



An Investor Brief on Impacts
that Drive Business Risks:

DAIRY

ENGAGE *the* CHAIN

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This brief provides a summary of the main environmental and social factors that affect dairy 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

- Global demand for dairy is expected to increase by approximately 60 percent by 2050, driven by population growth and rising incomes.
- The greenhouse gas emissions from dairy production are significant. In the U.S., the dairy industry accounts for around 2 percent of the country's total GHG emissions. More than half of dairy's GHG emissions are generated from crop production for animal feed, from methane produced by cows digesting their feed and from their manure.
- Dairy production can contribute to water pollution when manure and synthetic fertilizer (used for crops to feed cows) are not managed properly.
- Water scarcity poses risks to dairy production. In the U.S., the dairy industry accounts for 5 percent of total water withdrawal, over 90 percent of which is used to produce feed for cows.
- Investors should address risk in the dairy supply chain through direct engagement with their portfolio companies and by supporting relevant policies and multi-stakeholder collaborations.

COMMODITY OVERVIEW

Processed Milk, Butter, Cheese and Curd Dominate the Global Dairy Market¹

U.S. DAIRY REVENUE BY SEGMENT²

In the U.S., the three biggest dairy product segments (based on revenue) are cheese (about 40 percent), milk and milk products (35 percent) and dry and condensed milk products (20 percent).³

Other common products sold in the U.S. include butter, ice cream, cottage cheese and yogurt.⁴

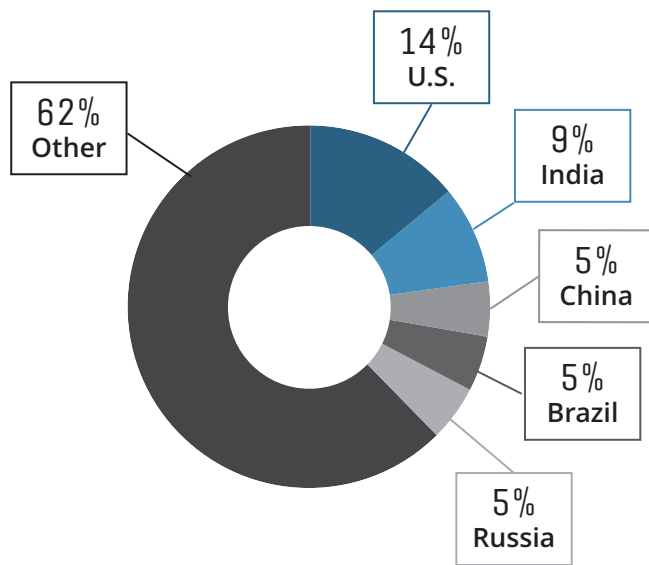
Given the importance of freshness, consumers primarily buy domestically raised milk—less than 10 percent of whole fresh milk is traded globally.⁵



GLOBAL PRODUCTION DATA

The U.S. and India are the Two Biggest Producers of Whole Fresh Milk
(though together they account for less than 25 percent of total production).

TOP FIVE PRODUCTION REGIONS⁶



628 MILLION METRIC TONS

Average global production of whole fresh milk, 2011-2013⁷

\$261.7 BILLION

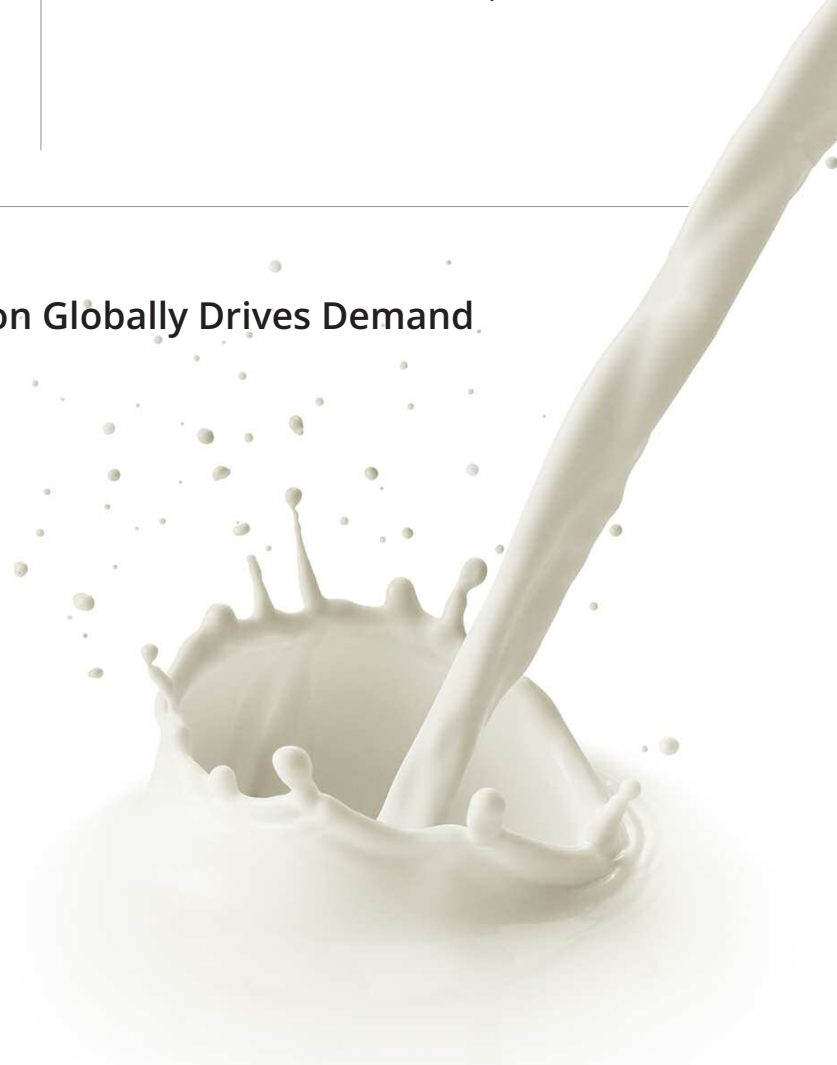
Global production value of whole fresh milk⁸

