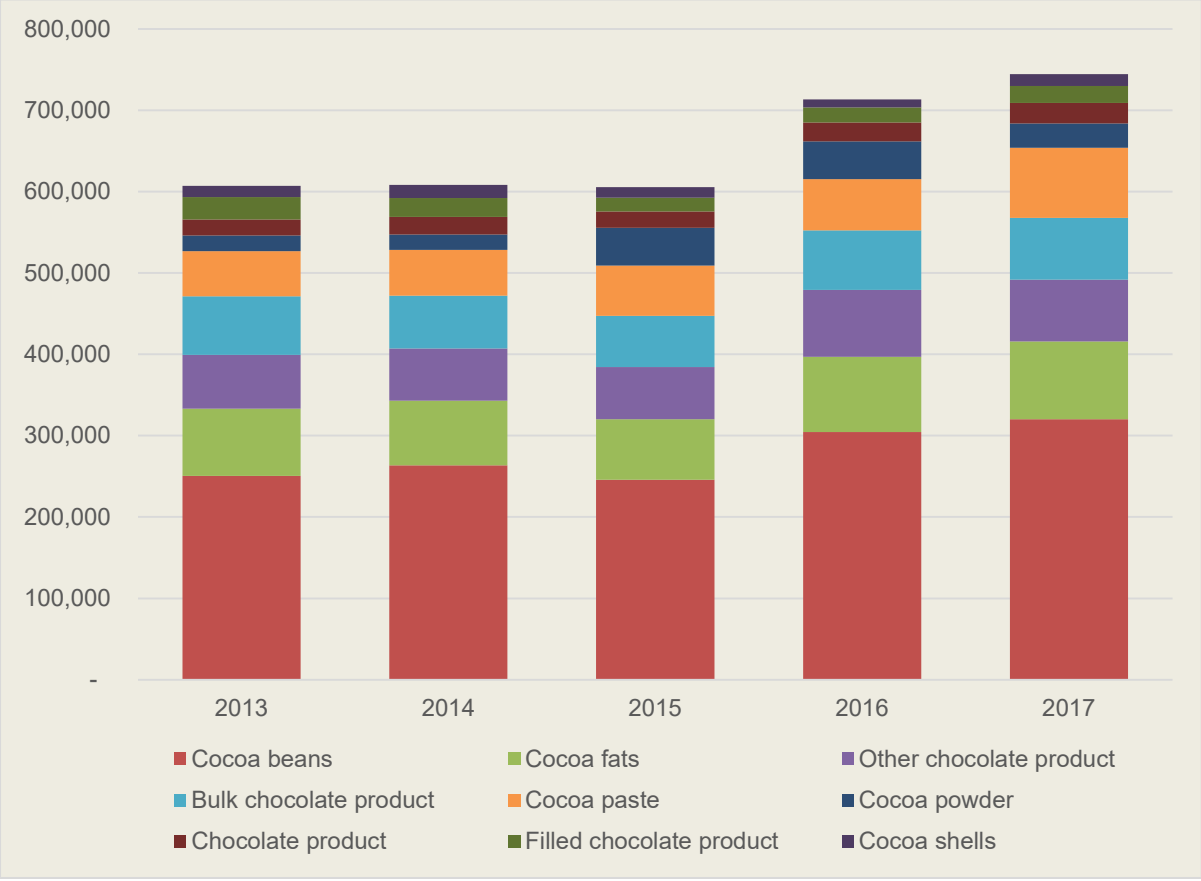
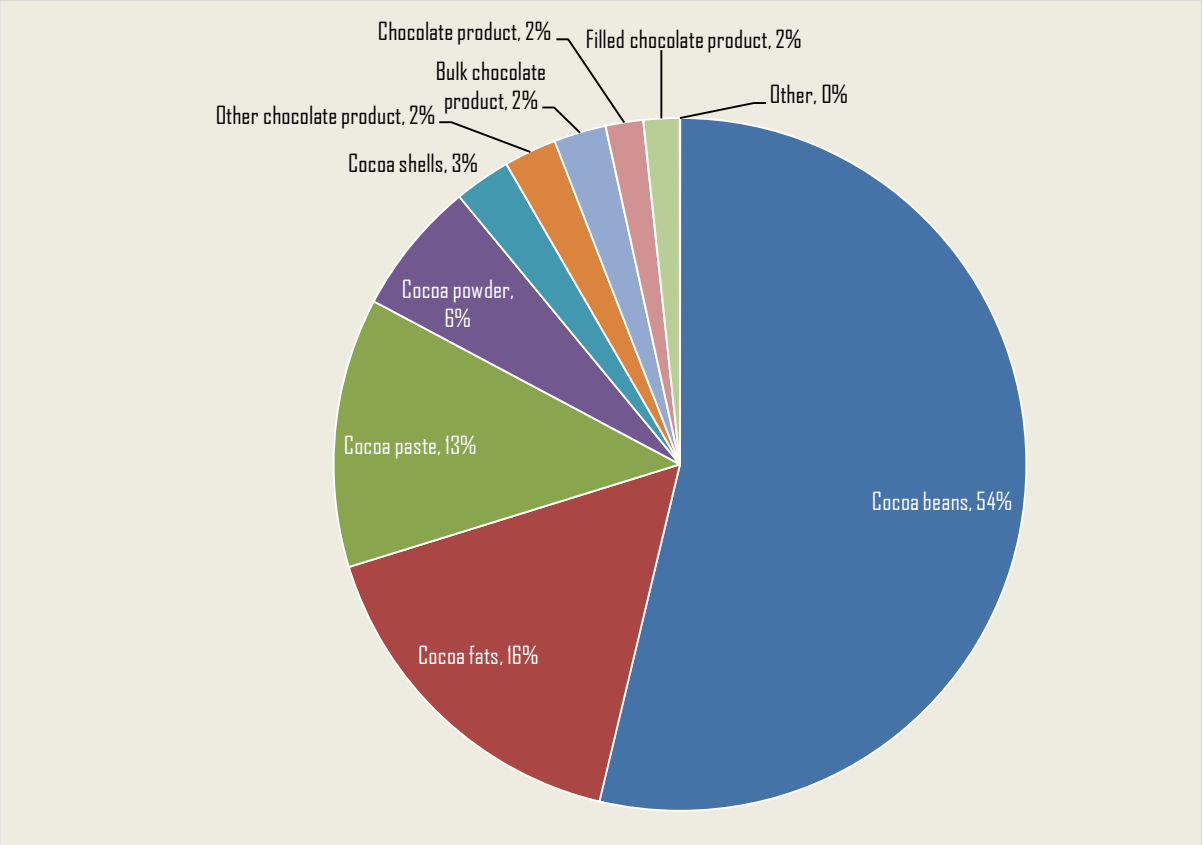


Table 6: Quantity of Belgium's cocoa imports by major product categories, 2013-17, adjusted for cocoa content (tonnes).

HS code	Product	2013	2014	2015	2016	2017	Average	%
1801	Cocoa beans	250,454	263,605	245,620	304,484	320,282	276,889	54%
1804	Cocoa fats	82,871	79,254	74,683	92,337	95,605	84,950	16%
180310	Cocoa paste	55,724	56,530	61,992	62,983	86,409	64,728	13%
1805	Cocoa powder	19,188	18,624	46,231	46,624	29,942	32,122	6%
1802	Cocoa shells	13,755	16,163	13,292	9,869	14,704	13,557	3%
180690	Other chocolate	11,893	11,593	11,545	14,806	13,682	12,704	2%
180620	Bulk chocolate	12,908	11,629	11,292	13,155	13,607	12,518	2%
180632	Chocolate product	8,074	8,973	8,303	9,419	10,323	9,018	2%
180631	Filled chocolate	11,326	9,484	6,849	7,630	8,513	8,760	2%
	Other	971	707	801	548	566	3,593	0%
Totals:		**467,164**	**476,562**	**480,607**	**561,856**	**593,632**	**515,964**	**100%**

Though the majority of Belgium's imports include cocoa products primarily made out of cocoa raw materials (e.g., cocoa beans, cocoa paste), the country also imports cocoa products which contain other ingredients (e.g., filled chocolate products). The weights of cocoa raw materials in these products are estimated using conversion factors (see Appendix 4). The amount of cocoa raw material required to supply Belgium's imports of cocoa products averaged nearly 516,000 tonnes per year between 2013-17. Corrected for cocoa content, cocoa beans contribute an even greater proportion of total import by quantity (54%), followed by cocoa fats (16%) and cocoa paste (13%, Figure 16).

Figure 16: Quantity of Belgium's imports of products containing cocoa, adjusted for cocoa content (tonnes). Average of 2013-17.



4.4 Provenance of Belgium's imports of cocoa

Between 2013 and 2017, Belgium imported cocoa products from a total of 123 territories. Corrected for the cocoa content of imports, Belgium imports over 50% of its cocoa directly from cocoa producing countries, dominantly from Côte d'Ivoire (32%) and Ghana (10%). However, at 45% of imports, an almost equal amount of cocoa is indirectly imported into Belgium through the EU, with the Netherlands (23%), France (10%) and Germany (8%) being the major traders (Figure 17).

Adjusting for the provenance of the EU exports into Belgium, the dominant role that Côte d'Ivoire and Ghana play in Belgium's cocoa supply becomes more apparent (Figure 18). Between 2013 and 2017, an average of 53% of Belgium's cocoa originated from Côte d'Ivoire and 19% from Ghana. Among other producing countries, only Nigeria (6%), Ecuador (3%), and Peru (3%) contributed more than 2% to Belgium's cocoa imports.

Figure 17: The quantity of Belgium's imports of cocoa between 2013-17 from major exporting countries (tonnes).

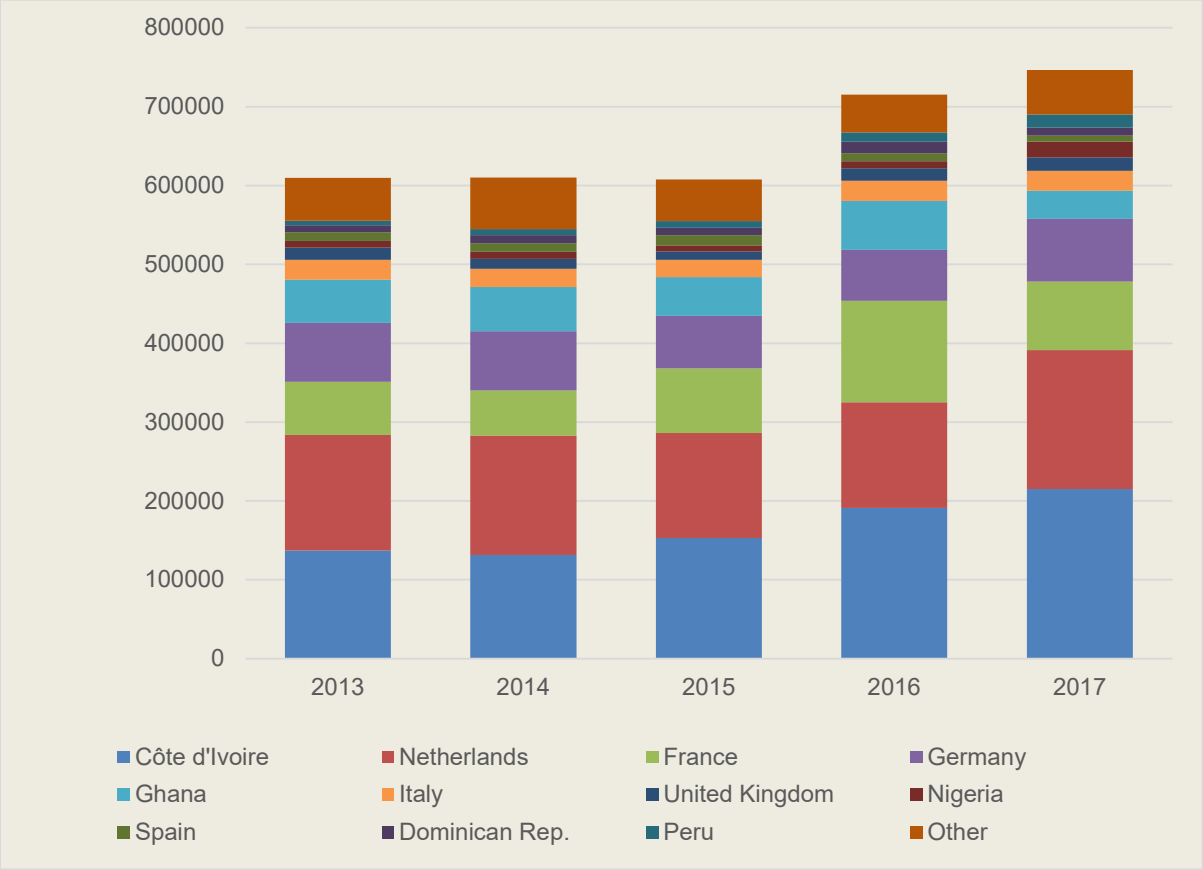
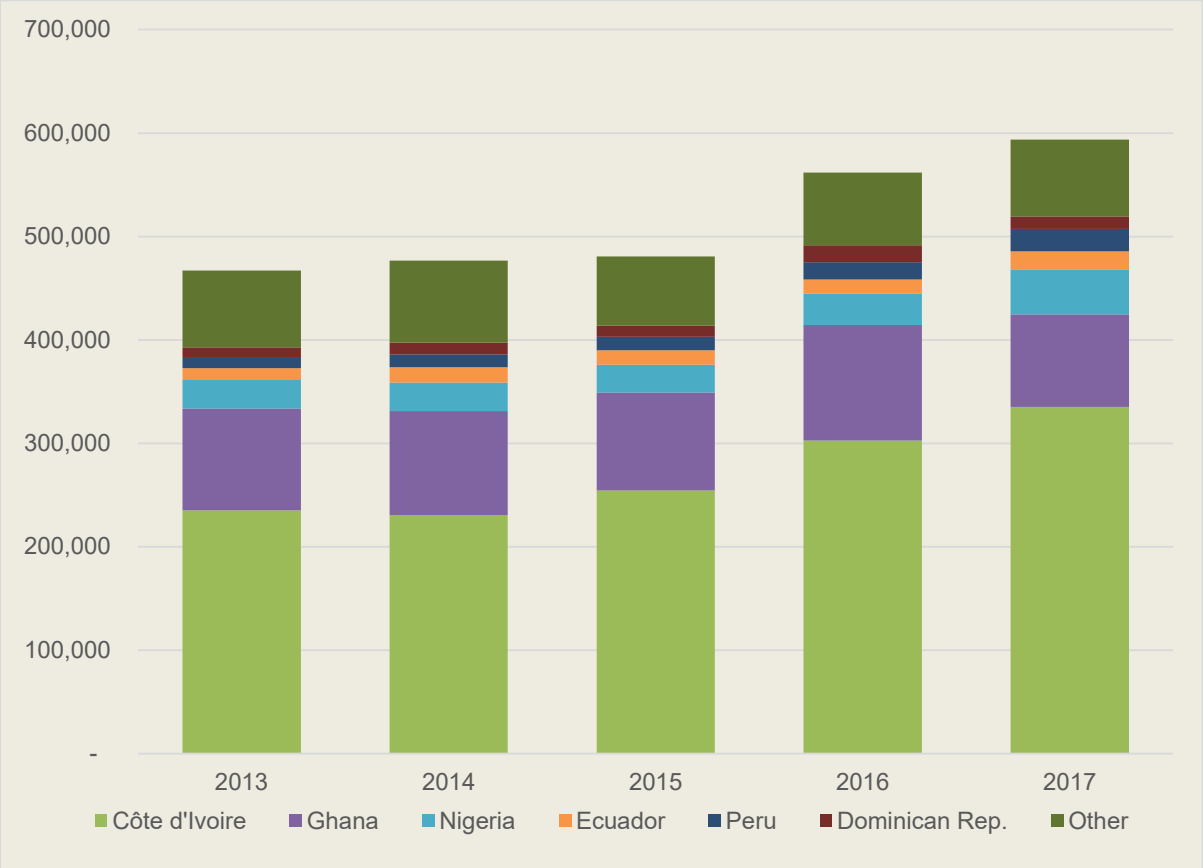


Figure 18: The quantity of Belgium's imports of cocoa between 2013-17, adjusted for provenance of third-party trade (tonnes).



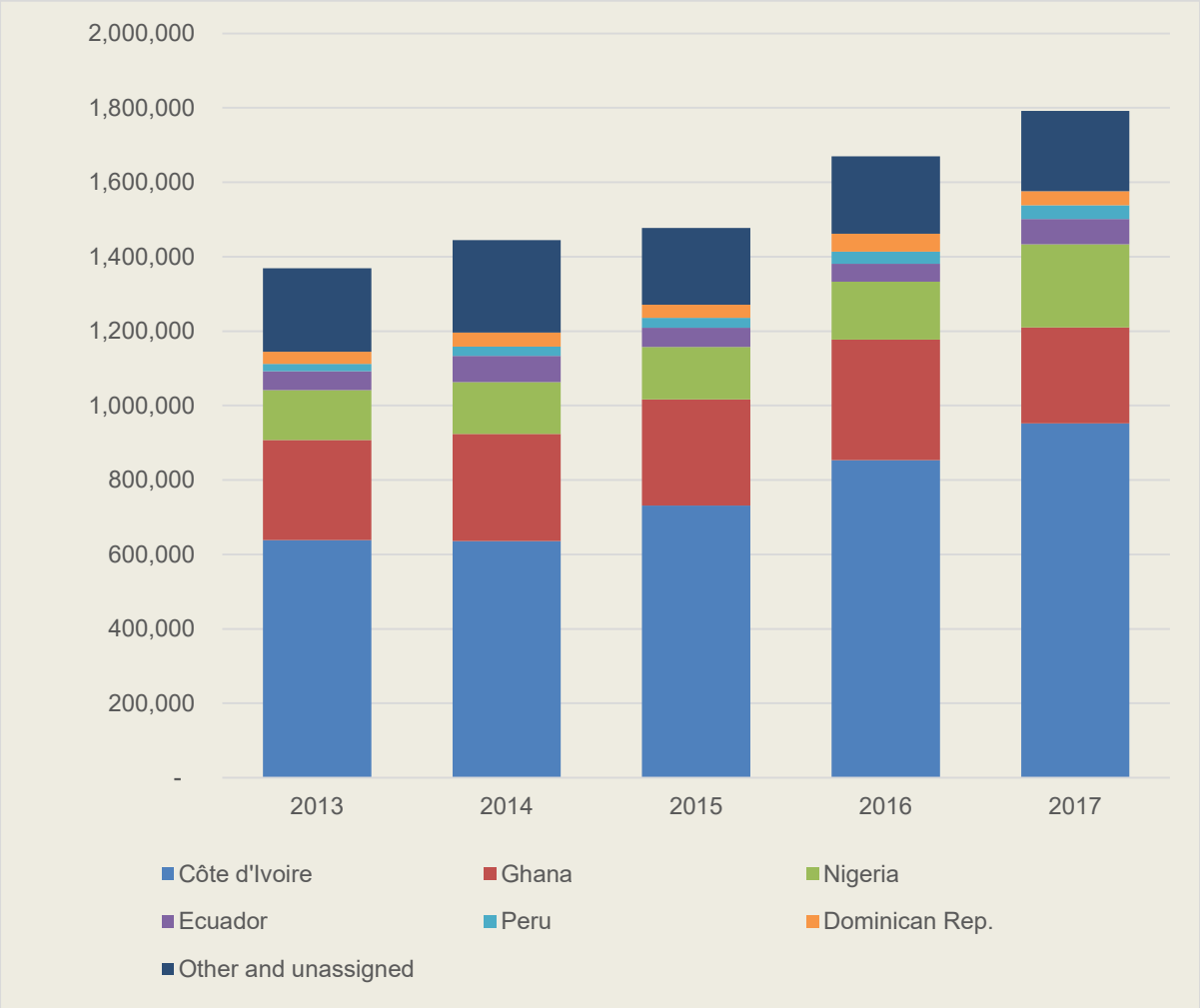
4.5 Belgium's cocoa footprint

To produce an estimate of land required to supply Belgium's cocoa imports, the cocoa used in the products imported by Belgium were first assigned to cocoa bean fractions, i.e. cocoa beans, cocoa liquor, cocoa butter, cocoa powder or cocoa bean shells. This was done to arrive at a figure on Belgium's cocoa imports per cocoa bean fraction. The imported fractions were allocated to yields that are specific to the cocoa fraction, which are as follows: beans 1.0; liquor 0.82; butter 0.41; powder 0.4 and shells 0.18.[85]

The estimated land area required to satisfy Belgium's demand for cocoa products averaged almost 1.6 million hectares per year between 2013-17 (Figure 19). This is equivalent to approximately 15% of the global harvested area of cocoa. Côte d'Ivoire dominates the land footprint, with an average of 762,000 hectares each year (49%), with Ghana contributing the second largest area (285,000 hectares, 18%). The land footprint from Nigeria (159,00 hectares, 10%) is also significant.

The land area required to supply Belgium's imports from Côte d'Ivoire rose from 639,000 hectares in 2013 to 952,000 hectares in 2017, unlike that of Ghana, which decreased from 268,000 hectares to 257,000 hectares over the period.

Figure 19: Estimated land footprint of Belgium's imports of cocoa between 2013-2017 (hectares)



[85] Fairtrade International (2013). Questions & Answers: Cocoa conversion rates for mass balance. 19 December 2013. Available at http://www.fairtrade.net/fileadmin/user_upload/content/2009/standards/documents/2013-12-19_EN_CocoaMBConversionRates_Q_ADocument_final.pdf Yield data was obtained from FAO STAT, last accessed 05 September 2016.

4.6 Estimated consumption

Belgium's consumption of cocoa is estimated by subtracting the quantity of exported cocoa (317,000 tonnes) from the overall quantity of imported cocoa (516,000 tonnes), providing an average consumption figure of almost 199,000 tonnes of cocoa per year between 2013-2017. This represents 39% of Belgium's annual import during that time period and 4% of all global cocoa production. The area necessary to produce this amount of consumed cocoa is nearly 598,000 hectares – which is equivalent to 6% of the global harvested area for cocoa and 20% of Belgium's land area.

4.7 Belgium's cocoa risk profile

Belgium is a major trading hub for cocoa – being the only country which is both a top 5 importer and exporter of cocoa in the world. This is primarily due to its prominent chocolate industry, which requires large import quantities of raw cocoa materials for production, but also creates processed chocolate products for export. Furthermore, the country's magnitude of domestic consumption signifies the importance of cocoa in Belgium as a major imported commodity and the subsequent need to ensure sustainable and responsible sourcing.

Belgium imports most of its cocoa products (65%) from high and very high risk countries: Côte d'Ivoire, Ecuador, Nigeria, and Peru (Figure 20). All of these countries have significant deforestation, labour and corruption issues. The majority of the remaining footprint is from the Dominican Republic and Ghana, which at national levels are both rated as medium risk due to their relatively modest rates of tree cover loss and natural forest loss (Table 15). However, the cocoa sector in Ghana has repeatedly been shown to rely on low paid or unpaid labour, coercion and violence, and systematic debt,[86] is included by the US Department for Labor in their List of Goods Produced by Child Labor,[87] and has directly been associated with deforestation.

While certification is well advanced within the cocoa sector, the safeguards that different schemes provide on deforestation and social exploitation vary (see 4.1.4), and there remain entrenched problems within the sector. However, voluntary certification, alongside initiatives such as the World Cocoa Foundation's Cocoa and Forests Initiative, remain the best option for reducing the risk of deforestation. Since levels of consumer awareness and demand for certified products in Belgium are low in comparison to other European countries,[88] awareness campaigns that communicate the environmental and social issues associated with cocoa production might be the first step in encouraging more consumption, as well as availability of, certified cocoa.

[86] Genevieve LeBaron (2018) The Global Business of Forced Labour: Report of Findings, SPERI & University of Sheffield.
[87] https://www.dol.gov/ilab/reports/child-labor/list-of-goods
[88] CBI www.cbi.eu/market-information/cocoa/belgium/. Last accessed 19 November 2018; BTC Trade for Development (2016). Market study on the presence of sustainable products in Belgian supermarkets

Figure 20: Belgium's cocoa footprint by risk category

5 Palm Oil

5.1 Production, uses and sustainability of palm oil

5.1.1 Production

The oil palm, *Elaeis guineensis*, is native to west and southwest Africa. It is now planted widely in tropical lowlands, with the most suitable areas for cultivation being between ten degrees north and south of the equator, with temperature ranges between 24-32ºC, and rainfall that is evenly distributed throughout the year.

Harvesting begins when the palms are three to four years old, and plantations are harvested year-round. The fruit is processed into three main raw materials:

- **Palm oil**, which is extracted from the pulp of the fruit that has been sterilised by heating and pounded mechanically (known as digestion) followed by mechanical pressing. The oil is then refined, bleached and deodorised for most uses.
- **Palm kernel oil** is extracted from the seed of the fruit by mechanical crushing to remove the shells, steam cooking and pressing.
- **Palm kernel meal**, which is the residue from palm kernel oil extraction.

Palm oil is both the most-produced and most consumed plant derived oil, ahead of soy oil.[89] It is the most productive vegetable oil crop, yielding around five times more oil per hectare than rapeseed (the next most productive oil seed) and yields over seven times more oil per hectare than soy.[90]

Large-scale palm oil plantations produce approximately 60% of the world's production, and usually also contain a processing mill, because fruit bunches must be processed within twenty-four hours of harvesting to maintain the quality of the oil. The mills typically take in fresh fruit brunches from the plantation as well as from small- and medium- sized growers in the vicinity. As there has been limited success in mechanisation to date, oil palm cultivation and harvesting is very labour intensive. To deal with the high labour requirement, plantations often rely on large amounts of migrant labour, with an estimated 2.5 million international or internal migrant labourers – legal and illegal – in Southeast Asia alone. These migrant workers are largely Indonesian, but also include Bangladeshis, Filipinos, Thai, and other nationalities.[91]

An estimated three million smallholders grow oil palm, accounting for approximately 40% of total global oil palm production.[92] Smallholders may be independent, or be part of a plantation development scheme. Oil palm is a popular crop among smallholders because of its continuous production, and because it can give a substantially higher income than subsistence food crops.[93] However, smallholders' yields are generally lower than that of large-scale plantations due to lack of access to higher-yielding stock and lower knowledge

[89] Note: these are 2011 figures. http://www.befair.be/sites/default/files/Huile%20de%20Palme%20EN.pdf
[90] Oil World (2016)
[91] Cramb, R, and McCarthy, J.F. 'Characterising Oil Palm Production in Indonesia and Malaysia', in Cramb, R, and McCarthy, J.F., eds., The Oil Palm Complex (Singapore, 2016) pp.27-77.
[92] http://www.rspo.org/certification/smallholders
[93] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)
http://ec.europa.eu/environment/forests/pdf/palm_oil_study_kh0218208enn_new.pdf

on agricultural practices.[94] The requirement to process harvested fruit rapidly means that most smallholders are effectively tied to sell to a single mill, via agents.

5.1.2 End uses

Palm oil is extremely versatile and can be easily separated into solid (stearin) and liquid (olein) components that are used in hard products such as soaps and margarines, or liquid products such as oils and lubricants. Palm oil, palm kernel oil and their derivatives[95] are estimated to be present in over 50% of packaged supermarket products.[96] Some of the key uses are:

- **Palm oil:** cooking oil, and an ingredient in manufactured foods including biscuits, baking, ice cream, margarines, snacks, confectionary, dairy products and dairy replacers. It is estimated that approximately 15% of palm oil is used as biofuel feedstock globally, but a larger proportion of imported palm oil is used for this purpose in many European countries.[97]
- **Palm kernel oil:** used in the oleochemical industry for making soap, detergent, toiletries and cosmetics, and for industrial use.
- **Palm kernel meal:** widely used as animal feed, and also in electricity production.

China and India use palm oil predominantly for cooking oil and other culinary purposes. The growth in demand in both India and China has been correlated with increasing incomes, urbanisation and an associated dietary shift towards processed foods.[98] By contrast, palm oil is used in the EU more in manufactured products than directly for cooking, and demand growth has been partly driven as an indirect consequence of policy support for biofuels: palm oil has replaced other vegetable oils, mainly rapeseed oil, for biofuel production.

Palm oil consumption is vulnerable to competition from other vegetable oils, particularly soybean oil; the two can substitute for one another as cooking oil, biodiesel feedstock and in certain foods. Belgium is listed as having two vegetable oil-based biodiesel refineries and two vegetable oil-based oleochemistry refineries,[99] suggesting that the country is able to produce a certain amount of biodiesel and refined vegetable oil products from imported palm and palm kernel oil.

[94] Smallholder yields have been reported as being between 90% of plantation yields in Malaysia and Indonesia where smallholders are directly supported by the government or private sector. In Indonesia, unsupported smallholder may have yields 81-48% of that of plantations. See: Sonja Vermeulen and Nathalie Goad (2006). Towards Better Practice in Smallholder Palm Oil Production. IIED.

[95] Derivatives of palm oil and palm kernel oil are variously labelled as palmitate, palmolein, glyceryl, stearate, stearic acid, palmitic acid, palm stearine, palmitoyl oxostearamide, palmitoyl tetrapeptide-3, sodium laureth sulfate, sodium lauryl sulfate, sodium kernelate, sodium palm kernelate, sodium lauryl lactylate/sulphate, hydrated palm glycerides, etyl palmitate, octyl palmitate, palmityl alcohol.

[96] https://www.pwc.com/id/en/publications/assets/palm-oil-plantation-2012.pdf

[97] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)

[98] https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2016-01-28-agricultural-commodities-brack-glover-wellesley.pdf

[99] Bio-refineries in Europe 2017. Nova Institute and Bio-based Industries Consortium. Last accessed December 2018 at https://biconsortium.eu/sites/biconsortium.eu/files/downloads/MappingBiorefineriesAppendix_171219.pdf

5.2 Environmental and social issues associated with palm oil production

A recent and comprehensive analysis of the environmental, social and economic impacts of palm oil cultivation is given in Barthel *et al.* (2018).[100]

The expansion of palm oil cultivation has resulted in deforestation, particularly in Indonesia and Malaysia. Remote sensing studies of a subset of plantations in 20 countries suggests that around 45% of oil palm plantations in Southeast Asia came from areas that were forested in 1989. In other regions, the planting on forested areas appears to have been lower: 31% in South America, 7% in Africa and 2% in Central America.[101] This high rate of deforestation in Southeast Asia – with plantations replacing previously logged and unlogged forest – has led to a significant loss of biodiversity, particularly of forest specialist species.[102] Converting logged or unlogged forest to palm oil plantations is a significant source of greenhouse gas emissions. When oil palm is planted on grassland or scrubland on mineral soils, there can be a net uptake of carbon dioxide.[103]

A specific concern with deforestation is the conversion of peat land. Peat swamp forest is a critically endangered of habitat characterised by deep layers of peat soil and highly acidic water. Malaysia, Indonesia and Papua New Guinea support some of the most extensive tropical peatlands in the world, covering around 27.1 million hectares. The development of peat land can have a disproportionate impact on greenhouse gas emissions: peat soil contains large quantities of carbon and plays a major role in carbon sequestration. Draining peat land results in carbon dioxide emissions, and drained peat is highly flammable, releasing further carbon dioxide if burnt.[104] Reliable estimates of peatland conversion suggest that 3.1 million hectares of former peatland in Malaysia, Borneo and Sumatra were covered by palm oil plantations by 2015, equivalent to 21% of the original area of peat land in these areas.[105]

The use of fire to clear forests for agriculture expansion, in particular in Kalimantan and Sumatra, is a major source of greenhouse gas emissions and air pollution, including haze. Burning is particularly severe during the droughts associated with El Niño, and drained peat land represents a particular fire hazard. The 2015 fires in Indonesia caused emissions of between 1.62[106] and 1.75[107] billion tonnes of CO_2 equivalent, and effectively tripled Indonesia's greenhouse gas emissions for that year. Approximately 19% of the land burned

[100] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)
[101] Vijay V., Pimm S.L., Jenkins C.N., Smith S.J. (2017). The Impacts of Oil Palm on Recent Deforestation and Biodiversity Loss. PLoS ONE 11/7, 1-19.
[102] For example, Brook, B.W., Sodhi N.S., Ng P.K.L. (2003). Catastrophic extinctions follow deforestation in Singapore. Nature 424, 420–423.
[103] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)
[104] Hooijer, A., Silvius, M., Wösten, H. and Page, S. (2016). PEAT-CO2, Assessment of CO2 emissions from drained peatlands in SE Asia. Delft Hydraulics report Q3943, Delft, Netherlands.
[105] Miettinen, J., Shi, C., and Liew, S.C. (2016). Land cover distribution in the peatlands of Peninsular Malaysia, Sumatra and Borneo in 2015 with changes since 1990' Global Ecology and Conservation, Volume 6, Pp 67–78
[106] Chamorro, A., Minnemeyer, S., and Sargent, S. (2017). Exploring Indonesia's Long and Complicated History of Forest Fires. World Resources Institute. http://www.wri.org/blog/2017/02/exploring-indonesias-long-and-complicated-history-forest-fires
[107] World Bank (2016). The Cost of Fire An Economic Analysis of Indonesia's 2015 Fire Crisis. Indonesia Sustainable Landscapes Knowledge Note: 1. The World Bank Group, Jakarta

in Indonesia in 2015,[108] and 16.6% of fires between 2012-15 in Sumatra and Kalimantan occurred within oil palm concessions. The resulting haze, lasting three months, resulted in an estimated 100,300 excess deaths across Indonesia, Malaysia and Singapore in 2015.[109]

The economic and social impacts of palm oil are complex and contradictory. Oil palm cultivation has improved incomes for many rural people, including smallholder farmers. It has also supported the development of rural economies and the growth of national economies of producer countries. However, oil palm production has often been associated with social concerns, the most important of which are land use rights (particularly in Indonesia,[110,111] but also in other producer countries[112]), forced and child labour (especially Indonesia and Malaysia),[113,114,] and issues relating to the terms and conditions of labour, (such as wages, health and safety and gender discrimination[115]).

5.2.1 Certification

The two major certification schemes for palm oil are the Roundtable on Sustainable Palm Oil (RSPO), which is used principally in consumer goods, and the International Sustainability and Carbon Certification (ISCC), which predominates in the biofuel sector. The two schemes have broadly similar requirements and procedures (including third party independent audits), however the RSPO has stronger requirements on social issues whilst the ISCC has stricter controls on deforestation.[116]

RSPO has been conspicuously successful in achieving scale when compared to sustainability certification schemes in most other commodities. The RSPO currently has 2,879 members and RSPO certified palm oil accounted for 17% of global production in 2016.[117] A more challenging standard ('RSPO Next') and a standard that is designed to be compliant with the EU Renewable Energy Directive ('RSPO RED') have been developed, but have negligible take up.

There have significant and recurrent doubts as to whether the RSPO's Principles and Criteria are sufficiently robust, the quality and transparency of the auditing system, and its ability to include smallholder producers. High profile investigations of certified plantation companies have revealed actions that are in direct contradiction of the RSPO standard,

---

[108] World Bank (2016). The Cost of Fire An Economic Analysis of Indonesia's 2015 Fire Crisis. Indonesia Sustainable Landscapes Knowledge Note: 1. The World Bank Group, Jakarta

[109] Koplitz, S.N., Mickley, L.J., Marlier, M.E., Buonocore, J.J., Kim, P.S., Liu, T., Sulprizio, M.P., DeFries, R.S., Jacob, D.J., Schwartz, J., Pongsiri, M. and Myers, S.S. (2016)'Public health impacts of the severe haze in Equatorial Asia in September–October 2015: demonstration of a new framework for informing fire management strategies to reduce downwind smoke exposure. Environmental Research Letters, 11, 094023.

[110] Siscawati, M. (2011). The Case of Indonesia: Under Soeharto's Shadow. *In The bitter fruit of oil palm: dispossession and deforestation.* World Rainforest Movement (2001), UK.

[111] Colchester, M. and Jiwan, N. (2006). Ghosts on our own land: Indonesian oil palm smallholders and the Roundtable on Sustainable Palm Oil. Forest People's Programme & Sawit Watch (2006), Moreton-in-Marsh, UK and Bogor, Indonesia.

[112] Colchester, Marcus and Sophie Chao (Eds.) (2013) Conflict or Consent? The Oil Palm Sector at a Crossroads, Forest Peoples Programme, Moreton-in-Marsh

[113] World Vision (2013). Forced, child and trafficked labour in the palm oil industry. World Vision Australia.

[114] Skinner, E.B. (2013).Indonesia's Palm Oil Industry Rife With Human-Rights Abuses: The hidden human toll of the palm oil boom. Bloomberg Business Week. https://www.bloomberg.com/news/articles/2013-07-18/indonesias-palm-oil-industry-rife-with-human-rights-abuses

[115] Amnesty International (2016), The Great Palm Oil Scandal: Labour Abuses Behind Big Brand Names. London: Amnesty International. https://www.amnesty.org/en/documents/asa21/5184/2016/en/, accessed 1 Feb. 2017.

[116] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)

[117] http://www.rspo.org/about Last accessed 07 December 2016

including land grabs, deforestation, and illegal working conditions.[118] RSPO certification has been found to have had some impact on reducing conversion of forest areas within existing plantations,[119] but may have had little impact on palm-oil associated deforestation more generally.[120]

The General Assembly of the RSPO recently approved a revised set of Principles and Criteria, which have stricter criteria on deforestation (excluding conversion of High Conservation Areas and High Carbon Stock forests), and exclude planting on peat soils of any depth.[121] It has also released a smallholder strategy in an attempt to make the scheme more accessible to smallholders.

Both Indonesia and Malaysia have developed palm oil certification systems in recent years. The Indonesian Sustainable Palm Oil Foundation (ISPO) was established in 2009 to implement a certification policy system designed by the Indonesian Ministry of Agriculture. The ISPO system is mandatory and applies to all oil palm growers operating in Indonesia, from large plantation companies to smallholders, although requirements for each vary. ISPO audits have been conducted by independent certification bodies since May 2012. The Malaysian Sustainable Palm Oil (MSPO) standard is a national certification standard created by the Malaysian government and developed with input from various stakeholders in the palm oil industry. It was first launched in November 2013, and officially came into implementation in January 2015. There are plans to merge ISPO and MSPO to create a coordinated 'Council of Palm Oil Producing Countries' (CPOPC). It is important to note that neither the ISPO or MSPO standard has criteria preventing deforestation, other than those instances where deforestation would be illegal.

The RSPO does not provide traceability data, and so in the absence of an industry survey it is not possible to estimate the penetration of certified palm oil and its fractions in the Belgian market. However, Belgium had the sixth largest number of facilities certified to handle RSPO certified palm oil of any country in 2015 (i.e., chain of custody certificates), behind only the UK, Germany, the Netherlands, France and Italy,[122] indicating that a significant proportion of certified material is likely to be available.

5.2.2 The EU and Belgium's responses to environmental and social issues with palm oil

Two-thirds of the forest area converted to oil palm plantations is estimated to be caused by the global trade in palm oil.[123] The EU alone was estimated to be responsible for 0.9 million hectares of embodied deforestation through its imports of palm oil between 1990 and

[118] See: EIA (2015). Who Watches the Watchmen. Auditors and the Breakdown of Oversight in the RSPO; and Amnesty International (2016). The Great Palm Oil Scandal: Labour Abuses Behind Big Brand Names.
[119] Kimberly M. Carlson, Robert Heilmayr, Holly K. Gibbs, Praveen Noojipady, David N. Burns, Douglas C. Morton, Nathalie F. Walker, Gary D. Paoli, Claire Kremen (2018). Oil palm certification, forests, and fire. Proceedings of the National Academy of Sciences, 115 (1) 121-126; DOI:10.1073/pnas.1704728114
[120] Ruysschaert, D. & Salles, D. 'Towards global voluntary standards: Questioning the effectiveness in attaining conservation goals: The case of the Roundtable on Sustainable Palm Oil (RSPO)'. Ecological Economics, Volume 107, 2014, Pp. 438–446
[121] RSPO (2018). Principles and Criteria for the Production of Sustainable Palm Oil. Available from: https://rspo.org/principles-and-criteria-review
[122] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)
[123] Henders, S., Persson, U.M. & Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. Environmental Research Letters 10/12, 125012.

2008.[124] In response to this, and the issues highlighted in the previous section, there are an increasing number of public, NGO and private-sector-driven initiatives and commitments relating to different aspects of palm oil sustainability.

Although there are no palm oil specific EU sustainability regulations, a recent study identified twelve EU regulations that relate to the key environmental, social, economic and trade and development aspects concerning palm oil. For example, the sustainability criteria of the EU Renewable Energy Directive exclude biofuels derived from previously forested land from counting towards the renewable energy targets. In addition, eleven UN instruments (e.g., the UNFCCC Paris Agreement), and further non-binding policy instruments are relevant to palm oil within the EU.[125]

In April 2017, the European Parliament made a Resolution on Palm Oil and Deforestation to ban biofuels based on palm and other vegetable oils that drive deforestation by 2021, and are considering a complete ban on the use of palm oil in biofuels by that date. In March 2018, the EC released a study that laid out policy options for the EU to tackle the impact on global deforestation caused by the trade in crop and animal products, including palm oil.[126]

Sitting within these evolving policy and regulatory landscapes – and often challenging them to do more, and at a faster pace – are an increasing number of public, NGO and private-sector-driven initiatives and commitments. These voluntary initiatives and commitments operate at different scales:

- Initiatives and commitments made by or through international organisations, regional governmental bodies and institutions – e.g. the Consumer Goods Forum's 2020 Zero Net Deforestation Commitment, which aims to achieve the commitment through the responsible sourcing of key commodities such as palm oil, soy, beef and paper. Belgium companies that are member of the Consumer Goods Forum members are few, but include Puratos (a manufacturer of baked foods), AB InBev (a beer manufacturer), and Greenyard (a fruit and vegetable supplier).[127]
- Intra-regional initiatives and guidance – e.g. the European Sustainable Palm Oil (ESPO) initiative, EPOA (European Palm Oil Alliance) and ESPOAG (European Sustainable Palm Oil Advocacy Group).
- The policies, strategies and commitments adopted by relevant international and national industry bodies and trade associations, whose members are end users of palm oil, For example, the Belgian Alliance for Sustainable Palm Oil (BASP) has members from the food, cosmetics and detergent sectors, with targets to source 100% certified palm oil by 2015 and achieve fully traceable certified palm oil, that has not been produced from converted High Carbon Stock forest or peat land by 2020. BASP has received criticism for its lack of coverage of certain key sectors, (e.g., biodiesel, retailers), the fact that its targets are non-binding for exports and for certain

[124] Cuypers, D., Geerken, T., Gorissen, L., Lust, A., Peters, G., Karstensen, J., Prieler, S., Fisher, G., Hizsnyik, E. and van Velthuizen, H. (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation. European Union Technical Report - 2013 - 063

[125] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)

[126] COWI/AS (2018). Feasibility study on options to step up EU action against deforestation. Final Report. European Commission Directorate General for Environment (Study Contract No.: ENV.F.1/FRA/2014/0063.

[127] For more information, please see: http://www.theconsumergoodsforum.com/sustainability-strategic-focus/sustainability-resolutions

members (e.g., cosmetics manufacturers) or for subsidiaries of member companies, and a lack of transparency in monitoring and reporting.[128]

- Individual corporate sustainability initiatives and reports – e.g. commitments from major producer companies and retailers to produce or source palm oil responsibly and sustainably, including reports on the progress they are making and the partnerships they have formed.

A fuller analysis of the voluntary and private sector initiatives on palm oil in Europe is given in Barthel et al. (2018).[129]

A growing number of companies and brands within the EU have launched palm oil-free initiatives and some have introduced palm oil-free labels on their products. Although there are no publicly available studies that attempt to quantify the scale of palm oil-free initiatives, a presentation to a recent Malaysian palm oil industry conference referenced a survey of 'No Palm Oil' labels that identified 1,750 of these labels in use in Italy, France and Belgium alone.[130] The level of interest in palm oil free products has prompted the recent launch of a new certification scheme: the International Palm Oil Free Certification Accreditation Programme (POFCAP).[131] This new, not for profit, consumer-facing certification scheme is already approved to certify products in twelve countries, with applications pending in five others, but it is still too early to determine what the update will be from the consumer goods industry.

5.3 Trade of palm oil

5.3.1 Global trade

Global palm oil production has increased from 15.2 million tonnes in 1995 to over 60 million tonnes in 2016.[132] This volume is predominantly produced by Indonesia (51%) and Malaysia (34%, Figure 21 a). Indonesia and Malaysia have increased the area cultivated for oil palm from 2.6 million hectares in 1990 to over 15 million hectares in 2014, with Indonesia accounting for just over 10 million hectares.[133] There has also been a marked increase in palm oil production in other parts of the world during recent years, with most of the additional volume generated in South and Central America, Thailand and West Africa.[134]

Global demand for palm oil has seen strong and sustained growth. Major consuming countries include India, China, the EU, Indonesia and Malaysia (Figure 21 b). In 2013, India, China and the EU combined accounted for almost 60% of global imports.

[128] Bogdan Vanden Berghe (Ed.) (2018). Le mythe de l'huile de palme 100% durable. Les limites des initiatives volontaires: le cas de la RSPO et de l'Alliance belge pour une huile de palme durable. Published by: CNCD-11.11.11, FIAN Belgium, Oxfam-Wereldwinkels, Commission Justice et Paix, Africa Europe Faith and Justice Network (AEFJN), RBRN (Réseau Belge Ressources Naturelles)

[129] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)

[130] Kalanithi Nesaretnam & Rafizah Mazlan – Palm Oil in Europe - presentation to the Malaysian Palm Oil Industry (Malaysian Palm Oil Board, 12 April 2017).

