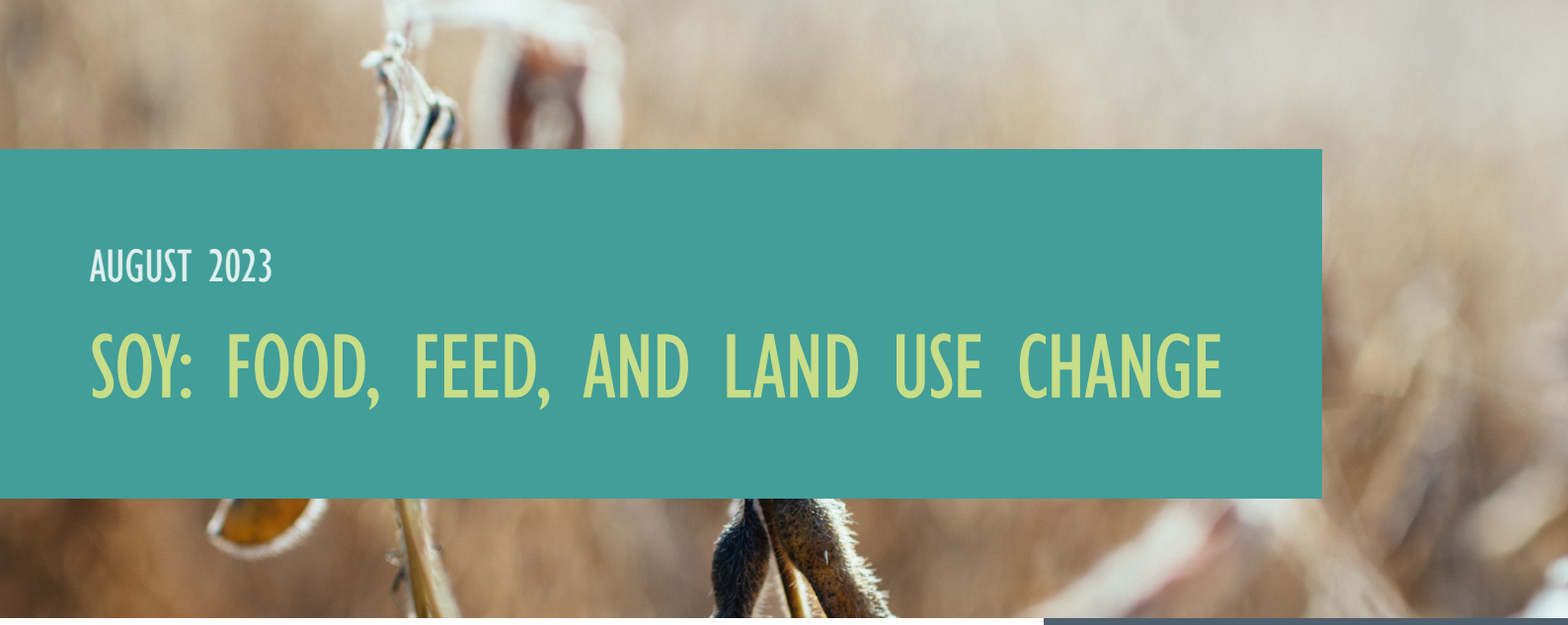


AUGUST 2023

SOY: FOOD, FEED, AND LAND USE CHANGE

This piece summarises the TABLE Explainer Soy: food, feed, and land use change, which explores the links between soy, land use change and animal- versus plant-based protein. Citations and references for the information discussed below can be found in the full explainer (note certain statistics have been updated if available).

Introduction

Over recent decades, global soy production has greatly increased. Soy is now the sixth most widely grown crop by production volume and the fourth by both production area and economic value. There are concerns about the sustainability of soy production, particularly because of its links to widespread land use change in the Amazon and Cerrado regions of Brazil along with other areas of South America.