10 PERCENT

Proportion of global production of whole fresh milk exported⁹

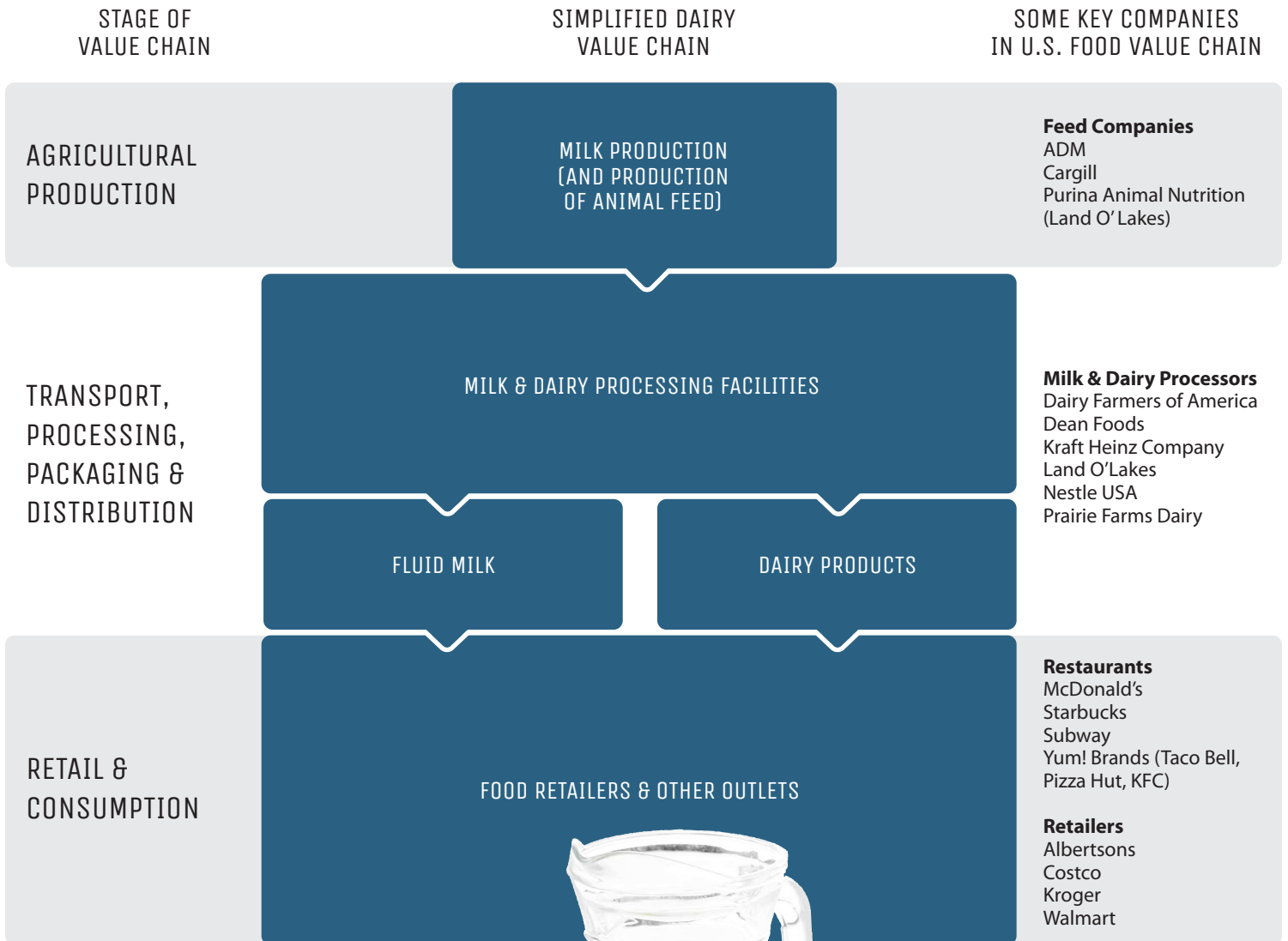
Rising Dairy Consumption Globally Drives Demand

Global demand for dairy is expected to continue increasing (by approximately 60 percent by 2050) in large part due to population growth, rising incomes, urbanization and westernization of diets in countries such as China and India.¹⁰ There are approximately 270 million dairy cows producing milk worldwide.¹¹



THE DAIRY VALUE CHAIN

Some Segments in the U.S. Dairy Products Value Chain are Highly Concentrated



KEY PLAYERS

The following provides additional information about some of the companies in the U.S. dairy 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.