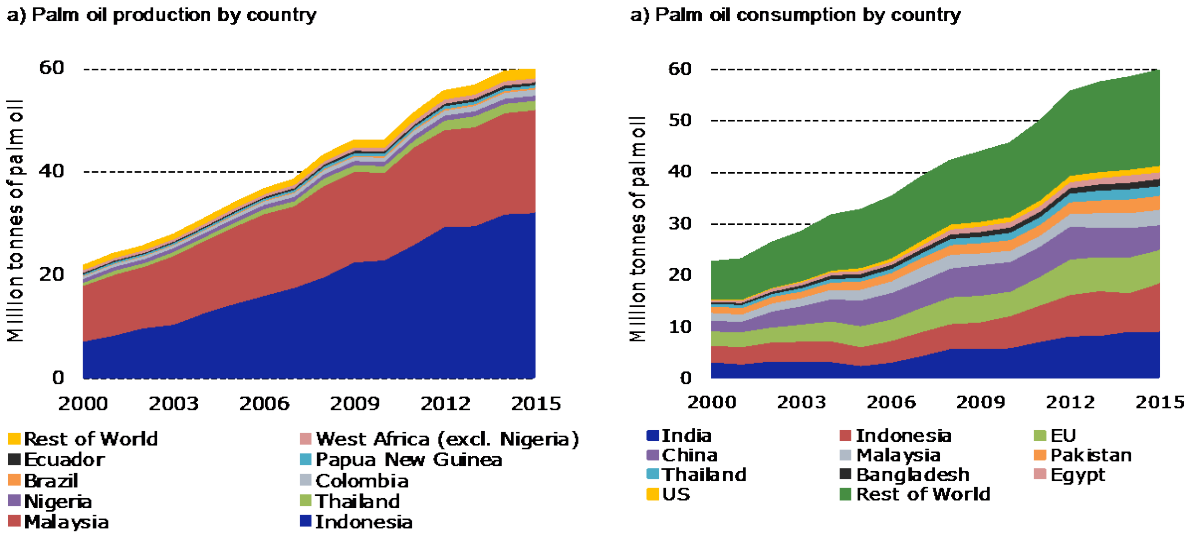
[131] See: http://www.palmoilfreecertification.org/ and https://innovationforum.co.uk/analysis.php?s=do-consumers-want-to-go-palm-oil-free for more information (accessed on 29 August 2017).

[132] FAOSTAT

[133] Cramb, R, and McCarthy, J.F. 'Characterising Oil Palm Production in Indonesia and Malaysia', in Cramb, R, and McCarthy, J.F., eds., The Oil Palm Complex (Singapore, 2016) pp.27-77

[134] Vijay V., Pimm S.L., Jenkins C. and Smith S.J., 'The Impacts of Oil Palm on Recent Deforestation and Biodiversity Loss', Accessed 05/07/2017, https://doi.org/10.1371/journal.pone.0159668

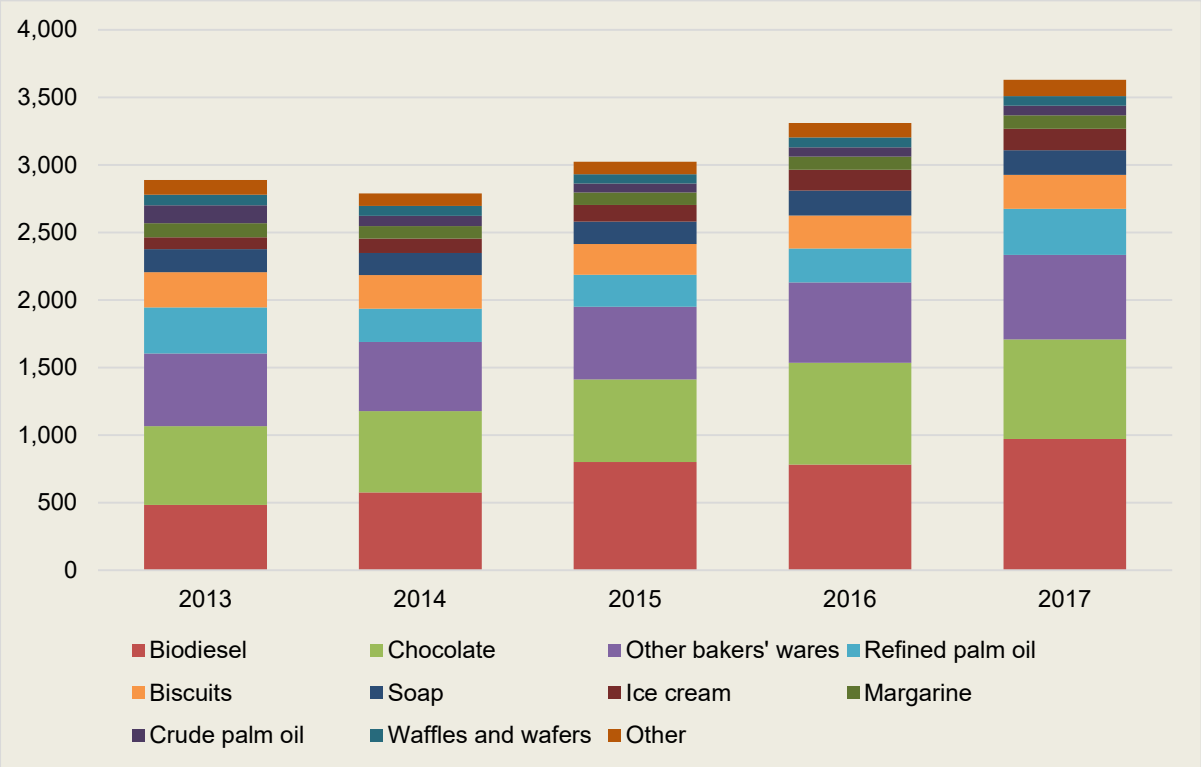
Figure 21: Palm oil production and consumption by country[135]



5.4 Belgium's imports of palm oil

Belgium imported an average of € 3.1 billion of palm oil, palm kernel oil and meal, products containing them or embedded in production processes each year between 2013-17. There was a steady increase in the value of this trade over time, from € 2.9 billion in 2013 to € 3.6 billion in 2017 (Figure 22). Twenty three percent of the value was in biodiesel, and more than 60% in edible products, in which palm oil can be an ingredient (e.g., chocolate, bakery products and biscuits).

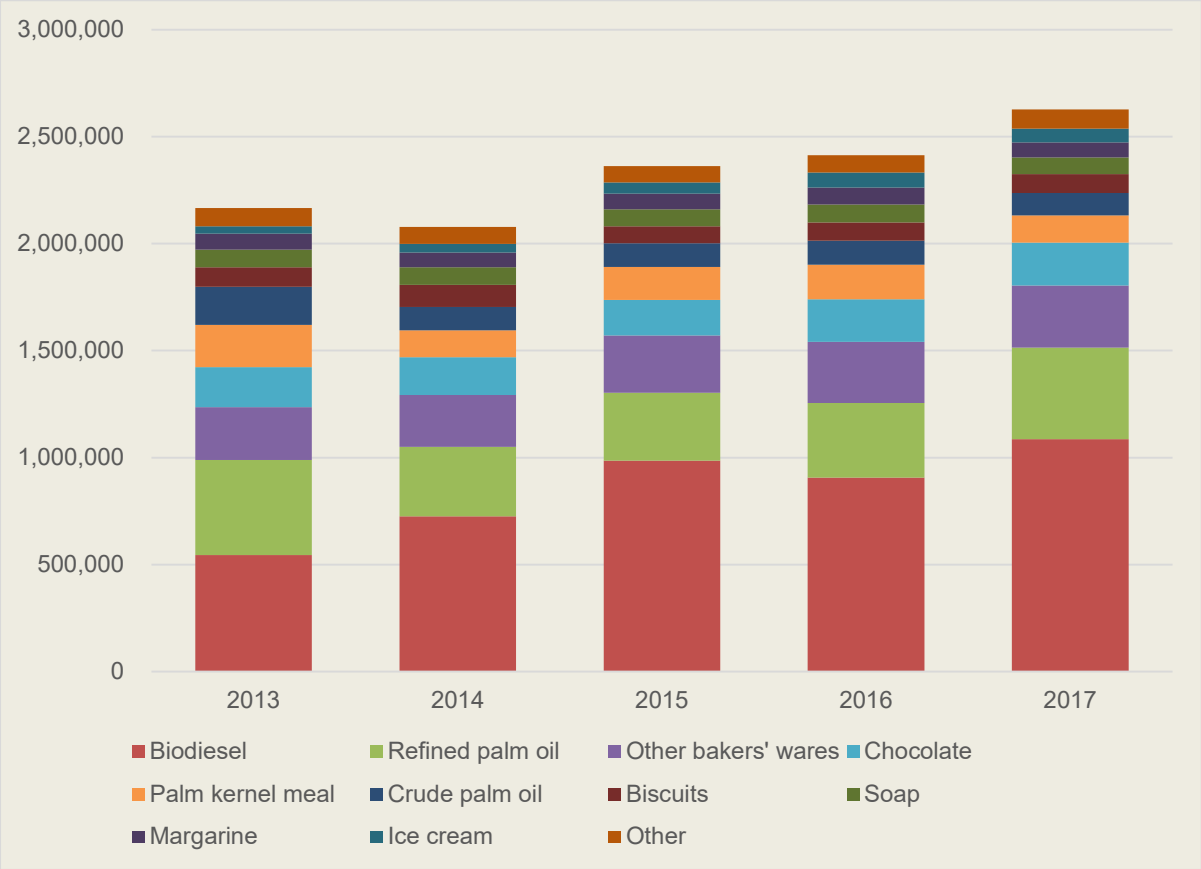
Figure 22: The value of Belgium's imports of palm oil and major products containing palm oil from 2013-17 (million €)



[135] Mark Barthel, Steve Jennings, Will Schreiber, Richard Sheane and Sam Royston, James Fry, Yu Leng Khor, and Julian McGill (February 2018). Study on the environmental impact of palm oil consumption and on existing sustainability standards. Final Report and Appendices. European Commission, DG Environment (Study contract No.: 07.0201/2016/743217/ETU/ENV.F3)
http://ec.europa.eu/environment/forests/pdf/palm_oil_study_kh0218208enn_new.pdf

Biodiesel remains the first-ranked import in terms of the quantity of imports, with an estimated 850,000 tonnes imported each year on average, having risen from 545,000 tonnes in 2013 to over 1 million tonnes in 2017 (Figure 23). Refined palm oil is the second largest import by quantity, with an average of 372,000 tonnes per year imported by Belgium.

Figure 23: Quantity of Belgium's imports of palm oil, products containing palm oil or embedded palm oil, 2013-17 (tonnes)



As Belgium's imports include oil palm fractions (palm oil, palm kernel oil and palm kernel meal), products that contain these raw materials as ingredients (e.g., soap, margarine), and palm oil embedded within the production process (e.g., biodiesel), imported quantities were converted to represent the quantity of oil palm fractions in the imports (see Appendix 5 for the conversion factors used in these calculations).

The amount of palm oil, palm kernel oil and palm kernel meal required to supply Belgium's imports averaged over one million tonnes per year between 2013-17 (Table 7, and see Appendix 5 for details of the HS codes used in these calculations). In line with the value of imports, the quantity of palm oil imported increased over the period, reaching 1.2 million tonnes in 2017. Part of this increase was due to greater imports of biofuel based on palm oil feedstock, which doubled over the period.

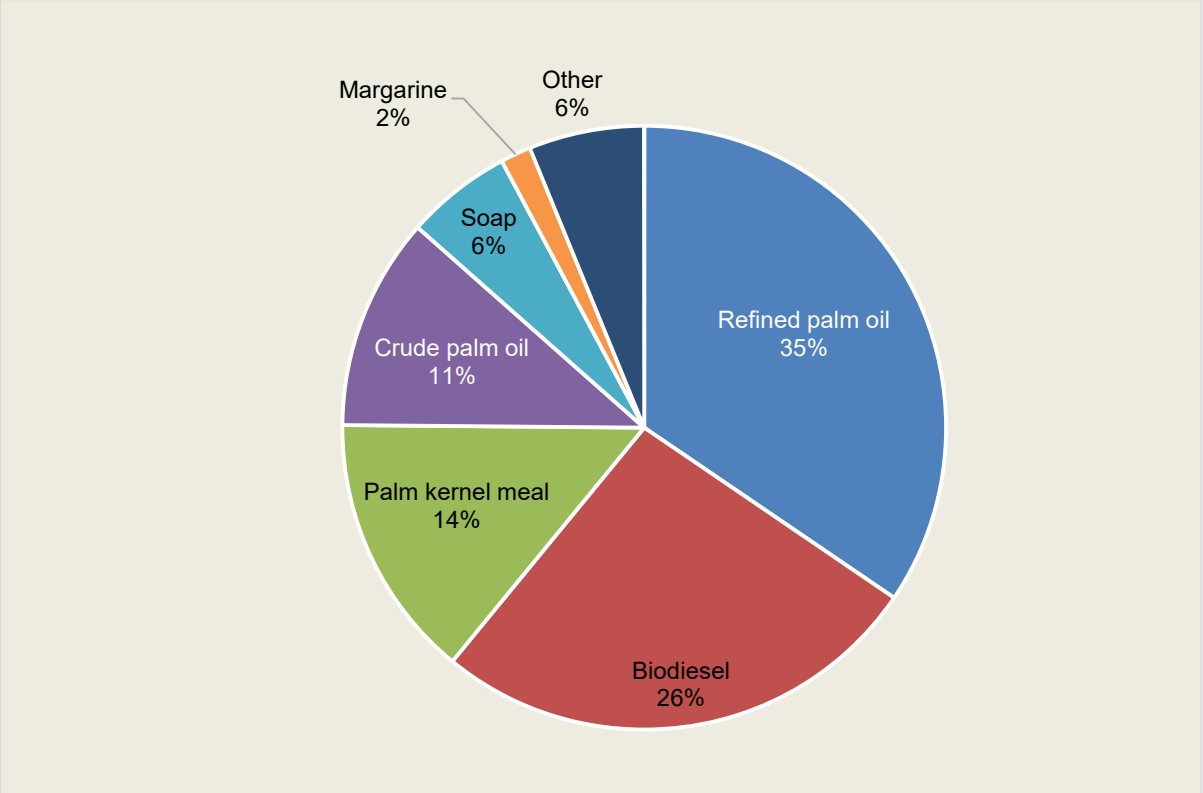
Corrected for palm oil content, refined palm oil was the main import by quantity (372,000 tonnes, 35% of the total) over the whole period, followed by biodiesel (285,000 tonnes, 26%), palm kernel meal (153,000 tonnes, 14%) and crude palm oil (123,000 tonnes, 11%, Figure 24).

Note that these figures do not represent end use, with for example, imported palm oil being refined within Belgium to produce biodiesel, serve as an ingredient in the domestic manufacturing of products (e.g., soap, margarine), or used in production processes (e.g.,

palm kernel meal used as animal feed). Note also that not all possible products containing palm oil are included. For example, palm oil is sometimes used in the manufacture of paints and solvents, however, many other oils and oil derivatives can be used for these purposes. Manufacturers are often unaware of the origin of the oleochemicals they use, and so it is difficult to assign a proportion of these products to palm oil.

Belgium's pattern of imports is different from some other EU countries, such as the Netherlands and the UK, which import a larger proportion of crude palm oil and palm kernel oil and refine it themselves, thus avoiding the higher tariffs on refined oils in consumer markets.[136]

Figure 24: Average quantity of Belgium's palm oil imports by major product categories 2013-17, converted to palm oil content.



5.5 Estimated consumption

Using the same HS codes and conversion factors (see Appendix 5 for details), we estimate that Belgium exports an average of 639,000 tonnes of palm oil each year, as raw material, an ingredient of exported products, or embedded in the production of products. Fifty-one percent of the palm oil contained within these exports was embedded in biodiesel, with a further 18% in soap. Belgium's estimated consumption of palm oil and its fractions was therefore on average 440,000 tonnes per year between 2013-17, equivalent to 41% of imports.

[136] WWF and RSPB (2017). Deforestation and Social Risks in the UK's Commodity Supply Chains. This report, and the summary report 'Risky Business', are available at https://www.wwf.org.uk/riskybusiness

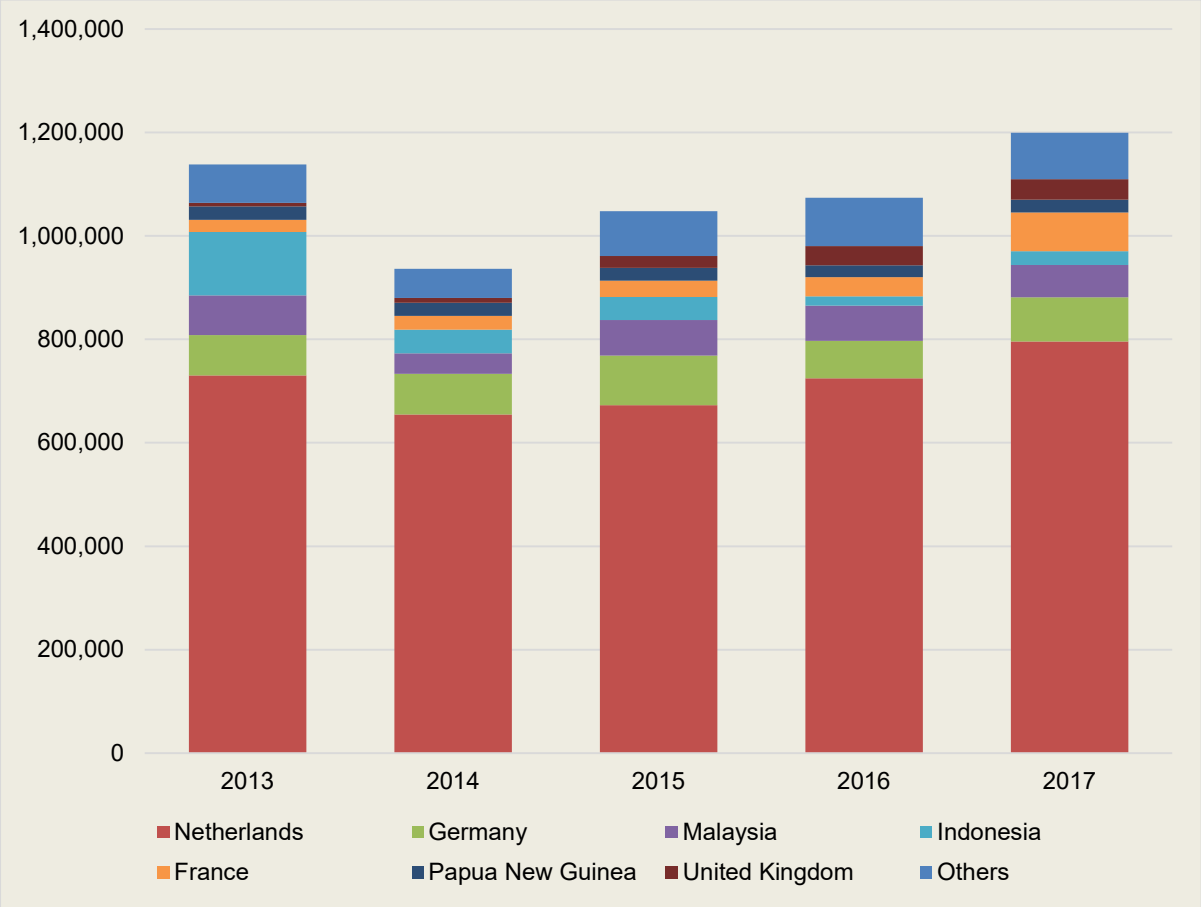
Table 7: Belgium's palm oil imports 2013-17 by quantity of palm oil, palm kernel oil and palm kernel meal (tonnes)

HS code	Product	2013	2014	2015	2016	2017	Average	%
151190	Refined palm oil	444,192	323,384	317,022	347,947	429,112	**372,331**	**35%**
382600	Biodiesel	174,982	234,912	327,904	300,797	387,549	**285,229**	**26%**
230660	Palm kernel meal	197,533	125,378	155,043	161,062	126,924	**153,188**	**14%**
151110	Crude palm oil	177,125	109,044	109,791	112,156	105,558	**122,735**	**11%**
3401	Soap	62,482	62,670	59,782	63,201	58,131	**61,253**	**6%**
1517	Margarine	17,741	16,429	17,623	18,962	16,949	**17,541**	**2%**
	Other	64,162	64,417	60,337	69,401	75,328	**66,729**	**6%**
	Totals	**1,138,216**	**936,233**	**1,047,502**	**1,073,526**	**1,199,552**	**1,079,006**	**100%**

5.6 Provenance of Belgium's palm oil imports

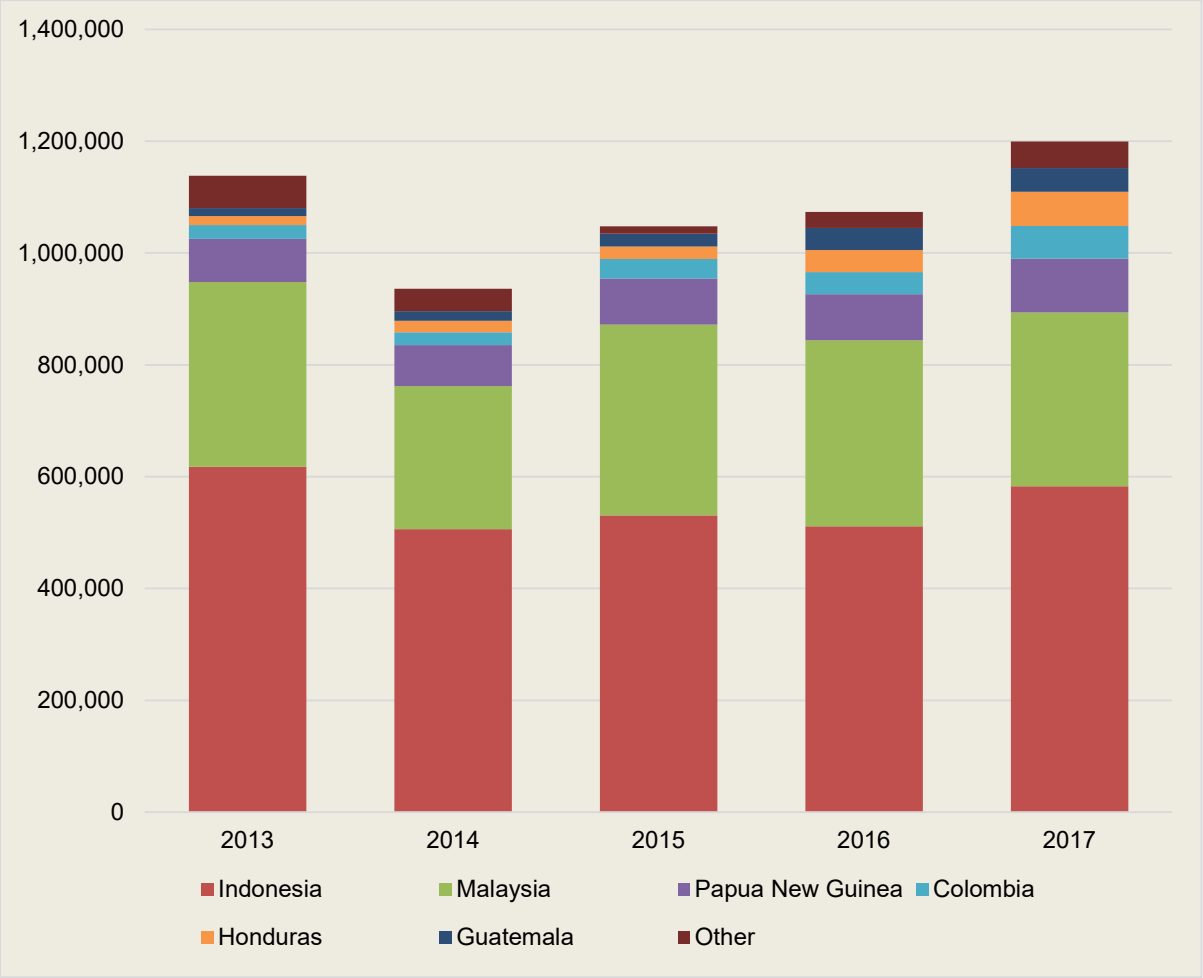
Between 2012 and 2016, Belgium imported palm oil, palm kernel oil and meal, and products containing them or embedded in the production process from a total of 132 territories. Major importers include producer countries, as well as EU countries, such as the Netherlands, that are major traders of palm oil and its fractions. The Netherlands alone accounts for 67% of Belgium's imported palm oil, with the EU as a whole providing 80% (Figure 25).

Figure 25: The quantity of Belgium's imports of palm oil as raw material, an ingredient or embedded within production processes from direct importers between 2013-17 (tonnes)



However, many of the countries from which Belgium imports products containing palm oil do not grow oil palm (e.g., the Netherlands). With provenance adjusted for to account for these indirect imports (see Section 2.2), Belgium's imports are dominated by Indonesia (an average of 550,000 tonnes per year, accounting for 51% of the total oil palm fractions imported) and Malaysia (314,000 tonnes, 29%, Figure 26). Papua New Guinea, with an average of 82,000 tonnes (8% of the total) is the third largest supplier. Central and South American growers make a small but rapidly increasing contribution.

Figure 26: The quantity of Belgium's imports of palm between 2013-17 adjusted for provenance of third-party trade and palm oil content of imports (tonnes)



5.7 Belgium's palm oil footprint

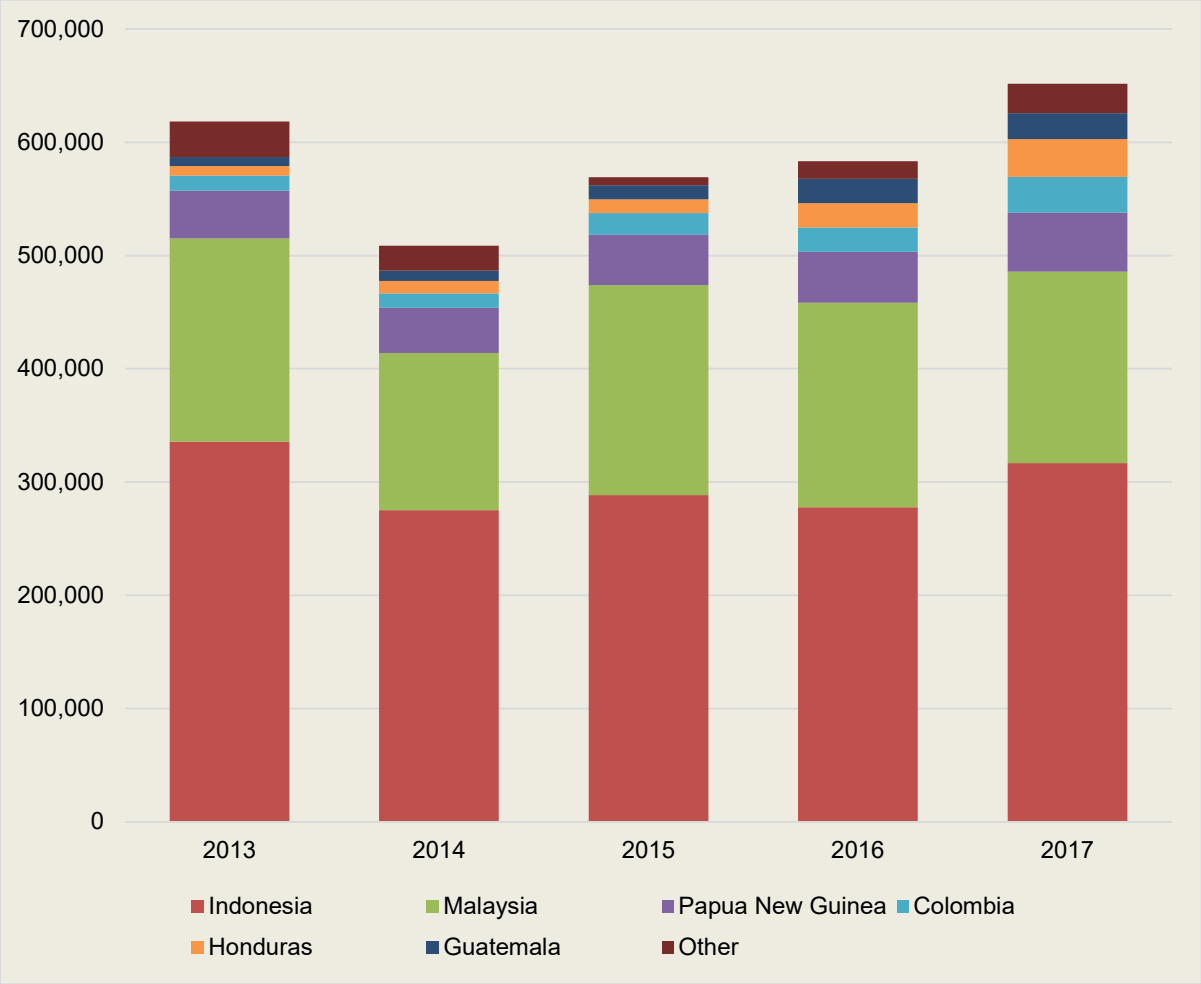
To estimate the land area required to supply Belgium's palm oil, palm kernel oil and meal, products containing them or embedded in their production were firstly assigned to palm fractions, i.e. crude palm oil, palm kernel oil and palm kernel meal. The imported fractions were allocated to yields that are specific to the fraction, which are as follows: palm oil: 3.7 tonnes per hectare, palm kernel oil: 0.5 tonnes per hectare, and palm kernel meal: 0.54 tonnes per hectare.[137]

The estimated land area required to satisfy Belgium's imports of oil palm fractions was 586,000 hectares per year between 2013-17 (Figure 27). This is equivalent to approximately 2.8% of the global harvested area of oil palm, or 19% of Belgium's own land area.

Indonesia also dominates the land footprint, with an average of 299,000 hectares each year (51% of the total), with Malaysia contributing the second largest area (171,000 hectares, 21%) and Papua New Guinea ranking third with 45,000 hectares (8%).

[137] Various sources, including RSPO

Figure 27: The estimated land footprint of Belgium's imports of palm oil between 2013-2017 (hectares)



5.8 Belgium's palm oil risk profile

Belgium imports most of its palm oil (89%) from high and very high risk countries, principally Indonesia and Malaysia (Figure 28). Both countries have significant deforestation, labour and corruption issues (Table 15). A smaller part of the footprint also comes from other high risk countries such as Honduras, Guatemala and Colombia: countries in which corruption, labour rights and natural forest loss are all high risk. Amongst producers supplying at least 2%, only Papua New Guinea is ranked as medium risk. Those countries that supply less than 2% (represented in Figure 27 as 'other') is likely to include a mix of medium and high risk countries.

The two major certification schemes within the sector, the RSPO (favoured by consumer goods companies) and the ISCC (favoured by the biofuel sector) have significant market penetration in many European countries, and are used by many companies to reduce the risk of deforestation and exploitation within their supply chains. The level of certification within the Belgium market is not known. In addition, conversion of High Conservation Value Forest and labour abuses have been reported from RSPO plantations, and so whilst certification remains the best way of managing deforestation risk, some organisations are also exploring complementary approaches, such as jurisdictional (landscape) scale initiatives.

Figure 28: Belgium's palm oil footprint by risk category

6 Soy

6.1 Production, uses and sustainability of soy

6.1.1 Production

Soy (or soybean, or soya), *Glycine max*, is a leguminous species native to East Asia, grown for its edible bean. Cultivation is successful in climates with hot summers, with prime growing conditions in mean temperatures of 20-30°C. It can grow in a wide range of soils, but optimum growth occurs in moist alluvial soils with a good organic content. Soy, like most legumes, fixes nitrogen via a symbiotic relationship with bacteria. It is grown widely in Asia, North, Central and South America.

Soy production has increased eightfold since the 1960's and has doubled since 2000. This growth in production has been dominated by three countries: the USA, Brazil, and Argentina, which together account for over 80% of global production. The rate of growth has been particularly rapid in South America, with more than half of Argentina's agricultural area now used for the cultivation of soy.[138]

Global soybean production is projected to increase by around 23% over the next decade, growing on average at 2.5% per year, compared to 5% during the past decade. Behind the slowdown in the growth rate are a marked decrease in the yearly expansion of area planted to soy in Argentina and Brazil, and a stagnation of planted area in the USA.[139] Still, growth in production is likely to continue primarily through the expansion of cultivated area, since soy has relatively limited potential for yield increases.[140] The majority of this expansion is projected to come from South America.[141] Developing countries are likely to account for the majority of additional soy meal consumption due to increased livestock production, driven by the trend of more meat-rich diets.

6.1.2 End uses

Soybeans contain 38% protein (double that of pork, and treble that of eggs), a wide range of essential amino acids, a high proportion of unsaturated fat, and they produce more protein per hectare than any other major crop. This high protein content has resulted in soy being a major animal feed ingredient.

The main uses of soy are:

- **Soy oil**: Soybeans contain approximately 18% oil, which is refined and used as vegetable oil for cooking, in a wide variety of processed foods, and also in the production of biofuels.[142]
- **Soy meal**: This is the material remaining from oil extraction, which can contain up to 49% protein.[143] The meal is 'toasted' (steam treated) and ground and then is almost entirely used in livestock feed.

[138] García-Lopez, G.A. and Arizpe, N. (2010), 'Participatory processes in the soy conflicts in Paraguay and Argentina', Ecological Economics, 70(2), 196-206.
[139] http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1215457178567/Soybean_Profile.pdf
[140] https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2016-01-28-agricultural-commodities-brack-glover-wellesley.pdf
[141] http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1215457178567/Soybean_Profile.pdf
[142] U.S. Soybean Export Council conversion table, see: https://ussec.org/resources/conversion-table
[143] Cromwell, G. L., 2012. Soybean meal - An exceptional protein source. Soybean Meal InfoCenter, Ankeny, IA

- **Direct human consumption**: Soy is used directly in a range of food – especially in China, Japan and Indonesia – including soy sauce, tempeh, tofu, soy flour, soy milk, textured vegetable protein, and edamame.

Close to 85% of the global soybean crop is crushed for oil and meal, with approximately 70% of the total used to feed livestock.[144] In the EU this figure rises to around 90%. Soy meal accounts for over 60% of the world's production of vegetable and animal meal and occupies a prominent position among protein feedstuffs used for the production of feed concentrates.

Soybean oil is the second most important vegetable oil (after palm oil), accounting for 25% of global vegetable/animal oils and fats consumption.[145] Soy oil is used in food products, cosmetics, detergents, industrial products, and increasingly it is being used to produce biodiesel (especially in the USA). A valuable by-product from the crushing process is soy lecithin. It is an effective emulsifying agent in food products such as chocolate, biscuits, peanut butter and coffee creamer, and also in cosmetics, textiles, paints, coatings and waxes.[146]

Only about 6% of the global production is directly used in food products, and this predominantly in Asia, with another small share of beans used in animal feed prior to extracting the oil ('full-fat soybeans').[147]

Belgium is listed as having two vegetable oil-based biodiesel refineries and two vegetable oil-based oleochemistry refineries,[148] suggesting that the country is able to produce a certain amount of biodiesel and refined vegetable oil products from imported soy products.

6.1.3 Environmental and social issues associated with soy production

The expansion of soy production in South America has been strongly associated with deforestation and other natural habitat destruction.[149] One recent study estimated that soy production accounted for 0.6 million hectares of land use change per year between 2000-11 in Brazil, Argentina, Paraguay and Bolivia. The same study estimated that 0.4 million hectares per year of this land use change was embedded in global trade.[150] Seventy per cent of the Saladillo wetlands in Cordoba, Argentina have been lost as a result of the construction of canals for soy cultivation.[151] Soy can also act as an indirect driver of deforestation, displacing cattle ranching towards the forest frontier.[152]

Soybeans and derived products were estimated to be responsible for 4.4 million hectares of the 9 million hectares of deforestation embodied in crop and livestock products imported into

[144] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[145] http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1215457178567/Soybean_Profile.pdf
[146] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf Note that there is no separate HS code for lecithin, but its imports are included within higher level codes for soy oil.
[147] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[148] Bio-refineries in Europe 2017. Nova Institute and Bio-based Industries Consortium. Last accessed December 2018 at https://biconsortium.eu/sites/biconsortium.eu/files/downloads/MappingBiorefineriesAppendix_171219.pdf
[149] Nepstad, D.C, et al. (2006), 'Globalisation of the Amazon Soy and Beef Industries: Opportunities for Conservation', Conservation Biology 20: 6
[150] Henders, S., Persson, U.M. & Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. Environ. Res. Lett. 10.
[151] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[152] Barona, E., et al. (2010) 'The Role of Pasture and Soybean in Deforestation of the Brazilian Amazon', Environmental Research Letters, 5 (2).

the EU between 1990 and 2008.[153] This estimate however does not include the role of soy as an indirect driver of deforestation via its impact on land prices.[154]

The expansion of soy cultivation has led to land rights issues with local communities and indigenous groups, sometimes escalating into violent conflict. Soybean expansion has been associated with poor labour conditions and violations of human rights in Brazil[155] and Paraguay.[156] The fertilisers and pesticides used in soy cultivation can pose health risks to people living near soy farms.[157]

6.1.4 Certification

Certification schemes have proliferated within the soy sector in recent years.

Perhaps the most prominent scheme is the Roundtable on Responsible Soy (RTRS). RTRS members include producers, industry, trade & finance, and civil society organisations. The scheme includes a standard with independent third-party verification, and chain of custody arrangements that include segregation, mass balance or a credit system. The RTRS standard excludes deforestation of High Conservation Value Forest[158] after 2009, and has social requirements that are at and above national legal minimum requirements for issues such as land rights and workers' terms and conditions.[159] A revised version of the standard effectively precludes the conversion of any natural vegetation from June 2016 onwards. A new module related to non-GM production was approved in 2018.

The first RTRS-certified soy came on the market in June 2011. Over 10,000 producers in Argentina, Brazil, Canada, China, India and Paraguay produced around 2.3 million tonnes of RTRS certified soy in 2015[160], which is approximately 0.7% of global production. Despite this modest volume, the amount of RTRS certified soy is increasing rapidly: in 2011 the amount of RTRS certified soy was around 400,000 tonnes.[161] Most of the companies buying credits are based in the EU.

A second certification scheme, the ProTerra Certification Program, was created in 2006 within Cert ID (part of Global ID Group), a global certification body that provides accredited certification programs to the food and agricultural industry. It was transferred in full to the ProTerra Foundation in 2012. The standard includes sustainability criteria and excludes genetically modified (GMO) soy. Certification of producers, handling, transport and storage, and processing and manufacturing is possible, involving independent third party verification. About 95% of the volume of certified ProTerra soy is from Brazil. The volume of Proterra certified soy has dropped from 4.5 million tonnes in 2007 to 2.8 million tonnes in 2014.[162]

---

[153] EU (2013). Comprehensive analysis of the impact of EU consumption of imported food and non-food commodities and manufactured goods on deforestation. http://ec.europa.eu/environment/forests/pdf/1.%20Report%20analysis%20of%20impact.pdf

[154] Richards, P.D., Walker, R.T., Arima, E.Y. (2014). Spatially complex land change: The Indirect effect of Brazil's agricultural sector on land use in Amazonia. Global Environmental Change 29: 1–9.

[155] *https://milieudefensie.nl/publicaties/factsheets/factsheet-2-dutch-soy-coalition-modern-slavery-in-brazil*

[156] Hobbs, J. 2012. Paraguay's destructive soy boom. The New York Times July 2 2012. http://www.nytimes.com/2012/07/03/opinion/paraguays-destructive-soy-boom.html

[157] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf

[158] High Conservation Value Forests are those that contain one or more outstanding biological, ecosystem, social or cultural value. First defined in the Forest Stewardship Council standard for sustainable forest management, the definition is now used in sustainability initiatives in many sectors.

[159] Jason Potts, Mathew Lynch, Ann Wilkings, Gabriel Huppé, Maxine Cunningham, Vivek Voora (2014). State of Sustainability Initiatives Review. IISD & IIED.

[160] http://www.responsiblesoy.org/mercado/volumenes-y-productores-certificados/?lang=en

[161] WWF (2016). Soy Scorecard: Assessing the use of responsible soy for animal feed. http://d2ouvy59p0dg6k.cloudfront.net/downloads/wwf_soy_scorecard_2016_r6.pdf

[162] http://www.proterrafoundation.org/index.php/certified-volumes Last accessed 06 June 2016.

In addition to these soy-specific multi-stakeholder standards, there are a numerous proprietary standards which include third party verification (e.g., ADM's Responsible Soy Standard, Cargill's 'Triple S' standard, the Certified Responsible Soya (CRS) standard owned by Cefetra), the FEFAC guidelines (which benchmarks standards), and the FEMAS standard (which is in essence a food quality benchmark with an add-on responsible soy module).

Proprietary standards typically focus on legal compliance, good agricultural practice, and legal treatment of workers. Their provisions regarding deforestation and social issues are typically weaker than those of RTRS and ProTerra. For example, FEFAC compliant standards need only exclude illegal deforestation, thus allowing legal deforestation, and the ADM and Triple S standards do not demand that workers have freedom of association and collective bargaining. Proprietary standards also tend to be significantly less transparent than RTRS and ProTerra, with no publicly available copies of audit reports, and in some cases the standard not being readily available (e.g., CRS).

Non soy-specific standards, including organic standards, are also used in the sector. The International Sustainability and Carbon Certification (ISCC) was created in 2010 and has developed a standard that is consistent with the requirements of the EU Renewable Energy Directive (Directive 2009/28/EC) for biofuel feedstock.

Certification of non-GM soy requires compliance with non-GM criteria, but no other environmental or social standards. Non-GM soy is often used for soy used for direct human consumption, as EU-labelling rules state that the presence of GM-ingredients in food products above a threshold of 0.9% has to be disclosed.

In Belgium, the animal feed industry (BFA) has introduced its own standard. According to the organization, the approximately 160 members account for 98 per cent of Belgian compound feed production.[163] BFA has developed its own step-wise standard ('maatschappelijk verantwoord', MV), which applies to full-fat soybeans and soybean meal. The principles, criteria and indicators are a based on the RTRS standard but include only a subset of the RTRS requirements.[164] BFA also recognises the Cefetra CRS standard and the Amaggo Protocol for Responsible Production of Soybeans as being equivalent to its own standard.[165] It appears that the verification system is based largely on internal audits, with external auditors checking the documents produced by internal processes.[166]

BFA has promoted sourcing soy compliant with both of its own MV standard and the purchase of RTRS credits.[167] By 2014/15 the quantity of MV certified soy on the Belgian market was sufficient to cover the soybean meal required for Belgian feed production for livestock destined for domestic consumption. Based on surveys of a sample of major companies, an estimated 46% of the soy available on the Belgian market was certified in 2014/15.[168] The majority of the certified soy (78%) was certified to the MV soy criteria; 17% was RTRS-certified; 3% per cent ProTerra certified; with non-GM and organic contributing a further 1%.

[163] Bemefa (2015, September), MV-soja, pp.4, 6
[164] Bemefa (2013, July), De Productie en Levering van Mengvoeders op Basis van Verbruik van Gecertificeerde Maatschappelijk Verantwoorde Soja – Lastenboek.
[165] Bemefa (2014), Certificaten mv soya - Certificaten 2013-2014 (aankoopjaar 2015)
[166] BFA (2018). Soja SoRes. Fiche documentaire - Q&R. Available at: https://bfa.be/BFA_MVDS
[167] Bemefa (2015, September), MV-soja, p.8
[168] Hassel Kroes & Barbara Kuepper (2016). Soy use in Belgium. A research paper prepared for WWF-Belgium. Profundo, Amsterdam, the Netherlands

6.1.5 The EU and Belgium's responses to environmental and social issues with soy

Many of the same instruments described for palm oil (see Section 5.2.2) also apply to soy. These include EU and international policies, such as the EU Renewable Energy Directive, the UNFCCC Paris Agreement, and voluntary initiatives such as the Consumer Goods Forum.

Internationally, one of the most significant initiatives to reduce deforestation associated with soy production is the Amazon Soy Moratorium. The Moratorium began in 2006 as a voluntary agreement designed to ensure that traders do not buy soy grown in the Amazon on land deforested after 2006. The commitment was renewed in 2008 with the participation of the Brazilian government, and since then has been renewed annually. In May of 2016, the agreement was renewed indefinitely '*until it is no longer necessary*'. The Moratorium is considered to have been successful in halting deforestation in the Brazilian Amazon: before the moratorium, 30% of soy expansion occurred through deforestation, compared with just one per cent after the Moratorium came into effect.[169] However, habitat destruction remains unmanaged in other soy sourcing areas such as in the *Cerrado*, and indeed conversion of *Cerrado* may have been exacerbated by the Moratorium. The recent change in administration in Brazil casts significant doubt over ongoing support for the Moratorium.

In 2017, a grouping of NGOs, including WWF, published the Cerrado Manifesto. The manifesto was a call to halt conversion of *Cerrado* vegetation in Brazil, the main causes of which are expanding agribusiness, and particularly soy cultivation. Over 60 companies recently signed a Statement of Support for the Cerrado Manifesto, committing them to work with local and international stakeholders to halt deforestation and native vegetation loss in the Cerrado, including support for implementation of Brazil's Forest Code.

Within Belgium, the Flanders government published an action plan on alternative protein sources in 2010,[170] subsequently revised.[171] The action plan combines two basic drives: to reduce the dependency on imported protein and increase the sustainability of protein. To these ends, it proposes the goals of developing and promoting international standards for social responsibility, maximising the potential of existing alternative protein sources, and reducing dependence on protein sourced from outside the EU. The revised plan notes the efforts made by the compound feed industry to replace soy meal with protein from by-products such as rapeseed scrap, dried distillers grains with solubles (DDGS), amongst others.

