

An Investor Brief on Impacts
that Drive Business Risks:

SOYBEANS

ENGAGE *the* CHAIN

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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 and provides examples of actions being taken by companies operating or headquartered in the U.S.

KEY TAKEAWAYS

- Soybean production has more than doubled worldwide over the past 20 years, becoming a \$115 billion market. Its use in livestock feed has exploded. In human food products, it is used as a cooking oil, a source of protein in meat and dairy substitutes and 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, displacement of indigenous communities and the decline of healthy ecosystems in key rain forest regions of South America.
- In the Amazon Basin, Atlantic Forests and the Brazilian Cerrado, carbon dioxide emissions from land conversion are estimated to equal half of the United Kingdom’s total emissions in 2009. While the Soy Moratorium in Brazil has reduced the impact to the Amazon, deforestation 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, such as expansion of the [Soy Moratorium](#)

COMMODITY OVERVIEW

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

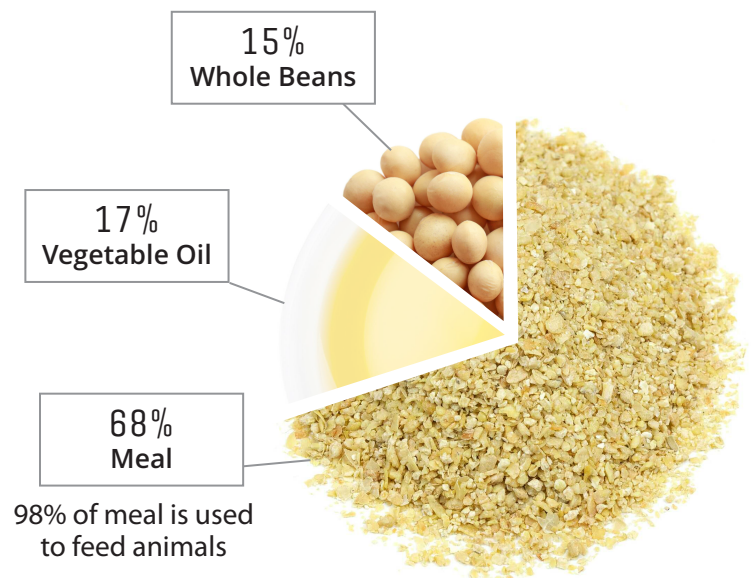
Globally traded and highly versatile, soybeans are the world’s largest source of animal protein feed and the second largest source of vegetable oil.¹

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.

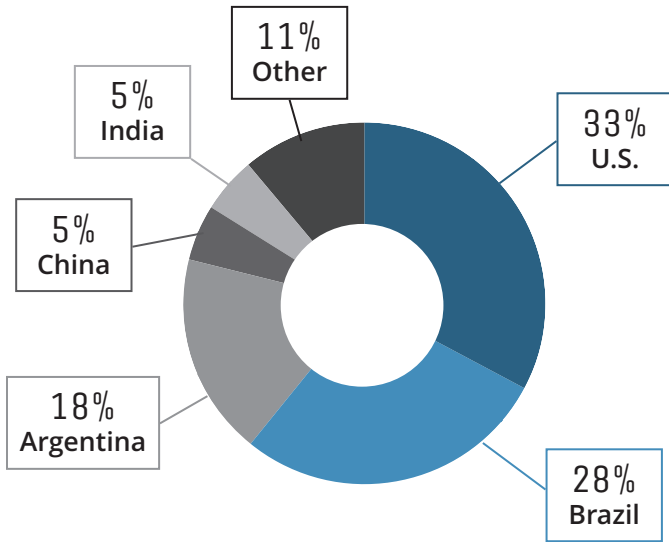


Global soybean production, by volume (data from multiple sources^{2,3,4,5})