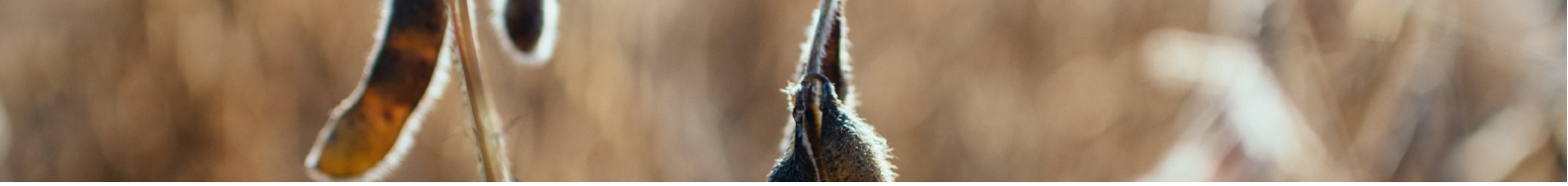
Facts, figures, and the uses of soy

The three largest soy producers (by weight and production area) are Brazil, the US, and Argentina, who were jointly responsible for ~81% of global soy production in 2021. The US has been a leading soy producer since the 1940s, whilst South America's share has increased enormously in recent decades. As of 2021, Brazil, Argentina, and Paraguay alone were responsible for 52% of global soy production, up from <3% in the 1960s. Moreover, in 2019, Brazil officially became the world's largest soy producer[1].

As with other legumes, soy fixes atmospheric nitrogen via its root system's symbiotic relationship with nitrogen-fixating bacteria, meaning it can grow in poor soils and is less fertiliser-dependent than other crops. Soy also has a good balance of all nine essential amino acids that cannot be synthesised by the human body; and depending on the protein quality evaluation method used, soy scores similarly to animal-based protein sources. Whilst this does mean that soy can be a key protein source in plant-based diets, as demonstrated in the figure below, the majority (~75% by weight) is actually used in animal feed for livestock (primarily pig and poultry) production.

Included in this summary

TABLE



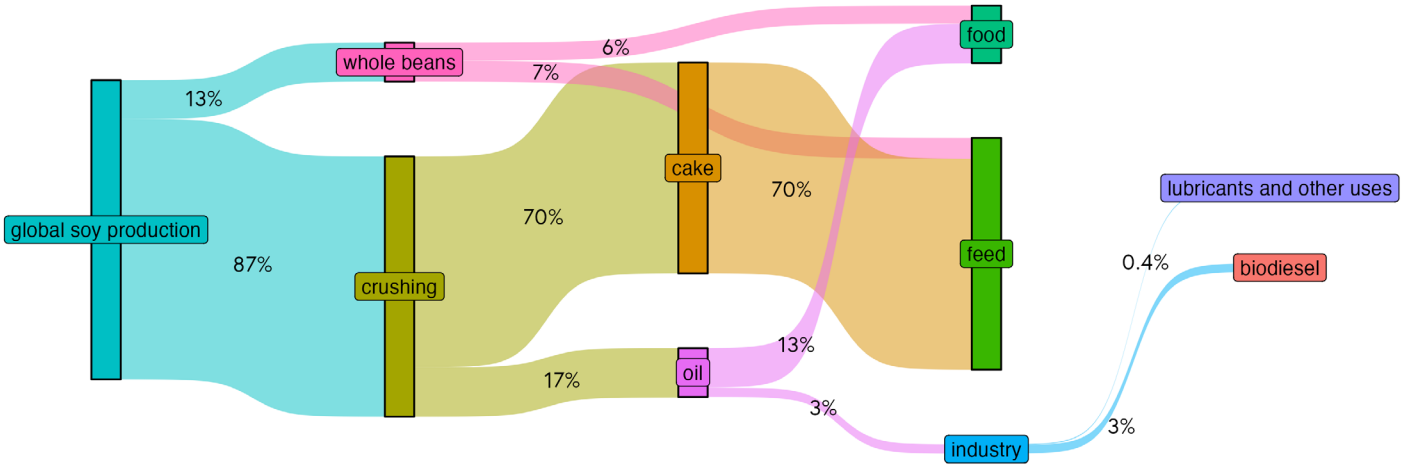


Figure 1: Sankey diagram displaying estimated soybean and soybean derivative usage by weight. Percentages are based on 2018-2019 data from the USDA and 2017-2018 expert estimations from the United Soybean Board. The use of soy oil for biodiesel was estimated by combining USB estimations with data from USDA biofuel annuals. Figure produced by TABLE.

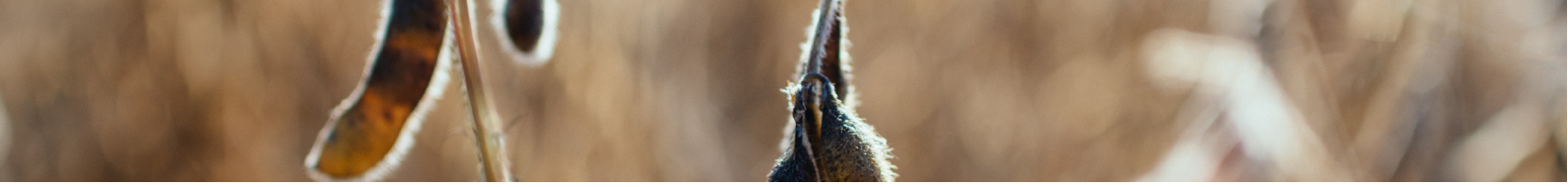
What has driven the global increase in soy production?