In Wallonia, technical research into alternatives to soy for various livestock types has been conducted, with the aim of increasing food self-sufficiency. The report suggests alternative feeds but does not comprehensively analyse the economic or other barriers to adoption of alternatives to soy.[172]

---

[169] Gibbs, H. K., L. Rausch, J. Munger, I. Schelly, D. C. Morton, P. Noojipady, B. Soares-Filho, P. Barreto, L. Micol, and N. F. Walker. 2015. 'Brazil's Soy Moratorium: Supply chain governance is needed to avoid deforestation.' Science 347(6220): 377-378

[170] Actieplan Alternatieve Eiwitbronnen (AAE). Available at: https://www.ilvo.vlaanderen.be/Portals/85/documents/actieplan-alternatieve-eiwitbronnen.pdf

[171] Tweede actieplan alternatieve eiwitbronnen (AAE2) 2016 – 2020. Flanders.Be/Land Construction Department, Agriculture & Fisheries. Available at https://lv.vlaanderen.be/sites/default/files/tweede-actieplan-alternatieve-eiwitbronnen.pdf

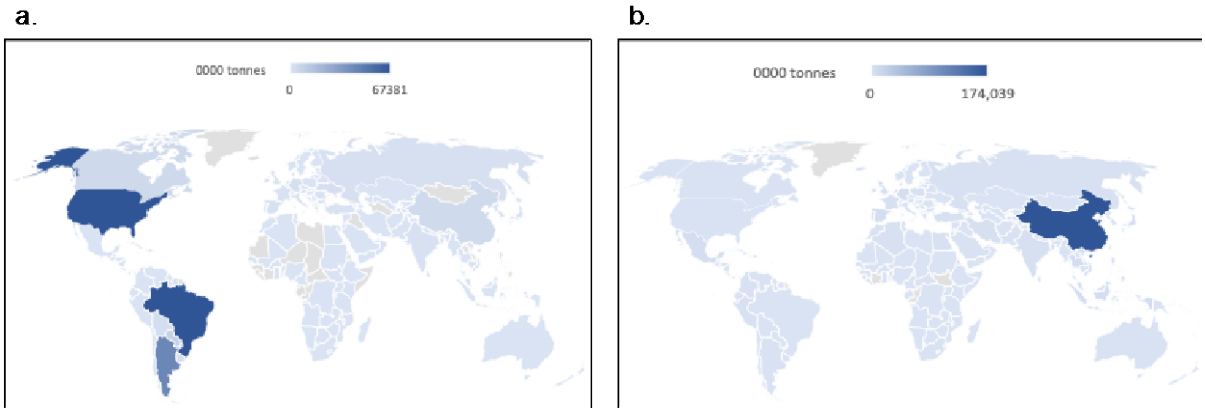
[172] Jacques Faux (2016). Essais sur l'autonomie alimentaire en élevage limousine et en engraissement de volailles fermières. Centre de Référence et d'Expérimentation de la Région Wallonne Contrat n° 7051. Rapport Final. Available at https://agriculture.wallonie.be/documents/20182/21906/Exploitation+mixte+90-95.pdf/77953736-1d4f-43b0-98d1-0f5904d0de3c

6.2 Trade of soy

6.2.1 Global trade

Soy is the most successful oilseed on world markets, with an estimated 60% share of global oilseed production. About two-thirds of the global soybean harvest is traded internationally,[173] which amounted to 217 million tonnes of soybean, soy meal and oil in 2016. Brazil, the USA and Argentina dominate international exports, with their exports an order of magnitude greater than other exporting countries such as Paraguay, India and Bolivia (Figure 29 a.). The soy products exported differ between countries: the United States, Brazil and Paraguay export comparatively more beans, while Argentina and India perform most of the crushing of beans domestically, and thus export comparatively more meal and oil.

Figure 29: Global trade in soybeans, soy meal and soy oil (million tonnes): a. exports, and b. imports[174]



China dominates global imports of soy beans, oil and meal, with the EU also importing significant quantities (Figure 29 b.). China's imports have increased sevenfold between 2000 and 2014, much of this demand being for animal feed in the pig and poultry industries. Demand has been primarily driven by a general deficit in protein crop production and by expanding livestock production, together with China's biofuel policy. The EU imported approximately 43 million tonnes of soy beans, oil and meal in 2016, equivalent to 11% of global imports in that year.

World prices of soy have fallen by about half since 2011, due to the end of the commodities price boom of the 2000's together with several years of strong harvests.[175] Compared with trade in other agricultural commodities, trade in whole oilseeds (particularly soybeans) is relatively unrestricted by tariffs. Oilseed meals, and particularly vegetable oils, typically have higher tariffs.[176]

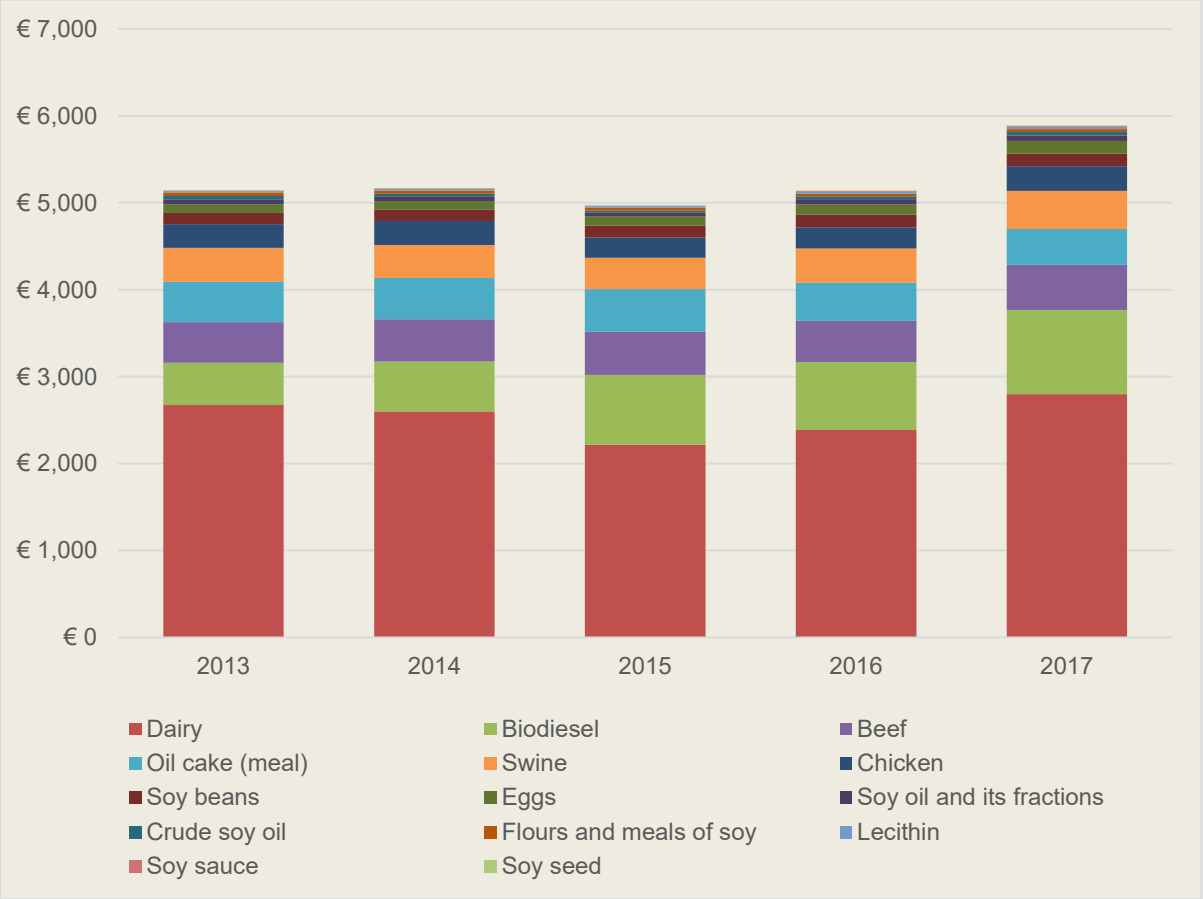
6.3 Belgium's imports of soy

Belgium imported an average of € 5.3 billion of soy beans, meal or oil, products containing soy (e.g., soy sauce) or embedded in production process (e.g., pig meat, poultry) each year between 2013-17. There was a sharp increase in the value of these imports in 2017, up to € 5.9 billion from € 5.1 billion in 2016 (Figure 30). There are significant contributions to the value of imports from raw materials, especially soil oil cake (meal), the import of which averages € 455 million each year; and soy embedded as feed used to produce dairy

[173] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[174] Source: FAOSTAT
[175] http://www.reuters.com/article/research-and-markets-idUSnBw295291a+100+BSW20150529
[176] http://www.ers.usda.gov/topics/crops/soybeans-oil-crops/trade.aspx

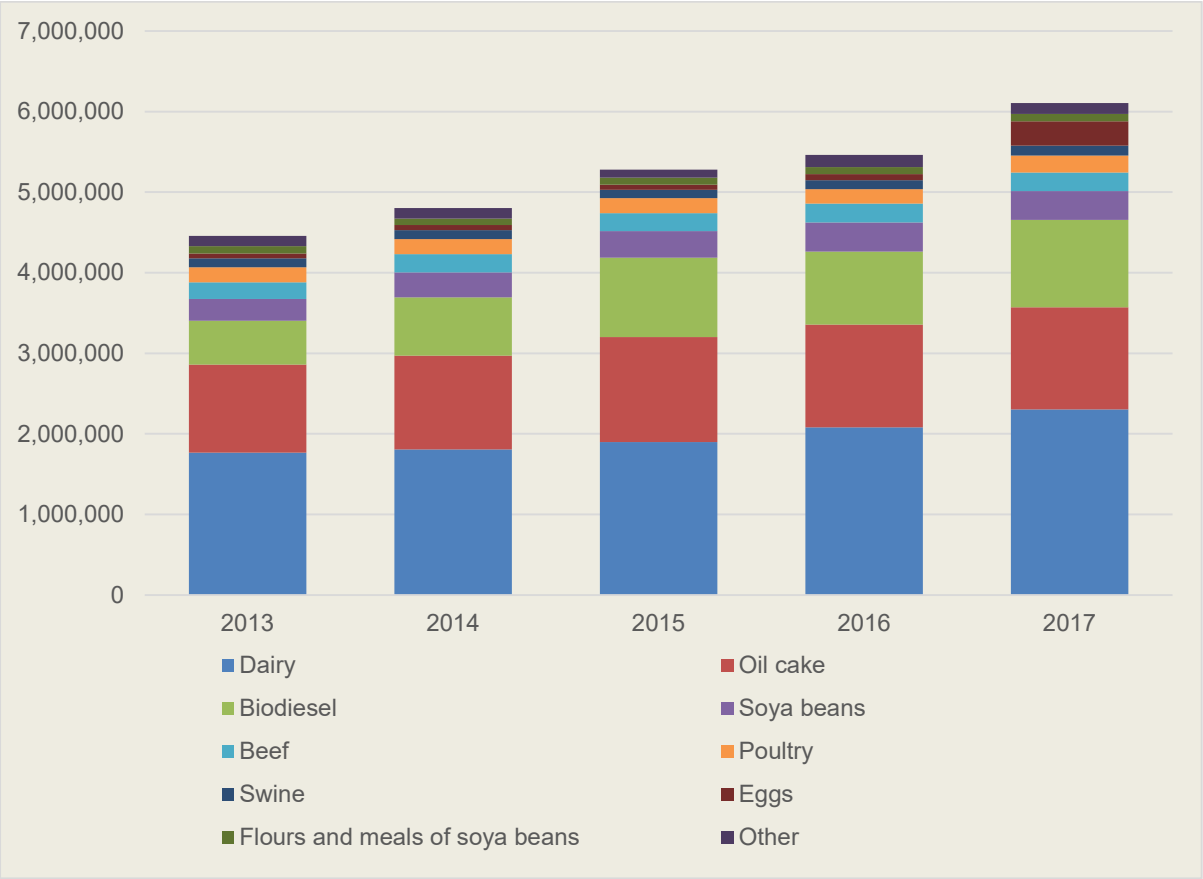
products, and chicken (see Appendix 6 for the HS codes used). Biofuel is the second largest import by value, imports of which have almost doubled by value over the period. Note that this figure includes biofuels made from all feedstock, the soy component of which is estimated later.

Figure 30: The value of Belgium's imports of soy and major products containing soy from 2013-17 (million €)



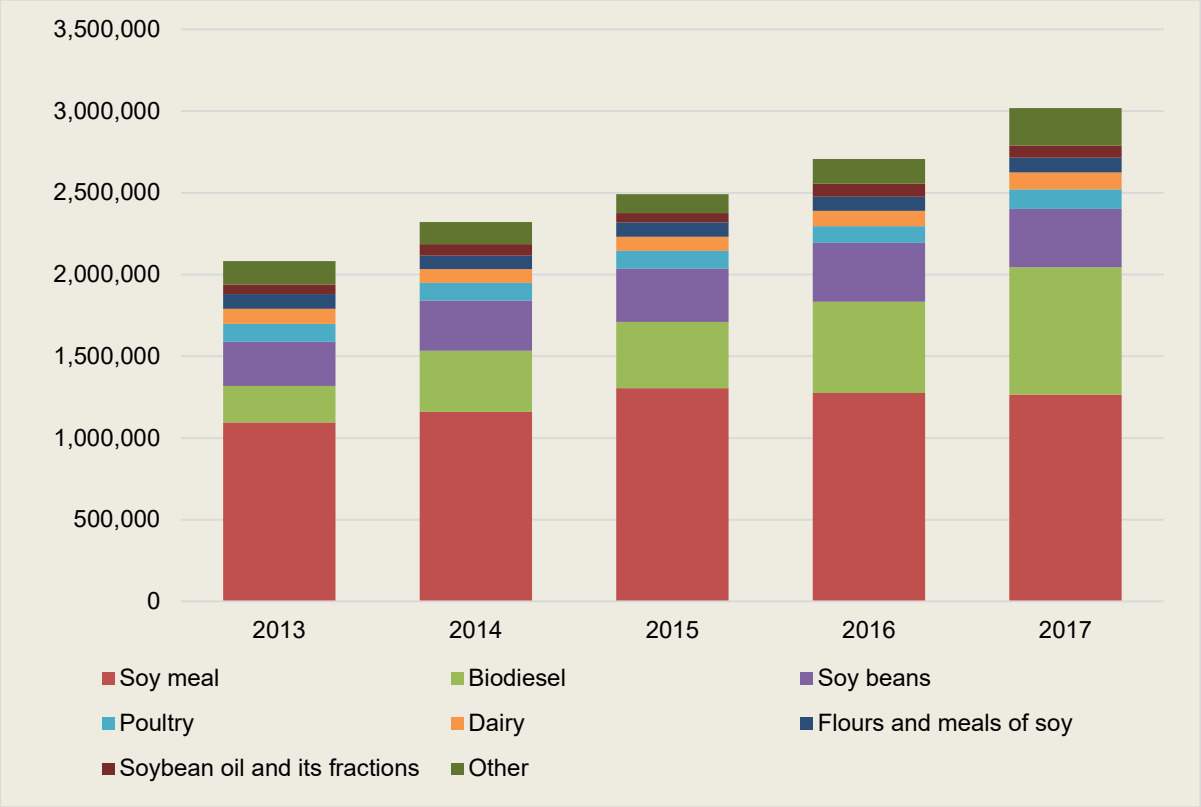
The volume of imports of soy, products containing soy as an ingredient or in which soy has been embedded in the production have risen each year between 2013-17 (Figure 31). Dairy, oil cake (meal) and biodiesel are the three largest product groups by weight, of which imports of dairy products and biodiesel in particular have increased significantly over the period.

Figure 31: Quantity of Belgium's imports of soy, products containing soy as an ingredient or in which soy has been embedded in the production 2013-17 (tonnes)



When adjusted for the soy content of imported products (see Appendix 6 for the conversion factors used), an average of 2.5 million tonnes of soy were imported each year between 2013-17 (Table 8, and Figure 32), as soybeans, soy oil, soy meal, as an ingredient or embedded within imported products. This is equivalent to 0.5% of global production.
The quantity of soy imported has risen from 2 million tonnes in 2013 to over 3 million tonnes in 2017. This rise has been driven by increased imports in almost all product categories, especially in soy meal (a 16% increase), soy oil embedded in biodiesel (248% increase), and soy beans (31% increase). Note that soy meal is commonly used as feed in aquaculture, but this use has not been included within this study as we were unable to find a reliable estimate for imports of fish produced in aquaculture systems.

Figure 32: The quantity of soy meal, oil and beans in Belgium's imports of 2013-17 (tonnes)



Over the period soy meal ('oil cake') is by far the main import, averaging 1.2 million tonnes per year and accounting for nearly half the quantity of soy in all imports (Figure 33). This reflects the dominance of soy in livestock feed. Biodiesel derived from soy oil feedstock (467,000 tonnes, 19%) and soy beans (324,000 tonnes, 13%, much of which will also be used to produce livestock feed) are also making major contributions.

Figure 33: Average quantity of Belgium's soy imports between 2013-17, converted to soy content.

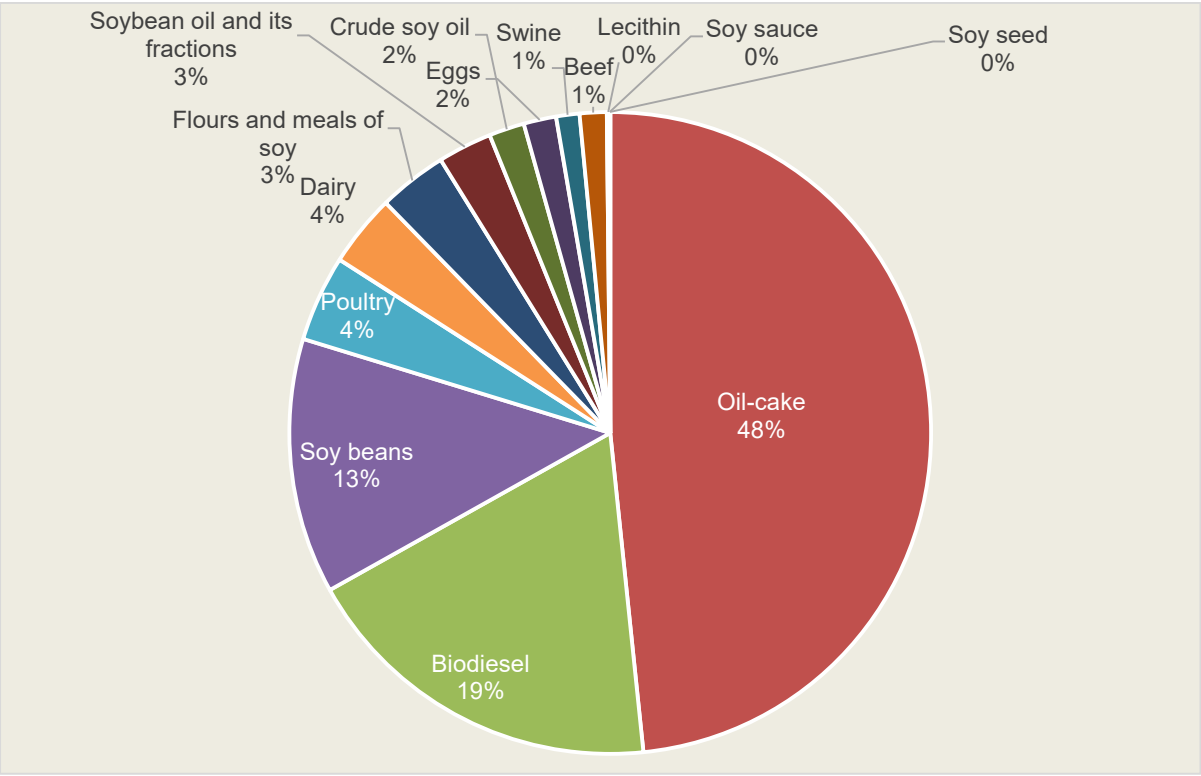


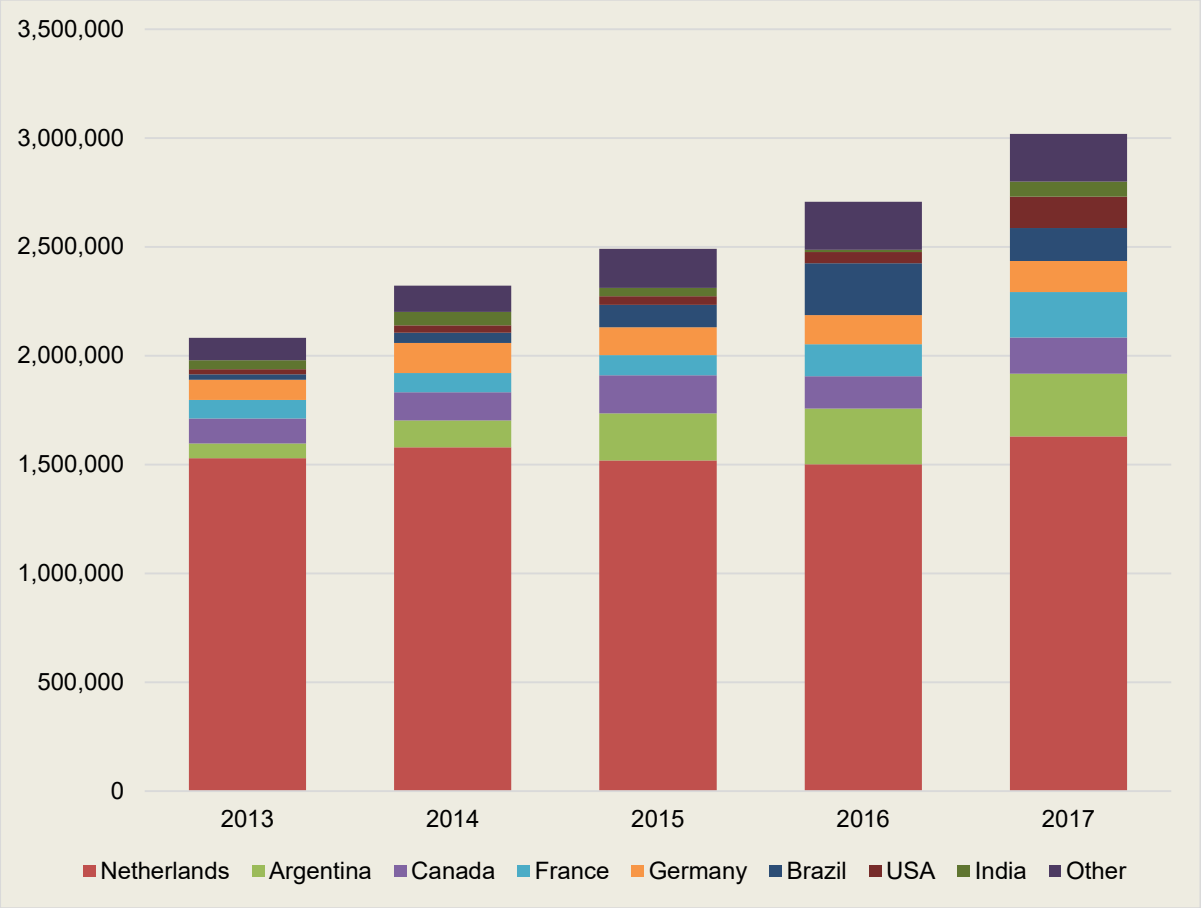
Table 8: Belgium's soy imports 2013-17 by quantity of soy meal, oil and beans (tonnes)

HS code	Product	2013	2014	2015	2016	2017	Average	%
230400	Soy meal	1,094,473	1,160,455	1,305,405	1,275,140	1,265,758	**1,220,246**	**48%**
382600	Biodiesel	223,720	372,508	404,609	558,004	779,429	**467,654**	**19%**
120190	Soy beans	270,624	308,020	327,913	359,729	355,393	**324,336**	**13%**
(Various)	Poultry	108,813	107,923	106,910	103,145	120,848	**109,528**	**4%**
(Various)	Dairy	91,708	84,029	85,464	93,786	102,969	**91,591**	**4%**
120810	Flours and meals of soy beans	90,833	81,708	87,822	85,788	90,571	**87,345**	**3%**
150790	Soybean oil and its fractions	59,104	72,061	57,376	79,857	75,004	**68,680**	**3%**
	Other	142,817	134,573	115,576	150,632	228,572	**154,434**	**6%**
	Total	**2,082,092**	**2,321,277**	**2,491,076**	**2,706,080**	**3,018,544**	**2,523,814**	

6.4 Provenance of Belgium's imports of soy

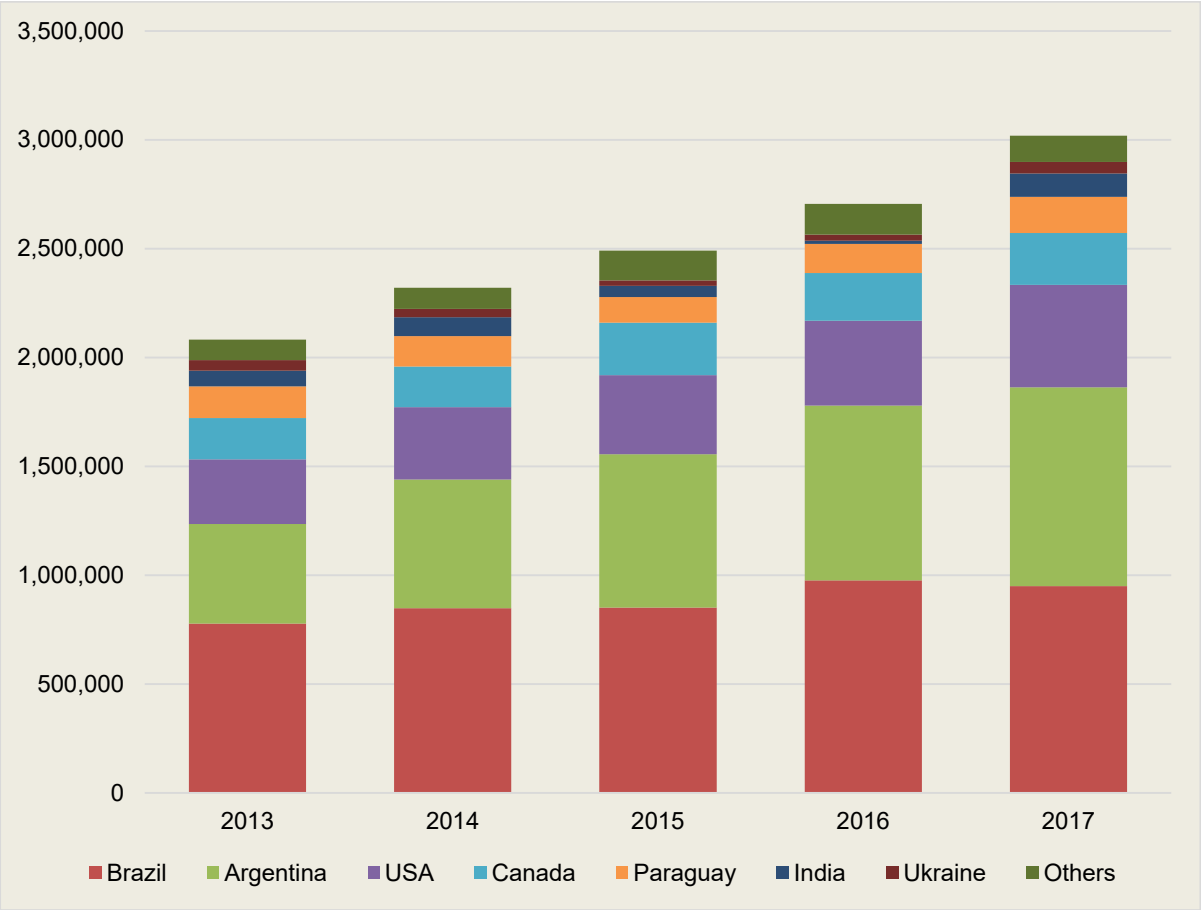
Between 2013 and 2017, Belgium imported soybeans, soy oil and meal, products containing them or with soy embedded in the production process from a total of 54 territories. Countries importing to Belgium include major producer countries (e.g., Argentina, Brazil, USA) as well as European trading countries (e.g., the Netherlands, France, Germany, Figure 34). The Netherlands alone accounts for 61% of the quantity of soy imported, and EU countries combined contribute 77% of soy imports.

Figure 34: Quantity of soy imported by Belgium from direct trading partners, 2013-17 (tonnes)



EU countries are not major producers of soy, and when the figures are adjusted for the origin of EU imports (see Section 2.2), the provenance of Belgium's soy imports is dominated by the world's three largest producers, Brazil (an average of 881,000 tonnes per year, 39% of the total), Argentina (694,000, 27%) and the USA (370,000, 15%, Figure 35). There has been a marked increase in soy imported from the USA (199,000 tonnes in 2012 to 650,000 tonnes in 2016) over the period. The increased imports of soy reported in Table 8 come largely from Argentina (100% increase over the period), the USA (59% increase) and Brazil (22% increase), with imports from India also increasing by 48%.

Figure 35: The quantity of Belgium's imports of soy between 2013-17 from major exporting countries (tonnes), adjusted for soy content and provenance



6.5 Belgium's soy footprint

To estimate the land area required to supply Belgium's soybeans, soy oil, soy meal, and products containing them or that have them embedded in the production process were firstly assigned to soy fractions, i.e., beans, oil and meal. For example, the quantity of soy embedded in poultry products is assigned to soy meal, whereas the quantity of soy used as a biodiesel feedstock is assigned to soy oil.

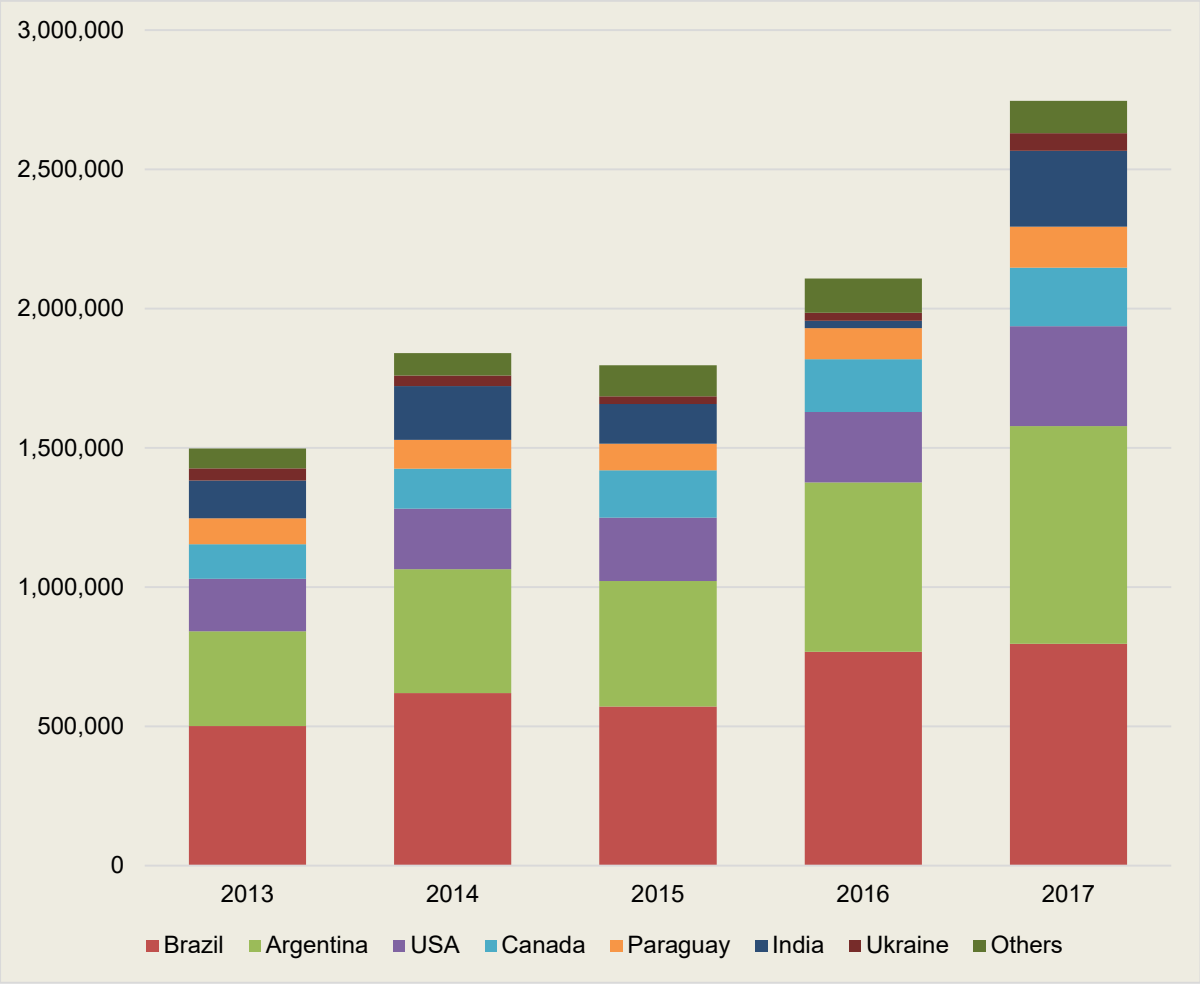
The imported fractions were then allocated to yields in the proportion in which they are produced from whole soy beans (i.e., the yield of oil and meal from a given quantity of soy beans): soybean quantity / yield; soy meal quantity / (0.82 * yield); and soy oil quantity / (0.18 * yield).[177] The yield data used to convert the quantity of soy to the land area required to produce it were country and year specific.[178]

The estimated land area required to satisfy Belgium's imports of soy was fractionally under 2 million hectares per year between 2013-17 (Figure 36). This is equivalent to approximately 1% of the global soy harvested area.[179] Belgium has the largest land footprint in Brazil, with an average of 651,000 hectares each year (33% of the total land area). Argentina ranks second (525,000 hectares, 26%), with the USA in third place (250,000 hectares, 12%). The

[177] U.S. Soybean Export Council conversion table, see: https://ussec.org/resources/conversion-table. The 3% waste is assigned proportionally to soy meal and oil.
[178] Source: FAOSTAT
[179] Source: FAOSTAT

land area required to supply Belgium's imports of soy have increased dramatically, from 1.5 million hectares in 2013 to 2.7 million hectares in 2017.

Figure 36: The estimated land footprint of Belgium's imports of soy between 2013-2017 (hectares)



6.6 Estimated consumption

Using the same HS codes and conversion factors (see Appendix 6 for details), we estimate that Belgium exports an average of over 1.7 million tonnes of soy each year, as raw material, an ingredient of exported products, or embedded in the production process of exported products. Thirty percent of the soy contained within these exports was embedded in biodiesel, with a further 27% in soy meal, 11% in fresh or frozen swine meat, and 9% in fresh chicken. With Belgium having no domestic soy production, this is equivalent to an estimated consumption of 780,000 tonnes of soy each year, accounting for 31% of imports. This is broadly similar to the 863,000 tonnes of estimated use of soy in Belgium in 2014,[180] and the FAO's 'supply' estimate of 840,000 tonnes in 2013.[181] These estimates use different methods and different time periods.

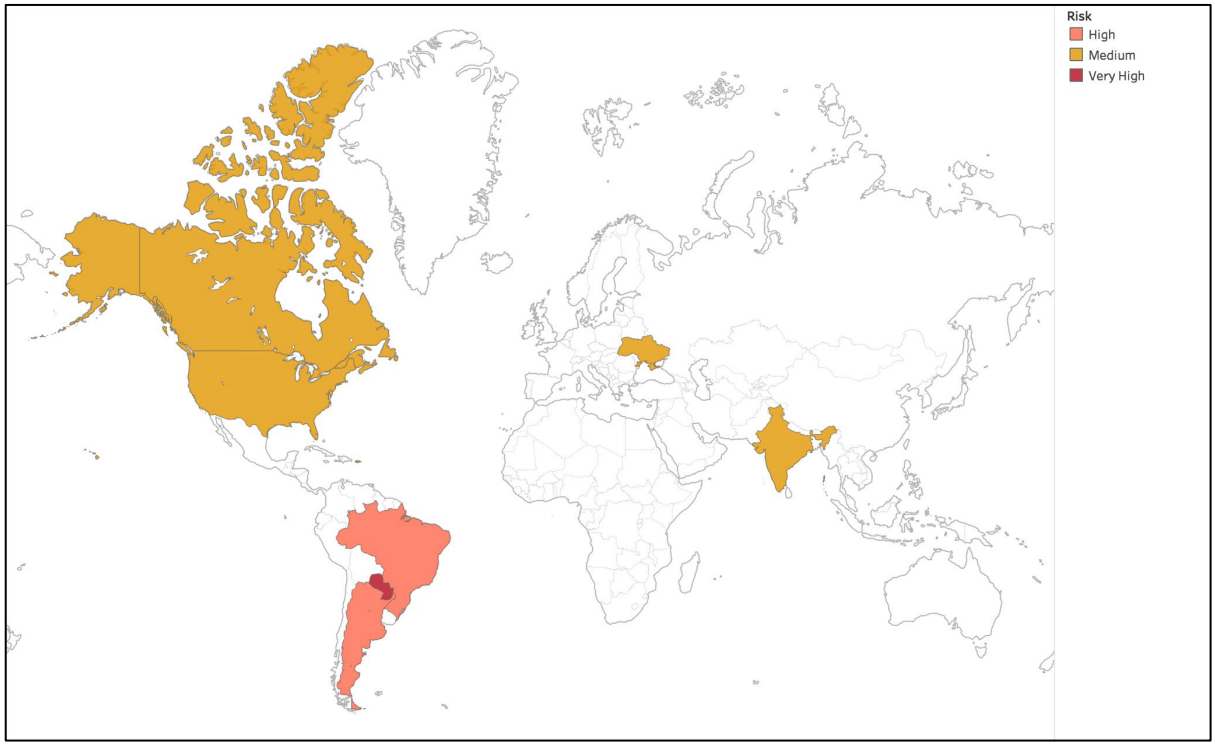
[180] Hassel Kroes & Barbara Kuepper (2016). Soy use in Belgium. A research paper prepared for WWF-Belgium. Profundo, Amsterdam, the Netherlands
[181] Source: FAOSTAT

6.7 Belgium's soy risk profile

Belgium imports most of its soy (64%) from high and very high risk countries: Brazil, Argentina and Paraguay (Figure 37). All three countries have very high levels of tree cover loss and high rates of natural forest loss (Table 15), and high perceived levels of corruption (especially Paraguay).

Credible certification schemes, such as the Roundtable on Sustainable Soy (RTRS) and ProTerra exist within the soy sector, and have strong safeguards against deforestation and conversion of natural habitats. However, their market penetration is limited (see Section 6.1.4), and many companies consider them too costly. Additional approaches to reducing the environmental cost of soy in Brazil have included the Amazon Soy Moratorium, and more recently the *Cerrado* Manifesto, and organisations are also beginning to develop jurisdictional (landscape) approaches to reduce the risk of deforestation in soy supply chains.

Figure 37: Belgium's soy footprint by risk category



7 Natural rubber

7.1 Production, uses and sustainability of natural rubber

7.1.1 Production

The primary source of natural rubber is the rubber tree, *Hevea brasiliensis*. The species is native to Brazil and the Guianas[182], and grows in humid, tropical lowland conditions, limiting its cultivation to areas within 15° of the equator. Production is now mainly in Southeast Asia, with plantations in South America hampered by a fungal disease, known as South American leaf blight.

A second type, synthetic rubber, is produced from petrochemical feedstocks (crude oil), with a range of varieties produced that possess different technical properties. More than half of the rubber produced is synthetic, and this results in the price of natural rubber being determined in part by the prevailing price of crude oil. Where they are substitutable, the competitive advantage between them is determined partly by oil prices.

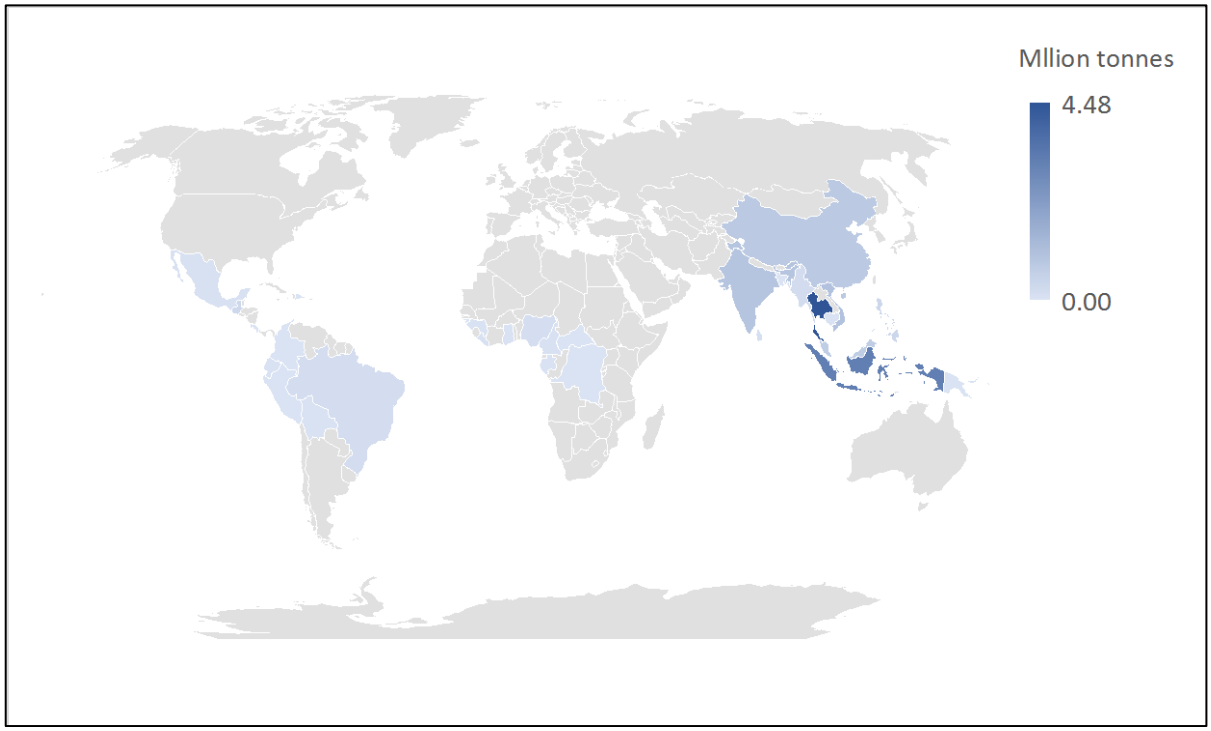
Rubber trees are grown in plantations, both large-scale and smallholder. Individual trees are tapped on alternate days with the latex collected in suspended vessels, and most plantations have a rest period where tapping is adjourned in the dry season. The latex is coagulated with acid to make rubber, which is further processed to a finished product. The most important of these processes is vulcanisation, which is most commonly done by adding a curing agent (e.g., sulphur compounds) and treating the rubber at high temperature and pressure.

Smallholders have traditionally dominated production in many of the major producing countries, including Indonesia, Malaysia, and India.[183] For example, about 7 million Indonesian farmers gain some or all of their income from growing and selling rubber, managing just over 85% of the planted area and producing 81% of the latex between 2000 and 2005.[184] However, large plantations are increasingly emerging on expansion frontiers (e.g., Laos PDR).

Global production of natural rubber was nearly 13.15 million tonnes in 2016,[185] a 75% increase since 2000. The overwhelming majority of the world's natural rubber is produced in Asia (Figure 38). Thailand accounted for 32% of world production in 2016, and Indonesia 23%. Along with Vietnam and India (both 7%), China (6%) and Malaysia (5%), these six countries accounted for 80% of global production.

[182] Mabberly, D.J. (1987). The Plant Book. Cambridge University Press.
[183] Manivong, V (2007). The Economic Potential for Smallholder Rubber Production in Northern Laos. http://lad.nafri.org.la/fulltext/LAD010320080112.pdf
[184] Pye-Smith C. 2011. Rich Rewards for Rubber? Research in Indonesia is exploring how smallholders can increase rubber production, retain biodiversity and provide additional environmental benefits. ICRAF Trees for Change no.8. Nairobi: World Agroforestry Centre. http://www.worldagroforestry.org/downloads/Publications/PDFS/B17073.pdf
[185] Source: FAO STAT http://faostat3.fao.org/home/E Last accessed 25 April 2015.

Figure 38: Global production of natural rubber in 2016 (million tonnes)



7.1.2 End uses

Natural rubber is used in thousands of ways, from engineering and industrial applications, to tyres, bouncing balls, boots, balloons and latex gloves. High quality latex is used to produce latex products such as surgeons' gloves, condoms, balloons and other relatively high-value products. Technically Specified Natural Rubber (TSNR) materials ends up largely in tires but also in conveyor belts, marine products, windshield wipers and miscellaneous goods.

Although synthetic and natural rubber are substitutable for many uses, some natural rubber is more or less necessary in tyre production as it provides the highest level of (unvulcanised) strength and high 'tack' (the ability of tyres to 'stick' to the road surface). Approximately 70% of the natural rubber produced globally is used in the manufacture of vehicle tyres.[186]

7.1.3 Environmental and social issues associated with rubber production

An estimated one million hectares of mainly secondary forest and subsistence crop land in China, Laos, Thailand, Vietnam, Cambodia and Myanmar has been converted to rubber trees over the last few decades.[187] A recent estimate that '*up to 8.5 million hectares of additional rubber plantations will be required to meet demand by 2024*' points to the serious threat that this expansion is likely to have on biodiversity.[188] The same study found that since there are no market prohibitions or deterrents on growing rubber trees on deforested land, some growers are converting forest to rubber plantations rather than oil palm. In Malaysia,

[186] Rubber, Natural – Chemical Economics Handbook (CEH)". IHS Markit. https://ihsmarkit.com/products/natural-rubber-chemical-economics-handbook.html Last accessed 22 October 2018.
[187] Li, Z. & Fox, J.M (2012). Mapping rubber tree growth in mainland Southeast Asia using time-series MODIS 250 m NDVI and statistical data. Applied Geography 32:420–432.
[188] https://www.uea.ac.uk/about/-/expanding-rubber-plantations-catastrophic-for-endangered-species-in-southeast-asia

whilst less important than other drivers such as oil palm, expansion of the area of rubber plantations has been cited as an important cause of deforestation in Sabah.[189]

Land grabs for rubber plantations have caused loss of land and livelihood for people in Southeast Asia. Two Vietnamese companies, HAGL and Vietnam Rubber Group, have been accused of land grabs to create rubber plantations in Cambodia and Laos[190,191], and a Chinese company has been reported as having been granted a concession to establish rubber on land traditionally owned by the Khmu ethnic minority in northern Laos.[192] The US Department of Labor lists Cambodia, Indonesia, Liberia, the Philippines, and Myanmar as using child labour in the production of rubber; it also lists Myanmar as using forced labour in natural rubber production.[193]

7.1.4 Sustainability initiatives for natural rubber

The Sustainable Natural Rubber Initiative (SNR-i) has developed a set of voluntary guidelines and criteria for members that include indicators on productivity, quality, forest sustainability, water management, and human/labour rights. Twenty-three of SNR-i's registered companies have completed the self-declaration stage. However, there is no independent third-party auditing or certification, and the scheme is expected to work as a credit/mass-balance scheme.[194]

Non-sector specific certification schemes that apply to rubber include FSC and organic standards. FSC claims just 0.1% of global rubber production,[195] and organic certified rubber is imported in diminutive quantities for specific niche uses (e.g., for use in mattresses).

