

VEG OR NON-VEG?

INDIA AT THE CROSSROADS

INDIA





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This policy paper is published as part of **Brighter Green’s Food Policy and Equity Program**. Policy papers and documentary videos on climate change and industrial animal agriculture in Brazil, China, Ethiopia, and India, along with additional resources on the globalization of factory farming, are available on Brighter Green’s website: www.brightergreen.org.

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Thanks to Deepa Balaram, Surendra S. Dhull, Nitya Ghotge, Nitin Goel, Jitender Khatri, Elaine Matthews, Chetana Mirle, Wan Park, Shiela Rao, Sowmya Reddy, Martin Rowe, Smita Sirohi, Vivasvaan Srivastava, Alli Tamboline, Vikram Yadav, and the photographers who post on Flickr. Special thanks to Humane Society International-India for facilitating access to production and processing facilities in and around New Delhi and Haryana described in the text and depicted in photos.

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INDIA HAS a several-thousand-year history of ethical vegetarianism, rooted in the Hindu and Jain religions' commitment to *ahimsa* or non-violence. Vegetables, legumes, and grains lie at the center of the country's varied regional cuisines, but cultural, ethical, and economic strictures on meat eating are weakening in globalizing, urbanizing India, and it is no longer a majority vegetarian nation. Only about 40 percent of India's 1.2 billion people identify themselves as vegetarian, according to a 2006 survey.^{1 2}

It is India's fast-expanding middle class that is driving growing demand for meat, eggs, and dairy products like ice cream and cheese, as well as milk, which is a part of most Indians' diets. For many middle class Indians, owning a television, driving a car, wearing Western brand clothing, and eating meat have become symbols of affluence, independence, and modernity.

To satisfy domestic consumption, and with an eye on export markets, India has joined the livestock revolution. It has a large and growing population of farmed animals and intensification in how they are produced, in the Western mold, is underway.

India is now among the world's largest producers of milk, poultry meat, and eggs. It has the world's biggest dairy herd, 300 million strong, comprised of cows and buffalos, and is the second largest global producer of cows' milk (after the U.S.) and first in buffalo milk.³

India is also the world's top national milk consumer, and demand for milk and other dairy products is growing by 7 to 8 percent a year.⁴ Between 1997 and 2007, the average Indian's milk consumption rose by 15 percent.⁵

Cows are sacred to Hindus (India's largest religious group, comprising about 80 percent of the population) and their slaughter remains controversial, but "beef" in India

comes from the meat of both buffalo and cows.⁶ Beef is eaten by India's Muslim and Christian communities, who

face no proscriptions on consuming it, as well as by some Hindus. With global prices of pulses like lentils rising, more Indians are opting for beef.⁷ Beef from buffalo is now the second most widely consumed meat in India after poultry.

India is also the world's fourth largest producer of eggs and fifth largest producer of poultry meat, principally from chickens.⁸ In 2010, India was the world's fastest-grow-

ing poultry market, outpacing Brazil, China, the U.S., the European Union (E.U.), and Thailand.⁹ On a given day, at least 650 million farmed birds—primarily chickens raised for meat and laying hens—are alive in India.¹⁰

Because of quick, large-scale production, particularly for chicken meat and eggs, no taxes, cash transactions, low waged labor, and few government regulations, animal products often sell in India for less than vegetables or pulses. Low production costs also provide a competitive advantage in international markets. The costs of producing chickens for meat in India are the world's second lowest, and production of eggs in India is cheaper than in any other country, according to the Poultry Federation of India.¹¹

While the majority of India's animal products are



Cows are considered sacred in the Hindu religion.

consumed domestically, trade in them, along with grain and oil meals used in livestock feed, is growing. India is the top global exporter of buffalo meat and it also exports increasing quantities of maize (corn) and soy, both important ingredients in commercial feed.¹² In addition, India's leading poultry producers are expanding sales to countries in Asia and the Middle East.

The government also has ambitions for once largely vegetarian India to assume a more significant role internationally. "As the country's livestock industry is changing, India attempts to become a key player in the global meat market," states India's National Meat and Poultry Processing Board, established by the government in 2009.¹³ Investment in Indian agribusinesses by U.S. and European animal protein and feed producers is increasing, and the government is encouraging this trend. In 2011, it announced a new policy: foreign direct investment for intensive livestock operations with 100 percent foreign ownership would be welcome.¹⁴

Livestock industry analysts predict that Indians will never eat as much animal protein as people living in the U.S. or China, given India's cultural and culinary traditions. However, the size of India's population, and its expanding middle class, mean small shifts can have large consequences. Marked increases in India's meat, egg, and dairy production have considerable impacts on India's environment, food security, and social and economic equity, as well as the global climate.

ECONOMIC GROWTH, BUT PRIVATION PERSISTS

India is now the world's tenth largest economy, with rates of annual growth—9 percent in 2009—that are well above global averages.¹⁵ ¹⁶ The composition of the economy has changed considerably over the past half-century. In 1950, 55 percent of India's gross domestic product (GDP) came from agriculture.¹⁷ Today, agriculture's share of GDP is much smaller, 18.5 percent in 2009, with services accounting for 55 percent and industry, 28 percent.¹⁸ Livestock contributes about one-quarter of India's agricultural GDP, but just 4 percent of national GDP.¹⁹ ²⁰

Despite the advent of globalization and the increasing

size of services and industry in its economy, much of India remains agrarian. More than 800 million Indians live in rural areas, and agriculture is the primary livelihood for nearly 60 percent of India's people.²¹ ²²

Even though the expansion of India's middle class has encouraged Indian and multinational enterprises to cater to their aspirations through an expanded array of consumer goods, luxury housing, shopping malls, and even fast-food outlets, poverty, low levels of human development, and hunger remain widespread. In 2010, the Indian government estimated that 37.2 percent of its people—410 million—live in poverty.²³ In its annual index of human development, the United Nations Development Programme (UNDP) ranked India 121st out of 169 countries.²⁴

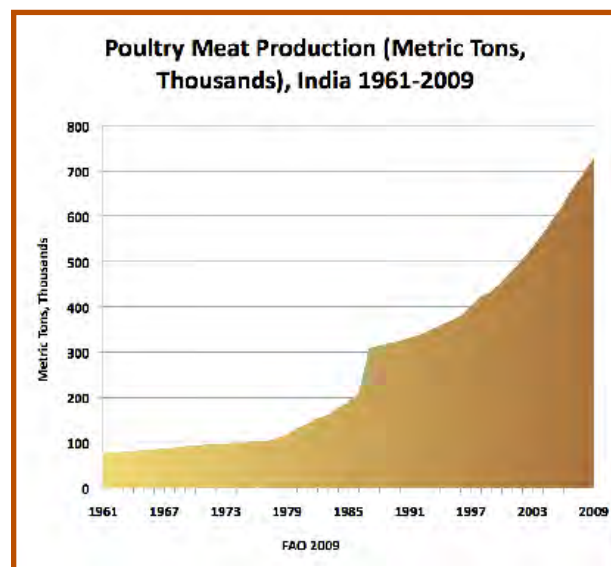
Gross national income per capita is U.S.\$1,220, with significant inequalities across economic groups.²⁵ The 10 percent of Indian households with the highest incomes con-

sume 31 percent of all goods and services; by contrast, consumption by households with the lowest 10 percent of income does not even reach 4 percent of the total.²⁶ "Inequality in the distribution of human development [income, health, and education] is distinctly pronounced in India," concluded a 2011 report by UNDP. If inequality was factored in, India's overall human development performance rating would fall by one-third.²⁷

Although more Indians are eating higher up the food

chain, under-nutrition remains stubborn and persistent. Forty-four percent of Indian children under 5 are malnourished, well above the average (still shockingly high) of 25 percent for other countries like India classified as lower-middle income.²⁸ One of every three of the world's malnourished children lives in India.²⁹

Under- and over-nutrition now co-exist in India, often in close proximity. Indian public health officials are raising concerns about the effects of rapid dietary changes toward over-consumption. Rates of chronic health conditions associated with affluence, such as diabetes and heart disease, are rising. More than 20 percent of Indians in urban areas are overweight. In India today, both malnutrition and obesity-related diseases are among the leading causes of death.³⁰



GLOBAL WARMING—OUTPUTS

India's greenhouse gas emissions (GHGs) are the world's fifth largest, after China, the U.S., the E.U, and Russia.³¹ Reflecting recent high rates of economic growth, India's emissions rose more than 50 percent between 1994 and 2007. (Per capita GHG emissions in India are, however, still extremely low: just 1.7 tons of carbon dioxide equivalent in 2007.)³²

India's livestock, particularly the enormous population of cows and buffalo, are a significant source of GHGs. India's emissions of the greenhouse gas methane from livestock are larger than any other country's.