FEED COMPANIES

Feed rations for U.S. dairy cows are made up of around 33 ingredients though the majority are [corn](#) (including a by-product called distiller's grains) and alfalfa.¹² About 35 percent of feed is grown by the dairy farmers themselves and the rest is purchased from other farmers, commodity markets and feed companies (two of the largest are Cargill and ADM).¹³

DAIRY FARMERS

The vast majority of U.S. dairy farms are family-owned and managed and are often members of producer cooperatives.¹⁴ In 2015, there were 43,000 dairy farms.¹⁵

MILK AND DAIRY PROCESSORS

There are more than 1,000 U.S. processing plants that turn raw milk into milk and dairy products, but these operations are highly concentrated.¹⁶ For example, the 50 largest fluid milk processors account for about 90 percent of segment revenue.¹⁷ A Dairy 100 report is issued annually listing the

largest dairy processors. Of the 10 largest processors operating in the U.S., four are publicly held. Three are headquartered in the U.S. (Dean Foods, Kraft Heinz Company and Kroger), with the largest headquartered in Switzerland (Nestle USA). Other processors are cooperatives (Land O'Lakes, Dairy Farmers of America, Prairie Farms Dairy) or privately held.

RESTAURANTS AND RETAILERS

Retailers and restaurants play an important role in the dairy 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 use high volumes of milk, cheese and cream for meals and beverages. In terms of quick-service and fast-casual restaurants, the four largest in the U.S. are McDonald's, Yum! Brands (Taco Bell, Pizza Hut, KFC), Starbucks and Subway. All are headquartered in the U.S.¹⁸ In terms of food retailers, the four largest in the U.S. are Walmart, Kroger, Costco and Albertsons.¹⁹

LARGEST U.S.-BASED DAIRY PROCESSORS, 2015²⁰

**Revenue is in USD (000,000)*

RANK	COMPANY	TYPE OF OWNERSHIP	REVENUE*
1	Nestle USA	Publicly Traded Company (CH)	9700.0
2	Dean Foods Co.	Publicly Traded Company	9503.2
3	Land O'Lakes Inc.	Cooperative	5098.1
4	Dairy Farmers of America Inc.	Cooperative	5005.0
5	Schreiber Foods	Privately Held Company	5000.0
6	Kraft Foods Cheese & Dairy Division	Publicly Traded Company	4066.0
7	Great Lakes Cheese Co.	Privately Held Company	3150.0
8	Leprino Foods Co.	Privately Held Company	3059.1
9	Prairie Farms Dairy	Cooperative	2993.0
10	The Kroger Co.	Publicly Traded Company	2901.4

U.S. SPOTLIGHT

U.S. milk production has steadily increased over the past several decades. At the same time, the number of dairy operations has declined and the number of cows per operation has risen.²¹ In 2015, there were 9.3 million dairy cows in the U.S.²² While milk is produced in all 50 states, the top five dairy states—California, Wisconsin, New York, Idaho and Pennsylvania—produce more than half.²³ The state of California alone accounts for about 20 percent of production. The farm value of milk production is significant, equaling that of corn production,²⁴ and the industry provides a significant source of revenue and jobs in several states.²⁵

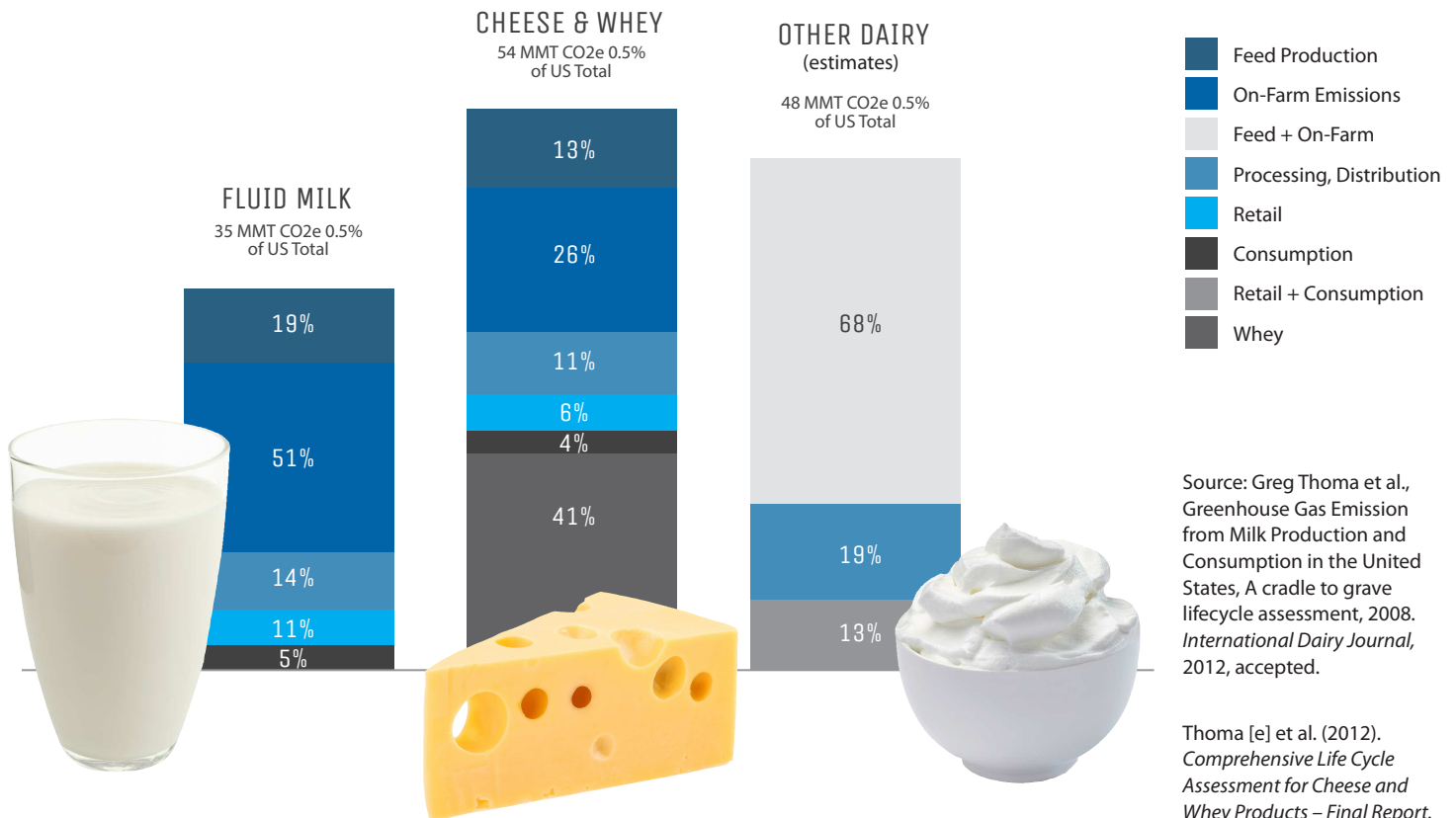
The Innovation Center for U.S. Dairy summarized the national environmental footprint of U.S. dairy in U.S. Dairy's

