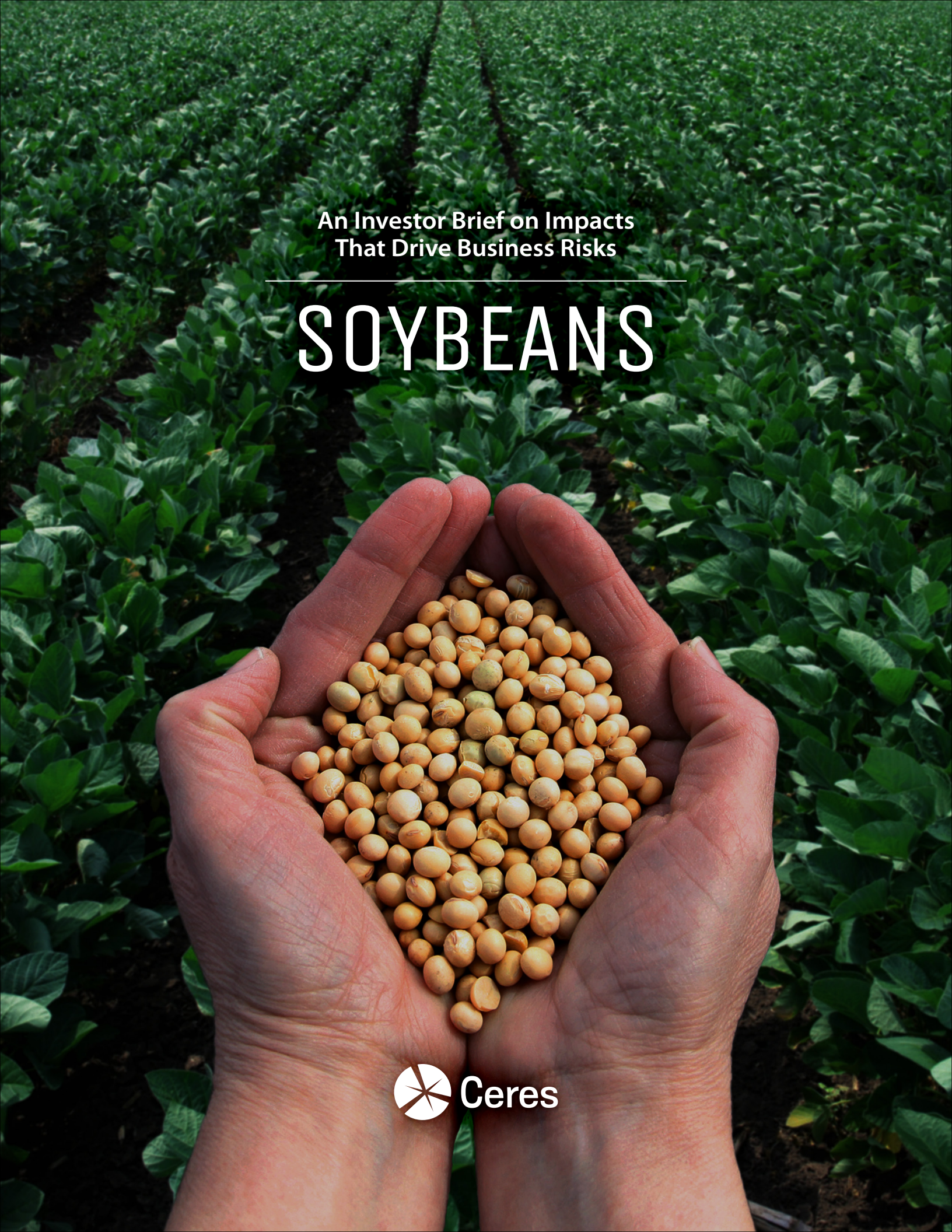
An Investor Brief on Impacts
That Drive Business Risks

SOYBEANS



Ceres

This brief provides a summary of the main environmental and social factors that affect soybean production worldwide; however, it spotlights key players in the U.S. value chain.