Although India's GHG emissions from agriculture fell between 1994 and 2007 to about 18 percent of the total, the livestock sector in 2007 produced 334 million tons of carbon dioxide equivalent (CO₂ eq). Enteric fermentation, from the digestive processes of ruminants, including cows, buffalo, sheep and goats, is responsible for a majority of this—63.4 percent—or 212 million tons of CO₂ eq. (Cultivation of rice, a key Indian crop, contributes just 21 percent of India's agricultural emissions, or 70 million metric tons of CO₂ equivalent.)³³

In 2009, scientists at India's Space Applications Centre conducted the first India-wide study of emissions of methane from India's nearly half billion cows, buffalo, sheep, and goats. They found that these emissions had risen almost 20 percent between 1994 and 2003, to 11.75 million metric tons annually.³⁴ Emissions have almost certainly risen further: in the four years between 2003 and 2007, India's population of cows and buffalo increased by 21 million.³⁵

Over a hundred-year period, methane has at least 21 times the global warming potential of carbon dioxide. Calculated over a 20-year period, methane's warming impact is much greater: 72 times that of carbon dioxide.³⁶ Methane's lifetime in the atmosphere is about ten years, while carbon dioxide's is at least a hundred years. Given its shorter lifespan, if methane emissions are lowered, the benefits would be realized sooner than for reductions in CO₂.

A lifecycle study of GHG emissions of various foods by researchers at the Indian Agricultural Research Institute found that a non-vegetarian meal including mutton (meat from lamb or sheep) emitted 1.8 times the GHGs of a vegetarian meal without dairy or eggs. The authors

concluded: "Change in food habit thus could offer a possibility for GHG mitigation."³⁷

GLOBAL WARMING—IMPACTS

The Indian sub-continent contains a range of ecosystems and microclimates, encompassing desert, rainforest, plains, mountains, and numerous river basins. Northern India has a temperate climate while the south is largely tropical. The annual monsoon, extending from June to September, provides more than 80 percent of India's annual rainfall.

The effects of global climate change are expected to hit India particularly hard in the form of rising temperatures, erratic monsoon rains, more frequent and more intense droughts, flooding, cyclones, and growing water scarcity and desertification. Food production will not emerge unscathed. Agricultural output in India still depends on the monsoon; 55 percent of India's crops are watered by rain, not irrigation.³⁸

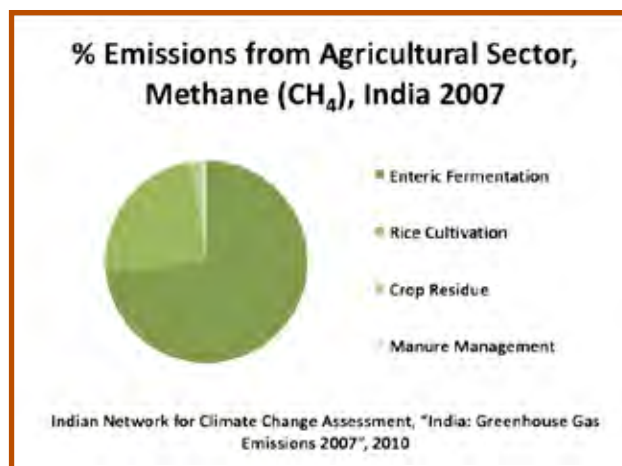
The 2009 monsoon, widely viewed as "failed" due to the low volumes of rainfall, led to crop losses, soaring food prices, and increased debt for many farmers.

Food imports have been seen as an "unnecessary evil," given India's experiences in the 1960s and 1970s of insufficient monsoon rains, large imports of grain, and regular shipments of food aid.³⁹ But maintaining food self-sufficiency may become far more challenging for India as production of animal-based

foods expands, along with intensification of the methods used to do so.

India is the world's third largest producer of cereals (including rice, wheat, maize, millet, barley, sorghum, and millet) after China and the U.S. But after decades of increases in the post-Green Revolution period, availability of food grains per capita is now declining; it fell by 4.5 percent between the periods 1991–2000 and 2001–2005. This "suggest[s] that complacency about India's food grain situation and claims of self sufficiency are clearly unwarranted," concludes a report on rural food insecurity in India by the UN World Food Programme and the M. S. Swaminathan Research Foundation, a Chennai-based think-tank working on issues of sustainable agriculture and rural development.

While the livestock sector in India contributes to global warming through emissions of GHGs, it will also be impacted



by climate change. Possible temperature increases in India of between 2.3 to 4.8 degrees Celsius by 2050 will add to heat stress in animals used to produce milk and affect reproduction and the amounts of milk each animal provides. Crossbred cows may be most vulnerable to higher temperatures.⁴⁰ Increased temperatures and sea-level rise may also reduce the availability of land to grow feed, and result in lower crop yields and an increase in the severity and spread of animal diseases.

U.K.-based risk-analysis firm Maplecroft placed India second in a list of 170 countries assessed for their vulnerability to the effects of climate change. “Almost the whole of India has a high or extreme degree of sensitivity to climate change, due to acute population pressure and a consequential strain on natural resources,” the assessment concluded.⁴¹

RISKS AND RETURNS?

India occupies just 2.4 percent of the Earth’s surface area, but has 17.5 percent of the world’s population. In the decade between 2001 and 2011 India added 181 million people.⁴² The most recent national census projects that by 2025 India will surpass China to become the world’s most populous nation and that by 2050, India’s population will reach 1.6 billion.⁴³

Consumption of meat—an average of 3.26 kilograms (kgs) (7.19 pounds/lbs) for every Indian a year—is less than one-sixteenth of levels in China, and one-thirty-fifth of those in the U.S.⁴⁴ Data show that for the period 1997–2007, per capita meat consumption was static or declining. But these

data average consumption across a large, diverse, and growing population.

By and large, poor Indians who eat meat or eggs do so relatively rarely or in small quantities. Most of India’s meat, eggs, and milk are consumed by those in middle and upper economic brackets. And while India’s middle class, estimated to number between 30 and 300 million, comprises at most just one-quarter of the population, it is the segment growing most quickly—and where shifts in diet are seen most clearly.^{45 46}

Water scarcity is a reality in all of India’s states, and animal agriculture is a significant source of water pollution. Strains on land are immense. Agricultural land per farmer is just .3 of a hectare (.8 of an acre), and an estimated 45 percent of India’s land is degraded from over-grazing and over-production of crops. By 2020, high population density (382 people per square kilometer/0.6 of a mile, according to the 2011 census) coupled with rapid economic growth will put India’s land, water, air, soil, and forests under more pressure than those of any other country, according to the World Bank.⁴⁷

This paper will ask: can India provide enough food for its people as well as support hundreds of millions of cows and buffalo and billions of chickens in increasingly industrialized conditions? And can it do so while protecting its natural resources and the global climate, and ensuring progress in human development?



Climate change threatens to increase the severity and frequency of drought and intensify water scarcity in India.

FACTORY FARMING COMES TO INDIA

“If India had the ‘green’ revolution [in grain], the ‘white’ revolution [in milk], and the ‘blue’ revolution [in fish], can the ‘pink revolution’ be far behind?” Dr. S. K. Ranjhan, a 40-year veteran of India’s livestock sector asked early in the 21st century.⁵⁷ Evidence suggests it isn’t. The transformation in egg- and chicken-meat production has been particularly quick and wide-ranging.

Once an important source of income for rural, landless Indians, the poultry sector is rapidly changing to cater to the needs of India’s middle class for employment and new business opportunities, and a desire to produce and eat more chickens and eggs. The methods of production look increasingly like those in industrialized countries. Just 10 percent of India’s poultry production remains small-scale or “backyard.”⁵⁸

About 90 percent of the more than two billion “broiler” (meat) chickens produced in India each year are raised in industrial-style facilities, according to the Poultry Federation of India.⁵⁹ The birds (international high-yielding breeds) are housed by the thousands and fed commercially produced feed, comprised largely of maize and soymeal. In addition, approximately 80 percent of India’s eggs come from the 140 million to 200 million egg-laying hens confined to small, wire “battery” cages stacked in rows in indoor sheds.⁶⁰

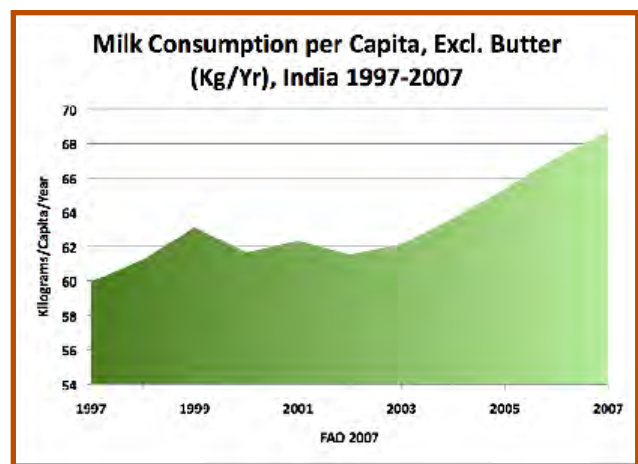
Dairy and beef production in India is not—yet—heavily industrialized, although the population of cows, 200 million, and buffalos, 105 million, is substantial.⁶¹ Most herds are still small, between two and six animals. By and large these cows and buffalo do not eat grain. Instead, they graze on community lands, if they are available or in forests (not ideal for protecting forests, biodiversity, or regular rainfall), and may also eat crop residues or green fodder (which includes maize, Egyptian clover, sorghum, and oats, and is grown by farmers themselves).⁶²

In India’s peri-urban areas, however, commercial dairies have become more common, with up to 200 cows housed in each. In addition, large, commercial, “mega” dairies with thousands of cows are being piloted in India with investment from domestic and foreign agribusinesses.

