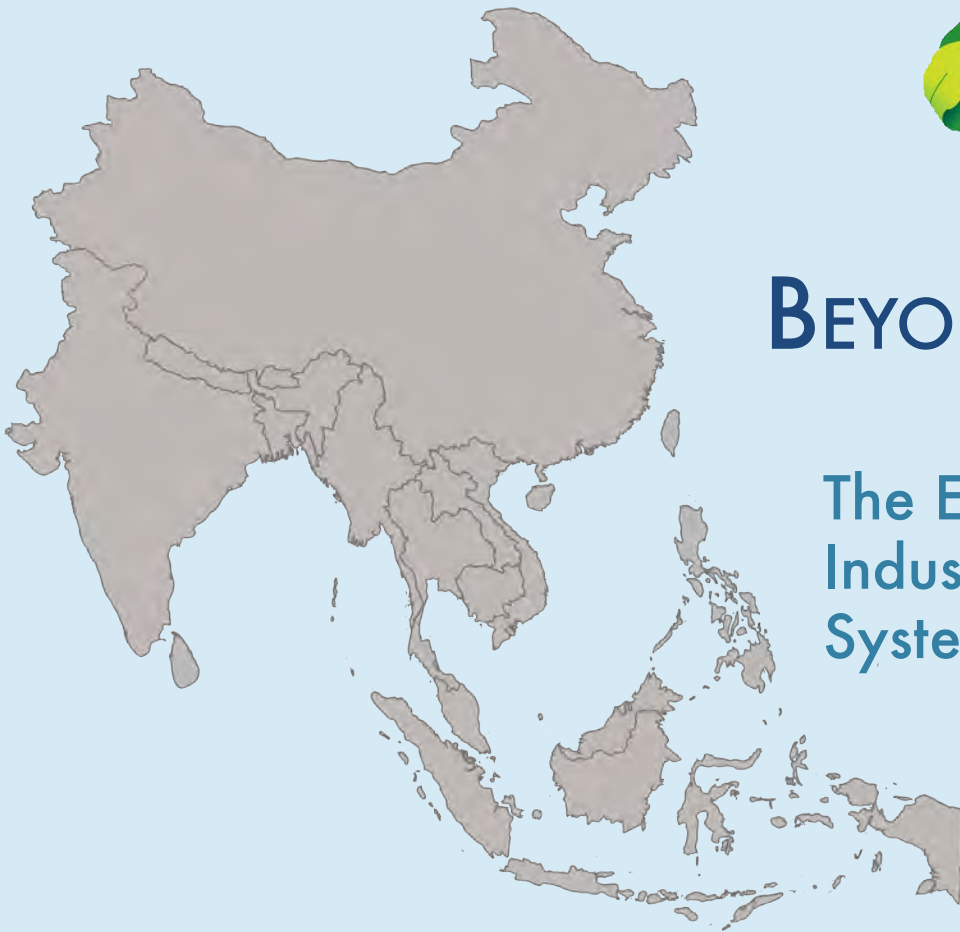




Brighter Green

# BEYOND THE PAIL

The Emergence of  
Industrialized Dairy  
Systems in Asia





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WITH MARKETS FOR DAIRY PRODUCTS in industrialized countries at a virtual saturation point, the global dairy industry has set its sights on expansion across Asia. Due to their fast-growing populations, rising incomes, rapid urbanization, and greater exposure to Western consumer products and lifestyles, China, India, and a number of countries in Southeast Asia are now a locus of attention and investment from international and domestic dairy producers operating, or seeking to operate, at an industrial scale.

## Overview

The dairy sector in Asia lies on the precipice of rapid formalization with the introduction of Concentrated Animal Feeding Operations (CAFOs), which are characterized by the lifelong, indoor confinement of hundreds or even thousands of animals in a single location (United States Environmental Protection Agency [U.S. EPA], 2012b). CAFOs are being established across Asia by private enterprises or through partnerships between multinational corporations and governments. CAFOs or “factory farms” are used widely in industrialized regions to produce milk as well as meat and eggs.

CAFOs are often perceived by governments in the global South as more economically efficient than traditional animal husbandry as a way of producing large outputs in a relatively short period of time. Industrial production is also a readily available model of agricultural development, and large, mainly Western agribusinesses have speed and financing on their side.

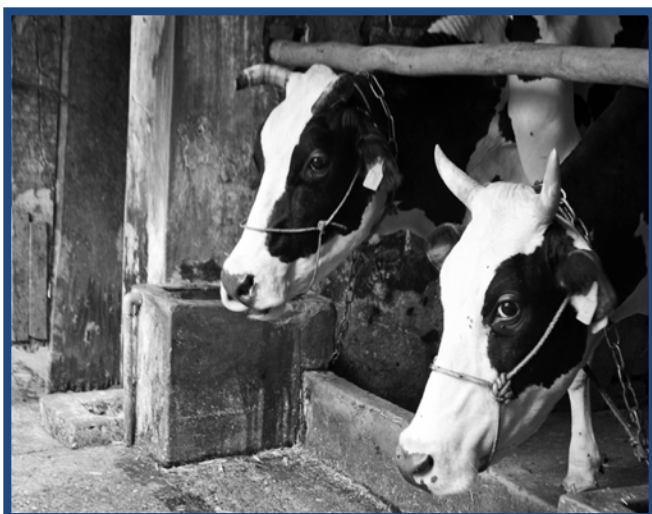
In this calculus, smaller-scale dairy production is displaced, and rising consumption of dairy products is judged a net benefit to societies. This is the case despite the fact that a large majority of the East Asian population

has difficulty digesting lactose, a sugar found in milk and milk products.

To make industrial dairy operations viable, other elements of the supply chain must be in place, in addition to the CAFO itself. These include large-scale production or import of feed, calf rearing, milk processing, cow slaughter, and beef and leather production and possibly exports. Industrial-scale dairy companies seeking to overcome competition from traditional milk suppliers are beginning to depict local milk as unhygienic and potentially tainted, stoking consumer fears, roiling farmers’ livelihoods, and building demand for packaged, CAFO-supplied dairy products (Genetic Resources Action International [GRAIN], 2011).

Even as the dairy CAFO model is gaining a foothold in Asia, researchers and advocates in industrialized countries have begun to document the often-devastating consequences of CAFOs for the environment, animal welfare, rural economies and workers, and public health (see sidebar, next page). They are also questioning the resource-intensity of these large-scale facilities, and are proposing alternatives, particularly given the realities of climate change.

Replication of a CAFO-centered dairy industry in



## CAFO DEFINED

Concentrated Animal Feeding Operations (CAFOs) are agricultural facilities where animals are kept and raised in confined situations. CAFOs “congregate animals, feed, manure and urine, dead animals, and production operations on a small land area. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures, fields, or on rangeland.”

U.S. Environmental Protection Agency (EPA), 2012b



India, China, and Southeast Asia faces specific challenges, including tropical climates ill-suited to non-indigenous cow breeds, a reliance upon imported feed grains, and lack of experience of industrial dairy systems.

Information in the region is limited about the negative impacts of industrial dairy production on water and land resources, human health, livelihoods, animals (domestic and wild), and prospects for achieving food security locally and globally (GRAIN, 2011; Nierenberg, 2003; Hazlewood, 2012; Stampede, 2012). *Beyond the Pail: The Emergence of Industrialized Dairy Systems in Asia* has been written to make these impacts better known.

This paper analyzes the state of industrialization of the dairy sectors in China, India, and across Southeast Asia; the effects of CAFOs on a range of ecological, economic, and social systems; and it recommends policy actions to ensure long-term sustainability and food security with far fewer negative effects on the environment, livelihood, and equity.

Country case studies chart the growth and effects, current or anticipated, of CAFO-style dairy production in Cambodia, China, India, Indonesia, Thailand, and Viet Nam.

Current trends in Asia are not destiny. Governments, civil society, and the private sector have an opportunity to be leaders in countering the seemingly inexorable adoption of industrial, ultimately inefficient methods of dairy production, and the dairy consumption habits of industrialized countries; such consumption and the rising incidence of non-communicable diseases (NCDs) is an increasing concern of the public health community (Kearney, 2010).

## Rising Dairy Consumption and CAFOs in Asia

By 2025, countries in the global South are expected to consume nearly twice as much milk and milk products as they did in 1997, rising to 375 million metric tons from 194 million metric tons (Delgado, 2003). Well-established multinational and new regional and national dairy corporations are targeting previously unreached populations, including the rural and urban poor and school children. This untapped “emerging” market consists of nearly 3 billion new potential dairy consumers, according to one estimate (Tetra Pak sees, 2011). Nonetheless, the Food and Agriculture Organization of the United Nations (FAO) says milk and other dairy products likely will remain too expensive or otherwise inaccessible to the poorest households (FAO, 2013a).

## CRITICISM AND PUBLIC PERCEPTION


The growth of industrial dairy production within Asia is occurring even as a widening reevaluation is underway in industrialized countries of the desirability and sustainability of a CAFO-centered agricultural sector. Also underway is a corresponding reexamination of the health consequences of high dairy consumption and of the need for dairy in a healthy diet.

A recent study of the United States (U.S.) dairy industry by scientists with expertise in climate change, economics, agronomy, animal welfare, and other relevant fields concluded that despite the efficiencies achieved in milk production, “the current structure of the industry lacks the resilience to adapt to changing social and environmental landscapes.” One of the main challenges the researchers noted was the widening chasm between dairy industry practices and public perceptions, and a resulting decline in public trust (Von Keyserlingk et al., 2013).

A multi-year, multi-sectoral commission on CAFOs in the U.S. concluded that this system has created “problems that are beginning to require attention by policymakers and the industry. Given the relatively rapid emergence of the technologies for industrial farm animal production, and the dependence on chemical inputs, energy, and water, many industrial farm animal production systems are not sustainable environmentally or economically” (Pew Commission on Industrial Farm Animal Production [PCIFAP], 2008b). In a preface to its final report, the Pew Commission’s executive director wrote that industrial farm animal production in the U.S. “...presents an unacceptable level of risk to public health and damage to the environment, as well as unnecessary harm to the animals we raise for food” (PCIFAP, 2008b).

The growing opposition to CAFOs in industrialized countries, combined with the lack of enforcement of animal welfare regulations, or the absence of such regulations altogether in most Asian countries, could be another driver of corporate dairies’ interest in expanding across Asia (People for the Ethical Treatment of Animals [PETA] India, n.d.; Levitt, 2013).



 Represents large-scale dairy facilities either currently operating or planned



## THAILAND

In the years between 1980 and 2003, milk consumption in Thailand increased by 150 percent and continues to rise (Knips, 2006), even though milk had not been a part of the Thai diet. This growth is due to the increase in Thailand's population as well as policies adopted by the Ministry of Agriculture and Development's Dairy Farming Promotion Organization (Dairy Education Center, n.d.), which oversees the marketing of dairy products, school milk programs, and the initiation of dairy cooperatives in the country.