KEY TAKEAWAYS

- Soybean production has more than doubled worldwide over the past 20 years, expanding into a $127.8 billion market. As global demand for meat has increased, the use of soybeans in livestock feed has exploded. In human food products, soybeans are used as a cooking oil, a source of protein in meat and dairy substitutes, and as an ingredient in many processed food products.
- Deforestation is the most salient, region-specific issue associated with soybean production. It is a significant driver of greenhouse gas emissions and leads to the loss of biodiversity, which impacts not only the health of the local ecosystem but also the natural populations that depend on these natural resources to survive.
- In the Amazon Basin, Atlantic Forests, and the Brazilian Cerrado, carbon dioxide (CO_2) emissions from land conversion are significant. Based on the Cerrado alone, this equals about 60 percent of Spain's total emissions in 2015. While the Soy Moratorium in Brazil has reduced impacts on the Amazon, the loss of native vegetation in areas like the Cerrado that are not covered by the Moratorium remain a material business risk.
- Investors should address risk in the soybean supply chain through direct engagement with their portfolio companies and by supporting relevant policies and multi-stakeholder collaborations. Effective implementation of a company's policies requires promotion traceability and having a clear approach to supplier engagement, verification, and disclosure of progress.

COMMODITY OVERVIEW

The Vast Majority of Global Soybean Production Is Used to Feed Animals

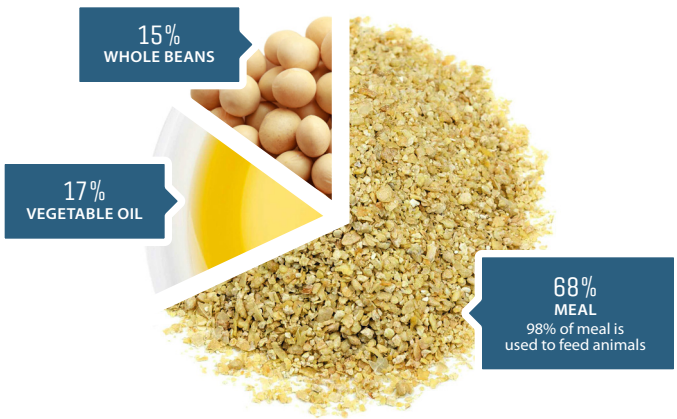
Globally traded and highly versatile, soybeans are the world's largest source of animal protein feed and the second largest source of vegetable oil.

About 85 percent of global soybean production is crushed into meal and vegetable oil. The other 15 percent is sold as whole beans.

Of the soybeans crushed: 80 percent is used for meal; 20 percent for vegetable oil.

For the meal: virtually all (98 percent) is used to feed animals (e.g., pigs, poultry, cattle and farmed fish); 2 percent is processed for food use.

For the oil: most (95 percent) is for food use — cooking oil and processed food products such as margarines, dressings, and mayonnaise — with the remainder (5 percent) used for industrial products such as fatty acids, soaps, and biodiesel.

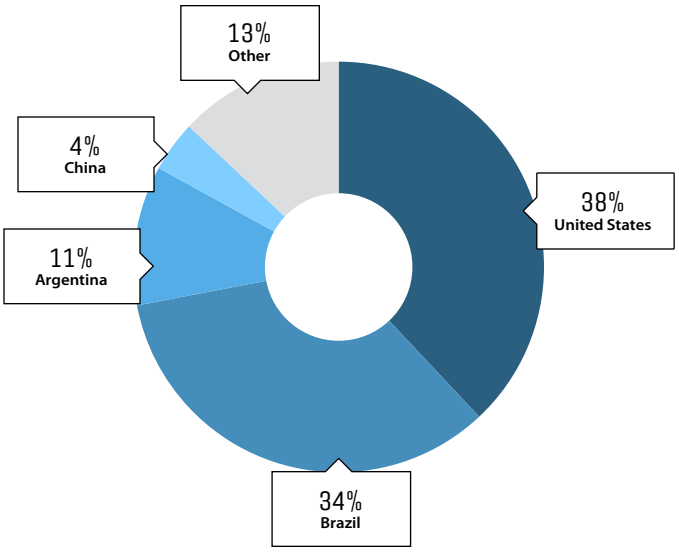


Global Soybean Production by Volume

GLOBAL PRODUCTION DATA

The U.S., Brazil, & Argentina Account for 83 percent of Global Soybean Production