Environmental Footprint: A Summary of Findings, 2008-2012, noting that:

- GHG emissions of the entire dairy industry total approximately 137 million metric tons CO₂ eq per annum, or about 2 percent of total U.S. GHG emissions.
- More than half of the dairy industry's GHG emissions arise during on-farm activities and from feed production. The visual below details where in the value chain these emissions occur across several products.
- The dairy industry accounts for approximately 5 percent of U.S. water withdrawals (excluding thermal power), with more than 90 percent of this use linked to growing feed for cows (irrigation).

U.S. DAIRY CARBON FOOTPRINT – ALL PRODUCTS²⁶

Total emissions = 137 MMT (The entire dairy industry – farm to manufacturer's gate - contributes approximately 2% of total U.S. GHG emissions)



ENVIRONMENTAL AND SOCIAL FACTORS



CLIMATE CHANGE



WATER USE & POLLUTION



WORKING CONDITIONS



LAND USE & BIODIVERSITY



LIVELIHOODS



LAND RIGHTS



DEFORESTATION



 High Impact
  Medium Impact
  Low Impact

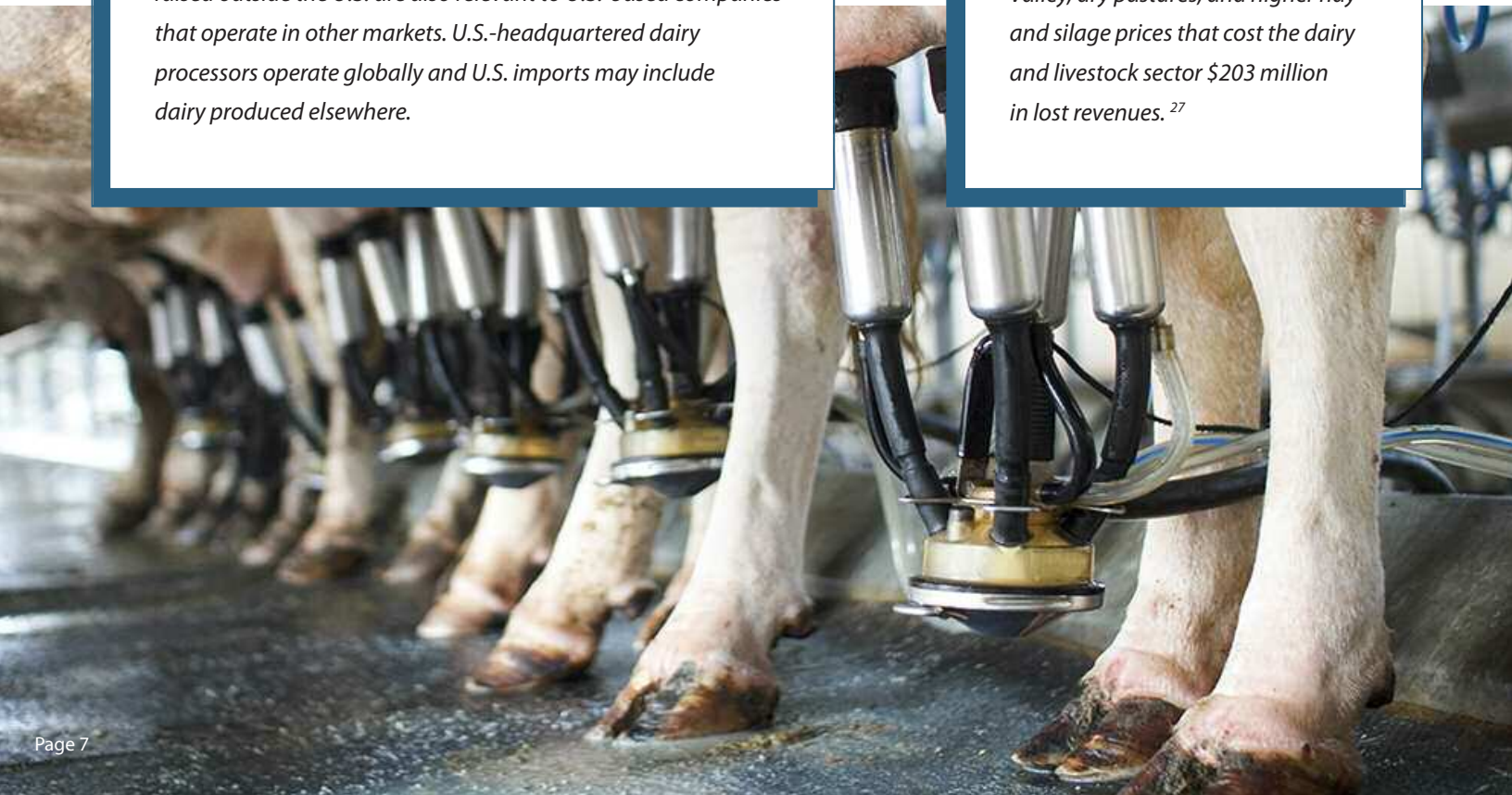
Globally, the environmental and social issues linked to dairy production include water pollution, groundwater depletion and land use impacts. The scale of the impacts depends on the practices used by individual dairy farmers and feed growers, as well as regional and local conditions.

