November 2020

Risky Business:

Deforestation and social risks in Switzerland's imports of commodities

Executive Summary

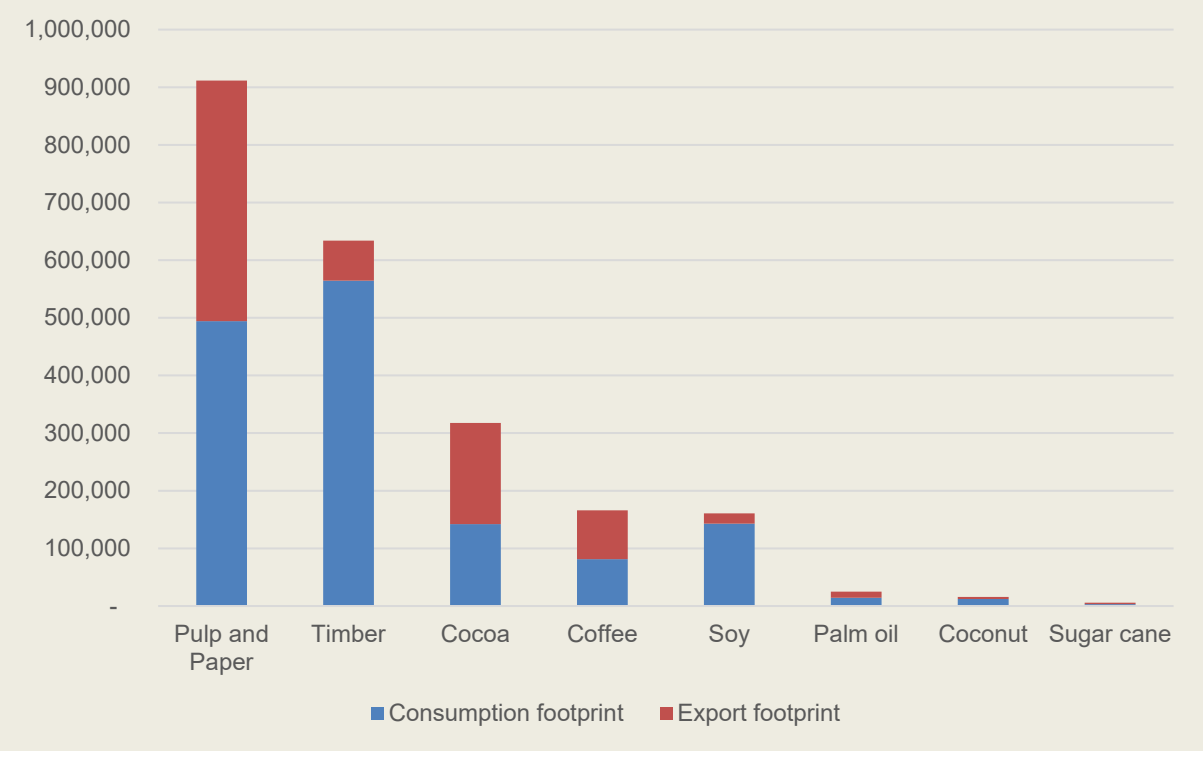
Between 1990 and 2020, the world lost 178 million hectares of forest. It is estimated that over 50% of deforestation, forest degradation and the conversion of natural habitats is, in the tropics at least, driven by commercial agriculture and forestry. The production of agricultural and forest commodities can also be associated with serious social issues and abuses, including appropriation of land from communities and indigenous groups, forced and child labour.

Switzerland 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 agricultural commodities cocoa, coffee, coconut, palm oil, sugar cane and soy, and forest commodities timber, pulp and paper, 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 Switzerland's demand for these commodities was on average over 2.2 million hectares each year between 2015-19. This is equivalent to a land area over half the area of Switzerland, or 1.8 times the size of Switzerland's own forest area.

Pulp and paper has the highest land footprint, at over 900,000 hectares per year, followed by timber at 634,000 hectares per year and then cocoa (300,000 hectares), reflecting the large quantities of these commodities that are imported by Switzerland (Figure A).

Figure A: Land area required to supply Switzerland with commodities (average 2015-19, hectares)



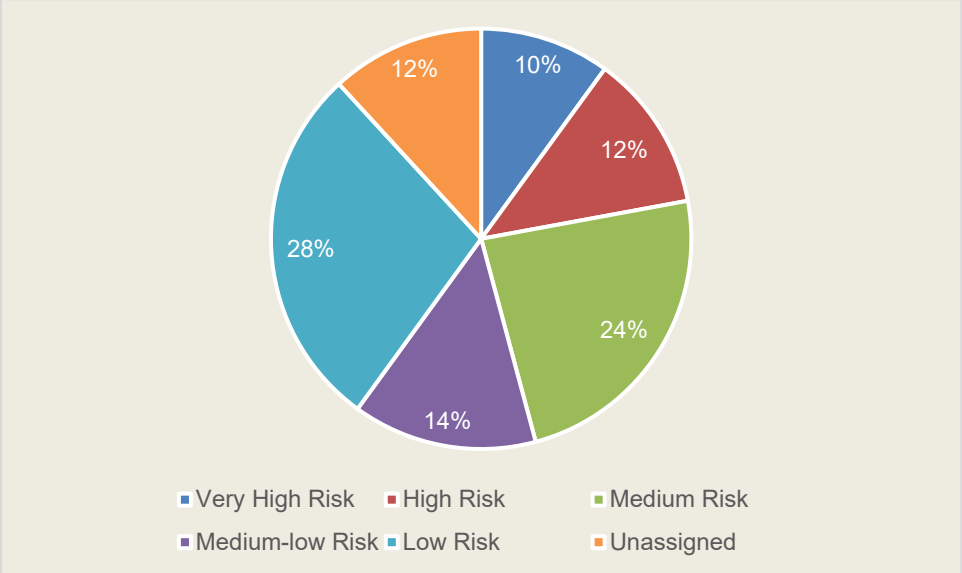
The estimated consumption of these commodities by Switzerland averages 65% of imports (or imports plus domestic production, in the case of timber, pulp and paper and soy). Separating the import footprint into consumption and export components leaves an estimated consumption footprint of 1.5 million hectares (one-quarter the size of Switzerland, or 1.2 times the area of Switzerland's forest) and a footprint of 780,000 hectares for commodities that Switzerland trades to other countries.

Switzerland's largest land footprints are in European countries, specifically Sweden (17% of the total footprint, almost 400,000 hectares), Germany (14%, 305,000 hectares) and then smaller but significant footprints in Austria and Italy (both 7% of the total footprint) and France (6%). These are due to imports of timber and pulp and paper. The largest footprint outside of Europe was in Brazil (120,000 hectares, 5% of the total) primarily due to imports of soy and coffee, as well as some pulp and paper and sugarcane. Large areas also occurred in Ghana (104,000 hectares, 5%) and Côte d'Ivoire (93,000 hectares, 4%) which primarily reflects the high imports of cocoa from both. Over 80% of the footprint of the agricultural commodities is in tropical and sub-tropical countries.

Commodity imports are rarely traceable back to individual farms or plantations, and so the exact contribution of Switzerland – 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 strength of the rule of law, and the labour rights conditions within those countries. The land footprint of Switzerland's commodity imports was then allocated to these risk ratings. Slightly more than one fifth of the import footprint (490,000 hectares) is in high and very high risk countries and almost one quarter is from medium-risk countries (24%, 530,000 hectares). Forty two percent (950,000 hectares) came from countries with low and medium-low risk ratings (Figure B). A final 12% is 'unassigned' as it is either related to imports from countries that each contribute less than 2% of Switzerland's imports of a commodity by weight, or imports that were not possible to allocate within the limitations of this study (see full methodology below). This portion is likely to come from countries with a range of risk profiles.

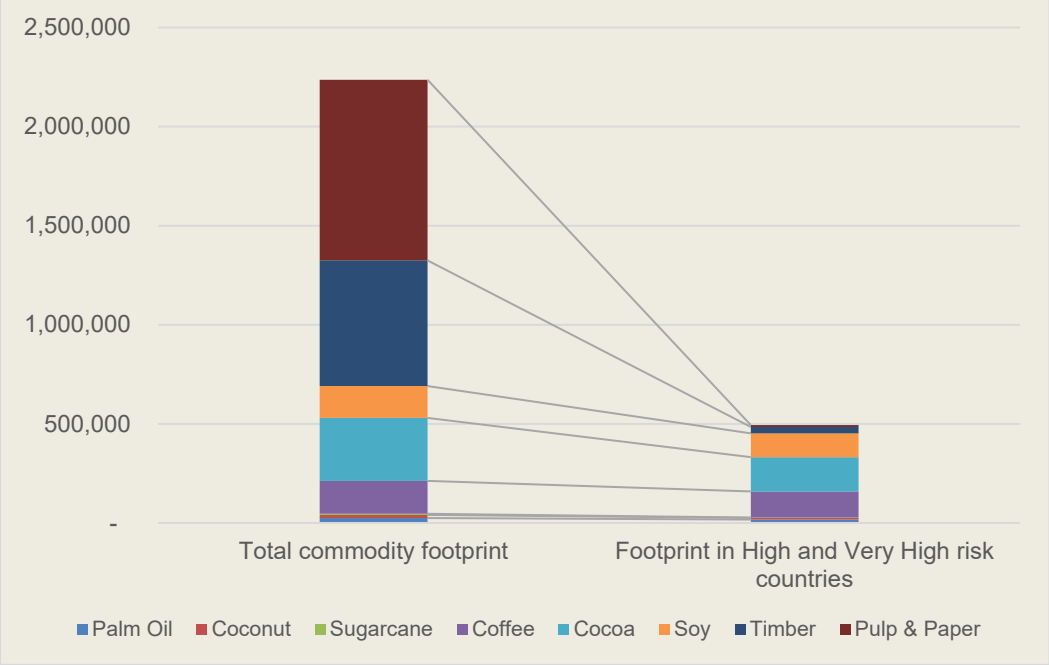
Figure B: Distribution of Switzerland's land footprint for imported commodities amongst risk categories



The majority of the land footprint of coffee (79%), soy (75%), palm oil (69%) and cocoa (54%) are from high and very high risk countries. Moreover, none of these commodities are sourced from countries with a low risk rating. Timber and (less so) pulp and paper are largely supplied from within the EU and have a much lower proportion of their footprints from high and very-high risk countries. However, even within these commodities, there are instances of sourcing from high risk countries such as China, the Russian Federation and Brazil.

Soy contributes just 7% (161,000 hectares) to the overall footprint but is responsible for nearly one-quarter (24%) of the high and very high risk footprint. Cocoa also makes a disproportionate contribution to the high and very high risk footprint, being responsible for 14% of the overall footprint but over one-third (35%) of the high and very high risk footprint. Coffee showed a similar pattern, contributing just 7% to the total footprint but over one-quarter (27%) of the high and very high risk footprint (Figure C).

Figure C: Contribution of commodities to Switzerland'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 Swiss Government, businesses, NGOs and the public have taken action to address some of these issues, through initiatives such as the purchase of FSC certified timber, the Swiss Platform for Sustainable Cocoa and the Soja Netzwerk Switzerland, and the provision and promotion of certified goods to the public.

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 Switzerland's imports of commodities and deforestation and social exploitation.

The conclusions of the research presented in this report are intended to underpin recommendations for policy-makers, businesses, investors, and consumers.

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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 2020, the world lost 178 million hectares of forest.[2]

Agricultural and forest commodities, such as cocoa, coffee, palm oil, paper and pulp, soy, and timber have been cited as major drivers of deforestation[3],[4] and habitat destruction in some of the most biodiverse and ecologically important places in the world.[5] It is estimated that over 50% of all global forest loss is linked to the production of agricultural and forest commodities[6]. 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 poor conditions of employment which fall below international norms and standards.

Switzerland is signatory to a number of international agreements to prevent deforestation. It has agreed to the United Nations Strategic Plan for Forests 2017-2030 which includes a goal to 'Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation…'[7]. Under the 2030 Sustainable Development Agenda goals Switzerland is also committed to 'halt(ing) deforestation'[8] and under the Aichi Targets of the Convention on Biological Diversity to ensuring that the 'rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced'[9].

Although domestic forest cover in Switzerland has increased in recent decades[10], there is increasing recognition of the significant role that countries play in deforestation overseas through consumption and trade of agri-commodities produced in other countries. For example, in July 2019, the European Commission – with which Switzerland has bilateral

[1] WWF. 2018. Living Planet Report - 2018: Aiming Higher. Grooten, M. and Almond, R.E.A.(Eds). WWF, Gland, Switzerland
[2] FAO (2020) Global Forest Resource Assessment 2020. Online at: http://www.fao.org/3/CA8753EN/CA8753EN.pdf
[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] Goldman, E., Weisse, M.J., Harris, N., and Schneider, M. (2020). Estimating the role of seven commodities in agriculture-linked deforestation: Oil Palm, Soy, Cattle, Wood Fiber, Cocoa, Coffee, and Rubber. World Resources Institute, Washington DC, USA.
[5] 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.
[6] https://science.sciencemag.org/content/361/6407/1108
[7] UN, 2017. United Nations Strategic Plan for Forests 2030. Briefing Note. Online at: https://www.un.org/esa/forests/wp-content/uploads/2017/09/UNSPF-Briefing_Note.pdf
[8] UN, 2015. Transforming our world: the 2030 Agenda for Sustainable Development. Online at: https://sustainabledevelopment.un.org/post2015/transformingourworld
[9] Convention on Biological Diversity, 2018. Aichi Biodiversity Targets. Online at: https://www.cbd.int/sp/targets/
[10] Le News, 2017. Swiss fact: forests expanded 9% in Switzerland since 1990. Online at: https://lenews.ch/2017/12/29/swiss-fact-forests-expanded-9-in-switzerland-since-1990/

trade agreements which commit it to comply with certain EU measures[11] – agreed a communication which explicitly acknowledges the contribution EU countries make to global deforestation through the trade and consumption of commodities. An explicit priority of this communication is to; “Reduce the EU consumption footprint on land and encourage the consumption of products from deforestation-free supply chains in the EU”[12]. Switzerland is not a member of the EU, though it is a member of the European Free Trade Association (EFTA). To facilitate free trade with the EU, Switzerland has adapted the Swiss food law to European law to a large extent[13].

Several European countries neighbouring Switzerland, and with whom Switzerland has close trading relationships, including France, Germany, the Netherlands and the UK have signed the Amsterdam Declaration Towards Eliminating Deforestation from Agricultural Commodity Chains with European Countries.[14] 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.

According to Swiss government statistics, Switzerland plays a role in over half of global coffee and vegetable oil trade, including palm oil, as well as 35% of global cocoa volumes. The impact of Switzerland’s trade and consumption on deforestation in countries where these commodities are produced is therefore critical. Switzerland's trade deals include a free trade agreement with the world's biggest supplier of palm oil – Indonesia – and there are discussions about a similar agreement with Malaysia[15]. There are also ongoing negotiations between Switzerland as a member of the European Free Trade Agreement (EFTA) and members of Mercosur (Argentina, Brazil, Paraguay and Uruguay) about a possible free trade agreement, which has important implications for the trade of commodities sourced from these countries, including soy[16]. As a major consumer and trader of agricultural and forest commodities, it is critical for Switzerland to identify and address the risk of deforestation and social exploitation associated with its agri-commodity imports.

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,[17] 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).

[11] European commission, 2020. Trade Policy: Switzerland. Online at: https://ec.europa.eu/trade/policy/countries-and-regions/countries/switzerland/
[12] European Commission, 2019. Commission steps up EU action to protect and restore the world's forests. Online at: https://ec.europa.eu/commission/presscorner/detail/en/IP_19_4470
[13] https://www.ceintelligence.com/files/documents/Cocoa%20Sector%20-%20Cacao%20in%20Switzerland.pdf
[14] https://www.euandgvc.nl/documents/publications/2015/december/7/declarations
[15] SwissInfo.ch, 2020. Why little Switzerland matters for the survival of tropical forests. Online at: https://www.swissinfo.ch/eng/why-little-switzerland-matters-for-the-survival-of-tropical-forests/45810264
[16] https://www.efta.int/free-trade/ongoing-negotiations-talks/mercosur
[17] https://www.euandgvc.nl/documents/publications/2015/december/7/declarations

The quantities involved are substantial. For example, over the period 1990-2008, the EU28 imported from other regions nine million hectares of deforestation embodied in crop and livestock products[18].

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 and has subsequently been used in analysis for WWF Belgium and WWF Denmark[19]. The approach has evolved slightly in each iteration of the study but the intention has remained to provide a robust and transparent approach that can be replicated in other countries, and to provide evidence to guide action.

2.1 Quantifying Switzerland's imports

The quantity (net weight) and value (in US$) of Switzerland's imports of each commodity were extracted from the UN COMTRADE database for the years 2015-19. The UN COMTRADE database is preferred to national data as it contains comparable data for all countries, which facilitates additional calculations for export countries and cross-checking of results. Unless otherwise stated, all trade data is derived from this database. The economic value of imported goods was converted from US$ to Euros, using historical annual conversion rates.[20]

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

- As **raw materials** (e.g., sawn timber);
- As a **component or ingredient** of imported manufactured goods (e.g., cocoa in chocolate);
- **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 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 Switzerland's imports

Three general situations are found:

- **A country is a producer and exporter**. Switzerland's imports can be assigned the provenance of the exporting country without further analysis (e.g., Brazil's production of soy).

[18] European Union (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation. Technical Report 2013-063.
[19] WWF and RSPB (2017). Deforestation and Social Risks in the UK's Commodity Supply Chains. Available at https://www.wwf.org.uk/riskybusiness; Jennings & Schweizer, (2019). Risky Business: The risk of corruption and forest loss in Belgium's imports of commodities.; Cooper & Jennings (2020). Risky Business: The risk of corruption and forest loss in Denmark's imports of soy, timber, pulp and paper.
[20] Historic exchange rates from Statista https://www.statista.com/statistics/412794/euro-to-u-s-dollar-annual-average-exchange-rate/

- **A country is an importer and exporter**. For example, the Netherlands imports palm oil and exports it, but does not produce it domestically. Switzerland'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 was analysed, and added to its national production. Exports to Switzerland 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 Switzerland'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% of Switzerland's imports, by volume (see Section 2.1).

2.3 Estimated consumption

Switzerland both consumes and exports many products that contain forest-risk commodities, a notable example of which is cocoa consumed and exported in Swiss chocolate. We provide an estimate of the quantity of each commodity consumed within Switzerland to separate Switzerland's role as a consumer from its role as a trader.

Consumption is estimated by deducting exports from the sum of imports plus Switzerland's domestic production. Domestic production is zero for commodities such as palm oil and cocoa but is significant for others such as timber.

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. Switzerland's production, where relevant, is from FAOSTAT.

(Swiss production + Swiss imports) – Swiss exports = Swiss consumption

2.4 Estimating the footprint of Switzerland's imports of commodities

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

Estimating the land area required to supply Switzerland'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 soybeans) 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,[21] 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 soybeans, soy meal,

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

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 fraction in the same proportion that the fraction is derived from the harvested crop. For example, one tonne of whole soybeans yields 0.82 tonnes of meal and 0.18 tonnes of soy oil[22]. The area required to supply Switzerland'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 and pulp and paper, 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 of '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,[23] 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).[24]

Switzerland'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 1: HS codes and conversion factors used for timber, pulp and paper products in this study),[25] 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

[22] U.S. Soybean Export Council conversion table, see: https://ussec.org/resources/conversion-table.
[23] 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 (2016). FRA 2015 Terms and Definitions. FAO, Rome.
[24] 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 Switzerland'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.
[25] 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/

Appendix 2: Net Annual Increment values used in timber, pulp and paper footprint calculations).[26]

2.5 Estimating the greenhouse gas emissions associated with land use change to produce Switzerland's imported commodities

Land use change to produce commodities for export results in emissions of greenhouse gases (GHG). To give an estimate of the GHG emissions associated with the production of Switzerland's commodity imports, we use data from the Direct Land Use Change (DLUC) Assessment Tool[27] which provides an estimated CO_2eq[28] emissions factor per hectare and per year, for each crop in each country in which it is grown. Here we use the version of the tool for when the country of origin for the imports is known, but the exact parcel of land used to produce the crop is unknown, which matches the level of detail of our provenance calculations. For this scenario, the tool uses an indirect approach to calculating emissions from land-use change, based on the relative rates of crop expansion at the expense of different previous land uses in a country. Using this approach, the greater the expansion in the area of a crop in a country, the greater the emissions factor[29]. The associated emissions per hectare are then calculated based on methods outlined by the Intergovernmental Panel on Climate Change[30] and in the PAS 2050-1 framework[31].

The tool offers three GHG emissions scenarios for each commodity. We use the weighted average to estimate final GHG emissions for Switzerland's land footprint per year in each country from 2015 to 2019, for cocoa, palm oil, soy, coconut, sugar cane and coffee. In a small number of cases, data is unavailable for some countries; these are flagged where relevant. In cases where the area of a specific crop or of cropland in general did not expand in a country, the emissions factors for that crop and country pairing are calculated to be zero in the DLUC tool[32].

To give the emissions values context, they are compared in the report to the annual greenhouse gas emissions for Switzerland. This value has been calculated based on data for per capita greenhouse gas emissions in Switzerland, multiplied by the population of Switzerland to give a value of 34.5 million tonnes[33].

Equivalent emissions factors are not available for timber and pulp and paper, so emissions values are not included for these forest commodities. It should be noted that the total

[26] 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').

[27] https://www.blonkconsultants.nl/portfolio-item/direct-land-use-change-assessment-tool/?lang=en

[28] CO_2eq (CO_2 equivalent) is a unit for the emissions of GHGs where amounts of GHGs other than CO_2 (e.g. methane, nitrous oxide) are converted to the **equivalent** amount of **carbon dioxide** based on their respective global warming potential rating.

[29] Therefore, crops which have not shown an expansion in production area in a country will have a land use change emissions factor of zero for that country.

[30] IPCC (2019). IPCC Guidelines for National Greenhouse Gas Inventories. Online at: https://www.ipcc.ch/site/assets/uploads/2019/05/01_2019rf_OverviewChapter.pdf

[31] BSI (2012). Assessment of life cycle greenhouse gas emissions from horticultural products. Online at: https://shop.bsigroup.com/upload/Shop/Download/PAS/PAS2050-1.pdf

[32] Van de Vijver, P. at Blonk Consultancy, *pers comm.* Email. 1st September 2020.

[33] Using 2016 data for per capita emissions (4.1 metric tons) multiplied by population of Switzerland in 2016 (8.42 million) (sources: World Bank and Switzerland Federal Statistics Office, respectively)

emissions given here are therefore an under-representation of the emissions associated with Switzerland's commodity imports.

2.6 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 Switzerland'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 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.

2.6.1 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% tree cover that lost that cover between 2015-19.[34] Using the low threshold of land with > 10% forest cover[35] 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

[34] Global Forest Watch. http://data.globalforestwatch.org/
[35] Readers interested in interrogating patterns of tree cover loss can use Global Forest Watch's interactive mapping tool at http://data.globalforestwatch.org/

proportion of their small remaining area of natural forest score highly on this indicator.[36]

- **Rule of law.** 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. The World Bank's Rule of Law Index is used as a proxy for the likelihood of the range of social and governance issues within an exporting country. It indicates the degree of legality, accountability and transparency of actors and actions in a country[37].
- **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.[38]

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 Switzerland to clearly distinguish between high and low impact. For example, Brazil lost 18.5 million hectares of forest with >10% tree cover between 2015-19 compared with the Netherland's 7,700 hectares. These countries score 'high' and 'low' respectively.

Table 1: Indicators and scoring used to indicate risk of deforestation and social issues with Switzerland'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 2015-19	≥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 based on reported violations of labour rights published in 2019	≤5	3 to 4	≥2
Rule of Law	Index of the level of accountability, legality and transparency in country business and policy in 2018 (World Bank)	<-0.3	-0.3-1	>1

[36] FAO Forest Land Use Data Explorer (FLUDE) data
[37] World Bank, 2019. World Bank Governance Indicators Data Source Summary: Rule of Law. Online at: https://info.worldbank.org/governance/wgi/Home/downLoadFile?fileName=rl.pdf
[38] ITUC (2019). Global rights index: the world's worst countries for workers. International Trade Union Confederation, https://www.ituc-csi.org/IMG/pdf/2019-06-ituc-global-rights-index-2019-report-en-2.pdf

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 8).

Switzerland'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.

2.7 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, cocoa is combined with sugar, milk, flour etc in many food 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 and commodities, 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 Switzerland's imports are sourced from a niche system with a productivity different from the country average.

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 Swiss government, businesses and civil society might target their efforts in order to have most impact in reducing the deforestation risk of Switzerland'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: timber, pulp and paper

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 3.75 billion hectares in 2020. Around 30% of the world's forests, 1.15 billion hectares, are designated as production forest, with a further 20% (approximately 750 million hectares) designated as multiple use, i.e., serving multiple functions including timber production.[39] The area of planted forest has increased by 123 million hectares since 1990, and now there is an estimated 290 million hectares of plantations, which vary in the intensity of production.

Switzerland's forest area was estimated at 1,269,110 hectares in 2020[40] and produced around 4.6 million cubic metres of timber (including fuel wood, saw wood logs and industrial wood) in 2019. Forests cover around one third of Switzerland's land area and the total area has been increasing steadily since 1990, predominantly through naturally regenerating forest as opposed to planting. Around 30% of the forests are primarily designated for production.[41]

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,[42] with fuel being a major use of timber in developing countries and increasingly in some EU countries also.[43]
- **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. Particle, chip and fibre (MDF) boards are also commonly used in construction.
- **Furniture:** Varying from softwood furniture (e.g. pine) and plywood/laminate flat pack furniture, to luxury hardwood (e.g., mahogany, teak). Particle, chip and fibre (MDF) boards are also commonly used in furniture.
- **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:** used in magazines, books, stationery, office paper, boxes, packaging, tissues, and labels. It can be coated with a wide variety of materials for

[39] FAO (2020) Global Forest Resource Assessment 2020: How are the world's forests changing? Food And Agriculture Organization Of The United Nations, Rome. Online at: http://www.fao.org/3/ca8753en/CA8753EN.pdf
[40] FAO (2020). Global Forest Resource Assessment: Switzerland. Online at: https://fra-data.fao.org/CHE/
[41] FAO (2020). Global Forest Resource Assessment: Switzerland. Online at: https://fra-data.fao.org/CHE/
[42] FAO (2020) Global Forest Resource Assessment 2020: Main report. Food And Agriculture Organization Of The United Nations, Rome. Online at: http://www.fao.org/3/ca9825en/CA9825EN.pdf
[43] For example, the UK (see https://www.wwf.org.uk/riskybusiness) and France (https://www.wwf.fr/deforestation-importee).

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,[44] forest degradation, habitat destruction, and species loss in some of the most biodiverse and ecologically important places in the world.[45] 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 in 2012, or 10–30% of global wood trade.[46] 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.[47]

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.

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 main global certification systems for sustainable forestry management and its supply chain – the Forest Stewardship Council (FSC), which has members in 89 countries[48], and the Programme for the Endorsement of

[44] 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 (2020). Global Forest Resource Assessment 2020: Terms and Definitions. Rome.
[45] 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.
[46] 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
[47] 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
[48] https://www.fsc.org/en/facts-figures

Forest Certification (PEFC), which has 53 member countries worldwide and certifies 75% of certified forests globally[49]. FSC has over 211 million hectares certified globally (of which 41.6 million hectares are in Europe), and the PEFC 319.5 million hectares (117 million hectares in Europe).[50]

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).[51]

Certification is well advanced within Switzerland. Over half of Swiss forests are FSC certified and these account for 70% of the country's timber production. Recognition of the FSC label by the Swiss public is high, at 87% (prompted), and the label is supported by several big retailers in the country. There is also a PEFC Alliance in Switzerland, managed by Lignum, an organisation of the Swiss forest and timber industry[52].

[49] https://www.pefc.org/discover-pefc/facts-and-figures
[50] Sources: FSC Facts & Figures: https://ic.fsc.org/en/facts-and-figures, PEFC Global Statistics June 2020:): https://cdn.pefc.org/pefc.org/media/2020-08/d48bcf2b-562f-4feb-bde6-e5a6316ec7c1/5948cc30-e0ea-59bd-b3bc-6dabbb108685.pdf
[51] https://www.greenpeace.org.uk/velvets-claim-protecting-forests-flushed-away/
[52] https://www.pefc.org/discover-pefc/our-pefc-members/national-members/pefc-switzerland

3.1.5 The Swiss response to illegal and unsustainable timber

Since 2012, the Swiss Declaration Requirement in Switzerland has made it a legal requirement for companies selling timber and timber products to declare the species and country of origin of the wood to allow informed consumer choices. However, it has faced enforcement challenges and only around 15% of audited companies were found to be declaring their products correctly in 2017[53]. The scope of this law covers roundwood, raw wood and some solid wood products, but not all timber products[54].

As of 2017 there were no 'due diligence' requirements in Switzerland for timber or wood products[55] which means that beyond the requirement to record the origin and species of sold timber, importers are not required to undertake a risk assessment to consider the possibility that their supply contains illegally produced and traded timber[56].

Illegality within the international trade in timber, pulp and paper has received significant attention within Europe. There is significant trade of timber between Switzerland and EU member states and in early 2020, Swiss Parliament endorsed[57] amendments to bring Swiss timber legislation in line with two major pieces of European timber legalisation; the EU Timber Regulation (EUTR) and the EU's Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan[58].

The EUTR came into effect in all EU countries in 2013. The Regulation prohibits the placing of illegally harvested (i.e., violates the laws of the country of harvest) timber on the European market. It covers both imported and domestically produced timber and timber products and includes solid wood products, flooring, plywood, pulp and paper (the complete list is given in the Annex of EUTR[59]) 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.

The FLEGT Action Plan was established in 2003 and sets out a range of measures to tackle illegal logging including; 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 (such as 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.

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

[53] https://www.swissinfo.ch/eng/business/consumer-affairs_wood-not-labelled-properly-in-switzerland/43880440
[54] https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=33174
[55] https://www.nepcon.org/sites/default/files/library/2018-12/NEPCon-TIMBER-Switzerland-Risk-Assessment-EN-V1.3.pdf
[56] Explanation of due diligence for timber at: https://ec.europa.eu/environment/forests/timber_regulation.htm#diligence
[57] https://www.parlament.ch/en/ratsbetrieb/amtliches-bulletin/amtliches-bulletin-die-verhandlungen?SubjectId=47470
[58] https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=33174
[59] http://ec.europa.eu/environment/forests/timber_regulation.htm

and environmentally responsible within the sector. As mentioned above, certification of timber in Switzerland is well advanced, through use of the FSC standard both domestically as well as in trade.

Other efforts to address unsustainable timber in Europe include the European Sustainable Tropical Timber Coalition (STTC) - an alliance of industry, business, government, and NGOs – works to increase demand for sustainably sourced tropical timber. Switzerland is not yet covered by this coalition, but there have been suggestions that it may be in the future[60].

3.2 Trade in wood products

3.2.1 Global trade

A total of € 430 billion of timber, pulp and paper were exported globally in 2018. Of this, timber products accounted for € 195 billion (45%), including raw timber, manufactured products such as plywood, and finished wooden articles (e.g., wooden furniture). Pulp and paper products accounted for € 238 billion (55%), including different types of paper and paperboard (writing paper, tissue paper etc) and wood pulp. 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 14% of the tonnage in 2018. However, by value, the Russian Federation ranked only seventh, with China (€ 35 billion, 18% of global trade), Canada (€ 14 billion, 7%), Germany (€ 14 billion, 7%), Poland (€ 11 billion, 5%) and USA (€ 10 billion, 5%), being the top five ranked countries. 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.

For pulp and paper products, The USA is the top-ranked country in terms of both quantity and value of pulp and paper products exported, accounting for € 26 billion in 2018 (11% of global pulp and paper exports). Germany (€ 25 billion, 10%), China (€ 21 billion, 9%), Canada (€ 14 billion, 6%) and Sweden (€11 billion, 4%) make up the rest of top five exporters of pulp and paper products.

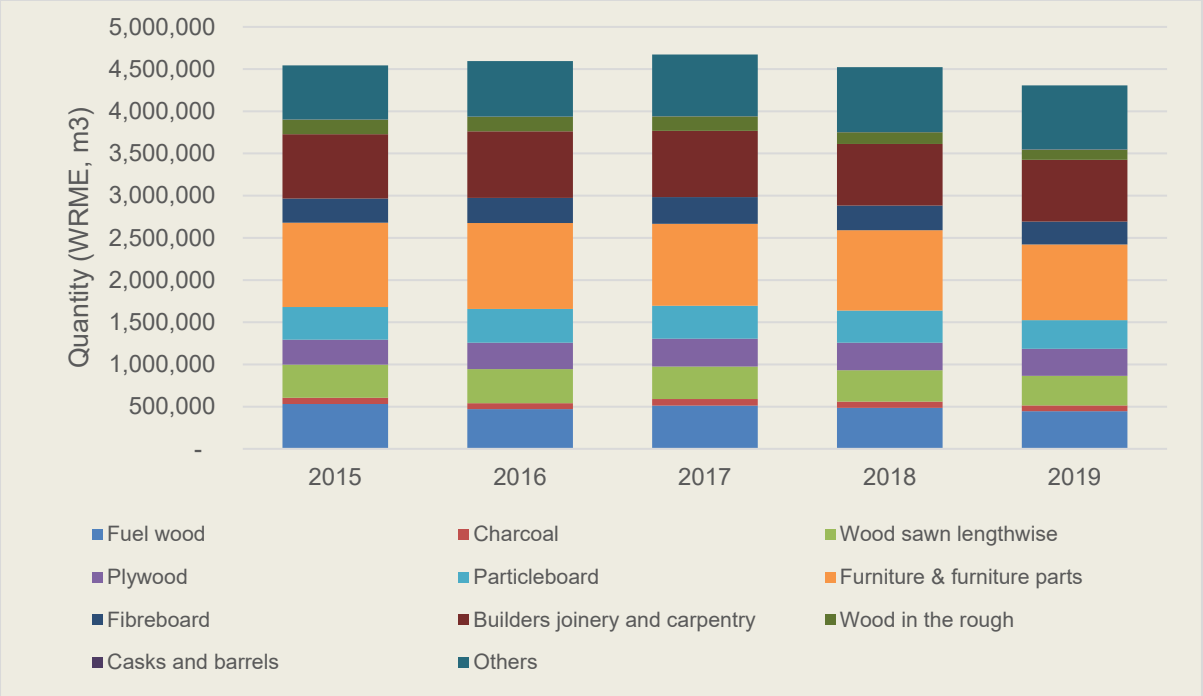
3.3 Switzerland's imports of wood products

3.3.1 Timber

When the imports are converted to the equivalent quantity of wood needed to produce them (in Wood Raw Material Equivalent, WRME in m^3), Switzerland's imports of timber and timber products average 4.5 million cubic metres of wood per year between 2015 and 2019 (Figure 1). After an apparent increase in overall volumes from 2015-2017 there was a slight decline in the past two years. The four largest categories of timber products by volume of wood were furniture and furniture parts (21% of import volumes on average), builders joinery and carpentry (17%) and fuel wood (11%). Declines in imported volumes of furniture and fuel wood, as well as of 'wood in the rough' have contributed to the reduction in total volumes over the last two years.

[60] http://www.europeansttc.com/wp-content/uploads/2019/12/STTC%20Conference%20report%202019.pdf

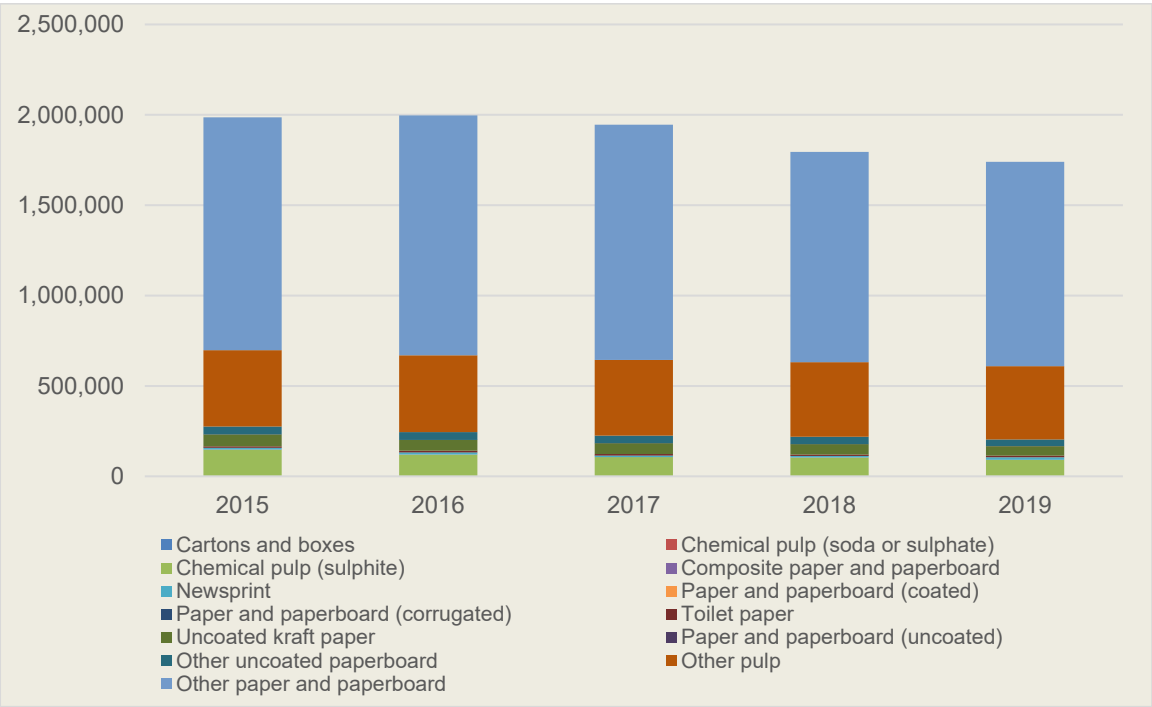
Figure 1: Quantities of Switzerland's imports of timber and timber products converted to wood content in WRME (m^3) 2015-19



3.3.2 Pulp and Paper

Switzerland's imports of pulp and paper products average 1.9 million tonnes per year between 2015 and 2019. By far the largest fraction is other paper and paperboard which accounts for an average of 66% of the imports by weight per year (Figure 2). The next largest fraction is other pulp which accounts for 22% of imports per year on average. Other forms of pulp and paper make up comparatively small proportions of imports by weight; chemical pulp (6%), uncoated kraft paper (3%), uncoated paperboard (2%) and newsprint (1%).

Figure 2: Quantities of Switzerland's imports of pulp and paper (tonnes) 2015-19

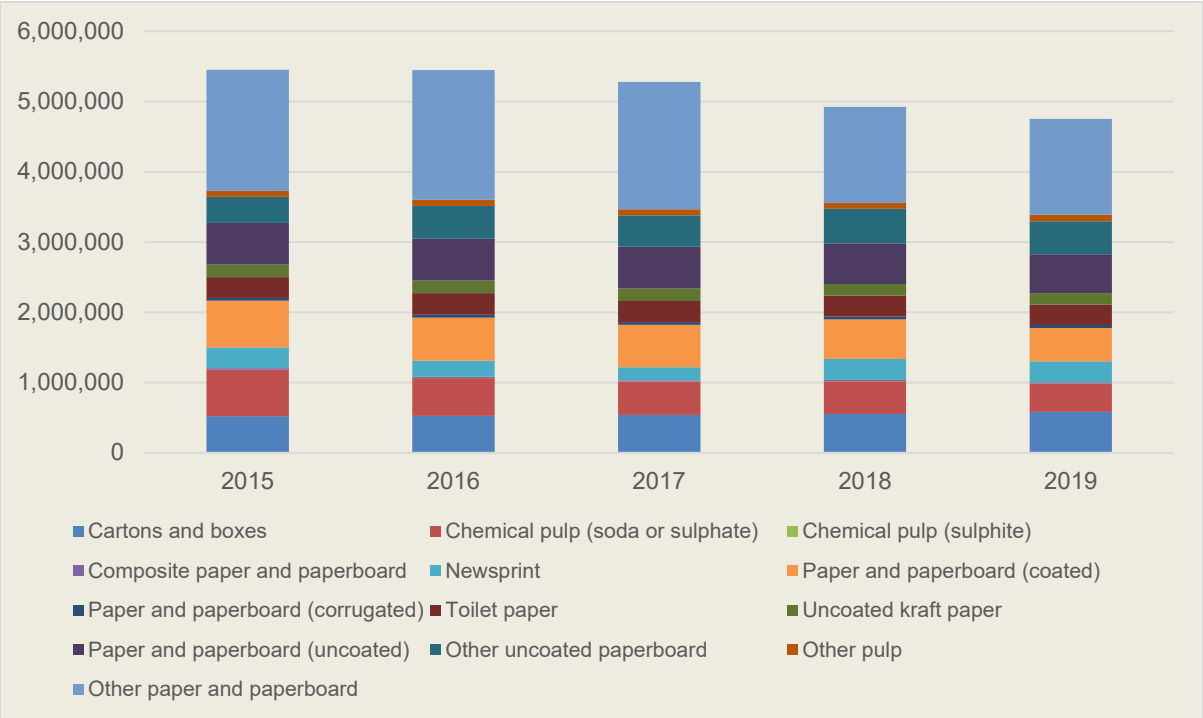


When imports are adjusted to give the equivalent volume of wood contained within them in WRME (m^3), imports of pulp and paper products averaged around 5.2 million cubic metres wood per year between 2015 and 2019. The largest fraction is still other paper and paperboard which accounted for an average of 31% of import volumes per year. Coated and uncoated paper and paperboard each accounted for a further 11% of import volumes. Chemical pulp accounts for 10%, followed by toilet paper (6%) and newsprint (5%).

There was a decline in pulp and paper import volumes by around 13% over the period, particularly driven by a reduction in other paper and paperboard from 1.8 million cubic metres in 2015 to 1.3 million cubic metres in 2019. Volumes of chemical pulp also declined, from around 660,000 cubic metres in 2015 to 403,000 cubic metres in 2019 (

Figure ***3***).

Figure 3: Quantities of Switzerland's pulp and paper imports converted to wood content in WRME (m^3) 2015-2019



In total, Switzerland imported an average of 9.7 million cubic metres of wood per year between 2015 and 2019; timber and timber products account for 46% of this volume (4.5 million cubic metres WRME) whilst pulp and paper products contributed 54% (5.2 million cubic metres WRME). Over the whole period and across both timber and pulp and paper, other paper and paperboard accounts for the greatest proportion of imports (1.2 million cubic metres WRME).