GLOBAL PRODUCTION DATA

The U.S., Brazil & Argentina Account for 80 Percent of Global Soybean Production

TOP FIVE PRODUCTION REGIONS⁶



260 MILLION METRIC TONS

Average global soybean production, 2011-2013⁷

\$115 BILLION

Global production value⁸

37 PERCENT

Proportion of global production exported⁹

Rising Meat Consumption and Biofuel Mandates Drive Demand

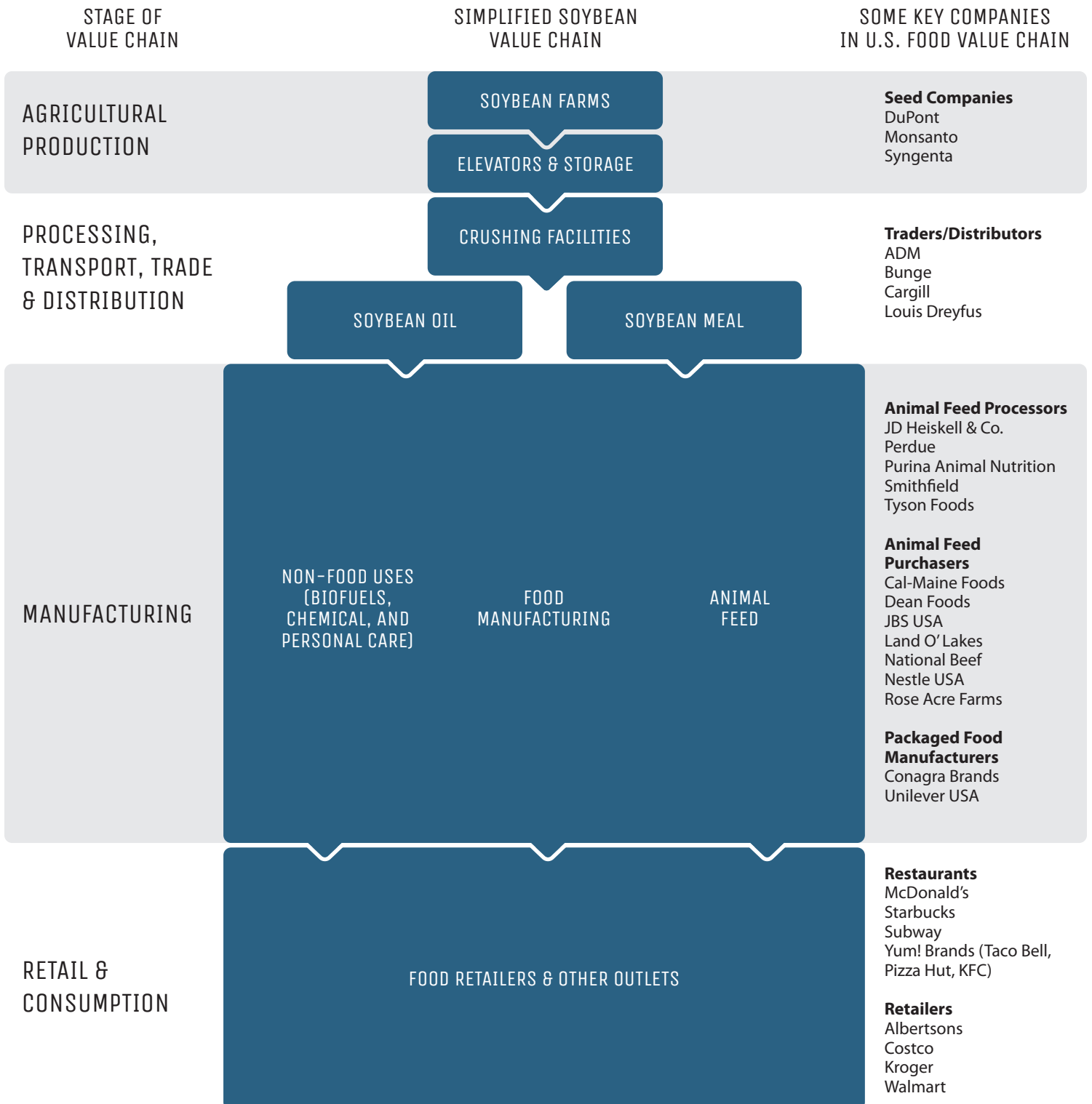
Global soybean production grew rapidly over the last decade, primarily in response to demand from China and Europe for soy-based animal feed as worldwide appetite for meat soars. The biggest jump in soybean production to meet this demand is happening in South America, particularly in Brazil, where soybean expansion contributes significantly to deforestation.¹⁰

In the U.S., multiple factors boosted soybean production over the last decade including: government policies supporting agricultural production through protection or subsidies,¹¹ biofuel mandates, international demand, and periods of high prices for agricultural commodities. Between 2008 and 2012, 5.3 million acres of highly erodible land in the U.S. were converted to grow row crops, an estimated 13 percent to soybeans.¹²



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

Monsanto, DuPont (Pioneer) and Syngenta (headquartered in Europe) are large publicly traded companies that provide seeds to farmers.