TOP FIVE PRODUCTION REGIONS



372.56 MILLION METRIC TONS

Average global soybean production, 2022

$127.81 BILLION

Global production value, 2020

38 PERCENT

U.S. proportion of global production exported in metric tons, 2018

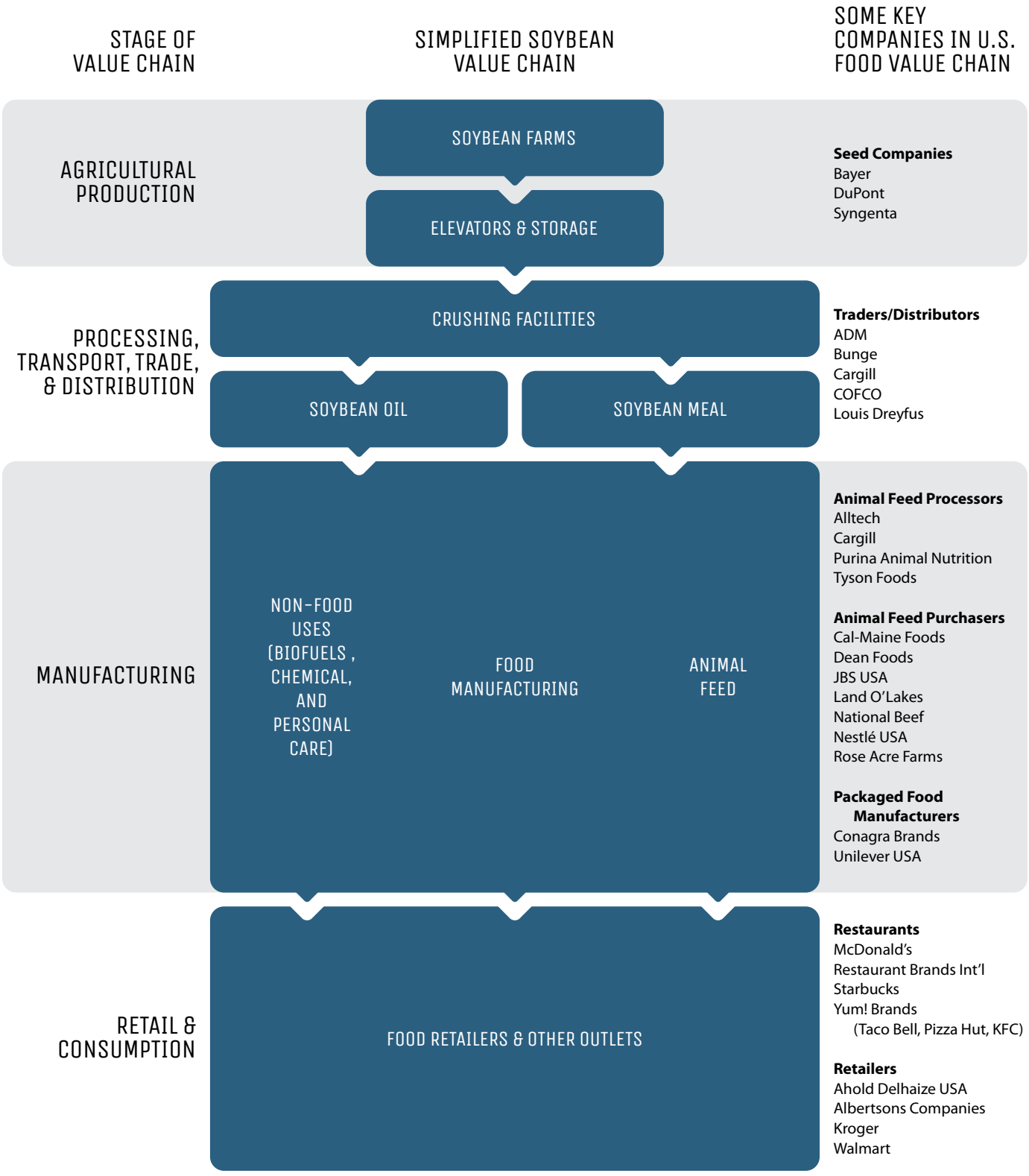
Rising Meat Consumption and Biofuel Mandates Drive Demand