REGIONAL CONTEXT MATTERS

When assessing risks to U.S. companies, it is important to keep in mind that most milk and dairy products are produced and consumed in the U.S. However, the impacts from dairy cows raised outside the U.S. are also relevant to U.S.-based companies that operate in other markets. U.S.-headquartered dairy processors operate globally and U.S. imports may include dairy produced elsewhere.

FINANCIAL IMPACTS

In the spring of 2014, California's record drought led to water restrictions in the state's Central Valley, dry pastures, and higher hay and silage prices that cost the dairy and livestock sector \$203 million in lost revenues.²⁷



1. DAIRY COWS AND THEIR MANURE GENERATE SIGNIFICANT AMOUNTS OF GHG EMISSIONS

Dairy production has a significant impact on climate change. Dairy cows release greenhouse gases when they digest their feed (enteric fermentation). Dairy operations contribute greenhouse gases during manure management (anaerobic decomposition of organic matter in manure). Fertilizers and energy used to grow feed also contribute to greenhouse gas emissions.²⁸

More than half of the global emissions from the livestock sector are related to beef and cattle milk (dairy cows

account for 20 percent; beef for 41 percent). Globally, cattle milk produces 1.42 gigatonnes of CO₂ eq per annum, representing 2.9 percent of human-induced GHG emissions.²⁹

When calculating a greenhouse gas footprint for a particular operation, it is important to take into account how the dairy cows are raised as changes in their feed composition and other management practices affect the amount and type of greenhouse gas emissions generated.³⁰

2. POOR HANDLING OF MANURE AND FERTILIZERS CAN POLLUTE LOCAL WATER RESOURCES

Dairy operations can significantly contribute to water pollution when manure and fertilizers for feed crops are poorly managed or used. The nitrogen and phosphorus nutrients from manure storage, handling and land application, and from synthetic fertilizers used to grow crops, can run off fields to surface water or leach into groundwater. Runoff contributes to “dead zones”³¹ that are devoid of life and are a growing concern around the world, while leaching to groundwater pollutes the water supply of communities, agriculture and industry.

As one example, the nearly 2 million dairy cows in California produce 65 billion pounds of manure each year. The resulting nitrates from dairies are a significant contributor to groundwater contamination in California and can pollute water sources on which millions depend.³² In 2014, a toxic algae bloom on Lake Erie caused primarily by agricultural runoff poisoned the water supply for nearly half a million people in Toledo. In response, the governor of Ohio signed legislation requiring dairies and livestock producers to change the way they handle manure.³³

To minimize pollution worldwide, dairy producers need robust nutrient management plans, the infrastructure and tools for tracking nutrient flows. They also need innovative technology to more precisely apply manure nutrients, and options for exporting excess manure.³⁴

FINANCIAL IMPACTS

In a potentially precedent-setting case, a federal judge in Washington ruled in 2015 for the first time that animal waste could be regulated as solid waste and not as a beneficial farm product, after finding that a large industrial dairy's handling of manure in Yakima Valley had polluted drinking water.³⁵

In 2014, manure flowed into a creek from an accidental spill at an Iowa dairy killing more than 860,000 fish. The dairy was ordered to pay \$160,000.³⁶

3. HIGH WATER DEMAND FOR ANIMAL FEED CONTRIBUTES TO DROUGHT VULNERABILITY AND GROUNDWATER DEPLETION

Milk production typically requires a lot of water to grow the feed, nourish cows, manage manure and process products. Since crops and pasture used as feed could have significant water demands, efficient use of water to produce these commodities is important, especially if the feed is grown in areas of water stress.

In the U.S., among the potential feed crops (corn, alfalfa, other hay, pastureland, soybeans), corn and alfalfa use the largest amounts of irrigation water. Corn-based feed is particularly vulnerable since 35 percent of global production is grown in regions of high or extremely high water stress, meaning that existing water supplies face intense competition.³⁷ In California, for example, dairy cows eat a lot of locally grown corn silage. Most of this corn is grown using flood irrigation that relies on highly stressed surface and groundwater resources.

It Takes
949 LITERS OF WATER

To Produce
1 LITER OF MILK

(Weighted Global Average)^{38, 39}

It Takes
4,703 LITERS OF WATER

To Produce
1 KG OF CHEESE

(Weighted Global Average)^{40, 41}

4. DAIRY FARMING AND ANIMAL FEED PRODUCTION CAN LEAD TO THE LOSS OF ECOLOGICALLY IMPORTANT AREAS AND SOIL EROSION

Poor dairy farming and animal feed production practices can damage ecologically important areas. The UN Food and Agriculture Organization estimates that globally around 9 percent of GHG emissions from livestock (including but not limited to dairy) are caused by converting prairies, wetlands and forest for pasture and crop production.⁴² Land conversion is a particular concern in South America. Land is converted to farms to grow commodity crops such as soybeans and corn for export to Europe and China as meal to feed dairy herds. (The U.S. dairy sector hardly

buys corn and soy from South America; the majority of feed crops for U.S. dairies are grown in the U.S.)