A key driver of expanding demand for milk in Thailand is the national school milk program, which purchases approximately 45 percent of the country's liquid milk (Knips, 2006). The program, launched as a means of improving child nutrition due to concerns about malnutrition, especially in rural areas, also aims to support the dairy sector by instilling a life-long habit of milk consumption, as well as providing an outlet for surplus milk production (Chungsiriwat & Panapol, n.d.; Suwanabol, n.d.; Kanemasu, 2007).

Thailand's dairy industry is mainly comprised of small-scale farmers and cooperative production systems. However, economic factors are contributing to increasing industrialization as rising fuel prices force some small-scale farmers to shrink the size of their operations or to leave the industry altogether (Chungsiriwat & Panapol, n.d.). Farm Chokchai Company Limited in Pak Chong district in southern Thailand, with more than 3,000 cows in production, is the largest dairy CAFO in Thailand and, so far, the only one (Farm Chokchai, n.d.). Farm Chokchai cows, known as Chokchai-Friesian, are a crossbreed between Holstein-Friesians, the most common breed used in Western dairy production, and the native Thai cow breed, and are exclusive to the company (Holstein-Friesian, n.d.).

In addition to producing milk domestically, Thailand also exports dairy products like condensed and dried milk to a number of countries, including Australia, Afghanistan, China, India, Indonesia, Myanmar, and Sweden (Food and Agriculture Organization of the United Nations Statistics Division [FAO ESS], n.d.-b).

Traditional diets in East Asian countries include virtually no or a negligible amount of dairy (unlike in South Asia where milk and other dairy products are more commonly consumed). But this is changing. Asia is now the world's highest dairy-consuming region, with 39 percent of global consumption, due mainly to China and India, the world's two most populous countries, as well as Pakistan, which has a large population and, like India, high levels of milk consumption (Yonkers, 2011).

Rates of dairy consumption across Asia vary widely, from 11.5 kilograms (kg) (25 pounds/lb) of milk per person a year in Viet Nam to 30 kg (66 lb) a year in China and 72 kg (159 lb) per capita each year in India (2009 data) (Food and Agriculture Organization of the United Nations Statistics Division [FAOESS], n.d.-c). But all these consumption levels remain below those in industrialized nations (Gerosa & Skoet, 2012).

Production of milk and dairy products in Asia is expanding. Three of the world's top five dairy-producing countries are in the region. India, with a vast herd of cows and buffalo, produces more milk than any other country, followed by the United States, China, Pakistan, and Brazil (FAO, 2013c).

Historically, population growth drove increased demand for dairy products (FAO, 2010a). This, combined with demographic shifts in Asia towards urbanization and an expanding middle class, have created a vast pool of potential new dairy product consumers (Gerosa & Skoet, 2012). Many regional policy-makers see the industrialized CAFO system as necessary to meet escalating demand amid intensifying pressures on natural resources like water, land, and forests. Burgeoning human populations, industrial development, and urban sprawl are also diminishing the land area available for pasture-raised animals.

Governments across Asia are eager to modernize agricultural production, leading them to welcome, and in some cases actively facilitate, corporate-led industrialization of their dairy sectors. At the same time, the CAFO model is promoted by industrialized country governments, agribusinesses, and food producers and packagers (including purveyors of fast food).

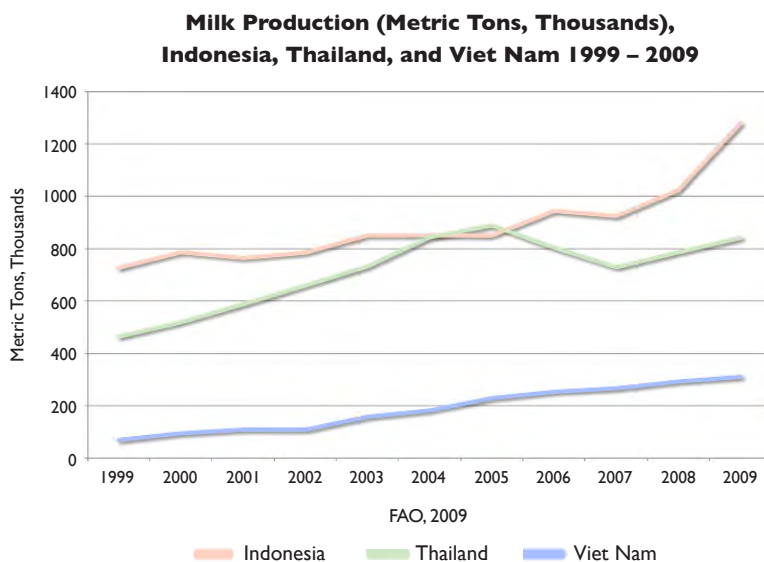
In several Asian countries, multinational corporations with dairy divisions like Nestlé and Tetra Pak have become major players in school milk programs and classroom nutrition education courses (Nestlé, n.d.; Tetra Laval, 2012).

These dairy industry-influenced education initiatives facilitate the development and use of curricula biased towards dairy interests that communicate the message that consuming dairy products is required for good nutrition in child- and adulthood (a position contested by a number of public health researchers). This is the case even though up to 98 percent of Asian children experience hereditary

lactose intolerance (National Center on Minority Health and Health Disparities [NCMHD] Center of Excellence for Nutritional Genomics, n.d.).

School milk programs and nutritional education courses can engender lifelong habits of milk or processed dairy product consumption, strategically helping create a long-term

market of industrial dairy product consumers (Nestlé, 2012a).

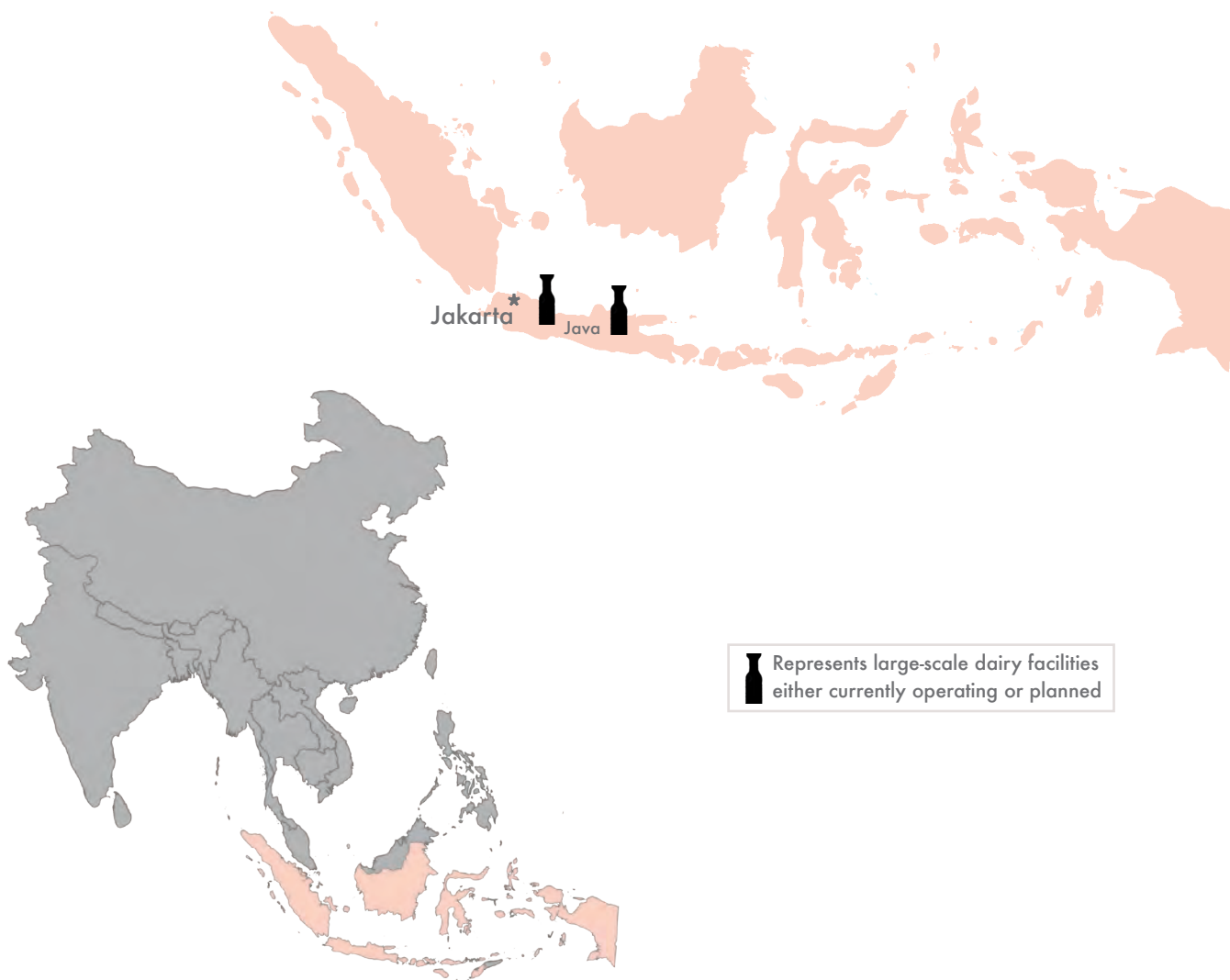


## The CAFO System: A Critical Review

The sections that follow contain current research and analysis on the realities of the dairy CAFO system for the environment; food security; worker health and safety; livelihoods; animal welfare; the quality of life of communities in close proximity to industrial dairy operations; and country case studies.

## Waste, Water, and Climate Change

The amount of animal waste produced by a CAFO far exceeds that of traditional, small-scale animal husbandry. The difference in the scale of industrial operations compared to traditional farms is immense. A dairy CAFO with 2,500 cows creates as much waste as a city of 400,000 people (U.S. EPA, 2004). The manure produced in CAFOs typically goes untreated. When treatment systems are in place, it is not uncommon for them to fail (Environment Canada, n.d.).



## INDONESIA

Milk is not a part of the traditional Indonesian diet, and the majority of milk in Indonesia is still consumed by infants and children (Global Business Guide [GBG] Indonesia, 2013). At 11.7 liters (1 liter = 0.26 gallons) annually, per capita milk consumption in Indonesia is much lower than in neighboring countries. However, with a growing middle class, more supermarket retail chains, and dairy promotion campaigns, dietary habits in Indonesia are quickly changing (GBG Indonesia, 2013). Demand for milk is rising by 10 percent annually and is set to nearly double by 2020, quickly outpacing supply (GBG Indonesia, 2013; Slette & Meylinah, 2012).