Global soybean production grew rapidly over the last decade, primarily in response to demand from China and Europe for soy-based animal feed as worldwide appetite for meat soars. The largest jump in soybean production to meet this demand has happened in South America (particularly Brazil), and this expansion has contributed significantly to deforestation and the loss of other high conservation value native vegetation. In the Matopiba region of Brazil's Cerrado, the area allocated for soybean production is expected to increase by 1.1 million hectares by 2030; current trends indicate that 20% of this is from the conversion of native vegetation.

In the U.S., multiple factors have boosted soybean production over the last decade. These factors have included government policies supporting agricultural production through protection or subsidies, biofuel mandates, international demand, and periods of high prices for agricultural commodities. Acreage for soybean production increased by 10 percent in the U.S. between 2019 and 2020 as a result of these factors.

THE SOYBEAN VALUE CHAIN

The soybean supply chain is complex and includes many sectors; however, a small group of big companies control large volumes of production at key points in the supply chain.



KEY PLAYERS

The following provides additional information about some of the companies in the U.S. soybean food value chain. While the focus is on publicly traded companies headquartered in the U.S., some of the companies mentioned are headquartered outside the U.S. and/or are privately held.

SEED COMPANIES

Bayer, DuPont (Pioneer), and Sygenta (privately owned by ChemChina) are among the largest companies that provide seed to farmers.

TRADERS AND DISTRIBUTORS

Archer Daniels Midland (ADM), Bunge, Cargill (privately held), COFCO, and Louis Dreyfus Commodities (headquartered in Europe) control much of this link in the supply chain.

MANUFACTURERS

Animal Feed Processors: The largest U.S. feed producing companies include Cargill, Purina Animal Nutrition (subsidiary of Land O'Lakes), Tyson Foods, and Alltech (privately held).

Animal Feed Purchasers: Some of the largest U.S. companies that purchase animal feed (likely to contain soybean-derived ingredients) are:

- ***Poultry Processors:*** Tyson Foods, Pilgrim's Pride (a subsidiary of JBS USA; JBS is headquartered in Brazil) and Perdue together account for 45 percent of the U.S. market.
- ***Pork Processors:*** Smithfield (the largest by far and privately owned by Shuanghui Group in China), Tyson Foods, and JBS USA together control more than half the U.S. market.
- ***Beef Processors:*** Tyson Foods, JBS USA, Cargill, and National Beef (privately held) collectively account for 75 percent of the U.S. market.
- ***Dairy Processors:*** Nestlé USA, Dean Foods, and Land O'Lakes (a cooperative) are among the leading dairy companies.
- ***Egg Producers:*** Cal-Maine Foods and Rose Acre farms (privately held) lead the sector in number of hens housed.

Packaged Food Manufacturers: Large U.S. buyers of soybean-derived ingredients include margarine and mayonnaise producers (e.g., Unilever USA) and vegetable oil producers (Conagra Brands).

RESTAURANTS AND RETAILERS

Restaurants and retailers play an important role in the soybean supply chain. These companies can indirectly influence production practices and supplier standards within their supply chain. Moreover, they are sensitive to external pressures and responsive to market trends and consumer preferences.

Restaurants are heavy users of both soybean oil, which is used directly in bakery products and as a cooking oil, and soybean meal, which is used indirectly in meat products produced with soybean meal. The four largest limited-service restaurants in the U.S. are McDonald's, Yum! Brands (Taco Bell, Pizza Hut, KFC), Starbucks, and Restaurant Brands International. In terms of food retailers, the four largest in the U.S. are Walmart, Kroger, Albertsons Companies, and Ahold Delhaize USA.