Overgrazing, soil compaction from cow's hooves and poor agricultural practices can lead to loss of topsoil and organic matter, which can take decades or centuries to replace. Conversely, dairy cows can contribute to healthy habitats and soils through well-managed grazing and manure applications, which can help to control flooding, protect wetlands, conserve open spaces, sequester carbon and revive degraded lands.⁴³

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

Several animal health and welfare⁴⁴ issues can create reputational risks for companies:

- Poor care for dairy cows can result in lameness and mastitis and not only decrease the productivity of cows due to stress and ill health, but also lead to increased greenhouse gas emissions.⁴⁵ A majority of consumers care about animal welfare and report a willingness to pay significantly more for animal products they think are humanely raised, according to surveys in Europe and North America.⁴⁶
- Routine, nontherapeutic use of antibiotics in food animal production is contributing to a growing crisis of antibiotic-resistant infections in humans⁴⁷, prompting regulatory action to limit the use of medically important human antibiotics for growth promotion in animals.⁴⁸
- The use of the artificial growth hormone known as recombinant bovine somatotropin (rBST), or recombinant bovine growth hormone (rBGH), is a consumer concern. Some companies publish policies on their use of rBST in the production of milk products they sell or provide labels on products stating that no rBST was used in milk production.

6. HEAVY RELIANCE ON MIGRANT LABOR POSES MARKET RISKS TO COMPANIES

Migrant workers are essential to the dairy industry in a number of countries (e.g., the U.S. and New Zealand⁴⁹). In the U.S., a recent survey reported that one-third of all dairy farms (producing nearly 80 percent of the nation's milk) employ foreign-born workers but seven in ten survey respondents reported having only moderate confidence in the employment documents of those workers.⁵⁰ Migrant agricultural workers are at particular risk for exploitation by labor brokers who may employ unethical practices such as high recruitment fees,

passport retention and contract fraud to lure them into forced labor schemes, and use threats of deportation to keep them from reporting abuses.^{51, 52} A 2014 survey of migrant dairy workers in Vermont found that 40 percent of respondents were not making minimum wage; 40 percent reported working seven or more days in a row; and 20 percent stated they had no access to bathrooms or water at work.⁵³



7. FARM ACTIVITIES CAN CREATE HAZARDOUS WORKING CONDITIONS AND CONTRIBUTE TO AIR QUALITY CONCERNS

On the farm, the greatest safety concerns for workers stem from operating heavy equipment and handling animals. In the U.S., 46 people were killed in 2014 while working on U.S. dairy farms, representing close to 10 percent of fatal injuries taking place in the agricultural sectors.⁵⁴ According to Occupational Safety and Health Administration statistics, the rates of injuries on dairy farms have declined,⁵⁵ though some risks and injuries to migrant workers may not be documented if workers feel unable to seek medical or legal help for fear of losing employment or facing immigration-related consequences.

Moreover, dust generated from animals and their feed as well as gases from animal wastes can be hazardous to human and animal health.⁵⁶ Particulate matter and odor from on-farm activities can negatively impact air quality.

8. SMALL-SCALE PRODUCERS LACK ACCESS TO RESOURCES WHICH LIMITS THEIR LIVELIHOODS AND PRODUCTIVITY

It is estimated that around 750 million people are engaged in small-scale milk production worldwide, the majority of them in developing countries.⁵⁷ Small-scale producers may lack access to resources needed to sustain their livelihoods, such as grazing and resource rights, affordable quality inputs (feed and medicine), fair pricing, credit, extension services and technology. For example, in some developing countries, a lack of proper cooling

infrastructure results in up to 30 percent of milk being wasted.⁵⁸ Although in many countries small-scale dairy producers have very competitive production costs and the potential to compete with larger, high-tech producers, lack of access often limits their ability to invest in the productivity and sustainability of their farms and participate in the growing global dairy market.⁵⁹



OPPORTUNITIES FOR ACTION

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

1. JOIN MULTISTAKEHOLDER SUSTAINABILITY EFFORTS

Many players, including buyers, producers, investors, governments, NGOs and communities understand the issues and are collaborating to ensure the long-term sustainability of dairy. Companies and investors can participate in these multi-stakeholder efforts. 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).

For the dairy industry, examples of multistakeholder efforts include:

- Innovation Center for U.S. Dairy provides a national forum for the dairy industry to work together: the US Dairy Sustainability Alliance.⁶⁰ The Center is leading several greenhouse gas reduction projects to help the dairy industry meet a voluntary goal set in 2009 to reduce GHG emissions by 25 percent by 2020.

It developed a *Stewardship and Sustainability Guide for U.S. Dairy*, a voluntary, standard framework for communicating continuous improvement, along with a science-based FarmSmart™ tool to measure, manage

and improve impacts related to energy and GHG emissions on dairy farms in the U.S. (The FarmSmart tool has been incorporated into the National Milk Producers Federation (NMPF)'s FARM Environmental Stewardship module.)⁶¹ The Innovation Center is also partnering with Field to Market to create a more consistent approach to sustainability in dairy feed production. This includes harmonizing metrics and tools.