Currently, 75 percent of Indonesia's milk is imported from Australia and New Zealand (GBG Indonesia,

2013). Small-scale farmers produce 90 percent of the domestic milk supply, approximately 1.6 million liters a day. Most small-scale farmers have no more than two to three cows and 99 percent of the country's dairy cows are located on the island of Java (Slette & Meylinah, 2012). The government plans to increase domestic milk supply to meet at least 50 percent of domestic demand by 2020 (Soedjana, 2012). In order to reach this goal, the government is expecting to double the number of domestic cows to approximately one million, and is relying on large-scale investors, both domestic and international, to fund imports of high-yielding Holstein-Friesian breed cows from Australia and New Zealand (GBG Indonesia, 2013).

Direct subsidy support is being offered for the purchase of dairy cows (Soedjana, 2012; Morey, 2011). The Indonesian government is also promoting investment by multinational corporations in dairy marketing campaigns to raise consumer awareness of dairy products (Slette & Meylinah, 2012). Nestlé and domestic companies such as Ultrajaya, are already extensively marketing dairy to Indonesians in middle and upper economic brackets (Slette & Meylinah, 2012; PT Ultrajaya Milk Industry Tbk., 2012).

The dairy sector in Indonesia is made up of approximately 30 corporations, both domestic and multinational. Key international players include Nestlé, Netherlands-based Frisian Flag, and Sari Husada, a subsidiary of Danone, the French dairy and bottled water company. Key local companies include Indolakto, Ultrajaya, and Greenfields Indonesia, which was established by Australian and Indonesian entrepreneurs in 1997 (GBG Indonesia, 2013).

Most operations consist of processing plants supported by a cooperative system, through which small-scale farmers supply milk. However, some companies are beginning to operate industrialized dairies. Located in East Java's second largest city, Malang, Greenfields is among the first and largest dairy CAFOs in Indonesia, housing 6,000 Holstein-Friesian cows imported from Australia (Greenfields, 2012). Ultrajaya also operates a large-scale dairy facility with 3,000 cows in Pangalengan,

West Java (GBG Indonesia, 2013).

Supplying sufficient feed for farmed animals in confined systems is a challenge; Indonesia currently imports commodities such as wheat and soy that are used in animal feed. The Indonesian government has recognized that its reliance on these imports is a major food security concern in the wake of rising global food prices (GBG Indonesia, 2012). Yet increasing the country's dairy cow population will only intensify Indonesia's dependence on imported feed grains.

The dairy industry also faces other obstacles to expanding production, including limited farmer education, scarcity of forage, high feed prices, the small size of existing farms, the dearth of land with suitable elevation for dairy operations, and outdated agricultural technology (Slette & Meylinah, 2012). Nevertheless, over the last decade multinationals such as Danone and Nestlé, as well as several private investors, have directed significant financial resources to developing livestock capacity and new production facilities (GBG Indonesia, 2013).

Indonesia previously exported powdered milk to the U.S. and Singapore, but has recently ceased most exports since meeting growing domestic demand has taken priority. However, economists speculate that increased multinational investments in dairy industry growth could make the country a key player in the dairy export market again (GBG Indonesia, 2013).

Untreated manure is used as a crop fertilizer, stored in waste lagoons, or disposed of in rivers and other water systems (Environment Canada, n.d.; Ebner, n.d.). Industry experts acknowledge that the majority of Chinese dairy CAFOs lack adequate waste treatment facilities. Consequently, manure is contaminating local water supplies, attracting insects, and creating strong odors, all of which are leading to grievances in neighboring communities (Yunxu, Shan-shan, & Qing, 2012).

Contamination of water systems by CAFOs is a significant problem. CAFO waste reaches ground and surface waterways through runoff, leaching, erosion, accidental spills and overflows, as well as direct discharges. Such contamination can also negatively affect marine ecosystems; in the most extreme cases, it can lead to the

death of fish and other marine life by depleting essential oxygen through a process known as eutrophication (United States Office of the Federal Register [U.S. OFR], 2003).

CAFOs also contribute to climate change. In 2006, the FAO estimated that the global livestock sector is responsible for 18 percent of human-induced greenhouse gas emissions (GHGs) (FAO, 2006). A 2013 FAO report put this percentage closer to 14.5 percent, lower but still significant (FAO, 2013b). Other research has found that GHGs from the world's livestock sector are a much larger portion: 51 percent of the total (Goodland & Anhang, 2009). Specific to dairy production, the FAO concluded the global dairy sector contributes 4 percent of anthropogenic GHGs (although with wide possible variations



in this number) (FAO, 2010b).<sup>1</sup> The FAO estimate includes GHGs from dairy production and processing; dairy-sourced meat production and processing; packaging production; transportation; and deforestation caused by the production of feed.

In its 2013 report on livestock and climate change, the FAO calculated that dairy cattle (for milk production) are responsible for 20 percent of the livestock sector's overall GHGs, or approximately 1.4 gigatonnes of carbon dioxide equivalent a year. If related meat and non-edible outputs of dairy production are included, this rises to 2.1 gigatonnes of carbon dioxide equivalent each year. Among livestock products, beef is the most GHG-intensive, averaging 300 kg (661 lb) of carbon dioxide equivalent for each kilogram of protein produced. Cows' milk's GHG intensity ranges. The average is less than 100 kg (220 lb) of carbon dioxide equivalent per kilogram of protein. While lower than beef, this is significantly higher than the GHG intensity of the meat of pigs or chickens, or of eggs (FAO, 2013b).

In industrialized regions the majority of GHGs from milk are the result of feed production and milk processing, as well as from the cows' manure. In less industrialized regions, most of the GHGs from milk production result from enteric fermentation (the digestive processes of ruminant animals) (FAO, 2013b).

Enteric fermentation and emissions from manure in industrialized countries may, however, be larger than most estimates suggest. In the U.S., a study published in 2013 by a group of climate scientists found that methane emissions from cows and other ruminants were vastly undercounted. Methane from ruminant digestion and the manure they produce in the U.S. is actually likely to be at least 50 percent higher than levels estimated by the U.S. government and the main global methane inventory. (Methane emissions from U.S. oil and natural gas extraction and processing were also much larger than previous estimates.) This led the researchers to conclude that methane emissions "associated with both the animal husbandry and fossil fuel industries have larger greenhouse gas impacts than indicated by existing inventories" (Miller et al., 2013).

India has the world's largest herd of cows and buffalo used in dairy production, about 300 million, and also has the highest emissions of the greenhouse gas methane from livestock of any country in the world. Methane is between 20 and 72 times more potent a global warming agent than carbon dioxide (Mims, 2010).

Cows in CAFOs require more feed to support their higher milk yields than indigenous breeds do, resulting in increased methane emissions (Knight, 2007). For example, an average dairy cow in India emits approximately 46 kg (101 lb) of methane a year compared to 118 kg (260 lb) of methane a year produced by a dairy cow in the U.S. (Matthews, 2007).

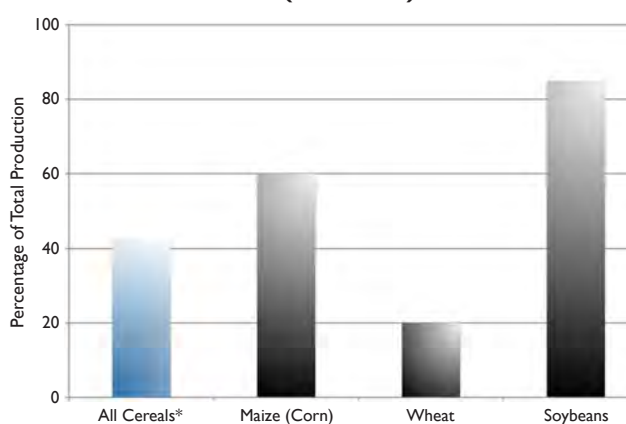
Recent research assessing dairy CAFOs' impact on local air quality found that dairies are the main contributor to the persistent smog in the U.S.' Los Angeles basin in

southern California (Nowak et al., 2012). India, China, and many Southeast Asian metropolises currently experience dangerously polluted air, and dairy CAFOs will only exacerbate this public health risk. One study concluded that Chinese CAFOs produce more than 40 times the nitrogen pollution (a significant contributor to poor air quality) than other industrial facilities within the country (Ellis, 2007).

Industrial milk production is also resource intensive. A CAFO dairy cow requires approximately 22 liters of water (1 liter = 0.26 gallons) a day, while a grazing dairy cow requires only 5 liters a day (FAO, 2006). On average, to produce one gram of milk protein requires 31 liters of water. These figures take into account water consumed by the animals directly and water required for feed production, cleaning, dilution of manure, dairy processing, and, ultimately, slaughtering. This is approximately 50 percent more water than is required per gram of pulse (legume) protein—the traditional source of dietary protein in many Asian countries (Mekonnen & Hoekstra, 2012). Moreover, dairy cows in CAFOs require much more water than grazing cows.

Animal agriculture also consumes a substantial portion of the global grain supply. Almost half (43 percent) of global grain produced is allocated to livestock feed (Murphy, Burch, & Clapp, 2012). The agricultural


**Global Grain & Soybeans Used for Animal Feed  
(2008 Data)**



\*including maize, corn, and wheat

Murphy, Burch, & Clapp, 2012



 Represents large-scale dairy facilities either currently operating or planned



## CAMBODIA

In Cambodia, as in other Southeast Asian nations, dairy has not been a traditional part of the staple diet and any milk was fed mainly to infants. Nor has dairy been a traditional element of livelihoods in Cambodia. Milk was entirely imported until 2011 when Cambodia milked its first cow during the opening of the country's first dairy operation, HPT Dairy in Kampong Speau province in the southwest of the country. The HPT Dairy CAFO is a \$250 million dollar joint venture between Cambodia's 7NG Group and Sweden's HPT Dairy, established with support from the Ministry of Industry, Mines, and Energy (Cambodia, 2011; Nerenberg, 2011).

The siting of the facility may cause problems. The HPT Dairy directly borders Kirirom National Park (Cambodia, 2011) and a number of resorts that attract both domestic and international tourists. Pollution and odors from the CAFO may well affect these tourist facilities as well as local residents (National Trust for Historic Preservation, 2009). Moreover, Kirirom Park is a refuge for many predatory species, including leopards and tigers (World Database on Protected Areas [WDPA], n.d.). Not only will the park be at risk of pollution impacts from the dairy CAFO, similar to Viet Nam's Ben En National Park (see Viet Nam case study), but a large dairy operation in proximity to large predators may lead to conflicts between wild and domesticated animals. These may, in turn, result in demands for lethal control of big cats and other species, threatening ongoing wildlife conservation efforts.

land used to grow these feed crops arguably could be used more efficiently and equitably to grow high-protein plant foods suitable for human consumption.