ENVIRONMENTAL AND SOCIAL FACTORS

BIODIVERSITY

DEFORESTATION & LAND USE CONVERSION

CLIMATE CHANGE

WATER USE & POLLUTION

Globally, the environmental and social issues linked to soybean production include deforestation and conversion of other high conservation value native vegetation, greenhouse gas emissions, groundwater depletion, water pollution, and land rights violations. The scale of the impacts depends on the practices used by individual soybean growers as well as regional and local conditions.

Soybeans are often grown in rotation with other crops (e.g., corn), which means that the impacts and risks may be linked to other commodities and therefore cannot be addressed in isolation.

DIFFERENT REGIONS, DIFFERENT IMPACTS

Most soybean meal and oil used in the U.S. is grown and processed in the U.S. where conversion of important grasslands and conservation lands to soybean production is one of the biggest issues driving risks. A 2021 study found that non-cropland to cropland conversion caused a 3.3 percent increase in total U.S. cropland between 2012 and 2017. In 12 Midwestern U.S. states, over 70 percent of the converted grasslands were planted with corn or soybeans. This had adverse effects, including increasing the annual soil erosion by 7.9 percent in the same states by 2016. However, many U.S. companies operate globally and may sell products made with soybeans from Brazil or other regions where other issues like deforestation are the primary concern.

1 CONVERSION OF NATURAL HABITAT LEADS TO GREENHOUSE GAS EMISSIONS AND LOSS OF BIODIVERSITY

Destruction of natural vegetation for soybean production generates greenhouse gases that contribute to climate change. It also leads to the loss of biodiversity, which impacts not only the health of the local ecosystem but also the local populations that depend on these natural resources to survive. These impacts are of particular concern in countries that are home to some of the most biodiverse areas on the planet, including Brazil, Argentina and Paraguay. In the U.S., the conversion of millions of acres of important grasslands in the Great Plains to cropland in the last several years has led to reductions in biodiversity (birds) and the loss of soil carbon. Companies that fail to understand and mitigate impacts related to these issues may face market, reputational, litigation, and operational risks.

2 IRRIGATION CAN CONTRIBUTE TO GROUNDWATER DEPLETION

Demand for irrigation water use varies greatly between soybean-producing countries and regions. For example, soybeans are mainly a rainfed crop in South America but are more heavily irrigated in other regions. In areas where soybean production relies on irrigation, unsustainable water use can strain aquifers, such as the Ogallala Aquifer in North America and the Guarani Aquifer in South America. Globally, nearly 70% of soybeans are grown in the U.S. and Brazil. Both countries experience water stress in particular regions, meaning existing water supplies face intense competition and, in some cases, growing regulation. In the agricultural frontier of Brazil's Cerrado region, an increasing rain deficit during the wet season may reduce production and inhibit future expansion. In Iowa, one of the highest producing U.S. states of soy by volume, experienced severe and extreme droughts during the summer of 2020. Companies that fail to understand and mitigate impacts related to these issues may face operational, reputational, and regulatory risks.

REGIONAL CONTEXT

In the Amazon and the Cerrado alone, emissions from land use conversion increased by 24 percent between 2019 and 2020, emitting more than Iran in the same period.

In the Amazon, an area of the world that plays a vital role in regulating the global climate, soybean production has historically been a major driver of deforestation. The Cerrado grassland is a global biodiversity hotspot that stores substantial amounts of carbon and is a key source of the water critical for Brazil's agricultural productivity. Soybean production has already contributed to the conversion of more than half the savannah. Estimates predict the possible destruction of an additional one-third of the Cerrado by 2050 if current conversion rates continue.

While the Soy Moratorium in Brazil and other factors have helped to reduce soybean production in the Amazon, the loss of important native vegetation in the Brazilian Cerrado, which is not covered by the Moratorium and where 60 percent of soy is grown, is expected to remain a material business risk. Since the current Brazilian law (the Native Vegetation Protection Law) allows for legal conversion of land in the Cerrado, various efforts are underway to stem the ongoing rapid conversion of this critical ecosystem. This includes collaborative announcements like the Cerrado Manifesto and other efforts to restore degraded lands.

