US SOY
Delivers Solutions

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A BETTER ENVIRONMENTAL FOOTPRINT

CARBON FOOTPRINT OF U.S. SOY

Soybeans are an important source of protein for feed and food products, and global demand is rising. An efficient crop, soybeans need relatively few inputs as they fix nitrogen from the atmosphere. However, the expanding area under cultivation is of concern because much of the expansion stems from deforestation that largely occurs in tropical areas. Blonk Consultants used data from its Agri-footprint™ database to assess the environmental footprint of soy from various origins using the Life Cycle Assessment (LCA) methodology, which takes into account the Land Use Change (LUC) impact according to the Product Environmental Footprint standard used by the European Commission to calculate the environmental footprint of a specific product.

While soy is used in many supply chains from farm to fork, much of it is used as feed for animals. It is often connected to environmental issues such as deforestation and other unwanted Land Use Change (LUC). In this context LUC refers to the conversion of natural land, such as forests, savannas, wetlands and grasslands, to cropland. Retailers, NGO's and consumers in Europe are increasingly concerned that this conversion leads to CO_2 emissions, land degradation and biodiversity loss.

Given the demand for soy in European markets, local (European) production only covers a fraction of the volume needed. Soy imported from regions overseas with favorable growing conditions remains important. Food manufacturers that use soy as an ingredient in their value chains have the ambition to reduce their environmental footprint.

Calculating the carbon footprint on science-based, factual data provides actionable insight and benchmarks for manufacturers and others throughout the value chain to know, measure and take steps to reduce the level of greenhouse gas emissions of their operations. Blonk Consultants developed the Agri-footprint™ database to calculate the carbon footprint for a wide range of country-crop combinations. Using the Agri-footprint™ database, Blonk Consultants assessed U.S. Soy, based on LCA methodology (see 'Calculating the Environmental Footprint of a Product').

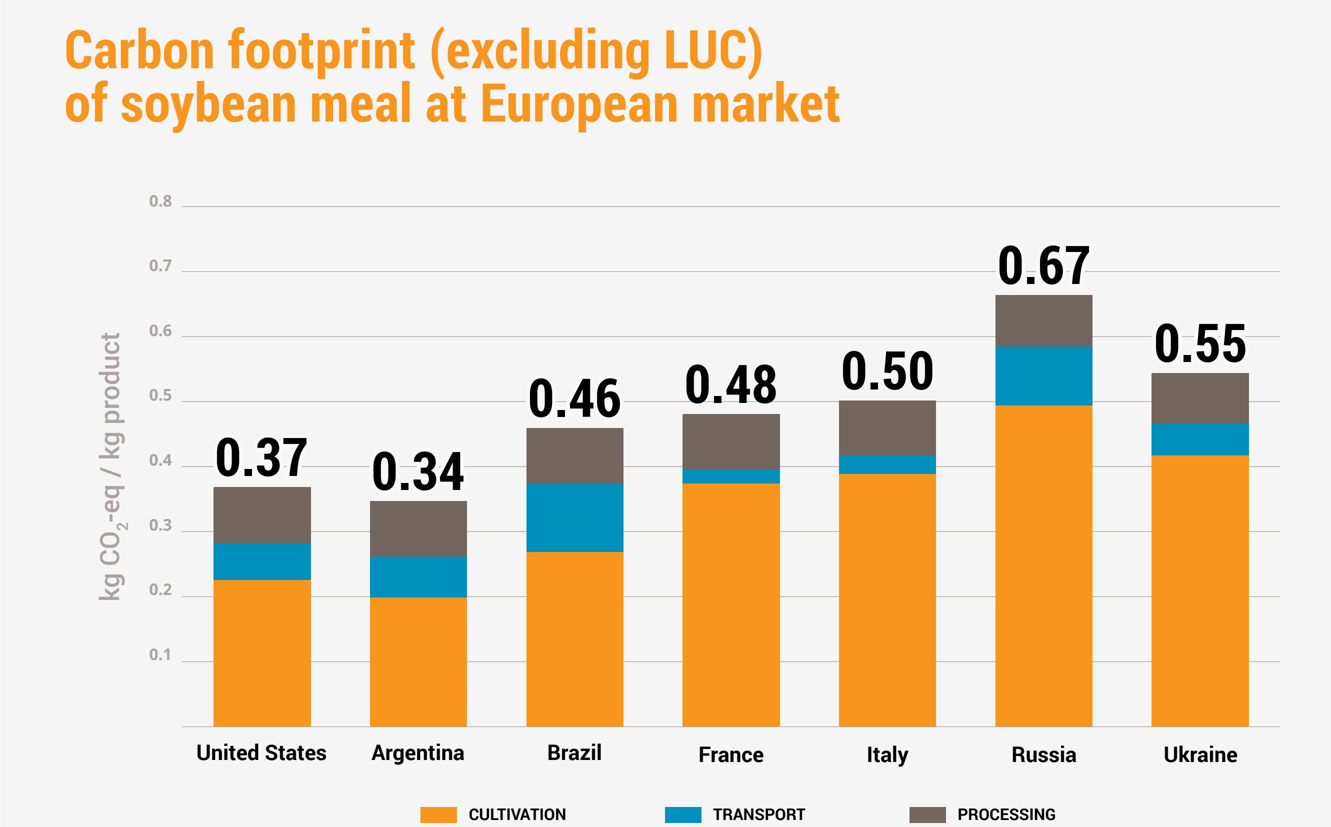
First, Blonk Consultants looked at the carbon footprint of soy cultivation in different countries excluding LUC. This work focused on the impact derived from farm practices and the transporting and processing of soy. Then, Blonk Consultants researchers included LUC in the calculations, which mostly reflects the impact of deforestation and other land conversion on the carbon footprint of soy.