In addition to the waste, emissions, and land and water pollution they create, industrialized dairies rely on product packaging, whereas most traditional Asian milk is sold unpackaged. The multinational food packaging company Tetra Pak has a strong interest in the expansion of industrial dairy operations. Tetra Pak pioneered aseptic packaging, which enables an extended, non-refrigerated shelf life for dairy and other non-dairy products, particularly advantageous where refrigeration capacity in retail stores, markets, and homes is limited. The company is the global leader in pasteurized dairy packaging (Tetra Pak, n.d.).

In developing nations, Tetra Pak has identified the 2.7 billion low-income consumer pool as the dairy industry's "next big opportunity." It projects a 30 percent growth in dairy consumption in developing nations over the next decade (Tetra Pak dairy, 2012). The company forecasts that sales of packaged milk from large, corporate producers like Nestlé, which controls approximately 5 percent of the global dairy market (GRAIN, 2012), will overtake unpackaged, local milk by 2014. By 2020, Tetra Pak estimates that 70 percent of milk sold will be packaged (Tetra Pak sees, 2011).

Tetra Pak has begun marketing affordable, single-serving milk cartons to rural populations in Pakistan, Senegal, Ukraine, Bosnia and Herzegovina, and Gaza and the West Bank (Global Child Nutrition Foundation [GCNF], 2010). Tetra Pak also partners with many developing nation governments and non-governmental organizations (NGOs) to implement public school milk programs, and disperses 6 billion single-serving milk cartons to public schools annually (GCNF, 2010).

Although Tetra Pak packaging is recyclable, it requires specialized recycling technology that is unavailable in the majority of Southeast Asian nations, particularly in rural areas. For countries with little to no formal public waste control, Tetra Pak's assertive use of single-serve packaging can be expected to result in dramatic increases in municipal garbage volume.

## Feeding Animals, Feeding People?

Historically, many Asian countries produced the majority of their own feed grains for domestic production. However, India, China, and most Southeast Asian nations do not have the agricultural capacity to grow sufficient feed to sustain a CAFO-based dairy sector. This means they must depend on imported feed grains and/or soymeal, exposing them to the vagaries of global commodity markets. As a result, animal products are more vulnerable to price spikes than grains, pulses, and produce, and a CAFO-based dairy industry only exacerbates this vulnerability.

It takes more than one kilogram of feed to produce one kilogram of dairy so, as grain prices rise, dairy prices rise exponentially, too. Moreover, cows within industrialized systems require more feed than indigenous breeds to sustain the high levels of milk production expected (Knight, 2007). Animal-sourced food production also contributes to price

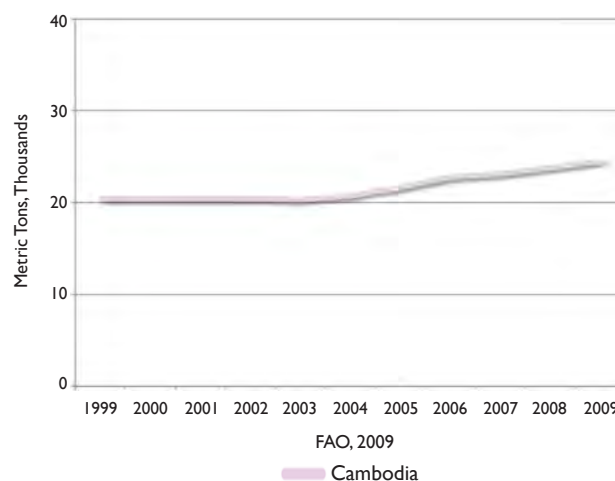
increases for other commodities. As grain prices rise, farmers tend to replace more expensive feed grains with other commodity crops. Increased demand for these crops also raises their prices (ActionAid, 2012).

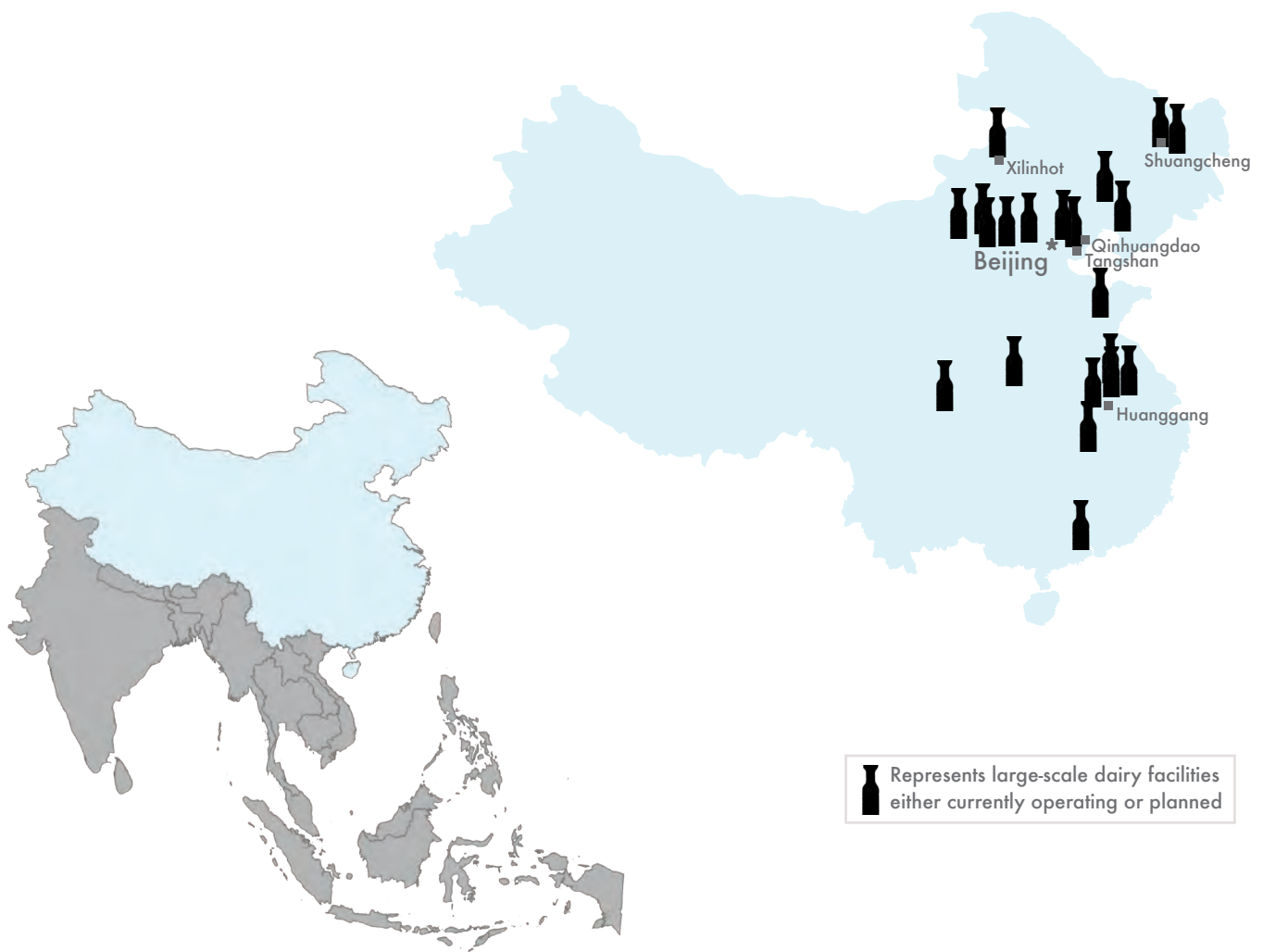
Factors contributing to grain price spikes are multifaceted, but harvest failure is a significant one. As climate change makes weather patterns more unpredictable, weather-related crop shortages are expected to occur more frequently. A global increase in animal-sourced food

production that is creating increased demand for feed grains and soymeal, in conjunction with erratic weather patterns, heightens the risk of recurring price spikes and food shortages (U.S. EPA, 2012a). People living in developing nations suffer more severe consequences of these price rises than those in industrialized countries, as they typically allocate a larger percentage of their income to food.

Not surprisingly, multinational grain traders have a vested interest in Asia's emerging dairy sector, including the four leading global commodity traders, Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus, which together control as much as 90 percent of the global grain trade. The increased prevalence of industrial animal agriculture opens markets for multinational suppliers and is also a component of rising foreign investment in agricultural land (Murphy et al., 2012).

**Milk Production (Metric Tons, Thousands),  
Cambodia 1999 – 2009**





## CHINA

China is experiencing unprecedented growth in dairy production and consumption. The population of cows used to produce milk is increasing quickly, as is the size of dairy operations. In 2012, China had 8 million dairy cows, up from about 3 million in 2002. Nearly 30 percent of Chinese dairies have 100 or more cows in production (Jianping, 2012). China today is the world's third largest milk producing nation (FAO ESS, n.d.-a). China's 2009–2013 National Development Plan projects that annual domestic production will triple by 2030 (Dobson, Dong, & Jesse, 2011; Hornby & Lee, 2012).

Increased production is now used predominantly to meet domestic demand, although China exports dairy products such as condensed whole milk, dried and evaporated milk, processed cheese, and yogurt. Major importing countries include Australia, New Zealand,

Canada, Thailand, and Japan (FAO ESS, n.d.-b). By 2017, China's dairy sector is expected to double its sales and become more highly concentrated: by 2018, China's top 10 dairy companies are expected to control 80 percent of the domestic market (Aldred & Kwok, 2013).

Traditionally, only children and senior citizens drank milk. However, more of China's people have begun consuming milk and other dairy products, with demand fueled by urbanization, a growing middle class, and marketing campaigns. The availability of refrigeration units has also been a factor in increased supply (Lu, 2009; Dobson et al., 2011).

The Chinese government considers adoption of the CAFO model an opportunity to modernize the country's agricultural sector and boost domestic milk production to meet growing demand (Stampede, 2012). The government also supports the use of both



genetic and hormonal means of increasing dairy cows' productivity (Hornby & Lee, 2012; Dairy giant, 2012; Locke, 2012; Zhuoqiong, 2012). Government policy-makers are promoting industrialization of the domestic dairy sector by offering subsidies and free land to corporate agricultural entrepreneurs. These include China Modern Dairy and its 20,000-cow CAFO located in Anhui province in eastern China (Stampede, 2012).

China Modern Dairy introduced the CAFO model to China (China Modern Dairy, 2012) and is the country's largest raw milk supplier. It sold more than 500,000 metric tons in the fiscal year that ended in June 2013, an increase of 30 percent over the year before. The company has 22 completed CAFOs across China and two under construction, with a total herd size of nearly 180,000 cows, which is projected to increase (China Modern Dairy, 2013).

At least one China Modern Dairy CAFO is located in each of China's six geographic regions, as well as Inner Mongolia (China Modern Dairy, 2010). In 2013, a \$140 million joint venture was announced among China Modern Dairy, U.S.-based private equity firm Kohlberg Kravis Roberts & Co. (KKR & Co.), and CDH Investments, a Chinese private equity firm, to build two, 10,000-cow dairy CAFOs in China (Aldred & Kwok, 2013). Both KKR and CDH have invested in China Modern Dairy in the past (KKR & Co. L.P., 2013).