The lack of sustainability mechanisms with meaningful market share suggests the need to raise awareness of sustainability issues within the sector, and catalyse a credible sectoral approach to sustainability. In 2016, Michelin announced a 'zero net deforestation policy' that excludes deforestation of primary forest, High Carbon Stock Forest and High Conservation Value Forest from their supply chains[196], which indicates that the sector is perhaps becoming more open to addressing its environmental impacts.

7.2 Trade in natural rubber

7.2.1 Global trade

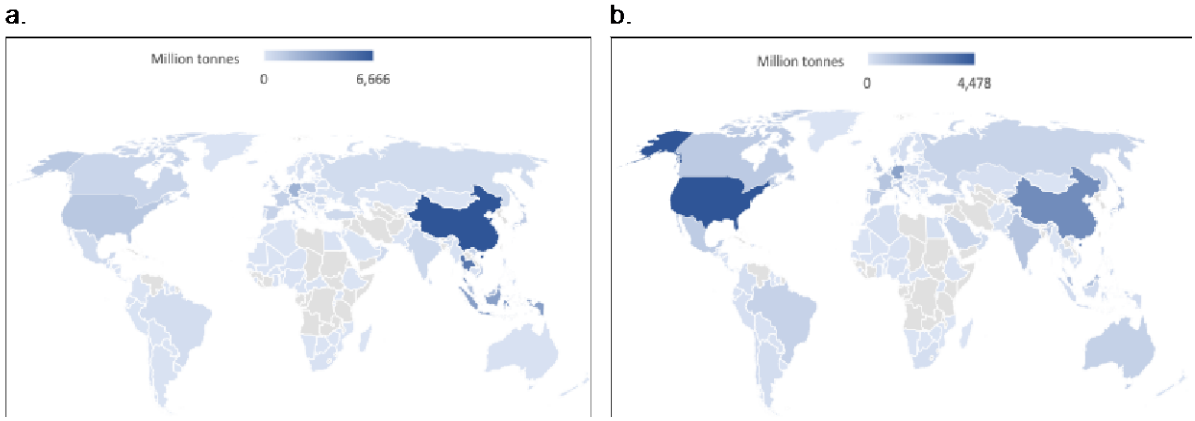
Asia dominates global exports, with China (which produces, imports, manufactures, exports and consumes products containing natural rubber) being the most dominant (Figure 39 a). Of producer countries, Thailand and Indonesia are important exporters to the global market.

The USA, China and Germany dominate global imports of natural rubber and products containing natural rubber (Figure 39 b), accounting for 30% of natural rubber traded as raw materials. Other major importing countries include, Malaysia, USA, Japan and South Korea, together accounting for around two-thirds of global imports. The EU accounts for approximately one quarter of the global imports of natural rubber and products containing natural rubber.

---

[189] Ratnasingham, J., et al. (2012), 'Production potential of rubberwood in Malaysia: its economic challenges', Not. Bot. Horti Agrobo, 40(2), pp. 317–22; and Sabah Forestry Department (2013), Annual Report 2013.
[190] https://www.globalwitness.org/en/campaigns/land-deals/rubberbarons/
[191] http://www.bbc.co.uk/news/world-asia-22509425
[192] McAllister, K. (2015). Rubber, rights and resistance: the evolution of local struggles against a Chinese rubber concession in Northern Laos. Journal of Peasant Studies, 42(3-4):1-21
[193] http://www.dol.gov/ilab/reports/child-labor/list-of-goods/
[194] http://www.snr-i.org/index.php
[195] https://ic.fsc.org/en/for-business/fsc-tools/local-market-successes/20-per-cent-of-forest-based-trade-by-2020

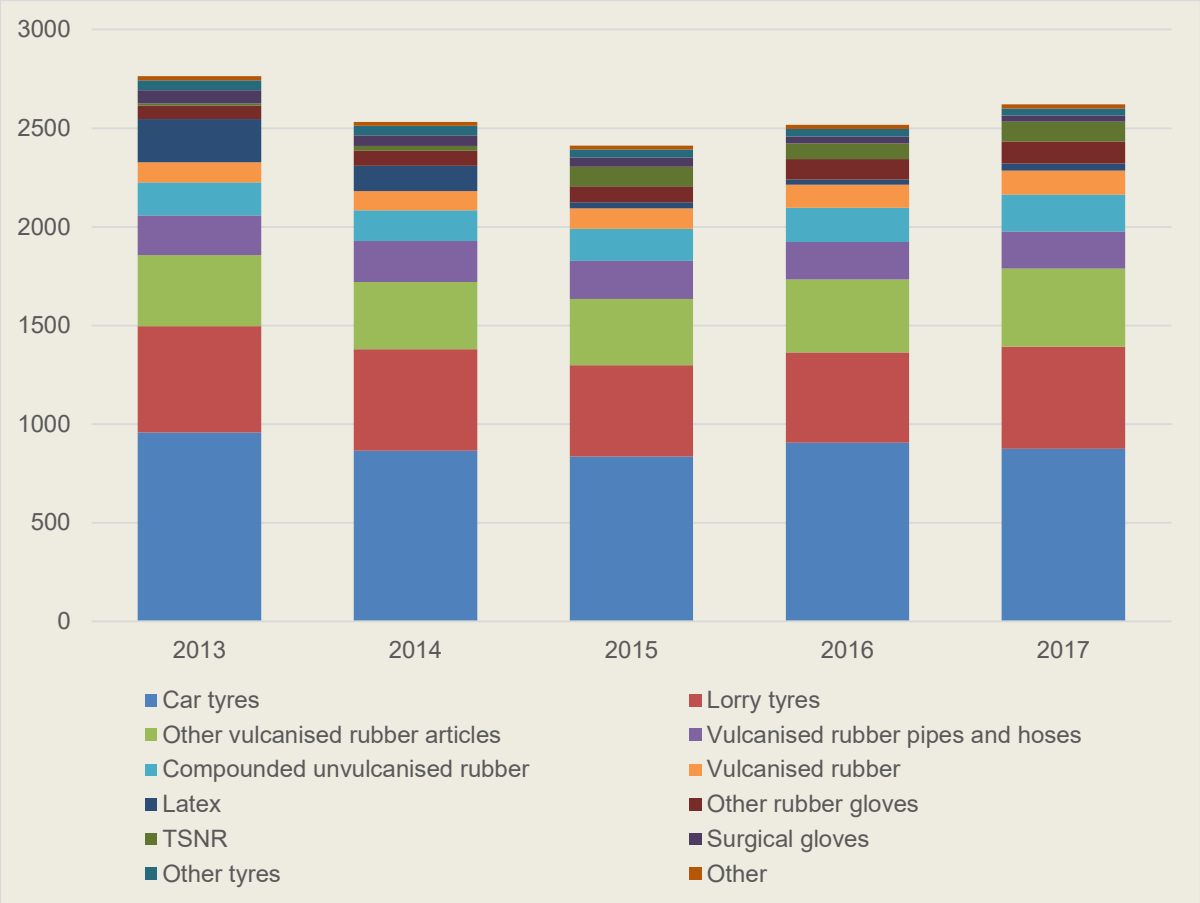
Figure 39: Global trade in natural rubber and natural rubber products in 2016: a. exports, and b. imports (million tonnes)



7.2.2 Belgium's imports of natural rubber

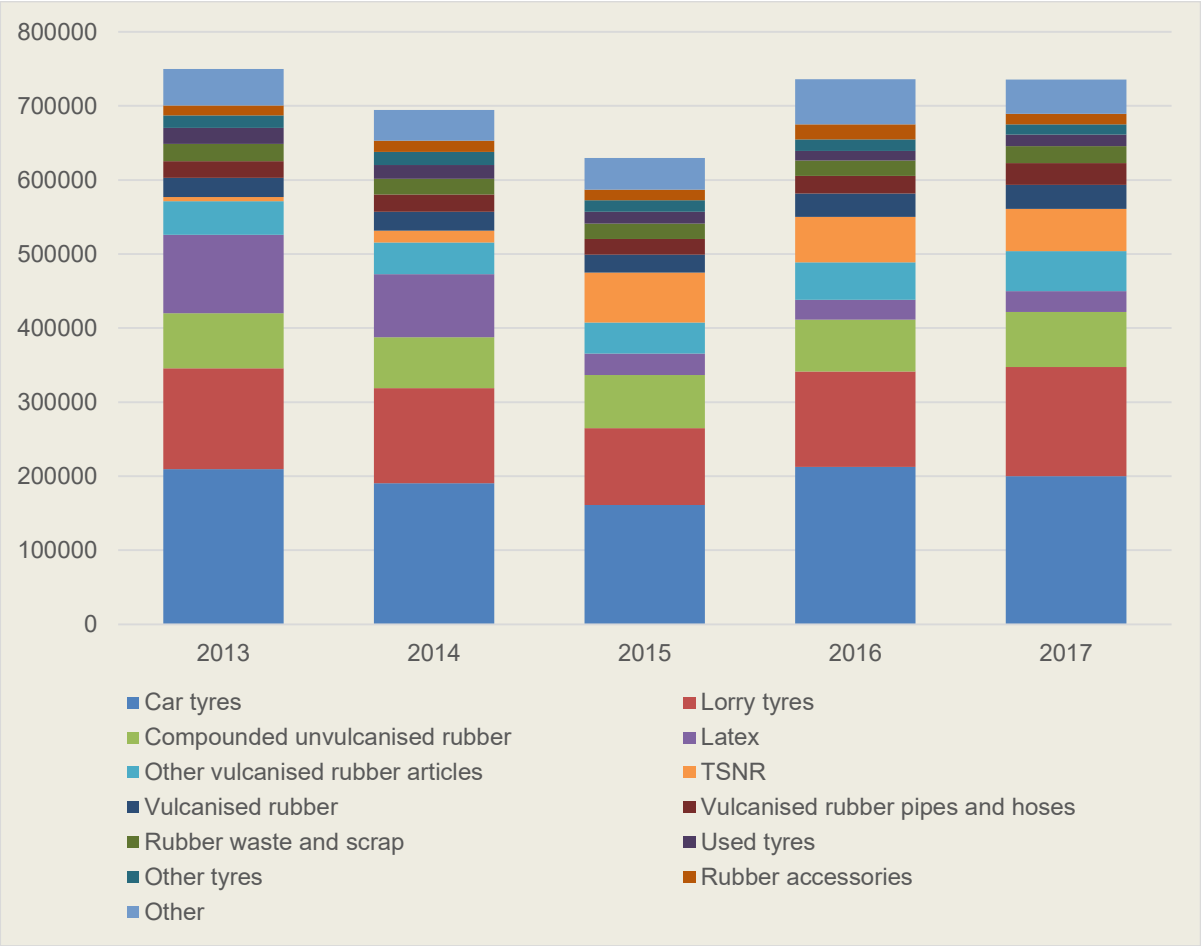
Belgium imported an average of € 2.6 billion of natural rubber and products containing natural rubber each year between 2013-17 (Figure 40). Over half of this value (52%) was in automotive tyres, especially car tyres (32%) and lorry tyres (18%).

Figure 40: The value of Belgium's imports of natural rubber and products containing natural rubber from 2013-17 (million €)



The quantity of natural rubber and products containing natural rubber has changed little between 2013-17 (Figure 41). Car tyres contribute the largest tonnage (an average of 195,000 tonnes per year, 27% of the total), with lorry tyres (129,000 tonnes, 18%), compounded unvulcanised rubber (72,000 tonnes, 10%) also contributing significant quantities (see Appendix 7 for the HS codes used).

Figure 41: The quantity of Belgium's imports of rubber and products containing rubber 2013-17 (tonnes)



As Belgium's imports include natural rubber raw materials, semi-manufactured natural rubber (e.g., TSNR) and products where natural rubber is a component (e.g., car tyres), the imported products have been converted to represent the natural rubber content of the imports (see Appendix 7 for the conversion factors used in these calculations). The amount of natural rubber raw material required to supply Belgium's imports of natural rubber products averaged 230,000 tonnes per year between 2013-17 (Table 9). This is equivalent to approximately 1.8% of global production.[197] There is a striking decrease in imports of latex, and a corresponding increase in TSNR imports over the period (Figure 42). Corrected for natural rubber content, over the whole period, latex (55,000 tonnes, 24% of the total) and TSNR (42,000 tonnes, 18%) become the largest import by quantity, followed by the natural rubber component of lorry tyres (35,000 tonnes, 15%) and car tyres (27,000 tonnes, 15%, Figure 43).

[197] FAOSTAT

Table 9: Quantity of Belgium's imports of natural rubber and products containing natural rubber 2013-17, adjusted for natural rubber content (tonnes)

HS code	Product	2013	2014	2015	2016	2017	Average	%
400110	Latex	105,976	85,354	29,183	26,780	28,405	55,140	24%
400122	TSNR	5,574	16,015	67,173	61,791	57,266	41,564	18%
401120	Lorry tyres	36,721	34,589	27,935	34,785	39,841	34,774	15%
401110 & 8703	Car tyres	37,121	33,433	30,485	38,445	28,604	33,618	15%
4005	Compounded unvulcanised rubber	15,009	13,885	14,503	14,172	14,987	14,511	6%
4016	Other vulcanised rubber articles	8,678	8,154	7,996	9,601	10,276	8,941	4%
400121	Smoked sheets	361	1,112	7,805	16,902	12,381	7,712	3%
4008	Vulcanised rubber	4,985	4,855	4,681	5,983	6,171	5,335	2%
4009	Vulcanised rubber pipes and hoses	4,261	4,447	4,031	4,505	5,593	4,568	2%
400400	Rubber waste	4,605	4,192	4,028	4,134	4,536	4,299	2%
401220	Used tyres	4,433	3,788	3,348	2,594	3,128	3,458	2%
	Other	18,140	16,758	14,935	18,600	14,025	16,492	7%
Total		**245,865**	**226,583**	**216,103**	**238,293**	**225,215**	**230,412**	**100%**

Figure 42: Natural rubber content of Belgium's imports of rubber and products containing rubber 2013-17 (tonnes)

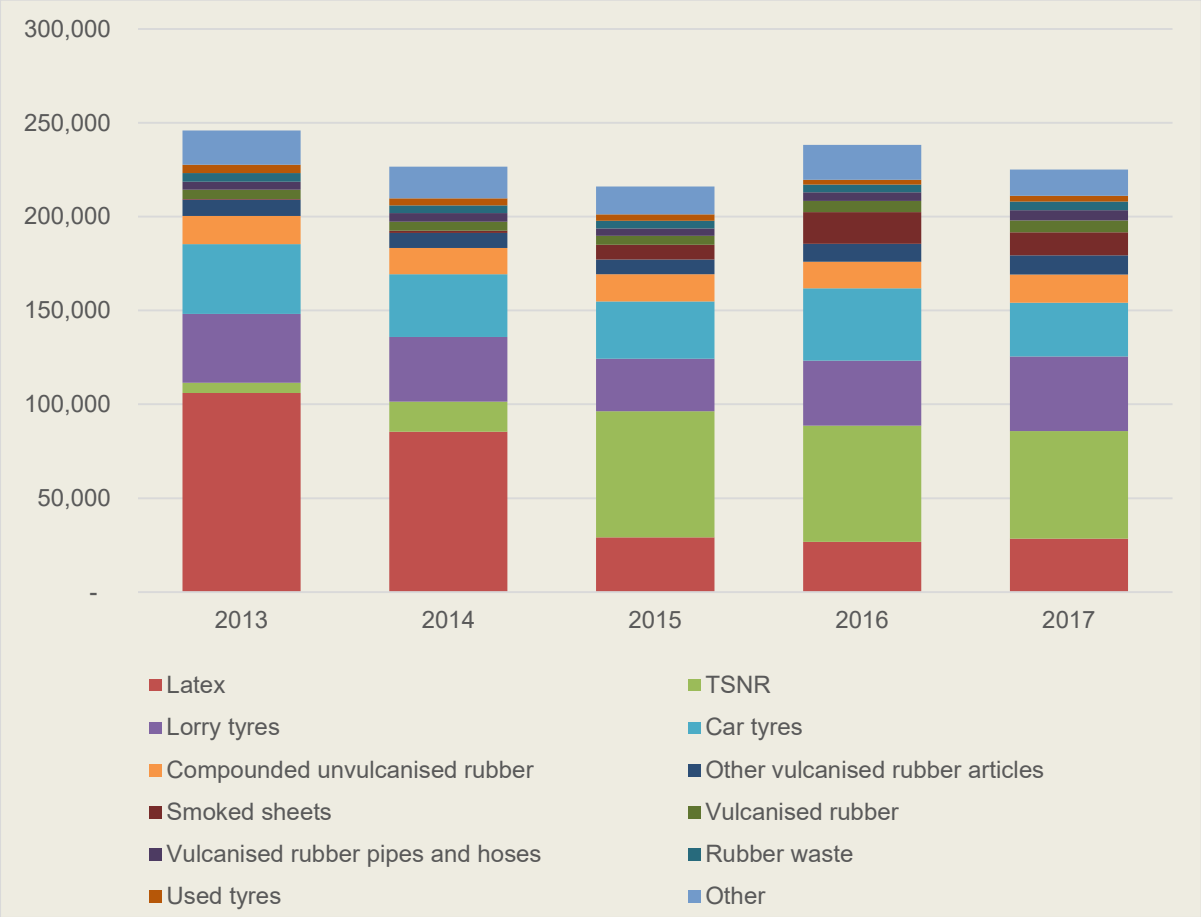
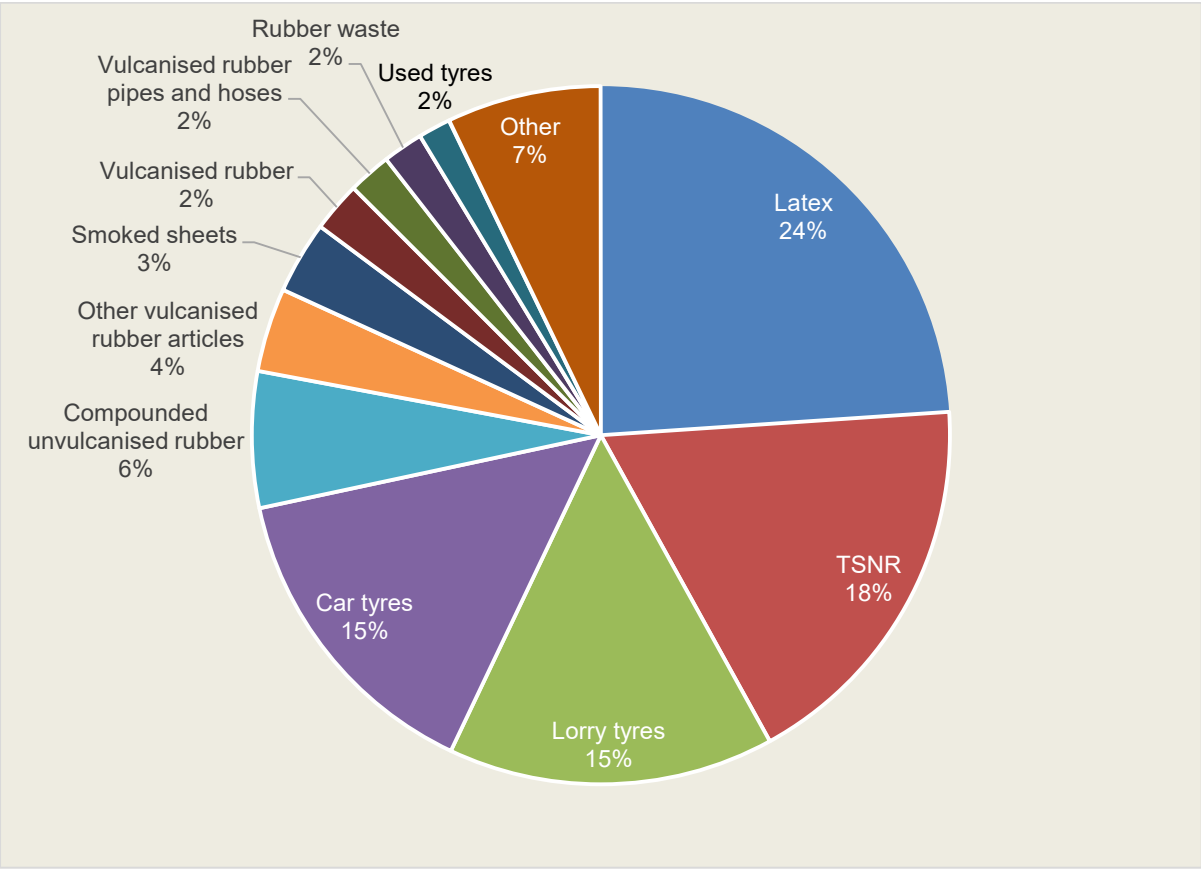


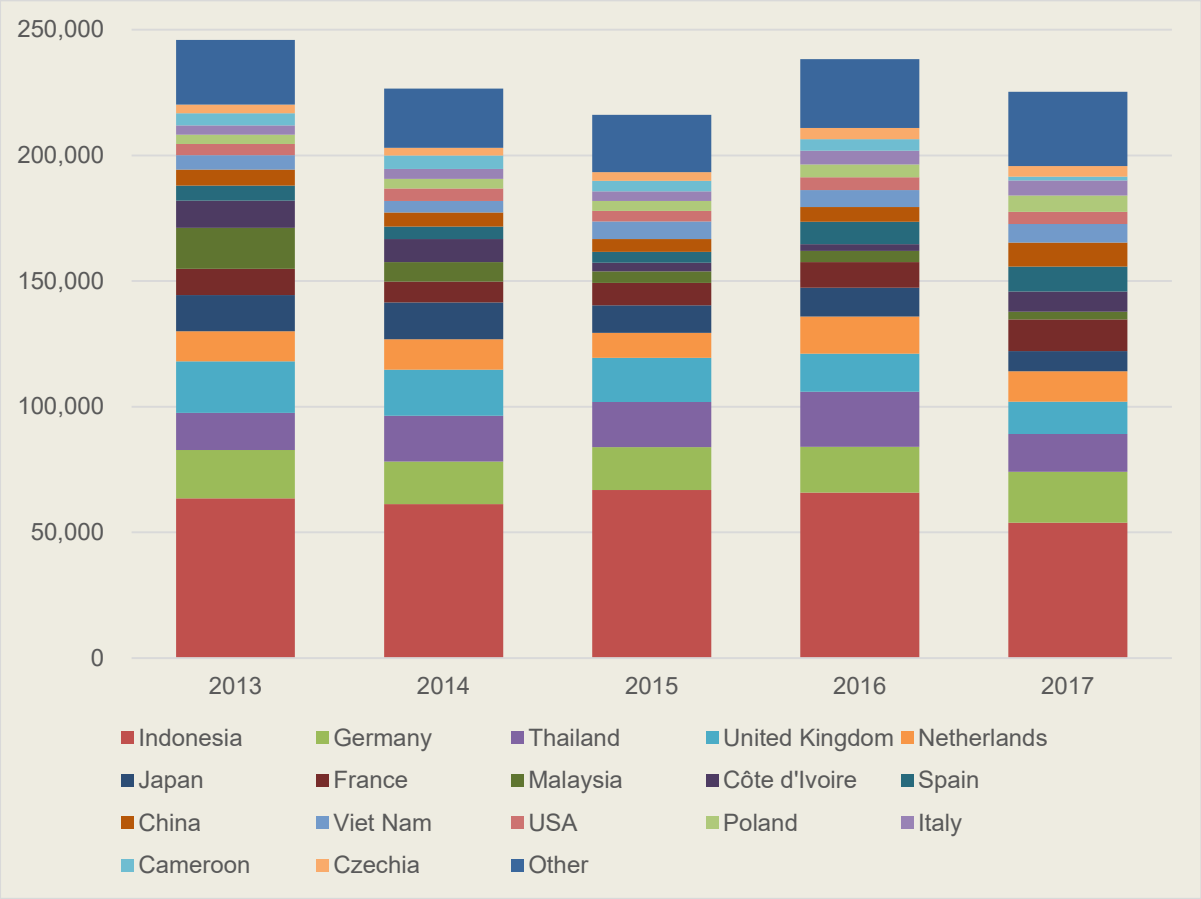
Figure 43: Quantity of Belgium's imports of natural rubber and products containing natural rubber, adjusted for rubber content (average 2013-17, tonnes)



7.3 Provenance of Belgium's imports of natural rubber

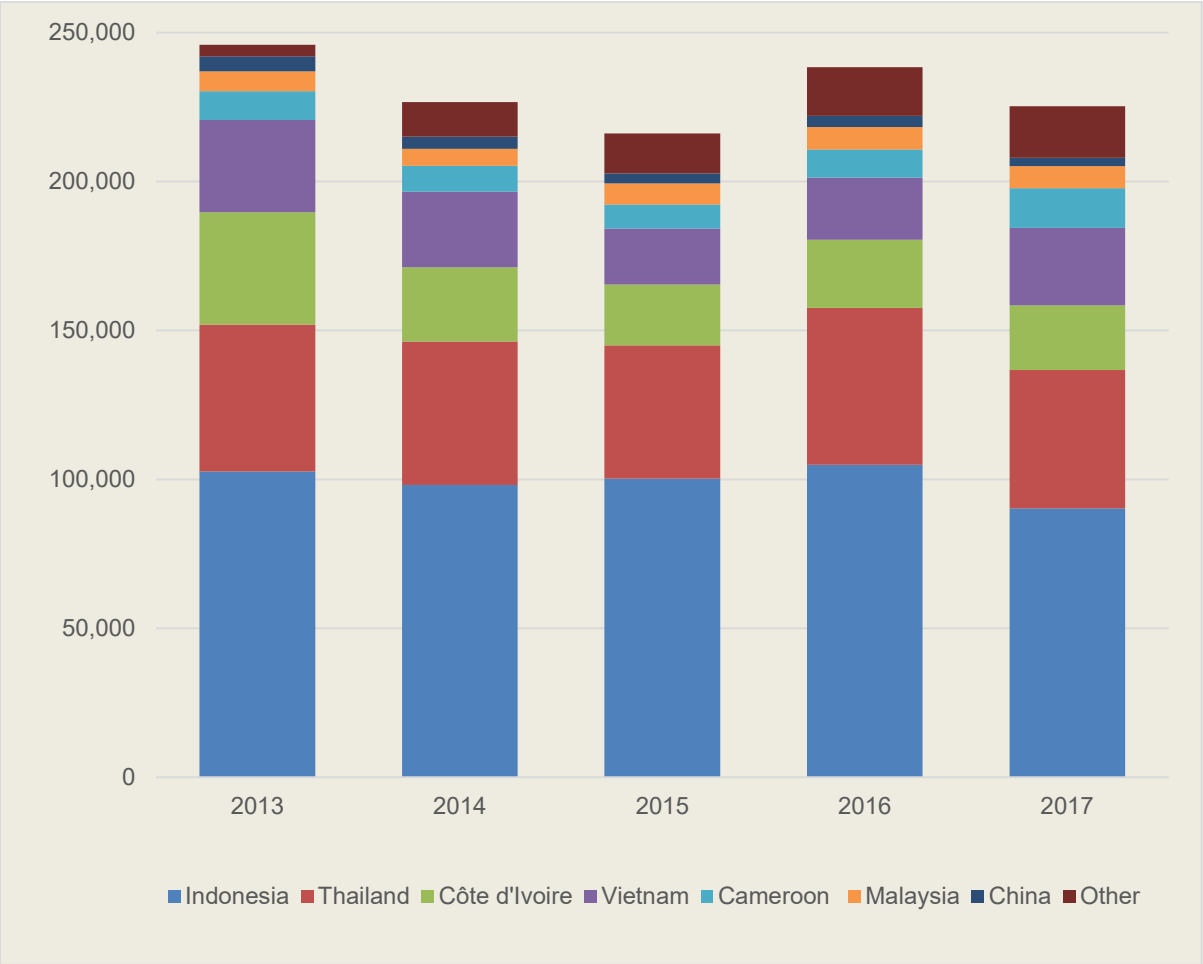
Between 2013 and 2017, Belgium imported natural rubber and products containing natural rubber from a total of 156 territories. The major exporters to Belgium include a mixture of producer countries (e.g., Indonesia, Thailand and Malaysia) and countries that are either trading rubber or selling manufactured goods to Belgium (e.g., the UK, Germany, Japan and France, Figure 44). Amongst this latter group, EU countries account for more than one third of the natural rubber imported by Belgium (38%). The quantity of natural rubber imported shows a slight decline over the period, with direct imports from Indonesia in particular falling from 64,000 tonnes in 2013 to 54,000 tonnes in 2017 (Figure 44).

Figure 44: The quantity of Belgium's imports of natural rubber and products containing natural rubber between 2013-17 from major exporting countries, adjusted for the content of natural rubber (tonnes)



As Figure 44 shows, many of the countries from which Belgium imports natural rubber do not produce it and are solely traders and/or manufacturers of natural rubber products. This means that some of the natural rubber in products imported by Belgium originates in third-party countries. With provenance adjusted to account for these indirect imports (see Section 2.2), Indonesia remains the main provider of natural rubber to Belgium (an average of 99,000 tonnes each year between 2013-17, 44% of the total, Figure 45). Thailand is ranked second (48,000 tonnes each year, 22%), Côte d'Ivoire third with an average of 26,000 tonnes (11%), and Vietnam fourth (24,000 tonnes, 11%).

Figure 45: Provenance of Belgium's imports of natural rubber 2013-17, adjusted for rubber content of imported products and for third party (intermediary) countries (tonnes)



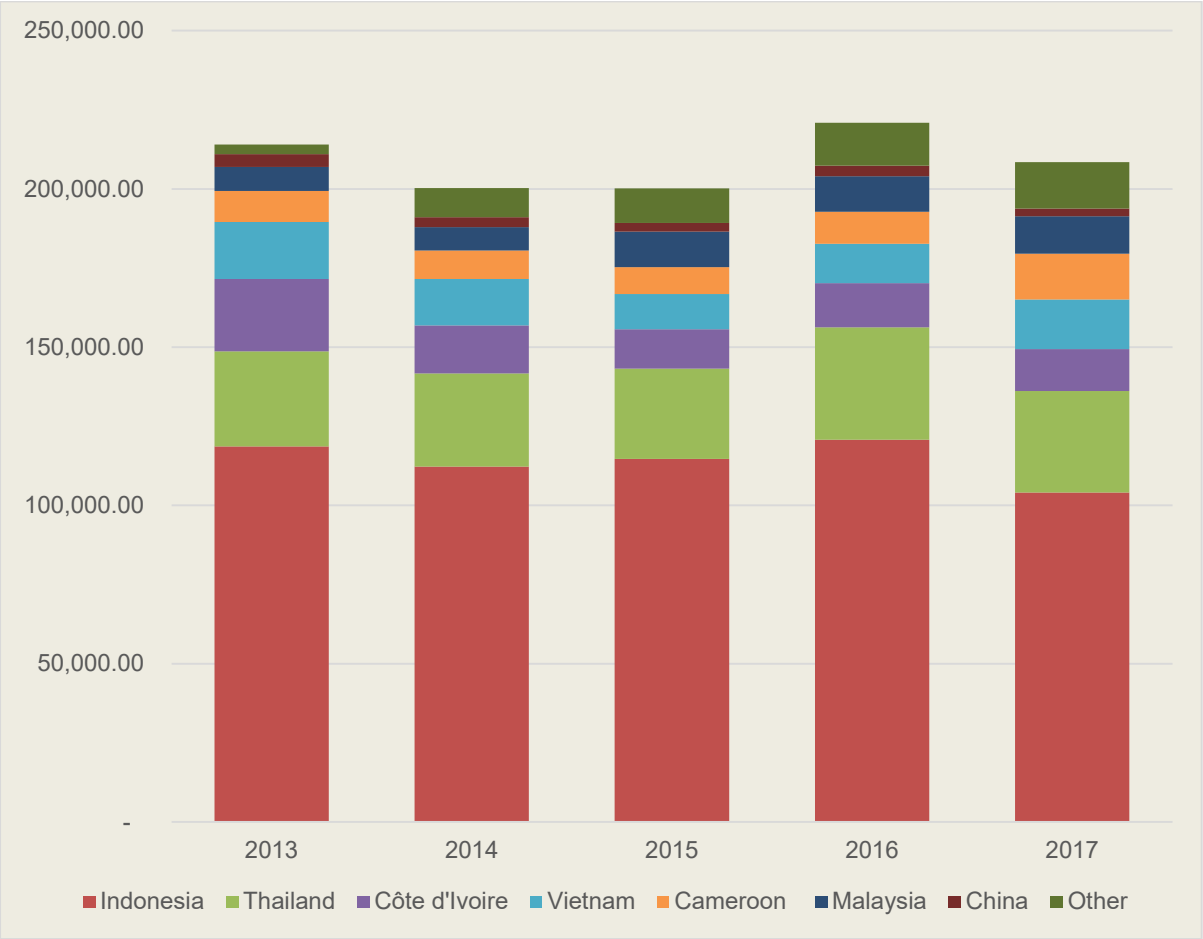
7.4 Belgium's footprint for natural rubber

To estimate the land area required to supply Belgium with natural rubber, the quantity of raw materials imported from each producer country were divided by the yield from that country for each year.[198]

The estimated land area required to satisfy Belgium's imports of natural rubber was 209,000 hectares per year between 2013-17 (Figure 46). This is equivalent to approximately 1.8% of the global planted area.[199] Two countries – Indonesia and Thailand – dominate Belgium's land footprint, contributing an average of 114,000 hectares (55%) and 31,000 hectares (15%) respectively each year.

[198] Source: FAOSTAT
[199] Source: FAOSTAT

Figure 46: Belgium's estimated land footprint for natural rubber (hectares)



7.5 Estimated consumption

Using the same HS codes and conversion factors (see Appendix 7 for details), we estimate that Belgium exports an average of 203,000 tonnes of natural rubber each year, either as raw material or as a component of exported products. With Belgium having no domestic natural rubber production, this is equivalent to an estimated consumption of 28,000 tonnes of natural rubber each year, accounting for just 12% of imports. Although this figure seems low, it is a similar proportion to the FAO's estimate of 'supply' estimate for 2013, which is also equivalent to 12% of imports.[200]

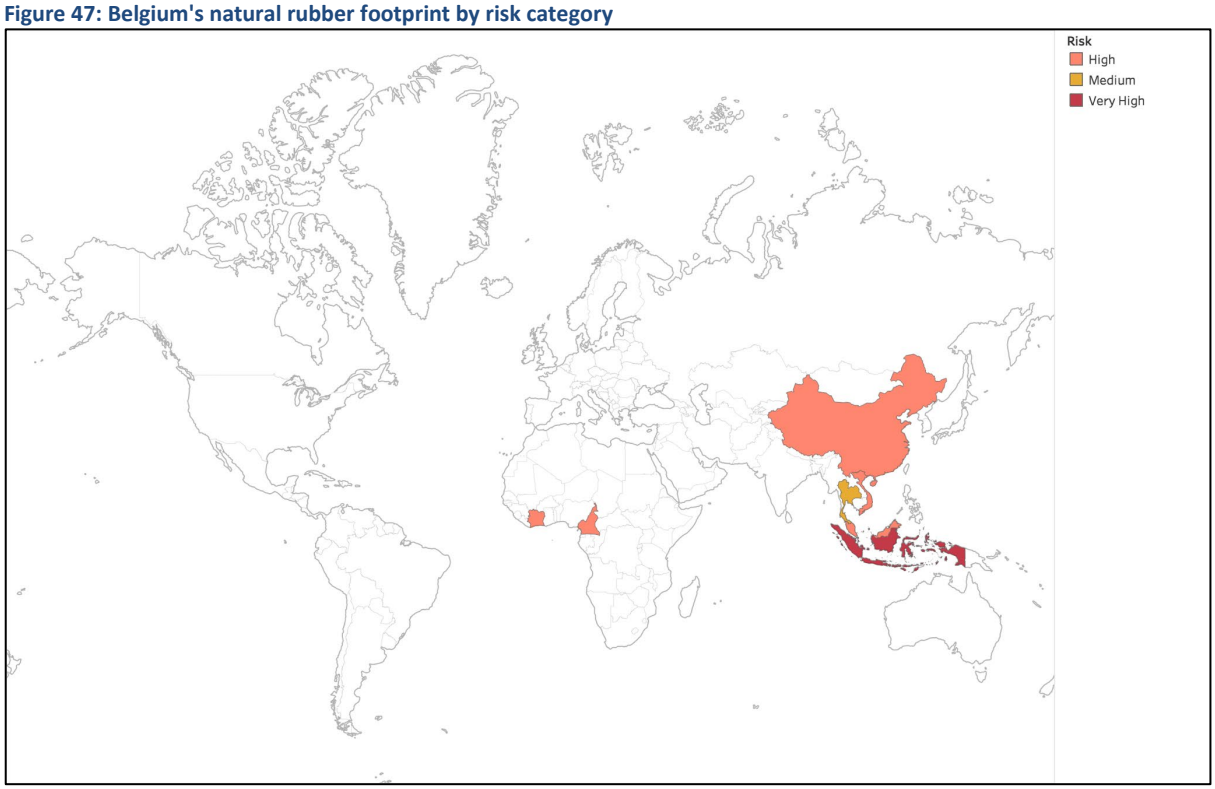
7.6 Belgium's natural rubber risk profile8

Belgium imports most of its natural rubber (74%) from high and very high risk countries: Cameroon, China, Côte d'Ivoire, Indonesia, Malaysia and Vietnam (Figure 47). All of these countries have either very high levels of tree cover loss and deforestation of natural forest, and/or a poor record of labour rights and corruption (Table 15). Only Thailand amongst producer countries is rated medium risk, a result of its low rates of natural forest loss.

There appear to be lower levels of awareness about the environmental consequences of production of rubber than of some other commodities, and very limited FSC certified material is available on the market. This means that the options for managing the risks of deforestation and exploitation associated with imports of natural rubber are currently limited.

[200] Source: FAOSTAT

Figure 47: Belgium's natural rubber footprint by risk category



8 Beef and leather

8.1 Production, uses and sustainability of beef and leather

8.1.1 Production

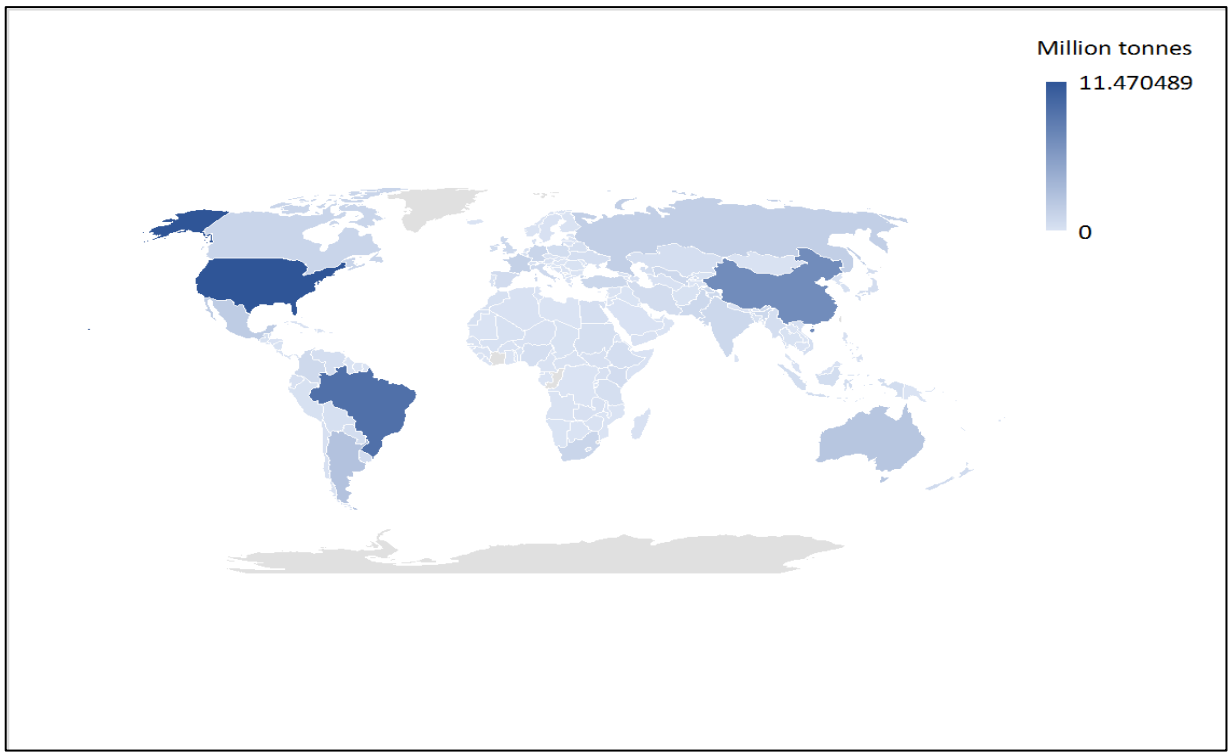
Beef and leather share the same supply chain at primary production and primary processing (i.e. slaughter). Beyond this, their routes to Belgium and their end uses are very different.

There are three main types of beef production systems around the world:

- Multipurpose animal beef production systems which mainly involve the use of cattle that will produce milk or be used for traction, as well as meat (e.g., China and India).
- Beef industry coupled with dairy. Cattle produce milk as the main product, but unproductive and bull calves are utilised for their meat. This is common in the EU and India.
- Stand-alone beef production (e.g., United States, Brazil, Australia and Argentina).

The top five producers of cattle – the USA, Brazil, China, Argentina and Australia – account for half of all global production. Belgium is not a major producer, ranking forty-first in global beef production with 278,000 tonnes, equivalent to 0.4% of global production in 2016 (Figure 48).

Figure 48: Global cattle production in 2016 (million tonnes). Source: FAOSTAT.



The typical supply chain for beef starts on farm and goes through a number of processing and packing stages before reaching the consumer. Depending on the supply chain, there can be agents and traders between all the main processing, manufacturing and retailing stages. This is particularly the case with imported beef that can be moved through intermediaries in other European countries.

In countries such as Australia, China, India, Namibia and the EU, pasture and forage remains the main source of food for cattle throughout their lifecycle. Some of these systems are extensive, with very low stocking densities. For example, the average stocking density of some farms in Namibia may be as low as one animal every 16.7 hectares.[201] By contrast, the stocking rate in the Brazilian Amazon has risen from one animal every 3.3 hectares in 1975[202] to around one per hectare in 2013.[203] In some countries, such as the USA and Argentina, cattle are moved from pasture to grain feedlots, and although Brazil is still dominated by pasture systems, it is transitioning into a grain-fed system for finishing.

Cattle hides or skins are converted into leather through the tanning process, in which the hide is treated with chemicals which cross link the microscopic collagen fibres to form a stable and durable product. The hair or wool may or may not have been removed. Leather can also be made from a hide or skin that has been split into layers or segmented either before or after tanning. The quality of leather varies depending on the quality of the hide and the degree to which it has been processed (Table 10).

Table 10: Common leather terms[204]

Term	Description
Full grain	Strongest and thickest type. Has the original grain surface of the skin. Used in high quality footwear & furniture.
Top grain	The first cut taken from the grain side of a split hide. Most common leather used in luxury goods.
Corrected grain	Lower quality hides that have the surface grain corrected by sanding, dyeing etc.
Split	What's left from the hide once the 'Top grain' has been removed. If thick enough it can be split more than once.

Bovine leather is the major source of leather globally, accounting for 69% of all leather. This document thus focuses on bovine leather, as cattle are an important driver of global land use change compared to other livestock species.[205]

There can be merchants and traders between all the main processing, manufacturing and retailing stages of the leather supply chain. Leather supply chains can be integrated (i.e. highly traceable and potentially owned downstream businesses), especially in premium products where quality and provenance of raw material are highly valued to ensure sufficient supply and quality of leather.