Between 1951 and 2007, India’s population of cows and buffalo grew by more than 50 percent.⁶³

GLOBALIZATION AND GROWING INEQUALITY

Urbanization is one of the factors underlying the expansion of India’s livestock sector. Animal-based foods are more readily available and in larger quantities in and around India’s cities, where they are sold at live markets and superstores, as well as in restaurants and fast-food outlets, including Western



“quick serve” chains like McDonald’s, KFC, and Taco Bell, all of which are present in India.

Changes in the rural economy also have played an important role. Most farms in India are small, on average just 1.3 ha (3.3 ac) and getting smaller as land is subdivided with each generation.⁶⁴ With the decline in common land in India since the 1950s, many small farmers no longer have sufficient terrain on which to graze their cows or buffalo, or water for them to drink. Indian pastoralists are also being squeezed as commercial crop producers acquire more and more of what was common lands.⁶⁵

India’s population of cows, buffalo, sheep, and goats has grown significantly since Independence in 1947, but areas of permanent pasture and grazing land have continued to decline.⁶⁶ Moreover, drought and insufficient rainfall—both more likely with climate change—make grazing land less hospitable, cultivation of fodder less predictable, and water for livestock or crops harder to come by.

India already imports fodder and feed ingredients for its livestock: 285,000 metric tons of it in 2008, more than double the quantity imported in 2003.⁶⁷ The U.S. Grains Council projects that by 2014–15, India will become a net importer of maize, an estimated 300,000 metric tons of it, and that maize imports will increase to 800,000 metric tons in 2018–19.⁶⁸ Such imports could affect world food prices, as well as the cost of food in India.

Similar to many developing countries, India has been experiencing steep rises in food prices. In June 2011, the Ministry of Commerce and Industry reported that food prices were increasing by an annual rate of more than 9 percent.⁶⁹ One of the contributing factors, according to the Reserve Bank of India, is that more Indians are adopting “protein-rich diets.”⁷⁰

The middle class, with more disposable income and a smaller percentage of their household budget spent on food, are not immune to the effects of rising food costs, but they can

cope more effectively. For 60 percent of India's population, however, "if the price of food goes up by 10 percent, that means one less meal a day," according to Jayati Ghosh, a professor of economics at Jawaharlal Nehru University in Delhi. "We're talking about very severe effects."⁷¹ In January 2011, vegetables in India cost 70 percent more than they did in January 2010.⁷²

As the M. S. Swaminathan Research Foundation and the UN World Food Programme report observes: "While famines and starvation deaths remain the popular representation of the contemporary problem of hunger, one of the most significant yet understated and perhaps less visible area of concern today is that of chronic or persistent food and nutrition insecurity."⁷³

Many concerned with India's human development and growing inequality charge that successive Indian governments have favored large agricultural producers—through subsidies, policies, and preferential treatment—at

the expense of India's small farmers, still a majority of the population. "[T]he sector [agriculture] that still employs the largest number of Indians is in deep trouble," journalist P. Sainath writes. "Obscene levels of inequality stare this society in the face. And there seems to be little concern over this at the top."⁷⁴

Sainath argues that India's 2010–11 national budget reads as if crafted for or by agribusiness, a "goldmine for large corporations, not the countless millions of small and marginal farmers who produce India's food."⁷⁵

THE WHITE REVOLUTION

Over the centuries, domestic animals have been central to India's agrarian economy. Due in part to India's vegetarian traditions, livestock were valued as more than sources of food. Buffalo, for example, provide draught power, dung for fuel, and urine to make organic pesticides. Moreover, the cow in Hinduism was exalted for the "gifts" she gives

THE PULSE OF INDIA

Given the large domestic population, varied climates and soils, including many well suited to agriculture, and a national priority on food self-sufficiency, it is not surprising that India is one of the world's leading food producers. It is first globally in production of fruit, buffalo milk, buffalo meat, and spices; and second in production of vegetables, wheat, rice, and tea. India is also a significant exporter of food. Milled rice, sugar, onions, and buffalo meat are among its top commodity exports.⁴⁸

Despite India's leading position in cultivation of vegetables, fruit, and pulses, millions of Indians do not have regular access to these foods. Pulses, including lentils, peas, and beans, are integral to India's varied cuisines, but rates of consumption are decreasing across all sectors of Indian society. This is unfortunate on public health grounds, since pulses provide protein and a number of micronutrients. One reason for the decline is steep price rises, as domestic production fails to keep pace with population growth. In 1961, 69 grams of pulses were available for each Indian. By 2005, that level had fallen by more than half, to 32 grams.⁴⁹

To make up for these shortfalls, India has become the world's largest importer of pulses. In 2008, India purchased more than half a million metric tons of pulses from Brazil and other countries.⁵⁰ By 2012, India will need more pulses, an estimated 21.3 million metric tons, according to Dr. Prema Ramachandran, director of the non-governmental Nutrition Foundation of India. Ramachandran and others would like to see the government, researchers, and farmers collaborate to support increased domestic cultivation of pulses and

remove obstacles to their reaching markets, with a particular focus on ensuring that poor Indians benefit.⁵¹

A variety of vegetables is another well-known feature of Indian meals. But consumption of vegetables among Indians on average is not even one-third of recommended levels, and the amount of cropland used for vegetable production, less than 2 percent, is tiny compared to the size of the population.^{52 53} (In 2010–11, India's production of vegetables is set to rise 5 percent over 2009–10 levels, to 14 crore (140 million) metric tons, with higher harvests of onions, potatoes, cabbage, cauliflower, and *brinjal*.)

Ramachandran attributes the prevalence of anemia and micronutrient deficiencies among millions of Indians to low vegetable and fruit consumption, including the absence of leafy green vegetables in most Indians' diets, and specifically those of the rural poor. She suggests increased public education on the benefits of eating leafy greens and incentives to increase cultivation of "locally relished vegetables" throughout the country to improve not only nutrition but also livelihoods.⁵⁴

"Adequate storage facilities and linkages between producers and markets similar to what has been done in 'Operation Flood' has to be replicated for the low-cost nutritious vegetables, in order to bring about improved access to nutritious vegetables at affordable cost throughout the year," Ramachandran adds.⁵⁵ In March 2011, the government announced it was launching an initiative to ensure the vegetable supply in large and medium-sized urban centers across the country, although not in rural areas.⁵⁶ ■

human beings: milk, ghee (clarified butter, a staple of Indian cooking), curds, and, like buffalo, manure (for fuel), and urine (used as a disinfectant or pesticide).⁸¹

The Green Revolution, which began in India in the 1960s, led to an overhaul of traditional agriculture and the introduction of mechanized farming, which greatly diminished the role of livestock on farms. The “White Revolution” or “Operation Flood,” launched in 1970, further propelled this shift, with cattle and buffalo becoming increasingly seen as sources of milk as well as meat and cash income.⁸²

A partnership of the Indian government, the World Bank, and the United Nations Food and Agriculture Organization (FAO) and the World Food Programme, among others, Operation Flood aimed to raise milk production exponentially as well as increase rural incomes. It facilitated the creation of dairy farmer cooperatives, which still include millions of Indians, and established a national milk grid. It also resulted in the anticipated flood of milk, which continues today.

In 2010, India produced nearly 112 million metric tons of milk, 44 percent more than in 2000.⁸³ In 2008, per capita milk consumption reached 250 g (8 ounces) a day, its highest level ever. Most is consumed by Indians as

fluid milk (46 percent), with smaller amounts as ghee (27 percent), yogurt (7 percent), butter (6.5 percent), and *khoa*, partially dehydrated condensed milk (6.5 percent).⁸⁴ Overall consumption of dairy products in India will rise by 50 percent by 2020, with annual levels of national milk demand reaching 170 million metric tons, according to A. K. Srivastava, director of India’s National Dairy Research Institute (NDRI).⁸⁵

India’s complex cooperative structure, developed during the Operation Flood era, enables the country to rely on relatively small-scale producers to supply large quantities of milk. The Indian Dairy Cooperatives Network has more than 12 million individual members, many of them women, who produce nearly a quarter (22 percent) of India’s milk.⁸⁶ Large private dairy companies source milk through the cooperatives, which they then process into value-added products like ice cream or yogurt.