The Impact of Cultivation

Figure 1 shows the carbon footprint of **soybean meal** imported from other countries for the European market. As the chart shows, cultivation is by far the biggest contributor to the global warming impact **(excluding LUC)** of soybean meal. Energy use (for machinery and irrigation), fertilizer (including lime) production and application and crop residue emissions are the most important parameters for the cultivation emissions. Countries with relatively low impact have relatively high yields, low fertilizer use and low energy use for machinery.

For all countries of origin, cultivation represents the highest contribution to the total carbon footprint. Farm practices of U.S. soybean farmers have the second-lowest cultivation impact, after Argentina and before Brazil. In Europe's primary soy- producing countries, farm cultivation has a larger contribution to greenhouse gas emissions due to lower yields, higher fertilizer use and higher energy consumption. As this soy is regionally-produced for the European market, transport has a lower impact with the exception of Russia, which has an even larger transport footprint than both the U.S. and Argentina (which is driven primarily by truck transport).

Figure 1.



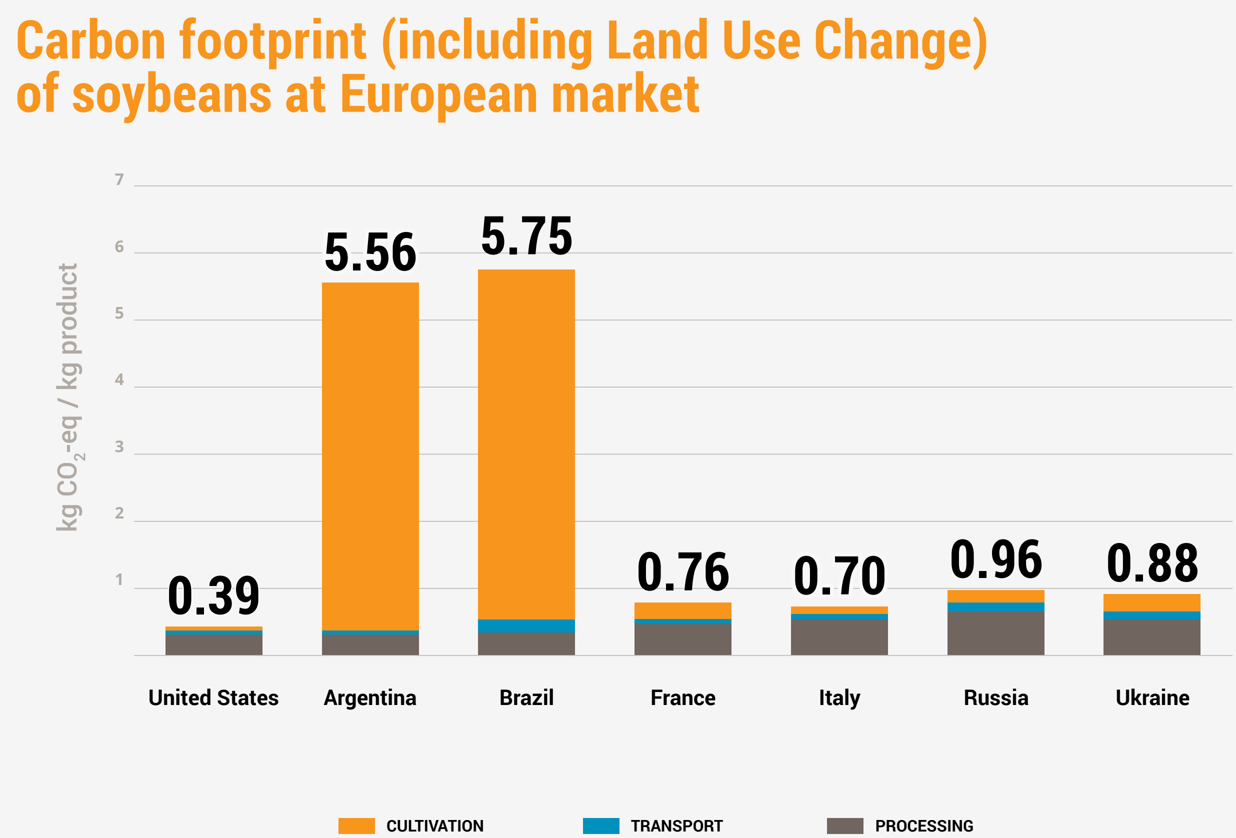
Focusing on U.S. Soy, the high levels of mechanisation and precision farming techniques also minimize emissions. Although not accounted for in the applied emission model for this project, conservation farming practises such as cover crops, no till or reduced tillage, and farmers leaving land plots unfarmed for at least 15 years under the **Conservation Reserve Program** also reduces emissions while benefitting soil health and biodiversity.