Table 2: Estimated wood raw material equivalent (WRME) content of Switzerland's timber and timber product imports, 2015-19 (m^3)

Timber commodity	Quantities of imports (WRME m^3)							
	2015	2016	2017	2018	2019	Grand total	Average	%
Fuel wood	532,096	470,488	512,799	485,511	445,424	2,446,318	489,264	11%
Charcoal	74,144	70,457	77,938	74,590	68,279	365,408	73,082	2%
Wood sawn lengthwise	392,545	404,123	385,282	371,299	351,195	1,904,443	380,889	8%
Plywood	295,550	312,182	329,043	325,732	320,350	1,582,856	316,571	7%
Particleboard	387,157	400,117	390,290	382,320	339,572	1,899,456	379,891	8%
Furniture & furniture parts	999,250	1,018,408	971,157	950,643	897,853	4,837,311	967,462	21%
Fibreboard	286,313	297,409	315,867	292,884	271,125	1,463,599	292,720	6%
Builders joinery and carpentry	762,313	789,832	785,767	728,905	731,202	3,798,020	759,604	17%
Wood in the rough	171,704	171,476	169,896	138,599	120,146	771,822	154,364	3%
Casks and barrels	2,077	2,229	2,668	2,338	2,373	11,686	2,337	0%
Others	640,945	657,360	732,828	770,608	759,962	3,561,704	712,341	16%
Total	**4,544,094**	**4,594,081**	**4,673,537**	**4,523,427**	**4,307,482**	**22,642,621**	**4,528,524**	**100%**

Table 3: Estimated wood raw material equivalent (WRME) content of Switzerland's pulp and paper imports 2015-19 (m^3)

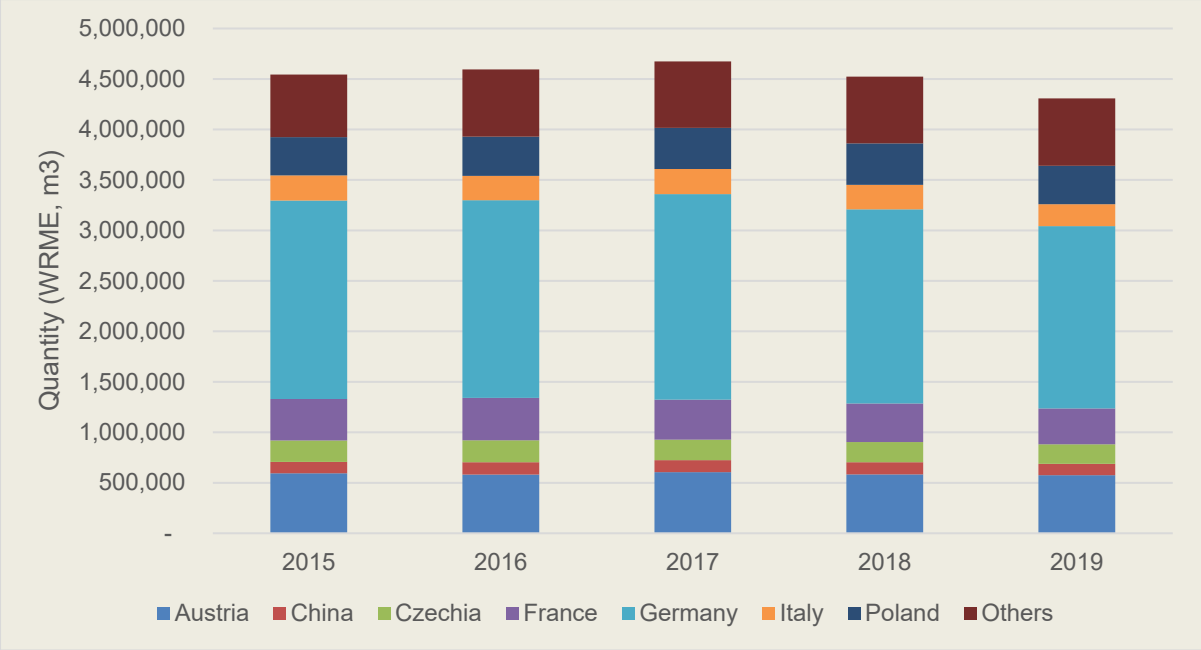
Pulp and paper commodity	Quantities of imports (WRME m3)						
	2015	2016	2017	2018	2019	Average	%
Cartons and boxes	521,902	525,652	539,412	553,178	583,307	544,690	11%
Chemical pulp (soda or sulphate)	660,983	538,133	474,576	465,510	403,355	508,511	10%
Chemical pulp (sulphite)	1,966	2,178	2,048	2,295	1,782	2,054	0%
Composite paper and paperboard	19,391	17,046	15,563	16,267	15,742	16,802	0%
Newsprint	295,314	229,389	186,223	299,656	297,237	261,564	5%
Paper and paperboard (coated)	665,816	612,733	602,960	561,845	475,382	583,747	11%
Paper and paperboard (corrugated)	39,960	39,966	38,577	40,951	42,335	40,358	1%
Toilet paper	295,403	307,790	301,984	298,584	290,844	298,921	6%
Uncoated kraft paper	179,816	179,963	176,729	163,695	162,519	172,545	3%
Paper and paperboard (uncoated)	592,041	594,337	594,685	579,192	554,668	582,985	11%
Other uncoated paperboard	370,414	468,010	448,098	492,500	467,338	449,272	9%
Other pulp	84,937	87,062	85,902	82,964	95,324	87,238	2%
Other paper and paperboard	1,725,418	1,846,056	1,813,255	1,367,534	1,363,228	1,623,098	31%
Total	**5,453,361**	**5,448,314**	**5,280,011**	**4,924,170**	**4,753,061**	**5,171,783**	**100%**

3.4 Provenance of Swiss imports of wood products

3.4.1 Timber

Between 2015 and 2019, Switzerland imported wood products from seven main source countries (Figure 4). EU countries dominate Switzerland's imports. By far the biggest proportion came from Germany (43% of imports on average). Austria was the next most significant exporter of timber to Switzerland at 13% of imports by volume, followed by France and Poland (both 9% of imports). China is the only non-EU country providing more than 2% of timber imports, at 3% on average (Figure 4).

Figure 4: The estimated provenance of Switzerland's timber imports, adjusted for wood content from 2015-19 (WRME, m^3)

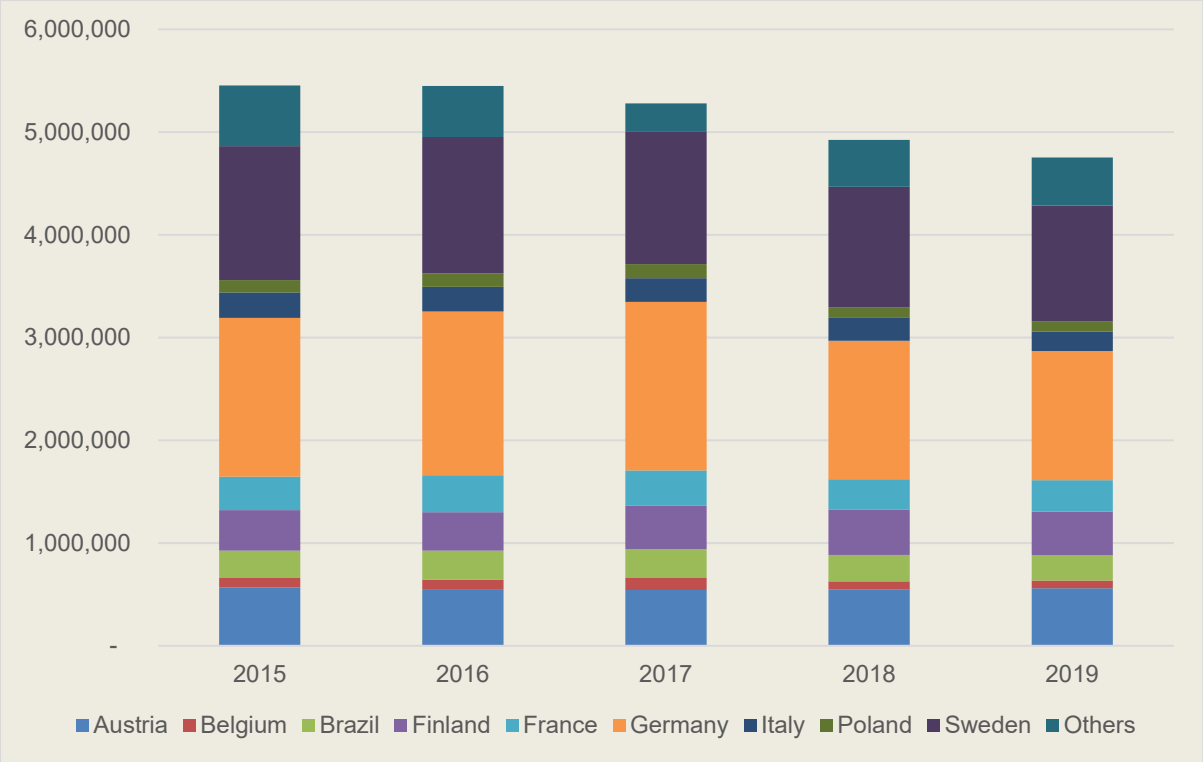


Switzerland's imports of timber from tropical and sub-tropical countries accounts for a relatively minimal proportion of its total imports. Other than China which has tropical and sub-tropical regions, all other countries in this category account for less than 0.5% of Switzerland's imports each (non-reassigned).

3.4.2 Pulp and paper

Switzerland imported pulp and paper products from 132 territories between 2015 and 2019. Ten countries contributed individually at least 2% of the imports by volume of wood equivalent (as WRME, m^3). As for timber, EU countries dominate these imports and again the biggest proportion came from Germany (29% of imports on average). For pulp and paper Sweden accounted for the second largest proportion (24% on average). Austria was the next most significant exporter at 11% followed by Finland at 8% and France at 6%. With the provenance reassigned to producer countries, Brazil account for 5% of Switzerland's pulp and paper imports amounting to average of 267,000 m^3 wood in WRME. These proportions have stayed more or less stable over the period (Figure 5).

Figure 5: The estimated provenance of Switzerland's pulp and paper imports, adjusted for wood content from 2015-19 (WRME, m^3)



3.5 Switzerland's wood product footprint

3.5.1 Timber

The total WRME volume of timber imports from each country (adjusted for provenance, as above) was divided by the Net Annual Increment (NAI, Appendix 3)[61] to produce an estimate of the area of forest required in each country to supply Switzerland's imports each year.

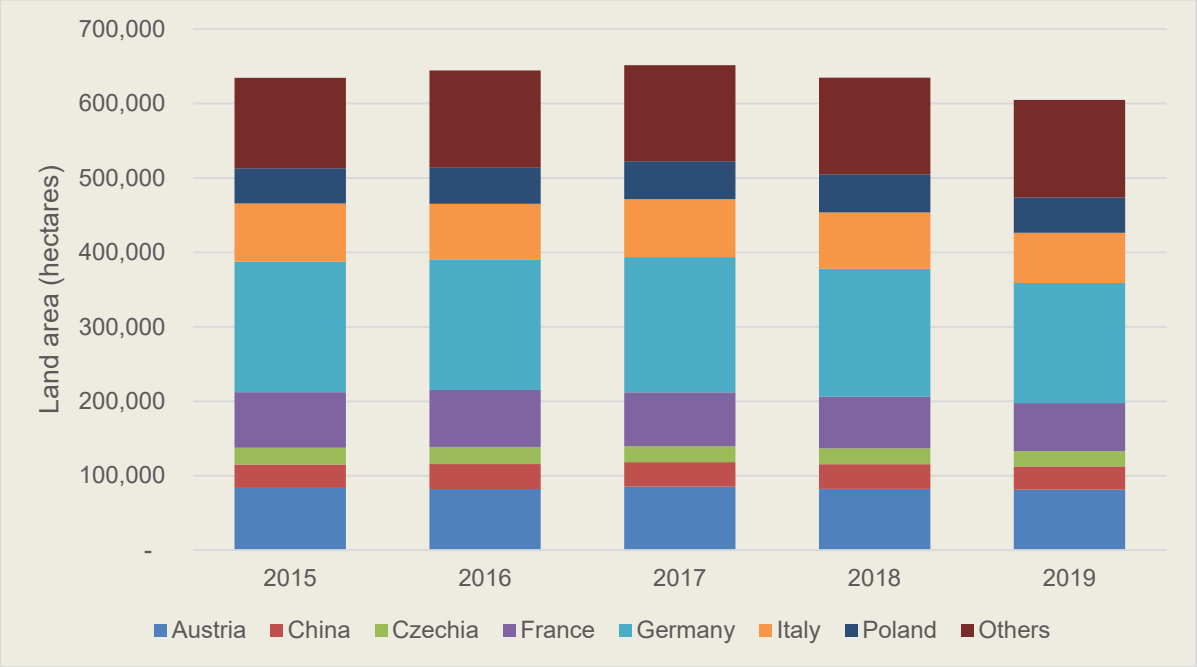
Switzerland's imports of timber products required an average of 634,000 hectares per year between 2015-19. This is equivalent to 16% of Switzerland's total land area of 4,129,039 hectares and 51% of Switzerland's own forest area (1,269,110 ha in 2020) [62].

The total footprint of Switzerland's timber imports apparently increased between 2015 and 2017, but has decreased in the past couple of years (

Figure 6). Germany accounts for the largest proportion of the footprint, explained by it being the source of the largest volumes of imports. The land footprint is slightly larger in France and Italy than the equivalent proportion of imports (Figure 5) which is explained by a lower NAI than in other countries.

[61] 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.
[62] https://fra-data.fao.org/CHE/

Figure 6: The estimated land footprint of Switzerland's timber imports, adjusted for wood content from 2015-19 (hectares)



3.5.2 Pulp and Paper

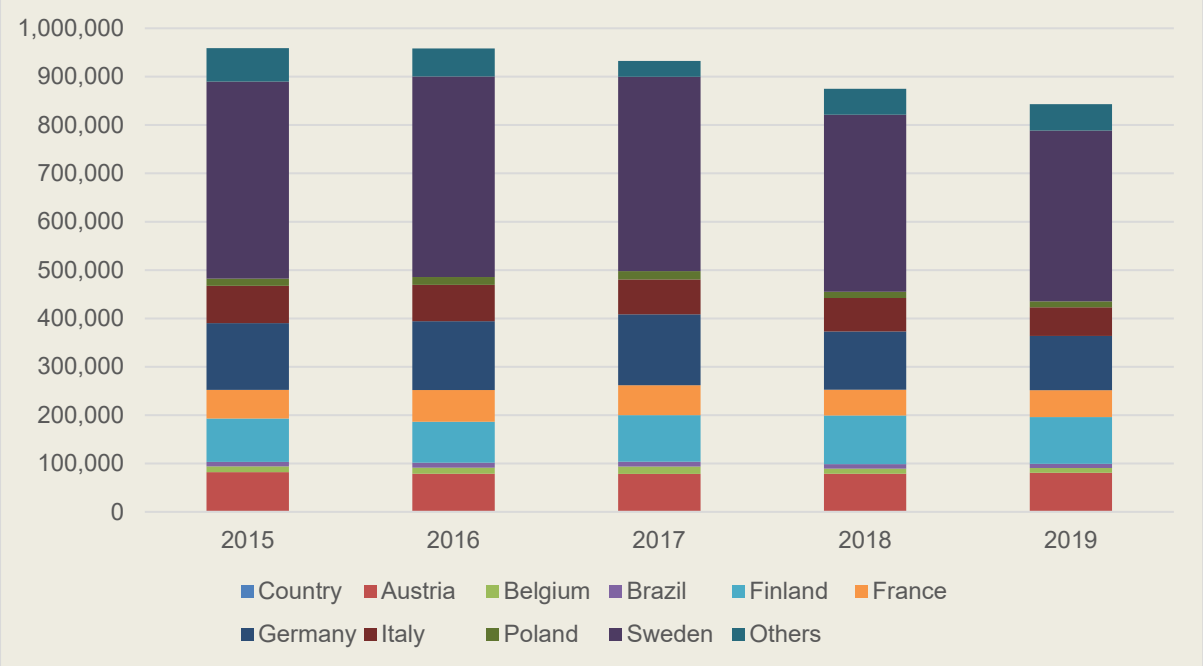
The footprint of Switzerland's imported pulp and paper was an average of 911,000 hectares per year for 2015-2019. This is equivalent to 20% of Switzerland's land area and 66% of its own forest area in 2020.

The largest footprint is in Sweden (289,000 hectares on average per year) (Figure 7), which correlates with it being the origin of the largest proportion of imports (Figure 5).The next largest footprints are in Germany (132,000 ha) and Finland (94,000 ha). Brazil contributes an average footprint of around 9,500 hectares.

Overall, the size of the footprint of Switzerland's pulp and paper imports has declined by around 12% in line with a decline in the imported volumes of pulp and paper (

Figure ***3***).

Figure 7: The estimated land footprint of Switzerland's pulp and paper imports from 2015-19 (hectares)



3.1 Estimated consumption

3.1.1 Timber

Switzerland's consumption of timber is estimated by subtracting the average quantity of timber products that Switzerland exported between 2015 and 2019 after conversion to WRME from the overall quantity of imported timber plus Switzerland's domestic production of timber products. This gives the average consumption figure of 14.3 million m^3 of wood as timber in WRME per year between 2015 and 2019 which means that consumption was equivalent to 89% of Switzerland's national stock of timber, whilst 11% was exported.

3.1.2 Pulp and paper

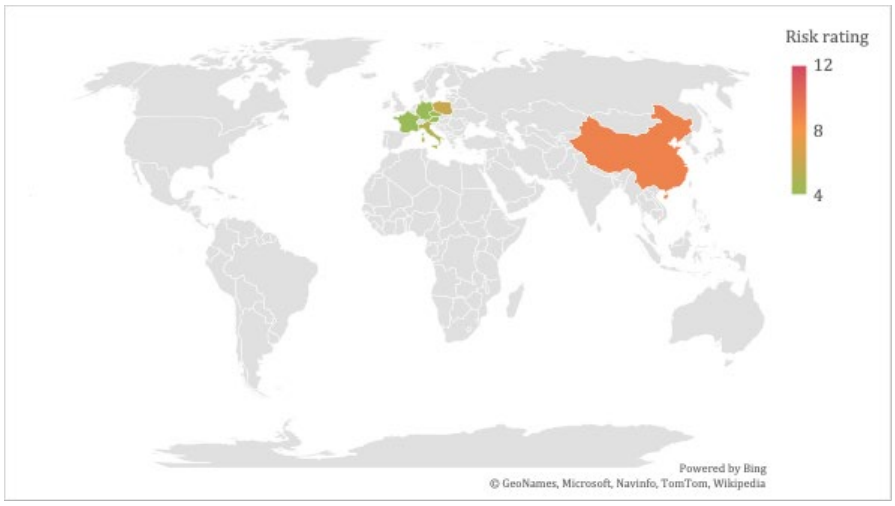
Switzerland's consumption of pulp and paper is calculated in the same way. The average consumption of pulp and paper for 2015-19 is equivalent to 5.7 million m^3 of wood in WRME. This is equivalent to 55% of the national stock, calculated by adding imports and national production and then subtracting exports. Exports of pulp and paper were equivalent to 4.6 million m^3 of wood. Major exports are other paper and paperboard (1.3 million m^3, 29% of exports), other uncoated paperboard (1.1 million m^3, 24% of exports) and newsprint (974,000 m^3, 21% of exports).

3.2 Switzerland's wood product risk profile

3.2.1 Timber

Switzerland imports most of its timber products from low and medium-low risk countries, including Germany, Austria and France[63]. Around 5% of the footprint is from a high risk country; China (Figure 8). In China, rates of forest cover loss are high and labour rights and standards are often poor. The rule of law – the level of legality, transparency and accountability in a country – is also weak. China is known as one country which acts as a conduit for illegal timber.[64]

Figure 8: Switzerland's timber footprint by risk category



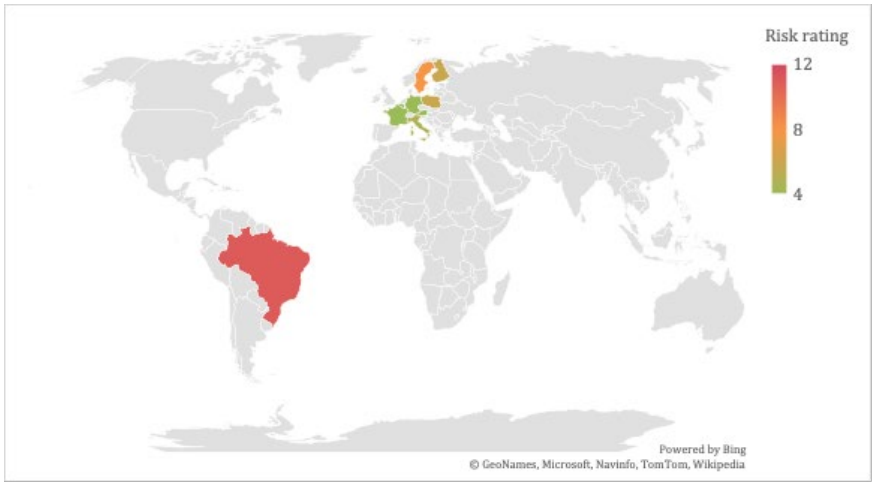
3.2.2 Pulp and paper

For its imports of pulp and paper, Switzerland again sources mainly from low and medium-low risk countries including Germany, Austria, Italy and Sweden. However, some imports come from a very high-risk country – Brazil – where high rates of forest loss combined with poor labour standards and high perceived levels of corruption means there is a high risk of negative social and environmental impacts of imports (

[64] 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

Figure *9*). However, these volumes account for just 1% of Switzerland's pulp and paper imports.

Figure 9: Switzerland's pulp and paper footprint by risk category



Finally, there are pulp and paper products that arrive into Switzerland 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 Switzerland's imports.

Greater uptake of FSC certification, which has the highest social and deforestation safeguards, would undoubtedly reduce the risk of association of Switzerland'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.

4 Cocoa

4.1 Production, uses and sustainability of Cocoa

4.1.1 Production systems

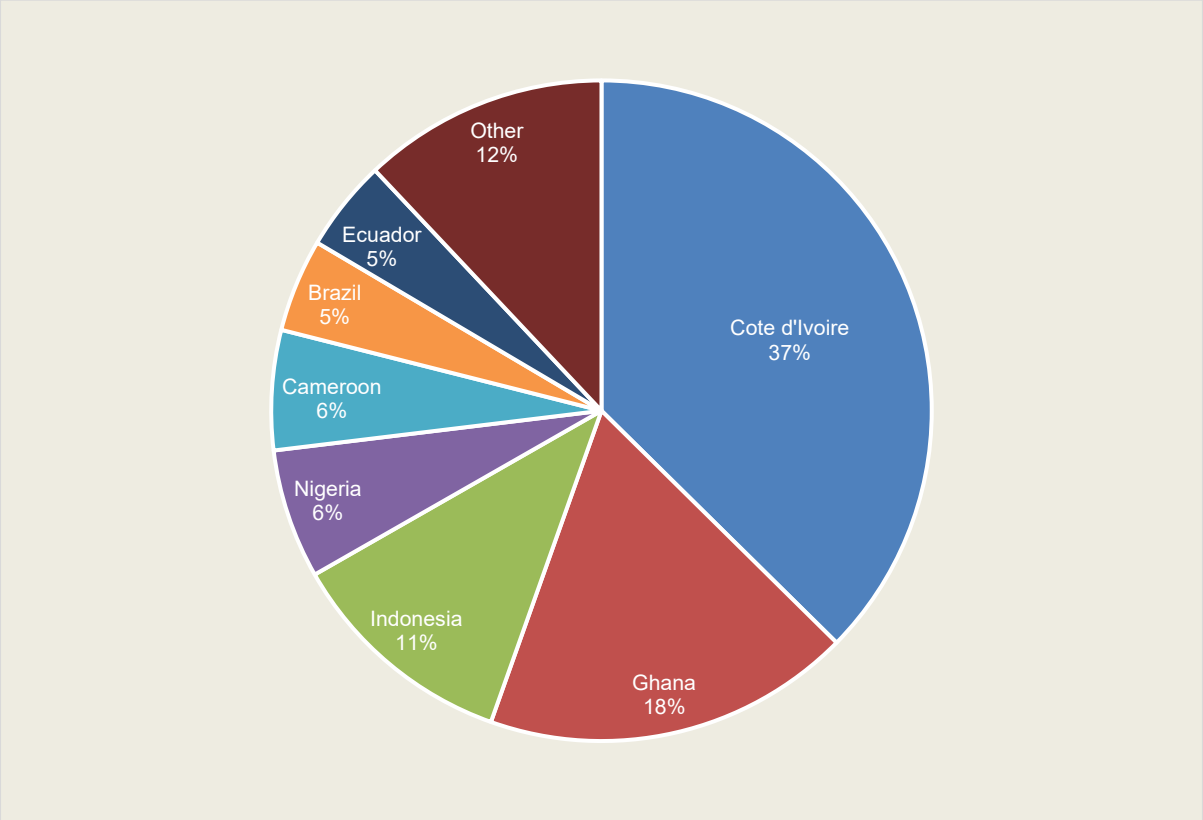
Cocoa products are made from cocoa beans, which are the seeds found inside cocoa pods: the fruits of the cocoa tree, *Theobroma cacao*. The trees require tropical conditions to grow and the geographic range of cocoa is close to the equator at latitudes between 10°N and 10°S where temperatures are warm and rainfall is relatively high. Cocoa naturally grows as an understorey tree in tropical rainforest and trees tend to prefer shaded conditions, especially in early years[65]. Cocoa trees generally start to produce fruit after 3-4 years and can be productive for around 25 years[66].

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 5.3 million tonnes of cocoa beans were produced globally in 2018 having increased steadily from around 4.3 million tonnes in 2010[67]. 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 (37%) and Ghana (18%). At 11% of global production, Indonesia is the third largest producing country (Figure 10).

[65] https://www.icco.org/about-cocoa/growing-cocoa.html
[66] https://www.icco.org/faq/57-cocoa-production/129-how-much-time-does-it-take-for-a-cocoa-tree-to-become-productive.html
[67] FAOSTAT http://www.fao.org/faostat/en/#data/QC. Last accessed 5th August 2020.

Figure 10: Primary cocoa producing countries in 2018



The majority of cocoa is produced by smallholders, with more than 90% of global cocoa production originating from farms covering only 2-5 hectares.[68] The majority of these smallholder farmers operate independently and are not part of cooperatives or other organizations.[69]

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.

[68] ICCO https://www.icco.org/component/content/category/9-economy.html. Last accessed 8 August 2020.
[69] Antonie Foundation & Friedel Huetz-Adams (2018). Cocoa Barometer 2018. Available at http://www.cocoabarometer.org/cocoa_barometer/Download_files/2018%20Cocoa%20Barometer%20180420.pdf

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[70]. 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.[71] Cocoa pods and husks are not imported in large quantities into Switzerland[72].
- **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 and Côte d'Ivoire, as well as in Latin America and Indonesia.[73] 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[74]. 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 Labour includes cocoa from seven countries on their List of Goods Produced by Child Labour: Brazil, Cameroon, Côte d'Ivoire, Ghana, Guinea, Nigeria, and Sierra Leone. Côte d'Ivoire

[70] ICCO https://www.icco.org/faq/52-by-products/115-products-that-can-be-made-from-cocoa.html. Last accessed 8 August 2020.
[71] http://www.new-ag.info/99-2/focuson/focuson6.html
[72] Switzerland's imports of HS code 1802 (Cocoa shells, husks, skins, and other waste) comprised an average of 2,633 tonnes per year for 2015-19. Source: https://comtrade.un.org/data/
[73] 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
[74] Kroeger, A. et al. (2017) Eliminating Deforestation from the Cocoa Supply Chain. World Bank Group, 2017.

and Nigeria are also on the list for forced labour.[75] 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*'.[76] Child labourers on cocoa farms are typically exposed to hazardous working conditions.[77] 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.[78] 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.[79] 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.[80] 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. Fairtrade International, which is part of the Global Living Wage Coalition, in 2019 launched a Living Income Reference Price intended to be used as a standard by cocoa industry actors. The government of Ghana and Côte d'Ivoire have also increasingly participated in discussions about fair prices to farmers and have raised the minimum export prices for cocoa, with the addition of a fixed 'living income differential' on all their cocoa sales applicable from the 2020/2021 crop.[81]

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.[82] 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:[83]

[75] https://www.dol.gov/sites/dolgov/files/ILAB/ListofGoods.pdf
[76] http://www.state.gov/j/drl/rls/hrrpt/2000/af/773.htm
[77] ILO (2007). Rooting out Child Labour from Cocoa Farms. Paper No. 2: health and Safety Hazards.
[78] 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.
[79] http://www.fairtrade.org.uk/~/media/fairtradeuk/farmers%20and%20workers/documents/cocoa%20commodity%20briefing_online7.pdf
[80] Antonie Foundation & Friedel Huetz-Adams (2018). Cocoa Barometer 2018. Available at http://www.cocoabarometer.org/cocoa_barometer/Download_files/2018%20Cocoa%20Barometer%20180420.pdf
[81] https://www.cbi.eu/news/living-income-gains-visibility-scale-cocoa-sector
[82] https://news.mongabay.com/2015/04/court-rules-deforestation-of-peruvian-rainforest-for-chocolate-was-legal/
[83] Except where otherwise stated, the following data is from: Helga Willer, Gregory Sampson, Vivek Voora, , Joseph Wozniak, and Duc Dang Julia Lernoud, Jason Potts, (2019), The State of Sustainable Markets – Statistics and Emerging Trends 2019. ITC, Geneva

- **Rainforest Alliance:** [84]. During 2019, the Rainforest Alliance certified more than 815, 000 hectares of cocoa farms (6.3% of the total global harvested area of cocoa) which produced almost 439,000 metric tons of RA cocoa. The vast majority of RA certified cocoa area are in Côte d'Ivoire, Ghana, Dominican Republic, Indonesia, and Ecuador.
- **Fairtrade certification:** Fairtrade International certified over 1 million hectares of cocoa in 2017 (10% of the global harvested cocoa area). 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 increased by 173% from 2013 to 2017.
- **Organic:** Almost 363,000 hectares (3.1% of the global cocoa area), and an estimated 157,275 tonnes of cocoa (approximately 3.5% of the world's cocoa production) were organic certified in 2017. 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 of cocoa was 74% between 2013-2017.

Combined, these schemes certified between 2.9 and 5 million hectares in 2017 (the range is provided because many producers are certified by more than one scheme), which represented 23.4-40.8% of the global cocoa area.

The above schemes include criteria on conservation, with varying levels of protection against deforestation.[85] While Fairtrade contains criteria on general biodiversity conservation, which includes the protection of areas of high conservation value (HCV), it does not have a specific deforestation criteria.[86] In contrast, the UTZ standard (now merged with the Rainforest Alliance) includes a criterion that excludes certification areas that were converted from HCV areas after 2008. The Rainforest Alliance – with which UTZ has merged – launched a new zero deforestation standard launched in 2020 which not only prohibits deforestation but also the destruction of all natural ecosystems, including wetlands and peatlands. It maintains a cut-off date of 2014 for destruction or conversion of any natural habitat. This means Rainforest Alliance (and UTZ when the merge takes full effect) is effectively zero deforestation, while Fairtrade is not.[87]

Fairtrade is the only certification scheme that has a system of price guards: there is a minimum price for cocoa (of US $2,600 per tonne as export price) as well as a fixed premium of US $400 per tonne of cocoa.[88] This helps provide farmers with greater financial security during periods of price volatility and decline on the world market for cocoa.

Switzerland has earned an international reputation for high quality chocolates and cocoa-related product and has the highest per capita consumption of chocolate compared to the rest of Europe. The high standard of Swiss chocolate mostly relates to the chocolate

[84] In 2018 Rainforest Alliance merged with UTZ, another major certification standard. Their combined and updated certification program, the Rainforest Alliance 2020 Certification Program, was published in July 2020 and after a phased roll-out, all stakeholders will be required to adopt the new certification requirements by July 2021. See: Rainforest Alliance, 2020. 2020 certification programme. For now, data is still reported separately for the two standards. Online at: https://www.rainforest-alliance.org/business/tag/2020-certification-program/
[85] 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
[86] http://www.fairtrade.net/fileadmin/user_upload/content/2009/standards/documents/SPO_EN.pdf
[87] http://sanstandard2017.ag/
[88] https://www.cbi.eu/news/living-income-gains-visibility-scale-cocoa-sector

processing techniques rather than the quality of the cocoa beans used. The Swiss market for Fairtrade and organic products is especially large compared to other countries, with a widespread availability of certified chocolate. In 2012, the market share of certified cacao (including the Organic and Fairtrade niche labels) was an estimated 22% and nearly all compliant production came from Rainforest Alliance and UTZ[89].

Mainstream sustainability certifications like Rainforest Alliance are commonly a market requirement for cacao in Switzerland meaning that traders wishing to sell in the country need to adopt these standards to keep up with competitors. Certification is becoming a key entry requirement for cocoa exporters in most of the Swiss market although there remains a lack of a coordinated and comprehensive approach to sustainable cocoa[90]. Fairtrade is especially popular; for example, the supermarket COOP focuses on Fairtrade, whereas since 2014 Migros sells all its chocolate under the UTZ label. In addition to these consumer labels, most Swiss companies including Nestle have formulated minimum sustainability requirements for key issues including child labour, safe working conditions, deforestation and pesticide use[91].

The Swiss Platform for Sustainable Cocoa was founded in 2018. Its members which include a range of industry stakeholders including manufacturers and retailers, have committed to sourcing at least 80% of cocoa from sustainable production by 2025[92].

4.1.5 Switzerland's response to environmental and social issues with cocoa

Consumer awareness and demand for sustainable cocoa in Switzerland is high and consumers are willing to pay the higher prices associated with buying Fair trade and organic cocoa products. Associated sales in the country rising sharply in recent years, increasing 71% between 2016 and 2017 whilst in 2018, the country sold 4,500 tonnes of Fairtrade-certified cocoa products, equivalent to 7% of the country's total volume of cocoa and chocolate products. In response to international pressure to improve Switzerland's cocoa supply chain, a growing number of retailers, Swiss chocolate manufacturers, and global chocolate companies operating in Switzerland have developed their own initiatives around sustainable cocoa. In 2018, the Swiss Platform for Sustainable Cocoa was founded, with the aim of promoting sustainability in the cocoa supply chain. Their target is to ensure that 80% of Swiss cocoa imports are either certified to standards such as Rainforest Alliance, organic or Fairtrade or are produced according to requirements that are equivalent to these standards by 2025[93]. Over 40 actors from the cocoa and chocolate sectors actively participate in this initiative, whilst its founding members include the large multinational Barry Callebaut.

Besides this sector-wide initiative, most chocolate companies based in Switzerland have their own sustainability strategies, standards and programs. These include Barry Callebaut's Forever Chocolate programme, Nestlé's Cocoa Plan, Lindt & Sprüngli's sustainable sourcing programme and Felchlin's Fair direct cacao strategy. Major companies also endorse certification schemes, for example, Maestrani ensures all cocoa it sources is certified by either Fairtrade, Rainforest Alliance/UTZ or Hand in Hand[94].

On an international scale, the World Cocoa Foundation (WCF), and especially its Cocoa and Forests Initiative, is a potentially important development in addressing deforestation and

[89] https://www.ceintelligence.com/files/documents/Cocoa%20Sector%20-%20Cacao%20in%20Switzerland.pdf
[90] https://www.ceintelligence.com/files/documents/Cocoa%20Sector%20-%20Cacao%20in%20Switzerland.pdf
[91] https://www.ceintelligence.com/files/documents/Cocoa%20Sector%20-%20Cacao%20in%20Switzerland.pdf
[92] https://www.cbi.eu/market-information/cocoa-cocoa-products/switzerland/market-potential
[93] https://www.kakaoplattform.ch/fileadmin/redaktion/dokumente/Absichtserklaerung_D_F_E.pdf
[94] https://www.cbi.eu/market-information/cocoa-cocoa-products/switzerland/market-potential

social issues in cocoa production. This initiative has brought together the two largest cocoa producing countries, 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[95].

4.2 Trade of Cocoa

4.2.1 Global Trade

The main producers of cocoa raw materials – cocoa beans, liquor, butter, paste, powder, and shells – are Côte d'Ivoire, Ghana, Indonesia, Nigeria and Cameroon. According to global trade data, Ghana and Côte d'Ivoire are also amongst the biggest exporters globally, but so are several countries in Europe. In particular, the Netherlands accounts for 19% of all global exports of cocoa raw materials in 2018, reflecting its role as a major trade hub into Europe[96] .

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%). These countries are involved in significant onward intra-European trade. Outside of Europe, the USA (12% of global imports) and Malaysia (6%) also play significant roles in the global trade of cocoa.

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 € 39.3 billion of cocoa products were exported globally each year in the period 2015-19. Of this, cocoa beans account for €8 billion, partly or fully processed cocoa products for € 31.3 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.

4.3 Switzerland's imports of cocoa[97]

Switzerland is not a member of the EU, though it is a member of the European Free Trade Association (EFTA)and to facilitate free trade with the EU, Switzerland has adapted the Swiss food law to European law to a large extent[98].

Imports of cocoa products averaged over 95,000 tonnes each year between 2015-2019 (

[95] https://www.worldcocoafoundation.org/initiative/cocoa-forests-initiative/
[96] Source: UN COMTRADE https://comtrade.un.org/data/. Last accessed 25 August 2020. Note: for Côte d'Ivoire, 2015 export data has been used as 2016 data was unavailable.
[97] Unless otherwise stated all data is derived from UN COMTRADE https://comtrade.un.org/data/
[98] https://www.cbi.eu/market-information/cocoa-cocoa-products/switzerland/market-entry

Figure *11*). Overall 46% of the total import quantity of cocoa are cocoa beans, indicating that the majority of Switzerland'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 (30%) and Cocoa paste (9%). See Appendix 3 for details of the HS codes used in these calculations.

Figure 11: Quantity of cocoa products imported by Switzerland between 2015-19, not adjusted for cocoa content (tonnes)

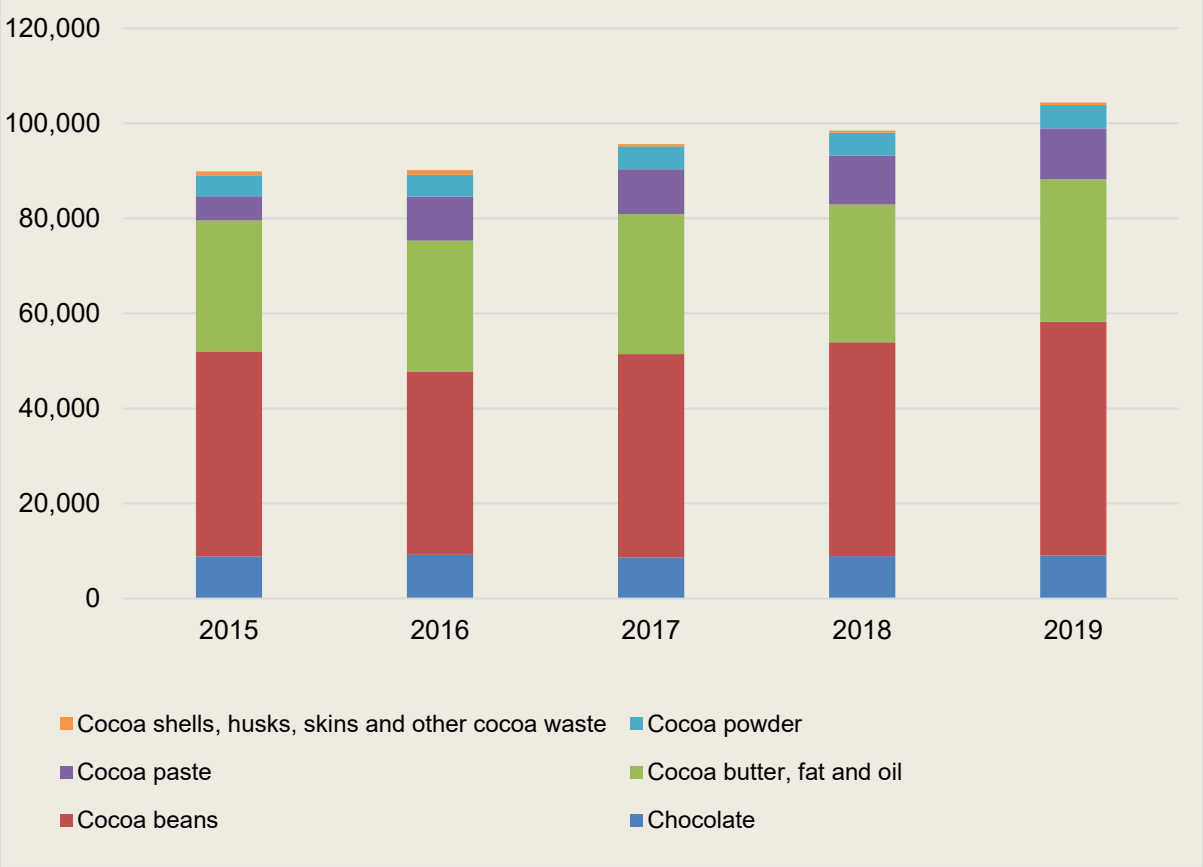
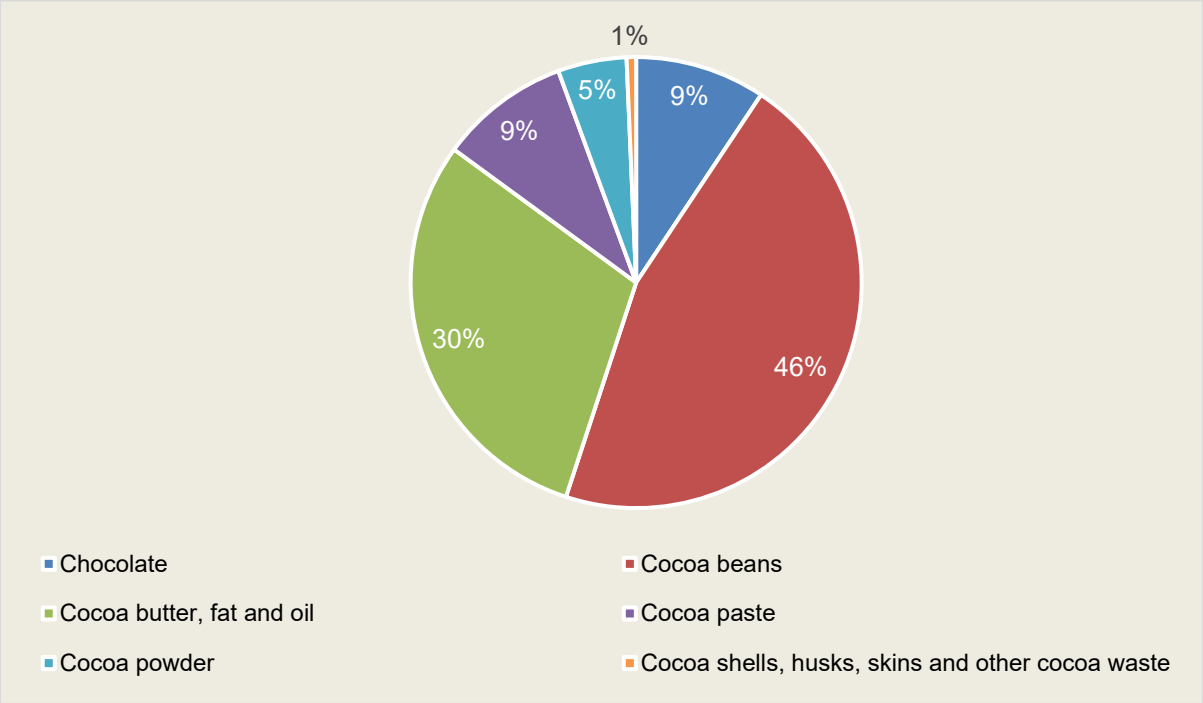


Table 4: Quantity of Switzerland's cocoa imports by major product categories, 2015-19, adjusted for cocoa content (tonnes)

	Volume of cocoa imports by year (tonnes)						
Form of cocoa import	**2015**	**2016**	**2017**	**2018**	**2019**	**Average**	**Total**
Chocolate	8,834	9,212	8,648	8,944	9,078	8,943	44,715
Cocoa beans	43,187	38,577	42,784	44,984	49,159	43,738	218,690
Cocoa butter, fat and oil	27,549	27,546	29,484	29,016	30,001	28,719	143,595
Cocoa paste	5,080	9,265	9,422	10,235	10,711	8,943	44,713
Cocoa powder	4,409	4,579	4,825	4,863	4,904	4,716	23,580
Cocoa shells, husks, skins and other cocoa waste	852	989	465	410	544	652	3,259
Total	**89,910**	**90,167**	**95,627**	**98,452**	**104,396**	**95,710**	**478,551**

Though the majority of Switzerland's imports comprise cocoa raw materials – cocoa beans, butter, paste and powder – the country also imports cocoa embedded in processed chocolate products. The equivalent weights of cocoa raw materials in these chocolate products are estimated using conversion factors (see Appendix 3). The amount of cocoa raw material required to supply Switzerland's imports averaged over 95,000 tonnes per year between 2015-19. Cocoa beans contribute the largest proportion of total imports by quantity (46%), followed by cocoa butter, fats and oil (30%) and cocoa paste (9%). Cocoa embedded in processed chocolate comprise 9% of imports (Figure 12).