Up to 90 percent of Indian dairy operations are small, with no more than five buffalo or cows in each, according to Smita Sirohi, principal scientist at the NDRI.⁸⁷ Many of India’s cows and buffalo, however, no longer graze on pasture, but rather live in and are fed and milked in barns. In and around India’s large metropolitan areas, dairies with between 50

GREENHOUSE GASES AND ANIMAL AGRICULTURE

Greenhouse gases (GHGs) are generated at virtually every point along the livestock production chain. The UN Food and Agriculture Organization (FAO) attributes to the global livestock industry nine percent of anthropogenic (man-made) CO₂ emissions; 37 percent of anthropogenic methane emissions; and 65 percent of anthropogenic nitrous oxide emissions. Methane and nitrous oxide, though lower in concentration in the atmosphere than CO₂, are far more potent heat-trapping gases.

CO₂ is produced by using fossil fuel-based energy in facilities that raise and process animals for food, transport them to slaughter, as well as through the export of animal-based products. In India, emissions from energy used by the agriculture and fisheries industries totaled 34 million tons of CO₂ eq, in 2007 or 3 percent of the GHGs produced by the energy sector. This does not include emissions from electricity taken from the national grid, e.g., to light and cool large poultry or egg operations or dairies, or to slaughter and process animals and their products.⁷⁶

CO₂ is also released through the production of feed crops. Soil cultivation related to animal agriculture globally emits about 28 million tons of carbon dioxide each year.⁷⁷ More than half of the energy used in producing meat, milk, and eggs can be attributed to feed production. There are other, indirect CO₂ emissions, specifically

from the manufacture of chemical- and nitrogen-based fertilizers, and the petroleum-based pesticides used widely on commodity crops. About 41 million tons of CO₂ are emitted globally each year from the production of nitrogen fertilizers applied to feed crops.⁷⁸

CO₂ is also released when forests and other vegetation are destroyed to make way for feed crops or pasture. Considerable uncertainty exists in calculating overall GHGs from such changes in land use, although the FAO estimates that 2.4 billion tons of CO₂ are emitted each year due to deforestation to create pasture for livestock or land for cultivation of feed crops. On top of this, an estimated 100 million tons of CO₂ are released every year from livestock-induced desertification of land.⁷⁹

In addition, maize and soybeans—widely processed into commercial animal feed—are often transported long distances, most frequently by vehicles or ships that run on fossil fuels that produce CO₂ along with various other pollutants.

Animal wastes also release nitrous oxide (N₂O). While India’s N₂O emissions from manure management in 2007 are small, just 70 tons (2,437 tons of CO₂ eq), N₂O has at least 296 times the global warming potential of CO₂.⁸⁰ If current trends persist, India is likely to see GHG emissions from its livestock sector continue to grow. ■

and 200 or more cattle are increasingly common. These cows are generally kept tethered or chained in stalls and fed on fodder, supplemented by crop residues, commercial feed, or feed concentrates.

“It was a very small space and just no place for movement,” Sirohi said of a visit she made to a “stall-fed” dairy operation. “And they said they [the cows] will only be taken out when they die.” No government regulations dictate the minimum space to be allotted to each cow in Indian dairies or the maximum number of cows allowed in a specific area or operation.⁸⁸

In larger, commercial dairies, cows are given antibiotics and hormones to increase milk yield. Use of the growth hormone oxytocin in Indian dairy cows and buffalo is “indiscriminant,” says Dr. Nitya Ghotge of ANTHRA, an association of women veterinarians working on livestock and livelihood issues, even though it is legally banned.⁸⁹ The cows are also routinely re-impregnated to enhance the amount of milk they provide.

One growing environmental problem with concentrated cow or buffalo populations is the large amount of waste that is created. Sirohi explains that while efforts have been made to ban large dairies in peri-urban areas because disposal of the wastes is such a problem, most have not succeeded.⁹⁰

The Indian dairy industry also contributes to the beef and leather industries. Dairy cows are typically slaughtered for meat and leather at the age of six; buffalo, with no legal protection from slaughter, can be sold for beef at any age.

Just five percent of India’s dairy production is exported, mainly as powdered milk and casein, a milk protein used in cheese and processed foods. In 2009–10 these exports, to the U.S., the United Arab Emirates (U.A.E.), Singapore, and India’s neighbor, Bangladesh, among other countries, earned U.S.\$144 million.^{91 92}

In early 2010, fearing shortages of milk products due to the weak 2009 monsoon that reduced the availability of fodder, the Indian government allowed duty-free import of 30,000 tons of non-fat dry milk and 15,000 tons of butter oil.⁹³ In early 2011, in a bid to expand domestic supply and arrest rising prices, the government blocked exports of both milk powder and casein and again allowed duty-free imports of milk powder and butter. Some analysts foresee India becoming a net importer of dairy products and also having

to end its exports to meet anticipated domestic demand in the coming years.⁹⁴

THE MILK MARKET

Domestic demand for milk and milk products is outpacing increases in production, estimated at 4 percent a year.¹⁰⁴ While all states in India have dairy production, the top state producers of cows’ milk are Uttar Pradesh in the north, Tamil Nadu in the south (which also has the largest number of exotic breeds of cow), and Maharashtra in the west.¹⁰⁵ The top three states for buffalo milk production are Uttar Pradesh, Punjab, also in the north, and Andhra Pradesh in the southwest.¹⁰⁶ Interestingly, buffalo comprise a majority (46 percent) of the country’s dairy herd; indigenous cows represent 40 percent; and 14 percent are imported North American

and European crossbreeds.¹⁰⁷

As with poultry, costs for producing dairy products in India are among the lowest in the world, mainly because most Indian cows and buffalo do not yet eat commercial feed.¹⁰⁸ But less and less of India’s agricultural land is available to plant with fodder crops, including as a result of urbanization.¹⁰⁹ Shortages of fodder have led to its price rising. Costs of de-oiled rice bran and molasses, also fed to cattle, have been going up, too, along with those of fuel to transport milk to markets and processing centers.¹¹⁰

Purchasing feed or securing sufficient fodder is difficult for smaller-scale producers in India, an issue noted by Tamil Nadu-based Hatsun, India’s largest privately held dairy company. “Presently the chronic shortage of feed coupled with the poor quality of fodder is widely regarded as the major constraint in animal production,” the company’s website states. “[I]n the present system of intensive livestock production, increasing concentrate feeding has increased the milk production cost and substantially decreased the profits of farmers. The increasing cost of feed ingredients and its seasonal variability also adds to the gravity of the situation.”¹¹¹ Consumer prices for dairy products are also rising.¹¹²

High input costs have driven some producers and cooperatives to abandon milk production altogether, according to P. G. Bhatol, chairperson of India’s largest dairy cooperative, Amul.¹¹³

The average Indian dairy cow provides 2.1 kgs (4.6 lbs)



METHANE AND INDIA'S DAIRY SECTOR

A large majority of India's emissions of methane (CH_4) in 2007—77 percent—is from agriculture, with livestock contributing a significant share. Methane, from enteric fermentation and manure management, accounted for just about half of India's total methane emissions in 2007.⁹⁵ Approximately 15 percent of the methane released globally from enteric fermentation is attributed to India.⁹⁶

How much methane is produced is related to what and how much domesticated ruminants (among them cows, buffalo, goats, and sheep) are fed. Indigenous cattle emit less methane than so-called “high-yielding” breeds, but the latter are gaining in popularity among larger Indian dairy operators. (Dairy cattle produce more methane than other cattle.) Indian buffalo each emit more methane on average than India's cows, and average methane missions from Indian dairy cows are nearly twice those of non-dairy cows.⁹⁷

Nonetheless, an average Indian dairy cow produces significantly less methane than a dairy cow in industrialized regions, due to differences in the animals' size and feed. A typical Indian dairy cow emits approximately 46 kgs of methane a year (101 lbs), about one-third as much as the 118 kgs (260 lbs) of methane released by a dairy cow in the U.S.⁹⁸

But, as Smita Sirohi of the National Dairy Research Institute says: “Even if our per head emissions are low ... if you multiply that by [200 million] cows, it becomes a very big problem.”⁹⁹

Indian dairy cows' individual emissions of methane are slightly below those of dairy cows in Brazil and China, which average

about 56 kgs (123 lbs) a year, although higher than cows used for dairy production in Africa and the Middle East, which each emit approximately 37 kgs (81 lbs) of methane annually.¹⁰⁰

Indian dairy producers, particularly large ones, are expected to use more crossbred cattle and foreign breeds in an effort to

boost milk yields—a priority of both the industry and the Indian government. To promote production, dairy cows in industrialized countries are fed three or four times as much as they need to eat, almost exclusively grain-based feed. As a result, their methane emissions rise, too.¹⁰¹

Globally, enteric fermentation is responsible for about 90 percent of methane emissions from animal sources; methane from animal manure can add

emissions equal to up to 10 percent of those from enteric fermentation.¹⁰²

“Manure management” in India's livestock sector, comprising emissions of methane (CH_4) and nitrous oxide (N_2O), resulted in 2.44 million tons of CO_2 eq in 2007.¹⁰³ The majority of manure in India is stored dry for use as fertilizer or fuel in rural areas, not in the wet, anaerobic conditions (without the presence of oxygen) that generate methane.