3 COMPETITION FOR LAND CAN LEAD TO EXPLOITATION OF COMMUNITIES AND WORKERS

Soybean production in developing countries, such as Brazil, Argentina, and Paraguay, has been associated with negative social impacts, particularly when small-scale farmers and communities have been pushed off their lands to make way for commercial soybean operations.[2] In such instances, land rights of indigenous or local communities may not be documented or recognized, leaving local people at risk of losing their homes and livelihoods when they are displaced from their land.[2] Companies that fail to understand and manage impacts related to land rights may face market and reputational risks such as protests, work stoppages, or damaging social campaigns from activist groups.[2]

4 SOY PRODUCTION IS LINKED TO BIODIVERSITY LOSS

Soy production can be linked to biodiversity loss in several ways. The main driver is through the conversion of native vegetation to agricultural lands. This conversion contributes to habitat loss, reduced genetic diversity, and the loss of wildlife. Further, to maximize crop yield, many soy plantations utilize soybeans that are genetically modified to withstand the chemicals in herbicides and pesticides that would otherwise kill the crop. In turn, this allows for the increased use of herbicides and pesticides. These agents harm local vulnerable species and contribute to the pollution of freshwater sources. Biodiversity holds intrinsic value through the ecosystem services a healthy ecosystem provides, such as recreational purposes, raw materials for food, commodities, and medicines, and the preservation of certain cultural/spiritual practices. Biodiversity loss also presents reputational and market risks to companies.

U.S. SPOTLIGHT

Soybeans used in the United States are typically produced domestically. More than 80 percent of U.S. soybean acreage is concentrated in the upper Midwest[2] where the crop is frequently rotated with corn. Nutrient pollution and groundwater depletion are significant concerns in this region. The U.S. Department of Agriculture reported that soybean production in the U.S. increased by 5 percent between 2020 and 2021. The year 2021 also saw record high yields in 21 states.[2] This increase in production has had significant environmental impacts. Between 1980 and 2000, the United States made progress in improving land use, irrigation water use, energy use, greenhouse gas emissions, and soil erosion associated soy production. However, between 2000 and 2020 progress in slowing soil erosion, reducing greenhouse gas emissions, and lowering energy use in generating soy slowed to a near stop.[2] Only soil erosion decreased by 32 percent, though more recent trends indicate a slight increase.

TRACEABILITY AND SUPPLY CHAIN ENGAGEMENT

In order to manage the supply chain risks associated with soybean production, an increasing number of companies are developing relevant policies and codes of conduct. They are also recognizing that in order to ensure their supply meets such policies, commodity traceability is paramount. To combat deforestation in supply chains, many companies are committing to traceability not only with their direct suppliers but also in their extended supply chains.

As companies focus on traceability and implementation of their policies, they are increasingly collaborating with suppliers as well as other stakeholders. This includes finding ways to support suppliers as they take the steps needed to upholder the company's policy. Supplier support can include education and technical support, support in goal setting, or financial incentives to meet new standards. To be effective in achieving their policies, companies are also increasingly establishing a monitoring and verification process to confirm that suppliers are following through on the company's commitments. Without verification, even the strongest policy leaves a company exposed to reputational and market risks. Verification can be conducted by the company or by a third-party certifier. Leading companies include a protocol for supplier non-compliance that facilitates time-bound action plans for suppliers to return to compliance.

COMPANIES IN ACTION

- **Unilever** sourced 72 percent of its soy oil from sustainable sources in 2017. In the U.S., soybeans are Unilever's most important agricultural raw material. As part of its commitment, Unilever partnered with ADM and other important stakeholders in a program that helps soy farmers and soy oil suppliers in Iowa increase the use of cover crops and qualify for cost share payments. This program involved around 170 farmers cropping more than 26,000 acres in 2017.
- **McDonald's** in Europe is striving for 100 percent sustainably certified soy in its chicken meat supply chain by 2020. In 2016, 50 percent of soy used for chicken feed in its European markets was covered by Pro Terra or Roundtable on Responsible Soy certification.
- **Smithfield**, as a pork producer which purchases large quantities of animal feed containing soybean meal, has set a goal to have 75 percent of its grain purchased go through a fertilizer optimization and soil health program by 2018. In 2016, 55 percent of Smithfield's total grain purchases came from farmland participating in the SmithfieldGro Program and/or the Land O'Lakes' SUSTAIN™ sustainability platform.