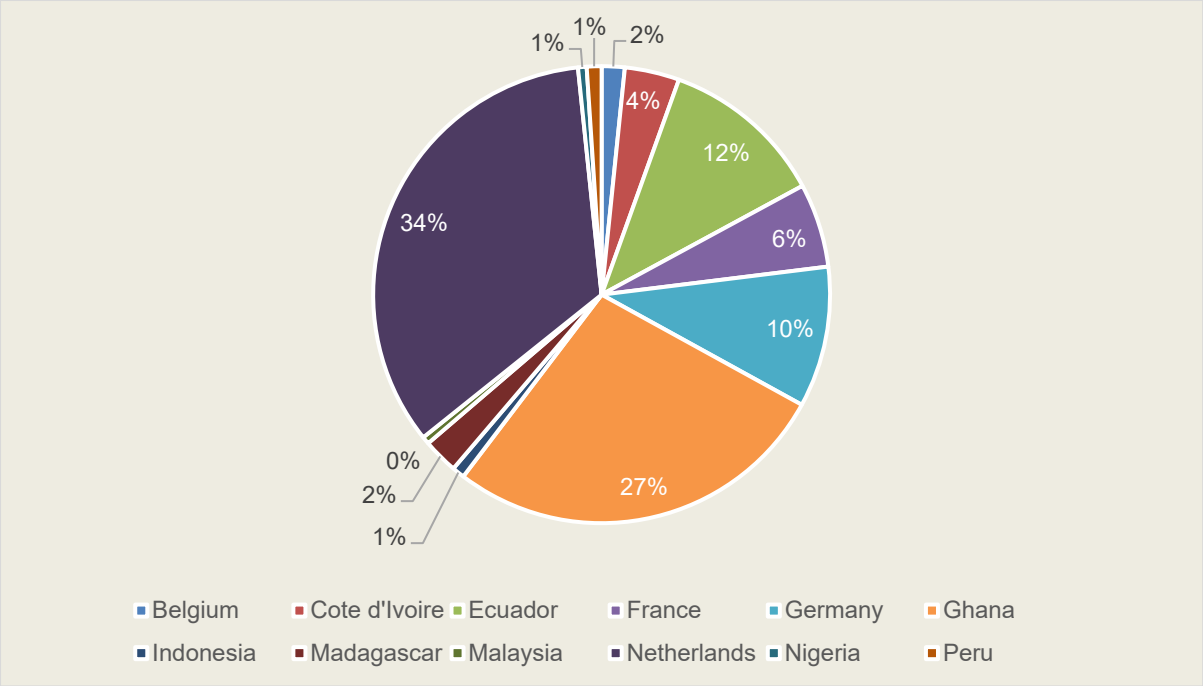
Figure 12: Quantity of Switzerland's imports of products containing cocoa, adjusted for cocoa content (tonnes). Average of 2015-19



4.4 Provenance of Switzerland's imports of cocoa

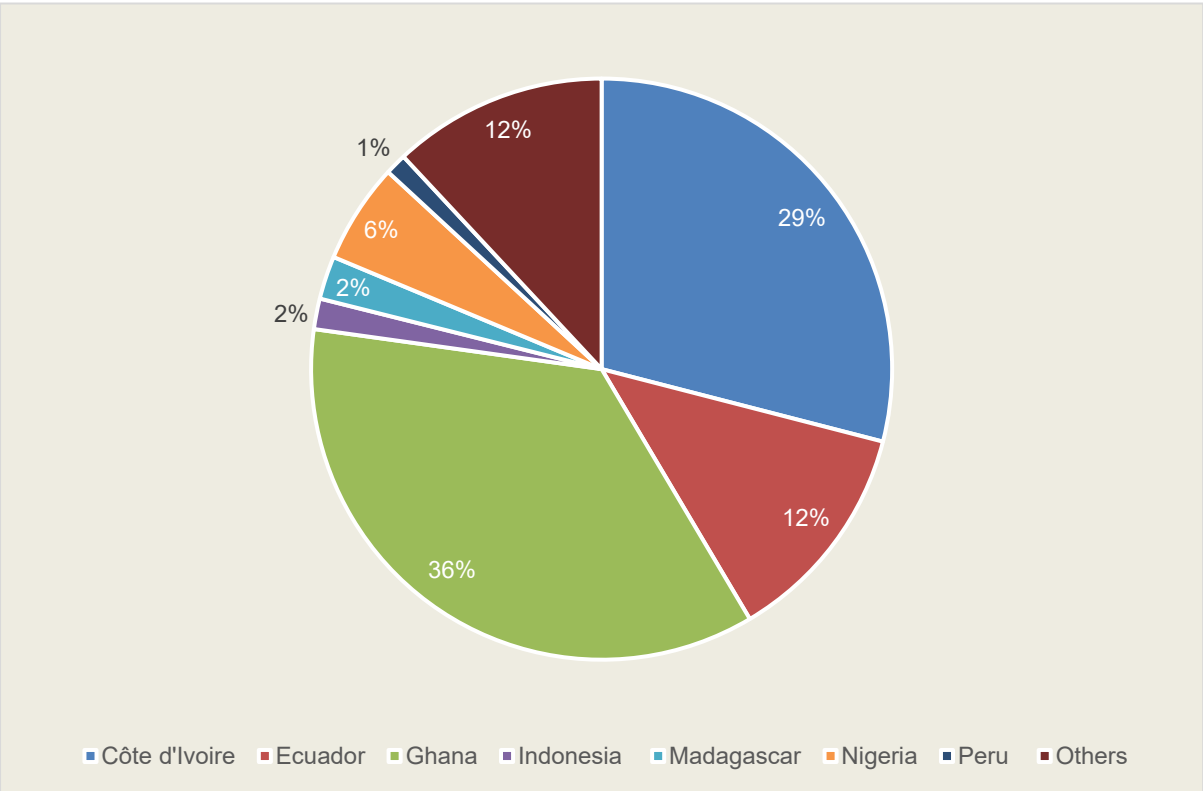
Between 2015 and 2019, Switzerland imported cocoa products from a total of 128 territories. Corrected for the cocoa content of imports, Switzerland imports 45% of its cocoa directly from cocoa producing countries, predominantly from Ghana (27%), Ecuador (12%) and Côte d'Ivoire (4%). However, some imports are received from European countries (France, Germany, the Netherlands and Belgium) (Figure 13).

Figure 13: The quantity of Switzerland's imports of cocoa between 2015-19 from major exporting countries (including non-producer countries, tonnes)



Adjusting for the provenance of these imports received from non-producer countries, the dominant role that Côte d'Ivoire and Ghana play in Switzerland's cocoa supply becomes more apparent (Figure 14). Between 2015 and 2019, an average of 29% of Switzerland's cocoa originated from Côte d'Ivoire and 36% from Ghana. Among other producing countries, only Nigeria (6%) and Ecuador (12%) contributed more than 2% to Switzerland's cocoa imports.

Figure 14: The quantity of Switzerland's imports of cocoa between 2015-19, adjusted for provenance of third-party trade (tonnes)



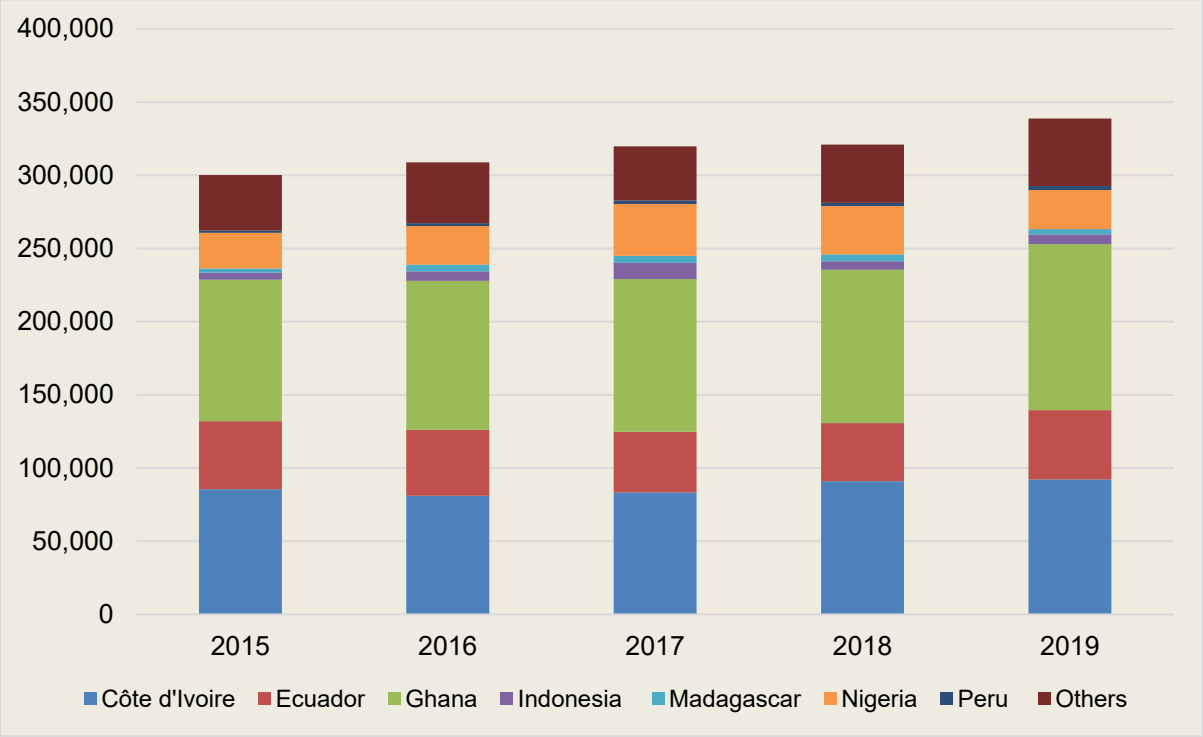
4.5 Switzerland's cocoa footprint

To produce an estimate of land required to supply Switzerland's cocoa imports, the cocoa used in the products imported by Switzerland 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 Switzerland'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.[99]

The estimated land area required to satisfy Switzerland's demand for cocoa products averaged over 300,000 hectares per year between 2015-19 (Figure 15). Ghana dominates the land footprint, with an average of 104,000 hectares each year (33%), with Côte d'Ivoire contributing the second largest area (86,000 hectares, 27%).

The land area required to supply Switzerland's imports from Ghana rose from 96,000 hectares in 2015 to 104,000 hectares in 2019, unlike that of Ecuador, which decreased from 46,000 hectares to 43,000 hectares over the period.

Figure 15: Estimated land footprint of Switzerland's imports of cocoa between 2015-2019 (hectares)



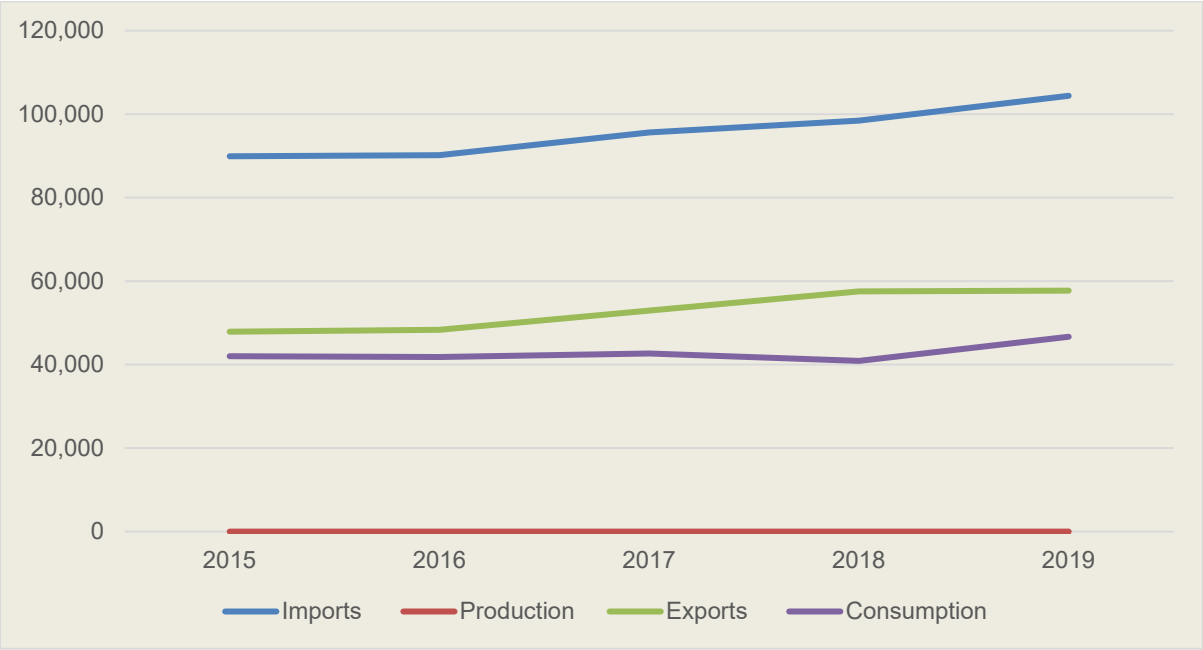
4.6 Estimated cocoa consumption

Switzerland's consumption of cocoa is estimated by subtracting the average quantity of exported cocoa (48,000 tonnes) from the overall quantity of imported cocoa (90,000 tonnes), providing an average consumption figure of almost 42,000 tonnes of cocoa per year between 2015-2019 (Figure 16). Consumption represents 45% of Switzerland's annual imports of cocoa during the period and 1% of all global cocoa production. The area necessary to produce this amount of consumed cocoa is just over 142,000 hectares – which

[99] 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.

is equivalent to 1% of the global harvested area for cocoa and 3% of Switzerland's land area.

Figure 16: Switzerland's imports, exports and consumption of cocoa 2015-19 (tonnes)



4.7 Switzerland's cocoa risk profile

Switzerland is a major trading hub for cocoa and amongst the top importers 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 Switzerland as a major imported commodity and the subsequent need to ensure sustainable and responsible sourcing.

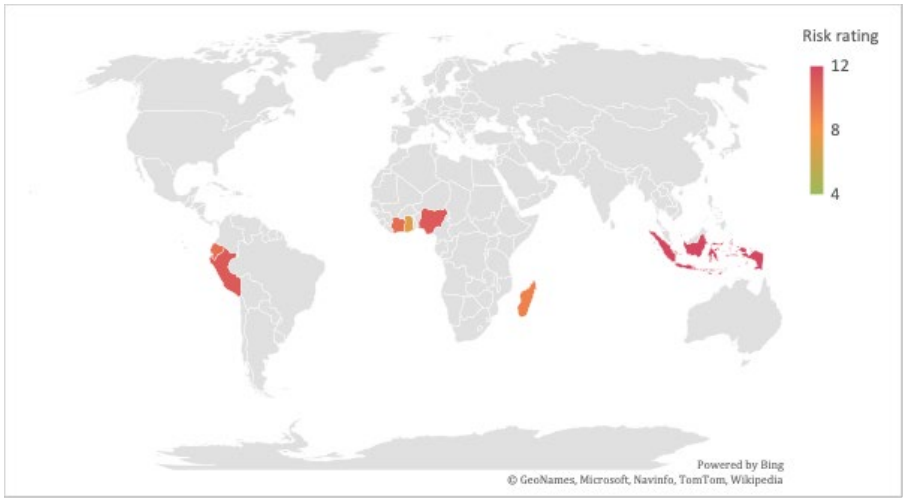
Switzerland imports over half – 54% - of its cocoa products from high and very high risk countries: Côte d'Ivoire, Ecuador, Nigeria, Peru, Indonesia and Madagascar. All of these countries have significant deforestation, labour and corruption issues. The majority of the remaining footprint is from Ghana (33%) which at national level is rated as medium risk due to relatively modest rates of tree cover loss and natural forest loss (Table 8). However, the cocoa sector in Ghana has repeatedly been shown to rely on low paid or unpaid labour, coercion and violence, and systematic debt,[100] is included by the US Department for Labour in their List of Goods Produced by Child Labour,[101] 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. Levels of consumer awareness and demand for certified products in Switzerland are high. The per capita consumption of organic and Fairtrade products in Switzerland is the highest per capita globally and sales of Fairtrade

[100] Genevieve LeBaron (2018) The Global Business of Forced Labour: Report of Findings, SPERI & University of Sheffield.
[101] https://www.dol.gov/ilab/reports/child-labor/list-of-goods

chocolate have increased sharply in recent years. There is therefore good potential for a further increase in sustainable sourcing[102].

Figure 17: Risk profile of origin countries for Switzerland's cocoa imports



4.8 Estimated greenhouse gas emissions from Switzerland's cocoa imports

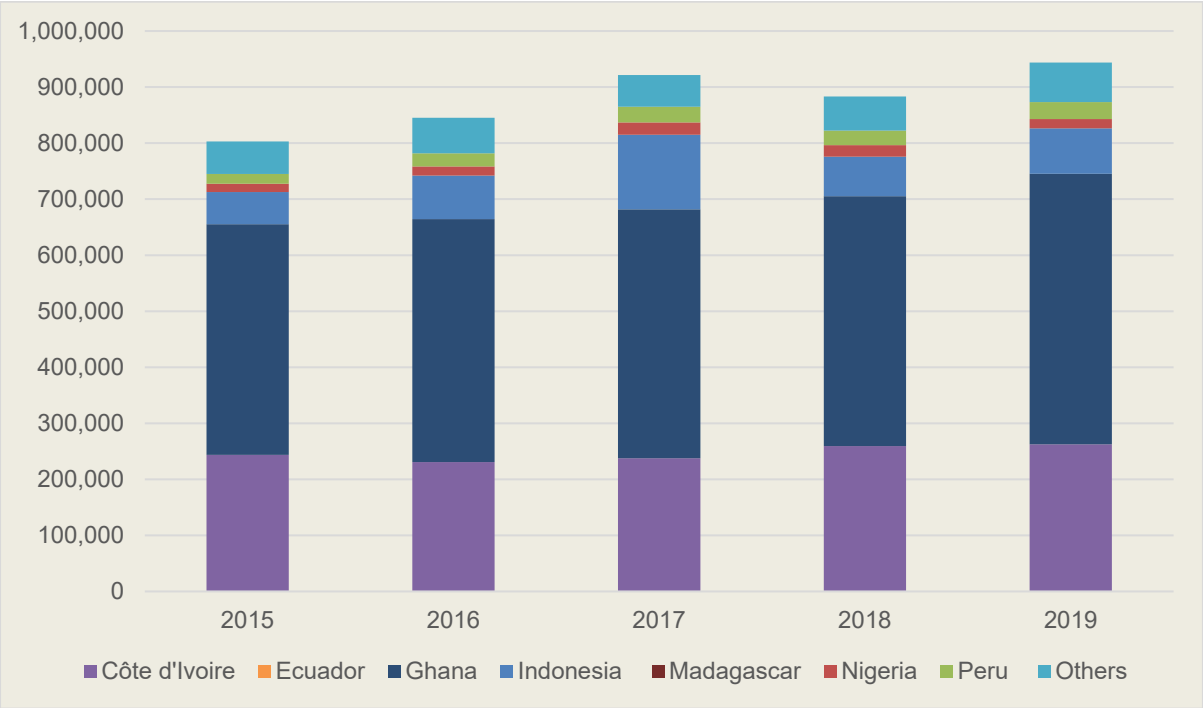
The greenhouse gas emissions associated with the production of cocoa for Switzerland's imports are estimated by taking the land footprint in each country and applying a calculated per hectare emissions value for the specific crop and country pairing (see Methodology).

The emissions from cocoa production were an average of 879,000 tonnes CO_2eq per year. This accounts for almost one third (29%) of the greenhouse gas emissions associated with the agricultural commodities analysed here and is equivalent to approximately 2.5% of Switzerland's annual greenhouse gas emissions[103].

Emissions generally increased over the period (Figure 18), fluctuating slightly due to changes in the annual land footprint in Indonesia and Nigeria. Ghana accounted for by far the largest proportion of GHG emissions, due to the significant land footprint of cocoa production in the country. This is particularly striking as emissions per hectare are actually relatively low in Ghana compared to Indonesia and Peru, at 4.26 compared to 12.09 and 11.49 tonnes CO_2eq per hectare per year.

[102] CBI. The Swiss market potential for cocoa. Online at: https://www.cbi.eu/market-information/cocoa-cocoa-products/switzerland/market-potential
[103] See Methodology for detail of how this is calculated.

Figure 18: Estimated greenhouse gas emissions from land use change associated with Switzerland's imports of cocoa 2015-19 (tonnes CO_2eq)



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.[104] 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.[105]

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.[106]

An estimated three million smallholders grow oil palm, accounting for approximately 40% of total global oil palm production.[107] 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.[108] However, smallholders' yields are generally lower than that of

[104] Note: these are 2011 figures. http://www.befair.be/sites/default/files/Huile%20de%20Palme%20EN.pdf
[105] Oil World (2016)
[106] 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.
[107] https://rspo.org/smallholders
[108] 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

large-scale plantations due to lack of access to higher-yielding stock and lower knowledge on agricultural practices.[109] 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[110] are estimated to be present in over 50% of packaged supermarket products.[111] 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 in 2019, the European Commission introduced measures to phase out palm oil in biofuel due to concerns over the sustainability of its production, and Switzerland has criteria which restrict imports of biofuels based on palm oil feedstocks (see below).[112]
- **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. In Switzerland, the Swiss Farmers' Association has called on members to eliminate palm oil from animal feed, predominantly from dairy cow supplements[113].

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.[114] By contrast, palm oil use in Switzerland is predominantly in manufactured products. Globally, the growth in demand for palm oil has been partly driven by 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.

[109] 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.
[110] 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.
[111] https://www.pwc.com/id/en/publications/assets/palm-oil-plantation-2012.pdf
[112] https://eeas.europa.eu/sites/eeas/files/20190321_press_release_palm_oil_en.pdf
[113] https://www.swissinfo.ch/eng/embarrassing-oversight_swiss-farmers-reject-palm-oil-cow-supplements/43223902
[114] https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2016-01-28-agricultural-commodities-brack-glover-wellesley.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).[115]

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.[116] 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.[117] 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.[118]

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.[119] 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.[120]

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[121] and 1.75[122] billion tonnes of CO_2 equivalent, and effectively tripled Indonesia's greenhouse gas emissions for that year. Approximately 19% of the land burned

[115] 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)
[116] 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.
[117] For example, Brook, B.W., Sodhi N.S., Ng P.K.L. (2003). Catastrophic extinctions follow deforestation in Singapore. Nature 424, 420–423.
[118] 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)
[119] 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.
[120] 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
[121] 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
[122] 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,[123] 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.[124]

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,[125,126] but also in other producer countries[127]), forced and child labour (especially Indonesia and Malaysia),[128,129,] and issues relating to the terms and conditions of labour, (such as wages, health and safety and gender discrimination[130]).

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.[131]

RSPO has been conspicuously successful in achieving scale when compared to sustainability certification schemes in most other commodities. The RSPO currently has more than 4,000 members and RSPO certified growers accounted for 19% of global production in 2014.[132] 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,

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[123] 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

[124] 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.

[125] 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.

[126] 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.

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

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

[129] 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

[130] 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.

[131] 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)

[132] http://www.rspo.org/about Last accessed 26th August 2020

including land grabs, deforestation, and illegal working conditions.[133] RSPO certification has been found to have had some impact on reducing conversion of forest areas within existing plantations,[134] but may have had little impact on palm-oil associated deforestation more generally.[135]

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.[136] It has also released a smallholder strategy in an attempt to make the scheme more accessible to smallholders.

Despite these considerable recent advances, a major drawback in the RSPO system is the lack of controls on the uncertified portion of mass balance certified palm oil. This is likely to be the major source of deforestation-associated palm oil in many European markets, where certification levels are high, but are in large part mass balance.

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.

5.2.2 Switzerland'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.[137] 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 2008[138]. Although Switzerland is not an EU member state and therefore not represented in this figure, over half of Switzerland's imports of palm oil come from EU partner countries so it is linked to the impacts. In addition, Switzerland has a free trade agreement with Indonesia,

[133] 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.
[134] 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
[135] 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
[136] RSPO (2018). Principles and Criteria for the Production of Sustainable Palm Oil. Available from: https://rspo.org/principles-and-criteria-review
[137] 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.
[138] 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

the largest producer of palm oil[139]. 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 sustainability regulations in the EU or Switzerland, 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[140]). As a significant proportion of Swiss palm oil imports come through EU partners, these measures are relevant to Switzerland.

Switzerland has established The Palm Oil Network (Palmoel Netzwerk), a forum for Swiss stakeholders involved in the palm oil supply chain to promote the sustainable development of its production. The founding members of the Network include Barry Callebaut, Coop, Florin, Migros, M-Industry, Nestlé Switzerland, Nutriswiss and Pro Fair Trade, who all claim to import 100% of their palm oil from RSPO-certified and segregated sources. The Palm Oil Network aims to continue developing the RSPO standard and improve the implementation of RSPO directives[141]. The member organisations of the network include traders responsible for a significant proportion of Switzerland's imports of palm oil and estimates from the Swiss State Secretariat for Economic Affairs are that sustainably sourced palm oil accounts for up to 90% of imports to Switzerland[142].

Palm oil is often used as a feedstock for biofuels but there are some restrictions on this in Switzerland. In 2008, Switzerland extended a tax exemption for biofuels – including biodiesel and ethanol – to imports which could be shown to meet ecological and social requirements. Importers must submit detailed supporting information to show the biofuels meet the necessary standards before they qualify for the exemption[143]. Amongst the criteria is a requirement that the raw materials for the fuels must not be obtained from land converted after 1 January 2008. Biofuels from palm oil are presumed not to fulfil the criteria, but applicants can submit evidence to prove that they do[144]. Therefore, although it is possible that some biofuels imported into Switzerland do derive from palm oil feedstock, for the purposes of this analysis it is assumed they pose minimal risk and therefore are excluded.

In the EU, the European Parliament made a Resolution on Palm Oil and Deforestation in 2017 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

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[139] Switzerland and Indonesia sign free trade agreement. Online at: swissinfo.ch
[140] 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)
[141] https://palmoelnetzwerk.ch/en/the-network/
[142] https://www.idhsustainabletrade.com/uploaded/2020/02/IDH_The-UoA-to-Tackle-Tropical-Deforestation_2020-web.pdf

[143] http://cf.iisd.net/gsi/news-events/swiss-certification-scheme-biofuels-may-prove-controversial; https://www.ezv.admin.ch/ezv/en/home/information-companies/taxes-and-duties/importation-into-switzerland/petroleum-tax/biofuels.html. This regulation was set to be reviewed in June 2020 – the outcomes of this are not yet available.
[144] https://www.cbd.int/agriculture/2011-121/Switzerland-nov11-en.pdf

impact on global deforestation caused by the trade in crop and animal products, including palm oil.[145]

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. There are 13 Swiss companies that are Consumer Goods Forum members, including Coop, Migros, Nestlé and EMD[146].
- 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 Forum for Sustainable Palm oil (FONAP), which aims to enhance the use of sustainable palm oil use in Swiss, German and Austrian markets. Its 51 members have publicly committed to using only sustainably produced palm and palm kernel oil in their products, as well as complying by traceability measures of their palm oil[147].

- 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, Jennings, Schreiber *et al*. (2018).[148]

A growing number of companies and brands in Switzerland 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, the level of interest in palm oil free products prompted the launch of a certification scheme: the International Palm Oil Free Certification Accreditation Programme (POFCAP) a not for profit, consumer-facing certification scheme approved to certify palm oil free products in twelve countries, although Switzerland is not currently covered[149].

[145] 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.
[146] https://www.theconsumergoodsforum.com/who-we-are/our-members/
[147] https://www.forumpalmoel.org/the-fonap
[148] 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)
[149] See: http://www.palmoilfreecertification.org/

5.3 Trade of palm oil

5.3.1 Global trade

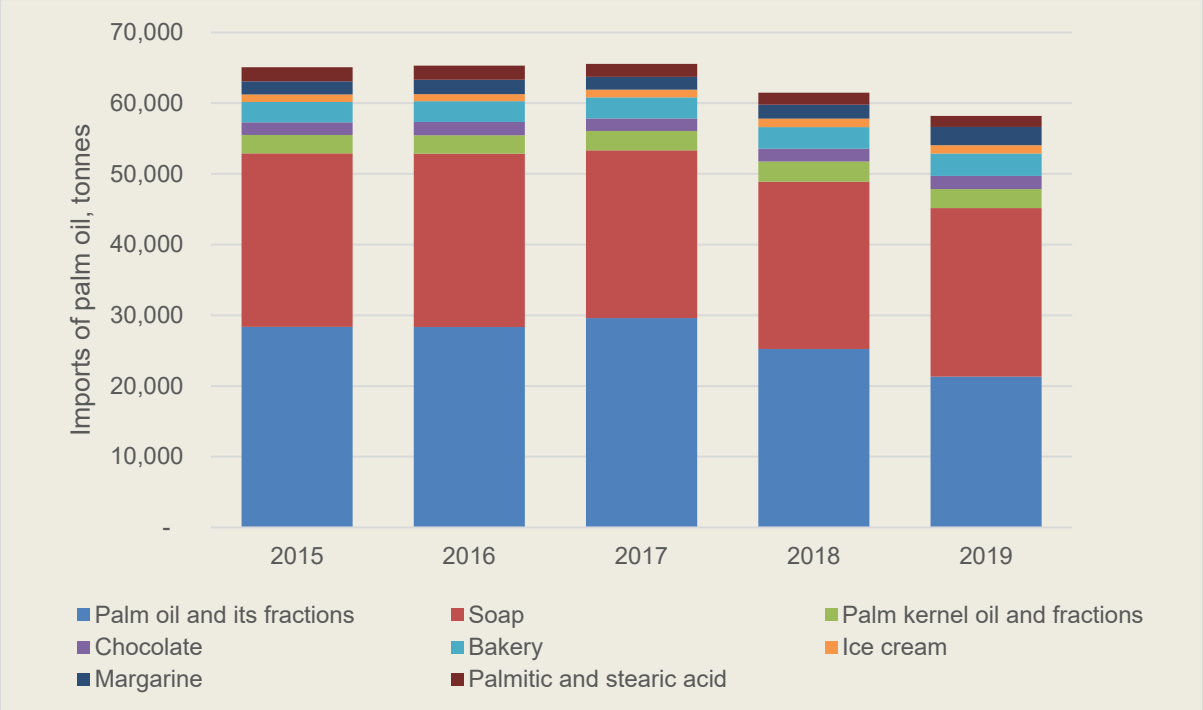
Global palm oil production has increased from 15.2 million tonnes in 1995 to over 70 million tonnes in 2018.[150] This volume is predominantly produced by Indonesia (46%) and Malaysia (34%). Indonesia and Malaysia increased the area cultivated for oil palm from 2.6 million hectares in 1990 to over 15 million hectares in 2014, with Indonesia accounting for just over 10 million hectares.[151] 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.[152]

Global demand for palm oil has seen strong and sustained growth. Major consuming countries include India, China, the EU, Indonesia and Malaysia. In 2018, India, China and the EU combined accounted for 55% of global imports[153].

5.4 Switzerland's imports of palm oil

Switzerland imported an average of 63,000 tonnes of palm oil per year between 2015-19. These include oil palm fractions (palm oil, palm kernel oil and palm kernel meal) as well as products that contain palm oil as an ingredient (e.g., soap, margarine) or embedded within the production process (Table 5, and see Appendix 4 for details of the HS codes and conversion factors used in these calculations). The total quantity of palm oil imports decreased over the period, from over 65,000 tonnes in 2018 to 58,000 tonnes in 2019. This decrease was mainly due to declines in volumes of palm oil and its fractions and of palmitic and stearic acid.

Figure 19: Quantity of Switzerland's imports of palm oil, products containing palm oil or embedded palm oil, 2015-19 (tonnes)



[150] FAOSTAT
[151] 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
[152] FAOSTAT, and Vijay V., Pimm S.L., Jenkins C. and Smith S.J., 'The Impacts of Oil Palm on Recent Deforestation and Biodiversity Loss', https://doi.org/10.1371/journal.pone.0159668
[153] Based on imports of HS code 1511 from https://comtrade.un.org/data/

Palm oil and its fractions was the main import by quantity (average of around 26,500 tonnes, 42% of the total) over the whole period, followed by soap (24,000 tonnes, 38%). However, in 2019, this ranking reversed and imports of soap accounted for the largest proportion of imported palm oil. For context, in similar analyses for the UK, soap was the third largest form of palm oil accounting for 155,000 tonnes of imported palm oil per year and in Belgium was the fifth largest form of palm oil after palm oil, palm kernel oil and biofuels[154,155]. Other imports comprised much smaller proportions of imports, for example bakery items containing palm oil accounted for 3,000 tonnes or 5% of imports and palm kernel oil and fractions which comprised 2,700 tonnes or 4% of total imports (Figure 19).

Note that these figures do not represent end use. For example, imported palm oil will be refined within Switzerland to 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.

Switzerland's pattern of imports is different from EU countries, such as Belgium, the Netherlands and the UK, which import a large proportion of biofuels, refined palm oil, crude palm oil and palm kernel oil[156].

[154] See; Jennings & Schweizer, 2019. Risky Business: the risk of corruption and forest loss in Belgium's imports of commodities. WWF Belgium; WWF-UK and RSPB, 2020. Riskier Business: the UK's overseas land footprint. Online at: https://www.wwf.org.uk/sites/default/files/2020-07/RiskierBusiness_July2020_V7_0.pdf

[155] Jennings & Schweizer, 2019. Risky Business: the risk of corruption and forest loss in Belgium's imports of commodities. WWF Belgium.

[156] Jennings & Schweizer, 2019. Risky Business: the risk of corruption and forest loss in Belgium's imports of commodities. WWF Belgium.

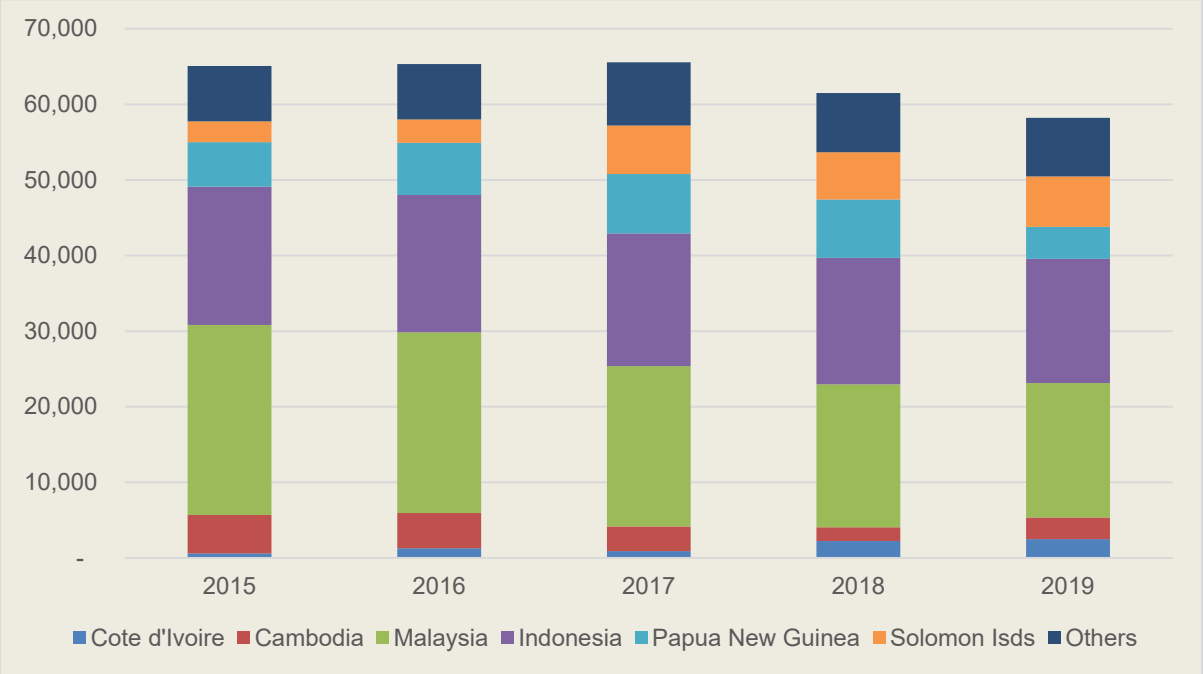
Table 5: Switzerland's palm oil imports 2015-19 by quantity of palm oil, palm kernel oil and palm kernel meal (tonnes)

Palm oil imports to Switzerland, converted to quantity of raw palm oil in tonnes							
Form of imports	**2015**	**2016**	**2017**	**2018**	**2019**	**Average**	**%**
Palm oil and its fractions	28,361	28,352	29,605	25,245	21,317	26,576	42%
Soap	24,542	24,502	23,716	23,650	23,837	24,049	38%
Palm kernel oil and fractions	2,591	2,604	2,743	2,843	2,691	2,695	4%
Chocolate	1,800	1,868	1,768	1,817	1,854	1,821	3%
Bakery	2,869	2,949	2,981	3,049	3,180	3,006	5%
Ice cream	1,061	998	1,108	1,201	1,169	1,107	2%
Margarine	1,869	2,045	1,792	1,969	2,598	2,055	3%
Palmitic and stearic acid	1,980	1,992	1,847	1,714	1,560	1,819	3%
Palm Kernel Expeller and oilcake	-	6	0	-	-	1	0.002%
Other	1	0	0	8	2	2	0%
Total	**65,075**	**65,318**	**65,560**	**61,496**	**58,207**	**63,131**	**100%**

5.5 Provenance of Switzerland's palm oil imports

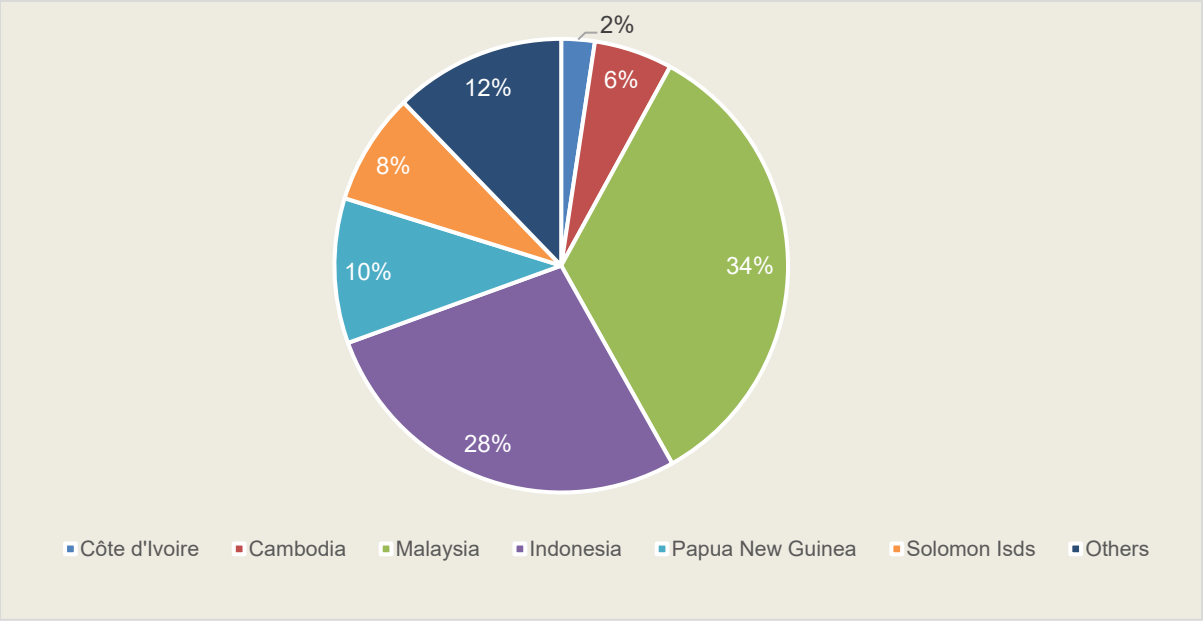
Between 2015 and 2019, Switzerland imported palm oil and its fractions, and products containing them or embedded in the production process from a total of 95 territories. Swiss imports are dominated by palm oil producer countries, principally Malaysia, which accounted for an average of 21,400 tonnes per year or 34% of total imports, and Indonesia which accounted for 17,400 tonnes, representing 28% of imports (Figure 20 and Figure 21).

Figure 20: The provenance and quantity of Switzerland's imports of palm oil as raw material, an ingredient or embedded within production processes between 2015-19 (tonnes)



The decline in import volumes in 2018 and 2019 were driven mainly by decreases in imports from Malaysia and Papua New Guinea.

Figure 21: The average proportion of Switzerland's imports of palm oil as raw material, an ingredient or embedded within production processes from supplier countries 2015-19 (tonnes)



5.6 Switzerland's palm oil footprint

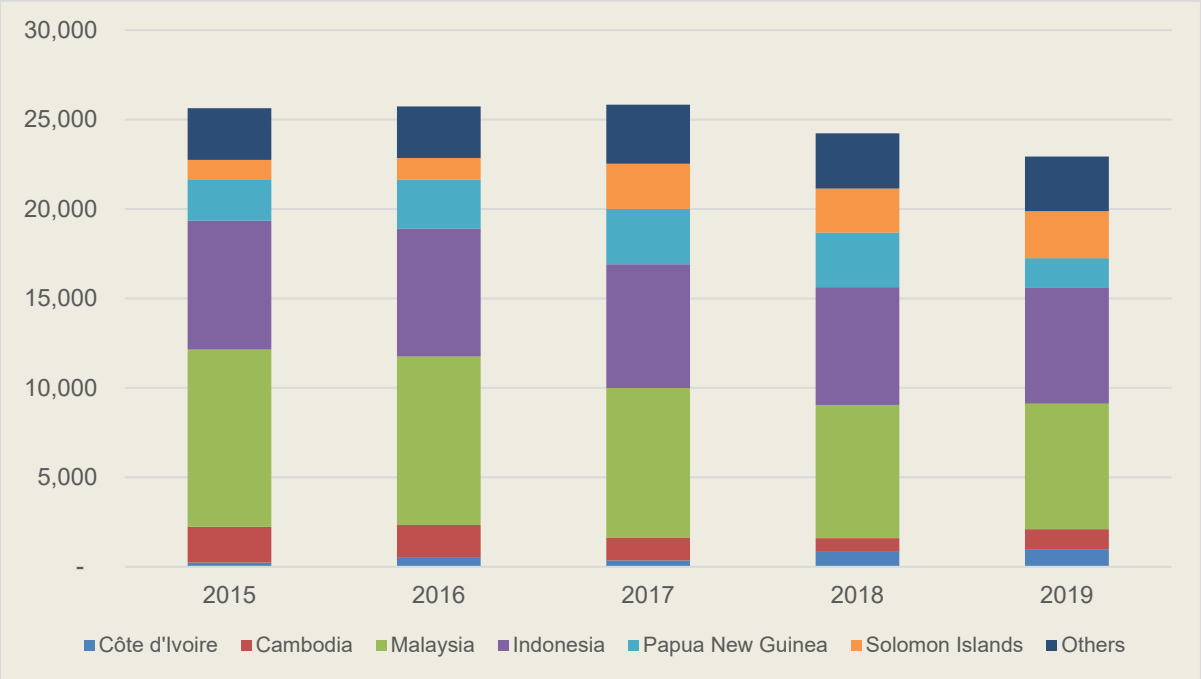
To estimate the land area required to supply Switzerland's palm oil imports, the forms in which palm oil is imported were firstly assigned to their respective palm fractions, i.e. crude palm oil, palm kernel oil and palm kernel meal. These fractions were then allocated to average per hectare yields specific to the fraction: palm kernel oil: 3.7 tonnes per hectare, palm kernel oil: 0.5 tonnes per hectare, and palm kernel meal: 0.54 tonnes per hectare.[157]

The estimated average land area required to satisfy Switzerland's imports of oil palm was 24,800 hectares per year between 2015-19 (Figure 22). This is equivalent to approximately 0.13% of the global harvested area of oil palm, or 0.6% of Switzerland's own land area.