Soy, like other non-perishable cereals and oilseeds, is well-suited to large-scale, mechanised production, and global trade. Moreover, the 1996 introduction of glyphosate-tolerant genetically modified soy facilitated reduced labour and machinery inputs, enabling expansion of soy production onto areas with high levels of native vegetation/weeds. Growth in soy production has primarily been driven by demand for soy cake as animal feed due to growing demand for animal-based products. However, soy oil and soy cake originate from the same bean and so the rapid expansion in soy's use for feed has also been facilitated by concurrent increases in demand for soy-based vegetable oil and biofuel.

Soybean production and land-use change in South America

The land area for growing soy in South America increased by more than 200 times from 0.26Mha in 1961 to 61.69Mha in 2021, primarily driven by the export market. Between 2000-2017, only 25% of South American soy production volume was used domestically, with the rest exported to foreign economies (in 2021, the EU and China took 11.3% and 33.6% of total production, respectively)[2].

This is an important cause of native vegetation loss. Historically, focus has been on deforestation in the Brazilian Amazon, but concern is growing over land-use change in other biodiverse areas like the Brazilian Cerrado and the Gran Chaco in Argentina and Paraguay. In 2018, Trase estimated that 40% (1.8 Mha) and 20% (3.5 Mha) of the areas in the Amazon and Cerrado, respectively, where soy was grown in 2015, had been under native vegetation in 2000. This illustrates that demand for soy plays an important role in rapid and large-scale transformation of land from native vegetation.



The Soy Moratorium

The Soy Moratorium, signed by the Brazilian government and almost all Brazilian soy traders (covering 90% of soy exports), aims to limit further native vegetation loss in the Brazilian Amazon. Signatory traders commit to not purchase soy grown on Brazilian Amazon lands cleared after July 2008. High compliance has likely contributed to observations, made by Brazil's space agency INPE, that the overall deforestation rate in the Brazilian Amazon has fallen to about a third the rate seen before the Moratorium. Moreover, *direct deforestation for soy*, reduced to nearly zero in 2014.

However, since the Moratorium only covers *direct deforestation for soy*, other types of deforestation (which contribute to *overall deforestation*) are not as tightly regulated. Since 2012, *overall deforestation* in the Amazon has risen, (but remains less than half the rate before the Moratorium) and extreme forest fires in summer 2019 led to exceptional increases. Whilst not directly linked to soy it still undermines progress made since the early 2000s. Furthermore, the Moratorium does not prevent conversion of pasture land that had been cleared prior to the July 2008 cut-off.

The Moratorium also only covers the Brazilian Amazon and does not prevent land-use change in other areas of Brazil, Argentina, and Paraguay, which may offset positive changes. Thus, in 2017, a group of Brazilian NGOs released the Cerrado Manifesto, which calls for similar actions in the Cerrado. However, large soy traders have pointed out that this may create tensions with local farmers who are legally permitted to clear 65-80% of native vegetation on their land (compared to the Amazon where they are only permitted to clear 20%).