TRADERS AND DISTRIBUTORS

Archer Daniels Midland, Bunge, Cargill (privately held) and Louis Dreyfus Commodities (headquartered in Europe) control much of this link in the supply chain.¹³

MANUFACTURERS

Animal Feed Processors: The largest companies include Cargill and ADM, poultry and pork processors (i.e., Tyson Foods, Smithfield and Perdue), Purina Animal Nutrition (subsidiary of Land O'Lakes) and J.D. Heiskell & Co. (privately held).¹⁴

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 (a subsidiary of JBS USA; JBS is headquartered in Brazil) and Perdue together account for 45 percent of the U.S. market¹⁵
- *Pork Processors:* Smithfield (the largest by far but no longer U.S. owned), Tyson Foods and JBS USA together control more than half the U.S. market¹⁶
- *Beef Processors:* Tyson Foods, JBS USA, Cargill and National Beef (privately held) collectively account for 75 percent of the U.S. market¹⁷

- *Dairy Processors:* Nestle 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 housed¹⁸

Packaged Food Manufacturers: Large U.S. buyers of soybean-derived ingredients include margarine and mayonnaise producers (e.g., Unilever USA) and vegetable oil producers (e.g., 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 as well as responsive to market trends and consumer preferences.

Restaurants are heavy users of soybean oil, which is used in bakery products and as a cooking oil. Also, many meat products are produced with animal feed that includes soybean meal. The four largest quick-service and fast-casual restaurants in the U.S. are McDonald's, Yum! Brands (Taco Bell, Pizza Hut, KFC), Starbucks and Subway. All are headquartered in the U.S.¹⁹ In terms of food retailers, the four largest in the U.S. are Walmart, Kroger, Costco and Albertsons.²⁰

ENVIRONMENTAL AND SOCIAL FACTORS



DEFORESTATION



LAND USE & BIODIVERSITY



CLIMATE CHANGE



WATER USE & POLLUTION



LAND RIGHTS



LIVELIHOODS



WORKING CONDITIONS



High Impact
 Medium Impact
 Low Impact

Globally, the environmental and social issues linked to soybean production include deforestation, 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 as well and 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**. 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

Cutting down and plowing up natural habitats for soybean production generates greenhouse gases that contribute to climate change and leads to the loss of biodiversity. These impacts are of particular concern in countries that are homes to some of the most biodiverse places on the planet, including Brazil, Argentina and Paraguay. In the U.S., largely driven by demand for biofuel feedstocks, millions of acres of important grasslands in the Great Plains have been converted to cropland in the last several years leading to reductions in biodiversity (e.g., bird populations) and the loss of soil carbon.²¹

REGIONAL CONTEXT

The three main ecoregions most affected by soybean production in South America are the Amazon Basin, Atlantic Forests, and the Brazilian Cerrado, where carbon dioxide emissions from land conversion are estimated to equal half of the United Kingdom's total emissions in 2009.²² In the Amazon, which plays a vital role in regulating the global climate, soybean production has historically been a major driver of deforestation.

While the Soy Moratorium in Brazil and other factors have helped to reduce soybean production in the Amazon, deforestation 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.²³

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 20 percent of soybeans are grown in regions of high or extremely high water stress (e.g., U.S. and China), meaning regions where existing water supplies face intense competition and in some cases growing regulation.²⁴

It Takes
2,107 LITERS OF WATER

To Produce
1 KG SOYBEAN
(Weighted Global Average)^{25, 26}

19 PERCENT
Percentage of Production
in Regions of Water Stress²⁷

8 PERCENT
Percentage of Global Production Irrigated²⁸

3. MANY CONVENTIONAL FARMING PRACTICES ERODE SOIL AND POLLUTE WATER

Worldwide, the rate of soil erosion is still several times greater than is sustainable. A great deal of progress has been made to reduce the high rates of soil erosion from growing soybeans by using methods such as conservation tillage—like in the U.S. for example—but more work needs to be done. Land classified as “highly erodible” is still being farmed for soybeans.