Methane emissions from dried manure are negligible compared to those from manure stored in lagoons. But the contribution of manure to India's emissions of methane will increase with further commercialization of dairy production; in large dairy operations, the use of lagoons for manure storage is common. ■



A cow walks up the steps of an ice-cream shop in Solapur, Maharashtra.

of milk a day; the average buffalo, 3.5 kgs (7.7 lbs).¹¹⁴ By comparison, the average dairy cow in the U.S., where the industry is virtually wholly industrialized, yields ten times more milk: 24 kgs (53 lbs) a day.¹¹⁵ Both the dairy industry and the government want to ensure an increased milk supply and more milk from each cow or buffalo.

To realize this, some of the Indian dairy industry's major players are eager to import more foreign breeds, as well as genetics. While the government has frowned upon such imports in the past, pressure for increased production, and the shift toward intensification, are changing the government's view.

India's national dairy plan, budgeted at 17,300 crore (U.S.\$3.88 billion), seeks to raise milk production to 180 million metric tons by fiscal year 2021–22. To achieve this, the government plans investments in infrastructure for producing, processing, and marketing milk products; improving milk yield per cow through artificial insemination of imported genetics; establishing new feed plants; and

expanding membership in dairy cooperatives and improving milk collection.¹¹⁶

In 2011, the government announced a Rs. 8,000 crore (U.S.\$1.67 billion) plan supported by the World Bank to raise the milk yield of dairy cattle through a national

artificial insemination plan supported by low interest loans to producers. (The program also seeks to increase fodder production.)¹¹⁷ The government is also reviewing long-standing proscriptions to allow regulated imports of high-

yielding dairy cows for breeding purposes.¹¹⁸

"Official policies . . . perceive local breeds to be unproductive and an environmental burden. Policies and plans thus attempt to reduce these local animals and advocate their replacement with crossbred varieties," write Dr. Nitya Ghotge and Sagari Ramdas, the co-founders of ANTHRA. "The focus, unfortunately, is on breed-replacement and there are minimal comprehensive attempts to address the real issue of [the] fodder and water crisis."¹¹⁹

Consumer prices for dairy products are also rising. High input costs have driven some producers and cooperatives to abandon milk production altogether, according to P. G. Bhatol, chairperson of India's largest dairy cooperative, Amul.

RAPID CHANGE—AND CONTINUITY

Urbanization is well underway in India: 377 million Indians now live in cities, nearly 30 percent of the population.¹²¹ Formerly agrarian landscapes are now dotted with office parks, shopping malls, and upscale residences. In some parts of India, the pace of change is rapid. In others, much of what is considered traditional India remains. As historian William Dalrymple writes in his book *Nine Lives: In Search of the Sacred in Modern India*:

The speed of development is breathtaking to anyone used to the plodding growth rates of western Europe: the sort of construction that would take twenty-five years in Britain comes up [in India] in five months . . . so extraordinary is all this that it is easy to overlook the fragility and unevenness of the boom. . . . Within twenty minutes of leaving the Gurgaon headquarters of Microsoft or Google Asia [30 km southwest of New Delhi], cars and trucks are beginning to give way to camel and bullock carts, suits, denim and baseball hats to dusty cotton *dhotis* and turbans. This is a very different

India indeed . . . suspended between modernity and tradition.¹²²

Even as India's cities boom with people and commerce, privation persists—relatively unchanged by rising national income. The capital, New Delhi, is home to the largest slum dwelling in Asia. Millions of urban-dwelling Indians live without basic services like running water, health care, or permanent homes. In urban areas, just over half of the population uses improved sanitation facilities (ranging from well-maintained pit latrines to flush toilets); in rural areas, only 21 percent of people do.¹²³

In villages, schools, health centers, clean water, and electricity are often in short supply, and subsistence agriculture is generally the norm. Poor roads and other infrastructure challenge farmers' abilities to take crops to market and limit households' access to a range of nutritious foods in sufficient quantities. Debt among farmers is widespread; and when harvests fail—as a result of insufficient rainfall, unusually high temperatures, or another extreme weather event—rural Indians' often threadbare safety net can shred. ■

A report from the government of India's Planning Commission estimated that by 2015 India will require 1.7 million tons of fodder. Given expected deficits in domestic production versus demand (64 percent for green fodder and a nearly 25 percent gap for dry fodder, which includes wheat straw and the husks and hull of grains), a substantial portion of this will have to be imported.¹²⁰

DAIRY PRODUCTS: BIG BUSINESS

Even though India's dairy industry has relied mainly on small-scale producers, this has not impeded the development of large dairy corporations, some of them created from numerous cooperatives. Hatsun, for instance, acquires 1.65 million liters of milk each day from farmers in 4,500 villages throughout southern India. The company, which started modestly in 1970 with the launch of the Arun ice-cream line, now produces an array of dairy products from butter to curd to *paneer*, a popular Indian cheese.¹²⁴

Reliance, India's top refiner and petrochemical manufacturer, owns Reliance Fresh convenience stores and is investing more than U.S.\$1 billion to expand its distribution and retail milk sales.¹²⁵

¹²⁶ Hyderabad-based Heritage Foods Ltd. supplies dairy products to over 800,000 Indian households. Its website urges visitors to "bring home health and happiness" by buying Heritage milk, and offers them the opportunity to become part of the company's growth. For Rs. 10,000 (U.S.\$225), entrepreneurial Indians can become Heritage Parlor franchise owners, selling Heritage's milk, ice cream, and eggs in festively colored hundred-square-foot shops.¹²⁷

Multinational dairy corporations are also present in India, including Nestlé, one of the first to have invested in the Indian dairy industry, establishing milk sheds (the geographic area where dairy cooperatives produce milk), and supplying large dairy operators with discounted milking machines

and affordable veterinary services in return for a constant supply of milk.¹²⁸

The French dairy giant Danone is launching new products in India, like flavored milk.¹²⁹ Wal-Mart, with the aid of Indian partner Bharti Enterprises, has set up a dairy processing plant that sources more than one million liters of milk a day from north Indian dairy producers for sale in its stores outside of India.¹³⁰ Within India, Wal-Mart-Bharti operate jointly a chain of retail "cash and carry" stores in the north of the country that sell milk produced by India's Macro Dairy Ventures.¹³¹

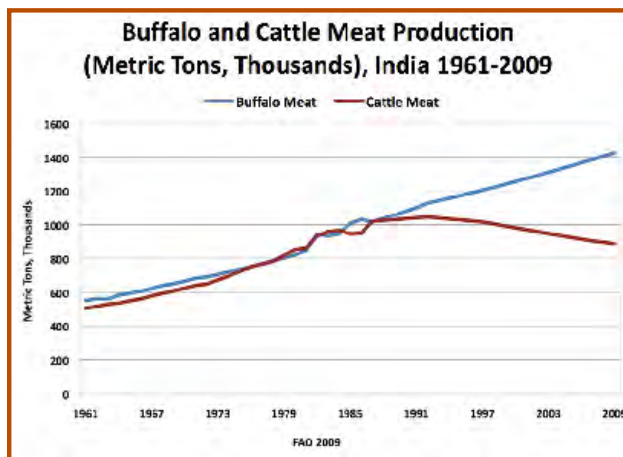
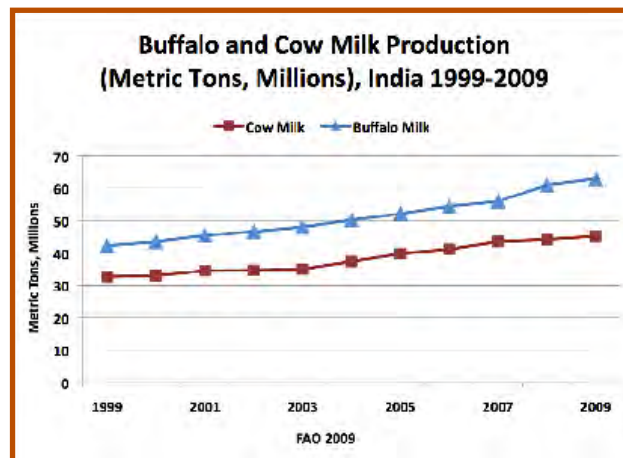
Coca-Cola, taking a page from its operations in China,

where it launched the "Pulpy Milky" dairy-fruit beverage, began selling a drink of milk mixed with mangoes called "Milky Delite" in India under the Maaza brand name in 2010.¹³²

The private sector arm of the World Bank, the International Finance Corporation (IFC), also has investments in India's dairy sector. In 2007, it provided \$4.7 million to Cream Bell, the milk and ice-cream branch of the Jaipuria group of companies, for a 20 percent ownership stake.¹³³ Family-run conglomerate Jaipuria's dairy holdings consist of Universal Dairy Products, owned by brother C. K., and Devyani Food Industries, owned by brother Ravi. A year after the initial IFC investment, Ravi Jaipuria bought out C. K. Jaipuria, and Devyani Food Industries began expanding its

operations into southern and western India.¹³⁴ The lucrative ice cream business, currently valued at Rs. 450–550 crore (U.S.\$101–123 million), has become part of Devyani's broad business portfolio, which includes franchise rights to Pizza Hut, KFC, and Costa Coffee chains throughout India.¹³⁵

The IFC also invested U.S.\$15 million in a U.S.\$54 million expansion of Haryana-based Modern Dairies' network of milk suppliers and processed dairy foods production.¹³⁶



SACRED COW NO MORE?