- Global Dairy Agenda for Action (GDAA), launched in 2009 by six organizations,⁶² commits the global dairy industry to actively reduce GHG emissions and share the sector's efforts. In 2013, GDAA expanded its focus beyond GHG emissions and adopted a Dairy Sustainability Framework (DSF), which lays out 11 key sustainability criteria, each with a strategic intent specifying the desired improvement across the whole dairy value chain. Members of the GDAA who can implement initiatives addressing the criteria and strategic intents (e.g., farming groups, dairy manufacturers) commit to endorsing the DSF, establishing appropriate governance for the "delivery" of the DSF within their organization, and participating in an annual reporting process.⁶³

2. ENGAGE DIRECTLY WITH DAIRY PROCESSORS AND PRODUCERS

When supply chains are transparent, companies can work with suppliers and supporting industries (e.g., farm equipment, soil amendment or irrigation companies) to promote better management practices. Opportunities to engage include providing loans and other financial incentives for dairy farmers to adopt new technologies and solutions that help them reduce their impacts (e.g., investments in anaerobic digesters, efficient irrigation systems that can handle manure, solar and wind power; upgrades to farm equipment and electronics; nutrient recovery technologies). This is particularly important where the price of milk is regulated (for example, in the U.S.) and producers have limited ability to pass on the cost of investments in the prices they charge.

Since many dairy farmers are members of cooperatives, several cooperatives have developed dairy sustainability

programs to guide their members' sustainability efforts. Other parts of the dairy supply chain are also working directly with producers. For example, Unilever works with over 300 dairy farmers in the U.S. and Europe through its Ben & Jerry's Caring Dairy™ program, which aims to address farm-related risks including working conditions, animal welfare and soil health. It helps farmers develop a tailored action plan based on a self-assessment of their operations and provides incentives to farmers who participate in the program.⁶⁴ More broadly, Unilever also provides training sessions to help farmers implement its Sustainable Agriculture Code (SAC).⁶⁵ As another example, Prairie Farms Dairy and McDonald's Corporation partnered to test the Farm Smart™ tool to assess how well it tracks and measures greenhouse gas impacts from feed to farm to plant.⁶⁶

3. SUPPORT GOVERNMENT POLICIES

Companies can support sustainability policies in producer countries. For example, working through the Innovation Center, the U.S. dairy industry partnered with the U.S. Department of Agriculture, Department of Energy, Environmental Protection Agency, and The White House to develop in 2014 a *Biogas Opportunities Roadmap*. The *Roadmap* highlights the economic potential⁶⁷ and environmental benefits (in particular lower GHG emissions) of using biogas systems on dairy farms. The roadmap also supports the Obama Administration's *Climate Action Plan Strategy to Reduce Methane Emissions*.⁶⁸

When it comes to improving water quality, a number of U.S. states are adopting policies, including promoting activities that reduce run-off from dairy farms. For example, in Vermont, water quality is a component of the state's

Farm to Plate Strategic Plan.⁶⁹ Collaboration with the farming and food sector (combined with funding from multiple sources including \$45 million from USDA), is providing technical assistance and awareness of stewardship practices particularly in the areas surrounding and feeding into Lake Champlain.⁷⁰

With respect to nutrient recovery opportunities, companies involved in dairy (and pork) production partnered with the U.S. EPA, USDA, and environmental and scientific experts to host a Nutrient Recycling Challenge, which identified technologies that can recycle nutrients from livestock waste and create valuable products.⁷¹ Linked to this competition is a collaboration among 12 dairy cooperatives to create Newtrient LLC, an organization to explore opportunities for better nutrient solutions.

4. ENCOURAGE USE AND DEVELOPMENT OF SUSTAINABILITY STANDARDS

In the U.S., the National Milk Producers Federation's FARM Program: Farmers Assuring Responsible Management™ has developed a voluntary program setting minimum standards for animal care and environmental stewardship. It is the only program in the U.S. exclusively focused on dairy cows. More than 90 percent of the U.S. milk supply comes from participating farms.⁷²

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

- USDA Organic program certifies that milk is from cows that get fresh grass, spend at least four months a year grazing in pastures and eat feed that is grown without chemical fertilizers, pesticides or genetically modified seeds. Milk from cows treated with hormones or antibiotics cannot be branded organic.⁷³
- The Animal Welfare Approved as well as Certified Humane Raised and Handled® labels apply to dairy products (as well as 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 and applies to beef and dairy production systems in the tropics.⁷⁴

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

- **General Mills** committed to purchasing 100 percent of its directly sourced fluid milk by 2020 from producing regions that demonstrate continuous improvements as measured by the Dairy Sustainability Framework in the U.S. and other comparable environmental metrics globally. As of fiscal 2014, 20 percent was sustainably sourced.⁷⁵ Projects are in place with dairy farmers in the U.S. (Michigan) and France to reduce GHG emissions.
- **Danone's** goal is to have at least 75 percent of its milk supply in compliance with its sustainable agricultural practices by 2020. Its program aims to improve and audit environmental practices, including water and energy consumption, use of fertilizers and manure, waste handling and wellbeing of animals. It provides a methodology customized for small milk producers.
- **Unilever** committed to sustainably sourcing all of its agricultural raw materials by 2020, a commitment that includes the milk it uses in ice creams—such as **Ben & Jerry's**—and margarines. To promote this goal, it developed a Sustainable Agriculture Code (SAC), which is a set of requirements for suppliers and farmers of raw materials, and implementation guides with specific advice for livestock farming and animal welfare. For dairy, this covers the treatment of cows and calves, pasture management, and management of manure, silage, run-off and other nutrient sources, as well as pesticides and veterinary medicines. In the U.S., Unilever and its suppliers benchmark dairy farms against the SAC that supply its ice cream plants (e.g., including but not limited to Ben & Jerry's).⁷⁶
- **PepsiCo** has developed a Dairy Sustainable Farming Initiative through which it shares best practices with dairy farmers and supports their implementation. The company also has a policy stating it “does not support the use of sub-therapeutic antibiotics in its fluid milk supply chain.”⁷⁷