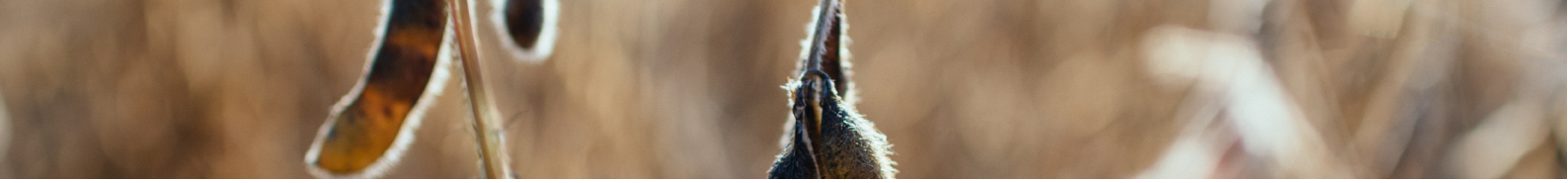
Soy certification schemes

Certification schemes (see RTRS and ProTerra) allow companies to unlink their supply chain from deforestation. However, since the schemes are not specific to a geographic region, increased adoption of certification may not automatically reduce soy-related deforestation. For example, most certified soy is destined for Europe; the Chinese market for certified soy is still very small. The 2020 European Soy Monitor report characterises two types of certified soy. Responsible soy is covered by one of 18 certification schemes meeting the European Feed Manufacturer's Federation's (FEFAC) criteria, including not being produced on land *illegally* deforested after cut-off dates determined by *national legislation*. Deforestation-free soy is covered by one of eight schemes that the Dutch non-profit Profundo identified as prohibiting the clearing of any type of native vegetation – *whether or not deemed legal by national legislation*. The European soy monitor estimates that in 2020, 43.8% of soybean feed used by EU27+ countries (Europe, UK, Norway, Switzerland) was classed as 'responsible', which encompasses the 25.9% classed as 'deforestation free'[3].

The difference between *responsible* and *deforestation-free soy* is critical. A 2019 IUCN report determined that the amount of land that can be cleared *in compliance with national legislation* on deforestation would amount to 7Mha in the Paraguayan Chaco, 10.5Mha in Argentina, and 88Mha (±6Mha) in Brazil – around 10% of which is in the Amazon and 40-50% is in the Cerrado (in total this comes down to slightly less than the entire land area of the UK, Norway and Sweden combined).

Certification also has its limitations. Whilst a large part of soy production area in South America meets the criteria for *deforestation-free* (41.4 Mha was already under soy production by 2008) the global market share of certified soy remains small (around 0.2-6% depending on the schemes included). Uptake may be low because, compared to coffee or chocolate, certified soy is harder to monetise since most soy consumption is embedded in foods such as chicken and pork, and is thus 'invisible' to end-consumers; this means farmer premiums are lower. Moreover, even if some countries only sourced *deforestation-free* soy, this may be offset by other countries simply sourcing more deforestation-linked soy. Thus, soy certification may lack the comprehensiveness to tackle the problem.

Furthermore, in 2018, the US-China trade war began – the US placed import tariffs on Chinese products and China responded by imposing tariffs on US goods. Following this, China reduced its US soy imports from 29.6 Mt in 2017-18 to 6.67 Mt in 2018-19 and increased Brazilian imports from 55.2 Mt to 65.9 Mt. With the Chinese market for certified soy being so small, this could lead to increased deforestation.



How this affects discussions about animal- and plant-based protein sources

Advocates for more plant-based diets often state that land use change in South America can be ascribed to a higher demand for pig and poultry products. They suggest soy currently used as animal feed could be eaten directly by humans as whole bean-based foods, meaning less soy would need to be grown to produce the same amount of food and nutrients (e.g., kg protein). This is the heart of the debate over feed-food competition (see What is feed-food competition?). However, commodity soy, which may not be as palatable (and so harder to sell) for direct human consumption, grows better in certain climates and contexts than food-grade soy, complicating this option's feasibility. Thus, a potential alternative, is to use soy oil and soy cake from crushed commodity beans to produce more processed foods and meat alternatives. However, to critics of ultra-processed foods (UPFs) (see our UPF explainer here), using soy cake for food rather than feed simply maintains a globalised food system controlled by large multinationals that foster monocultural production of GM soy on deforested lands, ultimately resulting in the manufacture of foods that they consider to be unhealthy (whether processed meats or plant-based UPFs).

Further research is needed to provide rigorous answers to the questions surrounding the issue of soy and land-use change, while recognising that people will also answer them differently depending on how they view and value the different issues.

The full report (with associated citations and references) is available at:
https://www.doi.org/10.56661/47e58c32

1 This data has been updated compared to the original explainer. The updated data was collected from: Food and Agriculture Organization of the United Nations. Crops. *FAOSTAT* (n.d.). Available at: http://www.fao.org/faostat/en/#data/QC/visualize. (Accessed: 2nd May 2023).

2 This data has been updated compared to the original explainer. The updated data was collected from: Food and Agriculture Organization of the United Nations. Crops. *FAOSTAT* (n.d.). Available at: http://www.fao.org/faostat/en/#data/QC/visualize. (Accessed: 2nd May 2023).

3 This data has been updated compared to the original explainer. The updated data was collected from: Wagenaar, D., de Jong, R., do Couto Justo, G., & Duchâtel, M. *European Soy Monitor; Insights on European uptake of responsible, deforestation, and conversion-free soy in 2020.* (IDH and Schuttelaar & Partners, 2022).