Cows can be slaughtered legally in just a handful of Indian states, but state laws regulating cow slaughter lack consistency.

Cows can be slaughtered legally in just two Indian states, Kerala and West Bengal, and seven union territories (regions administered by the central government). But state laws on cow slaughter lack consistency: the definition of “cow” is determined on a state-by-state basis. The slaughter of “spent” dairy cows over the age of 14 is legal in certain states. While most states ban the slaughter of calves, most also do not define a calf’s age.¹³⁸

The top three states for cow slaughter are Bihar followed by Kerala and Maharashtra, according to Indian government data. Slaughterhouses in the three states processed a total of nearly 1.4 million cows in the year 2009–10.¹³⁹ Male calves become, in effect, by-products of the dairy industry. They are regularly abandoned or sent to illegal slaughterhouses—processed for meat, the rennet in their stomachs, which is used in making cheese, and for leather.¹⁴⁰

The killing of cows in India, however, remains contentious, and can become a political lightning rod. Indeed, the Bharatiya Janata Party (BJP), India’s Hindu nationalist party, often uses the fact or risk of cows being killed as a rallying point during elections. At the same time, some Christian and Muslim organizations, as

well as those that work with the poor rural or urban communities, argue that restricting cow slaughter constrains their constituencies’ rights and food access.

Dairies also regularly release cows no longer producing enough milk to justify the costs of their feed or fodder into city streets. Others are slaughtered, often illegally, for beef, hides, skin, and even hooves. To house cows rescued from the streets or discarded by the dairy industry, state governments throughout India have set up a series of *gaushalas* or cow shelters. Many *gaushalas*, however, lack sufficient funding and often end up doubling as small-scale dairies.

In 2001, amid fears that the role of cows in Indian society was changing irrevocably, and with it the very nature of the Indian state, the government established the National Commission on Cattle. In its final report, the commission called for a nationwide ban on cattle slaughter and the prohibition of crossbreeding Indian cattle with foreign breeds. The commission also suggested halting tractor subsidies to encourage the re-introduction of draught animals to the countryside.¹⁴¹

Ultimately, however, India’s Department of Agriculture pushed to reject the commission’s proposals and recommended policy changes that were almost diametrically opposed to those of the commission. These included lifting all bans on Indian meat exports and regulations on processed meat imports; reducing the minimum age for slaughter of bullocks (young or castrated male cows); and removing all restrictions on buffalo slaughter. It also suggested facilitating the licensing of slaughterhouses, by centralizing the procedure and vesting control in each state government’s animal husbandry department.

These measures “clearly provide a thrust towards the creation of a significant meat market supplied by industrial abattoirs and corporate food marketers,” concluded *India Today*, a news service on development issues in India.¹⁴² ■

(This includes the export of Indian-made cheese to Japan to supply the Pizza Hut chain there.)¹³⁷

THE ERA OF MEGA-DAIRIES?

Large, industrialized operations could spell a significant reshaping of India’s dairy sector, while posing important ecological and ethical questions. “[I]n the longer term, the small-holder system will not survive the market pressure,” Sirohi says of the trend toward larger dairies. She continues:

“[T]here are huge environmental risks with industrialization and all biological systems are sensitive to extreme events. Heat stress can bring a sudden drop/death of a large number of animals, and the dairy sector is particularly vulnerable.”¹⁴³

New Zealand-based Fonterra, the world’s largest exporter of dairy products, exited a joint venture in India in 2009, but is one of three partners in a “mega-dairy” and processing plant slated to be built in Nellore, Andhra Pradesh.¹⁴⁴ The others are IFFCO (Indian Farmers’ Fertilizer Cooperative), the

BUFFALO MEAT—HOME AND ABROAD

Sales of buffalo milk and meat, free from cultural, religious, and legal restrictions, are rising. Consumption of buffalo beef reached an estimated 2.1 million tons in 2010, up six percent from the year before (average consumption is 2 kgs or 4.4 lbs by each Indian each year).¹⁵⁰ Uttar Pradesh, Andhra Pradesh, and Maharashtra are the top buffalo-slaughtering states, together processing nearly 3.5 million buffalo in 2009–2010.¹⁵¹

Buffalo meat in India is among the lowest-cost sources of protein, animal-derived or not. Domestic demand for it continues to grow, and in export markets, buffalo meat—largely frozen and deboned—is priced to move.¹⁵² India is the world's largest exporter and the trade is growing. Between 1997 and 2008, India's exports rose by 200 percent.¹⁵³ The 460,000 metric tons of buffalo meat India sold abroad in 2008 earned more than U.S.\$1 billion, making it India's third most valuable commodity export. More than

50 countries buy Indian buffalo meat, including Vietnam, Malaysia, the Philippines, Egypt, Kuwait, and Saudi Arabia, and new markets are emerging in central and west Africa and the Caucasus.¹⁵⁴

An estimated eight million male buffalo calves die from neglect or starvation each year in India, to preserve their mother's milk for human use.¹⁵⁵ India's national Department of Animal Husbandry, Dairying, and Fisheries has launched a program to encourage the raising of male buffalo calves for meat, specifically for export.¹⁵⁶

Few buffalo are fed grain or oil (soy) meals, with farmers instead relying on crop residues and green fodder, which is relatively inexpensive. Scaling up production, however, will require overcoming a lack of market infrastructure, the growing scarcity of feed and fodder, state anti-cow slaughter legislation that could apply to buffalo, environmental constraints, and concerns about food safety and the animals' health and welfare.¹⁵⁷ ■

world's largest fertilizer cooperative, and Global Dairy Health, a New Delhi-based agribusiness working to establish "large-scale integrated dairy farms" across Asia and Africa.^{145 146}

The Nellore operation could be enormous, with as many as 40,000 cows when fully operational (possibly in two facilities). The plans also call for 3,000 high-yielding, exotic dairy cows to be imported, which would require government approval.¹⁴⁷ If it goes ahead, the Nellore project will almost certainly not be the only one of its kind. Fonterra is interested in establishing more large-scale dairy production and processing operations in India. (It has a 6,000-cow dairy operation in China.)¹⁴⁸

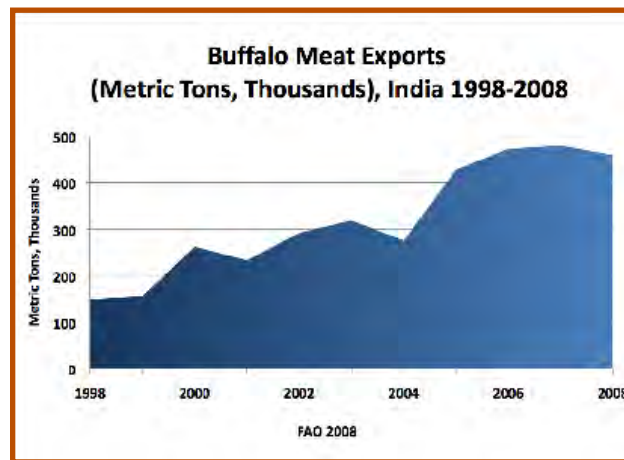
Mega-dairies are common in industrialized countries, and are gaining a foothold in emerging economies.

But they are viewed unfavorably by a growing number of activists and communities on the grounds of environmental, animal welfare, and economic impacts, as well as food safety. An undercover investigation of mega-dairies in the U.S. state of California's Central Valley region published in the *Ecologist* magazine described the facilities this way:

For a first-time visitor, the sight and scale of a mega

dairy is overwhelming; enormous open-air sheds, mountains of feed, million-gallon pools of slurry and thousands upon thousands of listless cows. . . .

