An Investor Brief on Impacts that Drive Business Risks:

BEEF

ENGAGE the CHAIN
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This brief provides a summary of the main environmental and social factors that affect beef 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**

- Demand for beef is expanding, propelled by rising incomes and population growth.
- The U.S. and Brazil are the two largest producers of beef worldwide.
- Beef production generates significant greenhouse gas emissions and wastes that contribute to water pollution, when handled poorly.
- Beef production also uses a lot of water. In the U.S., water availability is one of the key issues affecting beef production.
- The production of feed for beef and cattle uses a lot of land and also drives deforestation in countries like Brazil.
- Investors should address risk in the beef supply chain through direct engagement with their portfolio companies and support of relevant policies and multi-stakeholder collaborations. Effective implementation of a company’s policies requires promoting commodity traceability and having a clear approach to supplier engagement, verification and disclosure of progress.

**COMMODITY OVERVIEW**

*Beef is the Third Most Commonly Consumed Meat in the World, After Pork and Chicken*

Beef products are typically sold as wholesale cuts, ground beef for commercial use, or packaged cuts sold in retail outlets.¹

Beef byproducts, including leather and fat, are used for many non-food items, including candles, crayons, paint and shoes.

Global Meat Production (based on metric tons)²

- **36%** Pigs (Pork)
- **33%** Chicken
- **20%** Cattle (Beef)
- **12%** Other
The U.S. and Brazil are the Largest Producers of Beef, Accounting for One-Third of Global Production

On average, less than 5 percent of beef is exported globally, given the heavy weight of beef, trade policies, concern about spoilage and potential cold chain failures.

**TOP FIVE PRODUCTION REGIONS**

- **17%** U.S.
- **15%** Brazil
- **10%** China
- **4%** Australia
- **4%** Argentina
- **50%** Other

**65 MILLION METRIC TONS**
Average global beef production

**$308 BILLION**
Global production value

**3 PERCENT**
Proportion of global production exported

*Rising Incomes Globally Drive Beef Demand and Production*

Globally the demand for beef during the next several decades is expected to continue (by approximately 60 percent by 2050). This increase is driven in large part by a growing global population, rising incomes, urbanization and westernization of diets in developing countries.

*BEEF AND DAIRY SECTORS ARE LINKED IN SOME COUNTRIES*

When assessing beef production trends, it is important to keep in mind that in some countries, the beef industry is highly dependent on the dairy sector. This is the case in New Zealand and Europe, for example, where 80 percent of the total beef supply comes from dairy animals (culled dairy cows and surplus male calves). By contrast, in the U.S., given abundant grasslands and a large grain supply, the beef industry is not as closely linked to the dairy sector. An estimated 17 percent of all beef calories produced in the U.S. originated in the dairy system.
The Beef Supply Chain is Complex, Involving Numerous Steps and Types of Operations

**THE BEEF VALUE CHAIN**

**STAGE OF VALUE CHAIN**
- **AGRICULTURAL PRODUCTION**
- **TRANSPORT, PROCESSING, PACKAGING & DISTRIBUTION**
- **RETAIL & CONSUMPTION**

**SIMPLIFIED BEEF VALUE CHAIN**
- **RANCHING OPERATIONS (AND PRODUCTION OF ANIMAL FEED)**
- **MEAT PACKING & PROCESSING FACILITIES**
- **WHOLESALE MEAT, GROUND BEEF, PACKAGED CUTS**
- **NON-FOOD USES (OF BYPRODUCTS, INCLUDING LEATHER & FAT)**
- **FOOD RETAILERS & OTHER OUTLETS**

**SOME KEY COMPANIES IN U.S. FOOD VALUE CHAIN**

**Feed Companies**
- ADM
- Alltech
- Cargill
- Purina Animal Nutrition
- Tyson Foods

**Meat Packers & Processors**
- American Foods Group
- Cargill
- Conagra Brands
- Hormel Foods
- JBS USA
- National Beef
- Tyson Foods

**Restaurants**
- Burger King
- Carl’s Jr./Hardee’s
- McDonald’s
- Sonic
- Wendy’s

**Retailers**
- Ahold Delhaize USA
- Albertsons
- Kroger
- Walmart
The following provides additional information about some of the companies in the U.S. beef 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.