SUSTAINABILITY STANDARDS

The diversity of soybean production systems presents a major challenge for adoption of a single global standard. Five major international third-party standards apply to soybean production, including Roundtable on Responsible Soy (RTRS), Danube Soya Initiative, ProTerra, Fairtrade, and organic standards. World Wildlife Fund (WWF) has developed recommendations for buyers in animal feed, meat, dairy, food processing, and retail sectors that source soybean from countries where RTRS or ProTerra standards are applicable. The International Sustainability and Carbon Certification (ISCC) and the Roundtable on Sustainable Biomaterials (RSB) cover soybean as a biofuel feedstock. U.S. producers have adopted only the organic standard, which is relevant to multiple commodities.

ADDITIONAL RESOURCES

Engage the Chain offers briefs on seven other key commodities, a compelling case for sustainable agriculture and opportunities for action that cut across all types of agricultural commodities.

- The U.S. Department of Agriculture conducts research on multiple commodities, including soybeans. This includes data on production and consumption, prices and trade and is published through the Economic Research Service, Foreign Agricultural Service, and National Agricultural Statistics Service.
- Both The Sustainability Consortium and World Wildlife Fund offer high-level insights and analysis about potential risks and opportunities across a number of commodities, including soybeans.
- A U.S. Soybean Sustainability Assurance Protocol (SSAP) has been developed by members of the soybean industry (American Soybean Association, the U.S. Soybean Export Council, the United Soybean Board and state soybean boards). It uses existing aggregated data collected from farmers nationwide who participate in national conservation programs. As of May 2016, 95 percent of U.S. soybean producers participate in the U.S. Farm Program and are subject to audit.
- The Consumer Goods Forum has published multiple documents for companies to gain insight into where soybeans enter their supply chains and which product lines contribute the most to the company's "soy footprint": This includes *The Sustainable Soy Sourcing Guidelines* and *Calculation Guidelines for the Measurement of Embedded Soy Usage in Consumer Goods Businesses* (2016) which helps companies apply the principles of the CGF Soy Measurement Ladder published in early 2015.
- ProForest is producing a *Soy Toolkit*, which provides companies with guidance for implementing the five key steps needed to decouple soybean production from deforestation.
- *Harnessing the Power of Global Supply Chains to Halt Deforestation Driven by Soy* by Global Canopy and CDP lays out steps for policymakers and the private sector. The brief recommends companies map their supply chain and utilize other platforms such as Trase and Agroideal, along with initiatives such as the Global Forest Watch platform for ongoing monitoring of commodity-related risks.
- *The Plowprint Report* (2021) by World Wildlife Fund tracks year-to-year grassland conversion to cropland across the focal regions of the Mississippi River Basin and Great Plains.
- *Soybean Overlooked? The Investor Case for Deforestation-Free Soy* (2015) by CDP explores the regulatory risks in Brazil for companies purchasing products containing soybean associated with deforestation, discusses the implications for investors, and provides a set of recommendations for action.
- *The Growth of Soy: Impacts and Solutions* (2014) by World Wildlife Fund takes a deep dive into the impacts related to soybean production and provides a number of solutions for actors along the food value chain.
- The United Nations Food and Agriculture Organization has published *Tackling Climate Change through Livestock* (2013), which provides an in-depth analysis on issues and practical solutions for reducing greenhouse gas emissions related to livestock, including those related to producing feed for livestock.
- *Respecting Land and Forest Rights: A Guide for Companies* (2019) by The Interlaken Group and the Rights and Resources Initiative (RRI) was developed through a multi-stakeholder forum to support companies in respecting land rights by aligning operations with the United Nations Food and Agriculture Organization's Voluntary Guidelines on the Responsible Governance of Tenure (VGGT).

ABOUT CERES | WWW.CERES.ORG

Ceres is a sustainability nonprofit organization working with the most influential investors and companies to build leadership and drive solutions throughout the economy. Through our powerful networks and advocacy, we tackle the world's biggest sustainability challenges, including climate change, water scarcity and pollution, and human rights abuses.

Spring 2022