More akin to a factory production line than a farm, long lines of cows could be seen stumbling over outstretched udders as they were driven back and forth to the robotic-like, rotary-milking parlors.¹⁴⁹



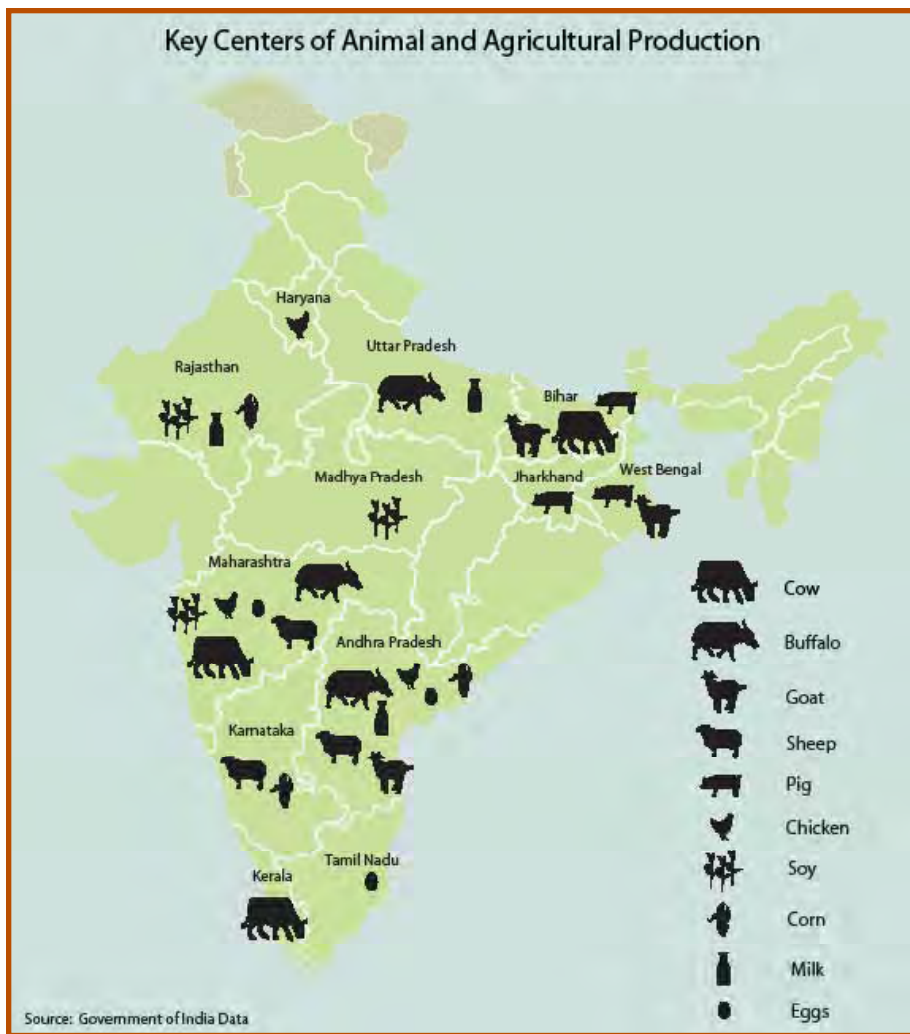
BIG CHICKEN AND EGG

India produces nearly 3 percent of the world's chicken meat—727 thousand metric tons of it in 2009.¹⁵⁸

¹⁵⁹ In the ten years between 1999 and 2009, chicken-meat production in India rose by almost 70 percent.¹⁶⁰ Urbanization, low prices, and increased availability all facilitate domestic

consumption of chicken. Chicken meat also has fewer cultural or religious taboos than beef or pork and is cheaper than meat from sheep and lamb (mutton) or goats. The average urban Indian eats 2.1 kgs (4.6 lbs) of chicken each year; a rural Indian consumes far less: 0.15 kgs (0.33 lbs).¹⁶¹

India's poultry industry, dominated by chicken meat, is worth approximately 200 billion rupees (U.S.\$4.48 billion) and is growing at a rate of 7 to 8 percent annually.¹⁶² It



earlier.¹⁷⁰ Each Indian eats about 36 eggs in a year, according to India's National Egg Coordination Committee.¹⁷¹

In the 1950s, an average of five eggs were produced each year for every Indian. Now, 50 eggs are technically available for each Indian, but consumption is skewed. While an Indian living in a city eats 100 eggs a year, a rural Indian eats an average of 15, slightly more than one egg a month.¹⁷² The National Egg Coordination Committee is ambitious: it wants to see India "on top of the world" in egg production, and each Indian eating 180 eggs a year. That would mean generating successfully 200 billion eggs a year, at a minimum. The committee also has plans to make eggs more broadly available, including in what it calls "far-off areas of the country—rural areas," and to expand exports.¹⁷³

Domestic demand is so strong that Indian poultry producers have not yet been able to secure significant export markets for

employs an estimated 3 million Indians, roughly half of whom are involved in farming, with the other half responsible for everything from feed production to pharmaceutical development to marketing.¹⁶³

Top state producers of meat chickens are Andhra Pradesh, Haryana in the north (adjacent to the capital, New Delhi), and Maharashtra in the west, where India's commercial capital, Mumbai, is located.¹⁶⁴ Vertical integration means that many large poultry players also have retail outlets, and are marketing and branding their products with determination. Nutrich's Hygienic Chicken—cleaned, deboned, and wrapped—can be bought in Reliance retail stores in India's capital, Delhi, as well as in Wal-Mart, which entered the Indian market in 2009 with its first store in the city of Amritsar in northern India.¹⁶⁵

In 2009, India produced 3 billion metric tons of eggs, or about 55 billion.¹⁶⁶ ¹⁶⁷ Egg production, like that of chicken meat, has been rising quickly, nearly doubling between 1999 and 2009.¹⁶⁸ The top three egg-producing states are Andhra Pradesh, Tamil Nadu, and Maharashtra.¹⁶⁹ In 2007, Indians consumed 40 percent more eggs than they did a decade

earlier.¹⁷⁴ Indian egg exports are constrained by competition from producers in the U.S., E.U., and Brazil, according to the country's poultry federation.¹⁷⁵ Only 5.5 to 6 million Indian eggs are sold abroad each year, mostly to countries in the Gulf region, as well as to Angola in southern Africa (also a significant purchaser of Indian buffalo meat). Along with eggs in the shell, destined for human consumption, India exports egg powder to the E.U. and Japan; hatching eggs to Singapore, the Maldives, and Oman; and eggs for use by the pharmaceutical industry to the E.U.¹⁷⁶

At the same time, Venky's, Suguna Poultry, and the Amrit Group are increasing their overseas sales of Indian-produced chicken. Importing countries include the U.A.E., Kuwait, Oman, Japan, and Germany.¹⁷⁷

GESTATING "MODERN" POULTRY

Since the 1970s, India's poultry sector has seen vast changes. Once reliant on small, backyard flocks raised by individual

farmers (many of them women), today the sector is almost wholly industrialized, vertically integrated, and controlled by a handful of large companies.¹⁷⁸

Industrial-scale poultry farms containing 50,000 or 100,000 or more birds now surround large cities like Delhi, Mumbai, and Hyderabad in Andhra Pradesh, a center of the information technology industry.¹⁷⁹

Varied breeds of indigenous chickens have been replaced by international hybrids, bred to gain weight quickly on a diet of grain-based feed, often supplemented by antibiotics and hormones to promote growth.

Soy and maize make up as much as 95 percent of the bulk of chicken feed. The remaining 5 percent is minerals, vitamins, coccidiostat (a chemical that fights the parasite coccidia), mold inhibitors, and growth promoters.¹⁸⁰

Having identified both chicken-meat and egg production as important sources of domestic employment, foreign currency, and nutrition, the Indian government is working to support the sectors' expansion. In 2009, it apportioned RS 150 crore (U.S.\$33.6 million) to a range of initiatives, from backyard-poultry to production of commercial feed compounds, as well as launching a program to add eggs to school lunch programs.¹⁸¹

Creation of India's modern poultry industry is credited to Dr. B. V. Rao, who began Venkateshwara Hatcheries in 1971 in Hyderabad. He had previously worked on a U.S. Agency for International Development project to establish a modern poultry farm, also in Hyderabad, and applied what he learned to his own operation. What started as a small, seven-acre farm Rao ran with his wife, Uttaradevi, soon expanded and after only a year had captured 70 percent of the local egg market.¹⁸²

Rao not only pioneered the use of high-yielding breeds

of chicken, but also the caged rearing of birds and franchise operations. In one of the first joint ventures between an Indian poultry producer and a large multinational, Venkateshwara Hatcheries teamed up in 1980 with U.S.-based Cobb-Vantress, a leading global supplier of broiler chickens, to develop a high-producing breed specifically for India. This resulted in the "Vencobb" series of birds, in wide use in Indian poultry production, and according to Venky's, as