**RANCHING OPERATIONS**

Before cattle are slaughtered by meat-packing or meat-processing companies, they are raised and handled at three distinct types of ranching operations: cow-calf operations, stocker and backgrounding operations, and feedlot operations.

Feedlots with less than 1,000 head of capacity compose the vast majority of U.S. feedlots, but market a relatively small share of fed cattle. In contrast, lots with 1,000 head or more of capacity compose less than 5 percent of total feedlots, but market 80- to 90-percent of fed cattle. While there are many businesses involved in this sector, the top five states with large cattle feedlots (with a capacity more than 1,000 head) are: Texas, Nebraska, Kansas, Colorado and Iowa.

**FEED COMPANIES**

Companies that supply animal feed are critical actors in the beef supply chain. Beef raised in the U.S. is primarily finished on grains, including corn, soybeans and alfalfa (by comparison, beef produced in Brazil is mostly grass-finished). The five largest U.S. animal feed producers are Cargill (privately held), Purina Animal Nutrition (subsidiary of Land O’Lakes, a member cooperative), Tyson Foods, Alltech (privately held) and Archer Daniels Midland (ADM). Collectively, these companies produce approximately 50 million metric tons of feed annually.

**BEEF PACKERS AND PROCESSORS**

The U.S. beef packing industry is highly concentrated. Four companies control the large majority of beef slaughtering operations: Tyson Foods, JBS USA (headquartered in Brazil), Cargill (privately held) and National Beef (owned by Marfrig, which is headquartered in Brazil). Other large companies involved in processing beef include Hormel Foods, Conagra Brands and American Foods Group (privately held).

**RESTAURANTS AND RETAILERS**

Restaurants and retailers play an important role in the beef value 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.

Roughly two-thirds of the U.S. beef supply goes into foodservice—restaurants and cafeterias—while the other third is sold in supermarkets. The five largest hamburger chains in the U.S. are McDonald’s, Burger King (headquartered in Canada), Wendy’s, Sonic and Carl’s Jr./Hardee’s (privately held). In terms of supermarkets, the four largest food retailers in the U.S. are Walmart, Kroger, Albertsons and Ahold Delhaize.
Globally, the environmental and social issues linked to beef production include deforestation and land conversion, greenhouse gas (GHG) emissions, water pollution, animal welfare and worker’s rights. The scale of the impacts depends on the practices used by ranching operations and feed growers, as well as regional and local conditions.

**REGIONAL CONTEXT MATTERS**

*When assessing risks to U.S. companies, it is important to keep in mind that most beef consumed in the U.S. is from cattle raised in the U.S. However, the impacts and risks linked to cattle raised outside the U.S. are also relevant to U.S.-based companies that operate in other markets. U.S.-headquartered beef packers and processors operate globally and U.S. imports may include beef produced elsewhere.*
1. CATTLE AND THEIR MANURE CONTRIBUTE SIGNIFICANTLY TO GREENHOUSE GAS EMISSIONS

Beef production has a significant impact on climate change, accounting for 5.9 percent of total manmade greenhouse gas emissions.27

- Cattle contribute directly to greenhouse gas emissions when they digest their feed and produce manure. Fertilizers and energy used for growing the animal’s feed also contribute to total greenhouse gas emissions.
- More than half of the global emissions from the livestock sector are related to beef and cattle milk (beef accounts for 41 percent; dairy cows for 20 percent).28

When calculating a “greenhouse gas footprint” for beef in any particular operation, it is important to understand how the cattle are raised, because their type of feed and other management practices affect the amount and type of greenhouse gas emissions generated.29 Companies that fail to understand and manage impacts related to these issues may face litigation and operational risks (see more at Ceres’ Agricultural Supply Chains as a Driver of Financial Risks).