A number of other Chinese dairy corporations operate CAFOs, and several are attracting international investment. Huishan Dairy, also known as Liaoning Huishan Holding Group, Co., Ltd., based in Liaoning province, is one of China's largest dairy companies, consisting of twenty CAFOs (Anderson, 2010) with a total of 250,000 cows (Chinese dairy, 2010). The company imports 3,000 cows a month from Australia and plans to increase its overall dairy herd size to 400,000 (Ho, 2012). The company's future viability was confirmed in September 2013 when it raised 10.1 billion Hong Kong dollars (\$1.3 billion U.S.) in its initial public offering (Gough, 2013). Huishan Dairy has reportedly established the world's largest biogas system that will extract methane from the waste of 60,000 cows. The system may generate up to six megawatts of electricity, sufficient energy to supply

the dairy operation itself, along with neighboring villages (Chinese dairy, 2010).

In 2013, Inner Mongolia Yili Industrial Group Co., Ltd. (known as Yili Group), another of China's leading milk producers, signed an agreement with Dairy Farmers of America (DFA), a U.S.-based cooperative of dairy producers, that will allow DFA to enter the Chinese dairy market using the Yili brand (Woke, 2013). In 2012, Yili Group began construction of a 5,000-cow CAFO in Qingshuihe County, part of northern China's Inner Mongolia region (Klynveld Peat Marwick Goerdeler [KPMG], 2008; Yao, 2012; Zhuoqiong, 2012). With strategic goals that include a dairy farm-expansion plan, development of additional Yili-backed dairy CAFOs should be expected (Aldred & Kwok, 2013). Fengxing Dairy also plans to build multiple CAFOs in the southern province of Guangdong, with a projected total population of 20,000 cows (Yao, 2012).

Global dairy corporations are increasingly active in China and regularly receive support from the government. In 2007, for instance, New Zealand-based Fonterra, the world's largest dairy processor and milk exporter, launched its first Chinese dairy CAFO in the industrial city of Tangshan, in Yutian county, Hebei province, in northeast China. It now operates with nearly 5,000 cows (Crewdson, 2009; Fonterra, n.d.). Fonterra's second dairy CAFO in China opened in 2012, also in Hebei, and currently operates with 2,200 cows (Fonterra, 2012). Upon completion, Fonterra's Hebei operation will contain five auxiliary CAFOs with a total of 15,000 cows (Fonterra, 2012; McBeth, 2012). Fonterra reports that the Yutian county government played an "integral" role in the CAFOs' development (Fonterra, 2012).

Fonterra's long-term expansion plans in China include additional dairy operations slated to be built across the country (Fonterra, 2012; Fonterra, n.d.).

In May 2012, Nestlé, the world's third largest milk processor, signed an agreement with the government of Chen Qi county in Inner Mongolia to develop a dairy CAFO. The CAFO, referred to by Nestlé as a "cow base," has a projected total population of 2,000 animals. Nestlé will supply a portion of the animals, mostly imported, high-yielding Holstein-Friesians; local govern-

ment and rural farmers will supply the remainder with indigenous breeds. Farmers will relocate their grazing herds to the confined, indoor unit of the Nestlé “cow base” for management by Nestlé staff (Russell, 2012). This will be among the first CAFOs directly undertaken by Nestlé, which historically has only managed processing units and supply chains (Genetic Resources Action International [GRAIN], 2012).

Nestlé describes the operation as a “transitional solution between small and individual farmers and a large modern farm” (Russell, 2012). In many developing countries, Nestlé employs a “dairy hub” model through which milk from the cows of many smaller-scale producers are collected and processed in a centralized location; goals are also set for increased milk yield and expanded herd size. Tetra Pak also uses the “dairy hub” model (GRAIN, 2012).

Nestlé’s aggressive public marketing is influential in Asia’s emerging dairy markets, and is shaping them in other important ways. In 2012, for example, Nestlé opened the Dairy Farming Institute in the city of Shuangcheng, in Heilongjiang province in northeast China (Nestlé, 2012c). The institute prepares individuals to develop and manage large-scale dairy CAFOs by providing training in industrial agricultural technology. With a 700-student annual enrollment, the institute eventually will have three training farms: a cow base with cows provided by local farmers (mentioned above) and three dairy CAFOs, containing 1,200, 1,520, and 8,000 animals each (Nestlé, 2012c; Nestlé, 2012b).

Even as dairy CAFOs expand across the country, Chinese environmental researchers recognize that excess manure is a concern for all types of CAFOs (Schneider, 2010). The Chinese Ministry of Agriculture reports that the volume of manure from dairy, poultry, swine, and other animal operations increased from 3.8 billion metric tons in 2000 to 4.8 billion metric tons in 2008 (Zhu, 2010). In 2010, the government released the results of China’s first national pollution census, which found that agricultural waste and manure are the largest sources of water pollution, contributing 67 percent of phosphorous and 57 percent of nitrogen discharged into Chinese waterways (Schneider, 2010).

Northeast China, where many dairy CAFOs are located, contains several major population centers and water systems highly vulnerable to ground and surface water pollution; regional monsoons increase the risk. The city of Tangshan, for example, borders the Luan River and is situated on a coastal plain 40 kilometers (km) (25 miles/mi) north of the Bohai Sea. The city of Xilinhot borders the Xilinhaote River, which leads to a major water reservoir. Further south, Huanggang, a city in Hubei province in east-central China, has a number of Yili dairies with a total population of more than 20,000 cows (Historical figure, 2010). Huanggang contains several major lakes, the Yangtze River runs through it, and the city lies south of the Dabie mountains.

For China’s three largest lakes, Dianchi, Chaohu, and Taihu, agricultural manure and other waste runoff are responsible for 70, 60, and 35 percent respectively of total water pollution. CAFO waste leads to toxic algae blooms, known as red tides, that affect much of China’s east coast (Ellis, 2007). In the U.S., clusters of CAFOs have been found to exacerbate damage to water quality within the same geographic region due to pollution accumulation (United States Government Accountability Office [U.S. GAO], 2008).

Recent research also shows that large dairy operations are a main contributor to urban smog (Nowak et al., 2012). China experiences some of the world’s highest air toxicity levels. Approximately 80 percent of China’s CAFOs are located in proximity to major metropolises where they will add to hazardous air pollution (Ellis, 2007). In Tangshan, air-borne pollution presents a specific critical concern. The city borders the Qinhuangdao metropolis, which has a population of 3 million, and is located 170 km (100 mi) from Beijing, the country’s capital, where more than 20 million people live.

Mountain ranges limit pollution dispersion and lead to an accumulation of toxic air within the valleys below (Central China, n.d.). This is a concern for the valley cities of Tangshan in Hebei province and Huanggang in Hubei, both provinces with a number of dairy CAFOs. Accumulation of toxic air within mountain valleys is recognized as a significant factor in China’s high levels of smog and poor air quality (Central China, n.d.).

In 2012, China overtook the U.S. as the world's leading consumer of livestock feed grain (including soymeal). Policy analysts assert that countries with large and growing populations, such as China and India, must invest in international agriculture opportunities to ensure their food security. Recognizing its lack of arable land, China is rapidly purchasing or leasing agricultural land abroad in the U.S., Brazil, and a number of African countries, among others (Farm Land Grab, n.d.). Like China, India is one of the top ten countries investing in foreign land. It has made purchases in Cambodia, Indonesia, Brazil, as well as multiple African countries for agricultural uses (The Land Matrix Global Observatory, n.d.). Other countries are also seeking arable land outside their borders that may end up being used to produce food (feed) for farmed animals in CAFOs, rather than people.

### CAFO Workers: Stagnant Opportunities?

The milk sector is an important element of rural economies in India and some Southeast Asian nations (GRAIN, 2011). Industrialization results in a loss of rural livelihoods as farmers with small- and medium-sized dairy operations, unable to compete with CAFOs and the economies of scale by which they operate, are pushed out of the marketplace (GRAIN, 2011; Cox, 2007). Researchers are expressing concern about the effects of further industrialization in countries like India where dairy production has provided many rural women with a livelihood and a measure of financial independence that can contribute to their rising out of poverty (Manish & Tanaka, 2007).

Large-scale producers often describe CAFOs as good employment options for displaced farmers in situations of economic transition. However, work conditions and remuneration for CAFO employees rarely equal let alone exceed those provided by independent farming (Cox, 2007).

By and large, CAFO jobs are low-paid, low-skilled, manual labor positions typically filled by migrants from

poor, rural villages or neighboring countries. They have few other employment options and are willing to work for low wages in difficult conditions (Pew Commission on Industrial Farm Animal Production [PCIFAP], 2008b).

Such individuals are unlikely to advance to a higher socioeconomic level through a job in a CAFO (Food Empowerment Project, n.d.). While CAFOs can create financial prosperity for investors and upper-level managers, the

wages of most CAFO employees generally remain near poverty levels (Cox, 2007).

### Accidents and Toxins: Dangerous Conditions

CAFO working conditions expose employees to occupational hazards unseen in traditional farming operations. Given that these employees often have little formal education and limited language skills, it is not uncommon for them to be unaware of CAFOs' hazardous working environments (Food Empowerment Project, n.d.). Research within industrialized countries has found that animal

waste creates toxic air in and around CAFO housing systems and manure-holding lagoons. This exposes workers to emissions of ammonia, hydrogen sulfide, and methane (Institute of Science, Technology and Public Policy [ISTPP], n.d.; Mitchell & Mitloehner, 2012).

Studies in the U.S. have found that more than 30 percent of CAFO employees develop respiratory ailments, including asthma, chronic bronchi-

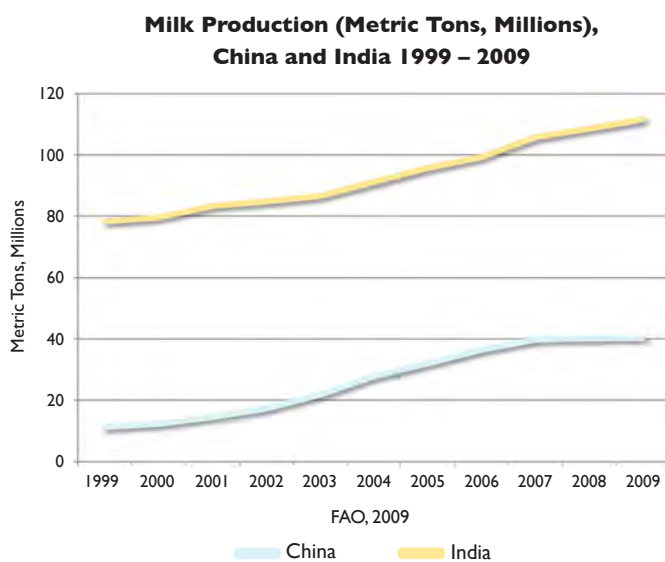
tis, and dust toxic shock syndrome, a respiratory disease linked to exposure to dust in agricultural environments (ISTPP, n.d.; Mitchell & Mitloehner, 2012).