ADDITIONAL RESOURCES

- The USDA conducts research on multiple commodities, including dairy. 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 dairy.
- [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 dairy cows. This report provides more recent data than the oft-quoted 2006 FAO report, [Livestock's Long Shadow](#).
- The nonprofit [Sustainable Conservation](#) has partnered with the dairy industry for over fifteen years to identify, test and promote management practices and technologies that protect air and water quality and reduce greenhouse gases with a particular focus on California. Recommendations are provided in [Greenhouse Gas Mitigation Strategies for California Dairies](#) (2015).
- [The Business Benchmark on Farm Animal Welfare Report](#) (2015), provides an annual evaluation of food company's actions on farm animal welfare. In the 2015 report, 90 companies were assessed; of the companies with significant operations in the U.S., McDonald's and Unilever are ranked as having the strongest commitments to farm animal welfare.
- [Good Practice Note: Improving Animal Welfare in Livestock Operations](#) (2014) by the International Finance Corporation (IFC), highlights the business case for improved animal welfare and describes good management practices.
- The National Milk Producers Federation has developed a [Dairy Environmental Handbook](#) (in collaboration with the USDA's Natural Resource Conservation Service) that includes many of the environmental best management practices available to dairy producers.
- [The International Dairy Federation](#) regularly publishes bulletins on issues of concern to dairy sustainability.
- The [Innovation Center for U.S. Dairy](#) provides information on [studies](#) related to dairy sustainability.
- The [Vital Capital Index](#), produced by Manomet with support from the Innovation Center for US Dairy, consists of 40 field-tested, science-based, practical indicators for on-farm application.

[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

- 1 Global Milk and Dairy Products Market Report: Industry Size, Share, Growth, Trend and Forecast, Industry Analysis, Overview, Research and Development for 2014. – MarketResearchReports.Biz (accessed at: <https://www.linkedin.com/pulse/20141009071241-269904646-milk-and-dairy-products-market>)
- 2 Hoovers, Dairy Products Manufacturing Industry Overview, <http://www.hoovers.com/industry-facts.dairy-products-manufacturing.1354.html>
- 3 Hoovers, Dairy Products Manufacturing Industry Overview, <http://www.hoovers.com/industry-facts.dairy-products-manufacturing.1354.html>
- 4 Hoovers, Dairy Products Manufacturing Industry Overview, <http://www.hoovers.com/industry-facts.dairy-products-manufacturing.1354.html>
- 5 Food and Agriculture Organization of United Nations, Statistics Division (FAO STAT) <http://faostat3.fao.org/home/E>
- 6 FAO 2016, FAOSTAT database collections, Food and Agriculture Organization of the United Nations. Rome. Data average of 2011-2013 URL: <http://faostat.fao.org>
- 7 FAO 2016, FAOSTAT database collections, Food and Agriculture Organization of the United Nations. Rome. Data average of 2011-2013 URL: <http://faostat.fao.org>
- 8 FAO 2016, FAOSTAT database collections, Food and Agriculture Organization of the United Nations. Rome. Data average of 2010-2012 URL: <http://faostat.fao.org>
- 9 FAO 2016, FAOSTAT database collections, Food and Agriculture Organization of the United Nations. Rome. Access date: Sept 2016. URL: <http://faostat.fao.org>
- 10 FAO, World Livestock 2011 – Livestock in food security, Table 16. Rome, FAO, <http://www.fao.org/docrep/014/i2373e/i2373e.pdf>
Note: This definition of dairy is for liquid milk equivalents and excludes butter.
- 11 World Wildlife Fund 2016, Sustainable Agriculture, Dairy, <http://www.worldwildlife.org/industries/dairy>
- 12 Juan M. Tricarico, “A descriptive analysis of how dairy cows convert feed into food in the US”, Innovation Center for U.S. Dairy, 2015, www.usdairy.com/~media/USD/Public/How-dairy-cows-convert-feed-into-food.pdf
- 13 Innovation Center for U.S. Dairy, “U.S. Dairy’s Environmental Footprint A summary of Findings”, 2008-2012, www.usdairy.com/~media/USD/Public/DairysEnvironmentalFootprintpdf.pdf
- 14 United States Department of Agriculture Economic Research Service. Dairy, Overview, <http://ers.usda.gov/topics/animal-products/dairy.aspx>
- 15 Dairy Good, Overview, <https://dairygood.org/about-us>
- 16 Innovation Center for U.S. Dairy’s, “U.S. Dairy’s Environmental Footprint: A Summary of Findings”, 2008 -2012, www.usdairy.com/~media/USD/Public/DairysEnvironmentalFootprintpdf.pdf
- 17 Hoovers, “Dairy Product Manufacturing Industry Overview”, <http://www.hoovers.com/industry-facts.dairy-products-manufacturing.1354.html>

- 18 Ranking is based on 2015 U.S. systemwide sales. Data from: QSR 50, August 2016, https://www.qsrmagazine.com/reports/qsr50-2016-top-50-chart?sort=total_units_in_2015&dir=desc
- 19 Ranking is based on sales of consumables, as reported in *Supermarket News*: <http://supermarketnews.com/rankings-research/2015-top-75-big-picture>
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