2. BEEF PRODUCTION CONTRIBUTES TO LAND CONVERSION AND SOIL DEGRADATION

Raising beef uses more land—between three to ten times more—than any other meat, including chicken and pork.30 Permanent pastures31 (much of it used for cattle) make up 70 percent of all the land used for agriculture.32 Overgrazing, soil compaction from cow’s hooves and poor agricultural practices can degrade topsoil and organic matter, which can take decades or centuries to be replaced.

When beef is raised in sensitive and important ecosystems, including the North American Great Plains, Brazilian Cerrado, the savannahs of Southern Africa and the Great Barrier Reef watershed of Australia, the impact of beef production can be significant.33 In the Chaco mixed grass and woodlands of Paraguay and Argentina, between 1976 and 2011, more than 29 million acres of habitat were converted largely first for the production of beef and then soy, a feed source for livestock. In Brazil, cattle ranching occupies about 80 percent of the deforested area in the Amazon, and it has led to the conversion of nearly 200 million acres of Cerrado habitat.34 While significant progress has been made in Brazil in the last decade to cut this high right of deforestation (for example, through collaborations like the Soy Moratorium), ongoing action to avoid further clearing of new land is required.35 Companies that fail to understand and manage impacts related to these issues may face market, litigation and reputational risks (see more at Ceres’ Agricultural Supply Chains as a Driver of Financial Risks).

While poorly managed production can contribute to land conversion and soil degradation, sustainably managed beef production can achieve conservation benefits in some regions. Grazing can maintain the health of grasslands, improve soil quality with manure and preserve open space and wildlife habitat. Additionally, carbon is sequestered in the grasses and soils of grazing lands, a process which actively slows the accumulation of greenhouse gases.36

U.S. SPOTLIGHT — ANIMAL DENSITY IMPACTS

In 2017, the U.S. produced approximately 26 billion pounds of beef,37 and at the start of 2018, there were nearly 32 million beef cattle.38 As animal density has increased in the U.S. (about 100 lots contain over 30,000 cattle), so have concerns about air and water quality, occupational health and waste management.39
3. POOR HANDLING OF MANURE, FERTILIZER AND PROCESSING WASTES POLLUTE LOCAL WATER RESOURCES

Cattle operations can contribute significantly to water pollution when manure and feed crop production are poorly managed. The nitrogen and phosphorus nutrients from the manure and synthetic fertilizers used to grow crops can run off fields or leach into the water. This contributes to “dead zones,” or areas of water bodies where aquatic life cannot survive because of low oxygen levels. Specifically in the Gulf of Mexico (into which runoff from production in the Mississippi River watershed flows), the National Oceanic and Atmospheric Administration (NOAA) reported that the dead zone in July 2017 was the largest ever measured, covering an area about the size of New Jersey.41

Not only are these dead zones harmful for aquatic life, but they pose serious human health risks and contaminate local drinking water supplies. The economic impact is significant with NOAA estimating that the harmful algae blooms causing dead zones cost the seafood, restaurant and tourism industries about $82 million every year.42

Surface water and groundwater can also be contaminated by sediment from poor grazing management. Moreover, as the global cattle industry expands, so have the beef slaughter and leather industries. Slaughterhouse and tannery waste—rich in organic matter, heavy metals and caustic solutions—is highly polluting to local water resources when it isn’t treated.43

Companies that fail to understand and manage impacts related to water pollution may face operational, reputational and regulatory risks (see more at Ceres’ Feeding Ourselves Thirsty).