8.1.2 End uses

Belgium has traditionally had one of the highest levels of per-capita meat consumption within the EU, but in recent years this has fallen at a faster rate than in other EU countries.[206] The

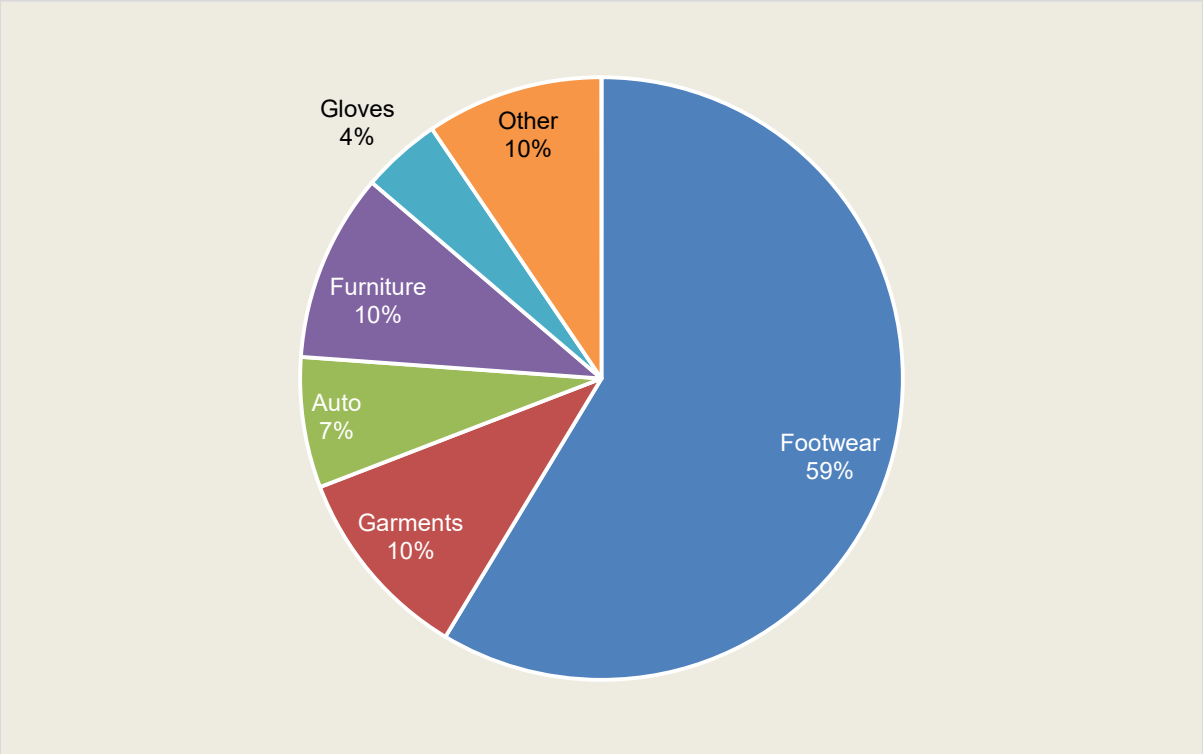
[201] John-Oliver Englera,, J-O., von Wehrdena, H. and Baumgartner, S. (2017). Determinants of farm size and stocking rate in Namibian commercial cattle farming. Leuphana University of Lüneburg, Scharnhorststr. 1, D-21335 Lüeburg, Germany
[202] Valentim J.F., Andrade de. C.M.S 2009. Tendências e perspectivas da pecuária bovina na Amazônia Brasileira. Amazônia: Ciência & Desenvolvimento, Belém, 4 (8: 273-283
[203] Walker, N.F., Patel, S.A., and Kalif, K.A.B. (2013). From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. Tropical Conservation Science – Special Issue Vol.6 (3): 446-467
[204] British Standard BS 2780:1983 Glossary of Leather Terms
[205] FAO (n.d.) Cattle ranching and deforestation. Livestock Policy Brief 03
[206] Euromeatnews.com (31 August 2018). Belgian Meat Round Table: Meat consumption decreased by 18% between 2008 and 2016. https://www.euromeatnews.com/articles/view/123 Last accessed 23 November 2018.

majority of beef is purchased by consumers as fresh or frozen cuts e.g. steaks, mince and roasting joints. However – like most meats – it is also found in a range of food products e.g. burgers, ready meals, pastry products, etc.

In comparison, hide accounts for about 10% of the slaughter value of cattle[207], so it makes a relatively small but still worthwhile contribution to the overall profitability of the beef livestock sector. Despite this value, cattle are not raised and slaughtered primarily for their hides but for their meat, and their management is no different from cattle raised for beef.

Leather is manufactured into a variety of end products, including shoes, bags, car seats, gloves, clothes, furniture upholstery, belts and saddlery. However, shoes are the dominant end use, accounting for 59% of leather use globally (Figure 49).

Figure 49: Global end uses of leather.[208]



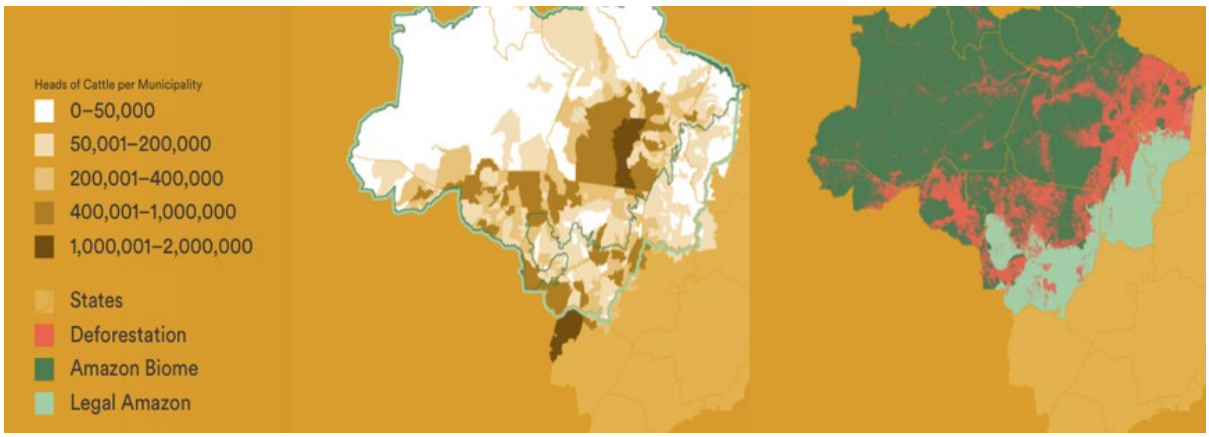
8.1.3 Environmental and social issues associated with beef and leather production

Cattle production is the dominant land use following deforestation in WWF Priority Places such as the Amazon, *Cerrado* and Pantanal. According to the research by Gibbs *et al*.[209]: '*Cattle ranching occurs on over two-thirds of deforested land in the Brazilian Amazon … The large-scale expansion of the cattle herd into the Brazilian Amazon has come at great environmental cost, as large expanses of tropical forests have been cut, burned, and converted to pastures*.' Figure 50 below shows the patterns of cattle herd expansion and forest cover loss in Brazil. It is important to note that the production of soy, which is

[207] Brack, D. Glover, A. and Wellesley L. (2016) Energy, Environment and Resources Agricultural Commodity Supply Chains Trade, Consumption and Deforestation. Chatham House Research Paper.
[208] Data from UK Leather (http://www.ukleather.org/trade-issues/industry-statistics.htm). 'Other' includes other leather goods e.g. bags, belts, wallets and purses.
[209] Gibbs et al. Did Ranchers and Slaughterhouses Respond to Zero-Deforestation Agreements in the Brazilian Amazon? Conservation Letters, January 2016, 9(1), 32–42

sometimes fed to cattle, is also driving deforestation in South America. This is analysed within the soy section of this report.

Figure 50: Patterns of cattle herd expansion and forest cover loss in Brazil.[210]



Most of the research on the links between cattle and deforestation has focused on Latin America, especially Brazil, but also Belize, Bolivia, Costa Rica, Ecuador, Mexico, and Peru. Pasture creation for cattle – often in concert with infrastructure development and settlement programmes – has also been cited as a cause of deforestation in Asia, albeit minor.[211] As with any other land use, even where little forest is cleared to create pasture directly, any increase in demand for cattle products can contribute to deforestation indirectly by displacing other land uses into previously forested areas.

Research for the US State Department identifies cattle ranching in Brazil as a source of forced labour in the country.[212] According to the International Labor Organisation, some 62% of slave labour in Brazil is employed in livestock farming-related businesses.[213]

Leather tanneries consume a large amount of water and produce large quantities of effluent. Tannery wastewater is a mixture of particles of hides and a large variety of organic and inorganic chemicals. These include hydrogen sulphide and residues of chromium that are highly toxic to many organisms. Indiscriminate discharge of effluents into water bodies or open land can result in contamination of surface and ground water, affect local flora and fauna, and have direct impacts on agriculture.

8.1.4 Certification

The issue of deforestation caused by cattle production has been tackled using several sector and supply chain approaches (see summary in Table 11 below). These are largely focused on the Brazilian Amazon, and many do not fully mitigate the risk of deforestation.

[210] zerodeforestationcattle.org citing Gibbs *et al*.
[211] Geist, H.J. & Lambin, E.F. (2011). What drives tropical deforestation? A meta-analysis of proximate and underlying causes of deforestation based on subnational case study evidence. – (LUCC Report Series; 4). CIACO Louvain-la-Neuve.
[212] US State Department (2016) Trafficking In Persons Report
[213] ILO (2009) Fighting Forced Labour: The Example of Brazil

Table 11: Private sector options for managing deforestation risk in beef value chains[214,215]

Type of intervention	Availability	Notes
Credible certification	Yes – but low adoption	The Sustainable Agriculture Network (SAN) Standard for Sustainable Cattle Production Systems (Rainforest Alliance).[216] It appears there has been relatively limited uptake[217] – with examples being a European beef burger producer[218] and Gucci (for leather handbags).[219]
Other credible zero deforestation mechanisms	Yes – but costs high and doesn't cover whole chain	Animal tracking and traceability systems have been developed and deployed in South America – however costs can be prohibitive.[220] These include programmes implemented by some of the biggest suppliers, such as Marfig and JBS. The G4 Agreement between Greenpeace and major beef producers has been seen as a good step forward but currently doesn't cover the full supply chain.
Other relevant initiatives	Yes	The Global Roundtable for Sustainable Beef (GRSB) and local chapter Brazilian Roundtable on Sustainable Livestock[221] (GTPS) are initiatives that are developing standards, criteria, and common practices that address the protection of native forests from deforestation.

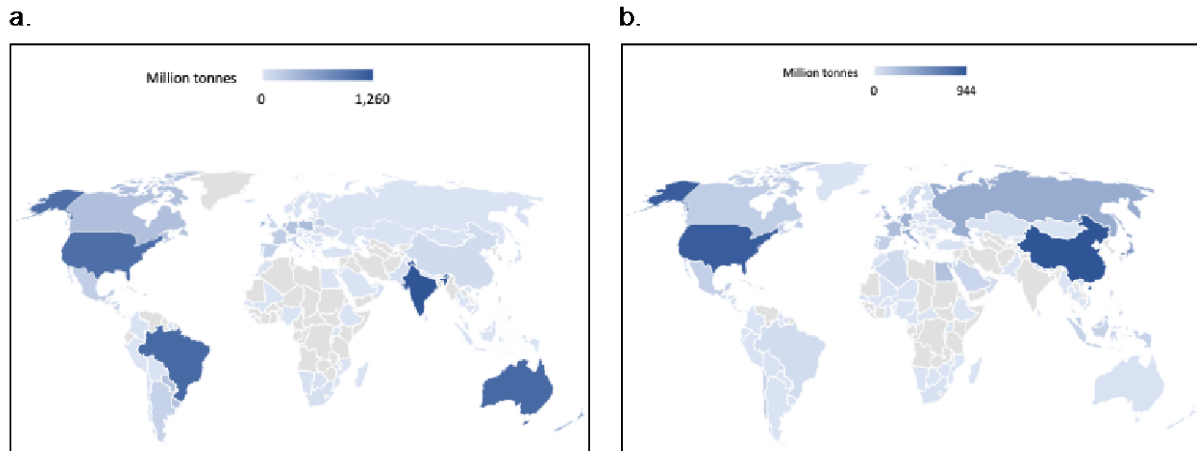
8.2 Trade in beef and leather

8.2.1 Global trade

The major cattle producing countries also dominate global exports of beef, with the addition of India, where beef consumption is minimal for religious reasons and hence most of its production is exported (Figure 51 a). Imports are dominated by China (12% of the total) and the USA (11%), with the EU accounting for more than 30% of global imports (Figure 51 b).

[214] Zero Deforestation Cattle website http://www.zerodeforestationcattle.org/
[215] DATU research (2014) Deforestation And The Brazilian Beef Value Chain
[216] According to the cattle standard guidance document it is critical that the farm can demonstrate: '*It purchases cattle born and raised on non-certified farms that do not violate the following SAN criteria: … Destruction of a high value ecosystem after November 1, 2005 (critical criterion 2.2)'* *http://www.san.ag/biblioteca/docs/SAN_GIG_Cattle_Standard___February_2013.pdf*
[217] The Rainforest Alliance 2015 Impacts report shows cattle land coverage is relatively small compared to others e.g. coffee http://www.rainforest-alliance.org/sites/default/files/publication/pdf/SAN_RA_Impacts_Report.pdf
[218] http://www.frozenfoodeurope.com/europes-first-rainforest-alliance-certified-frozen-beef-product-launches-at-anuga/
[219] Rainforest Alliance press release: http://www.rainforest-alliance.org/newsroom/press-releases/gucci-goes-sustainable
[220] http://www.zerodeforestationcattle.org/#reading/ch5t2
[221] http://www.pecuariasustentavel.org.br/

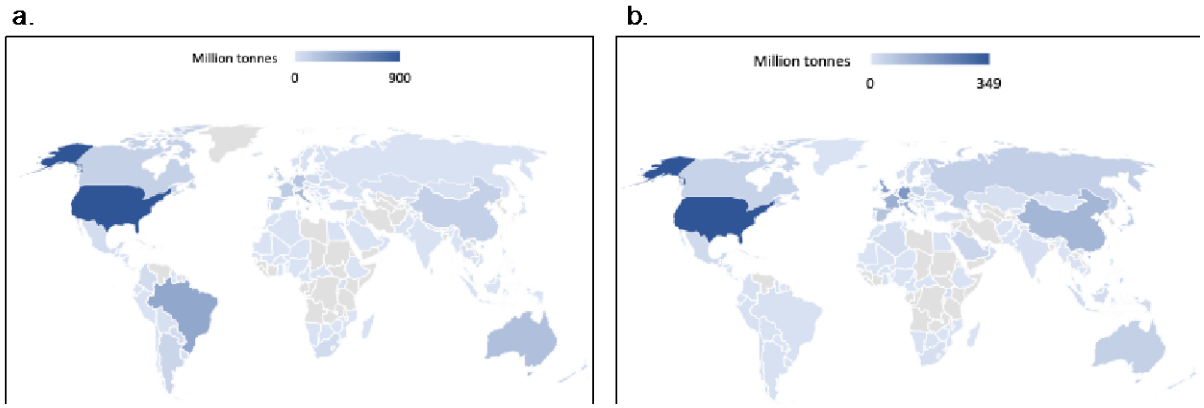
Figure 51: Global exports (a.) and imports (b.) of beef in 2016 (million tonnes). Source: UNCOMTRADE[222]



Leather can be traded having been just tanned (e.g. so-called 'wet blue' leather which has been tanned using chromium), as 'crust',[223] or as finished leather. Countries such as Brazil are increasingly adding value to raw leather before exporting it, e.g., it is exported either partly-processed as 'wet blue', as finished leather or as leather products such as clothing and bags.[224]

Global exports of hides broadly follow the same pattern as cattle production. However, there is a very large international trade in manufactured leather goods. China accounts for 35% of global exports of manufactured leather goods by weight (22% by value), with Italy second ranked with 7% by weight and 16% by value (Figure 52 a). The USA (18% of the value of global imports), China (10%), and Germany (7%) are other major importers of manufactured leather goods (Figure 52 b).

Figure 52: Global exports (a.) and imports (b.) of manufactured leather goods in 2016 (million Euro).

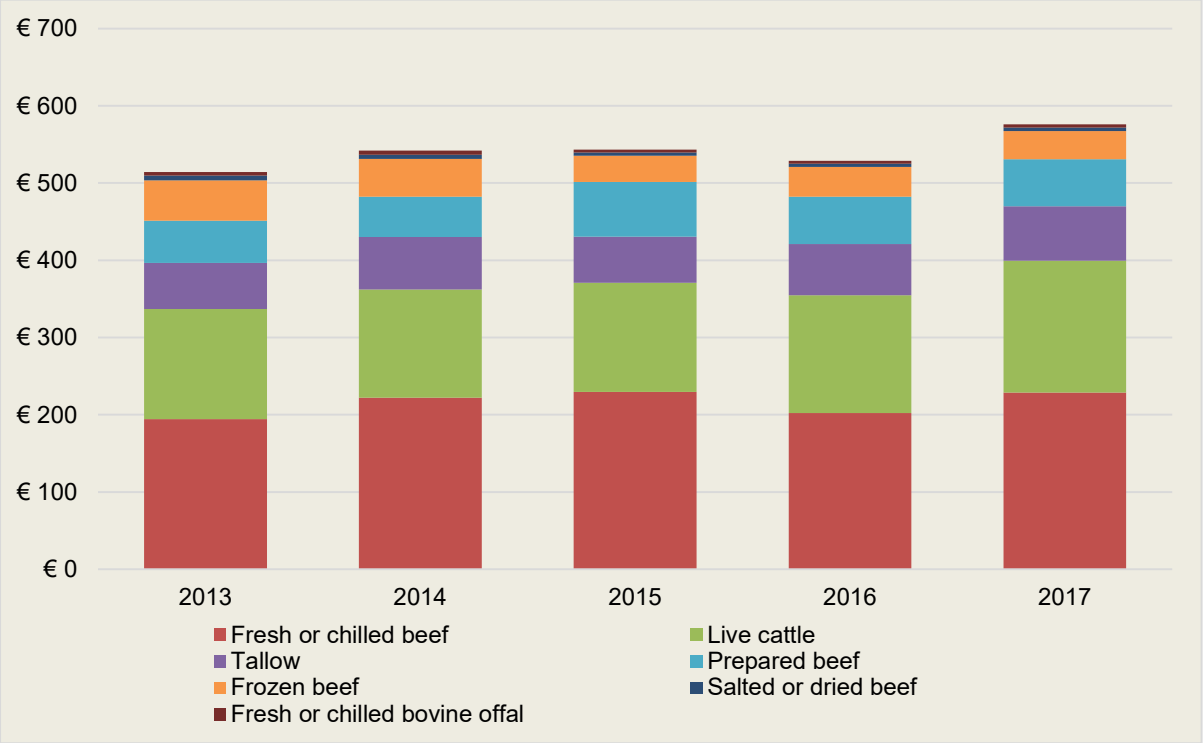


8.3 Belgium's imports of beef and leather

Belgium imported an average of € 541 million of beef and beef products each year between 2013-17 (Figure 53). The value of beef imports is dominated by imports or fresh and chilled beef (€ 245 million, 40% of the total) and imports of live cattle (€ 149 million, 28%). The overall value of imports has risen slightly over the period, from over €514 million in 2013 to € 576 million in 2017.

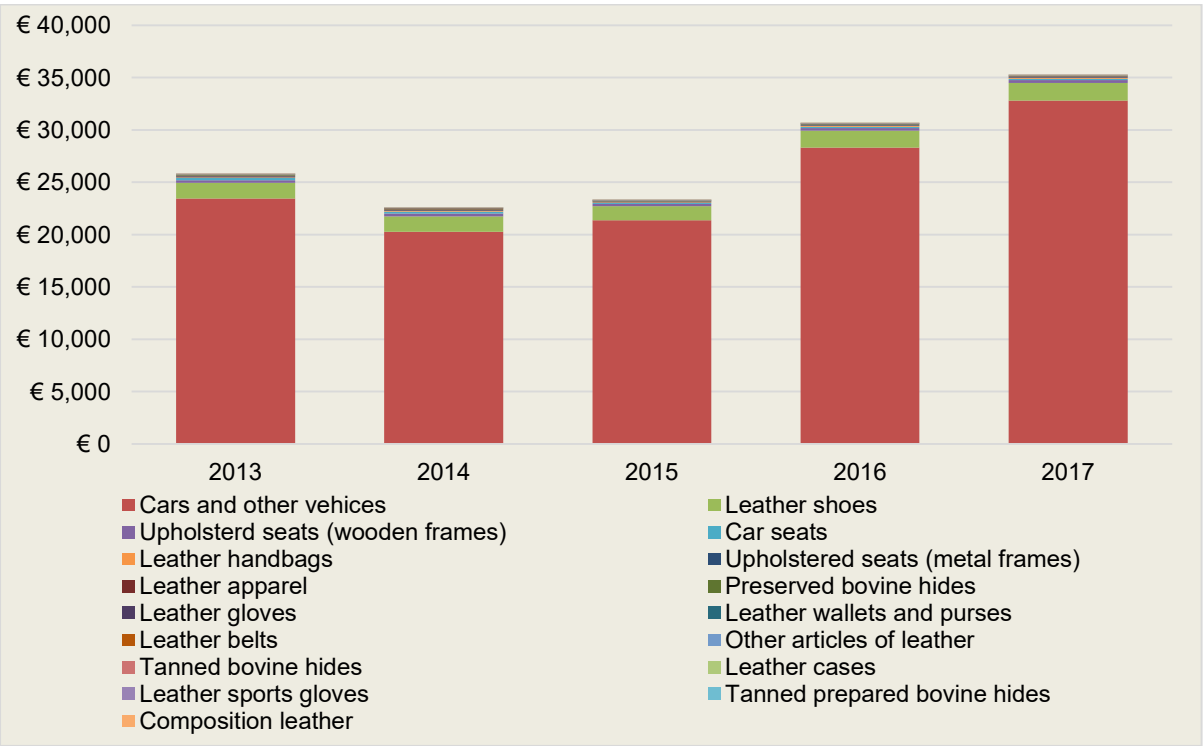
[222] Imports of fresh and Dynamics of Cattle Production in Brazil
frozen beef (see Appendix 8 for HS codes used).
[223] Crust leather is leather that has been tanned, dyed and dried, but not finished.
[224] Leather Panel (2010) Future Trends in the Leather and Leather Products Industry and Trade

Figure 53: The value of Belgium's imports of beef and products containing beef between 2013-17 (million Euro)



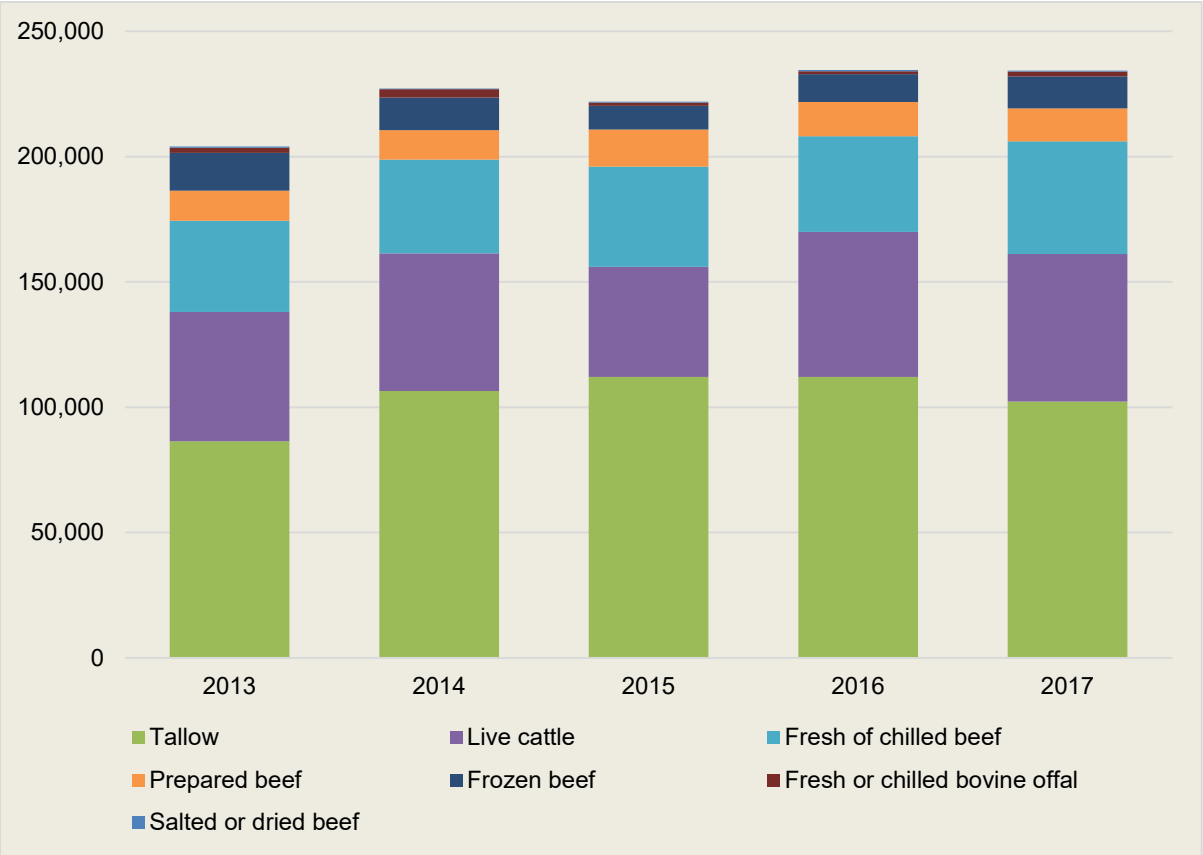
Imports of leather and products containing leather averaged € 27.2 billion each year (Figure 54). However, this figure is dominated by car imports, of which only a small fraction of the value is in leather seats (imports are adjusted for leather content in the subsequent analysis of import volumes). More pertinently, imports of leather shoes averaged € 1.5 billion per year. There was a sharp increase in the value of imported leather and products containing leather in 2016 and 2017, driven primarily by an increase in the value of imported cars.

Figure 54: The value of Belgium's imports of leather and products containing leather between 2013-17 (million Euro)



Belgium imports relatively small quantities of beef and beef products, and imports of meat are exceeded by those of tallow and live cattle (Figure 55). The quantities of imports of products containing leather are, as with value, dominated by car imports, only a small fraction of which is leather seats. Amongst imported leather products that are predominantly leather, shoes (an average of 60,000 tonnes) and preserved bovine hides (20,000 tonnes) are the most important categories.

Figure 55: Quantity of Belgium's beef product imports 2013-17, not adjusted for beef content (tonnes)



When adjusted for the quantity of beef contained in imports (see Appendix 8 for details), Belgium imported an average of 192,000 tonnes of beef (Carcass Weight Equivalent, CWE) each year between 2013-17 (Table 12). There was an increase in imports in 2017: from 189,000 tonnes in 2016 to approximately 210,000 tonnes in 2017. This is predominantly a result of an increase in the quantity of fresh or chilled beef imported (Figure 56). Fresh and chilled beef dominated imports over the whole period (49%) live cattle contributing 17% and frozen beef 15% (Figure 57).

Figure 56: Belgium's imports of beef between 2013-17, adjusted for beef content (Carcass Weight Equivalent, tonnes)

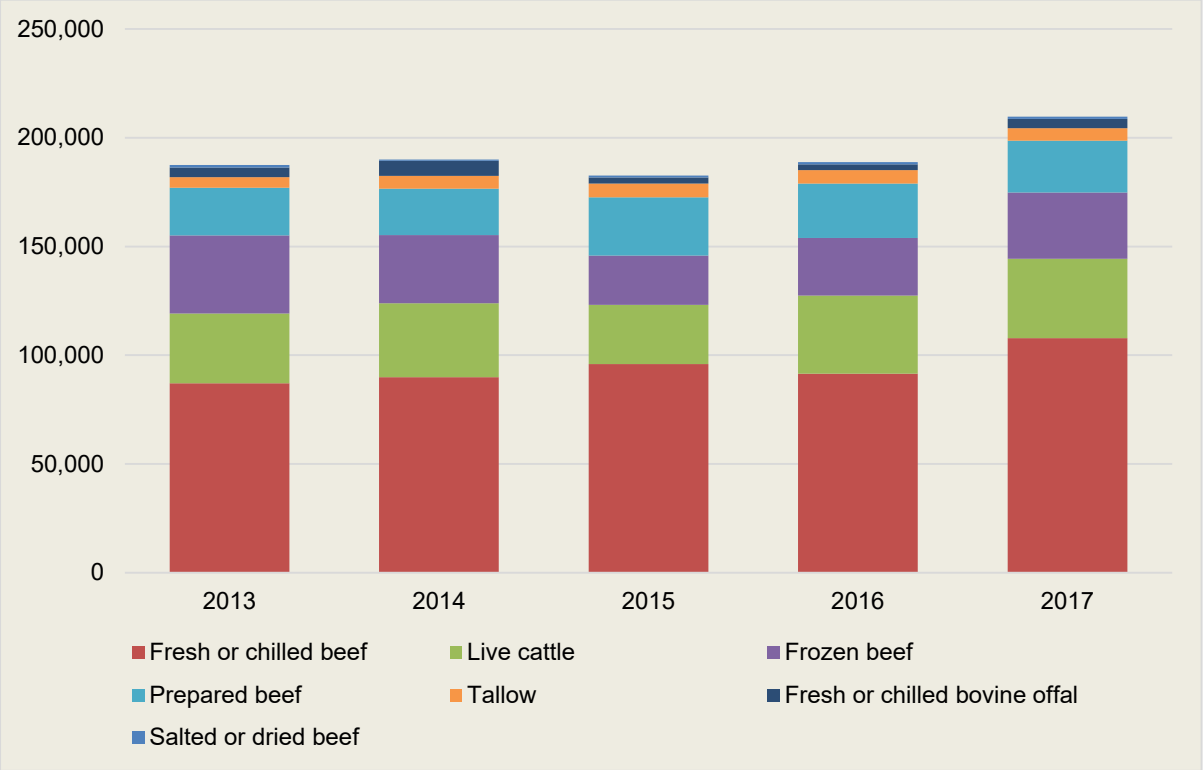
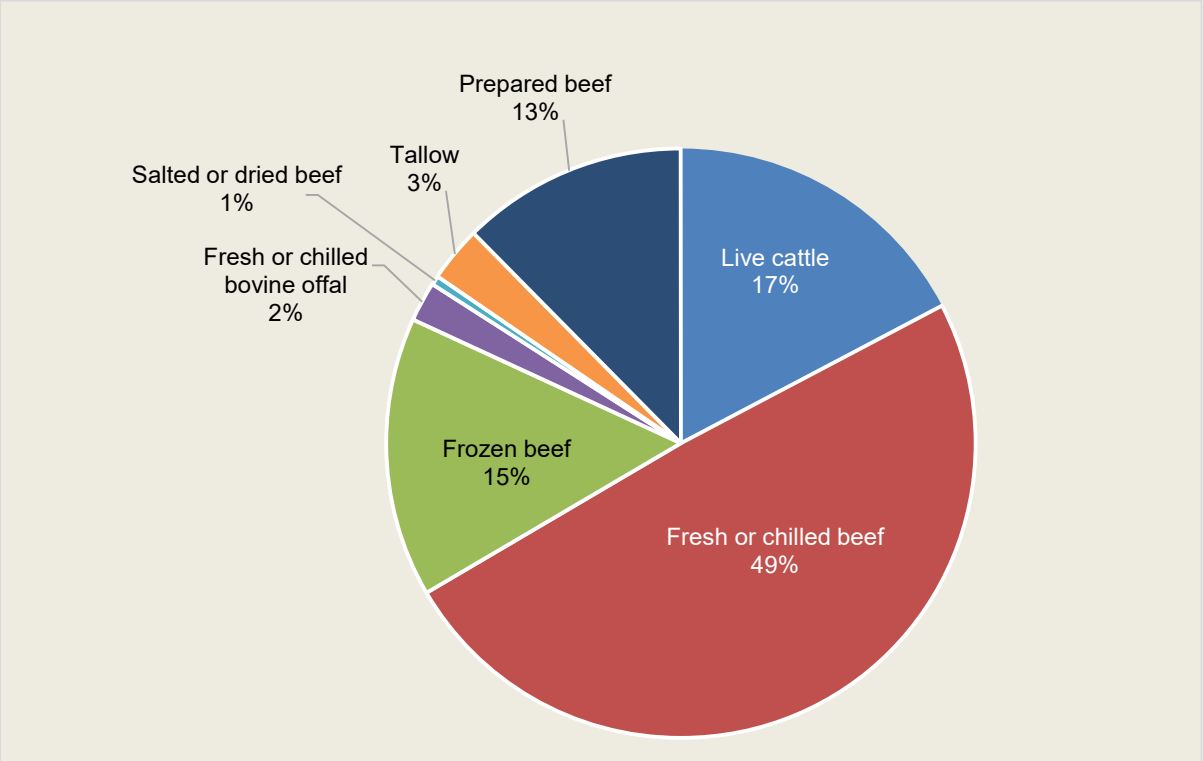


Figure 57: Belgium's imports of beef, adjusted for beef content (Carcass Weight Equivalent, tonnes, average 2013-17)



When adjusted for the quantity of leather contained in imports (see Appendix 8 for details of the conversion factors used), Belgium imported an average of 36,000 tonnes of leather (Hide Equivalent) each year between 2013-17. Preserved hides, tanned hides and leather shoes together account for the majority of leather imported. There was a steep decline in the quantity of leather imported in 2015, which has subsequently recovered (Table 13). This is predominantly a result of increases in imports of leather shoes and tanned hides (Figure 58).

Figure 58: Belgium's imports of leather, between 2013-17, adjusted for leather content (Hide Equivalent, tonnes)

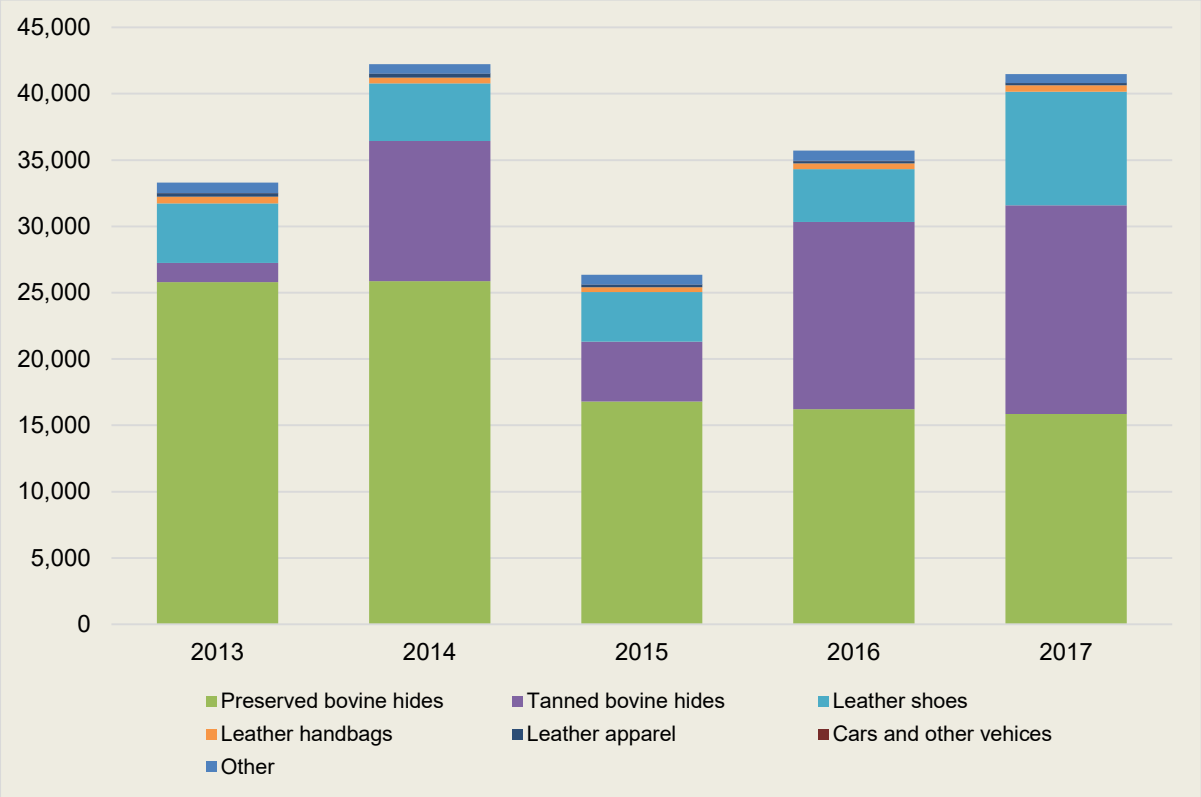


Figure 59: Belgium's imports of leather, adjusted for leather content (Hide Equivalent, tonnes, average 2013-17)

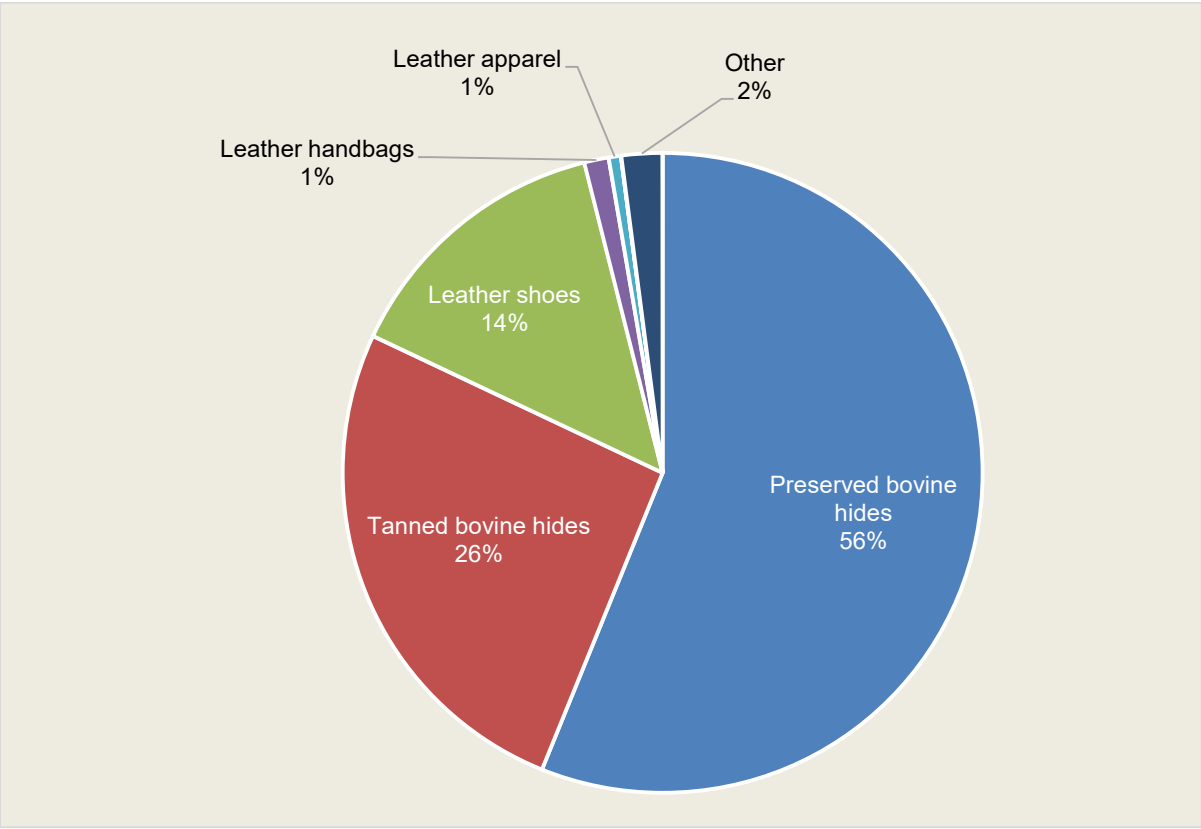


Table 12: Quantity of Belgium's imports of beef and products containing beef 2013-17, adjusted for beef content (Carcass Weight Equivalent, tonnes)

HS code	Commodity	2013	2014	2015	2016	2017	Average	%
0201	Fresh or chilled beef	87,147	89,855	95,903	91,508	107,848	94,452	49%
0102	Live cattle	32,013	34,006	27,202	35,857	36,522	33,120	17%
0202	Frozen beef	35,938	31,308	22,746	26,529	30,495	29,403	15%
160250	Prepared beef	21,909	21,332	26,782	24,968	23,809	23,760	12%
1502	Tallow	4,855	5,983	6,300	6,298	5,744	5,836	3%
020610	Fresh or chilled bovine offal	4,357	6,847	2,845	2,534	4,286	4,174	2%
021020	Salted or dried beef	1,257	611	892	1,139	926	965	1%
	Total	**187,476**	**189,944**	**182,670**	**188,833**	**209,630**	**191,711**	**100%**

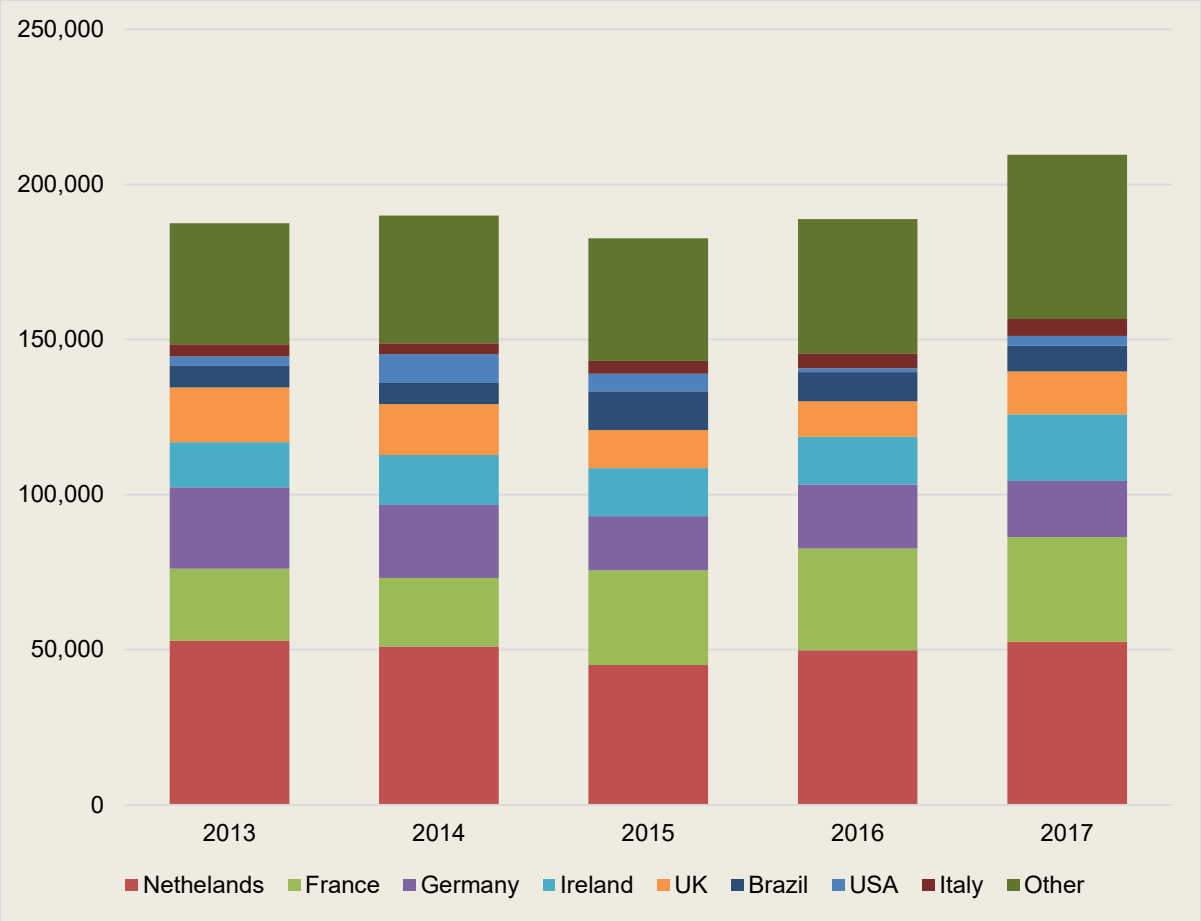
Table 13: Quantity of Belgium's imports of leather and products containing leather 2013-17, adjusted for leather content (Hide Equivalent, tonnes)

HS code	Description	2013	2014	2015	2016	2017	Average	%
4101	Preserved bovine hides	25,789	25,864	16,802	16,227	15,865	**20,109**	**56%**
4104	Tanned bovine hides	1,444	10,567	4,504	14,112	15,732	**9,272**	**26%**
6403	Leather shoes	4,495	4,347	3,749	3,984	8,565	**5,028**	**14%**
420221	Leather handbags	503	444	356	416	483	**440**	**1%**
420310	Leather apparel	263	289	199	187	161	**220**	**1%**
8703	Cars and other vehicles	4	4	4	5	4	**4**	**0%**
	Other	791	717	735	794	682	**744**	**2%**
	Total	**33,290**	**42,231**	**26,349**	**35,724**	**41,492**	**35,817**	**100%**

8.4 Provenance of Belgium's imports of beef and leather

Between 2013 and 2017, Belgium imported beef and products containing beef from a total of 39 territories. The EU dominates imports, accounting for an average of 91% of the total. Adjusting for indirect imports makes little difference to the estimated provenance, with EU countries remaining dominant, and the largest contributions coming from the Netherlands (an average of 50,000 tonnes CWE each year, 26% of the total), France (28,000 tonnes, 15%), and Germany (21,000 tonnes, 11%). The only non-EU countries that supply Belgium with significant quantities of beef are Brazil and the USA, with 5% and 2% of imports respectively (Figure 60).

Figure 60: The provenance of Belgium's imports of beef 2013-17, adjusted beef content and for third party country (intermediary) trade (Carcass Weight Equivalent, tonnes)



Belgium imported leather and products containing leather from a total of 165 territories between 2013-17. Direct imports are from a wide range of countries, with only Germany (an average of 8,000 tonnes per year, 22% of the total) and France (4,000 tonnes, 12%) being responsible for more than 10% of imports (Figure 61).

All the countries from which Belgium imports leather produce, import and export leather goods. This means that some of the leather in products imported by Belgium originates in third-party countries. With provenance adjusted to account for these indirect imports (see Section 2.2), the greatest quantities come from Germany (exporting an average of 5,600 tonnes of hide equivalent each year, 16% of the total), France (4,200 tonnes, 12%), Ireland and the USA (both 3,500 tonnes, 10%). Almost one quarter (24%) is from countries contributing less than 2% of the value of leather, or remained unassigned during the provenance adjustment (i.e., was imported by Belgium's major suppliers from 'other'

countries). There is notable volatility in the provenance of leather imports, with the quantities imported from many countries varying dramatically from year to year (Figure 62).