Soil erosion is a problem because it leads to both loss of valuable topsoil and contamination of waterways with agrochemicals and fertilizers. While soybeans require far

less commercial fertilizer than other commodities such as corn or wheat²⁹ (because soybeans can “fix their own nitrogen” in the soil), fertilizer may nonetheless wash off fields, leading to nutrient pollution and “deadzones” that are devoid of life and a growing concern around the world.³⁰

Soil compaction, which can lead to rainwater running off rather than percolating into the soil and groundwater, is also a problem on many large soybean farms because soybean cultivation is largely mechanized. This is particularly a concern in water-stressed growing regions.

4. 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.³¹ In such instances land rights of indigenous or local communities may not be documented or recognized

and corruption is often widespread, leaving local people at risk of losing their homes and livelihoods when they are evicted or wrongfully displaced from their land. Companies that fail to understand and manage impacts related to land rights may face financial and reputational risks such as protests, work stoppages or damaging social campaigns.³²



5. GENETICALLY MODIFIED SEEDS ARE LINKED TO HIGHER HERBICIDE USE AND CONSUMER CONCERNS

Genetically modified soybeans, which are altered to tolerate certain herbicides so that farmers can kill weeds without harming the plant, are grown in many parts of the world. For instance, in the U.S. and Argentina, most of the soybean crops are genetically modified.³³ While widespread adoption of genetically modified crops has decreased the use of insecticides, as weeds have become more resistant, there has been an increased use of weed-killing herbicides. In large doses, these herbicides can

harm biodiversity and increase water and air pollution.³⁴ Moreover, a number of civil society organizations that are concerned about human health and environmental impacts are raising awareness about the use of genetically modified organisms (GMOs) and promoting product labeling. Potential reputational risk may develop for companies that cater to consumers and suppliers within their supply chain. A market risk may exist if substitution of non-GMO product is demanded.

U.S. SPOTLIGHT

Soybeans used in the U.S. are typically produced domestically. More than 80 percent of U.S. soybean acreage is concentrated in the upper Midwest³⁵ where the crop is frequently rotated with corn. Nutrient pollution and groundwater depletion are significant concerns in this region. Environmental Working Group's maps of soybean production acreage in ecologically sensitive regions,³⁶ show that between 1980-2011, total soybean production doubled and yield (bushels per planted acre) increased by 55 percent in the U.S. This increase in production has had significant environmental impacts. Even though soybean production in the U.S. became more efficient across five indicators tracked on a "per bushel" basis, total resource use increased in four of those areas because of the significant increase in total production.³⁷

- Land use (+24 percent)
- Irrigation water applied (+271 percent)
- Energy use (+3 percent)
- Greenhouse gas emissions (+1 percent)

Only soil erosion decreased by 28 percent, though more recent trends indicate a slight increase.

OPPORTUNITIES FOR ACTION

Investors can encourage companies to take the following actions to reduce business risks.

1. JOIN MULTI-STAKEHOLDER SUSTAINABILITY EFFORTS

Many players, including buyers, producers, governments, NGOs and communities understand the risks at play and are collaborating to ensure the long-term sustainability of soybean production. Investors should encourage companies to join these multi-stakeholder efforts to demonstrate commitment and help accelerate progress. When a company is already involved in such efforts, investors should encourage constructive participation and progress in meeting commitments. This includes

supporting and actively participating in the development and use of sustainability standards (see section 4.)

While a number of multi-stakeholder efforts relate to multiple commodities, those specifically focused on soybean production include the Soybean Sustainability Assurance Protocol (SSAP) in the U.S., and the Soy Moratorium and the Soja Plus program in Brazil.

BRAZIL SOY MORATORIUM

In 2006, pressure from a Greenpeace report, consumers and large companies led by McDonald's culminated in multinational commodity traders (including ADM, Cargill and Bunge) agreeing to a voluntary "Soy Moratorium."³⁸ The Moratorium bans the purchase of soybeans grown on land deforested in the Brazilian Amazon after the agreement was signed. This agreement has been extended indefinitely and been critical to drastically reducing in the Amazon the amount of deforestation linked to soybean production from 30 percent prior to the Moratorium to just 1 percent in 2014. A 2015 study found that this private sector agreement was more effective at stemming deforestation than the government's own Forest Code.³⁹ Replicating the model and success of the Soy Moratorium in other at-risk regions could help reduce the risk of deforestation linked to soybeans produced elsewhere.⁴⁰



ADDRESSING DEFORESTATION ACROSS MULTIPLE COMMODITIES

Many of the issues affecting soybean production affect other commodities as well. Multi-stakeholder efforts that address deforestation related to soybean as well as other commodities include:

- **Tropical Forest Alliance 2020 (TFA)**
TFA is a global umbrella partnership that brings together governments, private sector, and civil society organizations to remove deforestation from palm oil, beef, soybean and pulp and paper. It supports commitments by partners to reduce deforestation in tropical forest countries and was founded in 2012 after The Consumer Goods Forum (CGF)⁴¹ committed in 2010 to zero net deforestation by 2020.
- **The “Soft Commodities” Compact**
The compact is a joint initiative of the Banking Environment Initiative (BEI) and CGF, mobilizing the global banking industry to help remove deforestation from soft commodity supply chains and achieve zero net deforestation by 2020.
- **New York Declaration on Forests**
In 2014, world leaders (close to 200 governments, financial institutions, companies at all points of the supply chain, and influential civil society and indigenous organizations) committed to cut natural forest loss in half by 2020, and to strive to end it by 2030. Concrete commitments and partnerships were also announced and are being implemented.
- **Field to Market Fieldprint Projects**
Field to Market: The Alliance for Sustainable Agriculture works in the U.S. with grower groups, retailers and other supply chain businesses, along with civil society, academia and public sector partners
- **Midwest Row Crop Collaborative**
Announced in 2016, this coalition of companies (Cargill, General Mills, Kellogg Company, Monsanto, PepsiCo and Walmart) and conservation groups (Environmental Defense Fund, The Nature Conservancy and World Wildlife Fund) is focused on supporting and accelerating sustainable solutions that address various environmental impacts from farming. The coalition will focus on three states: Illinois, Iowa and Nebraska, which produce nearly 44 percent of corn, soy and wheat. This region also sends 422 million kilogram/year of nitrogen downstream, which ultimately contributes to the annual Gulf of Mexico dead zone.⁴²
- **Adapt Network**
This collaboration of land grant university experts, farm advisors and NGOs works with farmers to help them fine-tune fertilizer application and use nutrients more efficiently.⁴³
- **to promote continuous improvement in row crop production practices using an outcomes-based approach. Projects in the U.S. are collecting data on several key science-based indicators, with supply chain members providing support for continuous improvement efforts by growers. Its Supply Chain Sustainability Program enables companies to benchmark sustainability performance, catalyze continuous improvement and measure and report out on progress against environmental goals.**

2. ENGAGE DIRECTLY WITH PRODUCERS

Where companies have visibility into their supply chains, companies can work with suppliers and supporting industries (e.g., farm equipment, soil amendment or irrigation companies) to promote better management practices. One option is to provide financial incentives or develop joint projects with growers to promote conservation tillage, cover crops⁴⁴ and appropriate application of agrochemicals. For example, the Unilever/ADM Sustainable Soy Continuous Improvement Program helps Iowa soybean farmers who want to start or expand the use of cover crops by helping pay for the cost of cover crop seed.⁴⁵ As another example, Smithfield, Campbell's, Unilever and General Mills are collaborating upstream with United Suppliers (a cooperative of agricultural retailers that's part of Land O'Lakes) to give growers access to a platform called SUSTAIN that provides field-tested products, technologies and agronomic practices for improving nutrient use efficiency, soil health and productivity.

3. SUPPORT GOVERNMENT POLICIES

Companies can support sustainability policies in producer countries. In the U.S. for example, this might mean promoting funding for voluntary conservation programs. In Brazil, it would include supporting implementation of land-use policies (e.g., the Forest Code). Additional recommendations for actions linked to government policies are included in *Soybean overlooked? The investor case for deforestation-free soy*.