4. HIGH WATER DEMAND RELATED TO BEEF PRODUCTION CONTRIBUTES TO VULNERABILITY DURING DROUGHTS AND GROUNDWATER DEPLETION

Producing beef uses a lot of water—for irrigating pastures, producing feed, watering animals, managing manure and processing products. Though beef’s “water footprint” varies based on production and feeding systems, in most cases the crops used as cattle feed make up a large part of that footprint.44 Among the different feed crop options, corn and alfalfa use the largest volume of irrigation water.45

As water stress increases, the vulnerability of beef production to drought and competition for other uses can increase:

• In early 2018 nearly 40 percent of cattle inventory in the U.S. was within an area experiencing drought.46

• During the drought in California in 2014, dry pastures and higher hay and silage costs caused $203 million in revenue losses for the dairy and livestock sector.47

• Several states in the U.S., including Colorado, Kansas and Texas, have a large number of cattle feedlots that rely on the already stressed Ogallala aquifer. About one-fifth of all U.S. cattle, corn, cotton and wheat depend on the Ogallala.48

Companies that fail to understand and manage impacts related to these issues may face operational, reputational and regulatory risks (see more at Ceres’ Feeding Ourselves Thirsty).
It Takes

14,964 LITERS OF WATER

To Produce

1 KG BEEF

(Weighted Global Average)49,50

U.S. SPOTLIGHT — OVERALL FOOTPRINT

One study calculated that beef production in the U.S. requires 28 times more land, 11 times more irrigation water, 5 times more greenhouse gases and 6 times more reactive nitrogen, respectively, than other livestock categories (i.e., dairy, poultry, pork and eggs).51

5. ANIMAL HEALTH AND WELFARE52 ISSUES SPUR CONSUMER AND PUBLIC HEALTH CONCERNS

Several animal health and welfare issues can create major reputational and regulatory risks for companies:

• Significant media attention has put the spotlight on “factory farming” and the industrialization of the beef business.53 A majority of consumers care about animal welfare, according to surveys in Europe and North America, which creates a risk of contracts by corporate customers being terminated to meet consumer pressure.54 In addition to the possible reputational risk, issues related to animal welfare link to food safety and drug use and are therefore critical for companies to take into account as a part of a comprehensive operational risk management strategy.55

• Routine, nontherapeutic use of antibiotics in food animal production is contributing to a growing crisis of antibiotic-resistant infections in humans.56 By contrast, the therapeutic use of antibiotics is shown to have positive effects on animal health and welfare. In the U.S., for example, 75 percent of all antibiotics are given to farmed animals. The misuse of these drugs for nontherapeutic purposes poses a business risk not only from a reputational perspective but also with respect to emerging regulatory and trade restrictions.57

• The use of growth-promoting hormone implants, designed to improve an animal’s weight gain and feed efficiency may contribute to consumer concern and therefore reputational risk.58

6. FARM ACTIVITIES CAN CREATE HAZARDOUS WORKING CONDITIONS AND AIR QUALITY CONCERNS

On ranches and farms, the greatest safety issues arise from operating heavy equipment and handling animals. In 2016, 46 people in the U.S. were killed while working in beef cattle ranching and farming, including feedlots. This represents around 11 percent of fatal injuries taking place in the agricultural sectors.59 Dust generated by animals and their feed, along with gases from animal wastes can be hazardous to human and animal health.60 The particulate matter and odor from farm activities can also negatively impact air quality.
7. HUMAN RIGHTS CHALLENGES COULD CONTRIBUTE TO CONSUMER CONCERN AND REPUTATIONAL RISK

Cattle and beef are reportedly produced with forced labor and/or child labor in a number of countries. U.S. companies face reputational, market and litigation risks if importing beef from countries where these challenges occur. Brazil is one of the countries that is an important exporter of beef to the U.S. and for which there is documented evidence of child labor.

8. SMALL PRODUCERS LACK ACCESS TO RESOURCES, LIMITING THEIR LIVELIHOODS AND ABILITY TO INVEST IN IMPROVED PRACTICES

In some countries, small producers are the largest producers of beef. They often don't have access to the resources they need to sustain their livelihood and invest in improving farming and cattle raising practices. In Brazil, for example, about 1.8 million ranchers raise cattle, with an average of only 110 heads of cattle per ranch. Small producers also may face other challenges, including limited grazing and resource rights as well as access to credit, fair pricing, extension services and cold chain infrastructure. Lack of attention to the issues involved with smallholder production can lower both the quality and quantity of supply for agribusinesses.
COLLABORATIVE INITIATIVES

Many players, including buyers, producers, governments, NGOs and communities understand the business risks at play and are collaborating to ensure the long-term sustainability of beef production.