Malaysia accounts for the largest proportion of the land footprint of Switzerland's palm oil imports, with an average of 8,400 hectares each year (34% of the total). Indonesia contributes the second largest area (6,800 hectares, 28%).

The footprint declined slightly in 2018 and 2019. This is mainly driven by a decrease in the size of the footprint in Malaysia which is due to a reduction in import volumes from here. A decline in the size of the footprint in Papua New Guinea and Cambodia has also contributed.

Figure 22: The estimated land footprint of Switzerland's imports of palm oil between 2015-2019 (hectares)



5.1 Estimated consumption

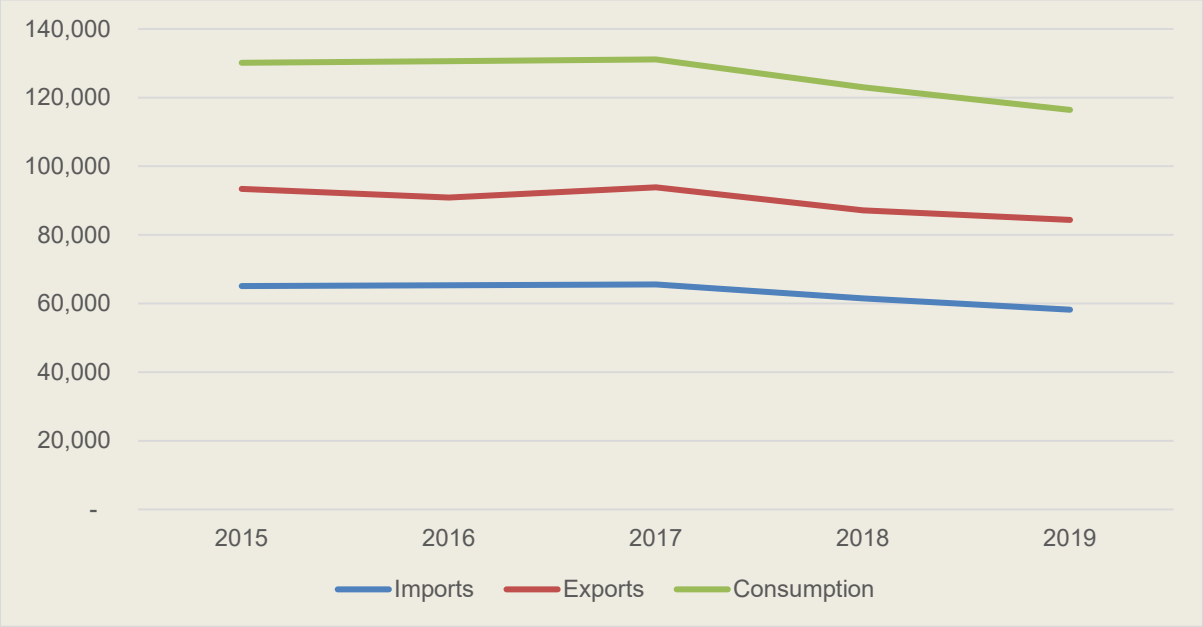
Using the same HS codes and conversion factors (see Appendix 4 for details), we estimate that Switzerland exports an average of approximately 21,000 tonnes of palm oil each year, as raw material, an ingredient of exported products, or embedded in the production of products. Sixty seven percent of the palm oil contained within these exports was embedded in soap, followed by an estimated 22% exported as chocolate[158]. Other exported products

[157] Various sources, including RSPO

[158] Although we found evidence that Swiss chocolate manufacturer Lindt-Sprüngli restricts the content of palm oil in their chocolate (by only using palm oil in fillings and not as the fat in their chocolate mass), we found no evidence of widespread restrictions on palm oil in chocolate. Source: https://www.lindt-spruengli.com/palmoil/

account for very small proportions of exported palm oil, with the next highest proportion being margarine (5%) Switzerland's estimated consumption of palm oil was on average 36,000 tonnes per year between 2015-19, equivalent to 56% of imports (Figure 23).

Figure 23: Switzerland's imports, exports and consumption of palm oil 2015-19 (tonnes)



5.2 Switzerland's palm oil risk profile

Switzerland imports most of its palm oil (69%) from high and very high-risk countries, principally Indonesia and Malaysia (Figure 24). Both countries have significant deforestation, labour and corruption issues (Table 8). Imports also come from Cambodia and Côte d'Ivoire where forest loss and labour rights are high risk. A smaller part of the footprint also comes from Papua New Guinea and Solomon Islands, both ranked as medium risk. The 'other' countries that supply 12% (in Figure 22 as 'others') is likely to comprise 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. 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 24: Switzerland's palm oil footprint by risk category

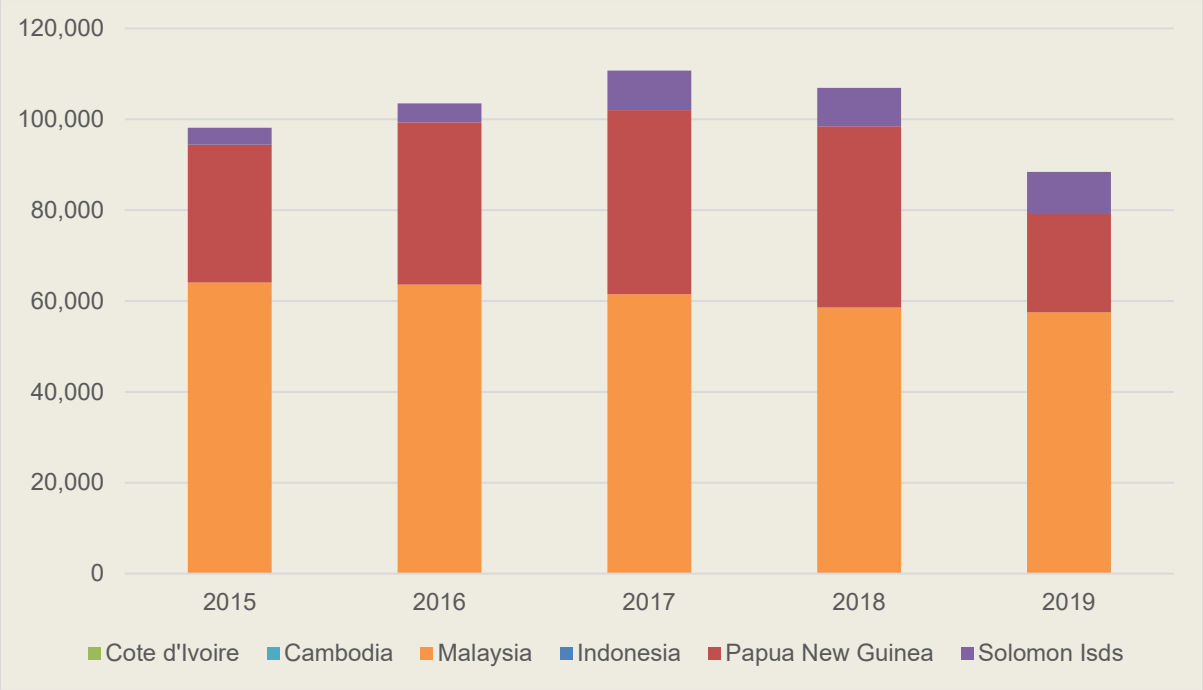
5.3 Estimated greenhouse gas emissions from Switzerland's palm oil imports

The greenhouse gas emissions associated with the production of palm oil for Switzerland's imports are estimated by taking the land footprint in each country and applying a calculated per hectare emissions value for the specific crop and country pairing.

For palm oil, average annual emissions were 102,000 tonnes CO_2eq per year, which is equivalent to 0.3% of the total emissions associated with the agricultural commodities analysed here. However, emissions data are not available for Indonesia, so this is a significant underestimate of the actual total.

The largest source of emissions (not considering Indonesia) was Malaysia, which accounted for an average of 60% of the emissions per year. The next largest source of emissions was Papua New Guinea and then the Solomon Islands. There were no land use change emissions associated with palm oil production in Côte d'Ivoire or Cambodia over the period (see Section 2.5). Emissions increased between 2015 and 2017 and then appeared to decline in the past two years, mainly due to a decline in the land area associated with Switzerland's palm oil imports from Malaysia.

Figure 25: Estimated greenhouse gas emissions associated with land use change for Switzerland's imports of palm oil



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 doubled between 2000 and 2018[159]. This growth in production has been dominated by three countries: the USA, Brazil, and Argentina, which together account for over 80% of global production[160]. The US has been the leading soy producer since the 1940s but the production in South America has increased rapidly in recent decades[161] with Brazil projected to become the largest global soy producer in 2019-20[162].

Global soybean production has grown by an average of 4% over the last 20 years, and after a contraction in 2019, is projected to increase by a similar amount again for 2020/21[163].Growth in production is likely to continue primarily through the expansion of cultivated area, since soy has relatively limited potential for yield increases.[164] The majority of this expansion is projected to come from South America.[165] 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.[166]

[159] FAOSTAT
[160] FCRN. Soy: food, feed and land us change. Online at: https://www.foodsource.org.uk/building-blocks/soy-food-feed-and-land-use-change#SOYBB2
[161] García-Lopez, G.A. and Arizpe, N. (2010), 'Participatory processes in the soy conflicts in Paraguay and Argentina', Ecological Economics, 70(2), 196-206.
[162] FCRN. Soy: food, feed and land use change. Online at: https://www.foodsource.org.uk/building-blocks/soy-food-feed-and-land-use-change#SOYBB2
[163] https://ihsmarkit.com/research-analysis/blog-world-soybean-production-projected-rebound.html
[164] https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2016-01-28-agricultural-commodities-brack-glover-wellesley.pdf
[165] http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1215457178567/Soybean_Profile.pdf
[166] U.S. Soybean Export Council conversion table, see: https://ussec.org/resources/conversion-table

- **Soy meal (or 'cake')**: This is the material remaining from oil extraction, which can contain up to 49% protein.[167] The meal is 'toasted' (steam treated) and ground and then is almost entirely used in livestock feed.
- **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, soymilk, textured vegetable protein, and edamame.

Over 85% of the global soybean crop is crushed for oil and meal, with approximately 70% of the total used to feed livestock[168]. Soy meal accounts for around 70% of the world's production of vegetable and animal 'protein meals'[169] and occupies a prominent position among protein feedstuffs used for the production of feed concentrates[170].

Soybean oil is the second most important vegetable oil (after palm oil), accounting for 25% of global vegetable/animal oils and fats consumption[171]. 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.[172]

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').[173]

Soy is also used to produce biodiesel. However, in Switzerland, there are some restrictions on this; a 2008 tax exemption for biofuels was extended to imports for which importers could provide detailed supporting information to show production meets ecological and social criteria, including proof that the materials were not obtained from land converted after 1 January 2008[174]. Biofuels from soybeans are presumed not to fulfil the criteria, but applicants can submit evidence to prove that they do[175]. Therefore, although it is possible that some biofuels imported into Switzerland do derive from palm oil feedstock, for the purposes of this analysis it is assumed they pose minimal risk and therefore are excluded.

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.[176] One recent study estimated that soy production accounted for 0.6 million hectares of land use change per year between 2000-11

[167] Cromwell, G. L., 2012. Soybean meal - An exceptional protein source. Soybean Meal InfoCenter, Ankeny, IA
[168] FCRN. Soy: food, feed and land us change. Online at: https://www.foodsource.org.uk/building-blocks/soy-food-feed-and-land-use-change#SOYBB2
[169] 'Meal' in this case refers to food materials that are ground into a powder as a base for other uses such as animal feed, other examples include fish meal
[170] Food and Agriculture Organization of the United Nations. Food Balance Sheets. *FAOSTAT* (n.d.). Available at: http://www.fao.org/faostat/en/#data/FBS. (Accessed: 11th August 2020)
[171] FCRN. Soy: food, feed and land us change. Online at: https://www.foodsource.org.uk/building-blocks/soy-food-feed-and-land-use-change#SOYBB2
[172] 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.
[173] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[174] http://cf.iisd.net/gsi/news-events/swiss-certification-scheme-biofuels-may-prove-controversial; https://www.ezv.admin.ch/ezv/en/home/information-companies/taxes-and-duties/importation-into-switzerland/petroleum-tax/biofuels.html. This regulation was set to be reviewed in June 2020 – the outcomes of this are not yet available.
[175] https://www.cbd.int/agriculture/2011-121/Switzerland-nov11-en.pdf
[176] Nepstad, D.C, et al. (2006), 'Globalisation of the Amazon Soy and Beef Industries: Opportunities for Conservation', Conservation Biology 20: 6

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.[177] Seventy per cent of the Saladillo wetlands in Cordoba, Argentina have been lost as a result of the construction of canals for soy cultivation.[178] Soy can also act as an indirect driver of deforestation, displacing cattle ranching towards the forest frontier.[179]

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 the EU between 1990 and 2008.[180] This estimate however does not include the role of soy as an indirect driver of deforestation via its impact on land prices.[181]

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[182] and Paraguay.[183] The fertilisers and pesticides used in soy cultivation can pose health risks to people living near soy farms.[184]

In response to concerns about these issues, and due to its requirements for soy used as animal feed to be GM-free, Switzerland has begun to switch its sourcing of soy to European producers as well as Russia and the Ukraine, which have seen significant increases in soy production since 2008[185]. Some reports suggest proportions of soy imports sourced from Europe are as high as 50% whilst other sources indicate it is closer to 10% having grown rapidly from just 1% of imports in 2010[186].

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[187] 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.[188] A revised version of the standard

[177] 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.
[178] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[179] Barona, E., et al. (2010) 'The Role of Pasture and Soybean in Deforestation of the Brazilian Amazon', Environmental Research Letters, 5 (2).
[180] 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
[181] 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.
[182] *https://milieudefensie.nl/publicaties/factsheets/factsheet-2-dutch-soy-coalition-modern-slavery-in-brazil*
[183] 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
[184] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[185] https://www.idhsustainabletrade.com/uploaded/2019/04/European-Soy-Monitor.pdf
[186] https://www.sojanetzwerk.ch/fileadmin/user_upload/Downloads/Faktenblatt_Soja_en_web.pdf
[187] 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.
[188] Jason Potts, Mathew Lynch, Ann Wilkings, Gabriel Huppé, Maxine Cunningham, Vivek Voora (2014). State of Sustainability Initiatives Review. IISD & IIED.

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 7,000 certified farms in Argentina, Brazil, China, India, Paraguay and Uruguay produced around 4.5 million tonnes of RTRS certified soy in 2018[189], which is approximately 1% of global production of soy in 2018[190]. Despite this modest volume, the amount of RTRS certified soy is increasing rapidly: in 2011 the amount of RTRS certified soy was just 400,000 tonnes.[191] Most of the companies buying credits are based in Europe.

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 area of Proterra certified soy production was 1.2 million hectares in 2017.[192]

In addition to these soy-specific multi-stakeholder standards, there are 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).

A number of major Swiss retailers including COOP Switzerland and the Federation of Migros Cooperatives are members of the Retail Soy Group (RSG), an independent group of international retailers working on industry-wide solutions to enhance the use of sustainable soy in both animal feed and human food supply chains[193].

There are also standards for non-genetically modified soy, including the RTRS Non-GM Standard and the International Sustainability and Carbon Certification voluntary add-on module which certifies non-GMO food and feed[194]. Certification of non-GM soy requires compliance with non-GM criteria, but no other environmental or social standards. European labelling rules state that the presence of GM-ingredients in food products above a threshold of 0.9% has to be disclosed. In Switzerland, this extends to feed for animals[195]. Various

[189] https://responsiblesoy.org/impacto?lang=en
[190] http://www.fao.org/faostat/en/#data/QC
[191] WWF (2016). Soy Scorecard: Assessing the use of responsible soy for animal feed. http://d2ouvy59p0dg6k.cloudfront.net/downloads/wwf_soy_scorecard_2016_r6.pdf
[192] Helga Willer, Gregory Sampson, Vivek Voora, , Joseph Wozniak, and Duc Dang Julia Lernoud, Jason Potts, (2019), The State of Sustainable Markets – Statistics and Emerging Trends 2019. ITC, Geneva
[193] https://www.retailsoygroup.org/#members
[194] The ISCC was created in 2010 to certify sustainable food and feed. Online: https://www.iscc-system.org/wp-content/uploads/2017/02/ISCC-for-Non-GMO-Food-and-Feed.pdf
[195] https://www.sojanetzwerk.ch/en/soja/#p-production-and-trade

labels in Switzerland (e.g. IP-Suisse, Naturafarm etc) require animals to only be fed non-GM feed. An estimated 82% of global soy production is GM and of the three largest soy producers, only Brazil grow significant amounts of GM-free soy (around 94% of US production is GM and 100% of production in Argentina)[196]. Swiss soy importers have therefore started to switch to European soy producers[197].

In 2011, Switzerland established the Soy Network (Soja Netzwerk) Switzerland to support the cultivation, purchase and use of certified and responsibly produced soy. It aims to ensure 90% of soy for the Swiss market is responsibly produced according to the following standards and certifications; the Basel Criteria, Bio Suisse Guidelines, Pro Terra Standard, the RTRS Non-GM Standard, Danube Soya Standard, Europe Soya Standard and the ISCC PLUS Non-GMO. The network is an alliance of around 20 traders and importers and over 100 feed mills[198]. In 2017, soy produced to one or more of these standards reportedly accounted for 96% of imports[199].

Non soy-specific standards, including organic standards, are also used in the sector.

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

Many of the same instruments described for palm oil (see Section 0) 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.[200] 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. In states within the *Cerrado* region the soybean area increased by 253% between 2000 and 2014[201]. The recent change in administration in Brazil casts significant doubt over ongoing support for the Moratorium[202].

In 2017, a grouping of NGOs, including WWF, published the Cerrado Manifesto[203]. 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. Nearly 160 companies

[196] https://www.sojanetzwerk.ch/en/soja/#p-production-and-trade
[197] https://www.sojanetzwerk.ch/fileadmin/user_upload/Downloads/Faktenblatt_Soja_en_web.pdf
[198] https://www.sojanetzwerk.ch/en/network-status/#p-importers-with-network-status
[199] https://www.sojanetzwerk.ch/en/soja/
[200] 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
[201] Soterroni, A., Ramos, F.M., Mosnier, A., Fargione, J., Andrade, P., Baumgarten, L., Pirker, J., Obersteiner, M., Kraxner, F., Câmara, G., Carvalho, A., Polasky, S. 2019. Expanding the Soy Moratorium to Brazil's Cerrado. *Science Advances.* 5:7. DOI: 10.1126/sciadv.aav7336.
[202] https://www.reuters.com/article/us-brazil-soy-moratorium/brazil-agriculture-minister-calls-amazon-soy-moratorium-absurd-idUSKBN1XN2LM
[203] https://d3nehc6yl9qzo4.cloudfront.net/downloads/cerradomanifesto_september2017_atualizadooutubro.pdf

have 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[204].

Swiss stakeholders including Coop and WWF were the some of the first actors to respond to the issue of the significant increase in the global demand for soy. Together, they created the "Basel Criteria" in 2004, which seek to encourage sustainable soy cultivation and formed the basis for standards such as ProTerra and RTRS.

The Soja Netzwerk Switzerland has successfully pushed for over 90% of the country's soy imports to be sustainably produced according to certification standards (see above). This is amongst the highest rate of certification amongst European countries[205]. Since the foundation of the Soja Netzwerk, members have increased the share of responsibly produced soy imports to 94% in 2015[206]. Other countries, including Holland, Belgium, Germany and Sweden have followed suit by created similar initiatives and objectives. Switzerland was also one of the first signatories of the Danube Soya Initiative to promote soy cultivation in Europe[207].

In the 2008 extension of Switzerland's tax exemption to imported biofuels, fuels produced from soy are presumed not to fulfil the necessary environmental and social sustainability criteria for tax exemption, although applicants can submit evidence to prove that they do[208]. Anecdotally, imports of biofuels produced from soy feedstock to Switzerland are minimal or zero[209].

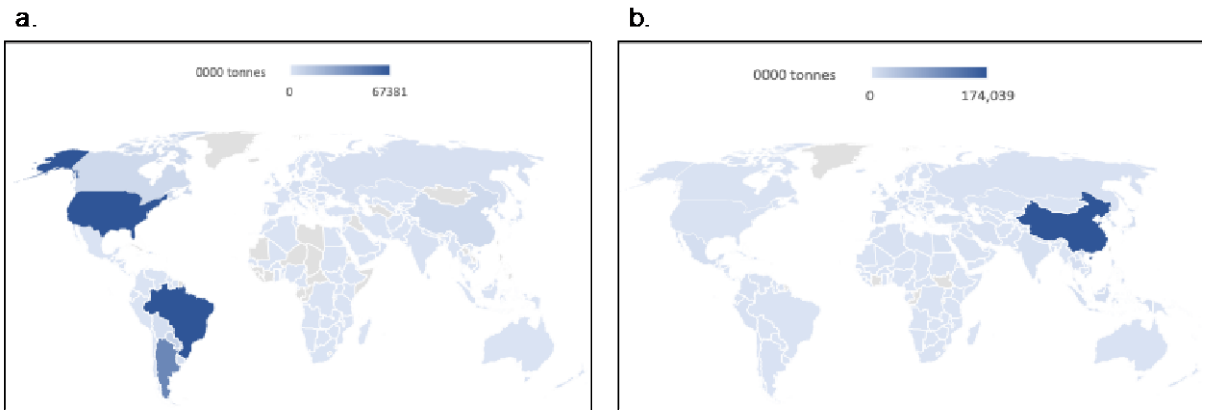
6.2 Trade of soy

6.2.1 Global trade

Soy is the most successful oilseed on world markets, with an estimated 60% share of global oilseed production. The majority of the global soybean harvest is traded internationally[210]. 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 26a). 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 26: Global trade in soybeans, soy meal and soy oil (million tonnes): a. exports, and b. imports[211]

[204] https://cerradostatement.fairr.org/
[205] https://www.idhsustainabletrade.com/uploaded/2020/02/IDH_The-UoA-to-Tackle-Tropical-Deforestation_2020-web.pdf
[206] https://www.sojanetzwerk.ch/fileadmin/user_upload/soja-factsheet-en_190218_update.pdf
[207] https://www.sojanetzwerk.ch/fileadmin/user_upload/soja-factsheet-en_190218_update.pdf
[208] https://www.cbd.int/agriculture/2011-121/Switzerland-nov11-en.pdf
[209] Stefan Kausch, Pluswert, *Pers. comm.* via email. 12th June 2020.
[210] http://www.bothends.org/uploaded_files/document/Soy_Barometer2014_ENG.pdf
[211] Source: FAOSTAT



China dominates global imports of soybeans, oil and meal, with the EU also importing significant quantities (Figure 26 b.). China's imports have increased eightfold between 2000 and 2018, 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 countries imported approximately 19 million tonnes of soybeans, oil and meal in 2018, equivalent to 13% of global imports in that year. Switzerland's imports were 19,600 tonnes, 0.01% of global imports.

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 and a general increase in global production.[212] Compared with trade in other agricultural commodities, trade in whole oilseeds (particularly soybeans) is relatively unrestricted by tariffs. However, in recent years there have been some exceptions to this; in 2018 China – the largest importer of soy globally – imposed tariffs on US soybeans as part of a 'trade war' between the two countries, although this was later removed[213] .

6.2.2 Switzerland's imports of soy

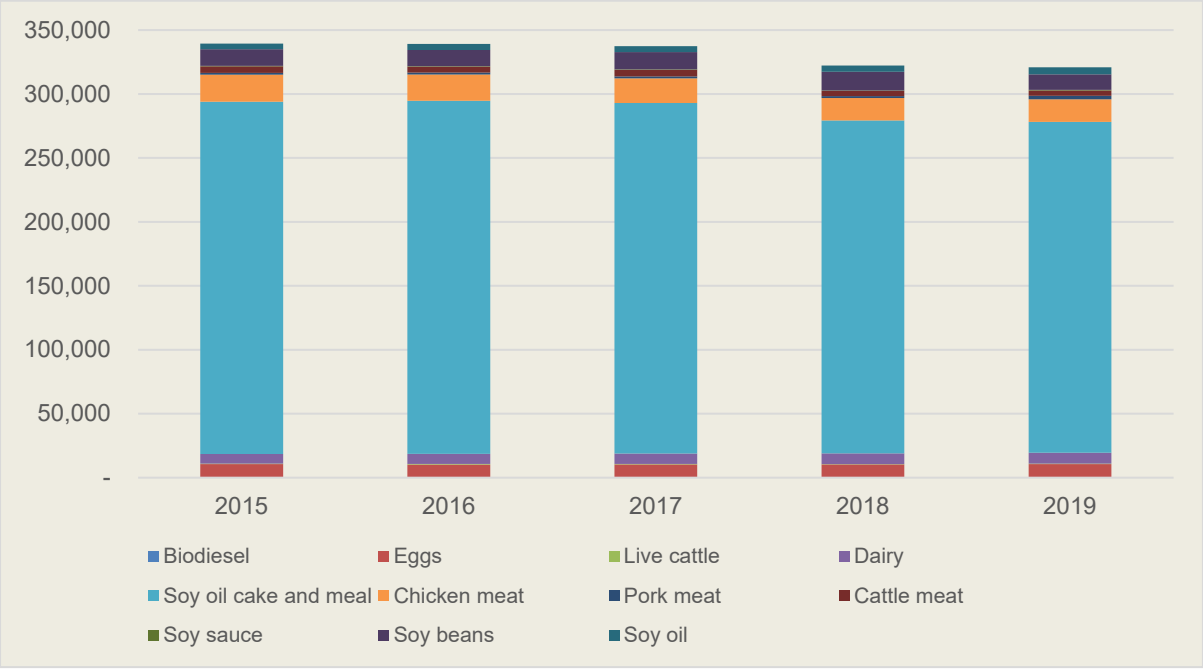
Switzerland's imports of soy are small relative to other countries, accounting for just 0.1% of global production.

When adjusted for the soy content of imported products (see Appendix 5 for the conversion factors used), an average of approximately 332,000 tonnes of soy were imported each year between 2015-19 (Table 6 and

[212] http://www.reuters.com/article/research-and-markets-idUSnBw295291a+100+BSW20150529
[213] https://www.world-grain.com/articles/13439-china-oilseed-demand-forecast-to-rise

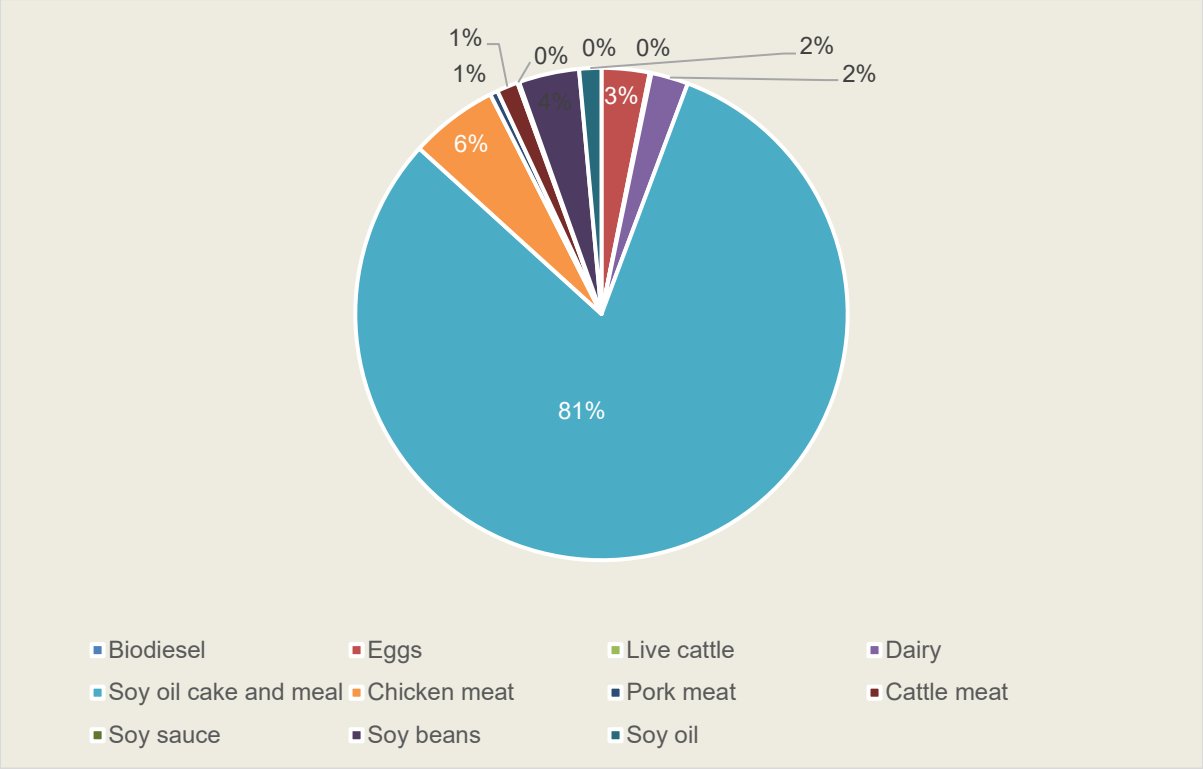
Figure *27*), as soybeans, soy oil, soy meal, as an ingredient or embedded within imported products. The quantity of soy imported has declined from 340,00 in 2015 to around 320,000 tonnes in 2019. This decrease has largely been driven by reduced imports of soy oil cake and meal as well as a slight decrease in imports of chicken and beef. 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 27: The quantity of soy meal, oil and beans in Switzerland's imports of 2015-19 (tonnes)



Over the period soy oil cake and meal is by far the main import, averaging almost 270,000 tonnes per year and accounting for 81% of the quantity of soy in all imports (Figure 28). This is predominantly used in livestock feed[214]. Chicken meat (19,000 tonnes, 6%) and soybeans (13,000 tonnes, 4%, much of which will also be used to produce livestock feed) are the second largest contributions.

Figure 28: Average quantity of Switzerland's soy imports between 2015-19, converted to soy content.



[214] Swiss Meat, 2020. Animal Feed. Online at: https://www.swiss-meat.com/en/why-swiss-meat/quality-and-safety/animal-feed.html

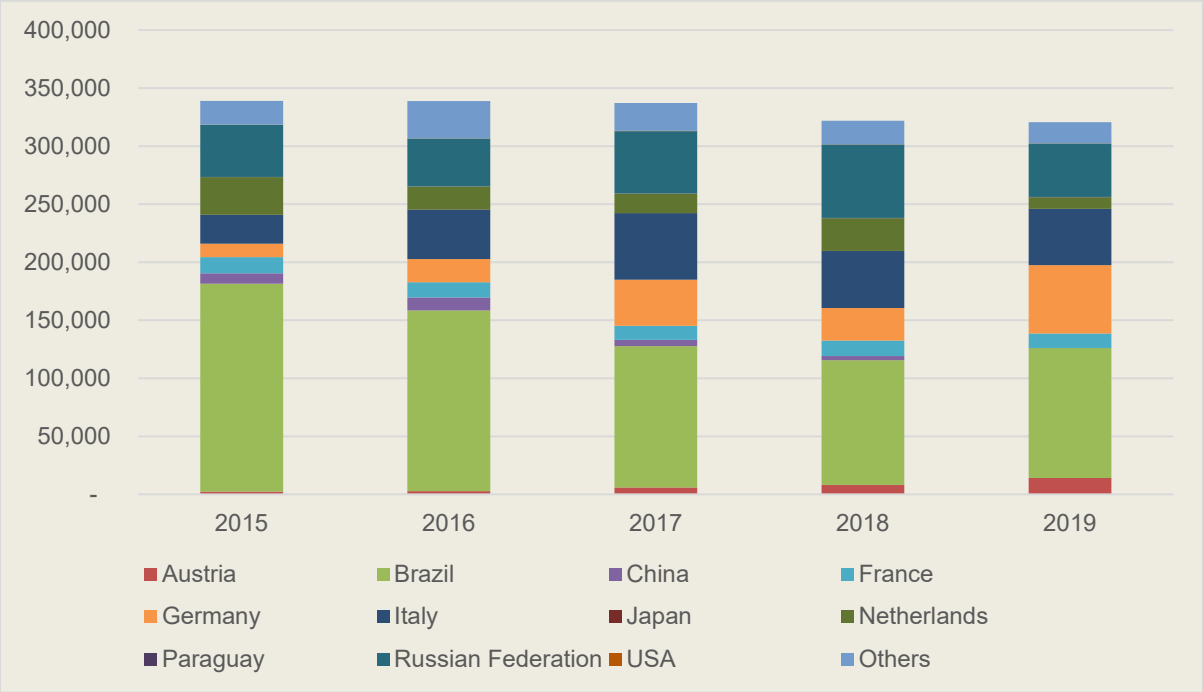
Table 6: Switzerland's soy imports 2015-19 by quantity of soy meal, oil and beans (tonnes)

Soy imports converted to quantities of soy meal, oil and beans (tonnes)							
	2015	2016	2017	2018	2019	Average	%
Biodiesel*	-	-	-	-	-	-	0%
Eggs	10,595	10,298	10,377	10,308	10,575	10,430	3%
Live cattle	362	408	391	372	373	381	0%
Dairy	7,562	7,979	8,163	8,322	8,559	8,117	2%
Soy oil cake and meal	275,424	276,005	274,008	260,356	258,648	268,888	81%
Chicken meat	21,234	20,511	19,305	17,545	17,654	19,250	6%
Pork meat	1,280	1,509	1,489	1,430	2,783	1,698	1%
Cattle meat	5,180	4,725	5,140	3,989	4,199	4,646	1%
Soy sauce	337	333	373	399	447	378	0%
Soybeans	13,088	12,695	13,504	14,625	12,109	13,204	4%
Soy oil	4,309	4,717	4,689	4,867	5,558	4,828	1%
Grand Total	**339,373**	**339,179**	**337,439**	**322,212**	**320,904**	**331,821**	**100%**
*Soy content of biodiesel imports to Switzerland assumed to be zero based on information detailed above.							

6.3 Provenance of Switzerland's imports of soy

According to global trade data, between 2015 and 2019, Switzerland imported soybeans, soy oil and meal, products containing them or with soy embedded in the production process from a total of 96 territories. Countries exporting to Switzerland include major producer countries (e.g., Brazil, USA) as well as a number of European countries (Figure 29). Direct imports from Brazil account for an average of 41% of the quantity of soy imported, although this has declined over the years whilst imports from Germany and Italy have increased. Around 50% of direct imports are from European countries.

Figure 29: Quantity of soy imported by Switzerland from direct trading partners, 2015-19 (tonnes)



Soy is produced in some European countries. Of the countries accounting for over 2% of direct imports (Figure 29), production is relatively small in Germany (59,000 tonnes in 2018), Austria (184,000 tonnes) and France (400, 000 tonnes). Italy (1.14 million tonnes) and Russia (4.03 million tonnes) produce greater quantities, although still a small fraction compared to production in Brazil (1.2 billion tonnes). The soy imported to Switzerland from these European countries may have been grown there, but is also likely to include some soy that originates in other producing countries.

When figures are adjusted to give an indication of the likely original provenance of imports (see Section 2.2), the dominance of Brazil as the origin of Switzerland's soy imports is more pronounced, accounting for an average of 56% of total imports per year (around 187,000 tonnes). The other two major global producers Argentina and the USA account for much lower proportions (7% and 9%, respectively Figure 30), although there has been an increase in imports from both between 2015 to 2019 (from 23,000 tonnes to 34,000 tonnes from the USA, and from 16,000 tonnes to 26,000 tonnes from Argentina). Italy has become an increasingly important trading partner over the period with imports increasing 119% from around 8,000 tonnes in 2015 to 18,000 tonnes in 2019. Italy produced an annual average of over 1 million tonnes of soy during this period whilst also importing a similar quantity from Argentina so it is likely that Switzerland's imports from Italy comprise a combination of Italian-grown soy and soy from other producer countries traded through Italy. Due to

requirements for non-GM soy Swiss importers have been increasingly switching to European producer countries.

Over the period, total import volumes have declined and this is driven largely by a decrease in import volumes from Brazil, from around 225,000 tonnes in 2015 to 169,000 tonnes in 2019 (Figure 30).

Figure 30: The quantity of Switzerland's imports of soy between 2015-19 from major exporting countries (tonnes), adjusted for soy content and provenance

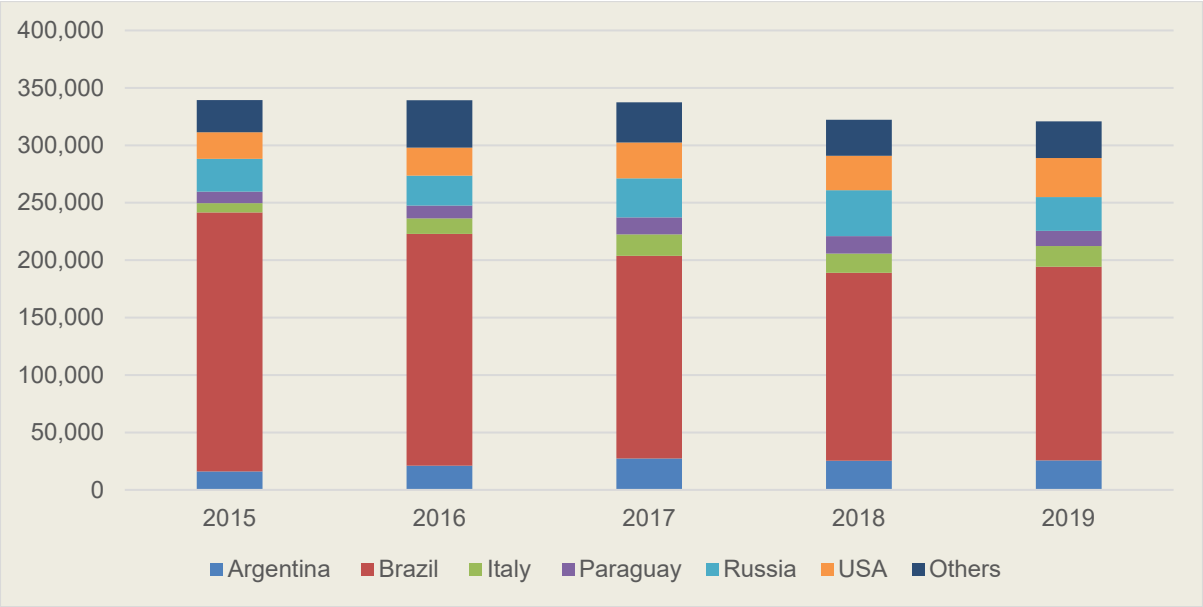
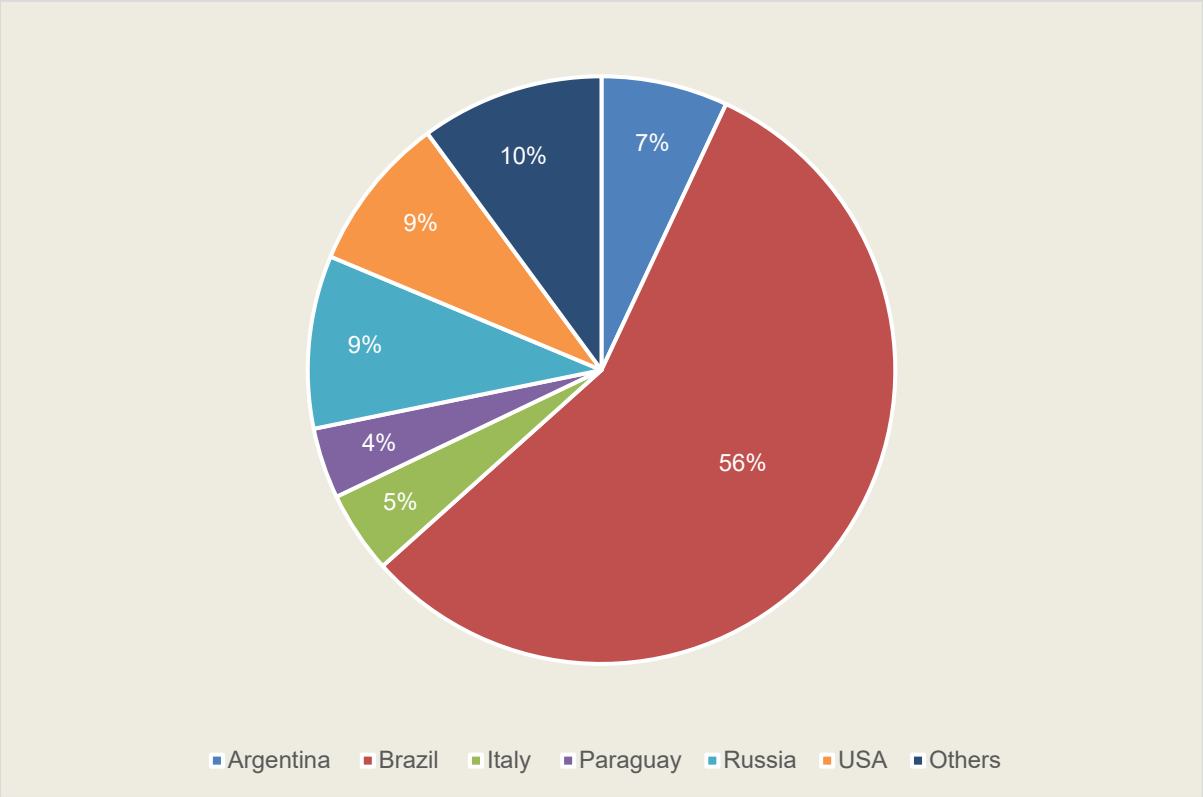


Figure 31: The provenance of Switzerland's imports of soy for 2015-19 from major exporting countries (tonnes)



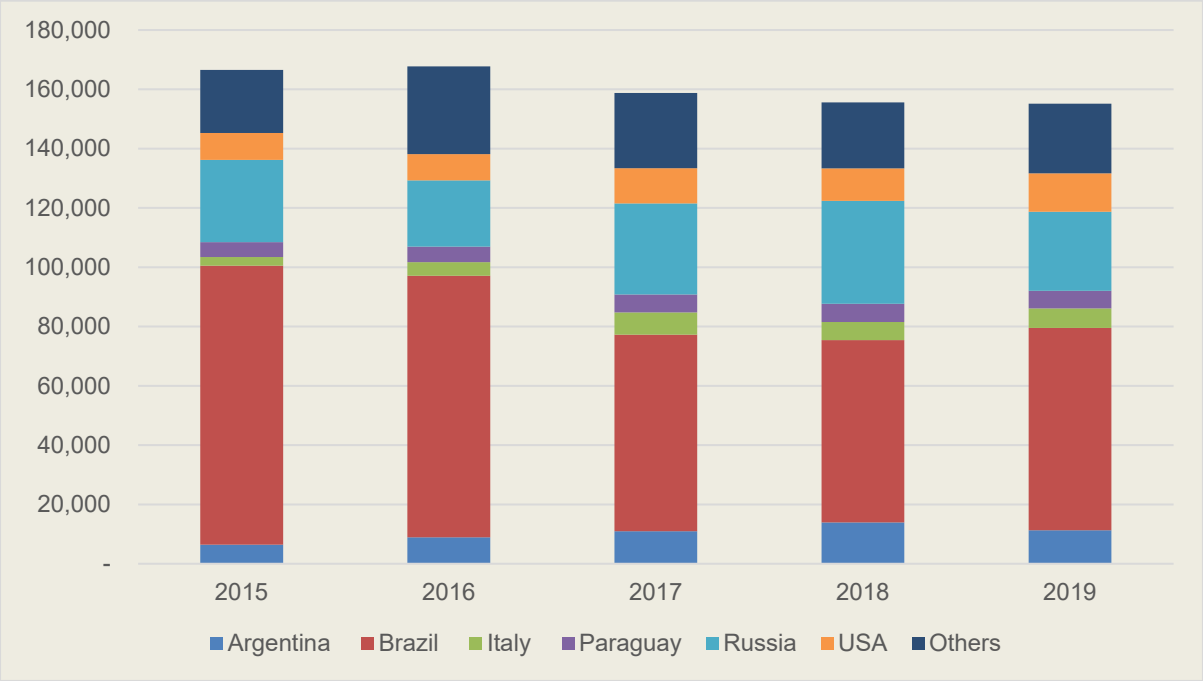
6.4 Switzerland's soy footprint

To estimate the land area required to supply Switzerland's imports of soy, products that contain soy or which have it embedded in the production process were firstly assigned to the relevant soy fractions; soybeans, oil and meal. For example, the quantity of soy embedded in poultry products is assigned to soy meal because this is the fraction predominantly used in poultry feed, whereas the quantity of soy used as a biodiesel feedstock is assigned to soy oil.