Figure 61: The quantity of leather imported by Belgium from direct trading partners 2013-17 (Hide Equivalent, tonnes)

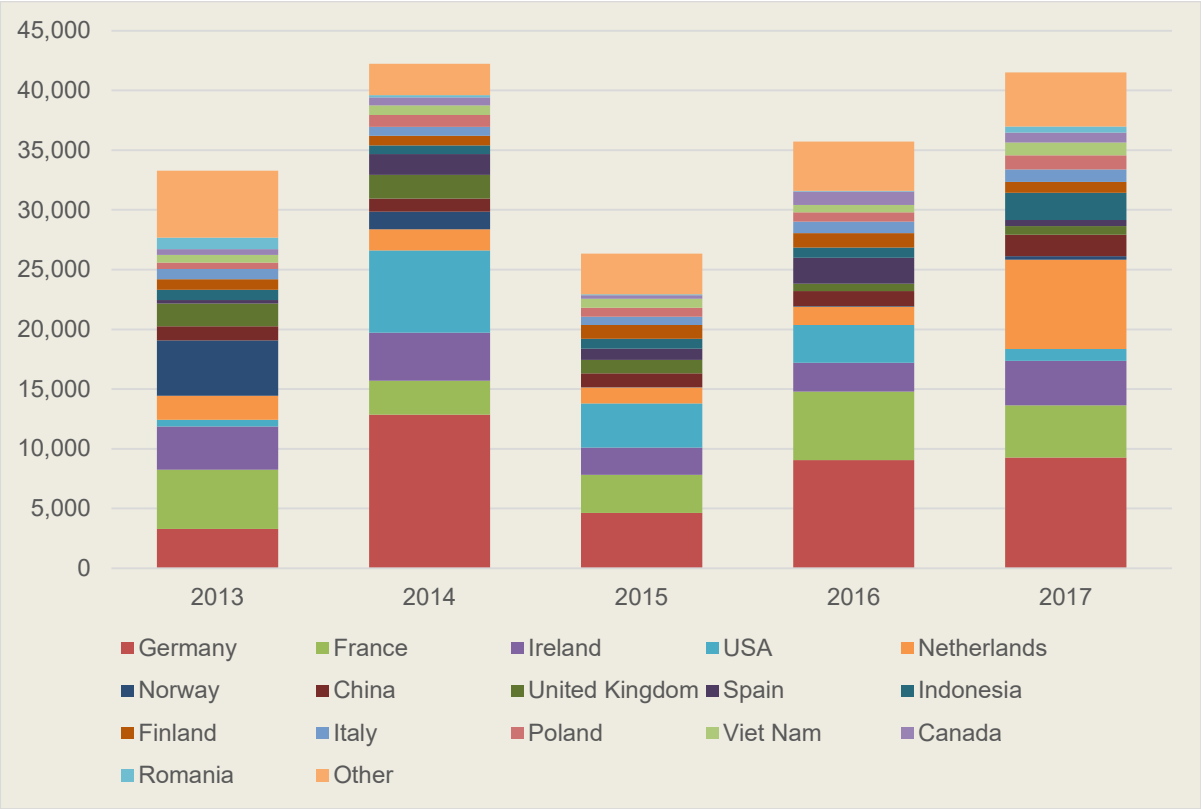
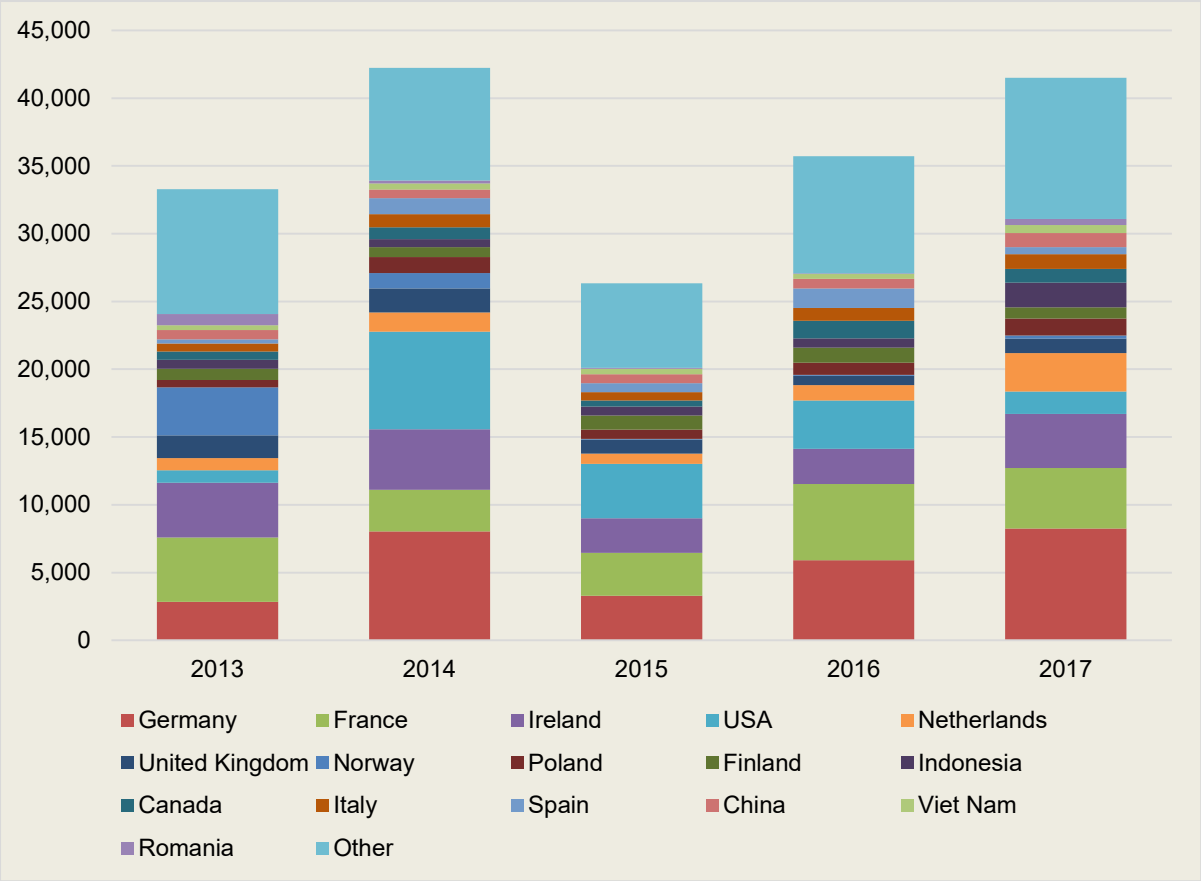


Figure 62: The provenance of Belgium's imports of leather 2013-17, adjusted leather content and for third party country (intermediary) trade (Hide Equivalent, tonnes)



8.4.1 Estimated consumption

Using the HS codes for fresh, chilled and frozen beef only, to allow comparison with production figures (see Appendix 8 for details), we estimate that Belgium exports an average of at least 140,000 tonnes of beef each year. With Belgium having a domestic production in excess of 263,000 tonnes, this is equivalent to consumption of approximately 175,000 tonnes of beef each year. Belgium is therefore a net exporter of beef, with imports being equivalent to 30% of consumption, a similar result to the FAO's estimate of 'supply' for 2013, which is 174,000 tonnes (30% of imports).[225]

The most recent FAO data on production of hides from Belgium is from 2011, and cannot be considered comparable with the time series used in this study to allow for an estimate of consumption.

8.5 Belgium's beef and leather footprint

To estimate the land area required to supply Belgium with beef and leather, the total area of pasture in each was assigned to different grazing animals based on the relative feed conversion efficiencies and overall sector production (see Section 2.4.2). This provided an estimate of the area of pasture allocated to beef cattle in each country. Given that beef cattle have two products (meat and leather), we further allocated this pasture to beef and leather co-products on the basis of their mass (since hide comprises 15% of the mass of a sold carcass,[226] it was allocated 15% of the cattle pasture allocation). This was to avoid the potential double-counting of land where beef and leather where sourced from the same country.

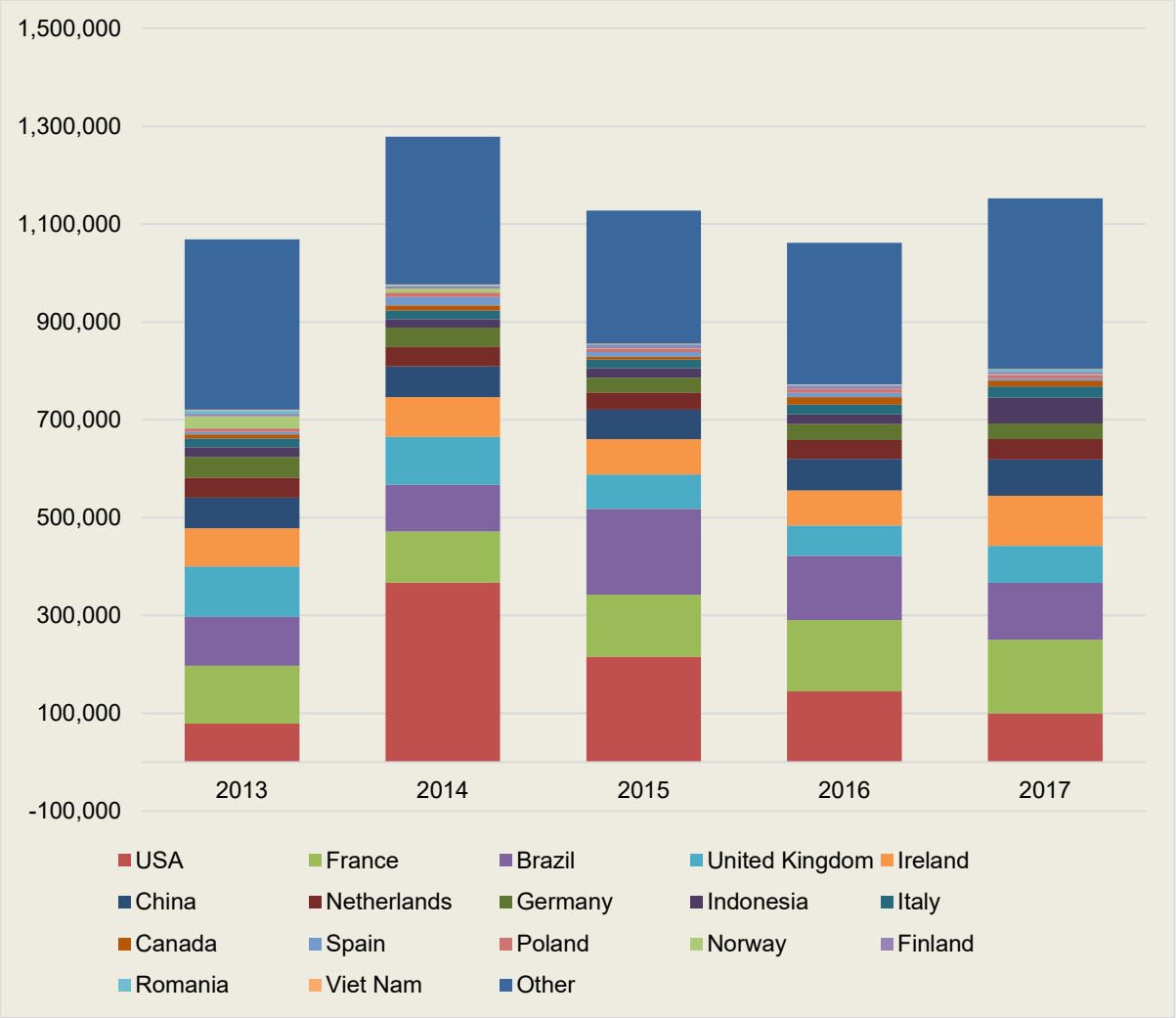
The estimated land area required to satisfy Belgium's demand for beef and leather was 1.4 million hectares per year between 2013-17 (Figure 63). Belgium has a total pasture area of approximately 570,000 hectares,[227] of which over half (308,000 hectares) can be allocated to beef cattle. The land required overseas to supply beef and leather to Belgium is thus equivalent to 37% of Belgium's total area of pasture, or twice the area of Belgium's beef cattle pasture.

The USA contributes an average of 181,000 hectares each year (16% of the total), France 129,000 hectares (11%) and Brazil 124,000 hectares (11%). A large proportion of the footprint (29%) is from countries contributing less than 2% of the value of beef or leather, or remained unassigned during the provenance adjustment (i.e., imports from 'other' countries to Belgium's major suppliers: 'Other' in Figure 63).

Beef accounts for 59% of the total footprint, with leather responsible for 41%. The disproportionate contribution of leather, which is imported in much smaller quantities than beef, is principally because leather is only 15% of the carcass weight of cattle, and hence requires more cattle and therefore more land to produce the same weight as beef.

[225] Source: FAOSTAT
[226] Agriculture and Horticulture Development Board (2014). AHDB Beef Yield Guide. AHDB, Kenilworth, Warwickshire, UK. http://www.qsmbeefandlamb.co.uk/books/beef-yield-guide/files/assets/common/downloads/beef-yield-guide.pdf
[227] FAOSTAT

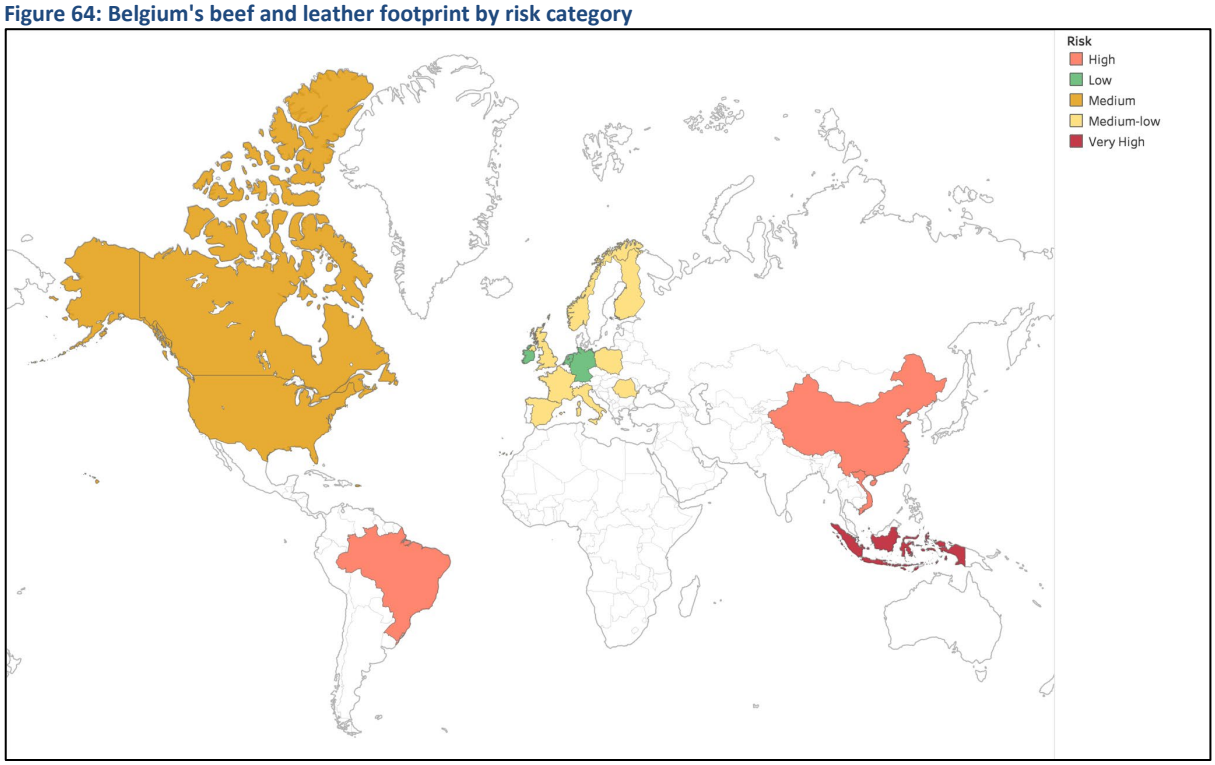
Figure 63: The land area required to supply Belgium with beef and leather (hectares)



8.6 Belgium's beef and leather risk profile

Almost all of Belgium's beef imports are from within the EU countries, including Germany, France, Ireland and the UK. These countries are rated as having low and medium-low risk of deforestation and social issues. However, leather has a different import pattern, coming from a wide range of countries with varied risk ratings. Nineteen per cent of the combined beef and leather footprint comes from very high risk (Indonesia) or high risk countries (Brazil, China, and Vietnam, Figure 64). Apart from Brazil, most of the imports from these countries are of leather, and hence it is with leather that the largest risk of Belgium's imports being associated with deforestation occurs. Part of the unassigned portion of the footprint will also originate in countries with high rates of deforestation, corruption and poor labour practice. Other than some initiatives largely focused on beef from the Brazilian Amazon (Table 11), there is little progress on certification or other supply chain mechanisms that would reduce these risks from other countries.

Figure 64: Belgium's beef and leather footprint by risk category



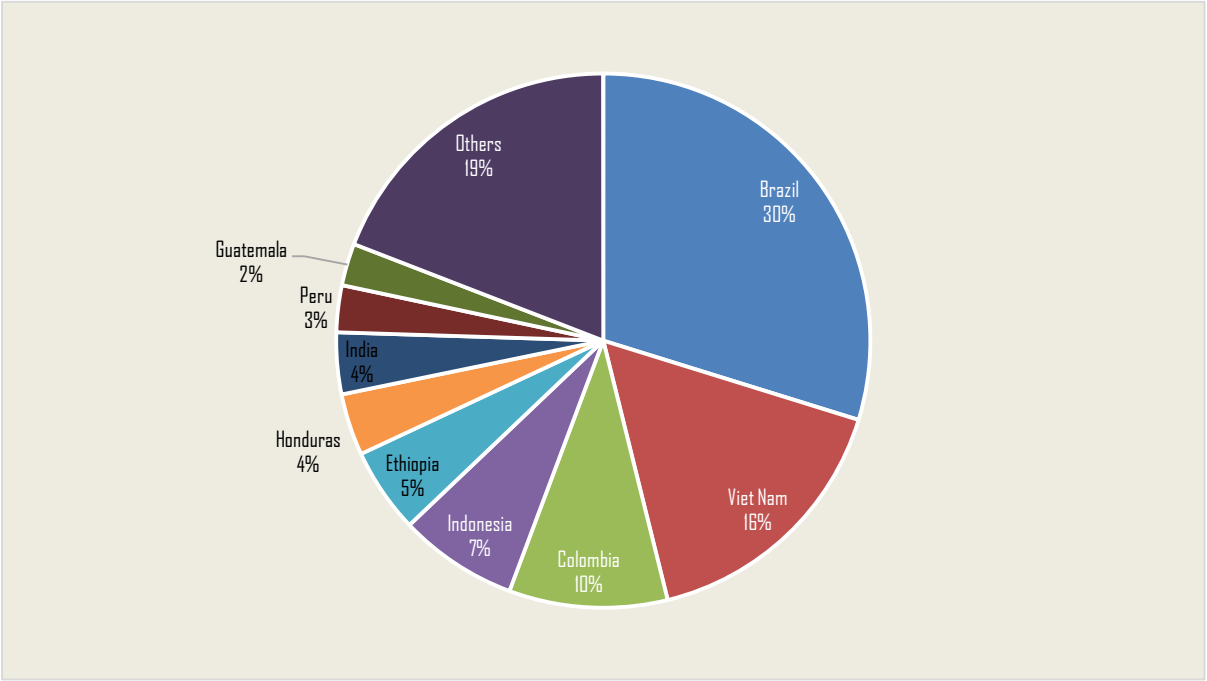
9 Coffee

9.1 Production, uses and sustainability of coffee

9.1.1 Production

Coffee is produced primarily around the equatorial belt, where there is an average temperature of 20°C, fertile soil, sufficient amount of rain, and alternating dry and rainy seasons. Coffee is the world's most widely traded agriculture commodity,[228] and is grown in 80 countries primarily throughout Latin and South America, Central and East Africa, and Southeast Asia. The two major producing countries are Brazil (accounting for 30% of global production) and Vietnam (16%, Figure 65).

Figure 65: Primary coffee producing countries in 2016.



The two main varieties of coffee that are grown are Arabica (*Coffea arabica*) and Robusta (*Coffea canephora*). Arabica varieties comprise 70% of global coffee production while Robusta comprises approximately 30%.[229] Though Arabica coffee is considered to be of higher quality, it has lower yields and is less disease resistant than Robusta. Robusta is typically grown in lower elevations.

Coffee plants take around 3-4 years to bear fruit. Once the fruit (known as coffee 'cherries') are ripe, they are harvested and then processed either by the 'dry method', whereby cherries are dried in the sun for up to three weeks and the pulp and skin is then manually removed, or the 'wet method', where cherries are submerged in water and then pressed through a machine which filters out the skin and pulp. The dried beans are milled to remove the outer

[228] International Trade Center (2011). Trends in the Trade of Certified Coffees. Available at http://www.intracen.org/Trends-in-the-trade-of-certified-coffees/.
[229] Killeen and Harper (2016). Coffee in the 21st Century: Will Climate Change and Increased Demand Lead to New Deforestation?. Conservation International. Available at https://www.conservation.org/publications/Documents/CI-Coffee-Report.pdf.

husk surrounding the bean. Once milled, the beans are referred to as green coffee, and they undergo sorting and grading before being packaged for sale or export.

Coffee production is dominated by smallholders, with an estimated twenty-five million smallholder farmers accounting for approximately 80% of total global coffee production.[230] Coffee is a labour-intensive crop, since coffee cherries ripen at different times, meaning that farmers must usually handpick the cherries so as to select the ripest ones. Labourers are often hired by farmers to assist with the picking process.

9.1.2 End uses

The primary end use for coffee beans is for the coffee beverage, though there is a small but growing use of coffee extract in food products and green coffee bean extract (which is high in chlorogenic acid) for weight loss and dietary supplements. Green coffee beans purchased for coffee production are first tasted for quality before they are roasted to either a light, medium, or dark roast level. The roasted coffee beans are finally ground either to varying levels of coarseness, or sold as whole beans to consumers.

Coffee consumption has been rising steadily around the world, increasing at an estimated rate of 2.5% each year since 2011.[231] Though Europe has traditionally dominated the global market for coffee, emerging demand for coffee is coming primarily from Asia-Pacific.[232] If the current pace of growth continues, global production of coffee will need to double or triple to produce 300 million bags of coffee by 2050.[233]

9.1.3 Environmental and social issues associated with coffee production

Coffee is traditionally grown under shade trees, which shield the coffee bushes from direct sunlight and create a natural barrier against pests. The use of shade trees provides a multitude of ecosystem services, including carbon sequestration, watershed protection, and a habitat for wildlife. However, in the 1970s, there was a movement in Central America towards open-sun coffee production systems to increase yields.[234] Accompanying this move away from shade management was also an uptake in the use of agrochemical inputs (e.g. pesticides) to combat pests and diseases. In regions that switched to intensified forms of coffee production, a decline in biodiversity and increase of deforestation resulted.[235] The expansion of coffee cultivation led to an estimated loss of 0.60 million hectares of forest in Southeast Asia, and 0.21 million hectares in Central America between 1990-2008.[236] Current land use data also indicates that many countries where coffee production is rapidly expanding (e.g. Vietnam, Indonesia, Ethiopia, and Peru) create new land for coffee through

---

[230] Oxfam (2002). Mugged. Poverty in your coffee cup. Oxfam International.
[231] World Coffee Research (2017). Creating the Future of Coffee. Available at https://worldcoffeeresearch.org/media/documents/Annual_Report_2017.pdf; Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018. Available at https://hivos.org/assets/2018/06/Coffee-Barometer-2018.pdf.
[232] Allied Market Research (2017). Coffee Beans Market by Product (Arabica, Robusta, and Others), End Use (Personal Care, Food, and Pharmaceutical) - Global Opportunity Analysis and Industry Forecast, 2017-2024. Available at https://www.alliedmarketresearch.com/coffee-beans-market.
[233] Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018,
[234] Krishnan, S (2017). Sustainable Coffee Production. Oxford Research Encyclopedia. 1-34. Available at http://environmentalscience.oxfordre.com/view/10.1093/acrefore/9780199389414.001.0001/acrefore-9780199389414-e-224.
[235] Krishnan, S (2017). Sustainable Coffee Production. Oxford Research Encyclopedia. 1-34. Available at http://environmentalscience.oxfordre.com/view/10.1093/acrefore/9780199389414.001.0001/acrefore-9780199389414-e-224
[236] Vito (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation, European Commission, Technical Report - 2013 – 063. Available at: http://ec.europa.eu/environment/forests/pdf/1.%20Report%20analysis%20of%20imp act.pdf

deforestation, using lightly shaded or full-sun production systems.[237] Given the rapid increase in annual coffee consumption, demand may increasingly be met through these intensified, open-sun production, which return higher yields but causes deforestation, rather than through shaded, agroforestry systems which are less ecologically damaging.

Climate change poses a substantial risk to coffee production, since coffee is a climate-sensitive species. Changes in temperature and rainfall will both increase pressure from pests and diseases and decrease the area suitable for coffee cultivation. A 2015 study predicts that climate change will reduce yields as well as the global area suitable for coffee production by about 50% across emission scenarios, with impacts being greatest in countries with low altitudes.[238] In particular, the largest coffee producing countries, Brazil and Vietnam, are expected to experience substantial reductions in the area of land suitable for coffee by 2050. The increasing likelihood of damages to coffee production caused by climate change will pose a large threat to smallholder farmers, who rely on coffee as their main source of livelihood.

There are also significant economic and social issues surrounding coffee production. Economically, world coffee prices have fallen by two-thirds since the early 1980s, and the earning of coffee farmers have halved during that time.[239] This reduction in earnings, combined with decreasing yields, directly threatens the livelihoods of smallholder coffee farmers, and it is becoming questionable whether coffee is still a profitable crop. The majority of the value produced by coffee goes to major retailers and brands rather than the farmers, and it is estimated that farmers only receive 7–10% of the retail price of coffee.[240] Given the pressure to cut economic costs, there are increasing reports of exploitation in coffee production. This includes accounts of debt bondage, child labour, exposure to deadly pesticides, a lack of protective equipment, and workers without contracts from several producing countries, especially Brazil.[241]

In 2016, two of the largest coffee companies, Nestle and Jacobs Douwe Egberts, admitted that the coffee they sourced from Brazil may come from plantations where forced labour is practiced.[242] While the two companies claim not purchase directly from blacklisted plantations with a history of labour violations, they do purchase from exporters and middlemen who might be sourcing the beans from these plantations. Nestle in particular has acknowledged its prior purchase of coffee from two plantations where authorities freed workers from conditions analogous to slavery in 2015.[243] Brands thus have an important role to play in ensuring transparency along their coffee supply chain and that they do not source from farms or plantations where child or forced labour is employed.

[237]Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018.
[238] Bunn et al. (2015). A bitter cup: climate change profile of global production of Arabica and Robusta coffee. *Climate Change*, 129: 89-101.
[239] Sachs et al. (2016). The impacts of climate change on coffee: trouble brewing. The Earth Institute. Available at http://eicoffee.net/files/report/public-supplement.pdf..
[240] World Vision (2016). No Child for Sale: Coffee. Available at http://nochildforsale.ca/wp-content/uploads/2016/04/Coffee_Infographic.pdf.
[241] Danwatch (2019). Bitter Kaffee. Available at https://old.danwatch.dk/en/undersogelse/bitter-kaffe/. Last accessed 28 November 2018.
[242] The Guardian (2016). Nestle admits slave labour risk on Brazil coffee plantations. Available at https://www.theguardian.com/global-development/2016/mar/02/nestle-admits-slave-labour-risk-on-brazil-coffee-plantations..
[243] Danwatch (2016). Bitter Kaffee.

9.1.4 Certification

In comparison to other commodities, the coffee sector has attained the highest levels of certification, with at least one quarter of the world's coffee land being certified. This is driven primarily by increasing consumer demand for certified and ethically produced coffee. The main third-party certification systems for coffee are:[244]

- **4C:** The 4C Code (Common Code for the Coffee Community) is a certification scheme solely for coffee, which is a part of the Global Coffee Platform (GCP). The 4C Code of Conduct aims to improve the social, economic, and environmental conditions of coffee production by promoting 27 'good practice' principles and banning 10 unacceptable practices. The scheme includes third-party verification. 4C has certified over 1.8 million hectares of coffee in 2016, representing 16.6% of the global coffee area and producing almost 2.8 million tonnes of coffee. The countries with the largest areas of 4C certification are Brazil, Colombia, Vietnam, Indonesia, and Peru. 4C certification has grown at the fastest rate of all compliance schemes, with the total amount of 4C coffee area tripling between 2011 and 2016.
- **Fairtrade certification:** Over half of all Fairtrade International certified area is for coffee production. In 2016, almost 1.3 million hectares of coffee land were certified by Fairtrade International (12.4% of the global coffee area), which produced 560,000 metric tons of coffee. The countries with the largest Fairtrade certified areas are Colombia, Ethiopia, United Republic of Tanzania, Peru, and Mexico.
- **Organic:** Almost 882,000 hectares (8% of the global coffee area) were organic certified in 2016, producing an estimated 447,000 tonnes of coffee. Mexico, Ethiopia, Peru, Indonesia, and United Republic of Tanzania are the biggest organic coffee-producing countries, together representing 73% of total organic coffee area.
- **Rainforest Alliance/SAN:** The Rainforest Alliance (RA) certified more than 287,000 hectares of coffee land in 2016, which produced over 500,000 metric tons of RA coffee (5.5% of the global coffee production volume). While the overall RA certified area increased doubled between 2011 and 2016, it dropped by 4% from 2015 to 2016.
- **UTZ:** Over 567,000 hectares of coffee were UTZ-certified in 2016, which represents 5.2% of the global coffee area. UTZ reported an estimated production volume of over 870,000 metric tons or 9.4% of the global coffee production volume in 2016. The countries with the largest UTZ-certified coffee areas are Brazil, Peru, Honduras, Vietnam, Colombia, and India, together comprising almost 70% of the total UTZ certified area.

Combined, these five schemes certified 2.8-5 million hectares in 2016 (the range is provided because many producers are certified by more than one scheme), which represented 25.8-45.3% of the global coffee area. The certified area has increased by almost 80% between 2011-2018.

It should also be noted that private corporations, including most notably Nespresso and Starbucks, have developed their own standards: the Nespresso AAA Sustainable Quality guidelines and the Starbucks C.A.F.E. (Coffee and Farmer Equity) Practices. The objective of both these private schemes is to ensure high-quality sustainable and ethical coffee in the

[244] The following data is from Julia Lernoud, Jason Potts, Gregory Sampson, Bernhard Schlatter, Gabriel Huppe, Vivek Voora, Helga Willer, Joseph Wozniak, and Duc Dang (2018), The State of Sustainable Markets – Statistics and Emerging Trends 2018. ITC, Geneva

companies' supply chains. However, their geographical coverage is low since they cover only Nespresso and Starbucks coffee growers.

Certification schemes have varying criteria on conservation (see Section 4.1.4), with Rainforest Alliance being the only standard to make a commitment to zero deforestation. Rainforest Alliance certified farmers reportedly retain more forest than non-certified producers in Colombia[245] and Ethiopia.[246]

With regards to social and economic measures, both Fairtrade and UTZ include a fixed premium for coffee. For Fairtrade, the fixed premium is € 1.20 per pound of Arabica coffee (plus 30 cents more if they are also organic), whereas for UTZ the fixed premium is only € 0.06 per pound of Arabica coffee and € 0.03 per pound of Robusta coffee.[247] Fairtrade also includes a minimum price for coffee, which varies depending on the coffee type and origin. Fairtrade certification often enables more inclusive democratic processes amongst smallholder farmers, and the inclusion of women in decision making.[248]

However, despite high rates of coffee certification in comparison to other commodities, many smallholder farmers in Africa and Asia still face challenges in attaining certification.[249] Several studies published on the effects of certification on smallholder coffee farmers show mixed results: on the positive side, there has been evidence demonstrating that certification is associated with higher yields, better access to credit, stronger farm organisations, and increased adoption of sustainable farming practices. On the other hand, certification is still unavailable to the poorest and most marginalized smallholders because of the time and costs necessary to meet the schemes' strict production requirements.[250]

To complement third-party and private certification schemes, several global multi-stakeholder initiatives have also been created to promote collaboration in addressing the environmental and social issues of coffee production. The two largest initiatives are the Global Coffee Platform (GCP) and the Sustainable Coffee Challenge (SCC). The Global Coffee Platform was founded in 2016 as a platform for coffee producers, roasters, traders, governments, donors and NGOs to facilitate public-private dialogue, align investments, act collectively on local priorities and critical issues, and scale sustainability initiatives across the sector.[251] It also directly supports national sustainability initiatives in several producing countries, including Brazil, Vietnam, and Indonesia. The Sustainable Coffee Challenge was founded in 2015 by Conservation International and Starbucks, and it is also a collaborative platform across different actors in the coffee supply chain. Its vision is to transition the coffee sector to being fully sustainable by working with its members to create greater transparency, a common vision for sustainability, and stimulate greater demand for sustainable coffee worldwide. The SCC calls for increases in coffee income and profitability, productivity, and greater environmental protections against deforestation. In comparison to the certification schemes, these initiatives seek to make changes in the coffee sector through multi-stakeholder collaboration and investment.

---

[245] Rueda, X, Thomas, N.E., & Lambin, E.F. (2015). Eco-certification and coffee cultivation enhance tree cover and forest connectivity in the Colombian coffee landscapes. Regional Environmental Change 15, 25–33
[246] Takahashira, R. & Todo, Y. (2014). The impact of a shade coffee certification program on forest conservation using remote sensing and household data. Environmental Impact Assessment 44, 76-81
[247] SCAA Sustainability Committee (2009). *Sustainable coffee certifications: a comparison matrix*. Available at https://www.scaa.org/PDF/SustainableCoffeeCertificationsComparisonMatrix.pdf
[248] Petrokofsky, G. & Jennings, S. (2018). The effectiveness of standards in driving adoption of sustainability practices: A State of Knowledge Review. ISEAL Alliance
[249] Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018.
[250] Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018.
[251] The Global Coffee Platform Website. Available at https://www.globalcoffeeplatform.org/about-new/. Last accessed 28 November 2018

9.1.5 The EU and Belgium's responses to environmental and social issues with coffee

There are no coffee-specific EU sustainability initiatives, which has resulted in significant variation in the levels of certification and sustainable sourcing across different European markets. In Northern Europe, especially, there has been a trend for increasing consumer awareness of and demand for certified coffee. Countries such as Sweden, Norway, Denmark, the Netherlands, and Germany have large and growing certified coffee markets.[252] Coffee roasters and retailers in Norway, Sweden, and in the Netherlands have also made long-term commitments to sustainable sourcing and are starting to interact directly with coffee farmers in Africa to create shorter and more transparent supply chains.[253]

In comparison, although demand for high-quality and sustainable coffee is growing, the certified coffee market in Belgium still remains relatively small.[254] A 2017 report by Euromonitor Consulting and the Belgian Development Agency (BTC) finds that this is largely because of cost concerns: Belgian consumers are price sensitive and find the costs of certification to be too high, especially if the quality of the coffee is not higher as a result, and the environmental, economic, and social benefits of certified coffee are not fully understood.[255]

A 2016 Market study carried out by the Trade for Development Centre (TDC) of the Belgian Development Agency (BTC) surveyed 56 retail outlets in Belgium to estimate the share of certified products and labels being sold in supermarkets. It found that 22% of all coffee sold in the surveyed supermarkets were certified by one of these labels. The certification scheme with the greatest supermarket presence was UTZ, followed by Fairtrade, Bio (Organic), and, to a lesser extent, Rainforest Alliance.[256] Belgium's comparatively low levels of coffee certification are, in part, because leading coffee brands Jacobs Douwe Egberts (JDW) and Nestle – which together accounted for 41% of coffee sold in 2016 – have not signed up for third-party certification schemes in Belgium.[257] In comparison, 45% of Belgian private label coffee (i.e., coffee that is exclusively manufactured for a retailer, to be marketed under the retailer's brand name) is certified, including the brands Rombouts and Ethiquable.

9.2 Trade of coffee

9.2.1 Global Trade

The global trade in coffee is characterised by a predominantly south-north flow of the commodity, with high levels of subsequent trading amongst northern hemisphere countries.

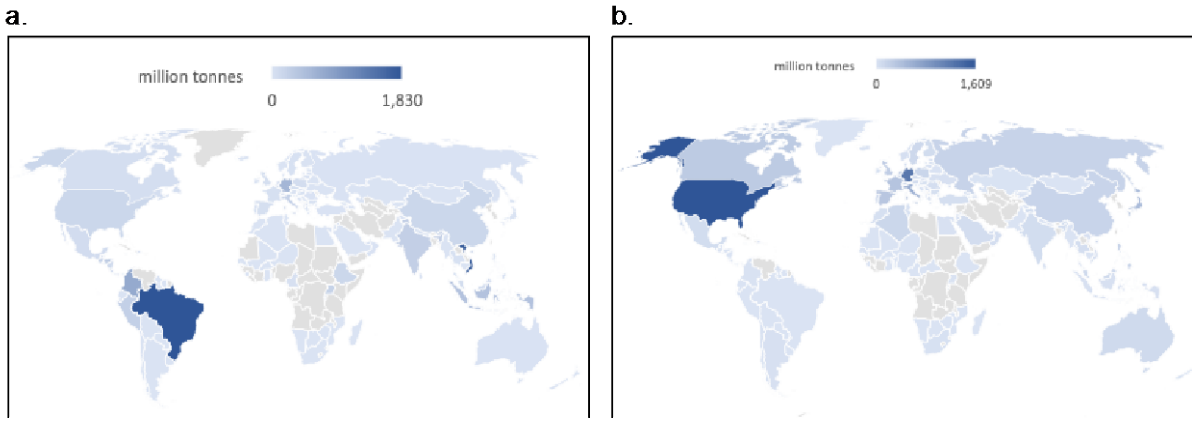
The global export value of coffee was € 28 billion in 2016. Both producer countries and trading countries play a significant role in coffee exports. Brazil and Vietnam are by far the leading exporters, with over 1.8 billion tonnes and 1.7 billion tonnes respectively in 2016 (

[252] Euromonitor International Consulting (2017). Market Research On Certified Coffee Market Potential In Belgium: A presentation compiled by Euromonitor International Consulting for the Trade for Development Centre of the Belgian Development Agency (BTC) and UTZ. Available at http://www.befair.be/drupal_files/public/all-files/brochure/Final%20Report_CERTIFIED%20COFFEE%20MARKET%20POTENTIAL%20IN%20BELGIUM.pdf.
[253] Euromonitor International Consulting (2017). *Ibid*.
[254] Euromonitor International Consulting (2017). *Ibid*.
[255] Euromonitor International Consulting (2017). *Ibid*.
[256] BTC Trade for Development (2016). Market study on the presence of sustainable products in Belgian supermarkets. Available at http://www.befair.be/drupal_files/public/all-files/brochure/Final%20report%20supermarkets.pdf. Last accessed 28 November 2018.
[257] Euromonitor consulting and BTC 2017 market research

Figure 66 a). Germany and Belgium are both within the top ten exporters of coffee, indicating the substantial role of trading countries in international exports. The EU combined exports over 17% of globally traded coffee.

The EU and the USA dominate global imports of coffee, accounting for 47% and 18% of global imports respectively. Germany is the second ranked country, accounting for 14% of all imports, and Belgium is the seventh ranked country (Figure 66 b).

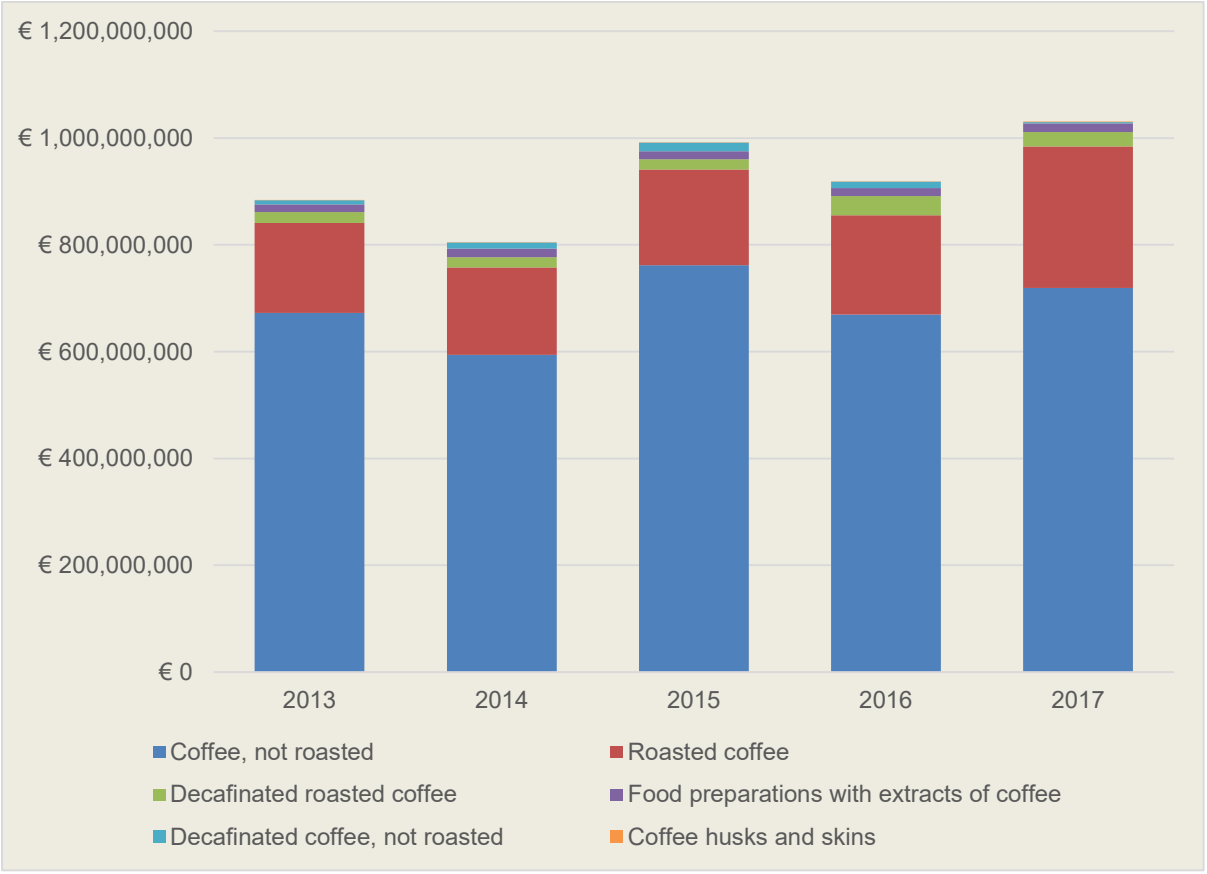
Figure 66: Global trade in coffee in 2016: a. exports, and b. imports (million tonnes)



9.3 Belgium's imports of coffee products

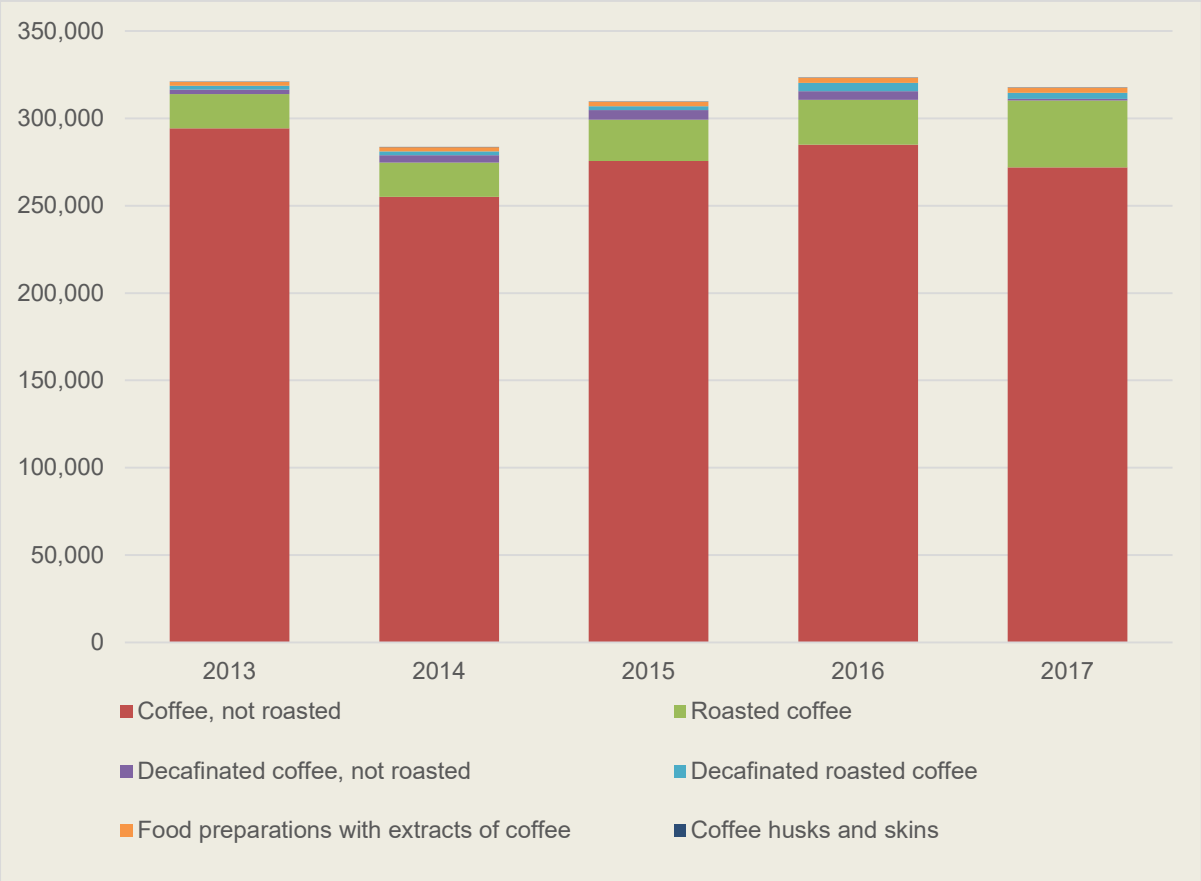
Belgium imported an average of € 926 million of coffee and products containing coffee each year between 2013-17 (Figure 67). Unroasted coffee (74%) and roasted coffee (21%) account for the overwhelming majority of this value, and there is some indication that the value of imports of these two products has increased in recent years (see Appendix 9 for the HS codes used).