MULTI-STAKEHOLDER SUSTAINABILITY EFFORTS

One of the most significant multi-stakeholder efforts focused on beef is the Global Roundtable for Sustainable Beef (GRSB). It was launched in 2012 and approved a definition for sustainable beef along with global principles and criteria in late 2014. Drawing on this global framework, regional roundtables are currently developing key indicators and metrics to measure sustainability progress. These roundtables include the U.S. Roundtable for Sustainable Beef (USRSB), Grupo de Trabalho da Pecuária Sustentável (GTPS; Brazil’s sustainable beef roundtable), the Canadian Roundtable on Sustainable Beef (CRSB) and similar groups in other beef-producing regions.

With respect to the U.S. beef value chain, the USRSB does not mandate standards nor verify individual stakeholder performance. However, it is identifying sustainability indicators, establishing verification methodologies, generating field project data to test sustainability concepts and providing a forum for discussion and information exchange. While the USRSB is an important step to promoting sustainable production practices, concern was expressed in the summer of 2018 by a coalition of 50 environmental, consumer, public health, justice and animal welfare groups that the USRSB doesn’t adequately address the impacts related to beef production including the need for effective state and federal policies. 66

In 2016, the Collaboration for Forests and Agriculture (CFA) was formed with a goal to define standards and outline incentives for the production of zero-deforestation beef and soy. The focus is on production in the Amazon and Cerrado regions in Brazil, and in the Gran Chaco region spanning Argentina and Paraguay. Funded by the Gordon and Betty Moore Foundation, the NGOs involved include the National Wildlife Federation (NWF), The Nature Conservancy (TNC) and World Wildlife Fund (WWF) as well as strategic corporate partners.

ADDRESSING DEFORESTATION ACROSS MULTIPLE COMMODITIES

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

- **Tropical Forest Alliance 2020 (TFA)**
  TFA is a global umbrella partnership that brings together governments, the private sector and civil society organizations to remove deforestation from palm oil, beef, soybean and pulp and paper. TFA supports commitments by partners to reduce deforestation in tropical forest countries and was founded in 2012 after The Consumer Goods Forum (CGF)67 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 forests loss in half by 2020, and to strive to end it by 2030. Concrete commitments and partnerships were also announced and are being implemented.

- **The Accountability Framework**
  The framework is being developed by a coalition of environmental and social NGOs in consultation with private companies, governments and other stakeholders. It is designed to harmonize deforestation definitions and concepts across high forest risk commodities and geographies. This process includes aligning with important regional initiatives such as the Deforestation/Conversion Free Protocol for beef and soy in South America being designed by CFA.
SUSTAINABILITY STANDARDS

There are several third-party sustainability standards relevant for beef production, including:

- The USDA National Organic Program’s standards include that animals are raised in living conditions that accommodate their natural behaviors, such as grazing on pastures, are fed 100 percent organic feed and forage, and aren’t given unnecessary antibiotics or hormones.68

- The Animal Welfare Approved as well as Certified Human Raised and Handled® labels apply to a range of meat products that come from farm animals raised in line with animal welfare and environmental standards.

- The Standard for Sustainable Cattle Production Systems was developed in 2010 by the Rainforest Alliance/Sustainable Agriculture Network (SAN) and applies to beef and dairy production systems in the tropics.69 The SAN standard is aligned with another standard under development by the Grasslands Alliance for beef cattle grazing operations in the U.S. and Canada.70
Only a few of the largest meat producers and processors have developed robust policies and processes to manage the risks associated with beef production and are lagging behind the broader food industry in this respect. In order to understand and address a company's supply chain risks, companies should have broad policies in place and a commitment to traceability.