The Impact of Land Use Change (LUC)

Including LUC in analysing the footprint of production and handling of soy in the different countries of cultivation dramatically changes the result. Figure 2 shows the carbon footprint including land use change (LUC) of soybeans for the European market for different sourcing countries. All calculations are country averages. Specific supply chains may have different carbon footprint results. (For more explanation about the LUC impact in LCA studies, see 'Climate Change Impact Due to Land Use Change').

The data clearly shows that land use change in Argentina and Brazil (primarily due to deforestation) is responsible for the lion's share of the crop's carbon footprint. When forests are cleared to make way for farming, the carbon that was stored in the trees is released into the atmosphere as carbon dioxide. Such emissions resulting from land use change (LUC) are accounted for in the LCA. Blonk Consultants used the PAS 2050-1 standard, the most-applied method for calculating LUC

Figure 2.



impact on the carbon footprint, to calculate the carbon footprint of soy sourced from different countries. Based on country-level statistics on the expansion or regression of cropland and forest area, deforestation is assigned to crops with high relative expansion.

LUC hardly impacts the carbon footprint of U.S. soybean cultivation. Compared to South America, deforestation and land conversion in the U.S. is much less an issue.

U.S. cropland decreased while forest land increased

Cropland Change 1982–2017

"U.S. Cropland Decreased While Forest Land Increased". Please see **Natural Resources Conservation Service Results** *for more information.*

Source: 2017 National Resources Inventory Summary Report

Case: U.S. Soy Carbon Footprint 25% Lower in Poultry Production*

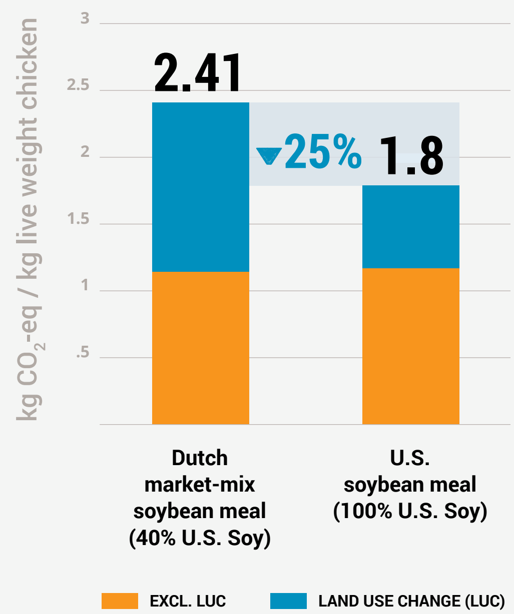
(Example: the Netherlands)

The high carbon footprint of soybeans with a large LUC impact is reflected when looking at products that use soy. ***Figure 3*** shows the contribution made by soy in the form of soybean meal for poultry feed to the overall footprint of poultry production in the Netherlands. In this case, the Dutch average market mix of soybean origin, which mainly comprises soy from Brazil, is compared to U.S. soybeans crushed to meal in the Netherlands.

Using similar analysis for pork production, the carbon footprint of pork is 22% lower using only U.S. Soy.

Figure 3.