Figure 67: The value of Belgium's imports of coffee and products containing coffee 2013-17 (million Euros)



The net weight of imports (not adjusted for coffee content) is similarly dominated by unroasted coffee, with an average of over 276,000 tonnes imported each year (89% of the total weight of imported coffee products. Imports of roasted coffee average 25,000 tonnes per year (8%) and no other product contributes more than one per cent of the total weight of imports (Figure 68).

Figure 68: Quantity of Belgium's imports of coffee products 2013-17, not adjusted for coffee content (tonnes)



When converted to the amount of coffee contained within imported products, Belgium imported an average of over 340,000 tonnes of coffee each year between 2013-17 (Table 14 and Figure 69, see Appendix 9 for HS codes and conversion factors used). This is equivalent to approximately 4% of global production.[258] The quantity of coffee and products containing coffee has changed little over the period. Unroasted coffee contributes the largest tonnage (an average of 276,000 tonnes per year, 81% of the total), with roasted coffee contributing 30,000 tonnes (9%, Figure 70).

[258] FAOSTAT

Figure 69: The quantity of Belgium's imports of coffee and products containing coffee 2013-17, adjusted for coffee content (tonnes)

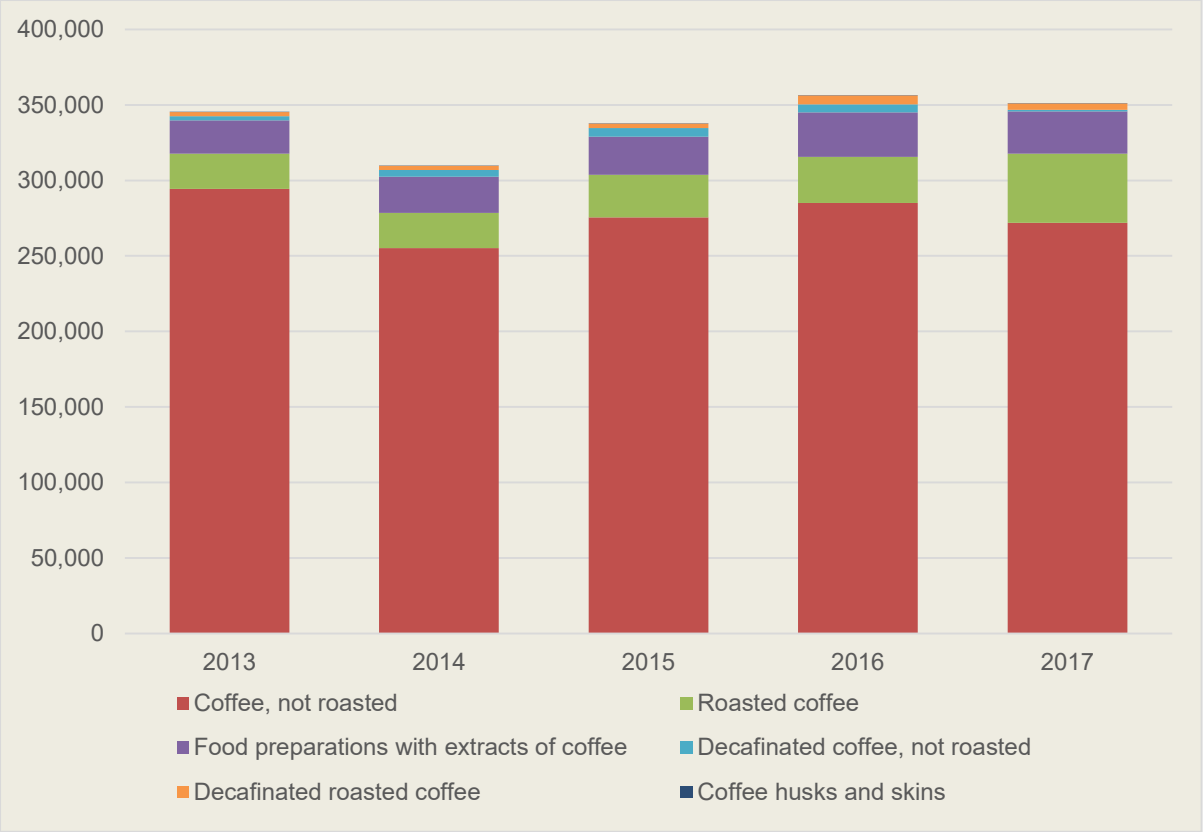


Figure 70: Belgium's imports of coffee. Adjusted for coffee content (tonnes, average 2013-17)

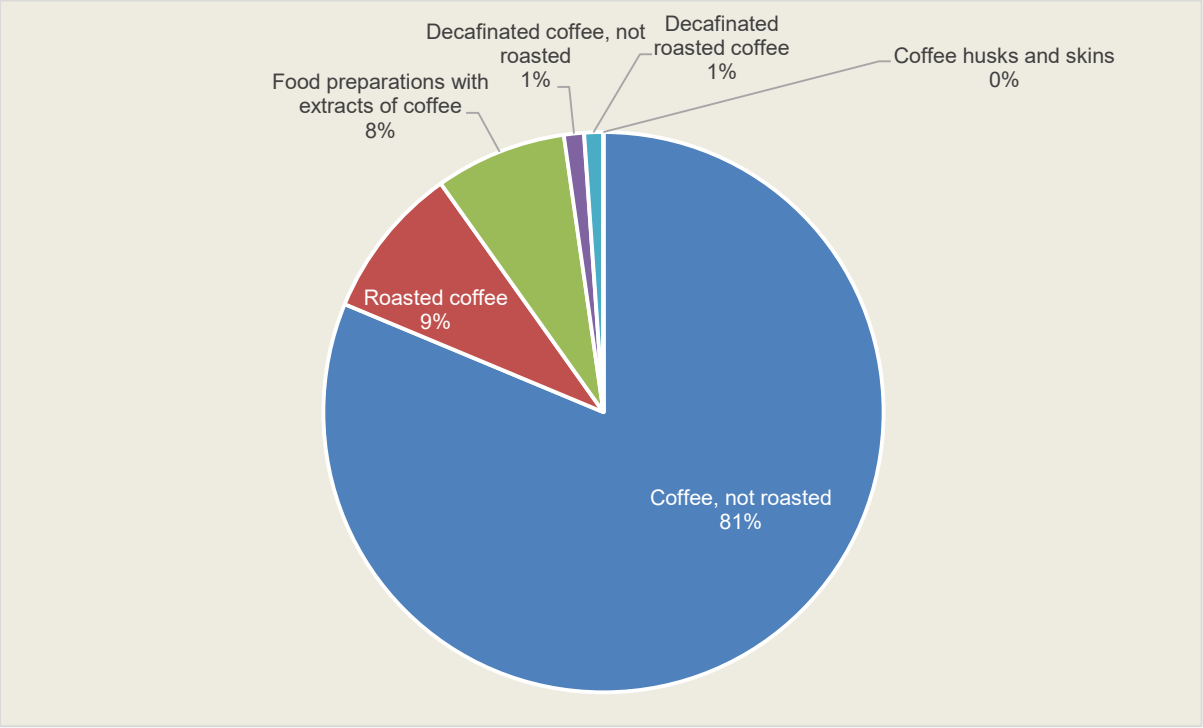


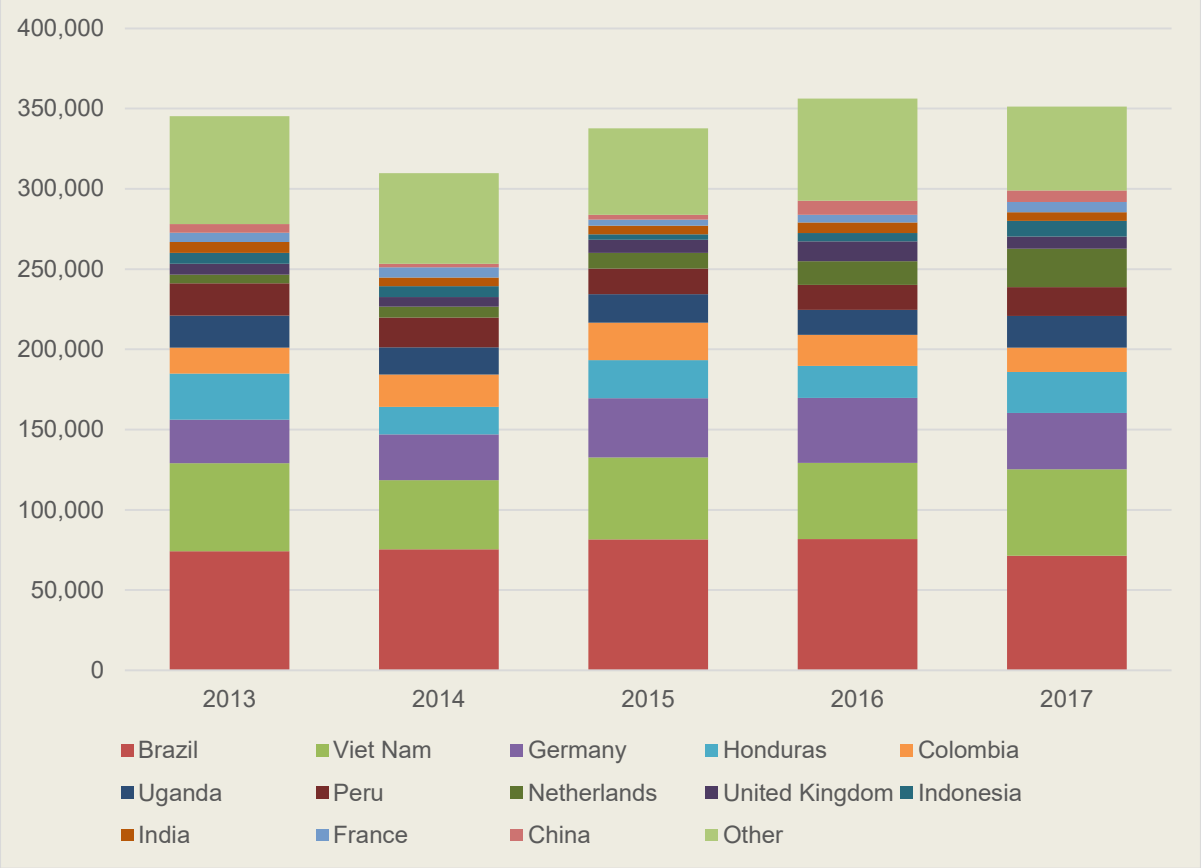
Table 14: Quantity of Belgium's imports of coffee and products containing coffee 2013-17, adjusted for coffee content (tonnes)

HS code	Product	2013	2014	2015	2016	2017	Average	%
090111	Coffee, not roasted	294,441	255,083	275,608	284,997	271,955	**276,417**	**81%**
090121	Roasted coffee	23,154	23,301	28,104	30,514	45,676	**30,150**	**9%**
210110	Food preparations with extracts of coffee	22,065	24,034	25,215	29,497	28,127	**25,788**	**8%**
090112	Decaffeinated coffee, not roasted	2,804	4,517	5,829	5,249	1,006	**3,881**	**1%**
090122	Decaffeinated roasted coffee	2,705	2,714	2,839	5,995	4,307	**3,712**	**1%**
090190	Coffee husks and skins	23	86	28	73	199	**82**	**0%**
	Totals	**345,192**	**309,734**	**337,624**	**356,325**	**351,271**	**340,029**	**100%**

9.4 Provenance of Belgium's import of coffee products

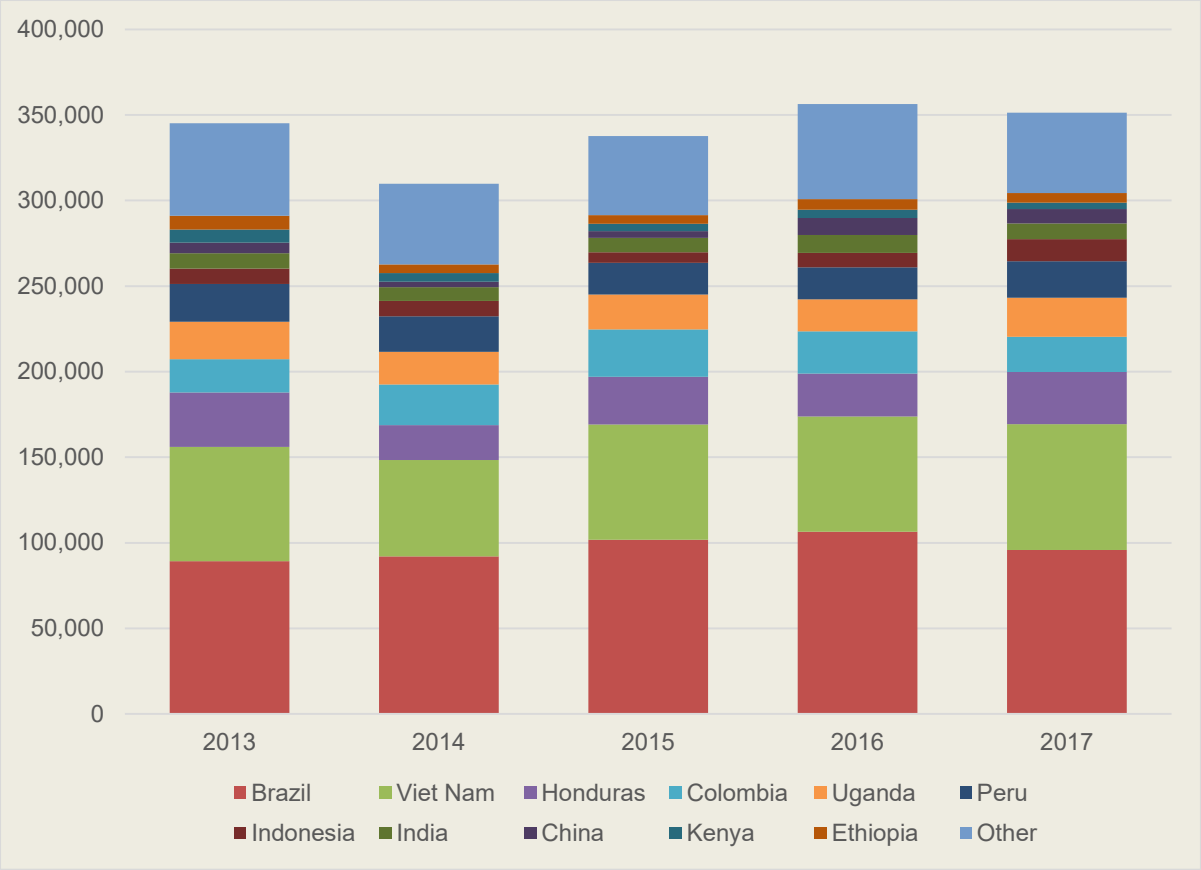
Between 2013 and 2017, Belgium imported coffee and products containing coffee from a total of 112 territories. The major exporters to Belgium include a mixture of producer countries (e.g., Brazil, Colombia, Honduras, Uganda and Vietnam) and countries that are trading coffee or products containing coffee (e.g., the UK, Germany, the Netherlands and the UK, Figure 71). Amongst this latter group, EU countries account for one fifth (20%) of the coffee imported by Belgium. The EU share of imports has increased over the period, from 14% in 2013, to 23% in 2017.

Figure 71: The quantity of Belgium's imports of coffee and products containing coffee between 2013-17 from major exporting countries, adjusted for the content of coffee (tonnes)



As Figure 71 shows, many of the countries from which Belgium imports coffee do not produce it and are solely traders and/or processors of coffee products. This means that some of the coffee in products imported by Belgium originates in third-party countries. With provenance adjusted to account for these indirect imports (see Section 2.2), Brazil remains the main provider of coffee to Belgium (an average of 97,000 tonnes each year between 2013-17, 29% of the total, Figure 72). Vietnam ranks second (66,000 tonnes each year, 19%), and Honduras third with an average of 27,000 tonnes (8%). Compared with some of the other commodities assessed in this report, imports are less dominated by a few producers, with 11 countries contributing 2% or more of imports.

Figure 72: Provenance of Belgium's imports of coffee 2013-17, adjusted for coffee of imported products and for third party (intermediary) countries. (tonnes)



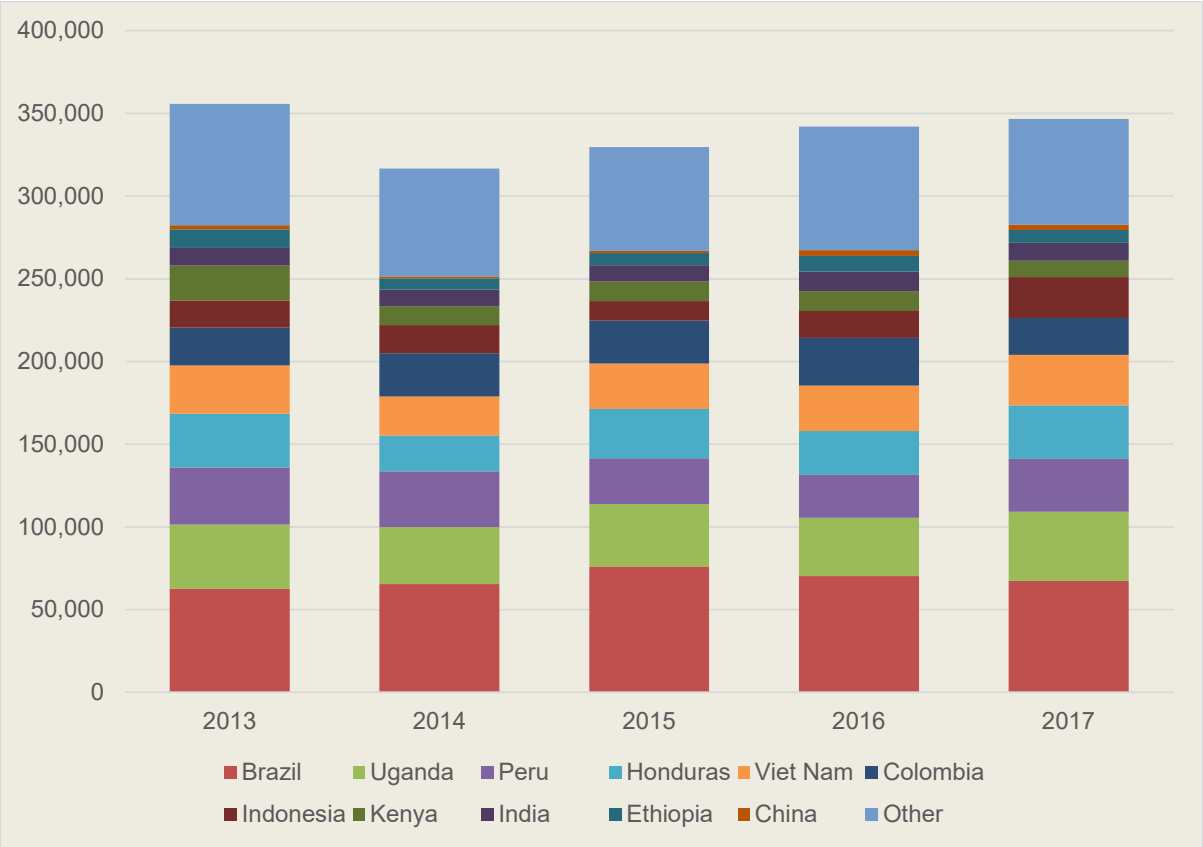
9.5 Belgium's coffee footprint

To estimate the land area required to supply Belgium with coffee, the quantity of raw materials imported from each producer country was divided by the yield from that country for each year.[259]

The estimated land area required to satisfy Belgium's imports of coffee was 338,000 hectares per year between 2013-17 (Figure 73). This is equivalent to just over 3% of the global planted area.[260] The largest footprint is in Brazil (an average of 68,000 hectares, 20% of the total). Significant differences in yield between countries mean that the land area required from Uganda (38,000 hectares, 11%) and Peru (31,000, 9%) is proportionally larger than the quantity of coffee imported by Belgium. By contrast, the higher yields in Vietnam mean that although it supplies the second largest quantity (Figure 72), it is only ranked fifth in terms of land area.

[259] FAOSTAT
[260] FAOSTAT

Figure 73: Belgium's land footprint for coffee (hectares)



9.5.1 Estimated consumption

Using the same HS codes and conversion factors (see Appendix 9 for details), we estimate that Belgium exports an average of 238,000 tonnes of coffee each year. With Belgium having no domestic coffee production, this is equivalent to an estimated average consumption of 102,000 tonnes of coffee each year between 2013 and 2017. This is equivalent to 30% of imports. This estimate is similar but somewhat higher than the FAO's 'supply' estimate of 83,000 tonnes in 2013 (the last date for which data is available).[261]

9.6 Belgium's coffee risk profile

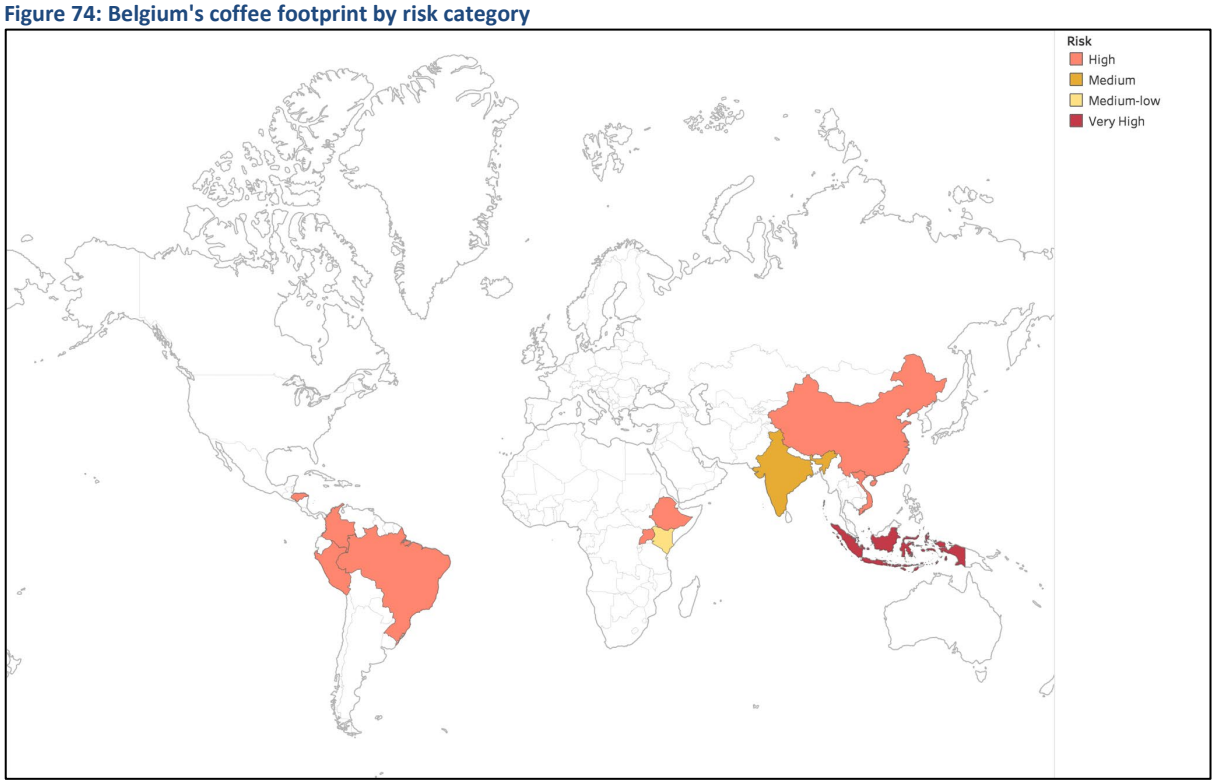
Almost all of Belgium's coffee imports – 73% of the footprint – are from countries rated as having a high or very high risk of deforestation, corruption and poor labour rights. This includes Brazil, China, Colombia, Ethiopia, Honduras, Indonesia, Peru, Uganda and Vietnam (Figure 74). Only India (medium risk) and Kenya (medium-low risk) are outside the highest risk categories (see Table 15). The 'unassigned' portion of the footprint (68,000 hectares) comes from countries with a range of risk profiles, including some high risk ones such as Cameroon, Côte d'Ivoire and Lao PDR.

Certification penetration in Belgium, however, remains low relative to many other northern European nations (see Section 9.1.5), largely because of consumer unwillingness to pay the premium for certified coffee and a lack of awareness surrounding the environmental and social issues associated with coffee production. Given that the majority of Belgium's coffee imports come from countries rated as high or very high risk, increasing rates of coffee certification should be an area of priority in the industry. There are already increasing initiatives from private coffee labels to ensure sustainable sourcing of coffee, but the majority

[261] Source: FAOSTAT

of the coffee sold on the Belgian market is through larger brands (Nestle and Jacobs Douwe Egbert) which have not yet taken steps to attain third-party certification schemes for coffee in Belgium.

Figure 74: Belgium's coffee footprint by risk category



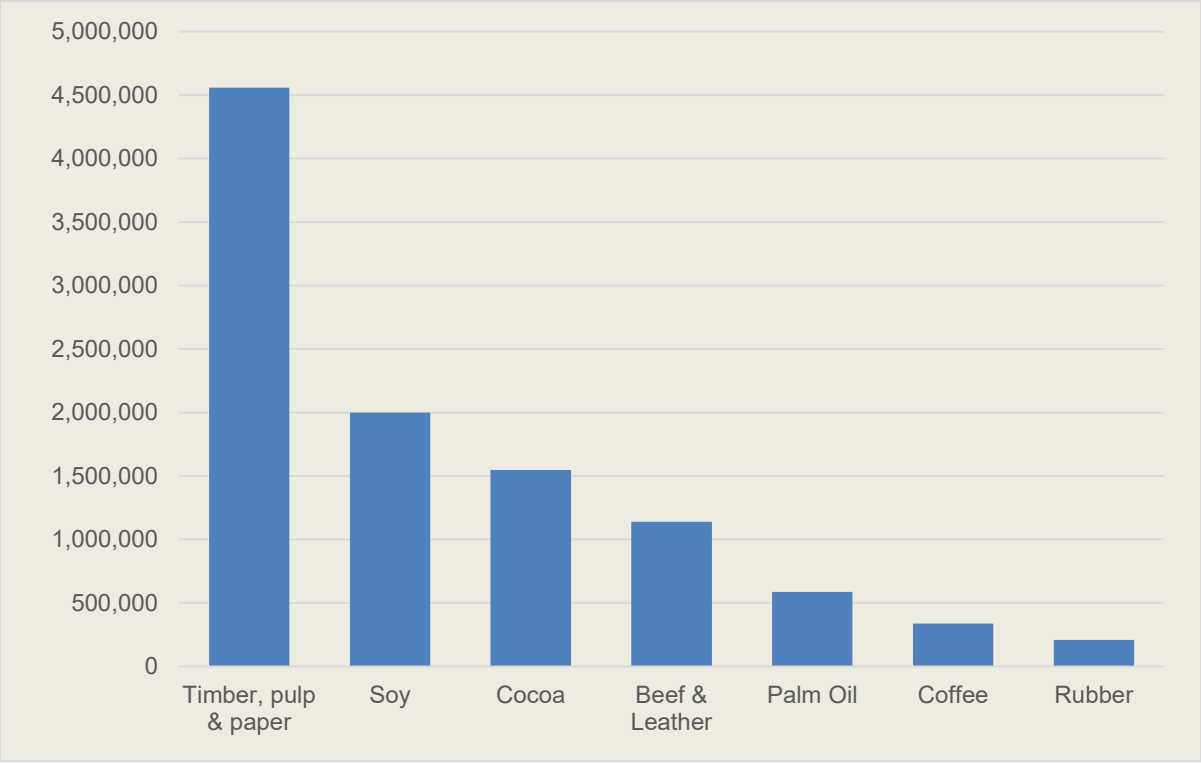
10 Belgium's commodity footprint

10.1 Import footprint

The estimated total land area required to supply Belgium with its imports of beef and leather, cocoa, coffee, natural rubber, palm oil, soy, timber, pulp and paper is shown in Figure 75. The overall land footprint of these commodities averaged 10.4 million hectares each year between 2013-17, an area equivalent to more than three times the area of Belgium, or 15 times the size of Belgium's own forest area.[262] The estimates are likely to be low-end estimates, as the assumptions made in their calculation are largely conservative (e.g., only major product categories of import have been assessed for each commodity, not every possible product).

Timber, pulp and paper had the highest estimated footprint, reflecting the large quantities of these commodities that are imported by Belgium and the low yields of wood (Figure 75). Soy also has a very significant footprint, a result of the large volumes imported by Belgium, principally to supply livestock and poultry industries with feed.

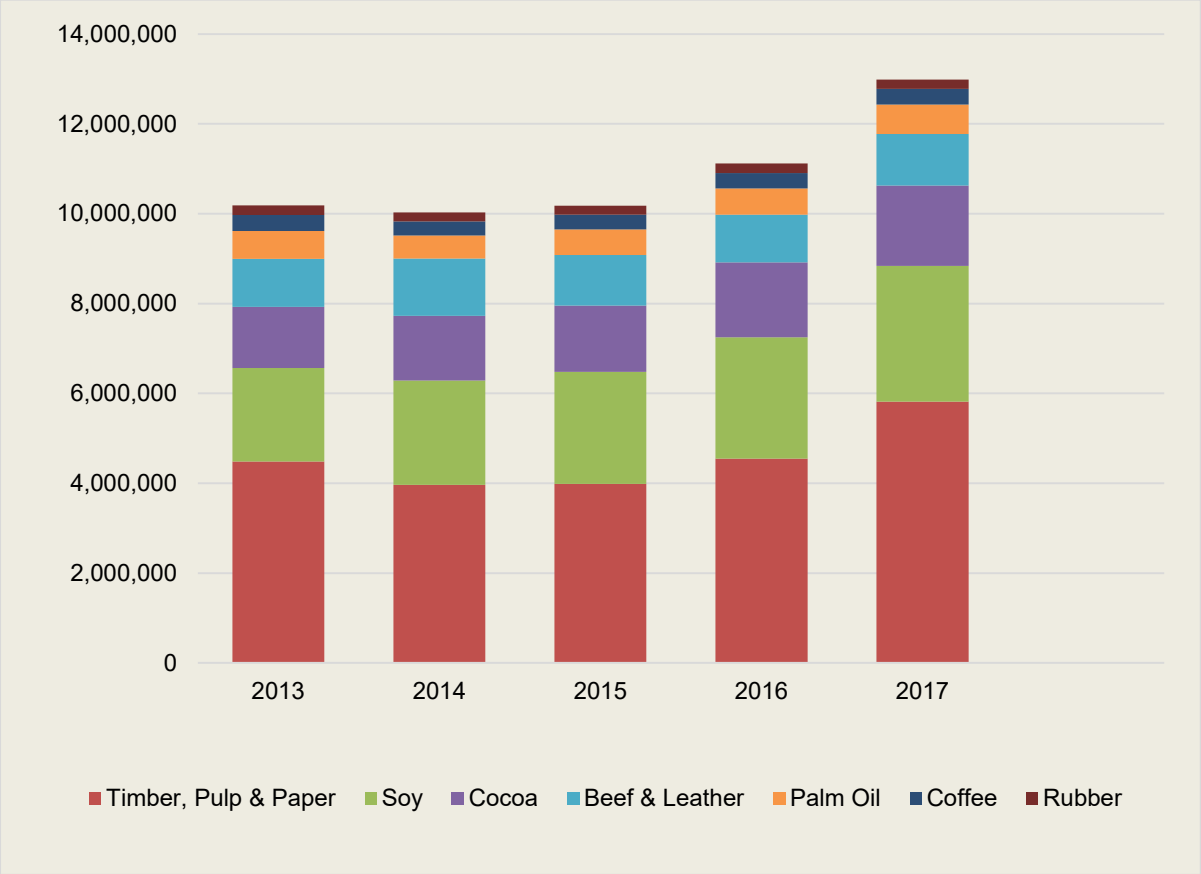
Figure 75: Land area required to supply Belgium with commodities (average of 2013-17, hectares)



There is evidence of an increase in the total land footprint, especially between 2016 and 2017 (Figure 76). This is driven largely by increased imports of timber, pulp and paper, and especially increased imports of wood in the rough, fibreboard, wooden packing cases and paper/paperboard cartons (see Section 3). The land area required to supply Belgium with soy and cocoa has also increased significantly, and the expansion of cultivation of both these crops is directly linked to deforestation in major producer countries. Timber, pulp and paper, soy, and cocoa consistently make the largest contribution to the overall footprint.

[262] FAO (2016) Global Forest Resource Assessment 2015: How are the world's forests changing? Food And Agriculture Organization Of The United Nations, Rome.

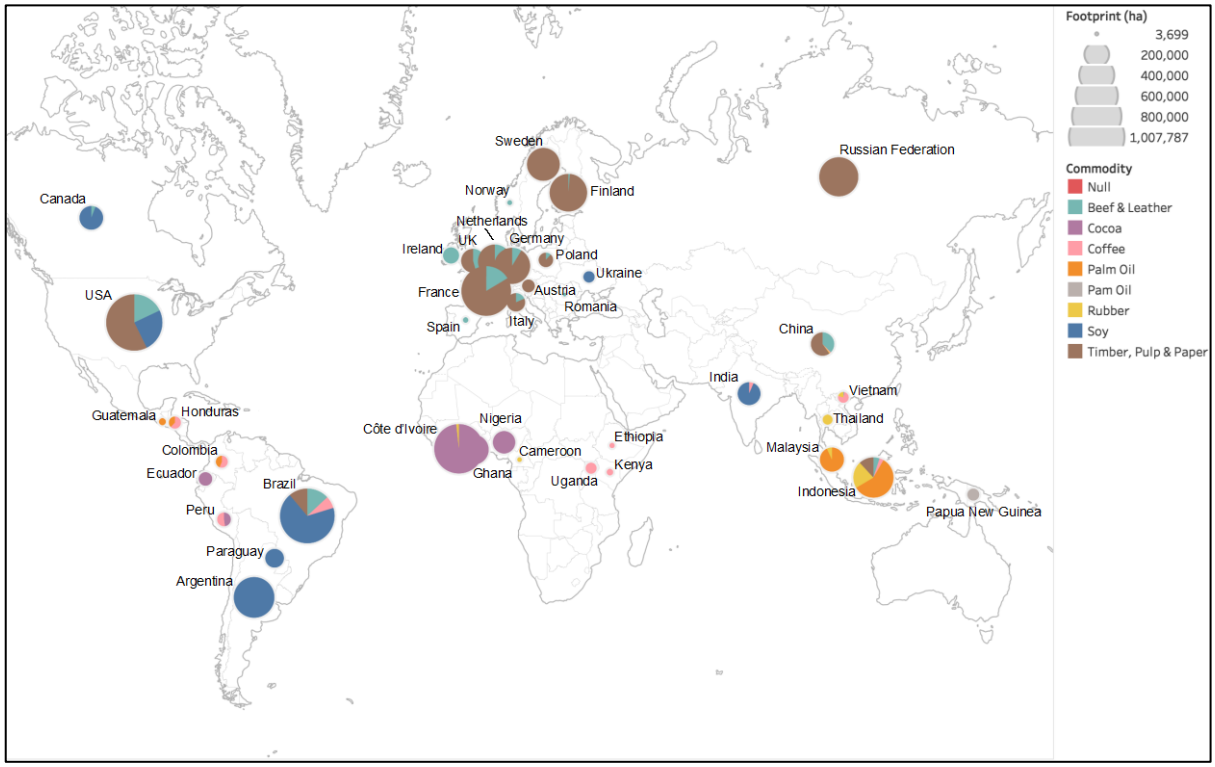
Figure 76: The area of land required to supply Belgium with commodities 2013-17 (hectares)



Six countries have footprints that are over half a million hectares. The largest comes from the USA at just over one million hectares, largely due to imports of timber, pulp and paper, soy, and beef and leather (Figure 77). Belgium's footprint in Brazil is of a similar size, at 949,000 hectares, due to imports of coffee, timber, pulp and paper, soy, and beef and leather. France (785,000 hectares, timber, pulp and paper, beef and leather), Côte d'Ivoire (776,000 hectares, mostly cocoa), Argentina (525,000, soy) and Indonesia (517,000 hectares, coffee, palm oil, timber, pulp and paper, natural rubber, and beef and leather) comprise the other countries where Belgium has footprints greater than half a million hectares.

Other significant footprints in tropical countries include Ghana (284,000 hectares, cocoa) and Malaysia (181,000 hectares of palm oil and natural rubber). In addition to France, EU countries, especially Finland (448,000 hectares) and Germany (414,000 hectares) also contribute significant land areas through their exports of timber, pulp and paper, and beef and leather.

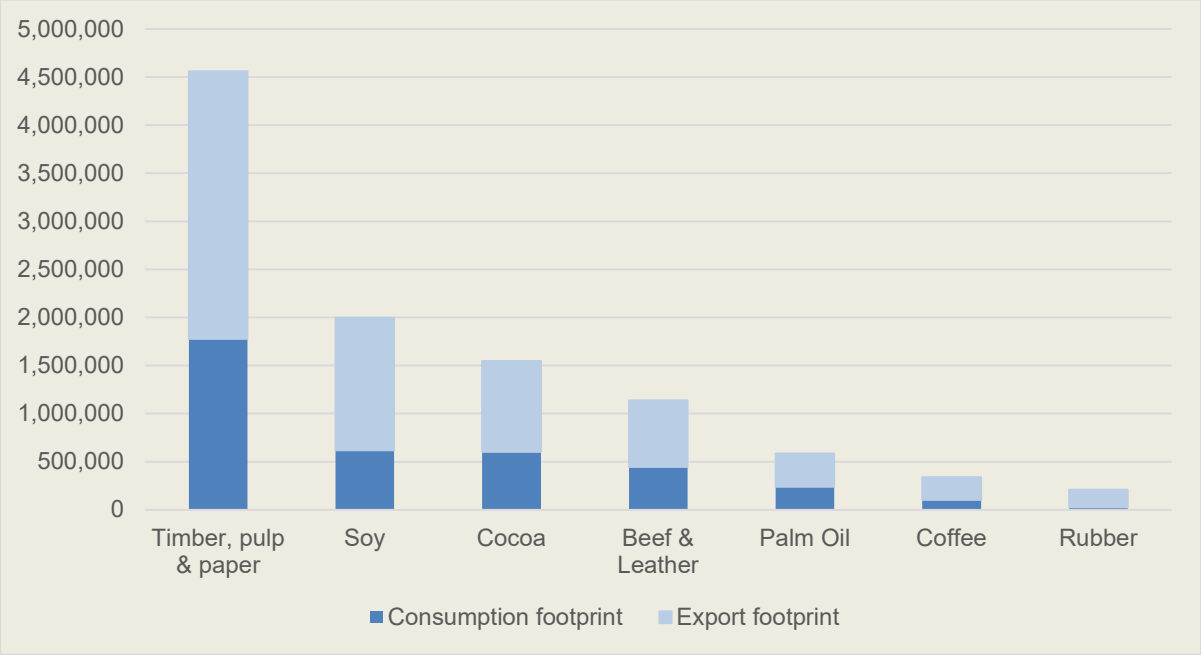
Figure 77: Country footprints for all commodities (hectares)



10.2 Belgium's estimated consumption footprint

The estimated consumption of commodities averages 33% of imports plus domestic production (in the case of beef and leather, timber, pulp and paper). There is considerable variation, from 13% for natural rubber, to 41% for palm oil (see preceding sections). However, the fact that the estimated consumption is below half of imports for all commodities demonstrates the importance of Belgium as a major commodity trading hub. Separating the footprint into a consumption and export components leaves an estimated consumption footprint of 3.8 million hectares (1.2 times the size of Belgium, or five times the area of Belgium's forest) and an export footprint of 6.6 million hectares (Figure 78).

Figure 78:The estimated area of land required to supply Belgium's consumption and export trade (average 2013-17, hectares)



11 Deforestation and social risk

11.1 Country risk rating

The degree of risk of Belgium's imports being associated with deforestation and social exploitation is related to the risk rating of the exporting country and the amount of production in that country that is required to fulfil Belgium's demand for imports.

As described in Section 2.2, each of the countries that contribute at least 2% by value of Belgium's imports of timber, pulp and paper, soy, palm oil, beef and leather, cocoa, coffee or rubber were scored against four risk indicators: tree cover loss, change in the area of natural forest, perception of corruption and labour rights. Scores from each of these indicators were summed to provide an overall indication of the risk of deforestation and negative social outcomes.

The country risk scores and overall risk rating were calculated and are presented in Table 15.[263] Of the 40 countries rated, only four (Austria, Germany, Ireland, and the Netherlands) scored the minimum overall score of four (i.e., low risk for each indicator). These countries are assigned a low risk status. A larger group of countries, including Finland, Spain, and the UK achieved a medium-low risk rating as they typically scored low risk on two or three of the indicators, and medium risk on the remainder. The majority of the countries with a low or medium-low risk rating are within the EU.

Three countries, Indonesia, Nigeria and Paraguay, were rated as very high risk, scoring high on three or all four of the indicators. A further fifteen countries, including Argentina, Brazil, Cameroon, China, Côte d'Ivoire, Guatemala, Malaysia, the Russian Federation and Vietnam were rated as high risk. These countries typically scored high risk on two of the indicators. Note that these risk ratings do not reflect sub-national trends (e.g., if particular region within a country is supplying Belgium, and has a lower or higher rate of deforestation) or commodity-specific factors (e.g., if labour conditions within a particular sector are significantly better or worse than the national picture).

[263] Note that data from different years as well as a different indicator are used in this study compared to the Risk Business report developed for the UK, and so some countries score slightly differently.

Table 15: Country risk ratings for Belgium's major suppliers of commodities associated with deforestation[264]

Country	Tree cover change GFW	Deforestation Rate FAO	Labour standards ITUC	Corruption Perception Index TI	Overall score
Argentina	1,306,691	-5.5%	4	39	10
Austria	61,452	0.6%	1	75	4
Brazil	17,490,377	-1.2%	4	37	10
Cameroon	693,475	-5.6%	4	25	10
Canada	13,606,286	-0.6%	2	82	7
China	3,160,065	1.4%	5	41	9
Colombia	1,219,548	-0.3%	5	37	10
Cote D'ivoire	1,709,634	-0.2%	4	36	10
Dominican Rep.	98,474	7.4%	2	29	6
Ecuador	228,606	-0.2%	5	32	9
Ethiopia	194,389	-2.2%	4	35	9
Finland	1,093,089	0.0%	1	85	6
France	252,840	-4.8%	1	70	6
Germany	111,252	0.1%	1	81	4
Ghana	707,911	0.9%	3	40	7
Guatemala	435,028	-6.5%	5	28	10
Honduras	462,343	-11.6%	5	29	10
India	757,510	0.0%	5	40	8
Indonesia	8,644,155	-4.0%	5	37	11
Ireland	31,414	0.0%	1	73	4
Italy	116,079	3.0%	1	50	5
Kenya	132,609	3.9%	4	28	7
Malaysia	2,504,976	-1.3%	4	47	10
Netherlands	5,206	0.0%	1	82	4
Nigeria	1,052,812	-24.6%	5	27	12
Norway	228,792	-0.5%	1	85	5
Papua New Guinea	643,278	0.0%	N/A	29	8
Paraguay	1,661,490	-9.9%	4	29	11
Peru	1,121,949	-1.4%	4	37	10
Poland	321,602	5.8%	3	60	6
Romania	86,451	5.3%	4	48	6
Russian Federation	24,307,957	-0.1%	3	29	10
Spain	458,841	0.9%	2	57	5
Sweden	1,307,387	-7.6%	1	84	8
Thailand	770,872	1.2%	4	37	7
Uganda	401,819	-25.2%	4	26	9
Ukraine	333,482	1.4%	5	30	8
United Kingdom	137,248	0.0%	3	82	5
USA	10,963,965	0.2%	4	75	7
Vietnam	1,318,507	7.8%	5	35	10

Key to Table 15

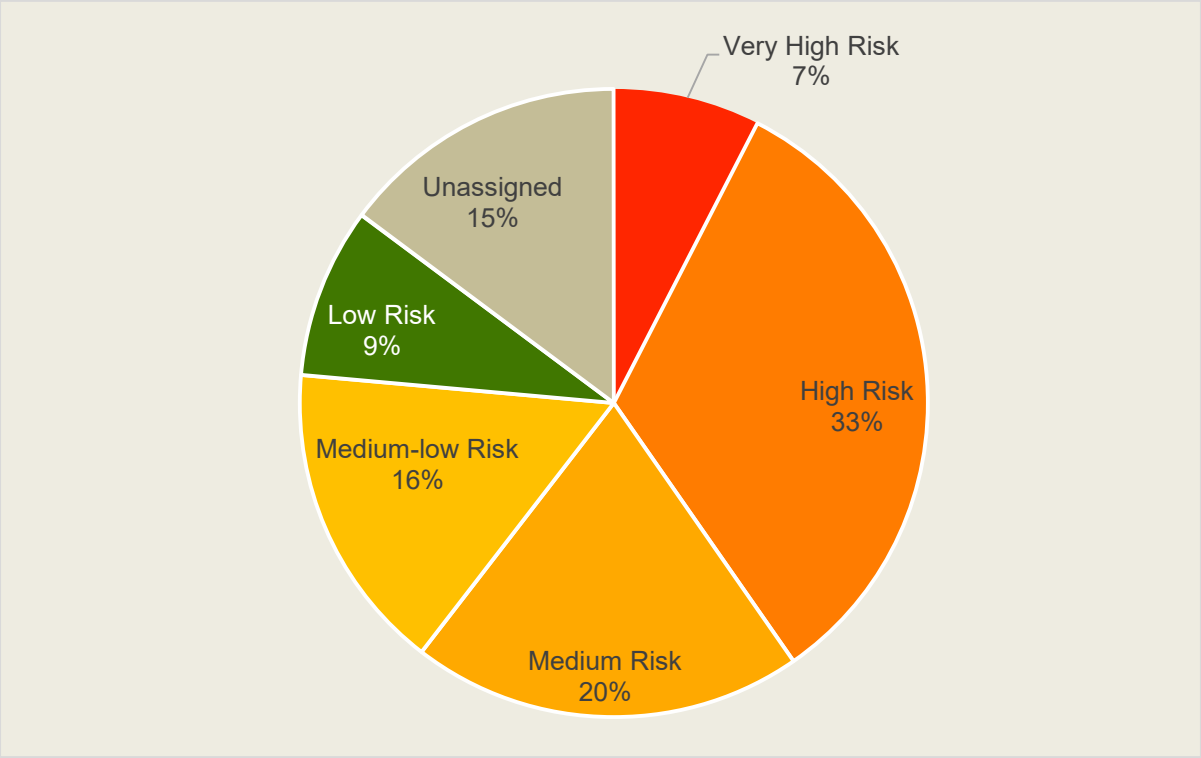
Risk rating	
Very High Risk	≥11
High Risk	9-10
Medium Risk	7-8
Medium-low Risk	5-6
Low Risk	4

[264] Côte d'Ivoire was not rated by the ITUC in 2017, so the 2016 rating was used instead. Papua New Guinea is not rated by ITUC, and is not scored for this indicator, meaning that the overall score is lower than it otherwise would be which reflects the fact that only commodity that it exports to Belgium in quantity is palm oil, which is largely produced by NBOP, widely regards as being one of the best plantations in the world for labour and environmental performance,; and the FAO data assigns no natural forest to the Netherlands, which is scored as zero change on that indicator.