A report on traceability (Zooming In) by Ceres and Supply Change assessed 800 companies sourcing cattle, palm oil, soy and timber and pulp. It found 469 have commitments to address deforestation; however, less than half of these companies (208, 44 percent) have made statements of traceability intent to manage their deforestation risks. Moreover, among those companies with a statement of traceability intent, only 98 (47 percent) companies have made clear and actionable commitments to carry out traceability.

In order to mitigate reputational risk and combat deforestation in supply chains, a company's policy and commitments to traceability should apply to all members of the supply chain (i.e., to direct suppliers as well as the extended supply chain). Companies are therefore increasingly collaborating with suppliers as well as other stakeholders. This includes finding ways to support suppliers as they take the steps needed to uphold 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.
• **McDonald’s** has made several commitments to improving beef production.

  - In 2011, McDonald’s helped found the Global Roundtable for Sustainable Beef (GRSB) and in 2016, the company began to purchase a portion of its beef from verified sustainable sources. In early 2017, it announced a 2020 aspiration to ‘support sustainable beef production’, which includes setting specific country-based beef sustainability targets in 10 countries.72
  - In 2017, 100 percent of the facilities from which the company buys beef (as well as poultry and pork) passed audits that complied with McDonald’s animal welfare standards.73

• **Walmart** has adopted an animal welfare policy and developed a position on responsible use of antibiotics in farm animals in the U.S. It has committed that, by the end of 2020, beef sourced from Brazil will be zero net deforestation and is working to create a dedicated sustainable beef supply chain for 15 percent of its beef sales in the U.S. It is also developing expectations for responsible labor practices with suppliers.74

• **Cargill** has committed to reduce in beef production the use of antibiotics medically important to human health. It does not use growth promoting antibiotics—that are medically important—in the cattle it owns or its partnership cattle. It is also encouraging other cattle feeders to evaluate their use of antibiotics.75
The U.S. Department of Agriculture conducts research on multiple commodities, including beef. 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 beef.

A number of benchmarking and evaluation tools provide insights about companies involved in beef production. These include:

- The Coller FAIRR Protein Producer Index by the Farm Animal Investment Risk & Return (FAIRR) investor network assesses how some of the world’s biggest, publicly listed producers and processors of meat and fish (a $300 billion group of 60 companies) are managing critical sustainability risk factors.

- The Business Benchmark on Farm Animal Welfare Report (2017) provides an annual evaluation of food company’s actions on farm animal welfare. In the 2017 report, 110 companies were assessed. Of the companies with significant operations in the U.S., Cargill, JBS, McDonald’s and Unilever are ranked as having the strongest commitments to farm animal welfare.

- Flunking the Planet: America’s Leading Food Companies Fail on Sustainable Meat (2018) by Mighty Earth assesses the nature of policies in place at the largest fast food, grocery and food service companies in the U.S. to reduce the environmental consequences of their meat supply chains.

- Cattle, Cleared Forests, and Climate Change: Scoring America’s Top Brands on Their Deforestation-Free Beef Commitments and Practices (2016) by the Union of Concerned Scientists scores the policies and practices of thirteen U.S. focused fast food, retail and manufacturing companies who source beef from South America.

- SCRIPT (the Soft Commodity Risk Platform) by Global Canopy in partnership with WWF and Ceres provides tools and guidance to help financial institutions screen their portfolios to determine the companies and issues that pose the greatest risk to their institutions, while recommending engagement priorities. It was launched with the support of CDP and the Sustainability Policy Transparency Toolkit (SPOTT) as data partners.

- Zooming In: Companies, Commodities & Traceability Commitments That Count (2018) by Forest Trends’ Supply Change Initiative and Ceres analyzed how companies that are committed to addressing commodity-driven deforestation are tracing supplies to their origin so they can determine the impact their supply chains have on forests.

- Grazed and confused? Ruminating on cattle, grazing systems, methane, nitrous oxide, the soil carbon sequestration question - and what it all means for greenhouse gas emissions (2017) by Food Climate Research Network at the University of Oxford explores the range of issues related to the role of different cattle production systems in contributing to, or mitigating climate change.
• *A Path Towards Zero Deforestation Cattle* (2015) by the National Wildlife Federation (NWF) and the Gibbs Land Use and Environment Lab (GLUE) focuses on beef, leather, and tallow production in the Brazilian Amazon and highlights how supply chain initiatives are supporting effective solutions for zero deforestation.