The imported fractions were then allocated to average soy yields in the proportion in which they are produced from whole soybeans. In other words, the fractions of oil and meal were converted to their equivalent in soybeans and then to the average production yield quantities for soybeans. For soy meal the calculation was; soy meal quantity / (0.82 * yield) where 0.82 is the factor to convert soybeans to soy meal. Soy oil quantity was calculated by: soy oil quantity / (0.18 * yield).[215] The yield data used to convert the quantity of soy to the land area required to produce it were country and year specific.[216]

The average estimated land area required to satisfy Switzerland's imports of soy was just over 160,000 hectares per year although this has apparently decreased in the past 3 years (Figure 32). This is equivalent to approximately 0.1% of the global soy harvested area.[217] Switzerland has the largest land footprint in Brazil, with an average of 76,000 hectares each year (47% of the total land area). Russia ranks second (28,000 hectares, 18%), with the USA in third place (11,000 hectares, 7%). The land area required to supply Switzerland's imports of soy have decreased overall from 167,000 hectares in 2015 to 155,000 hectares in 2019. This is mostly due to a decrease in soy imports as yields have remained fairly constant through this period.

Figure 32: The estimated land footprint of Switzerland's imports of soy between 2015-2019 (hectares)



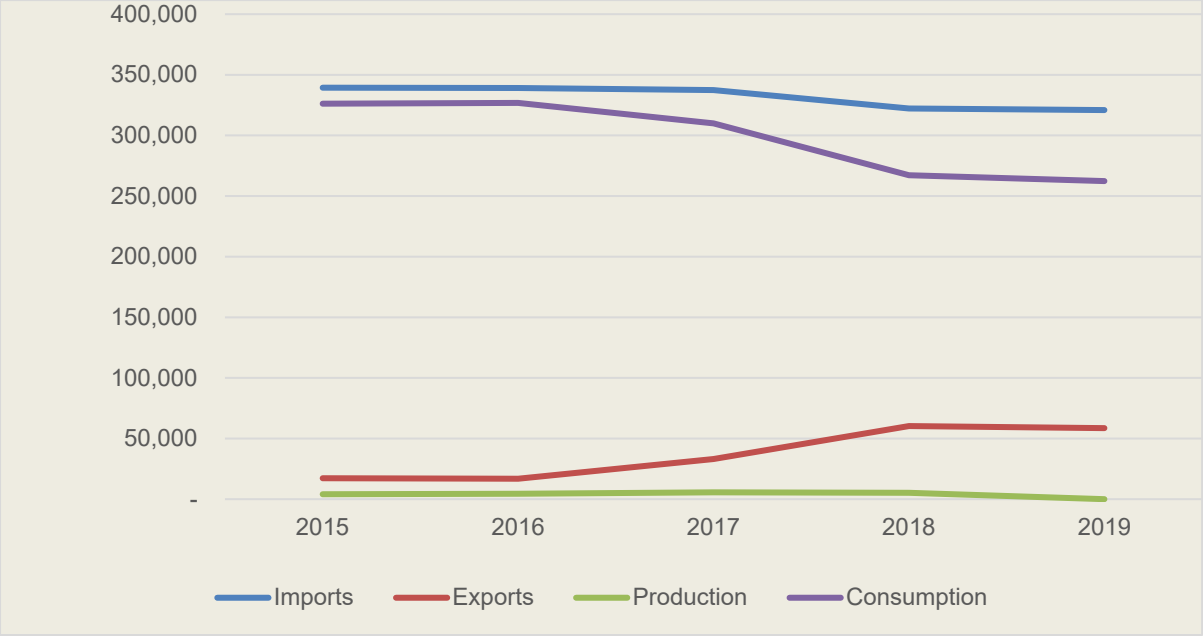
[215] U.S. Soybean Export Council conversion table, see: https://ussec.org/resources/conversion-table. The 3% waste is assigned proportionally to soy meal and oil.
[216] Source: FAOSTAT
[217] Source: FAOSTAT

6.5 Estimated soy consumption

Using the same HS codes and conversion factors (see Appendix 5 for details), we estimate that Switzerland exported an average of over 37,000 tonnes of soy each year as raw material, an ingredient of exported products, or embedded in the production process of exported products. This has increased significantly over the period from 17,000 tonnes in 2015 to 59,000 tonnes in 2019 (Figure 33).

Estimated consumption of soy is calculated by subtracting the yearly exports from imports and domestic production. In the time period between 2015 to 2019, the average yearly soy consumption was around 298,000 tonnes, but declined from 300,000 to 260,000 tonnes over the period.

Figure 33: Quantities of soy produced, imported and exported by Switzerland plus calculated consumption between 2015-2019 (hectares)



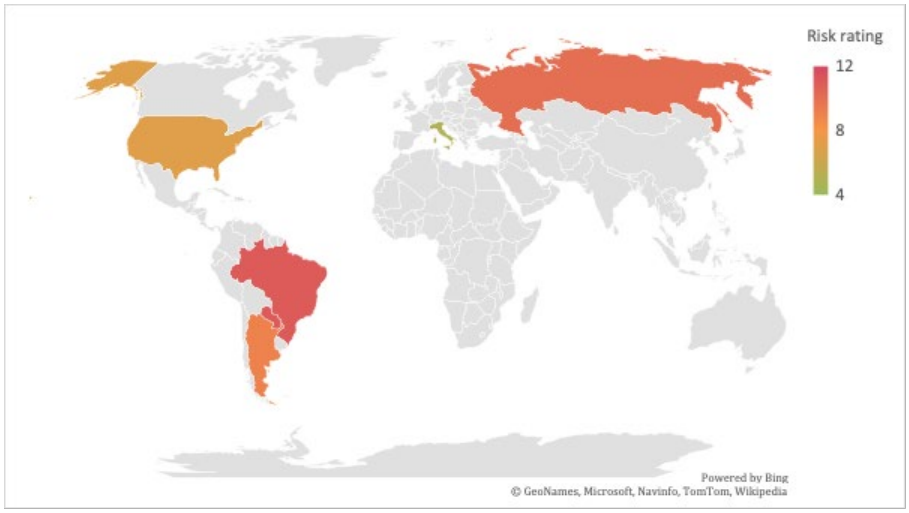
6.6 Switzerland's soy risk profile

Using global trade data and reassigning the provenance back to soy producer countries (see Section 2.2), Switzerland imports most of its soy (75%) from high and very high risk countries: Brazil, Paraguay, Argentina and Russia (Figure 34). All four countries have very high levels of tree cover loss and high or very high rates of natural forest loss (Table 8), weak rule of law (especially Paraguay and Russia) and poor labour rights.

A large element of this risk is mitigated in Switzerland by the fact that reportedly around 90% of soy imports are certified to a sustainability standard such as ProTerra or DanubeSoy[218]. Credible certification schemes within the soy sector, including ProTerra, have strong safeguards against deforestation and conversion of natural habitats. 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.

[218] https://www.sojanetzwerk.ch/fileadmin/user_upload/soja-factsheet-en_190218_update.pdf

Figure 34: Switzerland's soy footprint by risk category



6.7 Estimated greenhouse gas emissions from Switzerland's soy imports

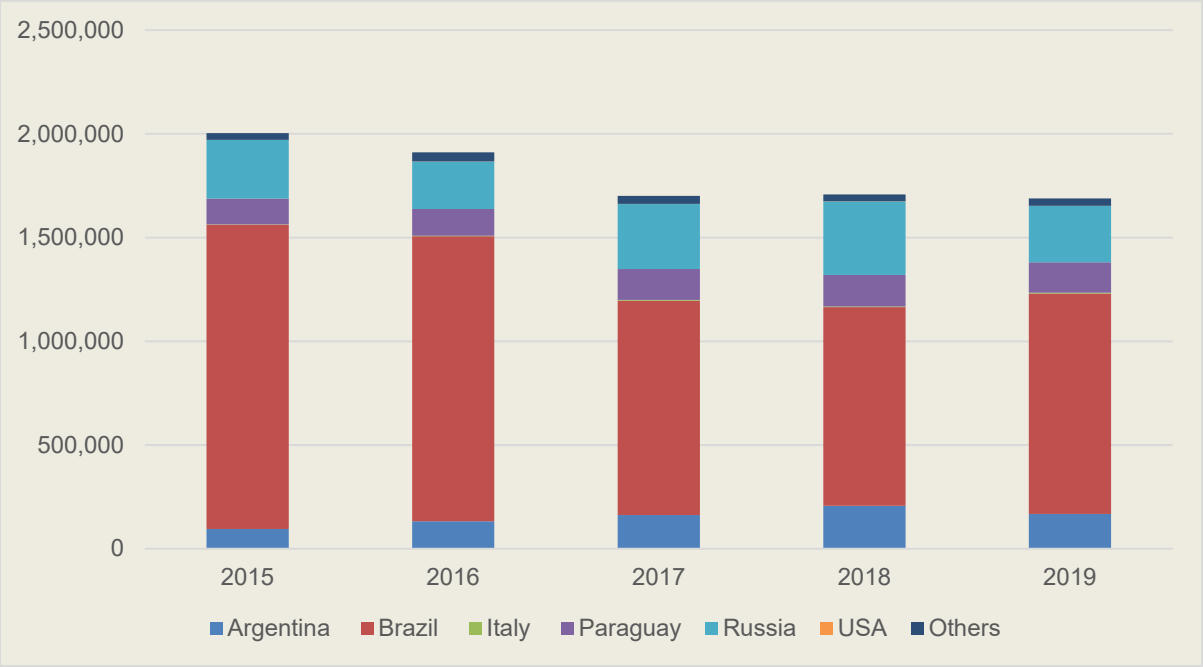
The greenhouse gas emissions associated with the production of soy for Switzerland's imports are estimated by taking the land footprint in each country and applying a calculated per hectare emissions value for the specific crop and country pairing.

For soy, emissions values are available for all of the major source countries for Switzerland's imports. The emissions from soy production in these countries averaged a total of 1.8 million tonnes CO_2eq per year which amounts to 60% of the emissions from the agricultural commodities analysed here. This is equivalent to around 3.5% of Switzerland's annual greenhouse gas emissions.

The main source of emissions for soy was production in Brazil due to the size of the land footprint for Switzerland's soy imports. Between 2015-19, Brazil accounted for of 65% of annual GHG emissions associated with soy on average.

Emissions fell between 2016 and 2017 and then remained relatively steady over the past couple of years. This fall was mainly due to a decrease in imports from Brazil resulting in a reduction in associated emissions.

Figure 35: Estimated greenhouse gas emissions from land use change associated with Switzerland's imports of soy



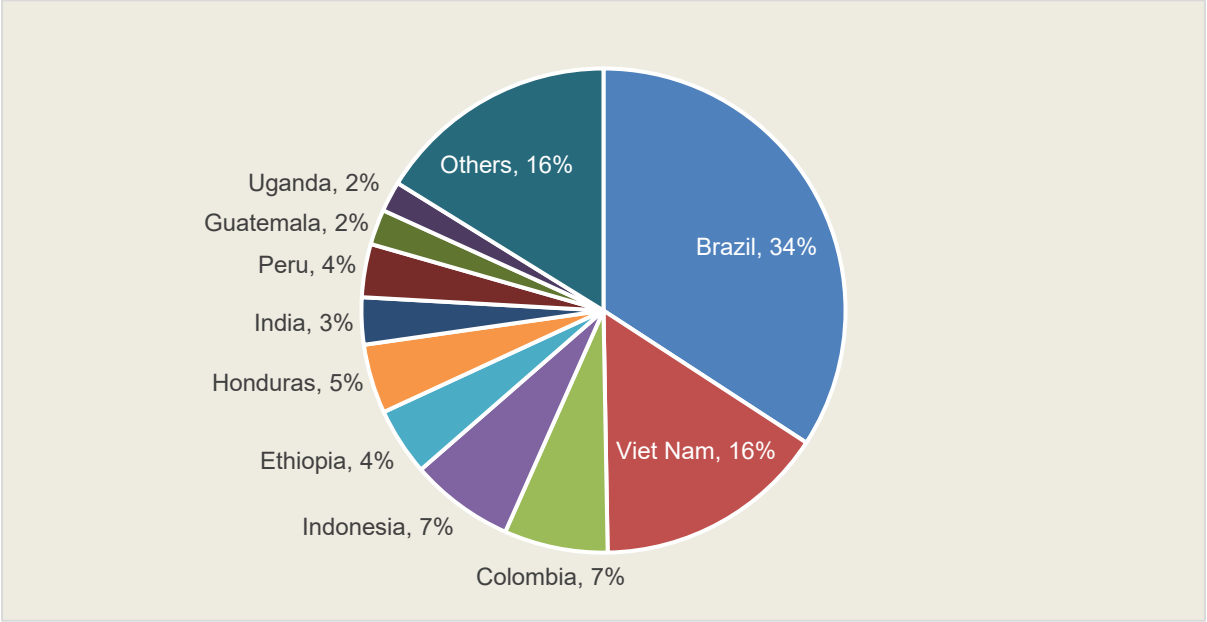
7 Coffee

7.1 Production, uses and sustainability of coffee

7.1.1 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,[219] 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 34% of global production) and Vietnam (16%, Figure 36).

Figure 36: Primary coffee producing countries in 2018



The two main varieties of coffee that are grown are Arabica (*Coffea arabica*) and Robusta (*Coffea canephora*). Arabica varieties comprise 57% of global coffee production while Robusta comprises approximately 43%.[220] 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

[219] International Trade Center (2011). Trends in the Trade of Certified Coffees. Available at http://www.intracen.org/Trends-in-the-trade-of-certified-coffees/.
[220] ICO, 2019. Coffee Market Report, July 2019. Online at: http://www.ico.org/documents/cy2019-20/cmr-0720-e.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 is grown by an estimated twenty-five million farmers worldwide and smallholder producers account for approximately 70% of total global coffee production.[221] 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.

7.1.2 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 2012.[222] Though Europe has traditionally dominated the global market for coffee, emerging demand for coffee is coming primarily from Asia-Pacific.[223] 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.[224]

7.1.3 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.[225] 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.[226] 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.[227] More recent 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

[221] Smallholder farmers are defined as those operating on less than 2ha of land. Acosta-alba, I. et al. (2019) Integrating diversity of smallholder coffee cropping systems in environmental analysis. *The International Journal of Life Cycle Assessment*. 25, 252–266.
[222] https://www.statista.com/statistics/292595/global-coffee-consumption/
[223] 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.
[224] Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018,
[225] 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.
[226] 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
[227] 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.[228] 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.[229] 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.[230] 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.[231] 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.[232]

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.[233] 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.[234] 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.

[228]Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018.
[229] Bunn et al. (2015). A bitter cup: climate change profile of global production of Arabica and Robusta coffee. *Climate Change*, 129: 89-101.
[230] 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..
[231] World Vision (2016). No Child for Sale: Coffee. Available at http://nochildforsale.ca/wp-content/uploads/2016/04/Coffee_Infographic.pdf.
[232] Danwatch (2016). Bitter Kaffee. Available at https://old.danwatch.dk/en/undersogelse/bitter-kaffe/. Last accessed 28 November 2018.
[233] 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..
[234] Danwatch (2016). Bitter Kaffee.

7.1.4 Certification

In comparison to other commodities, the coffee sector has attained the highest levels of certification, with around 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:[235]

- **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 had the largest certified coffee area in 2017 at over 1.6 million hectares, representing 15% of the global coffee area and producing almost 2.4 million tonnes of coffee. The countries with the largest areas of 4C certification are Brazil, Colombia, Indonesia and Vietnam. 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. However, it dropped by almost 11% in 2016-2017, mirroring an overall drop in certified coffee area due to stricter procedures for auditing.
- **Fairtrade certification:** Just under half of all Fairtrade International certified area is for coffee production. In 2017, around 1.2 million hectares of coffee land were certified by Fairtrade International (8.7% of the global coffee area), which produced 540,000 tonnes of coffee, of which around 184, 000 tonnes were sold on Fairtrade terms[236]. The countries with the largest Fairtrade certified areas are Colombia, Ethiopia, United Republic of Tanzania, Peru, and Mexico.
- **Organic:** Almost 850,000 hectares (7.8% of the global coffee area) were organic certified in 2017. Mexico, Ethiopia, Peru, Indonesia, and United Republic of Tanzania are the biggest organic coffee-producing countries, together representing 73% of total organic coffee area. The organic label showed the greatest growth out of all of the certifications, expanding by a third between 2013 and 2017.
- **Rainforest Alliance**[237]**:** The Rainforest Alliance (RA) certified more than 411,000 hectares of coffee land in 2017, which produced over 500,000 metric tons of RA coffee (5.5% of the global coffee production volume)[238]. The overall RA certified coffee area increased by 6.2% between 2016 and 2017.
- **UTZ:** Over 592,000 hectares of coffee were UTZ-certified in 2017, which represents 5.5% of the global coffee area. UTZ reported an estimated production volume of over 1.1 million metric tons[239] or 12% of the global coffee production volume in 2019. The countries with the largest UTZ-certified coffee areas are Brazil, Peru, Honduras,

[235] The following data is from : Helga Willer, Gregory Sampson, Vivek Voora, , Joseph Wozniak, and Duc Dang Julia Lernoud, Jason Potts, (2019), The State of Sustainable Markets – Statistics and Emerging Trends 2019. ITC, Geneva

[236] https://www.fairtrade.org.uk/media-centre/blog/10-facts-about-fairtrade-coffee/#:~:text=Fairtrade%20coffee%20farmers%20cultivate%20coffee,this%20coffee%20is%20certified%20organic.

[237] In 2018 Rainforest Alliance merged with UTZ, another major certification standard. Their combined and updated certification program, the Rainforest Alliance 2020 Certification Program, was published in July 2020 and after a phased roll-out, all stakeholders will be required to adopt the new certification requirements by July 2021. See: Rainforest Alliance, 2020. 2020 certification programme. For now, data is still reported separately for the two standards. Online at: https://www.rainforest-alliance.org/business/tag/2020-certification-program/

[238] https://www.rainforest-alliance.org/sites/default/files/2018-03/RA_Impacts_2018.pdf

[239] https://utz.org/?attachment_id=21421

Vietnam, Colombia, and India, together comprising almost 70% of the total UTZ certified area.

Combined, these five schemes certified 2.5-4.4 million hectares in 2017 (the range is provided because many producers are certified by more than one scheme), which represented 22.1-37.6% 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 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 were found to reportedly retain more forest than non-certified producers in Colombia[240] and Ethiopia.[241]

With regards to social and economic measures, both Fairtrade and UTZ/Rainforest Alliance include a fixed premium for coffee. For Fairtrade, the fixed premium per pound of Arabica is $ 0.2 per pound[242]. On the other hand, UTZ/Rainforest Alliance offer a variable premium on top of the market price.[243] Fairtrade also includes a minimum price for coffee, which varies depending on the coffee type and origin e.g. it is $ 1.30 per pound of Arabica coffee (plus 30 cents more if they are also organic). Fairtrade certification often enables more inclusive democratic processes amongst smallholder farmers, and the inclusion of women in decision making.[244]

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.[245] 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.[246]

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

[240] 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
[241] 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
[242] https://www.fairtrade.net/standard/minimum-price-info
[243] https://www.utz.org/wp-content/uploads/2016/04/Position-Paper-Premium.pdf
[244] Petrokofsky, G. & Jennings, S. (2018). The effectiveness of standards in driving adoption of sustainability practices: A State of Knowledge Review. ISEAL Alliance
[245] Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018.
[246] Panhuysen, S. and Pierrot, J. (2018). Coffee Barometer 2018.

sector.[247] 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[248].

7.1.5 Europe and Switzerland'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, as does Switzerland.[249] Coffee roasters and retailers in European countries including 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.[250]

Switzerland has a high per capita domestic consumption of coffee and is also responsible for around 7.6% of the European market share for exports of roasted coffee[251]. The market for sustainably produced coffee in Switzerland is good; it is one of the largest markets in Europe for UTZ certified coffee and one of the largest globally for organic certified coffee[252]. Coffee certified as Fairtrade accounted for 12% of the market in 2019[253].

7.2 Trade of coffee

7.2.1 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 $ 25.5 billion in 2019. Both producer countries and trading countries play a significant role in coffee exports. Brazil and Vietnam are by far the leading exporters, with over 2.2 billion tonnes and 1.4 billion tonnes respectively in 2019 (

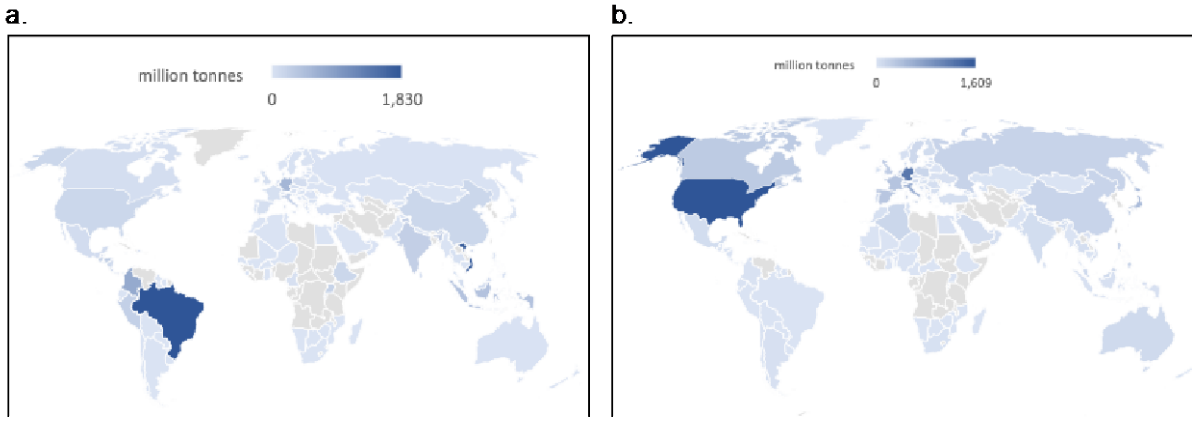
[247] The Global Coffee Platform Website. Available at https://www.globalcoffeeplatform.org/
[248] The Sustainable Coffee Challenge Website. https://www.sustaincoffee.org/
[249] https://www.intracen.org/Trends-in-the-trade-of-certified-coffees/
[250] Euromonitor International Consulting (2017). Market 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.
[251] https://www.cbi.eu/market-information/coffee/trade-statistics
[252] https://www.cbi.eu/market-information/coffee/sustainable-coffee
[253] https://issuu.com/maxhavelaarswitzerland/docs/mhch_annualreport2019

Figure *37*a). Germany, Belgium and the Netherlands are all within the top ten exporters of coffee, indicating the substantial role of trading countries in international exports.

The EU and the USA dominate global imports of coffee, accounting for around 50% and 21% of global imports respectively. Germany is the second ranked country, accounting for 15% of all imports. Switzerland is the 10th ranked country, accounting for 2% of global coffee imports (

Figure *37*b).

Figure 37: Global trade in coffee in 2016: a. exports, and b. imports (million tonnes)



7.3 Switzerland's imports of coffee products

The net weight of imports adjusted using conversion factors to give the equivalent weight in coffee (tonnes) is dominated by unroasted coffee, with an average of 150,000 tonnes imported each year (82% of the total weight of imported coffee. Imports of roasted coffee average 13,000 tonnes per year (7%) whilst unroasted decaffeinated coffee comprise and average of 6% and extracts of coffee an average of 5% imports by weight of coffee (Figure 38).

The volume of coffee imports has increased steadily between 2015 and 2019 driven mainly by an increase in imports of unroasted coffee.

Figure 38: Quantity of Switzerland's imports of coffee products 2015-19, adjusted for coffee content (tonnes)

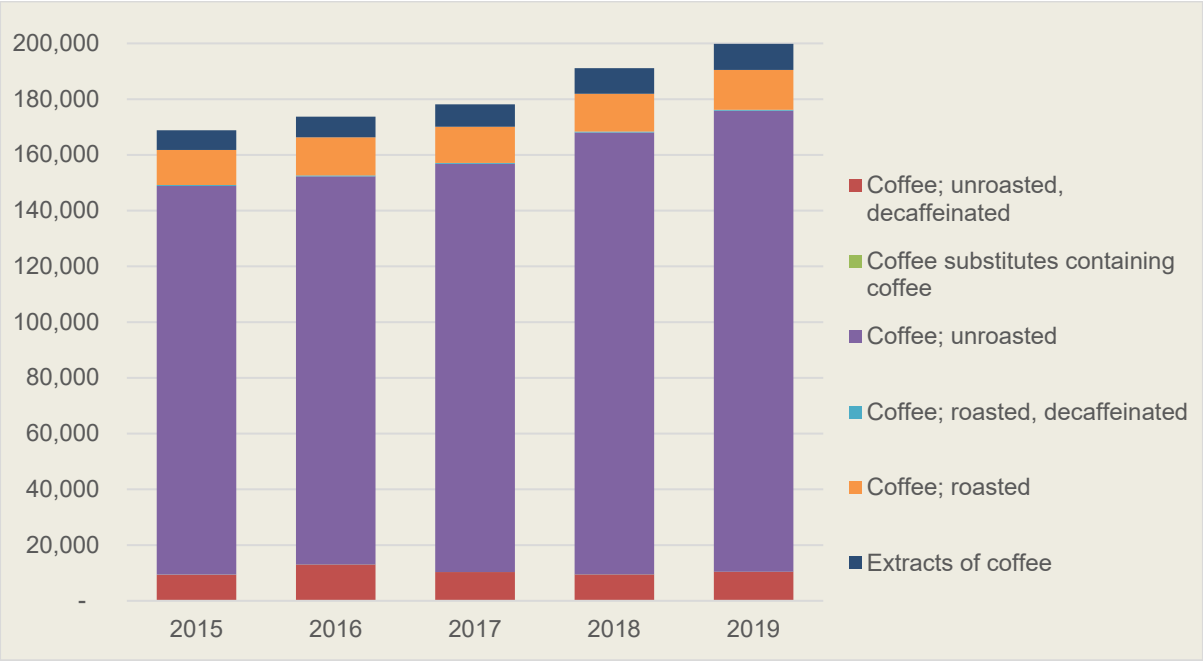

200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2015
2016
2017
2018
2019
Coffee; unroasted, decaffeinated
Coffee substitutes containing coffee
Coffee; unroasted
Coffee; roasted, decaffeinated
Coffee; roasted
Extracts of coffee

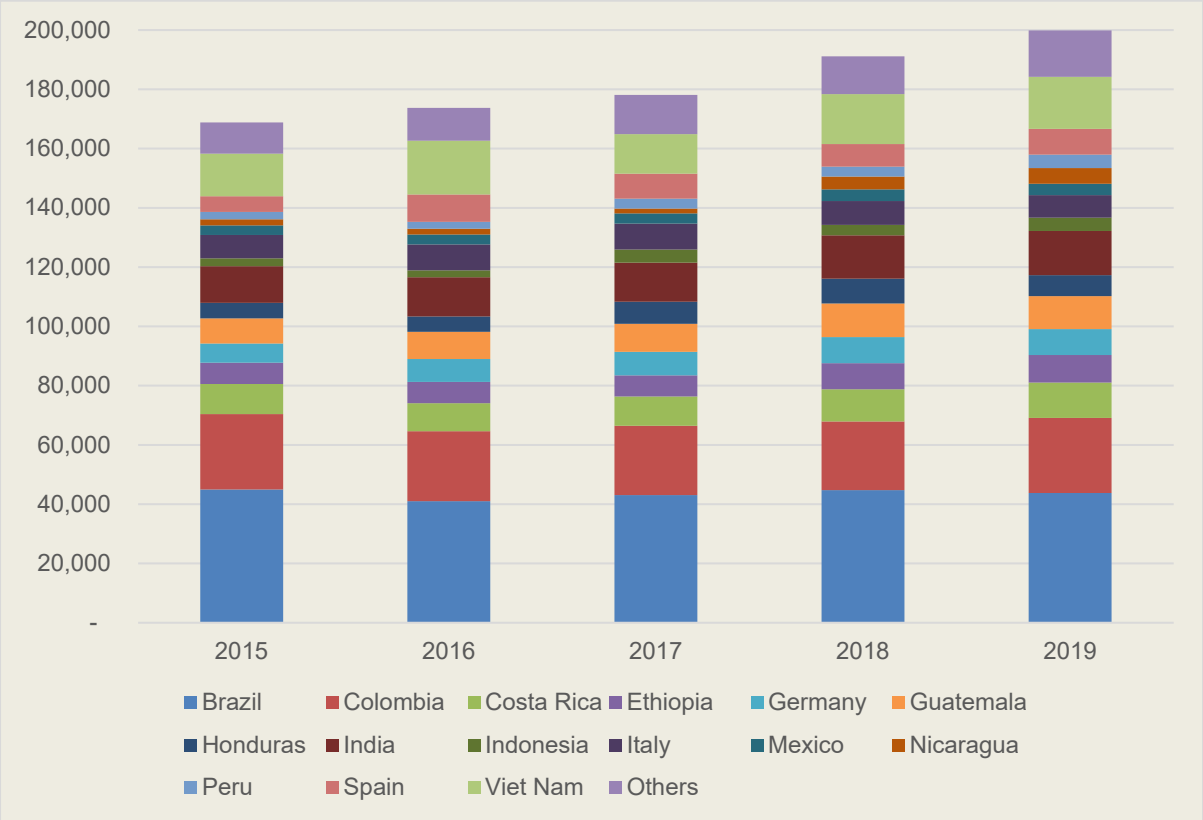
Table 7: Quantity of Switzerland's imports of coffee and products containing coffee 2015-19, adjusted for coffee content (tonnes)

HS code	Form of coffee imports	2015	2016	2017	2018	2019	Grand Total	Average	%
090112	Decaffeinated coffee, not roasted	9,370	13,026	10,326	9,445	10,424	52,592	10,518	6%
090190	Coffee substitutes containing coffee	9	7	10	18	24	68	14	0.01%
090111	Coffee, not roasted	139,481	139,238	146,453	158,542	165,390	749,104	149,821	82%
090122	Decaffeinated roasted coffee	307	385	356	372	355	1,775	355	0.19%
090121	Roasted coffee	12,590	13,673	12,950	13,539	14,267	67,019	13,404	7%
210110	Food preparations with extracts of coffee	7,060	7,393	8,037	9,220	9,409	41,119	8,224	5%
Grand Total		**168,816**	**173,722**	**178,132**	**191,136**	**199,869**	**911,677**	**182,335**	**100%**

7.4 Provenance of Switzerland's import of coffee

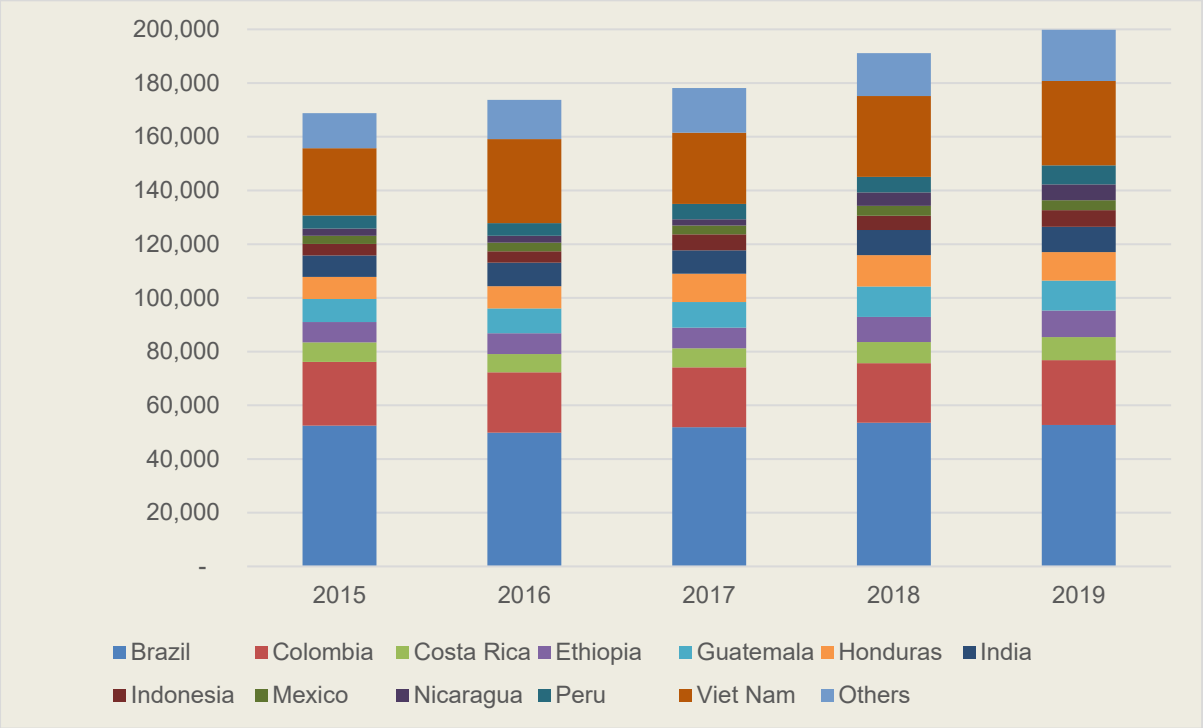
Between 2015 and 2019, Switzerland imported coffee and products containing coffee from a total of 99 territories. The major direct exporters to Switzerland include a mixture of producer countries (e.g., Brazil, Colombia, Costa Rica, Ethiopia, Guatemala, Vietnam) and countries that are trading coffee or products containing coffee (e.g., Italy, Spain, Germany, Figure 39). Amongst this latter group, EU countries account for around 16% of the coffee imported by Switzerland. This share has remained relatively steady over the period.

Figure 39: The quantity of Switzerland's imports of coffee and products containing coffee between 2015-19 from major exporting countries, adjusted for the content of coffee (tonnes)



These countries are not producers of coffee but instead import the coffee from elsewhere before re-exporting it to Switzerland. When the provenance is adjusted to account for these indirect imports and find the original provenance (see Section 2.2), Brazil remains the single most important provider to Switzerland accounting for an average of 29% of imports per year (52,000 tonnes) (Figure 40). Vietnam is the second largest exporter to Switzerland at 16% (29,000 tonnes) per year, followed by Colombia at 13% (23,000 tonnes per year).

Figure 40: The quantity of Switzerland's imports of coffee and products containing coffee between 2015-19 with provenance traced to major producer countries, adjusted for the content of coffee (tonnes)



Compared with some of the other commodities assessed in this report, imports are less dominated by a few producers, with 12 countries contributing 2% or more of imports.

7.5 Switzerland's coffee footprint

To estimate the land area required to supply Switzerland with coffee, the quantity of raw materials imported from each producer country was divided by the yield from that country for each year.[254]

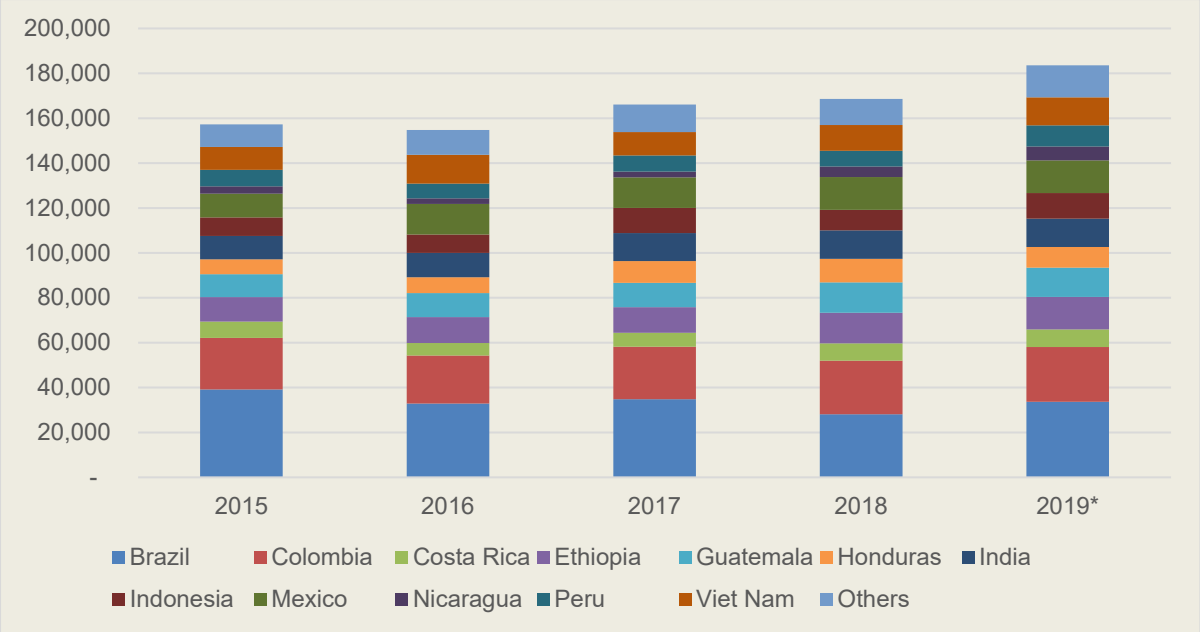
The estimated land area required to satisfy Switzerland's imports of coffee was 166,000 hectares per year between 2015-19 (Figure 41). This is equivalent to almost 2% of the global planted area of coffee, which is notably high when it is compared with Switzerland's share of the global population (0.1%) and gross domestic product (GDP) (0.58%)[255,256]. The largest footprint is in Brazil (an average of 64,000 hectares, 20% of the total).

Despite it providing the second largest proportion of Switzerland's coffee imports by weight, Vietnam is ranked seventh in terms of the size of the land footprint. The footprint is smaller than in Colombia, although the imports are higher. This is due to significantly higher yields in Vietnam at an average of 2.51 tonnes per hectare per year compared to 0.99 tonnes per hectare per year for Colombia. Yields vary significantly between countries meaning that, for example, the land footprint required in Mexico accounts for an average of 8% of the total footprint of Switzerland's coffee imports per year, whereas the volume of coffee imports from Mexico only account for an average of 2% of total coffee imports.

Overall, the land footprint is increasing, mostly due to the increase in the amount of coffee being imported.

[254] Based on data from FAOSTAT
[255] FAOSTAT
[256] https://tradingeconomics.com/switzerland/gdp Accessed 6th October 2020.

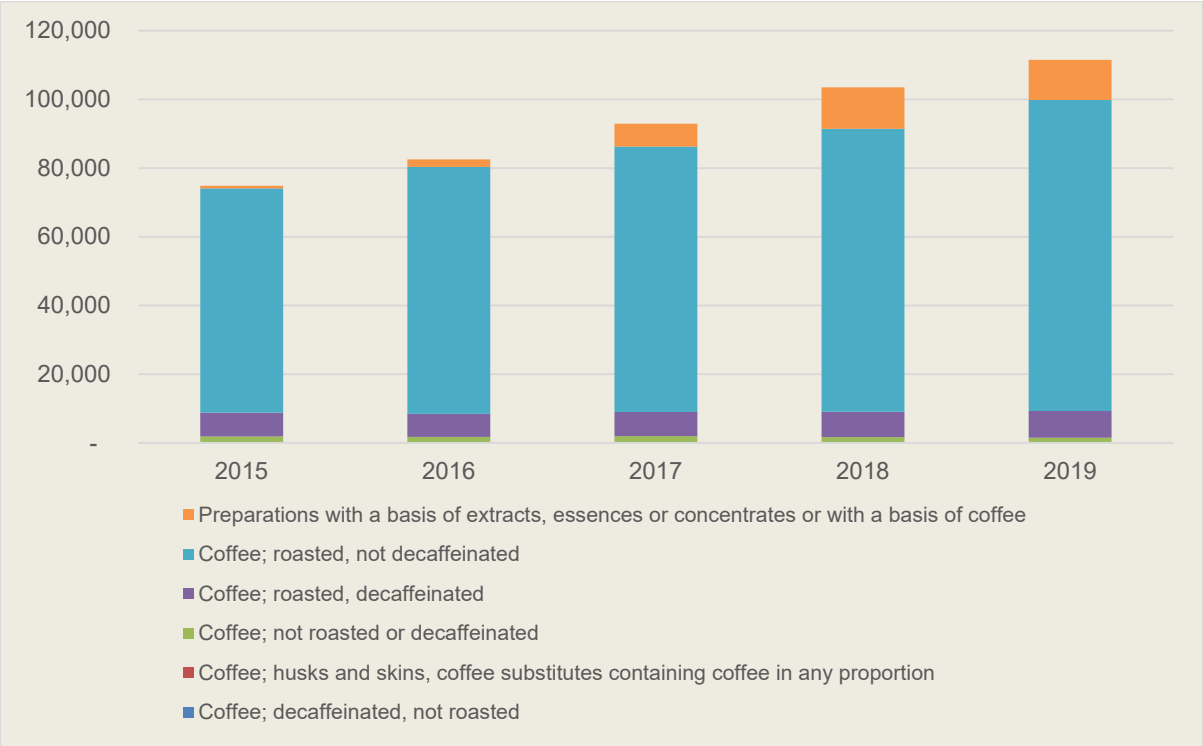
Figure 41: Switzerland's land footprint for coffee (hectares)



7.6 Estimated coffee consumption

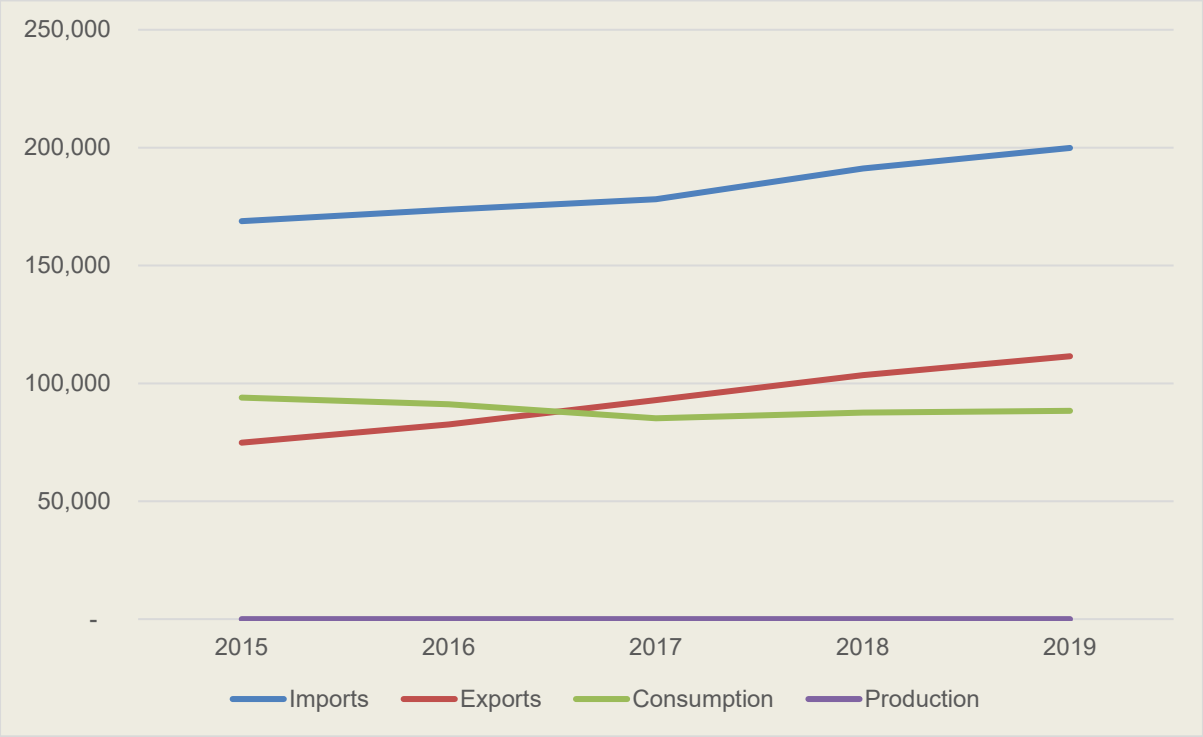
Switzerland exported an average of 93,000 tonnes of coffee per year between 2015 and 2019, of which 83% was roasted coffee (Figure 42). Comparing with imports, Switzerland imports a significant amount of unroasted coffee, roasts it and then exports it. The other exports are roasted decaffeinated coffee (8%) and coffee that has been processed into coffee extracts (7%).