Hydrogen sulfide, a gas that arises from stored animal waste, is a known neurotoxin (a substance that disrupts functioning of the nervous system) and can also cause brain damage. Studies show that exposure to minute amounts of hydrogen sulfide (i.e., of 0.1 part per million) can result in neurological afflictions such as vertigo and

A 10,000-cow dairy CAFO in the U.S. state of Idaho was found to produce each day:

- 1,625 kilograms (kg) (3,582 pounds/lb) of ammonia
- 15,042 kg (33,162 lb) of methane
- 186 kg (410 lb) of nitrous oxide

Perry, 2011



 Represents large-scale dairy facilities either currently operating or planned



## VIET NAM

Similar to China, Viet Nam has only relatively recently developed a taste for dairy products. Nonetheless, as of 2012, Viet Nam had the world's highest annual rate of growth in per capita milk consumption (Tung, 2011). Milk production in Viet Nam tripled between 1996 and 2002 (Garcia, Hemme, Nho, & Tra, 2006) and is projected to have tripled again by the end of 2013 (Tung, 2011). This unprecedented growth can be attributed to current government policy, which aims to increase milk consumption. One component is the government-backed school milk program, providing students in both urban and low-income rural areas with milk and nutritional education that promotes ongoing dairy consumption (Dairy Vietnam Company, n.d.-a).

The TH Milk Joint Stock Company began construc-

tion of Viet Nam's first dairy CAFO in 2011. When it is completed in 2017, the CAFO will be the largest industrial dairy in Asia and, reportedly, the largest undertaking of its kind in the world (Afimilk, n.d.-b). Located in the rural district of Nghia Dan in north Viet Nam, the CAFO is currently operating with 45,000 cows, and projects by 2017 to have a population of 137,000 cows (Dat, 2011). When fully operational, the TH Milk CAFO is expected to produce 40 percent of Viet Nam's milk demand: half a million liters a day (Special Agriculture Equipment [S.A.E.] Afikim, n.d.).

The Nghia Dan district sits approximately 50 km (30 mi) from the coast of the South China Sea and 20 km (12 mi) from Ben En National Park (Afimilk, n.d.-b).



## **Viet Nam continued**

Ben En National Park provides forest habitat for endangered species like the white-cheeked gibbon, which could face negative impacts from CAFO-caused water and air pollution (Ben En National Park, n.d.). Furthermore, this enormous CAFO lies on the Ho Chi Minh highway, which borders the park's western edge. CAFOs lead to increased truck traffic due to the transportation of animals, products, and feed, and more traffic increases the likelihood of collisions between wildlife and vehicles. Traffic emissions may also negatively affect endangered plant species.

TH Milk expects to become Viet Nam's leading milk producer, potentially outpacing current dominant suppliers, Vinamilk, Viet Nam's largest domestic producer of dairy products, and Netherlands-based Dutch Lady (American Chamber of Commerce in Vietnam, 2011).

S.A.E. Afikim, a global leader in dairy farm computerized technology and marketing based in Israel, is contracted to manage TH Milk's CAFOs and its public dairy promotion campaign (Afimilk, n.d.-a; Leichman, 2011). S.A.E. Afikim aims to boost Viet Nam's milk consumption to "unprecedented levels" above current average annual per capita consumption of 11.5 liters (Leichman, 2011).

Historically, village farmers supplied milk to Vinamilk. However, Vinamilk recently adopted the CAFO

model and now operates five CAFOs with 2,000 to 3,000 cows in each facility. These CAFOs are located across the country, in Tuyen Quang, Thanh Hoa, and Nghe An provinces in the north, Binh Dinh province in the south, and Lam Dong province in the central highlands (Vinamilk imports, n.d.).

Construction of an additional CAFO is underway in Binh Duong province in southeastern Viet Nam, with a projected population of 100,000 cows by 2016 (Tung, 2011). In September 2013, Vinamilk announced plans to expand and establish a subsidiary corporation with Thong Nat Co., which specializes in raising dairy cows. The new joint venture, Thong Nhat Thanh Hoa Cow Milk Company, is developing a 26,000-cow operation modeled after Australian and New Zealand factory farms, expected to be finished by 2018 (Vinamilk raises, 2013).

Vinamilk also sponsors a program with the National Fund for Vietnamese Children that provides free milk to thousands of school children across Viet Nam. In addition, Vinamilk's international sales of dairy products are growing rapidly. Vinamilk currently exports milk powder, condensed milk, and yogurt to fifteen countries, including the U.S., Australia, Canada, Russia, Turkey, Iraq, South Korea, and neighboring Cambodia (Vietnamese dairy, 2012).

verbal memory loss; exposure to levels greater than 100 parts per million can be fatal (ISTPP, n.d.; Merchant, Kline, Donham, Bundy, & Hodne, 2002). Within a CAFO concentrations of hydrogen sulfide regularly reach or exceed these levels (Merchant et al., 2002). Readings of hydrogen sulfide as high as 1,000 parts per million have been documented near CAFO manure-holding lagoons. These open-air lagoons are a common industry method of storing animal waste (Merkel, 2002).

A report chronicling the effects of CAFO air emissions in the U.S. described serious dangers to health and life posed by hydrogen sulfide. Encounters can be fatal: "High exposures of hydrogen sulfide, an asphyxiate, cause loss of consciousness, shock, pulmonary edema, coma and death," the researchers conclude. In the U.S. state of Iowa alone, at least 19 deaths of CAFO workers have been documented due to "sudden hydrogen sulfide exposure from liquid manure agitation" (Merchant et al., 2002; Merkel, 2002).

Large herds of closely confined, stressed animals put workers at risk of physical injury. In the U.S. each year an estimated 17,000 lost-time injuries (non-fatal injuries that cause any time to be lost from work) occur in dairy CAFOs, with nearly half of them resulting from animal-handling accidents (Mitchell & Mitloehner, 2012).

Studies also find that workers in the animal agriculture sector have lower identification with and empathy towards farmed animals than the general public. Industrial farms create a psychological disconnect, whereby workers no longer perceive the animals as living individuals, but as "food production units" (Hills, 1993; Porcher, Cousson-Gélie, & Dantzer, 2004). Workers' emotional responses towards and perception of the animals guide their behavior (Dillard, 2008). A lack of empathetic perception may result in workers who are less likely to assess the state of an animal's well-being, and as a result, more cruelty and neglect may occur.

## Animal Welfare: Sentience and Science

Overall, CAFOs create a stressful, unnatural environment for the animals housed in them (D'Silva, 2006). Animals are kept in continuous indoor confinement in overcrowded conditions, often in small stalls or cages. A cow's inability to express natural behaviors such as grazing, socializing, or even basic movements like lying down, are fundamental welfare concerns. Moreover, to overcome stress-induced behavior, the livestock industry resorts to mutilating farmed animals like dairy cows, including removing their tails and horns without anesthesia (PCIFAP, 2008b).

The cement flooring and constant limits on movement in dairy CAFOs regularly result in cows experiencing hoof lesions and lameness (Humane Society of the United States [HSUS], n.d.). Incessant milking commonly leads to mastitis, a painful infection of a cow's udders. Plus, an unnatural diet of feed grains can lead to rumen acidosis, i.e., intense stomach ulcers that can prove fatal.

To ensure consistent, high levels of production, dairy cows are continuously re-impregnated, which often leads to uterine infection and uterine prolapse (also known as a falling womb). Calves are removed from their mothers shortly after birth to protect the commercial milk supply, a practice that has shown to be highly stressful for both animals (HSUS, n.d.).

In India, the drug Oxytocin, although banned through the country's Prevention of Cruelty to Animals Act, is used regularly in dairy operations to raise milk yields. Oxytocin prolongs the lactation stage and causes the cow's uterus to contract, mimicking intense labor-like pains. This causes the cow to more easily release milk since doing so relieves the discomfort (Menon & Jadhav, 2013). In all countries, male calves are an unneeded by-product of the dairy industry, and as a result, are sent to slaughter soon after their birth; raised in extreme confinement to produce veal; or, as in India, simply abandoned to the streets (People for the Ethical Treatment of Animals [PETA] India, n.d.).

Most cows in CAFOs in India, China, and Southeast Asia are not indigenous, but are imported breeds that supply high milk yields. Several private entities, predominantly in New Zealand, Australia, and Uruguay provide the animals, generally the Holstein-Friesian breed (China raises, 2012; Jagannathan, 2010). Between 2009 and

2012, China imported more than 250,000 dairy cows, a larger number than any country in the world (Zhaoqiong, 2012; Frangos, 2012).

The trade in live animals raises significant animal welfare concerns (Royal Society for the Prevention of Cruelty to Animals [RSPCA] Australia, 2012). While pregnant, dairy cows are shipped long distances by sea, with trips lasting several weeks or even months. Purchasers regularly allow for an expected number of animal fatalities en route, evidence of the substandard conditions on cargo ships transporting livestock (RSPCA Australia, 2012). Numerous incidents of onboard diseases causing mass deaths have occurred in recent years (RSPCA Australia, 2006; Masr, 2012; Brodhagen, 2012). Public health concerns also have emerged around the lack of proper sanitary disposal of the carcasses of animals who die during sea transit.