• *Tackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities* (2013) by the UN Food and Agriculture Organization (FAO) provides an in-depth analysis of issues and practical solutions for reducing greenhouse gas emissions related to livestock, including beef cattle. This report provides more recent data than the oft-quoted 2006 FAO report, *Livestock’s Long Shadow*.

*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 time cattle spend in a feedlot is often called the "finishing phase." For further details about the various stages of beef production, see the side box titled: Stages of Beef Production.


National Cattlemen's Beef Association, "Directions", [http://www.beefusa.org/CMDocs/BeefUSA/Producer%20Ed/Directions_fall16%20Stats.pdf](http://www.beefusa.org/CMDocs/BeefUSA/Producer%20Ed/Directions_fall16%20Stats.pdf)


In cattle feedlots, beef cows feed on grain and other concentrates from 90 to as long as 300 days. For further details, see: USDA Economic Research Services, Cattle & Beef - Background, 2017, [http://www.ers.usda.gov/topics/animal-products/cattle-beef/background.aspx](http://www.ers.usda.gov/topics/animal-products/cattle-beef/background.aspx)

National Cattlemen's Beef Association, "Directions", [http://www.beefusa.org/CMDocs/BeefUSA/Producer%20Ed/Directions_fall16%20Stats.pdf](http://www.beefusa.org/CMDocs/BeefUSA/Producer%20Ed/Directions_fall16%20Stats.pdf)


*Note: Ranking is based on sales, as reported in Progressive Grocer, May 2018,* [https://progressivegrocer.com/top-50-grocers-amazon-7th-place-while-rest-industry-restragizes-reshuffles](https://progressivegrocer.com/top-50-grocers-amazon-7th-place-while-rest-industry-restragizes-reshuffles)


31 Max Roser, "Land Use in Agriculture", OurWorldInData.org, 2016, [http://ourworldindata.org/data/food-agriculture/land-use-in-agriculture/#note-16](http://ourworldindata.org/data/food-agriculture/land-use-in-agriculture/#note-16), Note: Permanent pastures are used for five years or more to grow herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land).


37 USDA Economic Research Service, Livestock, Dairy, and Poultry Outlook, July 18, 2018


40 Note: "Dead zones" are created when a body of water becomes enriched by inorganic plant nutrients, especially phosphates and nitrates, and the resulting growth of algae reduces oxygen for aquatic plant and animal life.


50 Note: Represents the combined "blue" and "green" footprints of beef


52 Note: While there is no common definition of animal welfare, the concept of the “five freedoms” form a widely accepted set of principles or targets: (1) Freedom from Hunger and Thirst (2) Freedom from Discomfort (3) Freedom from Pain, Injury or Disease (4) Freedom to Express Normal Behavior (5) Freedom from Fear and Distress.


55 FAIRR, "Coller FAIRR Protein Producer Index Report", 2018


57 FAIRR, "Responding to resistance: Investor exposure to antibiotic risk, and FAIRR's engagement with the restaurant sector", November 2017


67 *Note: CGF is a global network that brings together the CEOs and senior management of some 400 retailers, manufacturers, service providers, and other stakeholders across 70 countries. Its member companies have combined sales of EUR 3.5 trillion.*


70 Grasslands Alliance, http://grasslandsalliance.org/

71 A Path Towards Zero Deforestation Cattle, "Forest 500: Retailer Rankings on Cattle (Beef and Leather)" http://www.zerodeforestationcattle.org/#/reading/ch6t1; FAIRR "Coller FAIRR Protein Producer Index Report", 2018


76 Union of Concerned Scientists, "Cattle, Cleared Forests, and Climate Change: Scoring America's Top Brands on Their Deforestation-Free Beef Commitments and Practices"

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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.

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