11.2 Overall risk profile

The overall risk profile of Belgium's footprint for the commodities assessed in this report is given in Figure 79. Forty per cent of the land area (4.2 million hectares) is in high and very high risk countries, a land area equivalent to 1.6 times Belgium's own land area, or six times larger than Belgium's forest area). A further 20% (2 million hectares) is in medium risk countries. Just one quarter of the area (2.6 million hectares, 25%) came from countries with low and medium-low risk ratings. The portion that is 'unassigned' is either imports from countries that contributed less than 2% of Belgium's imports of a commodity by value, or imports that were not possible to allocate to a country within the limitations of this study. This portion is likely to come from countries with a range of risk profiles.

Figure 79: Distribution of the Belgium's land footprint for imported commodities amongst risk categories

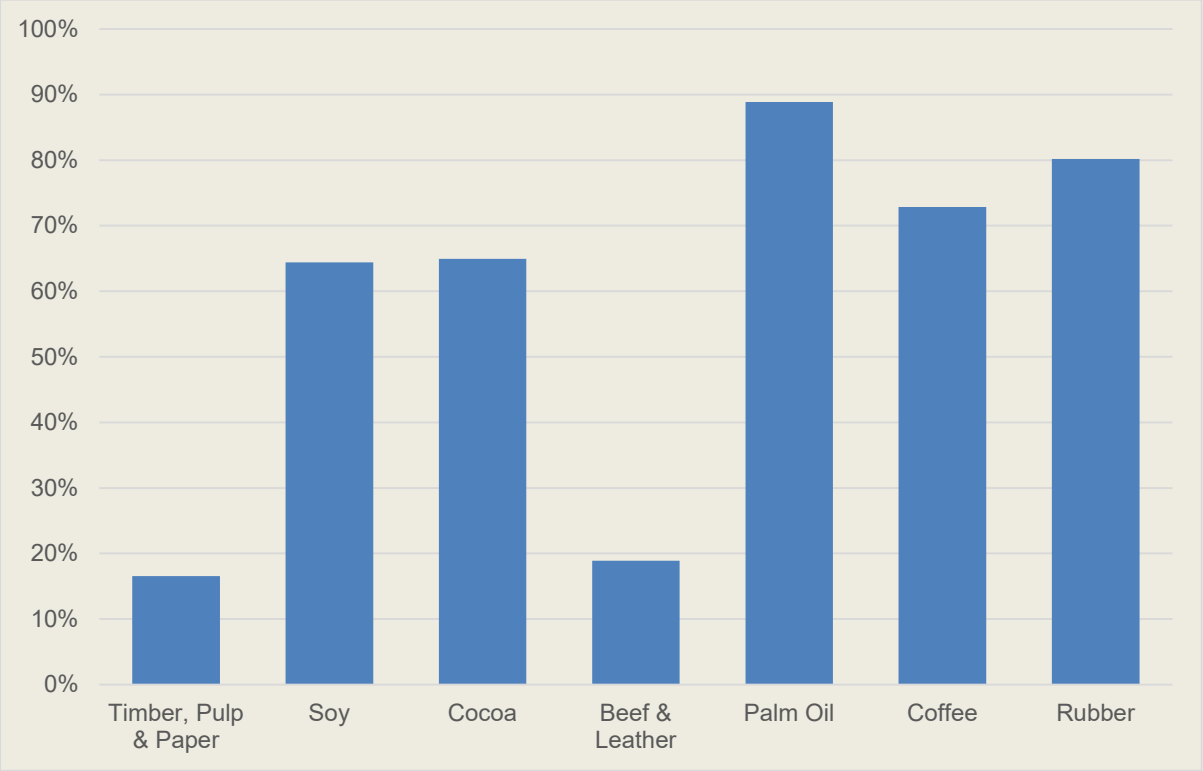


The majority of the footprints of palm oil (89%), natural rubber (80%), coffee (73%), cocoa (65%) and soy (64%) are from high and very high risk countries (Figure 80). Moreover, none of these commodities are sourced from countries with a low risk rating (Table 16). Timber, pulp and paper, and beef (less so leather) are largely supplied from within the EU, and have a much lower proportion of their footprints from high and very-high risk countries.

Table 16: Land requirements for Belgium's imports of commodities by risk category (hectares)

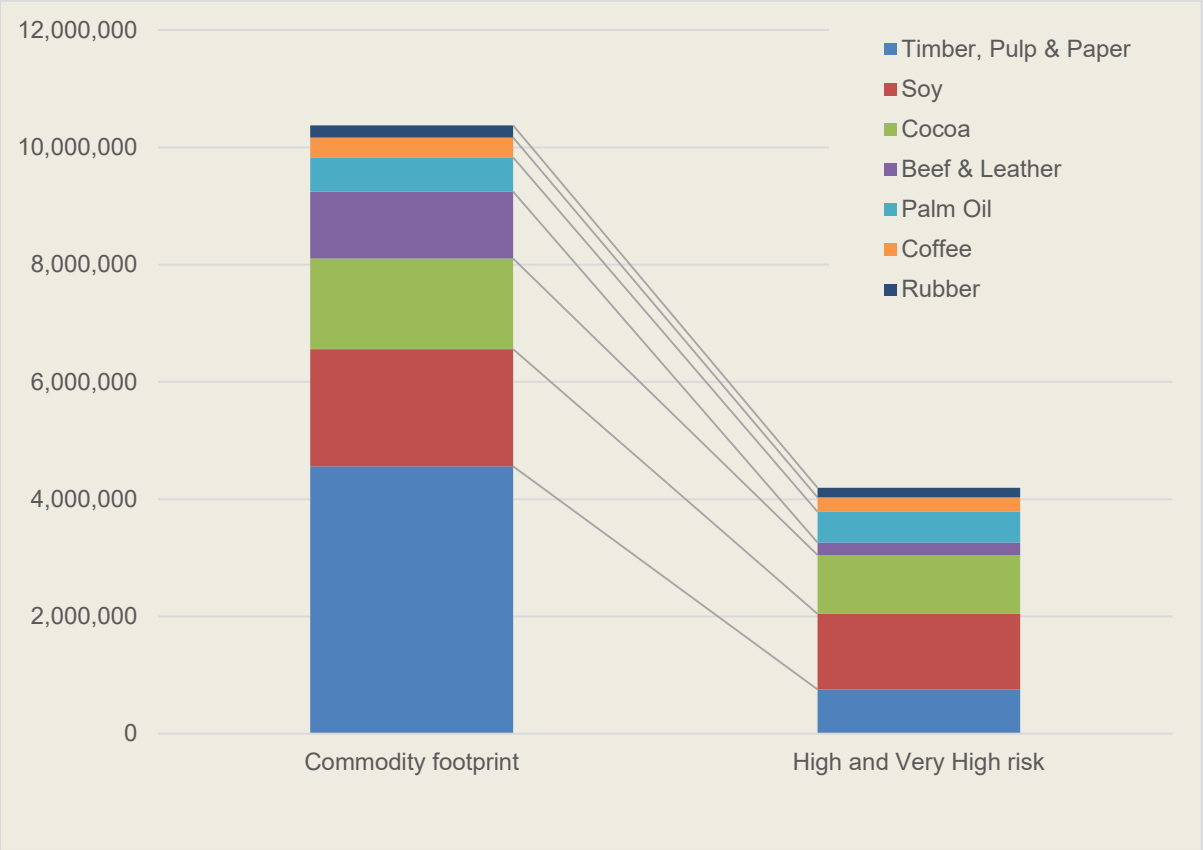
Commodity	Very High	High	Medium	Medium-low	Low	Unassigned	Total
Timber, pulp & paper	61,021	694,259	919,453	1,339,651	752,742	791,833	**4,558,958**
Soy	110,452	1,175,976	610,625	0	0	100,578	**1,997,631**
Cocoa	158,767	846,244	283,969	38,382	0	220,073	**1,547,436**
Beef & leather	25,543	189,489	191,370	263,542	155,818	312,005	**1,137,767**
Palm oil	298,751	222,390	44,710	0	0	20,403	**586,253**
Coffee	17,292	229,029	10,660	13,219	0	67,962	**338,163**
Natural rubber	114,102	53,268	31,127	0	0	10,257	**208,753**

Figure 80: Proportion of the land area of each commodity originating in high and very-high risk countries



Soy contributes 19% (2 million hectares) to the overall footprint, but is responsible for nearly one-third (31%) of the high and very high risk footprint (Figure 81). Cocoa also makes a disproportionate contribution to the high and very high risk footprint, being responsible for 15% of the overall footprint but 24% of the high and very high risk footprint.

Figure 81: Contribution of commodities to Belgium's high and very high risk footprint (hectares)



When the risk profile of each commodity is considered by quantity of imports, a broadly similar picture to that given by the land footprint, with differences reflecting the influence that variation in yield between countries has on land requirements. The provenance of palm oil (89%), coffee (81%), rubber (76%), soy (68%) and cocoa (64%) remain predominantly from very high and high risk countries (Table 17). The quantities of beef and leather (5%) and timber, pulp and paper (10%) from high and very high risk countries decreases somewhat compared with land footprint.

Table 17: Quantity of Belgium's imports of commodities by risk category

Commodity	Unit	Very High	High	Medium	Medium-low	Low	Unassigned
Timber, pulp & paper	m^3	152,552	2,095,549	2,769,102	7,014,611	6,959,203	4,129,149
Soy	tonnes	140,796	1,574,932	690,701	0	0	117,385
Cocoa	tonnes	14,764	314,944	14,366	98,943	0	72,947
Beef & Leather	tonnes	883	9,992	8,804	57,404	98,685	51,760
Palm Oil	tonnes	549,854	409,312	82,288	0	0	37,551
Coffee	tonnes	9,119	266,783	9,014	5,178	0	49,935
Rubber	tonnes	99,247	70,426	48,241	0	0	6,157

12 Conclusions

According to the FAO, a net area of six and a half million hectares of natural forest – an area more than twice the size of Belgium – were lost each year between 2010-2015.[265] Other habitats, such as the *Cerrado* in Brazil, have also been lost at an alarming rate: almost three quarters of the original extent of the *Cerrado* had been lost by 2002,[266] and a further 18,962 km² of the *Cerrado* was converted between 2013 and 2015.[267] Deforestation, forest degradation and habitat conversion causes a loss of biodiversity, often violates the rights of local communities and indigenous peoples, and contributes to climate change. Over 70% of tropical deforestation is driven by commercial agriculture.[268] Moreover, a significant proportion of this deforestation is embedded within the global trade in commodities.

Belgium's imports have undoubtedly contributed to these losses of forest and biodiversity, and to some of the exploitative production practices associated with the production of commodities in various countries. We find that a land area of approximately 10.4 million hectares was needed on average per year between 2013 and 2017 to supply Belgium with palm oil, soy, timber, pulp & paper, beef and leather, cocoa, natural rubber and coffee. This is an area equivalent to more than three times the area of Belgium, or 15 times the size of Belgium's own forest area.[269] The size of this footprint increased in 2016, and had reached nearly 13 million hectares by 2017 (Figure 76).

Forty per cent of this land area was from countries rated as high risk or very high risk from a deforestation and social point-of-view (Figure 79). The commodities that contribute the largest share of this high and very high risk footprint are soy and cocoa (Figure 81).

The commodities Belgium imports include ones grown solely in the tropics (e.g., palm oil, cocoa, natural rubber) as well as ones that are imported from across tropical, temperate and boreal regions (e.g., timber, pulp and paper, beef and leather). The loss and degradation of forest and other habitats in the tropics is a particular concern, as these contain the greatest biodiversity. Loss of tropical forests, or habitats where there are a high proportion of endemic species, can therefore have a greater impact on biodiversity than the conversion or degradation of forest and habitats elsewhere.

For palm oil, soy, cocoa and natural rubber, at least half of the land footprint was from countries rated as high risk or very high risk (Figure 80). In some of these commodities (e.g., palm oil) there are certification schemes with a degree of credibility. For other commodities - for example natural rubber, beef and leather – there are fewer options for managing the risk of deforestation and social exploitation, either because certification schemes lack sufficient market share or because credible schemes do not exist.
Belgium contributes to this land footprint, and to the risk of deforestation and exploitation in two ways. Firstly, Belgium is a significant consumer of many of these commodities, with estimated consumption ranging from 12%-41% of the total 'stock' available to the country

[265] FAO (2016) Global Forest Resource Assessment 2015: How are the world's forests changing? Food And Agriculture Organization Of The United Nations, Rome.
[266] Overbeck, G. E., Vélez-Martin, E. , Scarano, F. R., Lewinsohn, T. M., Fonseca, C. R., Meyer, S. T., Müller, S. C., Ceotto, P. , Dadalt, L. , Durigan, G. , Ganade, G. , Gossner, M. M., Guadagnin, D. L., Lorenzen, K. , Jacobi, C. M., Weisser, W. W., Pillar, V. D. and Loyola, R. (2015), Conservation in Brazil needs to include non-forest ecosystems. Diversity Distrib., 21: 1455-1460. doi:10.1111/ddi.12380
[267] INPE & Funcate. (2017). Anthropization data: The Cerrado between 2013 and 2015. Available at http://combateaodesmatamento.mma.gov.br/analises-no-cerrado
[268] Lawson, S., et al. (2014). Consumer Goods and Deforestation: An Analysis of the Extent and Nature of Illegality in Forest Conversion for Agriculture and Timber Plantations. Forest Trends.
[269] FAO (2016) Global Forest Resource Assessment 2015: How are the world's forests changing? Food And Agriculture Organization Of The United Nations, Rome.

(i.e., imports plus domestic production for those commodities also produced in Belgium). Secondly, Belgium is a major trader – particularly to other countries within the EU – of commodities, products that contain them, or in which commodities have been used in the production process. A quantity equivalent to well over half of the stock of each commodity is exported by Belgium. In effect, Belgium is trading commodities – and gaining economically from that trade – which have a high risk of having been produced at the cost of deforestation and social exploitation.

The EU, the Belgian Government, businesses, NGOs and consumers have taken action to address some of these issues, through initiatives such as the EUTR, purchase of FSC certified timber, and Consumer Goods Forum zero net deforestation commitments, the EU Action Plan Against Deforestation, and the commitments of the Cocoa and Forests Initiative. Yet the problems of deforestation and social exploitation have not gone away, and there are opportunities for the EU, the Belgian Government, companies and consumers to act in order to break the link between Belgium's commodity imports and deforestation and social exploitation.

The research presented in this report is intended to underpin recommendations for policy-makers, businesses, investors in these commodities, and consumers. These are being developed by WWF Belgium and are available in a separate document.

Appendix 1: HS codes used for timber, pulp and paper products

HS Code	Short description	In EUTR scope
4401	Fuel wood	Yes
4402	Charcoal	No
4403	Wood in the rough	Yes
4404	Hoopwood & poles	No
4405	Wood wool	No
4406	Railway sleepers	Yes
4407	Wood sawn lengthwise	Yes
4408	Veneer and ply	Yes
4409	Shaped wood	Yes
4410	Particle board	Yes
4411	Fibreboard	Yes
4412	Laminates	Yes
4413	Densified wood	Yes
4414	Wooden frames	Yes
4415	Wood packing	Yes
4416	Casks	Yes
4417	Wooden tools	No
4418	Joinery & carpentry	Yes
4419	Wooden kitchenware	No
4420	Wood marquetry and inlay	No
4421	Other articles of wood	No
4701	Mechanical wood pulp	Yes
4702	Chemical wood pulp, dissolving grades	Yes
4703	Chemical wood pulp, soda or sulphate	Yes
4704	Chemical wood pulp, sulphite	Yes
4705	Combined mechanical and chemical pulp	Yes
4801	Newsprint	Yes
4802	Uncoated paper and paperboard	Yes
4803	Tissues and napkins	Yes
4804	Uncoated kraft paper	Yes
4805	Other uncoated paper	Yes
4806	Glazed, transparent or translucent paper	Yes
4807	Composite paper and paperboard	Yes
4808	Corrugated paper and paperboard	Yes
4809	Carbon paper	Yes
4810	Paper and paperboard, coated with kaolin	Yes
4811	Paper and paperboard, surface-decorated or printed	Yes
4812	Filter blocks of paper pulp	Yes
4813	Cigarette paper	Yes

4814	Wallpaper	Yes
4816	Other carbon papers	Yes
4817	Envelopes and letter cards	Yes
4818	Toilet paper	Yes
4819	Cartons and boxes of paper and paperboard	Yes
4820	Note books	Yes
4821	Paper labels	Yes
4822	Bobbins and spools of paper	Yes
4823	Other paper and paperboard	Yes
9401 61	Upholstered wooden seats	No
9401 69	Seats with wooden frames, not upholstered	No
9403 30	Wooden office furniture	Yes
9403 40	Wooden kitchen furniture	Yes
9403 50	Wooden bedroom furniture	Yes
9403 60	Other wooden furniture	Yes
9403 90	Furniture parts	Yes
9406 10 00	Prefabricated wooden buildings	No[270]

[270] Note: HS code 9403 90 30 is specified under EUTR but not reported on UN COMTRADE. HS Code 9406 00 20, specified within EUTR does not exist. The description given of this code by them is prefabricated buildings; so code 9406 10 00 is used instead (description Prefabricated buildings; Of wood).

Appendix 2: Factors used to convert imported timber, pulp and paper products into roundwood equivalents

HS code	Short description	Factor	Notes[271]
4401	Fuel wood	1.2	
4402	Charcoal	6	
4403	Wood in the rough	1	
4404	Hoopwood	1.8	Conservative factors for sawnwood used: average of softwood (1.099) and hardwood (2.5)
4405	Wood wool	1.8	Conservative factors for sawnwood used: average of softwood (1.099) and hardwood (2.5)
4406	Railway sleepers	2.26	
4407	Wood sawn lengthwise	1.8	Average of softwood (1.099) and hardwood (2.5) sawn wood factors
4408	Veneer sheets	3.45	
4409	Shaped wood	2.5	'Other manufactured wood' in Forestry Commission factors
4410	Particle board	2.5	'Other wood based panels' in Forestry Commission factors
4411	Fibreboard	2.5	
4412	Laminates	2.5	
4415	Wooden packing cases and pallets	2	
4417	Tools and tool handles	2.5	'Other manufactured wood' in Forestry Commission factors
4418	Builders joinery	2.5	'Other manufactured wood' in Forestry Commission factors
4419	Wooden tableware	2.5	
4420	Wood marquetry	2.5	
4421	Other articles of wood	2.5	'Other manufactured wood' in Forestry Commission factors
4413	Densified wood	2.5	'Other manufactured wood' in Forestry Commission factors

[271] Unless otherwise stated, all conversion factors are from the UK's Forestry Commission https://www.forestry.gov.uk/website/forstats2009.nsf/0/8b4784e90b2a535480257361005015c6

4414	Wooden frames	2.5	'Other manufactured wood' in Forestry Commission factors
4416	Wooden casks and barrels	2.5	'Other manufactured wood' in Forestry Commission factors
940161	Wooden seats (upholstered)	2.5	'Other manufactured wood' in Forestry Commission factors
940169	Wooden seats, not upholstered	2.5	'Other manufactured wood' in Forestry Commission factors
940330	Wooden office furniture	2.5	'Other manufactured wood' in Forestry Commission factors
940340	Wooden kitchen furniture	2.5	'Other manufactured wood' in Forestry Commission factors
940350	Wooden bedroom furniture	2.5	'Other manufactured wood' in Forestry Commission factors
940360	Other wooden furniture	2.5	'Other manufactured wood' in Forestry Commission factors
940390	Wooden furniture parts	2.5	'Other manufactured wood' in Forestry Commission factors
4703	Chemical wood pulp, soda or sulphate	4.5	Bleached sulphate pulp is converted at 6.00, unbleached at 4.50. The more conservative factor is used.
4801	Newsprint	2.8	
4802	Uncoated paper and paperboard	2.8	
4804	Uncoated kraft paper	2.5	Conversion factor used is for 'other paper and paperboard'
4805	Other uncoated paper	2.5	Conversion factor used is for 'other paper and paperboard'
4810	Paper and paperboard, coated with kaolin	2.5	Conversion factor used is for 'other paper and paperboard'
4811	Paper and paperboard, surface-decorated or printed	2.5	Conversion factor used is for 'other paper and paperboard'
4819	Cartons and boxes of paper and paperboard	2.5	Conversion factor used is for 'other paper and paperboard'

Appendix 3: Net Annual Increment values used in timber, pulp and paper footprint calculations

Country	Sector	NAI (m^3/ha/yr)	Notes
Austria	Both	7.1	NAI from FAO GFRA 2015 Desk Reference[272]
Belgium	Both	7.7	NAI from FAO GFRA 2015 Desk Reference
Brazil	Timber	10.3	Various sources[273]
Chile	Pulp and paper	5.8	Pulpwood is likely to derive from pine and eucalypt plantations, so the average for European countries is used
China	Both	3.6	NAI from FAO GFRA 2015 Desk Reference
Finland	Both	4.4	NAI from FAO GFRA 2015 Desk Reference
Germany	Both	11.2	NAI from FAO GFRA 2015 Desk Reference
Italy	Both	3.2	NAI from FAO GFRA 2015 Desk Reference
Netherlands	Pulp and paper	7.3	NAI from FAO GFRA 2015 Desk Reference
Poland	Both	8.0	NAI from FAO GFRA 2015 Desk Reference
Portugal	Pulp and paper	2.6	Average of Italy and Spain used
Russian Federation	Timber	1.3	NAI from FAO GFRA 2015 Desk Reference
Spain	Timber	12.5	Pulpwood likely to derive predominantly from Eucalypt plantations[274]
Spain	Pulp and paper	1.9	NAI from FAO GFRA 2015 Desk Reference
Sweden	Both	3.2	NAI from FAO GFRA 2015 Desk Reference

[272] Net Annual Increment (NAI) data was obtained from FAO (2016). Global Forest Resource Assessment 2015: Desk Reference. Food And Agriculture Organization Of The United Nations, Rome unless otherwise stated.
[273] The FAO does not provide NAI for Brazil. This was calculated as the average of estimates given in D. Alder, J.N.M Silva, JOP de Ca Carvalho, J. do C. Lopes, A.R. Ruschel (2012). The cohort-empirical modelling strategy and its application to forest management for Tapajós Forest, Pará, Brazilian Amazon. Bois et Forets Des Tropiques, 314; D. Valle, M. Schilze, E. Vidal, J. Grogan & M. Sales (2006). Identifying bias in stand-level growth and yield estimations: A case study in eastern Brazilian Amazonia. Forest Ecology and Management, Volume 236, Issues 2–3, pp 127–135 (both Amazon); and http://www.fao.org/3/a-ac121e.pdf (Brazilian pine plantations). The average NAI of all major countries was applied to that portion of Belgium's imports that were from countries with less than 1% of imports by value.
[274] Luis Ugalde and Osvaldo Pérez (2001). Mean annual volume increment of selected industrial forest plantation species. Forest Resources Development Service Working Paper FP/1. Forest Resources Division FAO, Rome (Italy).

United Kingdom	Pulp and paper	7.4	NAI from FAO GFRA 2015 Desk Reference
USA	Pulp and paper	2.9	NAI from FAO GFRA 2015 Desk Reference
Other & Unassigned	Pulp and paper	5.8	Average of other NAI's used
Other & Unassigned	Timber	5.1	Average of other NAIs

Appendix 4: HS codes and conversion factors used for cocoa products in this study

HS Code	Short description	% cocoa	Source
1801	Cocoa beans	100%	
1802	Cocoa shells	100%	
180310	Cocoa paste	100%	
180320	Defatted cocoa paste	100%	
1804	Cocoa fats	100%	
1805	Cocoa powder	100%	
180610	Sweetened cocoa product	25%	The Cocoa and Chocolate Products (England) Regulations 2003, see: www.legislation.gov.uk/uksi/2003/1659/made
180620	Bulk chocolate product	18%	Based on average of underlying Combined Nomenclature (CN) code conversion ratios: 18062010 31% Lower limit in CN code description 18062030 25% Lower limit in CN code description 18062050 18% Lower limit in CN code description 18062070 9.9% Average cocoa content of different chocolate crumbs, see: meadowfoods.co.uk/chocolate-crumb-the-unsung-hero-of-british-chocolate/ 18062080 16% The Cocoa and Chocolate Products (England) Regulations 2003, see: www.legislation.gov.uk/uksi/2003/1659/made 18062095 10% Best estimate
180631	Filled chocolate product	41%	Based on shop research for WWF UK Risky Business
180632	Chocolate product	41%	Based on shop research for WWF UK Risky Business
180690	Other chocolate product	18%	Based on average of underlying Combined Nomenclature (CN) code conversion ratios: 18069011 20% Best estimate 18069019 20% Best estimate 18069031 20% Best estimate

			18069039	20%	Best estimate
			18069050	2%	Best estimate
			18069060	7.4%	Based on shop research
			18069070	41%	Based on shop research
			18069090	10%	Best estimate

Appendix 5: HS codes and conversion factors used for palm oil products in this study

HS Code	Short description	% palm	Source
120710	Palm nuts and kernels	100%	
151110	Crude palm oil	100%	
151190	Refined palm oil	100%	
151321	Crude palm kernel oil	100%	
151329	Refined palm kernel oil	100%	
1517	Margarine	24%	Based on estimate stated in a research report of the UK Department for Food, Environment and Rural Affairs on the palm oil supply chain, see: randd.defra.gov.uk/Document.aspx?Document=EV0459_10154_FRA.pdf
1806	Chocolate	5.15%	Based on estimate stated in a research report of the UK Department for Food, Environment and Rural Affairs on the palm oil supply chain, see: randd.defra.gov.uk/Document.aspx?Document=EV0459_10154_FRA.pdf
190510	Crispbread	2.37%	Based on palm oil content of toast products that are sold in France: sample of 3 products; content of total product minus fat content in other main ingredients (sources are in hyperlinks). Number is halved to correct for products that use different vegetable oils, blends or butter:
190520	Gingerbread	1.00%	Best estimate, based on palm oil content of gingerbread products that are sold in France: sample of multiple products indicates that there is often no palm oil in these products but rapeseed oil and butter *Example products (sources in hyperlinks):* Pain d'epice – Bjorg; Pain d'epice – Carrefour; Pain d'epice - Bonne Maman
190530	Sweet waffles and wafers	10.49%	Based on palm oil content of waffles/wafers that are sold in France: sample of 3 products; content of total product minus fat content in other main ingredients (sources are in hyperlinks). Number is halved to correct for products that use different vegetable oils, blends or butter:

Product	*Total fat (g/100g)*	*Wheat flour content*	*Fat in wheat flour*	*Fat due to wheat*	*Fat due to palm*
Biscotte Heudebert	7.4	96.4%	1.66	1.60	5.80
Narvik Pain Grillé	6.5	86%	1.66	1.43	5.07
Toast brioches	5	No info	1.66	1.66	3.34

<table>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Product</th><th>Total fat (g/100g)</th><th>(Soft) wheat flour content</th><th>Fat in (soft) wheat flour</th><th>Egg content</th><th>Fat in egg</th><th>Fat due to wheat and egg</th><th>Fat due to palm</th></tr>
<tr><td>Lotus Gaufres de Liège</td><td>21.7</td><td>50%</td><td>1.95</td><td>5%</td><td>9.51</td><td>1.45</td><td>20.25</td></tr>
<tr><td>Gaufres moelleuses</td><td>24</td><td>33%</td><td>1.95</td><td>13%</td><td>9.51</td><td>1.86</td><td>22.14</td></tr>
<tr><td>Gaufres au miel</td><td>21</td><td>28%</td><td>1.66</td><td>N/A</td><td></td><td>0.46</td><td>20.54</td></tr>
</table>
</td></tr>
<tr><td>190531</td><td>Biscuits</td><td>9.35%</td><td>Based on palm oil content of biscuits that are sold in France: sample of 3 products; content of total product minus fat content in other main ingredients (sources are in hyperlinks). Number is halved to correct for products that use different vegetable oils, blends or butter:
<table>
<tr><th>Product</th><th>Total fat (g/100g)</th><th>Wheat flour content</th><th>Fat in wheat flour</th><th>Oat content</th><th>Fat in oat</th><th>Fat due to oat and egg</th><th>Fat due to palm</th></tr>
<tr><td>Biscuits Thé</td><td>14</td><td>67.9%</td><td>1.66</td><td>N/A</td><td></td><td>1.13</td><td>12.87</td></tr>
<tr><td>Palmito L'original</td><td>30.5</td><td>58.9%</td><td>1.66</td><td>N/A</td><td></td><td>0.98</td><td>29.52</td></tr>
<tr><td>Good Morning Nature - McVitie's</td><td>16.7</td><td>33.7%</td><td>1.66</td><td>34.4%</td><td>7.03</td><td>2.98</td><td>13.72</td></tr>
</table>
</td></tr>
<tr><td>190532</td><td>Waffles and wafers</td><td>10.49%</td><td>See conversion for HS Code 190530</td></tr>
<tr><td>190540</td><td>Toasted bread products</td><td>2.37%</td><td>See conversion for HS Code 190510</td></tr>
<tr><td>190590</td><td>Other bakers' wares</td><td>1.00%</td><td>Best estimate (very variable)</td></tr>
<tr><td>2105</td><td>Ice cream</td><td>10.00%</td><td>Based on estimate stated in a research report of the UK Department for Food, Environment and Rural Affairs on the palm oil supply chain, see: randd.defra.gov.uk/Document.aspx?Document=EV0459_10154_FRA.pdf</td></tr>
<tr><td>230660</td><td>Palm kernel meal</td><td>100%</td><td></td></tr>
<tr><td>291570</td><td>Palmitic acid, stearic acid, their salts & esters</td><td>100%</td><td></td></tr>
<tr><td>3401</td><td>Soap</td><td>75%</td><td>Based on estimate stated in a research report of the UK Department for Food, Environment and Rural Affairs on the palm oil supply chain, see: randd.defra.gov.uk/Document.aspx?Document=EV0459_10154_FRA.pdf</td></tr>
<tr><td>3826</td><td>Biodiesel</td><td>102%</td><td>Calculations are based on an article by Mekhilef et al. (2011); Renewable and Sustainable Energy Reviews 15</td></tr>
</table>

Appendix 6: HS codes and conversion factors used for soy products in this study

Category	HS Code	Short description	%soy	Source
Soy	120110	Soya seed	100%	
	120190	Soya beans	100%	
	120810	Flours and meals of soya beans	100%	
	150710	Crude soya oil, whether or not degummed	100%	
	150790	Soya-bean oil and its fractions	100%	
	210310	Soya sauce	20%	Wilson, L. A. (1995) "Soy foods." Practical handbook of soybean processing and utilization. 428-459.
	230400	Oil-cake and other solid residues of soya bean	100%	
Beef	010210	Live breeding animals	18%	WWF Soy Report Card, see: d2ouvy59p0dg6k.cloudfront.net/downloads/soyreportcard2014.pdf
	010221	Live pure-bred breeding animals	18%	
	010229	Live cattle	18%	
	010290	Live animals except pure breeding	18%	
	020110	Fresh carcasses	18%	
	020120	Fresh beef meat cuts with bone	18%	
	020130	Fresh boneless beef meat	18%	
	020210	Frozen carcasses	18%	
	020220	Frozen meat cuts with bone	18%	
	020230	Frozen boneless meat	18%	
	020610	Fresh edible offal	18%	
	020621	Tongues	18%	
	020622	Livers	18%	

Poultry	020629	Other frozen offal	18%	WWF Soy Report Card, see: d2ouvy59p0dg6k.cloudfront.net/downloads/soyreportcard2014.pdf
	021020	Preserved beef meat	18%	
	160250	Other preserved beef meat, offal or blood	18%	
	020711	Fresh whole chicken	57.5%	
	020712	Frozen whole chicken	57.5%	
	020713	Fresh chicken cuts	57.5%	
	020714	Frozen chicken cuts	57.5%	
Swine	0203	Fresh or frozen swine meat	26.3%	WWF Soy Report Card, see: d2ouvy59p0dg6k.cloudfront.net/downloads/soyreportcard2014.pdf
	021011	Preserved swine hams and shoulders	26.3%	
	021012	Preserved swine bellies	26.3%	
	021019	Other preserved swine meat	26.3%	
	160241	Prepared swine hams	26.3%	
	160242	Prepared swine shoulders	26.3%	
	160249	Other prepared swine meat	26.3%	
Eggs	040711	Eggs for incubation	30.7%	WWF Soy Report Card, see: d2ouvy59p0dg6k.cloudfront.net/downloads/soyreportcard2014.pdf
	040721	Fresh eggs	30.7%	
	040891	Dried egg	30.7%	
	040899	Preserved egg	30.7%	
Dairy	040110	Low fat milk/cream	1.65%	Correct conversion factor for litre of milk > soy (0.017 - see: www.responsiblesoy.org/contribute-to-change/know-your-soy-print/?lang=en) for the weight of a litre of milk (1.03 kg / litre - see: hypertextbook.com/facts/2002/AliciaNoelleJones.shtml)
	040120	Semi-skimmed milk/cream	1.65%	See conversion for HS Code 40110
	040130	Medium fat milk/cream	1.65%	See conversion for HS Code 40110
	040140	Full fat milk/cream	1.65%	See conversion for HS Code 40110
	040150	Full cream milk/cream	1.65%	See conversion for HS Code 40110
	040210	Low fat milk/cream powder	14.03%	Use same conversion factor as for milk products but multiplied by 8.5 as 8.5 litres of milk are used to produce 1 kg of powdered milk (see: www.quora.com/How-much-milk-is-required-to-produce-1-kilogram-of-powdered-milk)
	040221	Milk/cream powder	14.03%	See conversion for HS Code 40210

	040229	Milk/cream powder (other)	14.03%	See conversion for HS Code 40210
	040291	Unsweetened concentrated milk/cream	3.30%	Use same conversion factor as for milk products but multiplied by 2 as the double amount of milk is used to produce 1 kg of condensate milk (general info).
	040299	Sweetened concentrated milk	3.30%	See conversion for HS Code 40229
	040310	Buttermilk	1.65%	Use same conversion factor as for milk products as this processing limitedly changers milk quantities in the product.
	040390	Buttermilk (other)	1.65%	Use same conversion factor as for milk products as this processing limitedly changers milk quantities in the product.
	0404	Whey	1.65%	Use same conversion factor as for milk products as this processing limitedly changers milk quantities in the product.
	040610	Fresh cheese	8.01%	Use same conversion factor as for milk products but multiplied by 5 as 5 litres of milk are used to produce 1 kg of fresh cheese (see: 3wheeledcheese.wordpress.com/2012/01/19/indian-cottage-cheese-paneer-raw-milk-indian-family-200-years-of-cheese-making)
	040620	Grated/powdered cheese	14.42%	Use same conversion factor as for milk products but multiplied by 9 as 8-10 litres of milk are used to produce 1 kg of cheese (see: cheeseforum.org/forum/index.php?topic=4475.0)
	040630	Processed cheese	14.42%	See conversion for HS Code 40620
	040640	Blue cheese	14.42%	See conversion for HS Code 40620
	040690	Other cheese	14.42%	See conversion for HS Code 40620
Biodiesel	3826	Biodiesel	1026%	(i.e. 10.26 tonnes of soy are required to produce one tonne of biodiesel). Calculations are based on publication of the University of Arkansas, see: www.uaex.edu/publications/PDF/FSA-1050.pdf

Appendix 7: HS codes and conversion factors used for natural rubber products in this study

HS Code	Short description	% rubber	Source
4003	Reclaimed primary rubber	19.6%	Best estimate, based on average of natural rubber estimate of compounded (20.2%) and vulcanised (19.1%) rubber. Note: this HS code most likely comprises of a mixture of scrapes of compounded and vulcanised rubber and synthetic and natural.
4005	Compounded unvulcanised rubber	20.2%	Best estimate, based on general formula of rubber compounding, see: https://www.tut.fi/ms/muo/vert/8_processing/2.3.htm. The rubber industry uses a special unit for expressing the components of a rubber mixture: parts per hundred rubber (phr), to calculate rubber content from phr values the phr rubber value is divided by SUM(rubber + compounding agents (carbon black and oil)); in this example 100/180. This number is corrected for the proportion of natural (36%) vs. synthetic (64%) rubber in France imports.
4006	Unvulcanised rubber articles	20.2%	See conversion for HS Code 4005
4007	Vulcanised rubber threads	19.1%	Best estimate, based on general formula of rubber vulcanisation, see: https://www.tut.fi/ms/muo/vert/8_processing/2.3.htm. The rubber industry uses a special unit for expressing the components of a rubber mixture: parts per hundred rubber (phr), to calculate rubber content from phr values the phr rubber value is divided by SUM(all phr values); in this example 100/190. This number is corrected for the proportion of natural (36%) vs. synthetic (64%) rubber in France imports. Note: vulcanised rubber contains highly variable rubber contents as different degrees of vulcanisation are used for different purposes so this is a best estimate.
4008	Vulcanised rubber	19.1%	See conversion for HS Code 4008
4009	Vulcanised rubber pipes and hoses	19.1%	See conversion for HS Code 4008
4013	Rubber inner tubes	19.1%	See conversion for HS Code 4008
4014	Vulcanised rubber hygienic articles	19.1%	See conversion for HS Code 4008
4016	Other vulcanised rubber articles	19.1%	See conversion for HS Code 4008
4017	Hard rubber articles	19.1%	See conversion for HS Code 4008
5604	Textile covered threads	19.1%	See conversion for HS Code 4008
400110	Latex	100.0%	
400121	Smoked sheets	100.0%	
400122	TSNR	100.0%	

400129	Other natural rubber	100.0%	
400400	Rubber waste and scrap	19.6%	Best estimate, based on average of natural rubber estimate of compounded (20.2%) and vulcanised (19.1%) rubber. Note: this HS code most likely comprises of a mixture of scrapes of compounded and vulcanised rubber and synthetic and natural.
400610	Camel-back strips	19.6%	See conversion for HS Code 400400
401110	Car tyres	14.0%	Based on information that 14% of passenger car tyre is natural rubber, see: http://infohouse.p2ric.org/ref/11/10504/html/intro/tire.htm
8703	Cars	0.51%	Based on the number of imported cars (not weight): assumes that each imported car has five tyres, at an average weight of 7.3 kg and a natural rubber content of 14%
401120	Lorry tyres	27.0%	Based on information that 27% of truck tyre is natural rubber, see: http://infohouse.p2ric.org/ref/11/10504/html/intro/tire.htm
401130	Aircraft tyres	27.0%	Based on natural rubber estimate of lorry tyres (27%)
401140	Motorcycle tyres	14.0%	Based on natural rubber estimate of car tyres (14%)
401150	Bicycle tyres	14.0%	Based on natural rubber estimate of car tyres (14%)
401161	Tractor tyres	27.0%	Based on natural rubber estimate of lorry tyres (27%)
401211	Retreated car tyres	14.0%	Based on natural rubber estimate of car tyres (14%)
401212	Retreated lorry tyres	27.0%	Based on natural rubber estimate of lorry tyres (27%)
401213	Retreated aircraft tyres	27.0%	Based on natural rubber estimate of lorry tyres (27%)
401219	Other retreated tyres	20.5%	Based on average of natural rubber estimate of car (14%) and lorry tyres (27%)
401220	Used tyres	20.5%	Based on average of natural rubber estimate of car (14%) and lorry tyres (27%)
401290	Other tyres	20.5%	Based on average of natural rubber estimate of car (14%) and lorry tyres (27%)
401511	Surgical gloves	19.1%	See conversion for HS Code 4008
401519	Other rubber gloves	19.1%	See conversion for HS Code 4008
401590	Rubber accessories	19.1%	See conversion for HS Code 4008

Appendix 8: HS codes and conversion factors used for beef and leather in this study

	HS code	Short description	Conversion Carcass Weight Equivalent	Source
Beef	0102	Live cattle	0.62	Holland, R., Loveday, D. & Ferguson, K. (n.d.). How much meet to expect for a beef carcass. UT Extension PB 2822. University of Tennessee.
	0201	Fresh of chilled beef	0.66	Holland, R., Loveday, D. & Ferguson, K. (*ibid*)
	0202	Frozen beef	0.66	Holland, R., Loveday, D. & Ferguson, K. (*ibid*)
	020610	Fresh or chilled bovine offal	0.47	Agriculture and Horticulture Development Board (2014). AHDB Beef Yield Guide. AHDB, Kenilworth, Warwickshire, UK. http://www.qsmbeefandlamb.co.uk/books/beef-yield-guide/files/assets/common/downloads/beef-yield-guide.pdf
	021020	Salted or dried beef	0.66	Holland, R., Loveday, D. & Ferguson, K. (op. cit.)
	0504000	Beef and veal tripe	0.03	Agriculture and Horticulture Development Board (2014). (*op. cit.*)
	160210	Homogenised meat preparations	0.66	Holland, R., Loveday, D. & Ferguson, K. (op. cit.)
	160250	Prepared beef	0.66	Holland, R., Loveday, D. & Ferguson, K. (op. cit.)
	160300	Meat extract	2.98	Estimate: assumes any (edible) part of carcass can be used, based on Holland, R., Loveday, D. & Ferguson, K. (*op. cit.*) and is concentrated to approximately 20% of original weight
	210410	Meat broths and soups	0.05	Estimate: products will include other ingredients
			Hide weight	
Leather	4101	Preserved bovine hides	1.000	
	4104	Tanned bovine hides	0.255	Source: http://leatherpanel.org/sites/default/files/publications-attachments/mass_balance.pdf
	410711	Tanned prepared bovine hides	0.255	Source: http://leatherpanel.org/sites/default/files/publications-attachments/mass_balance.pdf
	4115	Composition leather	0.128	European Committee For Standardization published EN 15987:2011 'Leather - Terminology - Key definitions for the leather trade' to stop further confusion about bonded leather. The minimum amount of 50% in weight of dry leather is needed to use the term 'bonded leather'.
	420211	Leather cases	0.230	Estimate, assumed 90% of the weight of the product is leather
	420221	Leather handbags	0.230	Estimate, assumed 90% of the weight of the product is leather
	420231	Leather wallets and purses	0.230	Estimate, assumed 90% of the weight of the product is leather

	420291	Other articles of leather	0.230	Estimate, assumed 90% of the weight of the product is leather
	420310	Leather apparel	0.230	Estimate, assumed 90% of the weight of the product is leather
	420321	Leather sports gloves	0.230	Estimate, assumed 90% of the weight of the product is leather
	420329	Leather gloves	0.230	Estimate, assumed 90% of the weight of the product is leather
	420330	Leather belts	0.230	Estimate, assumed 90% of the weight of the product is leather
	6403	Leather shoes	0.084	Assumes that approximately one third of the weight of a pair of shoes is leather, that 0.28 kg of leather is used per pair (http://www.unido.org/fileadmin/import/userfiles/timminsk/leatherpanel14schmelcosts.pdf)
	940120	Car seats	0.001	Estimated from proportion of leather used globally in car seats: https://ukleather.org/
	940161	Upholstered seats (wooden frames)	0.022	Estimated from proportion of leather used globally in upholstery: https://ukleather.org/
	940171	Upholstered seats (metal frames)	0.022	Estimated from proportion of leather used globally in upholstery: https://ukleather.org/
	8703	Cars and other vehicles	0.006	Estimated from proportion of leather used globally in car seats: https://ukleather.org/

Appendix 9: HS codes and conversion factors used for coffee in this study

HS Code	Short description	Conversion factor	Source
90111	Coffee, not roasted	1	The Coffee Guide[275]
90121	Roasted coffee	1.19	The Coffee Guide
90122	Decaffeinated roasted coffee	1.25	The Coffee Guide
210112	Food preparations with extracts of coffee	10	No conversion factor available. Estimated from recipes for coffee extract.
90112	Decaffeinated coffee, not roasted	1.05	The Coffee Guide
90190	Coffee husks and skins	0.8	The Coffee Guide

[275] The Coffee Guide. International Trade Centre. http://www.thecoffeeguide.org/coffee-guide/world-coffee-trade/conversions-and-statistics/