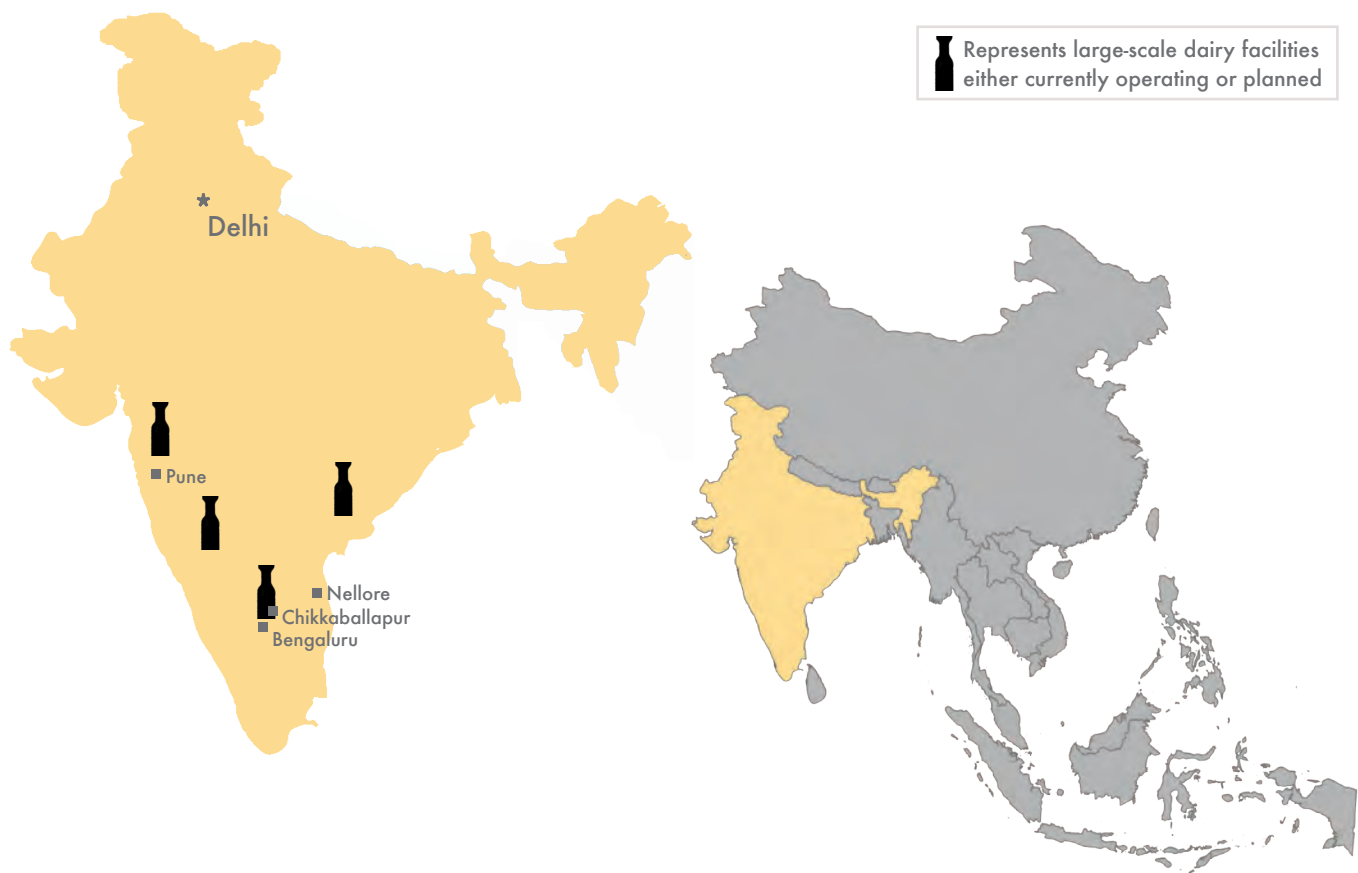
Non-indigenous cow breeds, not adapted to the high-temperature climates of India, China, and many Southeast Asian regions, face heat-induced stress (Speedy & Sansoucy, 1989). Researchers in countries such as China acknowledge that heat stress

is a significant problem facing industrialized dairy operations (Zhang, Guan, Yue, Hou, & Wang, 2012). In order to compensate for this, climate controlled, air-conditioned housing units are necessary. However, providing adequate temperature standards puts increased pressure on power sources while many Asian countries already face constraints on national energy supplies. Heat stress also reduces milk yield, even when cows are artificially cooled (Silanikove, Shapiro, & Shinder, 2009; Kadzere, Murphy, Silanikove, & Maltz, 2002).

Ultimately, when their productivity decreases, slaughter awaits all dairy cows. Slaughterhouse regulations are rare in India, China, and most Southeast Asian countries, and conditions are often inhumane or even brutal (Chambers & Grandin, 2001; Shortcomings cited, 2008).

Science is increasingly demonstrating the sentience of farmed animals and the necessity of ensuring their physical and mental well-being. Questions regarding the ethics of using sentient animals as commodities are naturally emerging, and in some countries, including India, public opposition to and organized campaigns against dairy CAFOs are growing (Federation of Indian Animal Protection Organisations [FIAPO], n.d.).

A cow's inability to express natural behaviors such as grazing, socializing, or even basic movements like lying down, are fundamental welfare concerns. Moreover, to overcome stress-induced behavior, the livestock industry resorts to mutilating farmed animals like dairy cows, including removing their tails and horns without anesthesia.



## INDIA

In India, dairy products are part of the culture's dietary identity. Since the government's 1970's-era "Operation Flood," a national dairy development program launched to dramatically increase milk production, India has emerged as a global leader in milk supply. As of 2011, India accounted for 16 percent of global milk production (National Dairy Development Board [NDDB], 2011), making it the largest milk producing country in the world (FAO, 2013c).

India is also a significant exporter of dairy products, including condensed and evaporated milk, processed cheese, and yogurt. Importing countries include the U.S., Russia, Canada, Germany, Australia, New Zealand, and several African nations (FAO ESS, n.d.-b).

Until recently, India's dairy sector was considered a pro-poor rural development initiative, providing livelihoods for village residents in lower socioeconomic classes, including many women (Report, 2006). However, the sector is changing as public policy shifts from pro-

poor to pro-commercialization.

In 2011, the National Dairy Development Board (NDDB) created a plan to nearly double milk production over the next fifteen years, placing a high priority on modernizing and formalizing the sector (NDDB, n.d.; Report, 2011). Among the results will be a complete restructuring of the long-standing cooperative dairy production model (Report, 2011).

That same year, India's first and currently only dairy CAFO opened. The 2,500-cow Bhagyalaxmi Dairy Farm covers 14 hectares (35 acres) and is located about 60 km (37 mi) from the western city of Pune in Maharashtra state. It contains one of India's first rotary parlors, a circulating platform on which numerous cows in metal stalls are milked mechanically.

This modern technology is reflected in the price of Bhagyalaxmi milk, which is more than three times that of traditional milk, enabling the company to gain a market niche among India's upper

economic classes. Its price, however, puts the milk out of reach of those in the middle and lower economic classes (Gowardhan, n.d.; Hazlewood, 2012).

More dairy CAFOs are envisioned. The Karnataka Co-operative Milk Producers' Federation Ltd. (KMF) plans to develop a CAFO on the outskirts of the country's third most populous city, Bengaluru (Bangalore) near Chikkaballapur in the state of Karnataka (KMF, 2010; Mega dairy, 2011). In Uttar Pradesh, the state government is planning a 600-cow and 400-buffalo dairy farm in Barabanki, in the center of the state, where an artificial insemination center and a training facility already exist (Nigam, Usmani, & Yadav, 2013).

In addition, a multinational consortium of New Zealand's Fonterra, India's IFFCO (Indian Farmers' Fertiliser Cooperative Limited), and Global Dairy Health, a South Asian agribusiness, planned to build a 40,000-cow CAFO in the eastern state of Andhra Pradesh (MacDonald & Iyer, 2011). The CAFO would have been located in a newly created *kisan* (farmer) Special Economic Zone (SEZ) (IFFCO Kisan Sez [IKSEZ], n.d.-b), in a rural area bordering the city of Nellore and directly on the Pennar River (IKSEZ, n.d.-a; IKSEZ, n.d.-b). Villagers rely on the river for water for crops, drinking, irrigation, and cleaning (Smal et al., 2011).

Indian animal protection groups, including the Federation of Indian Animal Protection Organizations (FIAPO) and the Blue Cross of Hyderabad (BCH), have worked to delay this CAFO's development. In September 2013, the groups were encouraged when the Andhra Pradesh Animal Husbandry Department rejected the Nellore "mega-dairy" partners' plan to import 9,000 pregnant dairy cows from New Zealand (FIAPO, 2013). As a result, FIAPO and other observers believe that the CAFO will not be built. In its press release on the state government's decision, FIAPO noted the animal welfare and environmental impacts of the proposed CAFO, as well as the region's lack of fodder as reasons

to oppose its construction. "We are delighted at the progressive stance taken by the department, which is the right step towards ensuring that cruel and exploitative mega-dairies are not set up in India," said Norma Alvares, FIAPO chairperson (FIAPO, 2013). FIAPO is working on a set of legal codes that would promote the welfare of dairy cows.

Global Dairy Health, however, still has big plans: it states its aim is to "take over India's milk production," and wants to build 100 dairy CAFOs across the country within the next ten to fifteen years, each housing a minimum of 3,000 cows (GRAIN, 2011).

The emergence of industrial dairy operations in India is an exceptional circumstance given India's cultural reverence for the cow, traditionally considered a Hindu deity. With government plans to introduce the high milk-yielding New Zealand Holstein-Friesian breed to the country, could India's once sacred indigenous cow breeds potentially be facing obsolescence (NDDDB, n.d.)?

In industrial dairies, cows are slaughtered once their milk production slows. This creates a moral conflict within India's Hindu community in which the killing of cows is a cultural taboo and is illegal in all but two Indian states. However, as public policy and practice change so does the legal status of cow slaughtering in India (MacDonald & Iyer, 2011). Indeed, the government plans to develop additional slaughterhouses throughout the country, even as each is met by public protest (Report, 2011; Sangli, 2012).

Ironically, India today is among the global leaders in leather production (from both cows and buffalo), and as of 2012 had become the world's top beef exporter, and such exports continue to rise (Kanpur BDS, n.d.; United States Department of Agriculture [USDA], 2012a; USDA, 2012b). Although these exports are mainly of buffalo meat, the establishment of dairy CAFOs in India means that exports of cows' meat are also likely in the future.





Of course, the traditional milk sector does not come without its own animal welfare challenges. Rising human populations have resulted in a lack of grazing land, and many village cows are no longer free-ranging, but instead often confined permanently in sheds and makeshift barns, at times in unsanitary and in humane conditions (PETA India, n.d.; Dairy Vietnam Company, n.d.-b).

In India, many village dairy farms have in recent decades grown into *tabelas*, or small, cowshed dairies. In *tabelas*, the cows are tied in narrow stalls, unable to turn around or exit the shed, conditions characteristic of CAFOs. Adequate veterinary care and feed are not always affordable for small-scale farmers, and cows can become malnourished or left with untreated injuries (PETA India, n.d.).

Overuse of manure as fertilizer, along with improper dumping of manure, can result in animal wastes reaching nearby water systems. This can lead to contamination of water by disease-causing pathogens, a particular concern in Asia where many rural communities rely on local water systems for livelihoods and household needs.

### Beyond the CAFO: Affected Communities

The negative effects of CAFOs also have an impact on surrounding communities. Air-borne toxins from industrial dairy operations, some of which have been linked to cancer, disperse up to 3 kilometers (km) (2 miles/mi) and can result in respiratory and sinus infections, headaches, and nausea (ISTPP, n.d.). Large amounts of manure, manure storage, and the use of manure as a crop fertilizer all create noxious odors, often making outdoor work or activities in the vicinity of a CAFO intolerable, while also considerably lowering neighboring communities' quality of life (PCIFAP, 2008a).