Figure 42: Switzerland's exports of coffee and coffee products, adjusted for the content of coffee (tonnes)



An estimate of domestic consumption of coffee in Switzerland can be made by total annual imports minus total annual exports. This gives an estimated average domestic consumption of around 89,000 tonnes of coffee per year in coffee green bean equivalent, which is equal to 49% of Switzerland's coffee imports. An alternative figure for Swiss domestic coffee consumption calculated by Procafé (a Swiss association for the promotion of coffee consumption) is 74,300 tonnes green bean equivalent for 2019[257]. The methodology for calculating this figure is not explained and therefore the reasons for the difference between the figures is not known. Both imports and exports have increased over the period, whilst the proportion consumed domestically appears to have dropped slightly (Figure 43).

Figure 43: Estimate of Switzerland's imports, exports and consumption of coffee 2015-19 (tonnes)



7.7 Switzerland's coffee risk profile

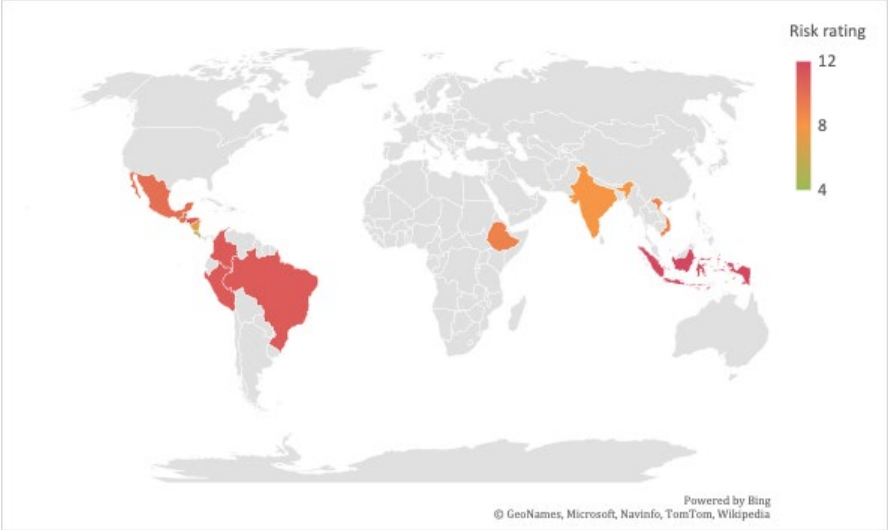
Almost all of Switzerland's coffee imports – 72% of the footprint – are from countries rated as having a high or very high risk of deforestation, corruption and poor labour rights. This includes Brazil, Colombia, Ethiopia, Guatemala, Indonesia, Honduras, Mexico and Peru (Figure 44). Imports also come from India, Nicaragua and Vietnam (all medium risk) and Costa Rica (medium-low risk) (see Table 8).

Per capita coffee consumption in Switzerland is amongst the highest in Europe at an average of 7.9kg per year[258]. Certification penetration in Switzerland is relatively good in general and most of the retailers offer UTZ certified coffee. Per capita spending on organic products is amongst the highest in the world[259] and the market for Fairtrade products is also very strong and grew 11% in 2017[260]. The market share of certified coffees in Switzerland is

[257] https://www.procafe.ch/wp-content/uploads/2020/07/StatAngaben2020_e_Juli-2020.pdf
[258] Compared to 12kg per year in Finland which has the highest consumption in the world https://www.cbi.eu/market-information/coffee/trade-statistics
[259] https://www.cbi.eu/market-information/coffee/specialty-coffee/market-potential
[260] https://www.cbi.eu/market-information/coffee/sustainable-coffee

estimated at 10%[261] so there is potential to expand this, especially given that the majority of Switzerland's coffee imports come from countries rated as high or very high risk.

Figure 44: Switzerland coffee footprint by risk category



7.8 Estimated greenhouse gas emissions from Switzerland's coffee imports

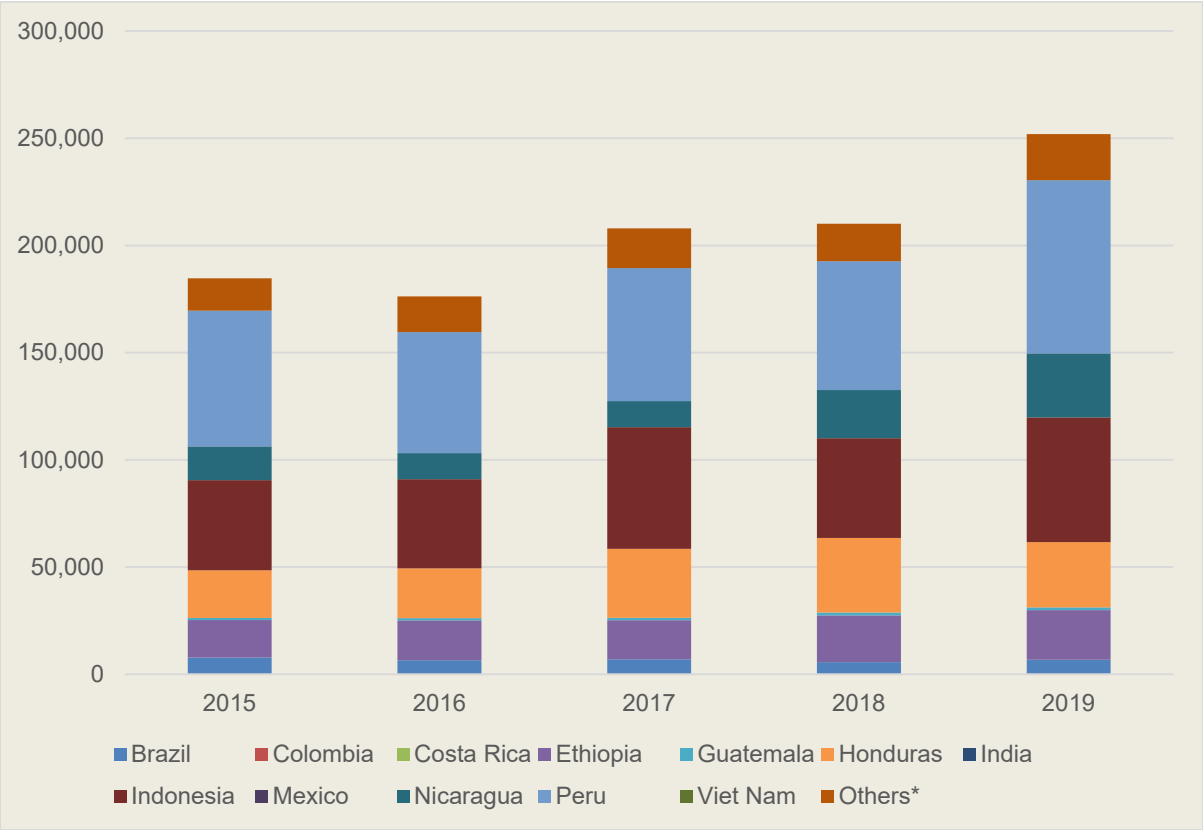
The greenhouse gas emissions associated with the production of coffee for Switzerland's imports are estimated by taking the land footprint in each country and applying a calculated per hectare emissions value for the specific crop and country pairing.

For coffee, average annual emissions were 206,000 tonnes CO_2eq per year, equivalent to 7% of the emissions from agricultural commodities presented here or 0.6% of Switzerland's annual national greenhouse gas emissions. The main source of emissions was production in Peru, Indonesia and Honduras which together accounted for 65% of annual GHG emissions on average.

Emissions increased over the period due to an increase in import volumes and in the area of the associated land footprint.

[261] https://www.intracen.org/WorkArea/DownloadAsset.aspx?id=37613

Figure 45: Estimated greenhouse gas emissions from land use change associated with Switzerland's imports of coffee 2015-19 (tonnes CO_2eq)



8 Coconuts

8.1 Production, uses and sustainability of coconuts

8.1.1 Production

Coconuts grow in equatorial regions at latitudes between 20°N and 20°S. The palms require a tropical climate and ideal conditions for growth and yields are temperatures around 27°C, humidity of at least 60% and well distributed rainfall of around 200cm per year. Coconut palms are naturally found at sea level but near the equator can grow at elevations up to 600m above sea level[262].

Coconut cultivation has occurred for thousands of years. The arrival of European colonists in many tropical countries in the 19th century started the commercialisation of coconut and led to the establishment of large coconut plantations. Today, coconuts grow in more than 80 countries across Asia, Africa, America and Oceania[263].

The palms typically grow to around 20-22 metres tall and can reach 35-40 metres[264]. The first mature fruits are produced 5-6 years after planting after which they are produced throughout the year, although can be hindered by drought or irregular rainfall[265]. Palms usually produce around 50-80 coconuts per year[266] and peak production usually occurs after around 15 years[267].

There are two main varieties of coconut; talls and dwarfs. Talls are by far the most common and varieties that have developed in relative isolation from a narrow initial sample are used in breeding programs to produce improved varieties. Dwarfs are less common and are rarely used for commercial production.

Around 90% of coconut production is on smallholder farms of less than 4ha[268].

The first stage of processing coconuts – the extraction of the kernel flesh, copra – is often carried out on the farm and this is then transported to oil mills where it is processed further[269].

8.1.2 End uses

Coconut fruits comprise a thick, fibrous husk around a large nut with a brittle, hairy shell. Within the shell is the coconut endosperm or kernel which is initially soft when the coconut is immature but becomes firm as the coconut matures. The central cavity of unripe coconuts contain a liquid called coconut water[270].

In countries where coconuts are grown almost every part of the coconut and its palm are used. The coconut flesh and water are consumed in a variety of ways and the coconut husk and other parts of the palm are used purposes including rope making, weaving, fuel and building materials.

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[262] https://vikaspedia.in/agriculture/crop-production/package-of-practices/plantation-crops/coconut/coconut-cultivation-practices
[263] https://www.cabi.org/isc/datasheet/11788#toidentity
[264] Chan & Elevitch, 2006. Species profiles for Pacific Island Agroforestry: *Cocos nucifera.*
[265] Chan & Elevitch, 2006. Species profiles for Pacific Island Agroforestry: *Cocos nucifera.*
[266] Chan & Elevitch, 2006. Species profiles for Pacific Island Agroforestry: *Cocos nucifera.*
[267] https://gro-intelligence.com/insights/articles/coconuts-growing-demand-stagnant-production
[268] http://www.fao.org/docs/eims/upload/216252/Infosheet_Coconut.pdf
[269] http://www.fao.org/docs/eims/upload/216252/Infosheet_Coconut.pdf
[270] https://www.cabi.org/isc/datasheet/11788#toidentity

Historically, much coconut was traded as copra which comprises the dried kernel flesh. However, these days, copra is rarely traded on the international market and instead the majority of coconut in a number of processed forms, most of which are produced from the kernel[271]:

- **Coconut milk or cream:** extracted by squeezing fresh coconut meat (kernel) from mature coconuts harvested at around 12 months, and either mixed with water to produce milk or centrifuged to produce cream. Commonly used as a cooking ingredient in Asian and African cuisines and increasingly popular in Europe.
- **Coconut oil:** extracted from copra. High quality oil can be used as cooking oil or in the manufacture of margarine, milk and ice cream. The oil is also processed into soaps, shampoos, paints and varnishes whilst remnant fatty acids and alcohols are used as components of emulsifiers and surfactants[272].
- **Desiccated coconut:** finely shredded and dried coconut kernel.
- **Coconut water:** extracted by tapping unripe or immature coconuts harvested after around 7 months. Drunk as a beverage which is increasingly popular on international markets due to reported health benefits[273].

Prices for copra (dried coconut kernel) tend to fluctuate and coconut oil competes with other vegetable oils including palm oil, which has similar properties[274].

Global demand for coconut products has grown rapidly over recent years and is projected to grow at an average of 13% from 2019 to 2026[275]. In particular, coconut water, which was previously mostly consumed locally, is now a popular product on international markets with sales in the US increasing from a few million dollars in the early 2000s to $800 million in 2015. Coconut milk sales have also grown, with sales in the UK rising 67% in 2015, and interest in coconut oil has increased, with virgin fresh-pressed varieties being seen as a 'superfood'[276].

However, coconut production in many of the major producing countries has stagnated and, in some cases, declined in recent years. This is due to the aging population of coconut palms, many of which were planted several decades ago and have passed their period of peak production which occurs at around 10-30 years[277]. Coconuts are also affected by a number of pests and diseases which threaten yields[278]. Responses to these declines in yields have included programmes which provide new trees to farmers whilst the increasing demand for coconut products has encouraged farmers elsewhere to adopt coconut production.

8.1.3 Environmental and social issues associated with coconut production

Most of the global production of coconuts occurs in tropical island nations which tend to support high levels of biodiversity and numbers of endemic plant and animal species. Many of these areas were forested in the past but have experienced high rates of forest clearance,

[271] Chan & Elevitch, 2006. Species profiles for Pacific Island Agroforestry: *Cocos nucifera.*
[272] https://www.cabi.org/isc/datasheet/11788#toidentity
[273] https://www.statista.com/statistics/325473/us-coconut-water-sales/
[274] Chan & Elevitch, 2006. Species profiles for Pacific Island Agroforestry: *Cocos nucifera.*
[275] https://www.verifiedmarketresearch.com/product/coconut-products-market/
[276] https://gro-intelligence.com/insights/articles/coconuts-growing-demand-stagnant-production
[277] http://www.fao.org/asiapacific/news/detail-events/en/c/203905/
[278] FAOSTAT

with some evidence suggesting that an expansion in coconut plantations has been amongst the drivers[279].

There are also social issues involved in coconut production. Incomes from coconut farming are very low. For example, the majority of the 3.5 million coconut farmers in the Philippines live below the poverty line, earning less than $1 per day[280]. Prices are volatile and often controlled by middlemen and, as a result, coconut farmers are not ensured a decent standard of living[281]. Low incomes also encourage the use of unpaid or child labour and coconut production is listed on the US Department of Labour's list of goods produced by child labour or forced labour in the Philippines, which is the second largest producer of coconuts globally[282,283].

Production and harvesting of coconuts can be dangerous. Falling coconuts can cause serious injury in plantations and harvesting by hand involves working at height, often without safety equipment[284].

Coconut production has also recently been criticised for animal welfare abuses as in some countries including Thailand, Macaque monkeys are sometimes used in the harvesting of coconuts. This practice has existing for around 400 years but with the growing international market for coconut products, this has recently received negative media attention[285].

8.1.4 Certification

Certification of coconuts to date is limited. There is not yet any broad supply chain certification scheme for coconut products equivalent to the Roundtable on Sustainable Palm Oil or the Cocoa and Forests Initiative, for example. Traceability is therefore low, which is an issue when there have been reported occurrences of child and forced labour and potential environmental damage including deforestation associated with coconut production.

The certification programmes that exist to date are:

- **Fairtrade:** Since 2013, Fairtrade have provided certification for coconuts, offering a guaranteed minimum price and a premium to Fairtrade certified coconut growers[286]. However, this only covers whole nuts, rather than processed forms[287].
- **Rainforest Alliance:** The Sustainable Certified Coconut Oil project, a collaboration between partners including giz and Cargill, supported coconut farmers in the Philippines and Indonesia to qualify for Rainforest Alliance certification for their production of coconuts to be processed into coconut oil[288]. Three hundred farmers[289] and around 80,000 tonnes of coconut were Rainforest Alliance Certified in 2019 as a result[290].

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279 https://osf.io/du5tp/download/?format=pdf
280 http://www.napc.gov.ph/sites/default/files/documents/articles/Issue%20No.%202%20-%20Coconut%20Road%20Map.compressed.pdf
281 https://www.rainforest-alliance.org/business/wp-content/uploads/2020/04/Better-for-business-Coconut-oil-A4.pdf
282 https://www.dol.gov/sites/dolgov/files/ILAB/ListofGoods.pdf
283 FAOSTAT
284 https://www.rainforest-alliance.org/business/wp-content/uploads/2020/04/Better-for-business-Coconut-oil-A4.pdf
285 https://www.npr.org/sections/thesalt/2015/10/19/448960760/monkeys-pick-coconuts-in-thailand-are-they-abused-or-working-animals?t=1597933060562
286 https://www.fairtradecertified.org/shopping-guides/guide-to-fair-trade-coconut
287 https://www.fairtrade.net/standard/minimum-price-info
288 https://www.giz.de/en/worldwide/54556.html
289 https://snrd-asia.org/sustainable-certified-coconut-oil-scno/
290 https://www.rainforest-alliance.org/business/wp-content/uploads/2020/04/Better-for-business-Coconut-oil-A4.pdf

- **Organic:** There are reportedly some sales of organic coconut in European markets[291] and some individual traders are certified organic[292], but there is limited market-level data on the extent of this certification.
- **Others:** smaller scale initiatives include programmes by the Fair Trade Sustainability Alliance[293] which supports community-based projects such as work by Kokonut Pacific[294]. The scale of these operations is generally small, and markets in Europe and America are usually in the form of individual traders.

The coverage of certification programmes for coconut remains limited. Current efforts by certifying bodies are on raising awareness and demand for sustainably produced products amongst brands and consumers[295].

8.1.5 Switzerland's responses to environmental and social issues with coconut

The focus on the environmental and social sustainability of coconuts appears to be similarly low in Switzerland and Europe as on the global scale. Certification, and markets for certified coconuts and coconut products, are so far very small scale.

However, with the market for coconut products set to continue growing rapidly, and particularly due to its potential as an alternative to palm oil which is widely seen as unsustainable, it is likely that there will be increasing focus on coconuts.

Several private companies headquartered in Switzerland are beginning to include coconuts in their sustainable sourcing policies, including Barry Callebaut[296], Nestlé[297] and Florin AG, Switzerland's biggest producer and supplier of cooking oil and edible fats[298]. This could create a potential market for certified sustainable coconuts.

8.2 Trade of coconut

8.2.1 Global Trade

Global exports of coconut as nuts, kernels and oil were over 84 million tonnes in 2019. This has increased significantly from around 2 million tonnes in 1999. The value of these exports was about $3.18 billion in 2019, not accounting for the significant value of products containing coconut, including cosmetics, hair care, soap and food items[299].

In most coconut producing countries, around 70% of production is for domestic consumption although exports are increasing[300]. In the same period that the quantity of global exports has increased over forty-fold, global production has increased by only around 25%[301].

European countries are a growing market for coconut products. Although demand for fresh coconut and coconut water is relatively small compared to the scale of global consumption,

[291] https://www.cbi.eu/market-information/processed-fruit-vegetables-edible-nuts/desiccated-coconuts/europe
[292] E.g. https://www.coconutbusiness.eu/private-label/?lang=en
[293] https://www.fairtsa.org/
[294] https://www.kokonutpacific.com.au/
[295] https://www.triplepundit.com/story/2020/coconut-products-gain-popularity-certification-essential-sustainability/87261
[296] https://www.barry-callebaut.com/sites/default/files/2019-05/Sustainable%20Sourcing%20Policy_Coconut_FINAL.pdf
[297] https://www.nestle.com/csv/raw-materials/coconut
[298] https://www.earthworm.org/pt/members/florin-ag
[299] UN COMTRADE data
[300] http://www.fao.org/docs/eims/upload/216252/Infosheet_Coconut.pdf
[301] FAOSTAT production data

the EU is the world's largest importer of desiccated coconut, accounting for 30% of global imports in 2019, and the demand for virgin coconut oil is increasing significantly[302]. Europe and the US comprise the largest market for coconut oil.

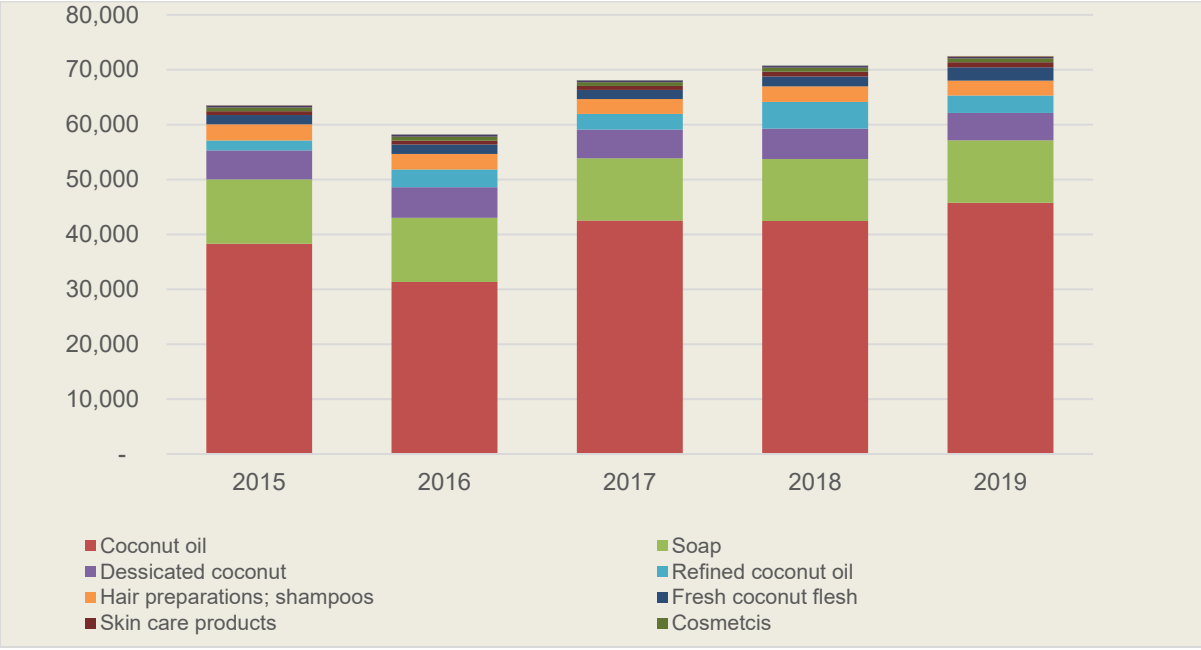
There is a significant amount of intra-European trading of coconut between. For example, around 90% of all exports of desiccated coconut from European countries are to EU countries. Significant exporters include the Netherlands and Belgium. After Russia, Switzerland comprises the largest non-EU market for exports of desiccated coconut from European countries[303].

8.3 Switzerland's imports of coconuts and coconut products

Switzerland imported an average of 67,000 tonnes of coconuts per year between 2015-19. By far the largest proportion of imports were in the form of coconut oil which accounted for an average of 60% of annual imports (40,000 tonnes) over the period (Figure 46). The next largest fraction was in the form of soap, which comprised around 17% of annual imports on average, followed by desiccated coconut (8%), refined coconut oil (5%), shampoos (4%) and fresh coconut flesh (3%). Other forms of coconut comprised less than 1% of imports by weight of embedded coconut.

Imports have increased significantly over the period, by around 15%, with the growth mostly driven by an increase in coconut oil imports from a low of 31,000 tonnes in 2016 to 46,000 tonnes in 2019.

Figure 46: Quantity of Switzerland's imports of coconut products 2015-19, adjusted for coconut content (tonnes)

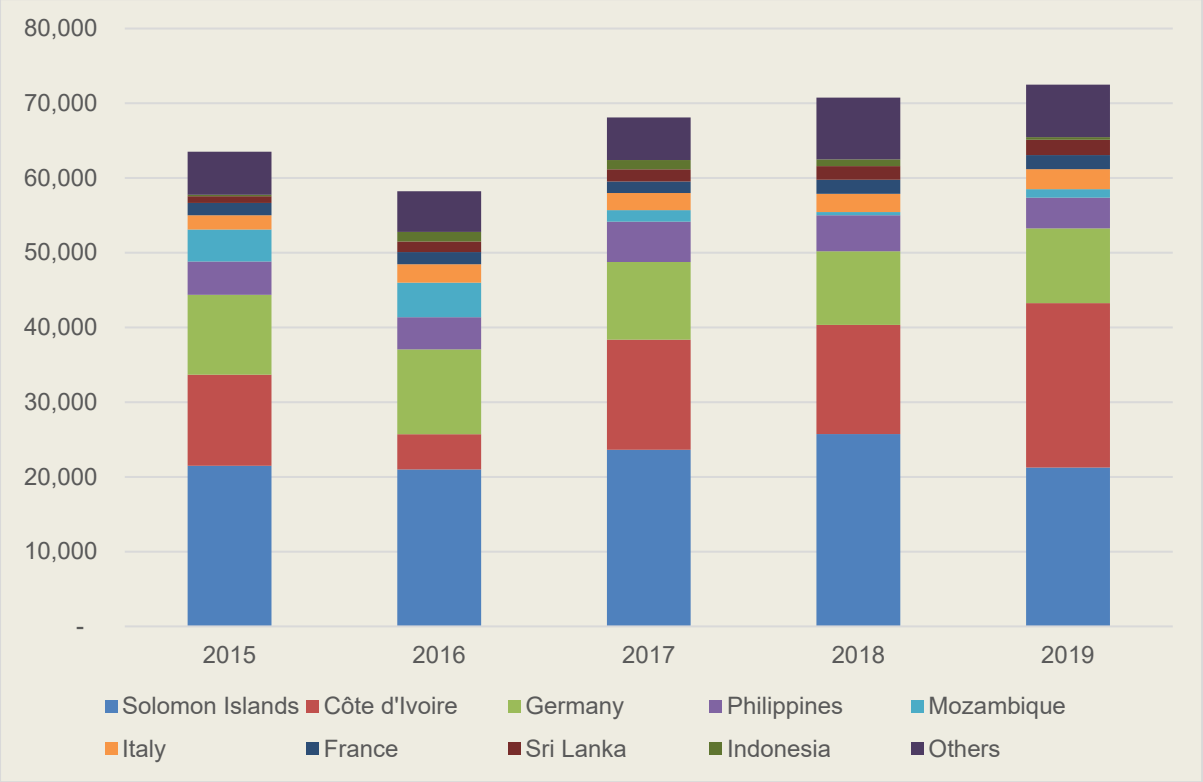


8.4 Provenance of Switzerland's import of coconuts

Switzerland's imports of coconuts include imports directly from a number of producer countries (Solomon Islands, Côte d'Ivoire, Indonesia, Philippines and Mozambique) as well as a number of European trading partners including Italy, France and Germany. These European countries account for 22% of imports to Switzerland, but do not produce coconuts themselves so the volumes originate elsewhere (Figure 47).

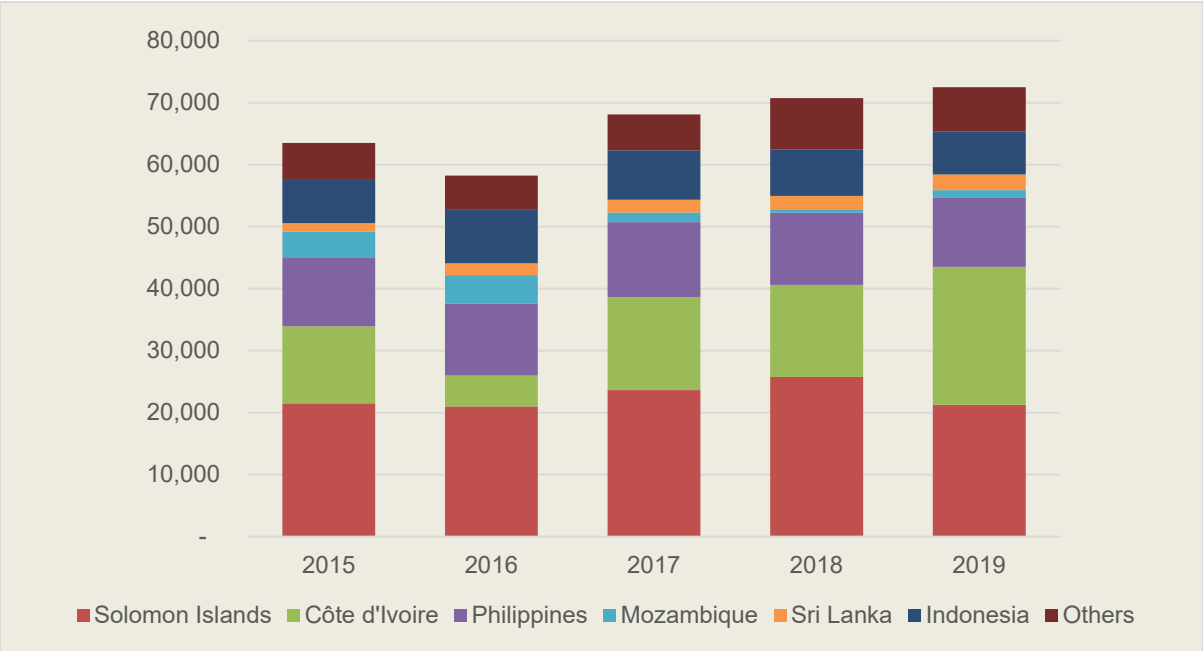
[302] https://www.cbi.eu/market-information/processed-fruit-vegetables-edible-nuts/
[303] https://www.cbi.eu/market-information/processed-fruit-vegetables-edible-nuts/desiccated-coconuts/europe

Figure 47: Provenance of Switzerland's direct imports of coconut 2015-19 (tonnes)



When the provenance of coconut imports is reassigned (see Section 2.2), the Solomon Islands is found to account for one third (34%) of Switzerland's coconut imports by weight, followed by Côte d'Ivoire (21%), the Philippines (17%) and Indonesia (11%) (Figure 48).

Figure 48: Provenance of Switzerland's imports of coconut, reassigned to origin country 2015-19 (tonnes)

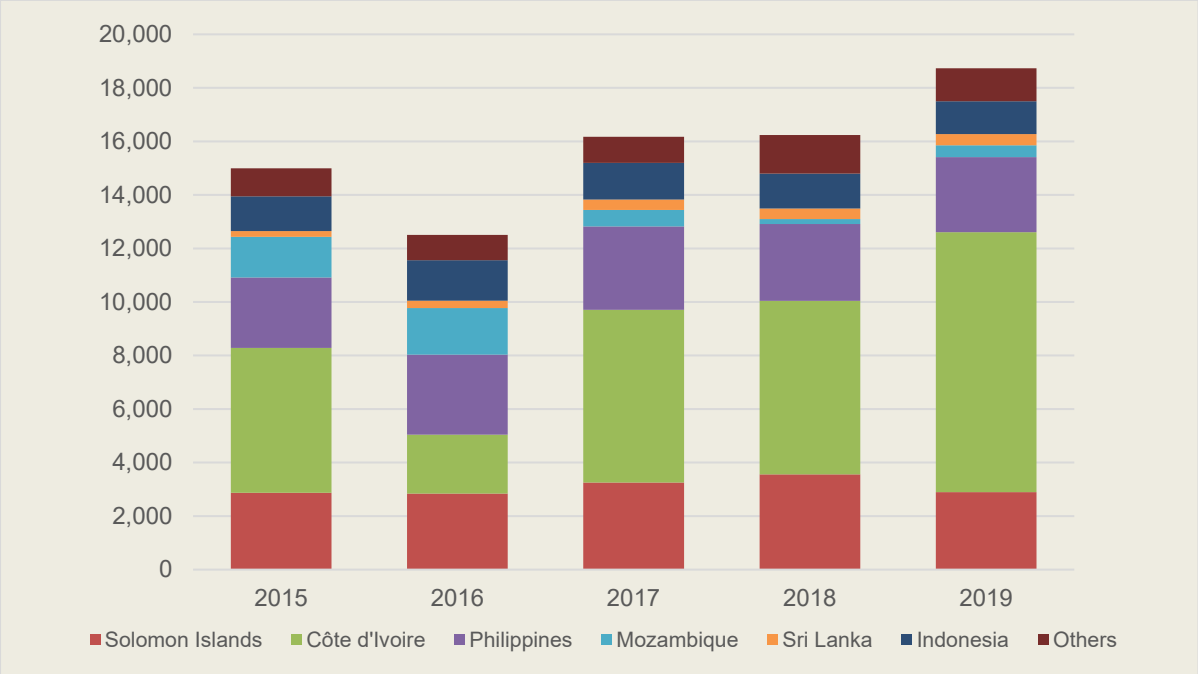


8.5 Switzerland's coconut footprint

The area of land required to supply Switzerland's coconut imports averaged 16,000 hectares per year between 2015-19. There has been a significant increase in this footprint from 15,000 hectares in 2015 to 19,000 hectares in 2019. This reflects both an increase in the volumes being imported and a decline in yield per hectare in some countries including the Solomon Islands and the Philippines and relatively static yields in the other countries[304].

By far the largest footprint is in Côte d'Ivoire, accounting for an average of 38% of the annual footprint of Switzerland's coconut imports. The next largest footprint is in Solomon Islands which accounted for an average of 20% of the footprint area per year. This is the reverse of their ranking for the volumes of imports to Switzerland which is the result of significantly lower yields per hectare in Côte d'Ivoire at an average of 2.29 tonnes per hectare over the period compared to 7.35 tonnes per hectare in the Solomon Islands (Figure 49)[305].

Figure 49: Estimated footprint of Switzerland's imports of coconut (hectares)

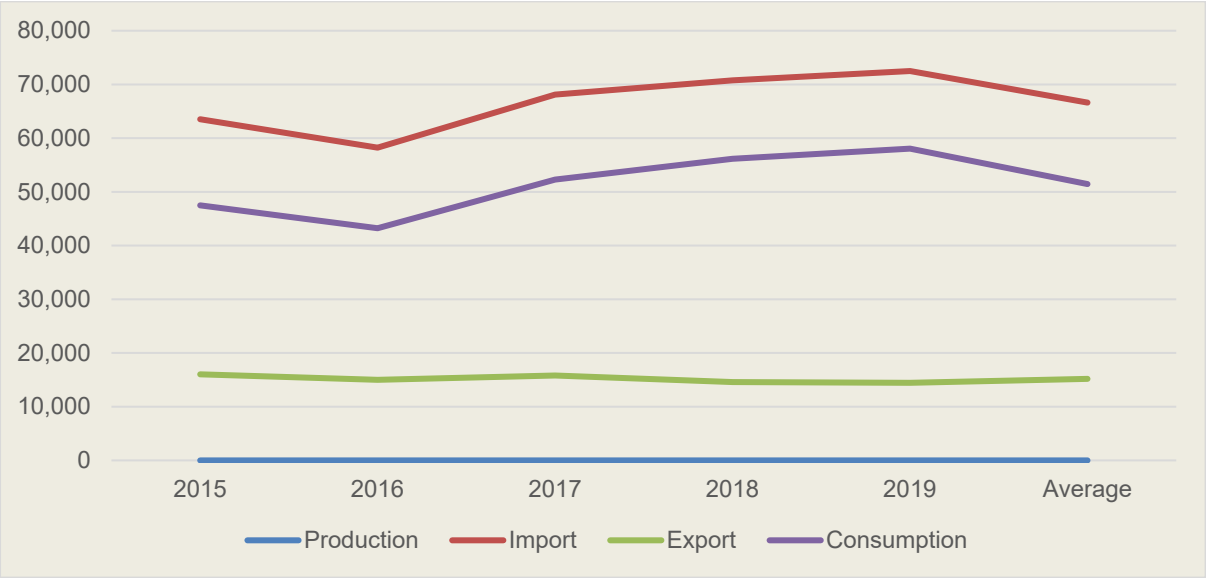


8.6 Estimated coconut consumption

Switzerland's consumption of coconuts is estimated by subtracting the average quantity of exported coconuts (15,000 tonnes) from the overall quantity of imported cocoa (67,000 tonnes), providing an average consumption figure of almost 52,000 tonnes of coconut per year between 2015-2019 (Figure 50). Consumption represents 77% of Switzerland's annual imports of coconut during the period and 0.14% of all global coconut production. Patterns in consumption are closely tied to imports, whilst exports have remained relatively steady throughout the period. The area necessary to produce this amount of consumed coconut is just over 12,000 hectares – which is equivalent to 0.1% of the global harvested area for coconut and 0.3% of Switzerland's domestic land area.

[304] FAOSTAT
[305] FAOSTAT

Figure 50: Switzerland's imports, exports and consumption of coconut 2015-19 (tonnes)

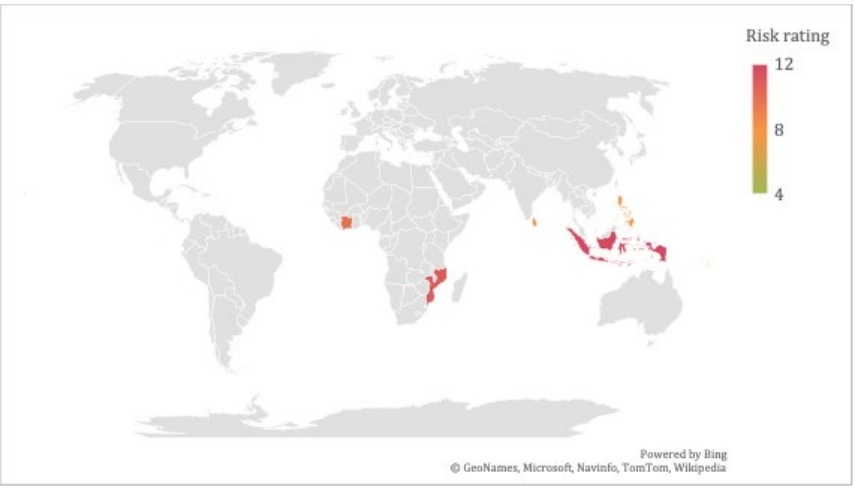


8.7 Switzerland's coconut risk profile

Switzerland imports over half – 53% - of its coconut imports from high or very high risk countries. This include principally Indonesia which is considered very high risk due to high rates of deforestation, poor labour standards and high rates of corruption (Figure 51). Imports also come from Mozambique which is also classified as very high risk and from Côte d'Ivoire which is classified as high risk. Significant imports come from the Solomon Islands and Philippines which are considered medium risk, as is Sri Lanka which also provides a proportion of imports.

Coconut sustainability certification is currently small scale but with the significant social and environmental issues associated with production, broader certification is critical. Several major companies headquartered in Switzerland have recently started to include coconut in their sustainable sourcing policies and per capita consumption of organic and Fairtrade goods in Switzerland is the highest in the world. This suggests there is good market potential for the broader introduction of coconut certification in Switzerland.

Figure 51: Risk profile of provenance countries for Switzerland's imports of coconut 2015-19



8.8 Estimated greenhouse gas emissions from Switzerland's coconut imports

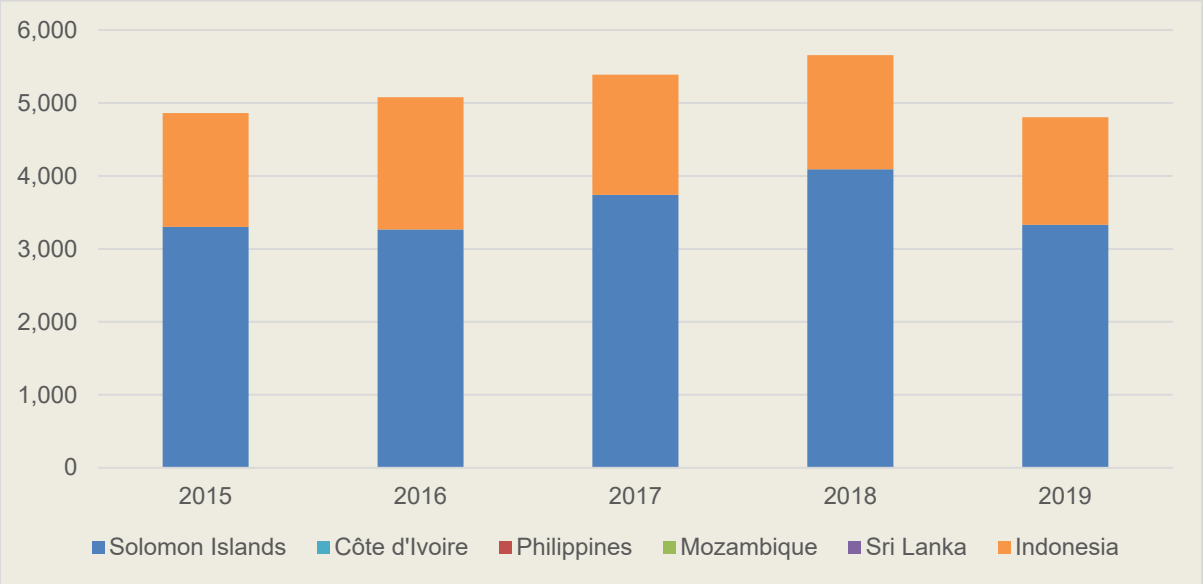
The greenhouse gas emissions associated with the production of coconut for Switzerland's imports are estimated by taking the land footprint in each country and applying a calculated per hectare emissions value for the specific crop and country pairing.

The emissions from coconut production averaged a total of 5,000 tonnes CO_2eq per year, which is less than 1% of the greenhouse gas emissions calculated to be associated with the agricultural commodities analysed here.

The main source of emissions was production in the Solomon Islands due to the higher proportion of coconut imports coming from Solomon Islands. The per hectare emissions values for the two countries was roughly the same at 1.15 tonnes CO_2eq per hectare per year for Solomon Islands and 1.20 for Indonesia. According to the DLUC database assessment, there were no emissions from land use change in Côte d'Ivoire, Philippines, Mozambique or Sri Lanka over the period.

Emissions increased between 2015 and 2018 and then appeared lower for 2019, due to a decrease in import volumes and therefore in the area of the associated land footprint in both countries.

Figure 52: Estimated greenhouse gas emissions from land use change associated with Switzerland's imports of coconut 2015-19 (tonne CO_2eq)



9 Sugar cane

9.1 Production, uses and sustainability of sugar cane

9.1.1 Production

Sugar cane (*Saccharum officinarum*) is a tall perennial member of the grass family, which grows as thick stems of around 3-6m tall[306]. It requires a warm climate and optimum temperatures for sugarcane growth are between 22 and 30°C. However, ripening requires slightly lower temperatures and dry conditions. A long growing season is necessary for optimum yields and adequate moisture is essential as vegetative growth of the sugar cane is directly related to water levels. Rainfall of between 1500-2500mm per year are optimal. Sugar cane grows mainly in the tropics, between 35°N and 35°S of the equator[307]. Sugar cane is thought to originate in New Guinea but is now cultivated in more than 70 countries[308]. The same plants can be harvested for several years, although at declining yields[309].

Harvesting of sugar cane is usually by hand. It is then transported to mills where it is grinded to extract sugarcane juice as well as by-products including bagasse (the dry pulp residue left after extraction of juice from sugar cane), molasses and filtercake. The sugarcane juice from the mills is strained, clarified and then evaporated in a controlled process to produce a syrup which is then crystallised to produce solid cane sugar (sucrose). This cane sugar may be used in this raw form or further refined to produce refined sugar[310]. In some countries, particularly Brazil, some proportion of the sugar cane juice, and molasses from the production process, is used to produce ethanol[311].

Global production of sugar cane has increased from around 1.23 billion tonnes in 1995 to 2.02 billion tonnes in 2018. Brazil and India have remained the biggest producers, together accounting for 56% of global sugar cane production in 2018 with the next largest producers, China and Thailand, each only accounting for 5% of global production[312]. Global production is projected to continue to increase over the coming decade particularly as it is favoured by policies which support sugarcane as a feedstock for ethanol biofuel production, such as Brazil's Renovavio programme. Sugar mills are able to shift between sugar and ethanol production and therefore quickly switch between the two products in response to global demand and market prices[313].