Carbon footprint of poultry production in the Netherlands



**Poultry production model is developed by Blonk Consultants based on 2019 FAO statistics about compound feed composition and industry expert judgement. System boundary is from cradle-to-farm gate. Background data on feed ingredient production is used from Agri-footprint™ 5.0®.*

Background Information on LCA Methodology

Calculating the Environmental Footprint of a Product

Life Cycle Assessment (LCA) is a research method for evaluating the environmental impact of a product throughout its entire life cycle. An LCA assesses all the stages in the production, processing and use of a product, from raw materials, packaging and transport to retail, consumption and waste processing (cradle-to-grave). Multiple environmental impact categories are captured, such as climate change, eutrophication, acidification, water use and land use. An LCA reveals the environmental impacts and where they occur in the life cycle of a product (hot spots).

Carbon Footprint of U.S. Soy

Blonk Consultants used its Agri-footprint™ database, the most extensive LCA database on agricultural and food products, to compare U.S. soybeans and U.S. soybean meal with that of other countries. The scope of the study was cradle-to-market, which means emissions of cultivation, processing (crushing), and transport to the market are taken into account.

Input Data for Soybean Cultivation

For a full explanation of the input data for soybean cultivation by country, see **chapter 3.2** of the Agri-footprint™ 5.0 methodology report.

Land Use Change

Land Use Change data was retrieved in November 2018 from the **Food & Agriculture Organization of the United Nations**.

Climate Change Impact Due to Land Use Change

When forests are cleared to make way for farming, the carbon that was stored in the trees is released into the atmosphere as carbon dioxide. Such emissions resulting from Land Use Change (LUC) also need to be accounted for in LCA. This is not a straightforward exercise as appropriate data are often lacking. In an ideal situation, information from satellite imagery or other sources would be used to determine the exact historic land use of a certain area (over the past 20 years). However, such data are often not available, because when the exact locations of cultivated areas are not known, other methods must be employed. The PAS 2050-1 standard is the most-applied method for calculating the land-use-change impact on the carbon footprint. Based on country-level statistics on the expansion or regression of cropland and forest area, deforestation is assigned to crops with high relative expansion. Blonk Consultants has developed a **tool** that calculates LUC for each country–crop combination. This LUC is also integrated into Blonk Consultants' Agri-footprint™ database.

Some Considerations: Strengths and Weaknesses of LCA of Soy

It should be borne in mind that LCA can only provide an approximation of the environmental impact. Results presented in this factsheet are based on country averages. Data of specific regions within a country or even specific farms could provide other results.

While many impact categories are included in this study, not all environmental issues, such as soil degradation, are yet covered by LCA methodology.

Reduced inputs of mineral or organic fertilizers would lead to a lower cultivation footprint, however the resulting depletion of soil nutrients would be unaccounted for.

Tropical regions generally have favourable climate conditions for soybean cultivation. The high carbon footprint of soy production in these regions could lead to expansion of soy cultivation into areas that are less suitable for soy, or to the cultivation of alternative crops that are less efficient.

agri footprint
understanding the impact of food

Agri-footprint™ is a high-quality Life Cycle Inventory database for the agriculture and food sector. It covers data on agricultural products: feed, food and biomass. The aim of the database is to facilitate transparency and a more rapid transformation to sustainable food supply chains.

Since its release in 2014, Agri-footprint™ is widely accepted by the food industry, LCA community, scientific community, and governments worldwide and has been critically reviewed. Agri-footprint™ 5.0 was released in 2019, contains approximately 5,000 products and processes, and is available in LCA software SiomaPro. Besides Agri-footprint™, Blonk Consultants also developed other major feed databases like **GFLI** and the **EC feed database** for the European Commission. More information can be found on **www.agri-footprint.com**.

KNOW THE CARBON FOOTPRINT IMPACT BEFORE YOU PURCHASE

The sustainability advantage of U.S. Soy is clear. U.S. soybean farmers are implementing practices and techniques to minimize emissions, while U.S. forest land has remained stable for nearly 40 years. When making your purchasing decisions, be sure to evaluate the carbon footprint of soy.

SOURCING VERIFIED U.S. SUSTAINABLE SOY IS SIMPLE WITH THE U.S. SOY SUSTAINABILITY ASSURANCE PROTOCOL (SSAP)

Indicate to your soy supplier that you require an SSAP certificate for your U.S. Soy purchase. The SSAP certificate offers an origin specific, sustainability verification of U.S. Soy.

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For more information about the sustainability of U.S. Soy, visit
USSOY.org/sustainability