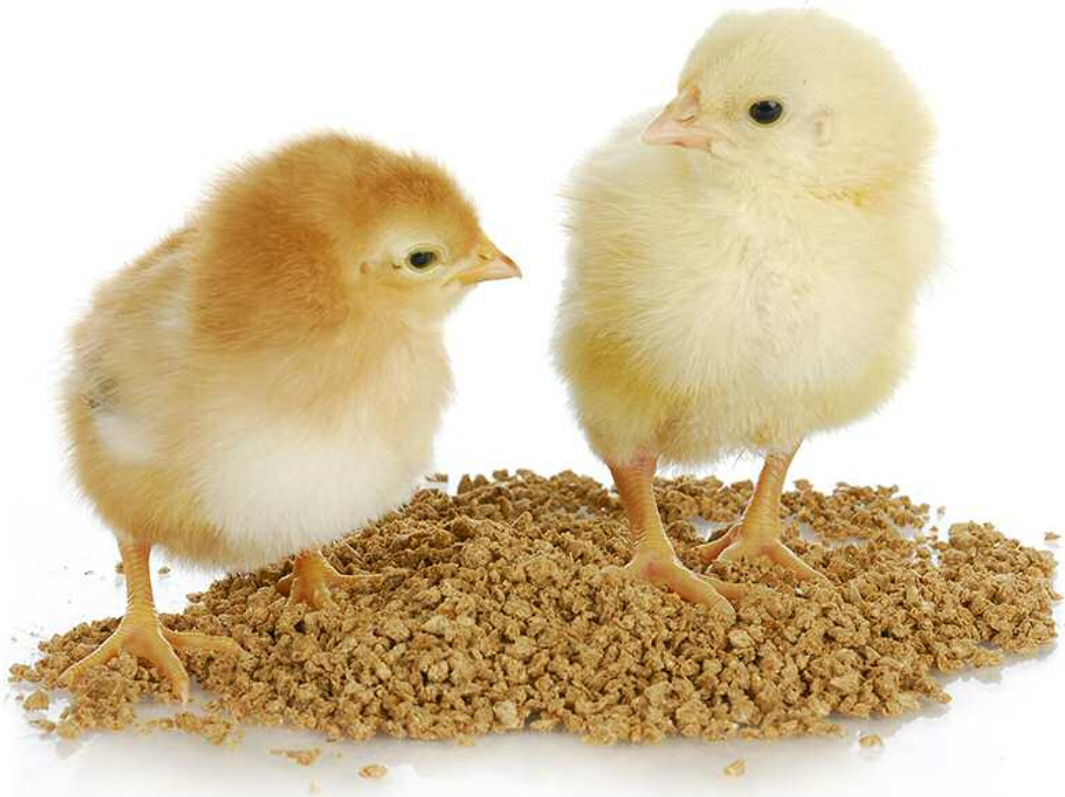
4. ENCOURAGE USE AND DEVELOPMENT OF SUSTAINABILITY STANDARDS

A diversity of soybean production systems presents a challenge for adoption of a single global standard. Five major international third-party standards apply to soybean production,⁴⁶ including: [Roundtable on Responsible Soy \(RTRS\)](#), Danube Soya Initiative, ProTerra, Fairtrade and organic standards.⁴⁷ 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.⁴⁸ Also, 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.

Ceres has not evaluated the robustness and effectiveness of these standards but is providing them as options to consider. Ideally, standards are comprehensive and focused on measuring improvements across environmental as well as social issues.

COMPANIES IN ACTION

- **Unilever USA** has committed to source 100 percent of its soy sustainably by the end of 2017. In the U.S., soybeans are its most important agricultural raw material as the oil is used in Hellmann's mayonnaise.⁴⁹ As part of this commitment, Unilever is partnering with ADM and other important stakeholders in a program promoting continuous improvement (in 2014, 100 farmers, representing 160,000 acres, were enrolled).⁵⁰
- **McDonald's** in Europe is striving for 100 percent sustainably certified soy in its chicken meat supply chain by 2020. In 2014, its suppliers of chicken products purchased more than 58,000 RTRS credits, which covered about 20 percent of its soy needs.⁵¹
- **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 Southeast grain-sourcing acres participate in a fertilizer optimization and soil health program by 2018.⁵²
- Grain traders **ADM**, **Bunge** and **Cargill** have made soybean-related commitments, which include eliminating deforestation from their supply chains and protecting indigenous rights. These are being implemented through partnerships focused on ensuring improvement on the ground.⁵³



ADDITIONAL RESOURCES

- 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).⁵⁴ It uses existing aggregated data collected from farmers nationwide who participate in national conservation programs.⁵⁵ As of May 2016, 95 percent of U.S. soybean producers participate in the U.S. Farm Program and are subject to audit.⁵⁶
- 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.
- The [Plowprint Report](#) (2016) 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.
- [Soya and the Cerrado: Brazil's Forgotten Jewel](#) (2011) by WWF-UK, which analyses the impacts on the Cerrado from soybean expansion.
- [Strategies for reducing the negative impacts of soy production: Responsible soy production](#) (2010) by The Dutch Soy Coalition provides background on various certification efforts related to soybean production.
- 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](#) (2015) 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).

[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.



ENDNOTES

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