[306] http://www.kew.org/plants-fungi/Saccharum-officinarum.htm
[307] http://www.fao.org/land-water/databases-and-software/crop-information/sugarcane/en/
[308] http://www.kew.org/plants-fungi/Saccharum-officinarum.htm
[309] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf
[310] https://www3.epa.gov/ttn/chief/ap42/ch09/final/c9s10-1a.pdf
[311] Dias et al 2015. Sugarcane processing for ethanol and sugar in Brazil. Environmental Development. 15. Online at: https://doi.org/10.1016/j.envdev.2015.03.004
[312] FAOSTAT data
[313] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf

9.1.2 End uses

The main uses of sugarcane are[314,315,316]:

- **Sugar:** the main use for sugarcane is sugar. The raw form is known as cane sugar. It has a golden colour is often used in this raw form in producer countries. Cane sugar is also exported for use as a sweetener in a number of products including non-dairy milk alternatives such as almond milk. For use as table sugar in many other countries, particularly in Europe and the US, cane sugar is refined to produce refined sugar which is white and often has finer grains. Sugar is used in a huge variety of food products including confectionary, chocolate, cereals, yogurts, baked goods, ice cream and preserves as well as beverages. It is mainly used as a sweetener but also to balance acidity and prevent spoilage[317]. Around 86% of sugar used globally comes from sugar cane, with the rest produced from sugar beet[318].
- **Ethanol**: ethanol can be produced directly from the juice extracted from sugar cane as well as from sugarcane molasses. A major use of sugarcane ethanol is as a biofuel, particularly in Brazil which accounts for around 90% of global sugarcane-based bioethanol production. In fact, the share of sugarcane allocated to producing sugar is anticipated to decline over the period to 2028 as more is projected to be used to produce ethanol.
- **Molasses**: molasses is produced during the milling of sugarcane in two forms; blackstrap molasses which is inedible to humans, and a syrup which is edible. The former is mainly used as an animal feed additive, but is also used in the production of ethanol.
- **Alcoholic drinks**: sugarcane is used to produce rum and cachaça, a popular alcoholic beverage in Brazil.
- **Bioplastics:** sugarcane is used to make bioplastics used in a wide range of rigid and flexible materials including food packaging, single-use cutlery and drinking receptacles, electric car panels and airplane parts.
- **Cosmetics**: crystallised and refined cane sugar is sometimes used as an exfoliator in beauty products and extracts from sugarcane can be used in moisturisers and face masks.
- **Medicines**: cane sugar is used for flavouring, coatings and for adding volume and texture in some medicines.

In addition to these uses of sugarcane, bagasse, a by-product of the milling process is often used as fuel and is used in Brazil to generate energy for sugarcane bioethanol production. Other uses include agricultural mulch and for the production of some paper and paperboard products used as stationary or to make products such as food take-out containers.

An estimated 70% of sugarcane is consumed within the country of origin[319].

[314] https://www3.epa.gov/ttn/chief/ap42/ch09/final/c9s10-1a.pdf
[315] Dias et al 2015. Sugarcane processing for ethanol and sugar in Brazil. Environmental Development. 15. Online at: https://doi.org/10.1016/j.envdev.2015.03.004
[316] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf
[317] https://www.sugar.org/diet/role-in-food/
[318] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf
[319] https://www.confectionerynews.com/Article/2016/09/13/Sugar-sustainability-in-confectionery-Tough-choices-ahead

Estimates for sugar imports to the European Union – including both sugar cane and beet – are that around 78% is imported as sugar whilst 22% is within processed products[320].

9.1.3 Environmental and social issues associated with sugar cane production

Sugarcane production is a significant source of rural employment providing an estimated 100 million livelihoods in the areas in which it is produced. However, prices received by producers are very low and volatile[321]. Global market fluctuations, such as the impact of the end of European sugar quotas in 2017, and government subsidies which favour large-scale producers in countries like Brazil make it particularly hard for smallholder growers to make a reliable living. The particular complexities and distortions of sugar pricing mean that standards such as Fairtrade are also not able to guarantee a minimum price for sugar[322]. Consequently, there is significant poverty amongst sugarcane producers and, although there is a lack of data on the exact incidence of child labour, studies in Asia, Latin America and Africa have found children between the ages of five and 17 working on sugar plantations and evidence suggests that it is a widespread issue[323].

The US Department of Labour lists 13 countries including India, Thailand, Colombia and Mexico where sugarcane production is found to involve child labour. In Pakistan, it is found to involve forced labour and in four other countries – Brazil, Bolivia, Burma and the Dominican Republic – both a child labour and forced labour have been found in sugarcane production[324].

For all sugarcane labourers, but particularly child labourers, the manual harvesting of the cane and the application of agrochemicals, often without adequate protective gear, mean the work is highly hazardous and injuries are common[325,326].

Sugarcane is grown in several countries with valuable and biodiverse habitats including tropical forest. Positively, projected increases in production of sugar cane for the period until 2028 are estimated to come mainly from higher yields rather than area expansion[327]. Previous studies have also found that, at least in Brazil, expansion of sugarcane plantations has generally been onto pastureland, existing cropland or citrus groves and therefore has not contributed directly to clearance of forest. However, displacement of existing production may lead indirectly to the clearance of forested areas or conversion of biodiverse habitats such as the *Cerrado* in Brazil[328,329].

A significant impact of sugarcane production is water use. Sugarcane is a water intensive crop, requiring around 1,600 litres of water to produce 1kg of sugar. Around half of all

[320] European Commission, 2020. EU Sugar Balance: May 2020. Online at: https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/sugar-balance-sheet_en.pdf
[321] http://www.ilo.org/ipecinfo/product/download.do?type=document&id=29635
[322] https://info.fairtrade.net/product/sugar
[323] http://www.ilo.org/ipecinfo/product/download.do?type=document&id=29635
[324] https://www.dol.gov/sites/dolgov/files/ILAB/ListofGoods.pdf
[325] http://www.ilo.org/ipecinfo/product/download.do?type=document&id=29635
[326] https://www.hrw.org/report/2004/06/09/turning-blind-eye/hazardous-child-labor-el-salvadors-sugarcane-cultivation
[327] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf
[328] Bordonal et al, 2018. Sustainability of sugarcane production in Brazil. A review. *Agronomy for Sustainable Development.* 38:13. https://doi.org/10.1007/s13593-018-0490-x
[329] Goldemberg, J., Coelho, S. T., & Guardabassi, P. (2008). *The sustainability of ethanol production from sugarcane. Energy Policy, 36(6), 2086–2097.* doi:10.1016/j.enpol.2008.02.028

sugarcane globally is irrigated which can lead to depletion of groundwater resources as well as leaching of soil and fertilisers to waterways and the wider environment[330,331].

There is a significant lack of transparency and traceability in sugarcane supply chains which means that environmental and social impacts currently go unmeasured and unaddressed[332].

9.1.4 Certification

There are four standards which certify the production of sugarcane[333]:

- **Bonsucro:** Bonsucro is a certification standard specifically for sugarcane. It has more than 540 members across farmers, mills, NGOs, traders and retailers. In 2019, 107 sugar mills were Bonsucro-certified. Sugar, ethanol, molasses and bagasse are all covered by the standard. In 2017, Bonsucro certified 940,000 hectares of sugarcane, comprising 3.6% of the global sugarcane area, the majority of which was in Brazil.
- **Fairtrade international:** Around 146,000 hectares of sugarcane were certified Fairtrade in 2017, accounting for 0.6% of the total harvested sugarcane area. Unlike for other commodities, there is no Fairtrade Minimum Price for sugar cane because global sugar markets and prices involve so many complexities and distortions. However, producers are paid a premium of $60 per tonne of sugar and $80 per tonne of organic sugar sold on Fairtrade terms[334].
- **Proterra:** The Proterra standard was originally developed for soy and soy-derived products, however it is now being used in other sectors including sugarcane. All products certified under the standard are 'identity preserved' and traceable back to production. The standard aims to protect the environment and biodiversity as well as the rights of communities and workers. Proterra covered the largest area of sugarcane production in 2017 at 1.1 million hectares or 4.3% of the global sugarcane area. Proterra first covered sugarcane in 2017, which accounts for a significant increase in the total certified area of sugarcane.
- **Organic:** Organic certification of sugarcane grew the most between 2013-2017 at more than 50%. The total certified area was around 84,000 hectares in 2017, accounting for 0.3% of the global sugarcane area.

Combined, these standards certified between 2 and 2.3 million hectares of sugarcane in 2017. This was a significant increase of 80% compared to 2013. However, the certified area of sugarcane only accounts for between 7.6% and 8.8% of the total area of sugarcane production.

9.1.5 The EU and Switzerland's responses to environmental and social issues with sugar cane

There are currently no regulatory initiatives in Europe in relation to the sustainability of sugar and it has received relatively little attention compared to other commodities such as cocoa

[330] https://www.solidaridadnetwork.org/publications/a-decade-of-sustainable-sugarcane-initiatives
[331] E.g. Thorburn et al, 2011. Environmental impacts of irrigated sugarcane production: Nitrogen lost through runoff and leaching. *Agriculture, Ecosystems and Environment.* 144:1. Online at: https://www.sciencedirect.com/science/article/abs/pii/S0167880911002829
[332] https://www.confectionerynews.com/Article/2016/09/13/Sugar-sustainability-in-confectionery-Tough-choices-ahead
[333] Helga Willer, Gregory Sampson, Vivek Voora, , Joseph Wozniak, and Duc Dang Julia Lernoud, Jason Potts, (2019), The State of Sustainable Markets – Statistics and Emerging Trends 2019. ITC, Geneva
[334] https://info.fairtrade.net/product/sugar

and palm oil, as the majority of focus has been on the health implications of sugar consumption[335].

However, increasing pressure from stakeholders including NGOs and Bonsuro – the global standard specifically for sugarcane – is leading to some large companies such as Italian confectionary manufacturer Ferrero, to start focusing on the sustainability of their sugarcane supply[336].

In Switzerland, corporates including Nestlé, Bacardi and Alvean Sugar are members of Bonsucro and have targets for sustainably sourced cane sugar[337]. Swiss chocolate manufacturer Barry Callebaut also has a sustainable sourcing policy for sugar cane[338].

9.2 Trade of sugarcane

9.2.1 Global Trade

The global value of sugarcane exports – in the form of sugarcane, cane sugar, cane molasses and sucrose – was around $16.7 billion in 2019[339]. Global exports of sugar – from both sugarcane and sugar beet – totalled around 52 million tonnes in 2019 of which an estimate 46 million tonnes were produced from sugarcane, accounting for 88% of global sugar exports by weight.

The largest exporter of sugarcane, cane sugar, and cane molasses by far is Brazil, accounting for 53% of exports in 2019. The next largest exporters were Thailand (14%) and India (7%). The biggest importer of sugarcane is the USA, accounting for 12% of imports by weight in 2019. Other significant importers include Korea (8%), Indonesia (7%) and Malaysia (6%). Italy is the largest European importer in the EU at 5% whilst Switzerland ranks 60th with imports accounting for only 0.25% of global imports of sugarcane.

Global demand for sugar has been steadily increasing. However, reduced population growth rates and health concerns over excessive sugar consumption have reduced demand in places including the US and Europe. Consumption continues to grow in Asia, the Middle East and North Africa, however, and is projected to drive an overall increase in global demand over the next decade[340]. Nevertheless, increasing awareness of health concerns associated with high consumption of sugar has led to the development to of policies and taxes which aim to reduce consumption in both developed countries and, increasingly, developing countries including Brazil, Mexico, South Africa and Turkey[341].

Caloric sweeteners including high fructose corn syrup (HFCS) – known as isoglucose in Europe – represent competition for sugar and their consumption is projected to increase over the next decade. However, sugar continues to dominate the sweetener market at 80% compared to 10% for HFCS[342].

[335] https://www.confectionerynews.com/Article/2016/09/13/Sugar-sustainability-in-confectionery-Tough-choices-ahead
[336] https://epamonitoring.net/sustainability-choosing-between-beet-sugar-and-cane-sugar/
[337] http://www.bonsucro.com/bonsucro-members-2/
[338] https://www.barry-callebaut.com/sites/default/files/2019-05/Sustainable%20Sourcing%20Policy_Sugar%20Cane_FINAL.pdf
[339] Sugarcane estimated to comprise 80% of chemically pure sucrose in solid form with beet comprising the remaining 20%. UN COMTRADE data. See also: http://www.worldstopexports.com/sugar-exports-country/
[340] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf
[341] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf
[342] http://www.fao.org/3/CA4076EN/CA4076EN_Chapter5_Sugar.pdf

The EU is the second largest consumer of sugar globally[343]. Until 2017, it had a sugar quota system which controlled levels of production and ensured minimum pricing for European sugar produced from sugar beet. The lifting of the quotas in 2017 led to an initial boom in European sugar beet production which led to a steep decline in sugar beet prices[344]. This made imports of cane sugar relatively more expensive and total imports of cane sugar to the EU have roughly halved since the removal of the quota. Cane sugar refineries, which already accounted for only a small proportion of sugar refining in Europe compared to beet refineries, now account for just 5%[345].

As the EU is such a large market for sugar, these shifts in sourcing and pricing had effects around the world. In Switzerland, the fall in prices of European sugar led to an increase in imports of European-produced sugar beet to Switzerland. Despite significant subsidies paid to Swiss sugar beet farmers, their numbers, and particularly the area under sugar beet, have been declining in recent years, and seemingly especially since the end of the EU quotas in 2017[346].

The use of sugarcane to produce ethanol as a biofuel means that global prices and trade fluctuate depending on the demand for fossil fuels and prices of crude oil. Around 25% of ethanol globally is produced from sugarcane. When prices paid for raw sugar are high, processors can switch to producing raw cane sugar. When demand for biofuels are high, for example because of an increase in crude oil prices, producers can switch to processing sugarcane to ethanol[347,348].

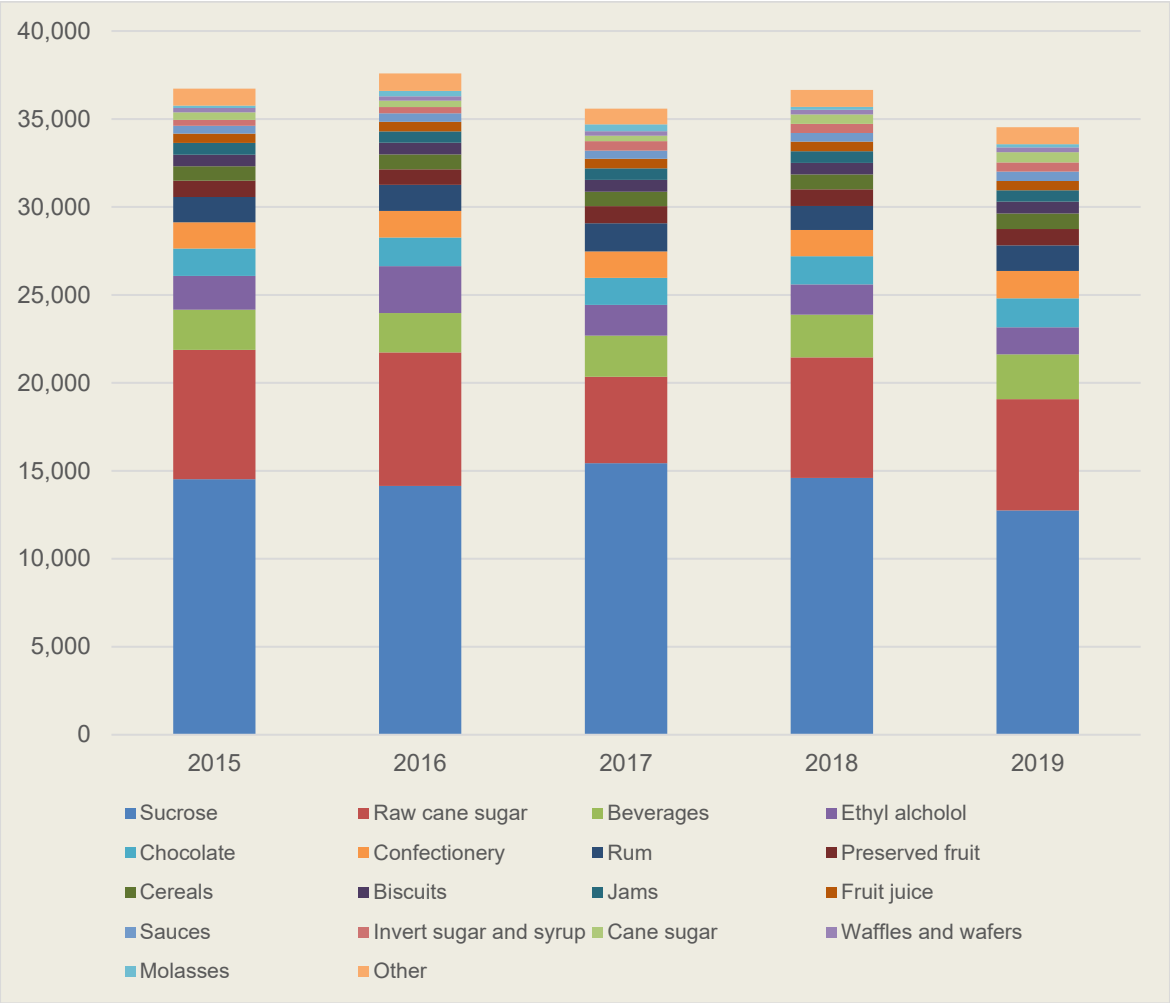
9.3 Switzerland's imports of sugar cane

Switzerland imported an average of 36,000 tonnes of sugar cane per year between 2015-19, the vast majority of which was within products containing sugar. The largest proportion of imports was sucrose which accounted for an average of 14,000 tonnes – 39% - of imports per year. Raw cane sugar was the next largest fraction of imports by weight at an average of 6,600 tonnes per year which accounted for 18% of imports. Other significant forms of sugar cane imports include beverages (7%), ethyl alcohol (5%), chocolate, confectionary and rum (all 4%) (Figure 53).

Total import volumes have fluctuated over the period and show no clear upward or downward trend. In 2017, the total volume of sugarcane imports was lower than in other years, mostly due to a reduction in imports of raw sugar cane. This is likely due to the end of the EU sugar quota which led to a sharp increase in the availability and decrease in the price of European sugar beet and an increase of European sugar beet imports to Switzerland.

[343] ESRA, 2018. Study on Raw Materials in the EU Sugarcane Sector. Online at: https://nove.eu/wp-content/uploads/2019/02/ESRA_study_raw_materials_2019.pdf
[344] https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/sugar-balance-sheet_en.pdf
[345] ESRA, 2018. Study on Raw Materials in the EU Sugarcane Sector. Online at: https://nove.eu/wp-content/uploads/2019/02/ESRA_study_raw_materials_2019.pdf
[346] Schweizer Zucker, 2019. Zuckerrübenstatistik 2019. Online at: https://www.zucker.ch/fileadmin/user_upload/Zuckerruebenstatistik_2019.pdf
[347] http://www.agri-outlook.org/commodities/Biofuels.pdf
[348] Bentivoglio et al, 2016. Interdependencies between biofuel, fuel and food prices: the case of the Brazilian ethanol market. *Energies.* 9. doi:10.3390/en9060464

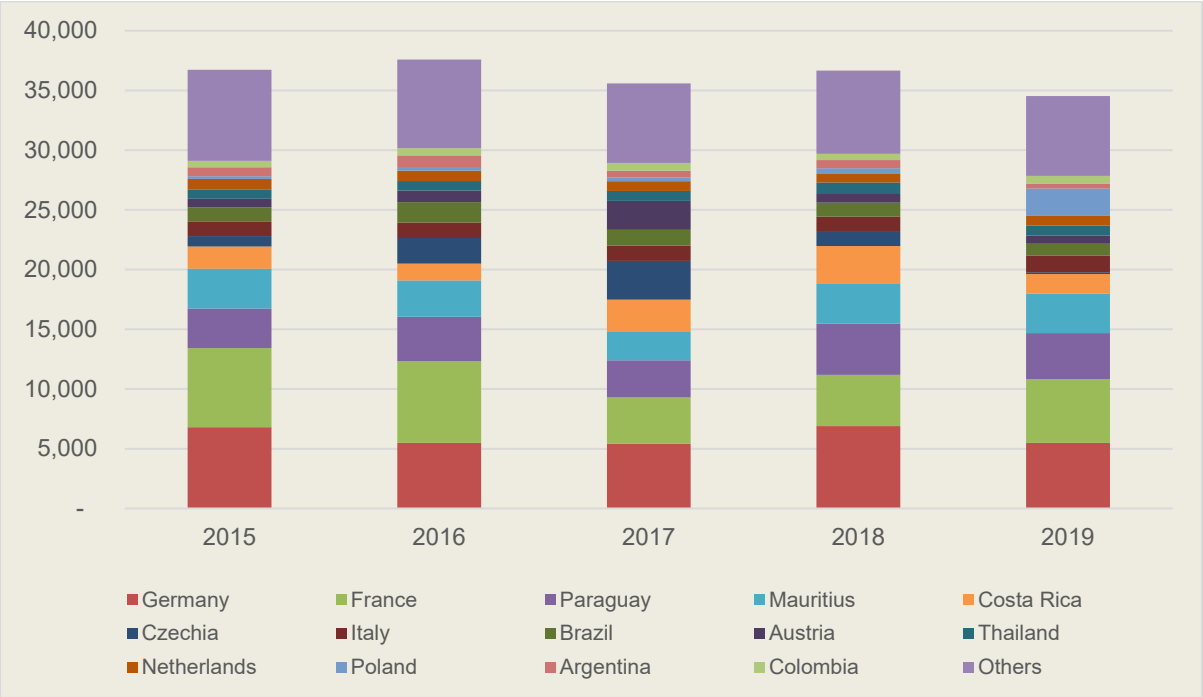
Figure 53: Quantity of Switzerland's imports of sugar cane 2015-19, in different forms adjusted for sugar cane content (tonnes)



9.4 Provenance of Switzerland's import of sugar cane

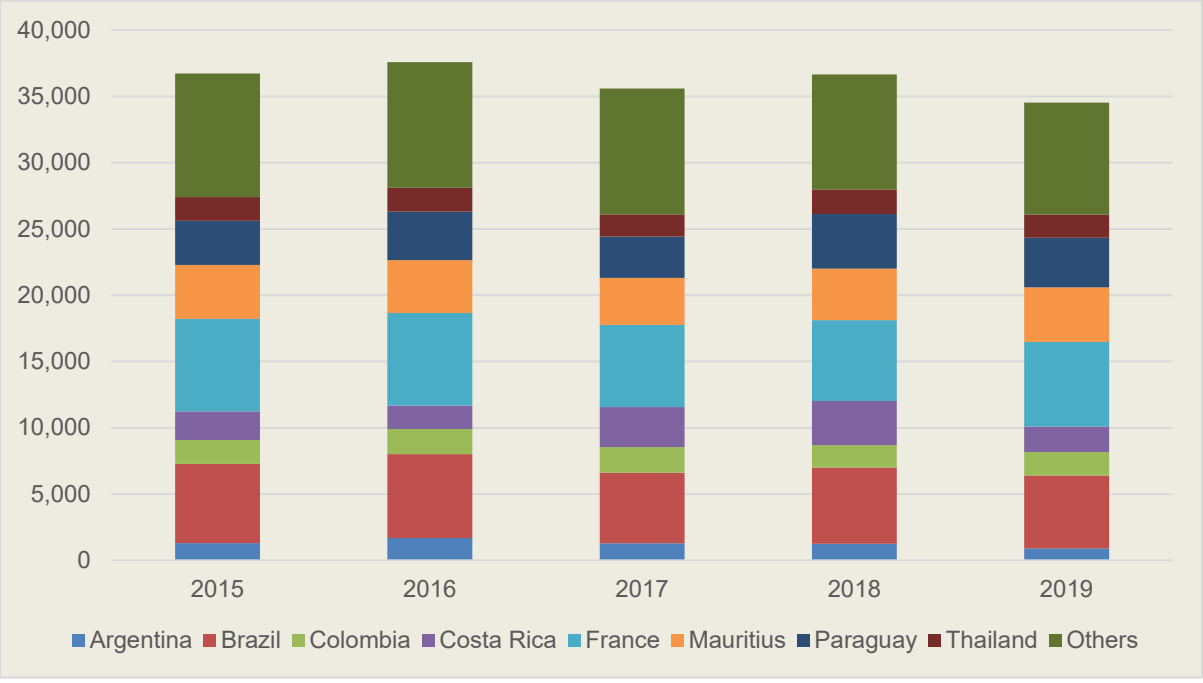
Switzerland's immediate trading partners for imports of sugarcane include a number of European countries including Germany, France and Italy. Although a number of European countries grow sugar beet, no sugar cane is grown in Europe, so these volumes originate elsewhere. Compared to other commodities in this report, a relatively large number of countries – 14 – account for over 2% of imports (Figure 54). Both of these factors are due to the range of processed products sugarcane occurs in, both as an ingredient or embedded in the production process as for ethyl alcohol.

Figure 54: Provenance of direct imports of sugar cane to Switzerland 2015-19 (tonnes)



When provenance of sugar cane imports is reassigned, source countries for Switzerland's imports are seen to be producer countries (Figure 55). The only exception is France which appears because of sugar cane production in French overseas territories (départements). These French territories account for the largest proportion of Switzerland's sugar cane imports at an average of 18% (6,500 tonnes) of imports per year. The next largest provider of sugar cane imports is Brazil which accounted for an average of 16% (5,800 tonnes) of imports per year. Other significant sources include Mauritius (11%, 4,000 tonnes per year), Paraguay (10%, 3,600 tonnes) and Costa Rica (7%, 2,400 tonnes). Proportions from each country have remained relatively steady over the period.

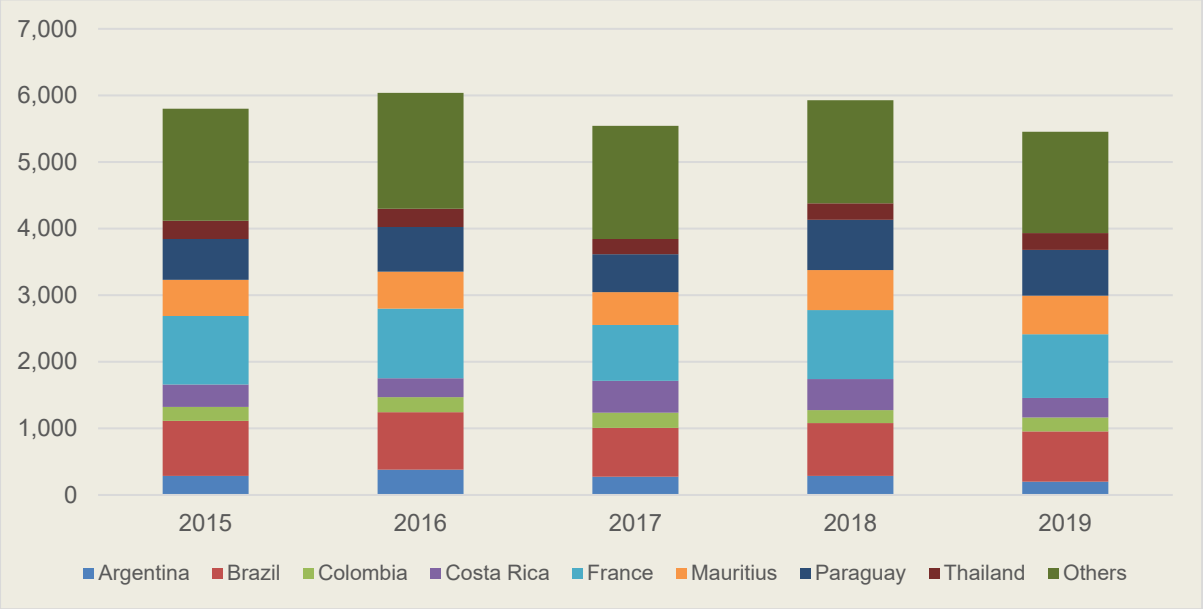
Figure 55: Provenance of Switzerland's imports of sugarcane with provenance reassigned to producer countries



9.5 Switzerland's sugar cane footprint

The footprint of Switzerland's sugar cane imports was an average of 5,700 hectares per year for 2015-19. The biggest area is in French overseas territories which accounted for an average of 17% of the footprint per year which matches its ranking as the source of the greatest proportion of imports by weight. The next largest area was in Brazil (14%) and then Paraguay (11%) and Mauritius (10%) (Figure 56). The difference in ranked position for the last two compared to the proportion of imports by weight is due to differences in yields per hectare which are lower for Paraguay at an average of 56 tonnes per hectare compared to Mauritius where they are 73 tonnes per hectare on average.

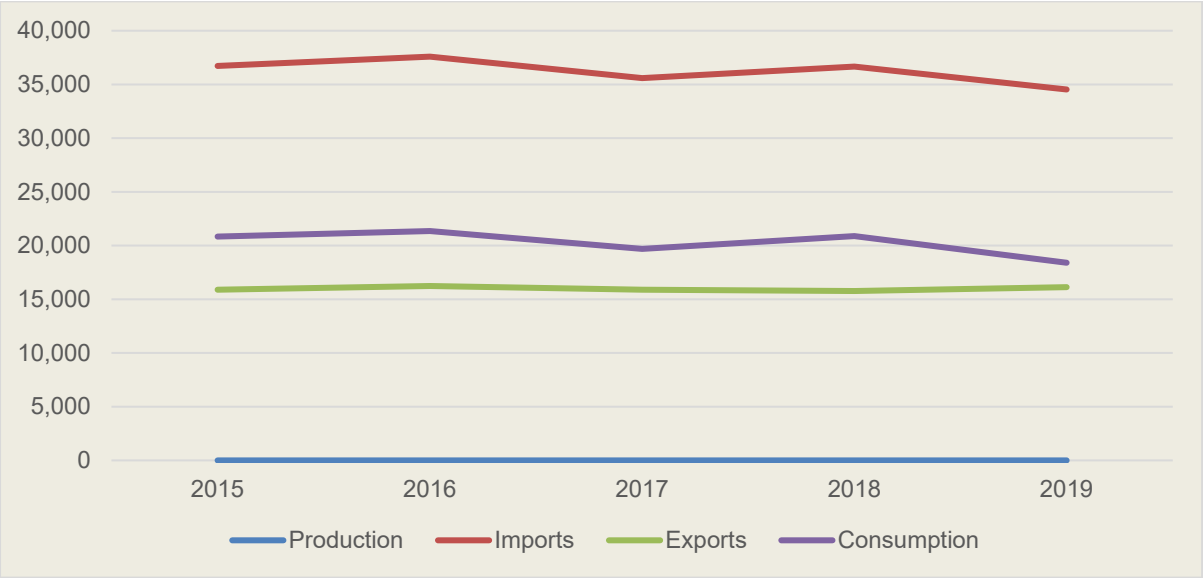
Figure 56: Estimated footprint of Switzerland's imports of sugar cane in provenance countries (hectares)



9.1 Estimated sugar cane consumption

Switzerland's consumption of sugarcane is estimated by subtracting the average quantity of exported sugarcane (16,000 tonnes) from the overall quantity of imported sugarcane (36,000 tonnes), providing an average consumption figure of 20,000 tonnes of sugarcane per year between 2015-2019 (Figure 57). Consumption represents 56% of Switzerland's annual imports of sugarcane during the period. The consumption amounts to just 0.001% of all global sugarcane production. The area necessary to produce this amount of consumed sugarcane is just over 3,200 hectares – which is equivalent to 0.01% of the global harvested area for sugarcane and 0.08% of Switzerland's domestic land area. This relatively limited consumption of sugarcane compared to global production is in part due to the predominant use of sugar beet for sugar in Switzerland.

Figure 57: Switzerland's imports, exports and domestic consumption of sugarcane 2015-19 (tonnes)

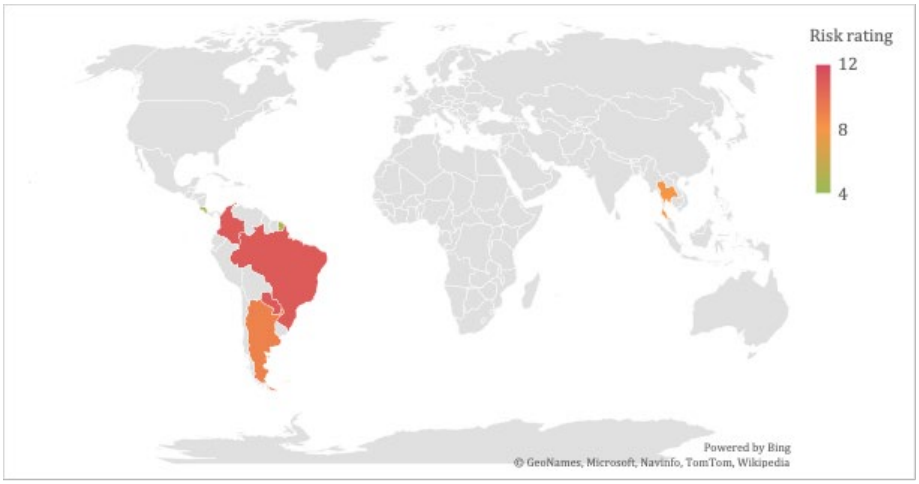


9.2 Switzerland's sugar cane risk profile

Around one third of Switzerland's sugar cane import footprint – 34% - is in high or very high-risk countries including Brazil, Colombia, Thailand and Argentina. All of these countries have high rates of deforestation, poor labour rights and high perceived levels of corruption. Other imports come from Thailand (medium risk) and Costa Rica, French Guiana and Mauritius (all medium-low risk) (Figure 58).

The high per capita consumption of organic and Fairtrade products in Switzerland creates a good potential market for certified sugarcane. In fact, after the UK and Germany, Switzerland is one of the most important markets in Europe for Fairtrade cane sugar, and particularly organic Fairtrade cane sugar[349].

Figure 58: Risk profile of origin countries for Switzerland's imports of sugarcane 2015-19



[349] 2014 data, https://www.cbi.eu/market-information/honey-sweeteners/organic-fairtrade-cane-sugar

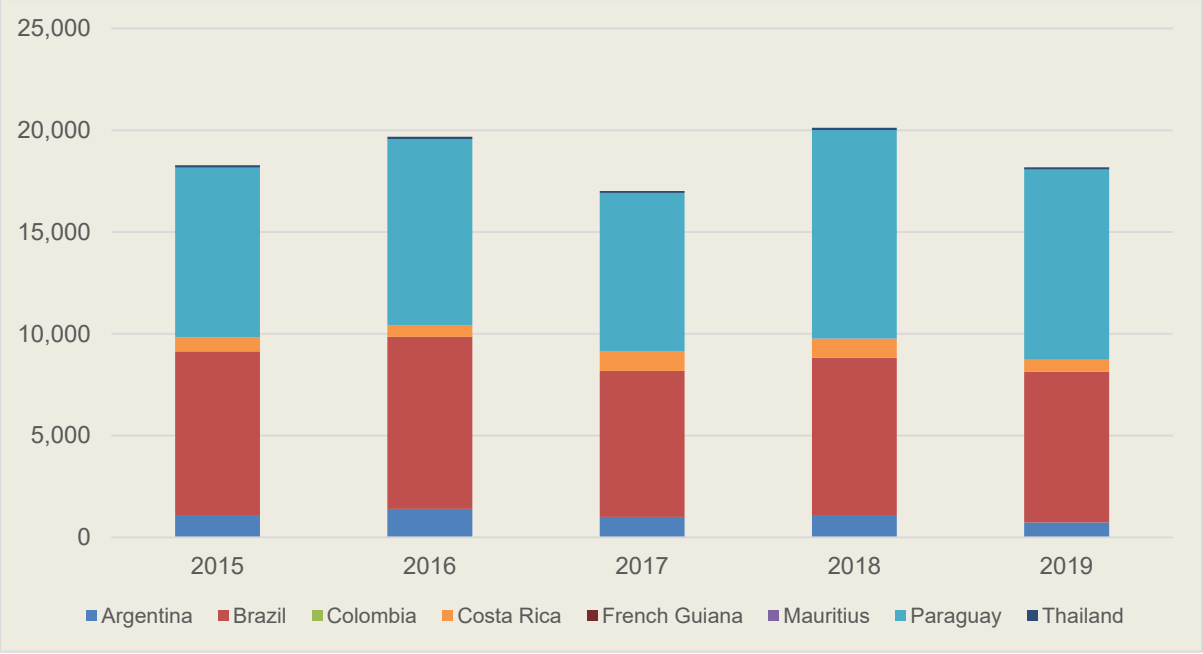
9.3 Estimated greenhouse gas emissions from Switzerland's sugarcane imports

The greenhouse gas emissions associated with the production of sugarcane for Switzerland's imports are estimated by taking the land footprint in each country and applying a calculated per hectare emissions value for the specific crop and country pairing.

For sugarcane, average annual emissions were 19,000 tonnes CO_2eq per year, amounting to around 1% of the emissions associated with the agricultural commodities analysed here (Figure 59). The main sources of emissions were production in Paraguay and Brazil due to a combination of relatively large area of the footprint of Switzerland's imports from these countries coupled with high emissions per hectare at 13.6 tonnes CO_2eq per hectare per year in Paraguay and 9.8 tonnes CO_2eq per hectare per year in Brazil.

Emissions fluctuated over the period due to fluctuations in the amount of imports coming into Switzerland.

Figure 59: Estimated greenhouse gas emissions from land use change associated with Switzerland's imports of sugarcane 2015-19 (tonnes CO_2eq)



10 Switzerland's commodity footprint

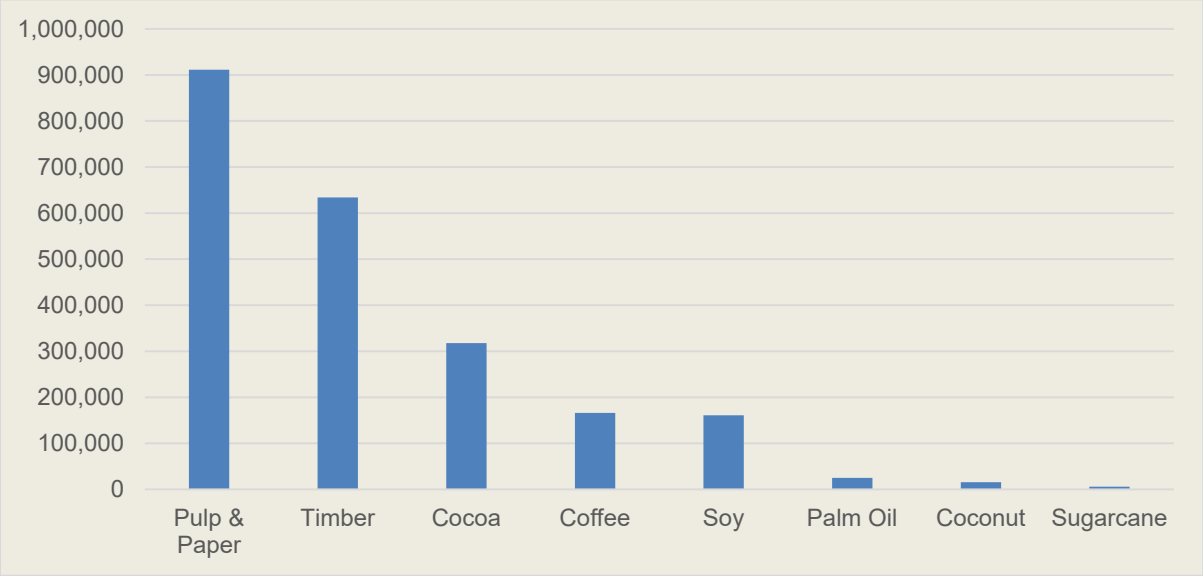
10.1 Import footprint

The estimated total land area required to supply Switzerland with its imports of cocoa, coffee, palm oil, soy, timber, pulp and paper, coconut and sugar cane is shown in Figure 60. The overall land footprint of these commodities averaged 2.24 million hectares each year between 2015-19, an area equivalent to over half the area of Switzerland, or 1.8 times the size of Switzerland's own forest area.[350] 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).

[350] Switzerland's forest area = 1,269,110 hectare. Source: FAO (2020). Global Forest Resource Assessment: Switzerland. Online at: https://fra-data.fao.org/CHE/

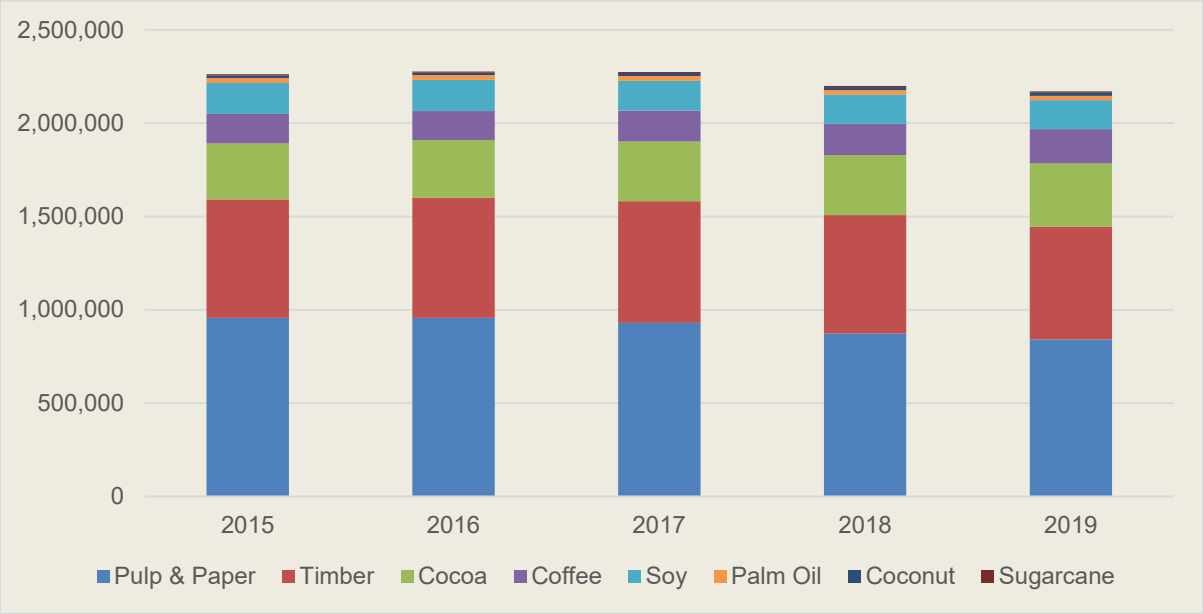
Pulp and paper had the highest estimated footprint followed by timber, reflecting the relatively large quantities of these commodities that are imported by Switzerland and the low yields of wood per hectare (Figure 60). Cocoa also has a very significant footprint, a result of the large volumes imported by Switzerland for the chocolate manufacturing industry which supplies both domestic consumption – which is the highest per capita in the world[351] – and a large export market.

Figure 60: Land area required to supply Switzerland with commodities (average of 2015-19, hectares)



The total land footprint has remained relatively steady over the period, although there is evidence of a slight decrease in the past two years (Figure 61). This is driven largely by an apparent decrease in imports of pulp and paper mainly due to a reduction in imports of other paper and paperboard and chemical pulp (see Section 3.3.2). There was also a decrease in imports of soy mainly due to reductions in volumes of imported soy oil cake and meal as well as a slight decrease in imports of chicken and beef which contain embedded soy. Timber, pulp and paper and cocoa consistently contribute the largest proportion of the land footprint.