Temperatures in India, China, and Southeast Asian countries regularly reach 38° C (100° F) and higher, and many daily activities are undertaken outside. So, whether working on their farms, shopping or selling goods in open-air markets, or using outdoor living areas, rural residents living near a CAFO are at risk of continuous exposure to air-borne toxins and noxious odors that create numerous public health hazards. Noxious odors, for instance, have been linked to psychological mood disorders like malaise and depression (Thu et al., 1997; ISTPP, n.d.).

Cow manure contains pathogens responsible for more than 90 percent of food and waterborne diseases, including Giardia, E. coli, Salmonella, and Listeria (Farm Land Grab, n.d.). Exacerbating this risk is the grain-intensive diet of CAFO animals, which is known to increase

bacterial and viral loads in manure (Centers for Disease Control and Prevention [CDC], n.d.; Imhoff, 2010). The huge amounts of waste produced by animals in CAFOs increase the risks of pathogens in manure spreading.

Using manure as fertilizer on agricultural crops is a common method of disposing of the waste. However, overuse can result in crop contamination, posing a risk to public health (Ebner, n.d.). In the U.S., crop contamination from manure has been responsible for numerous recent outbreaks of food poisoning (Beuchat, n.d.), including Salmonella found in cantaloupes in 2011 (Neuman, 2011) and in peanut butter in 2008 (Harris, 2009).

Overuse of manure as fertilizer, along with improper dumping of manure, can result in animal wastes reaching nearby water systems. This can lead to contamination of water by disease-causing pathogens, a particular concern in Asia where many rural communities rely on local water systems for livelihoods and household needs (Nierenberg, 2003). Nitrogen from CAFO manure waste can also leach into soil, a process known to limit crop yields (U.S. OFR, 2003).

Excess manure also creates a breeding environment for disease-carrying insects, such as the common housefly. Houseflies contaminate food with dysentery-causing pathogens (Rozendaal, 1997) and are a source of food poisoning throughout India, China, and Southeast Asia. The insects can travel up to 3 km (2 mi), invading neighboring communities (Townsend, n.d.) and outdoor markets (Tambekar, Jaiswal, Dhanorkar, Gulhane, & Dudhane, 2008).

### Rising Zoonosis and Rampant Antibiotics

Recent decades have seen an unprecedented global rise in zoonotic diseases: infectious diseases transmitted from animals to humans (Greger, 2012). The International Livestock Research Institute (ILRI), the U.K. Institute of Zoology, and the Hanoi School of Public Health estimate there are 2.5 billion cases of zoonotic-caused human illness resulting in 2.7 million human deaths annually (Grace et al., 2012). Two prominent recent examples are Severe Acute Respiratory Syndrome (SARS) and the Swine Flu (H1N1). The growing incidence of zoonosis correlates strongly with a rise in the number of CAFOs. Physiological stress and the loss of genetic diversity asso-

ciated with industrial animal agriculture leave farmed animals prone to illness (Greger, 2007), so the proliferation of CAFOs can intensify the threat of zoonotic diseases to human and animal populations.

Another public health concern related to CAFOs is that animals in industrial agricultural operations are regularly fed antibiotics and growth hormones to improve productivity and decrease the risk of disease outbreaks resulting from the close confinement in which they live. Antibiotics and hormones reach surface and groundwater aquifers, and can enter potable water supplies through manure runoff, dumping, or fertilizer application, as well as flooding (Hribar, 2010). Scientists acknowledge that the presence of antibiotics and other hormonally active agents in water systems is a significant public health concern (Pew Campaign, 2011).

The World Health Organization (WHO) and public health experts confirm that routine use of antibiotics in CAFOs is a major cause of the development of antibiotic resistant bacteria (WHO, n.d.; Pew Campaign, 2011; Zhu et al., 2012). A recent assessment in China conducted at large, commercial pig CAFOs found 149 unique antibiotic resistant genes (ARGs) in three stages of manure processing for eventual disposal on land.

The researchers concluded that: “Diverse, abundant, and potentially mobile ARGs in farm samples suggest that unmonitored use of antibiotics and metals is causing the emergence and release of ARGs to the environment.” They defined ARGs as a potential threat to human health globally, since ARGs can reach people in food and drinking water, and added that “intensive animal husbandry is believed to be a major contributor to the increased environmental burden of ARGs” (Zhu et al., 2012).

With the spread of CAFO systems, it can be expected that antibiotics and hormones in livestock will become a more significant and precarious facet of the global food supply. At the same time, however, demand for animal pharmaceuticals is projected to rise by nearly 6 percent a year until 2016 (Zoetis, 2013b). Major pharmaceutical companies, including U.S.-based Alltech and Zoetis, the former animal medicine branch of Pfizer, are expanding to meet this market demand (Zoetis, 2013a; Alltech, 2013).

## Conclusions and Recommendations

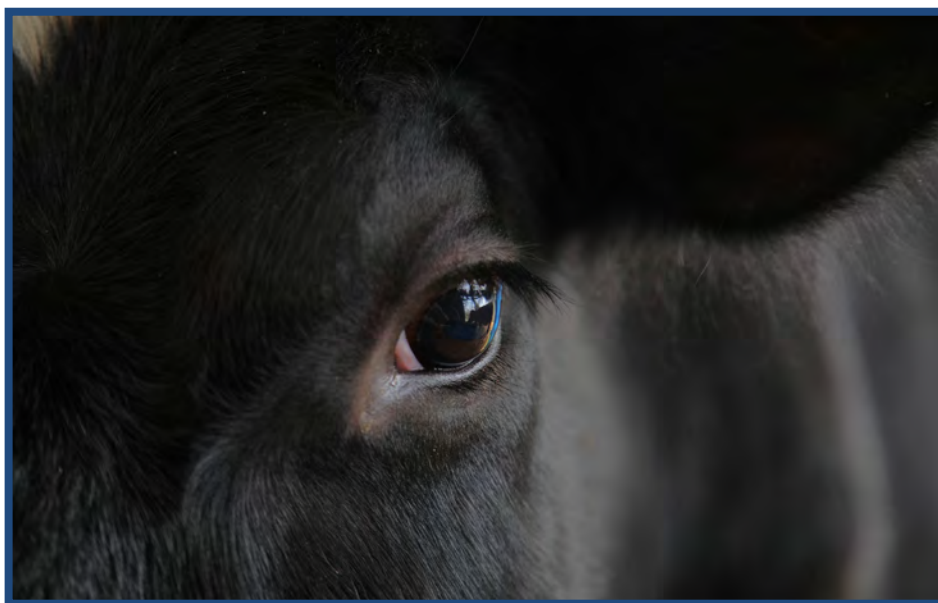
As industrialized nations begin to comprehend the range of consequences of industrialized animal agriculture, civil society and concerned citizens are advocating for enhanced regulations and a shift away from large-scale animal agriculture. Nevertheless, dairy corporations are encouraging adoption of the CAFO system in the global South with claims of economic gain, agricultural modernization, and improved food systems responsive to consumer demand. Wider use of the CAFO model in Asia, joined to an ever-expanding supply of dairy products, guarantees the opposite: that the shortcomings embedded in this model documented in the industrialized world will be replicated.

In India, China, and Southeast Asia, policy-makers, civil society, and private sector investors have a chance to interrupt this cycle and create more sustainable, equitable, and humane food and agriculture systems:

In India, China, and Southeast Asia, policy-makers, civil society, and private sector investors have a chance to interrupt this cycle and create more sustainable, equitable, and humane food and agriculture systems.

- Governments should prioritize long-term food security and consider all the consequences of industrial dairy operations and other intensive livestock operations when setting national food and agricultural policies. Governments and the food industry should place a priority on fostering less resource-intensive agricultural practices, including diverse and nutritious crops and products for direct human consumption.
- Governments should eliminate incentives for large-scale dairy and other livestock investors and corporations, including the elimination of land giveaways, subsidies, the use of special economic zones, and tax incentives. Governments should instead provide incentives to promote cultivation of and equitable access to less resource-intensive, plant-based foods that provide key nutrients and are likely to be resilient to the effects of climate change.
- Governments should impose taxes, fines, or other sanctions on CAFO pollution, including but not limited to excessive animal waste, carcasses, odors, land degradation, water contamination, biodiversity loss, and other natural resource impacts. Governments ought to ensure that all facets of dairy CAFOs are covered by pollution control regimes, including feed production, slaughtering, and meat and leather processing.

- Governments and civil society should launch national public education efforts to promote healthy eating habits based on traditional, plant-based, and predominantly regionally-available foods.
- Governments should eliminate investments in industrial dairy training institutions and programs, and alternatively, provide incentives for wider replication of sustainable, plant-based agricultural techniques; and offer technical assistance and training so farmers can adopt these methods.
- Food policy, animal welfare, and environmental organizations in industrialized nations should make efforts to forge closer ties to civil society organizations, policy-makers, and researchers in India, China, and Southeast Asia to share information and resources on dairy CAFOs and industrial animal agriculture more broadly, as well as other, better models.
- Governments should eliminate dairy industry-created school nutritional programs, dairy industry-influenced public nutrition guidelines, and corporate marketing campaigns asserting the nutritional necessity of dairy consumption. School nutritional programs and public nutritional guidelines ought to be developed by independent nutrition scientists and include plant-based alternatives.
- Governments ought to prohibit misleading marketing strategies for dairy products that include depictions of free-range or content animals or otherwise unrealistic and misleading advertising tactics. The industry itself should act in good faith and not engage in this kind of false advertising.
- A coalition of civil society groups, with government input, should undertake outreach to any corporate social responsibility arms or principles of dairy corporations or financiers of dairy CAFOs to raise their awareness of the documented negative effects of such operations on the environment, animals, and humans.
- Governments should prohibit importation and breeding of non-indigenous dairy cows not adapted to the high heat climates of India, China, and Southeast Asia.
- Governments should impose taxes, fines, or other sanctions for excessive product packaging (like for milk) and any subsequent increase in packaging litter. Governments ought to require all packaging to be recyclable with necessary recycling technology readily available and its use enforced. They should also support public recycling education campaigns; these could be funded, at least in part, by the dairy industry.



## Endnotes

<sup>1</sup>According to the FAO, the reasons for the large margin of uncertainty is as follows: "For the preparation of this global assessment, numerous hypotheses and methodological choices were made, most of which introduce a degree of uncertainty in the results. Furthermore, a lack of data forced the research team to rely on generalisations and projections. A sensitivity analysis was thus conducted to test the effect of these approximations, and results were compared to existing literature in specific locations/farming conditions. This allowed the computation of a margin of error of  $\pm 26$  percent at the 95 percent level of confidence within which the results are reported." These data include emissions from dairy production and processing; dairy-sourced meat production and processing; packaging production; transportation; and deforestation caused by the production of feed.

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