Figure 61: The area of land required to supply Switzerland with commodities 2015-19 (hectares)



[351] https://www.cbi.eu/market-information/cocoa-cocoa-products/switzerland/market-potential

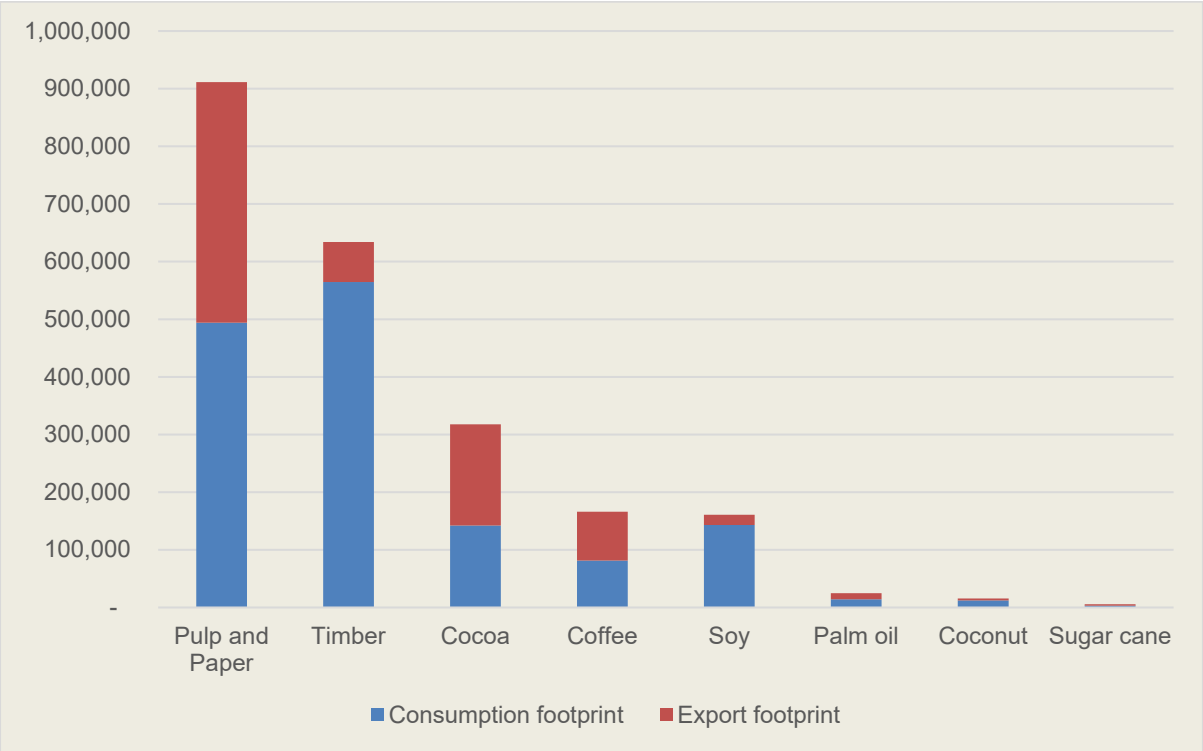
The largest land footprints were in European countries. The largest footprint was in Sweden (17% of the total footprint, almost 400,000 hectares), followed by Germany (14%, 305,000 hectares) and then smaller but significant footprints in Austria and Italy (both 7% of the total footprint) and France (6%). These are due to imports of timber and pulp and paper.

The largest footprint outside of Europe was in Brazil (120,000 hectares, 5% of the total) primarily due to imports of soy and coffee, as well as some pulp and paper and sugarcane. Large areas also occurred in Ghana (104,000 hectares, 5%) and Côte d'Ivoire (93,000 hectares, 4%) which reflects the high imports of cocoa from both, as well as coconuts and a small amount of palm oil from the latter.

10.2 Switzerland's estimated consumption footprint

The estimated consumption of commodities averages 65% of imports, or imports plus domestic production in the case of timber, pulp and paper and soy. This varies from 45% for cocoa to 89% for soy and timber (see preceding sections). The relatively high rates of consumption indicate that Switzerland does not function as much of a physical trading hub as some other European countries[352]. Exceptions are cocoa and coffee where consumption is less than half (45% and 49%, respectively) reflecting high rates of processing and export as chocolate and roasted coffee. Separating the footprint into a consumption and export components leaves an estimated consumption footprint of 1.5 million hectares (two-thirds the size of Switzerland, or 1.2 times the area of Switzerland's forest) and an export footprint of 780,000 hectares (Figure 62).

Figure 62: The estimated area of land required to supply Switzerland's consumption and export trade (average 2015-19, hectares)

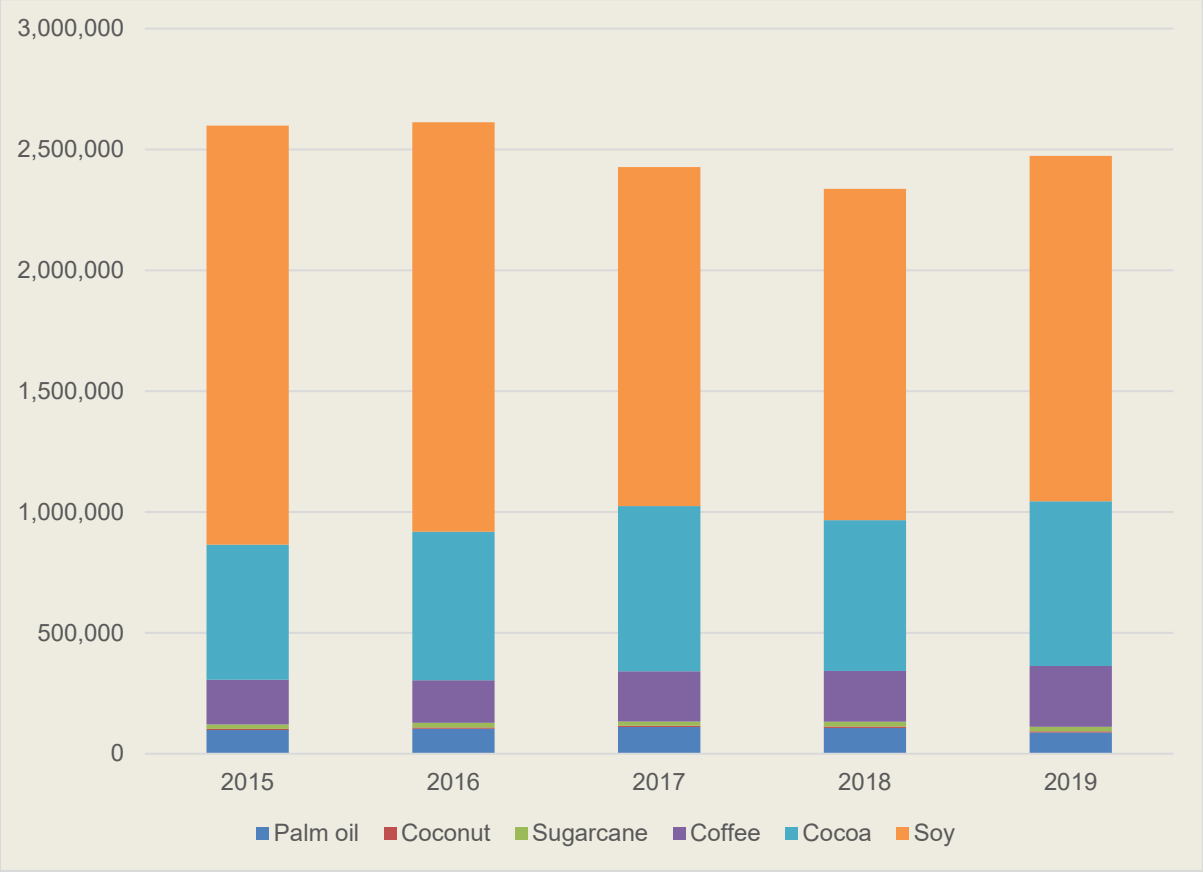


[352] Jennings & Schweizer, (2019). Risky Business: The risk of corruption and forest loss in Belgium's imports of commodities

10.3 Switzerland's estimated land use change greenhouse gas emissions from commodity import footprint

The combined greenhouse gas emissions associated with Switzerland's imports of palm oil, coconut, sugarcane, coffee, cocoa and soy averaged over 3 million tonnes CO_2eq per year, equivalent to around 8.7% of Switzerland's annual national greenhouse gas emissions. The total emissions over the period 2015-19 were 12.4 million tonnes CO_2eq.

Figure 63: Estimated greenhouse gas emissions from land use change associated with Switzerland's imports of commodities average per year 2015-19 (hectares)



Soy imports comprised by far the largest proportion of these emissions at an average of 1.8 million tonnes CO_2eq per year. This is predominantly associated with imports from Brazil, which account for 56% of the soy import volumes (see Section 6.3) and has a high GHG emissions factor at 15.58 tonnes CO_2eq per hectare per year. This reflects a significant expansion in the soy growing area in Brazil at the expense of habitats including forest. By comparison, weighted average per hectare emissions for soy produced in Italy are estimated at 0.54 tonnes CO_2eq per hectare per year.

The next highest emissions were associated with cocoa at an average of 879,000 tonnes CO_2eq per year. These are predominantly associated with production in Ghana which accounted for 36% of cocoa imports (see Section 4.4), and with imports from Indonesia which have a high associated emissions factor, at 12.09 tonnes CO_2eq per hectare per year. Emissions from cocoa have increased over the period due to increasing import volumes. Emissions from coffee have similarly increased from 185,000 to 252,000 tonnes CO_2eq over the period due to increased import volumes.

11 Deforestation and social risk

11.1 Country risk rating

The degree of risk of Switzerland'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 Switzerland's demand for imports.

As described in Section 2.2, each of the countries that contribute at least 2% by volume of Switzerland's imports of timber, pulp and paper, soy, palm oil, cocoa, coffee, coconut or sugarcane were scored against four risk indicators: tree cover loss, change in the area of natural forest, rule of law 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 8.[353] Of the 41 countries rated, only five (Austria, Belgium, Czech Republic, France and Germany) 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, French Guiana, Costa Rica, Italy and Poland 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[354]. The majority of the countries with a low or medium-low risk rating are within the EU with the exception of Costa Rica, which scores well on all criteria, and French Guiana which is administratively part of France and does not receive its own scores for rule of law or labour rights.

Nine countries from which Switzerland sources significant volumes of agricultural and forest commodities, including Brazil, Colombia and Indonesia are rated as very high risk, scoring high on three or all four of the indicators. A further nine countries, including Argentina, China, Guatemala, Malaysia, Mexico and the Russian Federation 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 Switzerland, 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).

[353] Note that data from different years as well as a different indicator are used in this study compared to previous Risky Business reports for WWF UK, WWF Belgium and WWF Denmark, so some countries score differently.
[354] Mauritius also falls within the medium-low risk category, but does not have a scored for area of forest cover loss from GFW, so the total score is artificially low

Table 8: Country risk ratings for Switzerland's major suppliers of commodities associated with deforestation[355]

Country	Area of forest cover loss (GFW)	% of Natural forest loss (FAO)	Rule of law (World Bank)	Labour rights score (ITUC)	Area of forest cover loss (GFW)	% of Natural forest loss (FAO)	Rule of law (World Bank)	Labour rights score (ITUC)	Combined rating
Argentina	998,819	-5%	-0.24	4	2	3	2	2	9
Austria	104,018	1%	1.88	1	1	1	1	1	4
Belgium	22,662	2%	1.37	2	1	1	1	1	4
Brazil	18,498,475	-1%	-0.28	5	3	3	2	3	11
Cambodia	771,939	-6%	-1.11	5	2	3	3	3	11
China	3,332,509	1%	-0.20	5	3	1	2	3	9
Colombia	1,505,188	0%	-0.41	5	3	2	3	3	11
Costa Rica	64,591	15%	0.48	2	1	1	2	1	5
Côte d'Ivoire	1,864,843	0%	-0.58	4	3	2	3	2	10
Czechia	171,070	3%	1.05	2	1	1	1	1	4
Ecuador	222,285	-3%	-0.63	5	1	3	3	3	10
Ethiopia	162,089	-2%	-0.43	4	1	3	3	2	9
Finland	1,320,402	0%	2.05	1	3	1	1	1	6
France	331,689	5%	1.44	2	1	1	1	1	4
French Guiana	20,306	0%	1.44	2	1	2	1	1	5
Germany	235,838	0%	1.63	1	1	1	1	1	4
Ghana	710,063	1%	0.07	3	2	1	2	2	7
Guatemala	481,395	-7%	-1.05	5	1	3	3	3	10
Honduras	520,576	-12%	-1.02	5	2	3	3	3	11
India	796,913	0%	0.03	5	2	1	2	3	8
Indonesia	8,019,910	-4%	-0.31	5	3	3	3	3	12
Italy	179,727	3%	0.25	1	1	1	2	1	5
Madagascar	1,969,545	0%	-0.81	3	3	1	3	2	9
Malaysia	2,362,560	-1%	0.62	4	3	3	2	2	10

[355] French Guiana is not listed by ITUC or World Bank so is given the same rating as France (administratively it is considered part of France). Mauritius is not included in the GFW report so has a lower combined score than it would if it was scored for area of forest cover loss. Papua New Guinea, Nicaragua, and the Solomon Islands are not rated by ITUC, and are not scored for this indicator, meaning that the overall score is lower than it otherwise would be.

Country	Area of forest cover loss (GFW)	% of Natural forest loss (FAO)	Rule of law (World Bank)	Labour rights score (ITUC)	Area of forest cover loss (GFW)	% of Natural forest loss (FAO)	Rule of law (World Bank)	Labour rights score (ITUC)	Combined rating
Mauritius	0	0%	0.78	3	1	1	2	2	6
Mexico	1,437,962	-1%	-0.67	4	3	2	3	2	10
Mozambique	1,583,423	-3%	-1.04	3	3	3	3	2	11
Nicaragua	544,517	1%	-1.04	0	2	1	3	1	7
Nigeria	1,191,630	-25%	-0.88	4	3	3	3	2	11
Papua New Guinea	693,921	0%	-0.77	0	2	2	3	1	8
Paraguay	1,571,587	-10%	-0.54	4	3	3	3	2	11
Peru	1,149,880	-1%	-0.52	4	3	3	3	2	11
Philippines	462,478	0%	-0.48	5	1	1	3	3	8
Poland	404,798	6%	0.43	3	1	1	2	2	6
Russia	24,237,793	0%	-0.82	3	3	2	3	2	10
Solomon Islands	87,263	-1%	-0.23	0	1	3	2	1	7
Sri Lanka	64,715	-2%	0.03	4	1	3	2	2	8
Sweden	1,492,661	-8%	1.90	1	3	3	1	1	8
Thailand	813,137	1%	0.02	5	2	1	2	3	8
United States	11,764,776	0%	1.45	4	3	1	1	2	7
Vietnam	1,425,770	8%	0.00	5	3	1	2	3	9

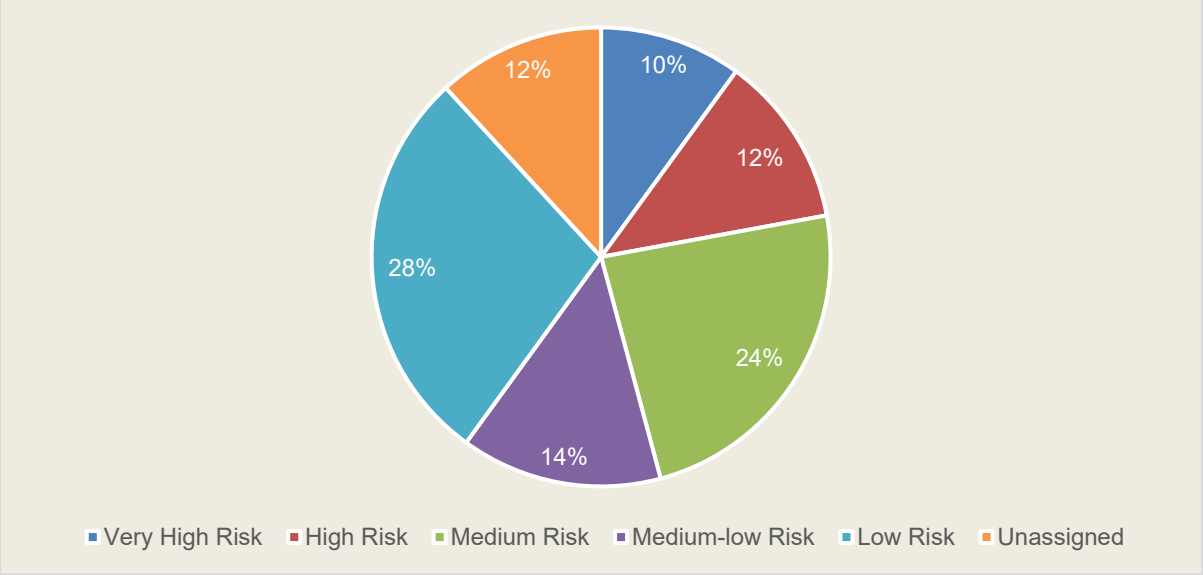
Key to Table 8

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

11.2 Overall risk profile

Overall, almost one quarter – 22%, or 490,000 hectares – of the land area associated with production of agricultural and forest commodities imported to Switzerland is in high and very high risk countries. A further 24% (530,000 hectares) is in medium risk countries. Forty two percent (950,000 hectares) came from countries with low and medium-low risk ratings[356]. The overall risk profile of Switzerland's footprint for the commodities analysed here is shown in Figure 64.

Figure 64: Distribution of the Switzerland's land footprint for imported commodities amongst risk categories



In terms of commodities with particularly high-risk footprints, the majority of the footprints of coffee (79%), soy (75%), palm oil (69%) and cocoa (54%) are from high and very high risk countries. Moreover, none of these commodities are sourced from countries with a low risk rating (Table 9).

Table 9: Land requirements for Switzerland's imports of commodities by risk category (hectares)

Commodity	Very High	High	Medium	Medium Low	Low	Unassigned	Total
Palm Oil	8,258	9,020	4,554	-	-	3,040	**24,871**
Coconut	2,244	6,053	6,304	-	-	1,128	**15,729**
Sugarcane	1,666	285	255	1,907	-	1,639	**5,754**
Coffee	82,694	48,949	15,650	6,921	-	11,853	**166,068**
Cocoa	38,260	134,730	104,227	-	-	40,494	**317,711**
Soy	81,363	38,726	10,763	5,528	-	24,376	**160,755**
Timber	-	32,448	-	123,987	349,188	128,360	**633,983**
Pulp & Paper	9,540	-	388,664	178,919	280,850	53,509	**911,482**
Total	**224,025**	**270,212**	**530,418**	**317,262**	**630,038**	**264,398**	**2,236,352**

[356] The portion that is 'unassigned' is either imports from countries that contributed less than 2% of Switzerland's imports of a commodity by weight, 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.

Soy contributes just 7% (161,000 hectares) to the overall footprint, but is responsible for nearly one-quarter (24%) of the high and very high risk footprint (Figure 65). Cocoa also makes a disproportionate contribution to the high and very high risk footprint, being responsible for 14% of the overall footprint but over one-third (35%) of the high and very high risk footprint. Coffee showed a similar pattern, contributing just 7% to the total footprint but over one-quarter (27%) of the high and very high risk footprint.

These commodities – soy, cocoa, coffee – therefore contribute particularly significantly to Switzerland's forest-risk footprint. For soy, a reported 90% of soy imports into Switzerland are certified to standards including the Basel Criteria, the Pro Terra Standard, the RTRS Non-GM Standard and the Danube Soya Standard. A large element of risk is mitigated by certification according to these credible, third party standards, but schemes vary in the extent to which they provide a guarantee that certified materials are deforestation-free.

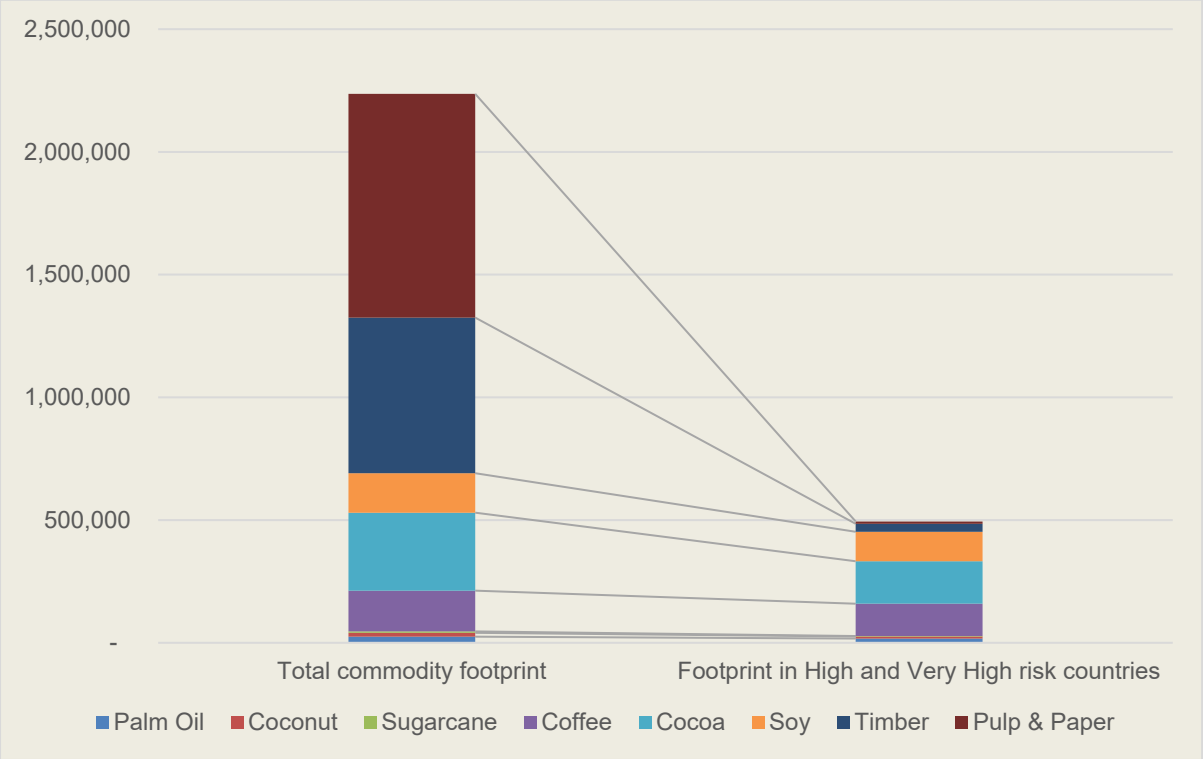
Switzerland's imports of both cocoa and coffee are particularly notable as they represent a high proportion of global area of production (3% for cocoa and 2% for coffee) in comparison to the country's share of global population (0.1%) and GDP (0.58%)[357]. Over half of the land footprint (54%) of cocoa and almost three-quarters (72%) of the footprint of coffee is in countries rated high or very high risk for deforestation and human rights abuses. Furthermore, none of the imports of either are from low risk countries. This is important to consider given the profile of Switzerland's chocolate industry and high per-capita consumption of both chocolate and coffee.

Palm oil represents a much smaller area of land (25,000 hectares), but predominantly in high or very-high risk countries. Again, the risk is mitigated by the fact that – according to the Swiss State Secretariat for Economic Affairs – up to 90% of palm oil imports are sustainably sourced, according to RSPO certification. However, note that the RSPO has been criticised for not always effectively penalising producers that engage in deforestation, and potentially allows deforestation-associated material in some supply chain models (see Section 5.2.1).

On the other hand, timber and (less so) pulp and paper are largely supplied from within the EU and have a much lower proportion of their footprints from high and very-high risk countries. Therefore, although they contribute very high proportions of the overall footprint of the commodities analysed here (69% combined), they account for a very small proportion of the high and very high risk footprint (9%). Nevertheless, given the size of the areas involved and the fact that some proportion of imports do come from high-risk countries (China, in the case of timber and Brazil in the case of pulp and paper), the impacts of Switzerland's wood product imports should not be ignored.

[357] https://tradingeconomics.com/switzerland/gdp Accessed 6th October 2020.

Figure 65: Total footprint and size of footprint in High or Very High risk countries, for each commodity (footprint in hectares)



12 Conclusions

According to the FAO, a net area of 4.7 million hectares of forest were lost each year between 2010 and 2020[358]. 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,[359] and a further 18,962 km² was converted between 2013 and 2015.[360] 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.[361] Between 2001-2015, it is estimated that pasture grazed by cattle occupies 45.1 million hecatres, oil palm replaced 10.5 million hectares, soy 8.2 million hectares, and cocoa, coffee and plantation-grown wood fibre around 2 million hectares each.[362] Moreover, a significant proportion of this deforestation is embedded within the global trade in commodities.

Switzerland's imports have undoubtedly contributed to these losses of forest and biodiversity, and to the exploitative labour practices associated with the production of commodities in various countries. We find that a land area of approximately 2.2 million hectares was needed on average per year between 2015 and 2019 to supply Switzerland with palm oil, soy, timber, pulp & paper, cocoa, coffee, coconuts and sugarcane. This is an area equivalent to over half the area of Switzerland, or 1.8 times the size of Switzerland's own forest area.[363] The size of this area increased between 2015-17, although appeared to decrease very slightly in 2018 and again in 2019 (Figure 61).

Almost one quarter – 22% – of this land area is in countries rated as high risk or very high risk in terms of deforestation and human rights (Figure 64). The commodities that contribute the largest share of this high and very high risk footprint are soy, cocoa and coffee (Figure 65). The risk is mitigated to some extent by the fact that a reported 90% of soy imports to Switzerland are certified to sustainability standards (see Soy chapter), although schemes vary in the extent to which they guarantee that certified materials are deforestation-free.

The commodities Switzerland imports include ones grown solely in the tropics (e.g., palm oil, cocoa, coffee) as well as ones that are imported from across tropical, temperate and boreal regions (e.g., timber, pulp and paper, soy). 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 soy and coffee, over three-quarters of their land footprint was in countries rated as high or very high risk, and for cocoa, palm oil and coconut, such countries accounted for at least

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[358] FAO (2020) Global Forest Resource Assessment 2020: How are the world's forests changing? Food And Agriculture Organization Of The United Nations, Rome.

[359] 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

[360] INPE & Funcate. (2017). Anthropization data: The Cerrado between 2013 and 2015. Available at http://combateaodesmatamento.mma.gov.br/analises-no-cerrado

[361] 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.

[362] Goldman, E., Weisse, M.J., Harris, N., and Schneider, M. (2020). Estimating the role of seven commodities in agriculture-linked deforestation: Oil Palm, Soy, Cattle, Wood Fiber, Cocoa, Coffee, and Rubber. World Resources Institute, Washington DC, USA.

[363] https://fra-data.fao.org/CHE/

half of their associated land footprint. For some of these commodities there are certification schemes with a degree of credibility, and a reported 90% of Switzerland's imports of palm oil and soy are certified under one of these schemes. However, for other commodities – for example sugarcane and coconut – 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. In general, certification schemes are robust mechanisms for excluding deforestation-associated material when their standard unambiguously excludes deforestation; when their systems and processes in ensuring compliance with the standard are robust and reliable; and when the certified supply chain options have mechanisms to exclude deforestation-associated material (e.g., where there are controls on the uncertified portion of mass balance material).

The market for goods certified as Fairtrade or organic is relatively strong in Switzerland and there is good recognition amongst the public of certification labels, suggesting some potential to capitalise on this when pushing for greater sustainability of commodity imports.

The disproportionately large share of global production of cocoa and coffee that Switzerland imports suggest that the country has particular responsibility to drive sustainability in these commodities.

Switzerland contributes to the land footprint of commodities, and to the risk of deforestation and exploitation in two ways. The majority is through domestic consumption of the commodities which averaged 65% of the total 'stock' available to the country (i.e. imports plus domestic consumption). The lowest proportion, for cocoa, was still 45% whilst the highest – for both soy and timber – was 89%. The remainder of the contribution to the footprint is in goods exported by Switzerland, either of the commodities but more commonly in products that contain them, or in which commodities have been used in the production process. On average, a quantity equivalent to over one-third of the stock of each commodity is exported by Switzerland, although this ranges from 11% for timber and soy to 55% for cocoa, the latter of which reflects Switzerland's significant exports of chocolate. Switzerland is therefore consuming and 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.

Switzerland's imports also result in greenhouse gas emissions from the land use change associated with the production of the commodities. In particular, soy – especially volumes coming from Brazil – and cocoa contribute significantly to the total greenhouse gas emissions.

The Swiss Government, businesses, NGOs and consumers have taken action to address some of these issues, through initiatives such as the purchase of FSC certified timber, national schemes like the Timber of Swiss Origin standard, the Swiss Platform for Sustainable Cocoa and the Soja Netzwerk Switzerland, and the provision and promotion of certified goods to the public. Yet the problems of deforestation and social exploitation still persist, and there are opportunities for the Swiss Government, companies and consumers to act in order to break the link between Switzerland'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.

Appendix 1: HS codes and conversion factors used for timber, pulp and paper products in this study

HS code	Short description	Factor	Notes[364]
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	
4416	Wooden casks and barrels	2.5	'Other manufactured wood' in Forestry Commission factors
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	8	'Other manufactured wood' in Forestry Commission factors
4414	Wooden frames	9	'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
940610	Prefabricated wooden buildings	1	
4701	Mechanical wood pulp	2.5	
4702	Chemical wood pulp, dissolving grades	2.5	

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

HS code	Short description	Factor	Notes[364]
4703	Chemical wood pulp, other than dissolving grades	4.5	Bleached sulphate pulp is converted at 6.00, unbleached at4.50. The more conservative factor is used.
4704	Chemical wood pulp, sulphite, other than dissolving grades	5	
4705	Wood pulp from a combination of mechanical and chemical processing	2.5	
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'
4806	Parchment and greaseproof paper	2.5	
4807	Composite paper and paperboard (made by sticking layers together with an adhesive)	2.5	
4808	Corrugated paper and paperboard	2.5	
4809	Carbon 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	
4812	Slabs and plates of paper pulp	2.5	
4813	Cigarette paper	2.5	
4814	Wallpaper	2.5	
4816	Carbon paper (other than heading 4809)	2.5	
4817	Envelopes and plain postcards	2.5	
4818	Toilet paper	2.5	Conversion factor used is for 'other paper and paperboard'
4819	Cartons and boxes of paper and paperboard	2.5	
4820	Account books and diaries	2.5	
4821	Labels of paper or paperboard	2.5	
4822	Bobbins and spools of paper or paperboard	2.5	
4823	Paper, paperboard and cellulose wadding	2.5	
3703	Photographic paper	2.5	
370400	Photographic plates and film	2.5	
470620	Pulp from waste or scrap paper or paperboard	2.5	
4707	Waste and scrap of paper and paperboard	2.5	
4901	Printed books, brochures, leaflets and similar printed matter,	2.5	
4902	Newspapers, journals and periodicals	2.5	
4903	Children's books	2.5	
4904	Music, printed or in manuscript	2.5	
4905	Maps and hydrographic or similar charts	2.5	
4906	Plans and drawings for architectural, engineering, purposes	2.5	
4907	Unused postage or similar stamps	2.5	
4908	Transfers (decalcomanias)	2.5	

HS code	Short description	Factor	Notes[364]
4909	Printed or illustrated postcards	2.5	
4910	Calendars	2.5	
4911	Printed matter, n.e.c., including printed pictures and photographs	2.5	
9619	Sanitary towels (pads) and tampons, and napkins for babies	2.5	
9704	Stamps used or unused, other than heading 4907	2.5	

Appendix 2: Net Annual Increment values used in timber, pulp and paper footprint calculations

Country	Conversion factor (NAI)	Source
Austria	7.1	NAI from FAO GFRA 2015 Desk Reader
Belgium	7.7	NAI from FAO GFRA 2015 Desk Reader
Brazil	28	Yield of Brazilian Eucalypt and Pine in pulpwood plantations (mean of the two species used) from Campinos (1999). ftp://ftp.aphis.usda.gov/foia/FOLDER_10/AR00036413%20Campinhos_1999.pdf)
China	3.6	NAI from FAO GFRA 2015 Desk Reader
Czech Republic	9.4	NAI from FAO GFRA 2015 Desk Reader
Finland	4.4	NAI from FAO GFRA 2015 Desk Reader
France	5.5	NAI from FAO GFRA 2015 Desk Reader
Germany	11.2	NAI from FAO GFRA 2015 Desk Reader
Italy	3.2	NAI from FAO GFRA 2015 Desk Reader
Netherlands	7.3	NAI from FAO GFRA 2015 Desk Reader
Poland	8	NAI from FAO GFRA 2015 Desk Reader
Sweden	3.2	NAI from FAO GFRA 2015 Desk Reader

Appendix 3: 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 4: 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 average palm oil content of a sample of toast products; fat content of total product minus fat content in other main ingredients (example below). 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*	
			Product 1	7.4	96.4%	1.66	1.60	5.80	
190520	Gingerbread	1.00%	Best estimate, based on palm oil content of a sample of multiple gingerbread products: there is often no palm oil in these products but rapeseed oil and butter						
190532	Waffles and wafers	10.49%	Based on palm oil content of multiple waffles/wafers products; fat content of total product minus fat content in other main ingredients (example below). Number is halved to correct for products that use different vegetable oils, blends or butter:						
			Product	*Total fat (g/100g)*	*(Soft) wheat flour content*	*Fat in (soft) wheat flour*	*Egg content*	*Fat in egg*	*Fat due to wheat and egg*	*Fat due to palm*
			Product 1	21.7	50%	1.95	5%	9.51	1.45	20.25

HS Code	Short description	% palm	Source						
190531	Biscuits	9.35%	Based on palm oil content of multiple biscuit products from leading brands; fat content of total product minus fat content in other main ingredients (example below). 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*	*Oat content*	*Fat in oat*	*Fat due to oat and egg*	*Fat due to palm*
			Product 1	14	67.9%	1.66	N/A		1.13	12.87
190540	Toasted bread products	2.37%	See conversion for HS Code 190510							
190590	Other bakers' wares	1.00%	Best estimate (very variable)							
2105	Ice cream	10.00%	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							
230660	Palm kernel meal	100%								
291570	Palmitic acid, stearic acid, their salts & esters	100%								
3401	Soap	75%	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							
3826	Biodiesel	0%	Due to legislation which restricts imports of biofuel based on palm oil feedstock into Switzerland, whilst it is possible that some biofuels do derive from palm oil feedstock, for the purposes of this analysis it is assumed they pose minimal risk and therefore a conversion factor of zero is used (see Palm Oil chapter).							

Appendix 5: HS codes and conversion factors used for soy 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				WWF Soy Report Card, see: d2ouvy59p0dg6k.cloudfront.net/downloads/soyreportcard2014.pdf
	010221	Live pure-bred breeding animals	18%	
	010229	Live cattle	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%	
	020629	Other frozen offal	18%	
	021020	Preserved beef meat	18%	
	160250	Other preserved beef meat, offal or blood	18%	
Poultry	020711	Fresh whole chicken	57.5%	WWF Soy Report Card, see: d2ouvy59p0dg6k.cloudfront.net/downloads/soyreportcard2014.pdf
	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%	

Category	HS Code	Short description	%soy	Source
	040721	Fresh eggs	30.7%	WWF Soy Report Card, see: d2ouvy59p0dg6k.cloudfront.net/downloads/soyreportcard2014.pdf
	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
	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

Category	HS Code	Short description	%soy	Source
				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	0%	Due to legislation which restricts imports of biofuel based on soybean feedstock into Switzerland, whilst it is possible that some biofuels do derive from soybean feedstock, for the purposes of this analysis it is assumed they pose minimal risk and therefore a conversion factor of zero is used (see Soy chapter).

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

HS Code	Short description	Conversion factor (to whole coconut weight)	Source and methodology
80111	Desiccated coconut	4.4	1000 coconuts yield an average of 154.5kg desiccated coconut (or 0.1545 tonnes); 1 coconut is 680g so 1000 coconuts = 0.68 tonnes; 1 tonnes of desiccated coconut = 0.68/0.1545 = 4.4
80112	Coconuts, in the inner shell	1.538	The husk is 35% of the coconut, so inner part of coconut represents 65%. Therefore 1/0.65 =1.538
80119	Coconuts, fresh or dried (not desiccated or in the inner shell)	2.326	Coconut consists of four parts: about 35% husk, 12% shell, 28% meat (kernel), and 15% water (Aten et al., 1958). The meat and water = 43%. Therefore 1/0.43 = 2.326
151311	Coconut (copra) oil and its fractions, crude, not chemically modified	5.44	1 coconut = 680 grams = 0.00068 tonnes Need 8000 coconuts to make one tonne of crude oil, so 8000*0.00068 = 5.44
151319	Coconut (copra) oil and its fractions, other than crude, not chemically modified	5.44	As above
1203	Copra	3.4	1 coconut = 680 grams = 0.00068 tonnes Need 5000 coconuts to make one tonne of copra, so 5000*0.00068 = 3.4
291570	Acids: saturated acyclic monocarboxylic acids; palmitic acid, stearic acid, their salts and esters	0.1632	Coconut oil is a source of lower chain length fatty acids, the traditional use of which is in the manufacture of soap. Coconut oil is c. 3% of oils used to produce fatty acids. Conversion from oil to coconut is 5.44, giving a conversion of 0.03*5.44 = 0.1632.
330730	Perfumed bath salts and other bath preparations	0.3128	Coconut oil can be found in many categories of cosmetic and personal care products. Conversion factor calculated based on average percentage of ingredients based on coconut for top selling products. Average: 5.75% This is in the form of oil, so converting oil to coconuts using factor of 5.44 (above), conversion to coconuts is 0.0575*5.44 = 0.3128
330499	Skincare cosmetics (excluding sunscreen)	0.0594	Coconut Oil can be found in many categories of cosmetic and personal care products. Conversion factor calculated based on average percentage of ingredients based on coconut for top selling products. Average: 0.011 This is in the form of oil, so converting oil to coconuts using factor of 5.44 (above), conversion to coconuts is 0.011*5.44 = 0.0594
330510	Shampoos	0.36992	Average percentage of ingredients from coconut for top selling shampoo products is 6.8%. This is in the form of oil, so converting oil to coconuts using factor of 5.44 (above), conversion to coconuts is 0.068*5.44 = 0.36992
330710	Pre-shave, shaving or after-shave preparations	0.0435	Approximately 40% of top selling shaving preparations were found to contain coconut-based ingredients, normally towards the end of the ingredient list. It is therefore assumed c. 2% of total volume is coconut-derived in c. 40% of products: 2% * 40% = 0.08 of products. Then to convert oil into coconuts = 0.008*5.44 = 0.0435.
3401	Soap in bars, cakes, pieces, shapes, liquid or cream	0.358	Average across top selling soap products is 0.66% of ingredients from coconut. Then to convert from coconut oil to coconuts; 0.66 *5.44 = 0.358

Appendix 7: HS codes and conversion factors used for sugarcane in this study

Products only ever made from sugar cane			
HS code	**Short description**	**Conversion factor**	**Notes**
121293	Sugar cane; fit for human consumption, fresh, chilled, frozen or dried, whether or not ground	0.1	
170113	Raw cane sugar, in solid form	1	
170114	Other raw cane sugar, in solid form	1	
170310	Sugar cane molasses	0.75	
220840	Rum and other spirits from sugar-cane products	1.13	Depending on production, molasses sugar content is usually ~50%. So 1kg of cane sugar yields up to 1.2 litres of rum, 80 proof. Therefore, 1 kilo of molasses (50%) yields up to 600 ml of 80 proof beverage. In practice, the amount of rum is always lower than the theoretical 8-15% for sugar and 15-25% for molasses.

Products made from sugar cane and sugar beet (see below)					
HS code	Short description	Conversion factors			Notes
		EU	**USA**	**Rest of World**	
3826	Biodiesel and mixtures thereof	0	0	0	Biodiesel feedstocks mainly fats/oils, not sugars; sugars make bioethanol
403	Buttermilk, curdled milk and cream, yoghurt etc containing added sugar or sweetener	0.012	0.041	0.072	Calculated from median sugar content of leading brands of children's, flavoured, and organic yogurts. Buttermilk contains only natural sugars. Some kefirs contain added sugar.
1806	Chocolate	0.043	0.153	0.27	
2207	Ethyl alcohol of an alcoholic strength by volume of 80% vol. or higher	0.011	0.040	0.071	
190510	Crispbread	0.004	0.013	0.023	Average sugar content from leading brands on Swiss supermarket website
190520	Gingerbread	0.052	0.183	0.323	Average sugar content from leading brands on Swiss supermarket website
190540	Rusks, toasted bread and similar toasted products	0.036	0.128	0.225	Average sugar content from leading brands on Swiss supermarket website
190531	Sweet biscuits	0.036	0.128	0.225	Average sugar content from leading biscuit brands; varies from 28g to 40g per 1000g
190532	Waffles and wafers	0.042	0.149	0.263	Average sugar content from leading biscuit brands
2009	Fruit juices	0.002	0.009	0.015	
2008	Fruit, nuts and other edible parts of plants prepared or preserved	0.007	0.026	0.045	Average from recipe for leading brand of pickle
2105	Ice cream	0.016	0.057	0.101	Average from recipe of leading ice cream brands
2007	Jams, fruit jellies, marmalades, fruit or nut puree and fruit or nut pastes	0.046	0.164	0.289	Average of sugar content in recipes of leading brands of nut spread and jams
402	Milk and cream; concentrated or containing added sugar or other sweetening matter	0.058	0.207	0.365	Average from recipes for leading brands e.g. of condensed milk

Products made from sugar cane and sugar beet (see below)					
HS code	Short description	Conversion factors			Notes
1904	Prepared foods made of swelled or roasted cereals or cereal products (e.g. corn flakes)	0.032	0.115	0.203	Average sugar content of leading brands of breakfast cereals
2103	Sauces and condiments	0.007	0.026	0.045	
170490	Sugar confectionery (excluding chewing gum)	0.072	0.255	0.450	
170410	Chewing gum	0.033	0.119	0.210	Global average for proportion of chewing gum containing sugar (as opposed to sugar-free gum)
170250	Fructose, in solid form (chemically pure)	0.012	0.044	0.075	
170260	Fructose (not chemically pure) and fructose syrup	0.012	0.044	0.075	
170290	Invert sugar and other sugar syrup blends containing, 50% by weight of fructose	0.012	0.044	0.075	
170191	Sucrose, chemically pure, in solid form, containing added flavouring or colouring	0.120	0.425	0.750	
170199	Sucrose, chemically pure, in solid form, not containing added flavouring or colouring	0.120	0.425	0.750	
2006	Vegetables, fruit, nuts, fruit-peel and other parts of plants, preserved by sugar	0.060	0.213	0.375	From supermarket recipes for fruit peel mixes
2202	Waters containing added sugar or sweetener	0.007	0.026	0.045	Sources including carbonated soft drink recipes
404	Whey and other milk constituents, whether or not containing added sugar	0.003	0.012	0.021	Average content from recipes for whey protein powders

Sugar is produced from sugar cane and sugar beet. Globally, sugar cane accounts for 70-80% of sugar[365]. However, the proportion in which sugar used in a country is produced from cane or beet varies. In the EU, for example, most countries grow sugar beet so only 15-20% of sugar is from sugar cane[366]. The USA grows both sugar cane and sugar beet so the proportion of sugar from sugar cane is around 40-45% whilst sugar beet comprises around 55-60%. In the rest of the world, countries use varying proportions of cane and beet and a global average is applied to these countries. Therefore, three separate conversion factors are calculated; one for EU countries, one for the USA, and one for the rest of the world. All are calculated by: i) the proportion of the product(s) in the HS code category that contain any sugar, ii) the proportion of the product that comprises sugar, iii) the proportion of this sugar that is from sugar cane.

[365] Estimates include: 'about three quarters of the world's sugar is supplied from cane' (https://www.absugar.com/perch/resources/world-sugar-market-bookletfeb18web.pdf); 'over 75% of the world's sugar comes from sugarcane' (https://www.agmrc.org/commodities-products/grains-oilseeds/sugarcane-profile); '…supplying 86 per cent of the world's sugar (the remaining coming from beet), sugarcane…' (https://www.iisd.org/sites/default/files/publications/ssi-global-market-report-sugar.pdf)
[366] https://www.sugarrefineries.eu/about-cane