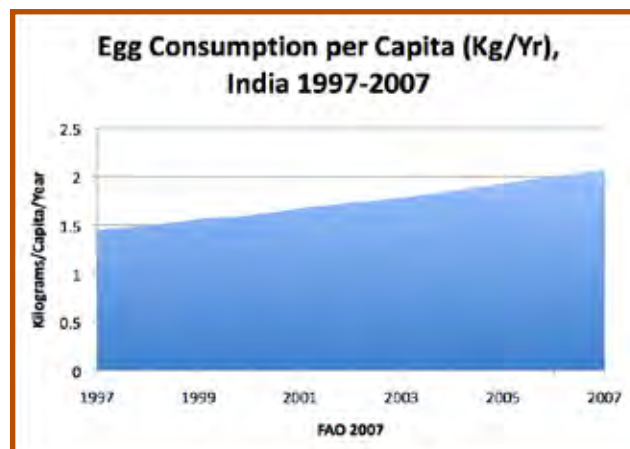
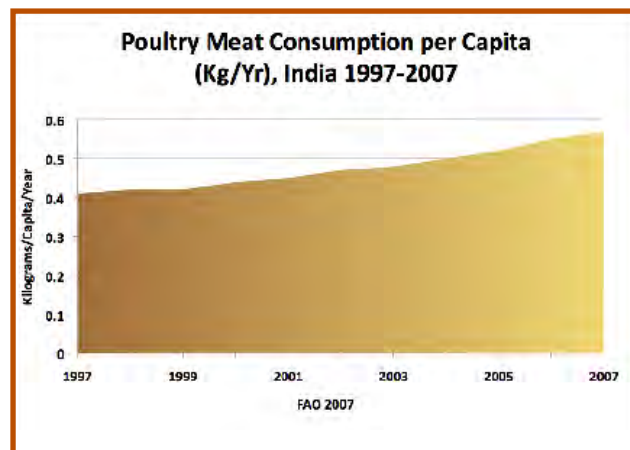
the company is now known, "the chicken of choice" for U.S. fast-food chains KFC, Pizza Hut, McDonald's, and Domino's Pizza in India.¹⁸³

Venky's is the largest integrated poultry producer in Asia. It runs eight feed plants in India, has offices in 24 cities across the country, and is expanding its ambit globally, with operations in 38 countries. These include a vaccine plant in Switzerland, offices to source maize and soy for feed from Brazil and Argentina, and feed mills in Vietnam and Bangladesh.¹⁸⁴ It is also India's largest exporter of poultry products, including day-old chicks and breeding stock, eggs, egg powder, processed chicken products, and "turnkey operations" for those wanting to establish breeding farms or hatcheries.¹⁸⁵

Venky's has enlarged its product portfolio to encompass pet food, personal hygiene products, and dietary supplements.¹⁸⁶ Expanding still further, Venky's, now led by Rao's daughter, Anuradha Desai, has another recent acquisition. In a world where fast-food chains sponsor stadiums and have their advertisements splashed across sporting events, in 2010 Venky's bought the Blackburn Rovers, a top-ranked English football (soccer) team.¹⁸⁷

THE RISE OF CONTRACT FARMING: SHAPING AN INDUSTRY

In 1991, Suguna Poultry, India's top producer of broiler chickens and eggs, introduced to India the concept of contract



INDIA'S GROWING APPETITE FOR CHICKEN

At Ghazipur wholesale market located just outside New Delhi, approximately 100,000 birds are slaughtered each day, manually in the open air. In 2008, Ghazipur was severely affected by a bird flu—scare in the adjacent state of Haryana. Live markets like this one have been criticized as being unhygienic and having inhumane slaughter conditions.

Modern abattoirs and processing plants are also emerging in India, supplying packaged fresh and frozen chicken meat. Nutrich “Hygienic Chicken” is one such brand targeting more affluent consumers. Bringing this chicken from production and processing facilities to store shelves entails a number of steps. First is the feed.

The mill that supplies and packages the birds’ feed is run by Skylark, a

large poultry integrator based in northern India. The plant, which packages 10,000 tons of grain a month, is the first automated “batch plant” in India. It mixes different feed formulas for each stage of the chickens’ brief lives.

Although the plant is located in Haryana, a state known for its production of rice, wheat, sugarcane, and mustard seed—as well as chicken meat—the two main feed ingredients are maize and soy. Significant plantings of each crop are found in Rajasthan, Bihar, and Andhra Pradesh.

At the production facilities in Haryana, the birds are housed by the thousands in sheds. Unlike egg-laying hens, these chickens are not confined to cages, but are still densely packed, often carpeting the sheds’ floors. Providing the feed as well as the water is done manually. Many of the workers have migrated from poorer regions like Bihar, Uttar Pradesh, and even Nepal. They and their families are often provided housing on the facilities’ grounds, and return home once a year.

In the winter, it takes 30 to 40 days for each bird to reach 2 kgs (4.4 lbs), the weight at which they are normally slaughtered. In the summer, weight gain is slower and at 42 days the birds usually only reach 1.8 kgs (4 lbs).

The chickens are normally transported to the slaughterhouse at night. At the Nutrich processing plant, the birds are

stunned, their throats slit, and then they enter a scalding tank of boiling water. Their feathers are removed, after which their bodies go through several stages of processing: evisceration (removal of the internal organs), de-skinning, chilling, chopping, and finally, packaging. Eight thousand birds are slaughtered here each day.

The workers on the processing floor wear protective clothing (shower

caps, shoe covers, face masks, and lab coats). The plant uses 80,000 to 90,000 liters of water a day (21,134 to 23,775 gallons) for scalding, de-feathering, washing, and freezing. It has its own wastewater treatment plant, from which the effluent goes into the municipal treatment plant.

Many of the workers who have direct contact with the birds (e.g., those who transport them and do the evisceration work) have migrated from Nepal. They live in accommodations provided by the slaughterhouse, their health is monitored, and, like workers at the broiler production facilities, they usually return home once a year. More than half of the workers on the processing and packaging floors are women who live locally.

In comparison to Ghazipur market and other live/kill markets, this modern abattoir is more costly—requiring more labor, more electricity, and more water, plus refrigeration and packaging. As a result, the retail price of the chickens processed here is higher than for those sold at Ghazipur. ■



A broiler-chicken facility near New Delhi, in Haryana

farming, an agreement through which a farmer provides a buyer with specific quantities of a product that meets the buyer's standards.¹⁸⁸ Suguna has a network of more than 15,000 contracted poultry farmers and is actively seeking more. The company acts as an integrator, selling farmers under contract all the production inputs required, from day-old chicks to vaccines, feed, and medical support. (For its broiler stock, Suguna uses Germany-based Aviagen's Ross 308 breed known for its "maximum performance and livability.")¹⁸⁹

In return, farmers provide a consistent amount of meat chickens or eggs in line with the company's requirements. Suguna then processes and markets the products, which are sold through its chain of Suguna Daily Fresh stores. These stores, launched in 2007—offering a range of "fresh chilled chicken for your convenience," as well as fresh, frozen, and processed meat products, eggs, and seafood—are now found in Indian cities, both large and small.¹⁹⁰ The number of Suguna roadside live poultry markets is also increasing.

While the poultry and egg industries present contract farming in India as a stable, lucrative profession, the terms of the contract are heavily biased in favor of the integrator. The integrator cannot be held accountable for deficiencies in the quality of the chicks, the feed or grain, or the veterinary care it supplies to the farmer, and can also fine the farmer for any drops in productivity.

Critics of contract farming cite farmers' limited control over production, the costs of housing and feed, low profits, and the risks. Birds or eggs can be rejected if they do not meet set criteria. Disease can radically reduce earnings. Most contract farmers operate very close to the margin of profitability, and many incur debts to set up their operations.

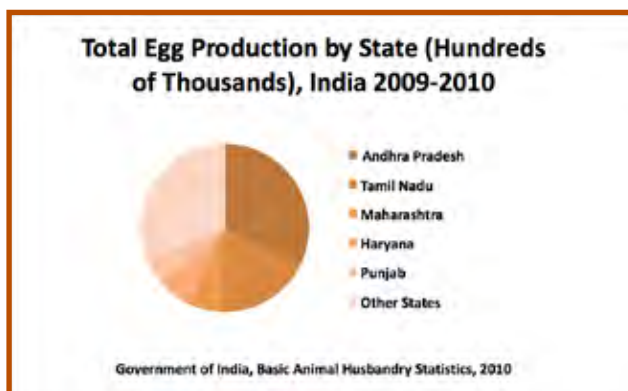
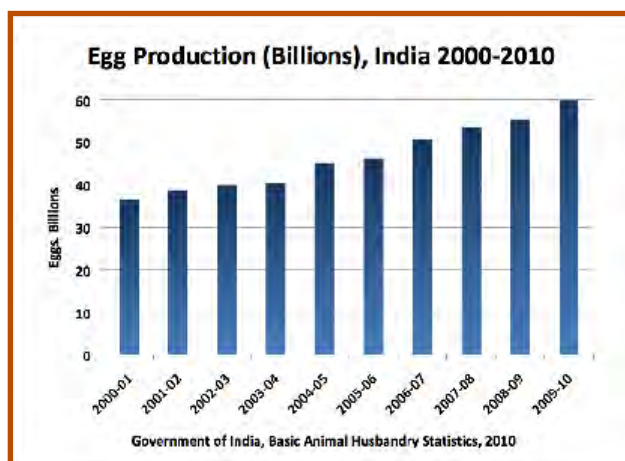
In a 2011 report, the UN Special Rapporteur on the right to food, Olivier De Schutter, cautions that contract farming often leads to farmers losing control over production, rendering them "essentially wage-earning agricultural laborers on

their own land, but without the benefits associated with paid labor, such as minimum wages, sick leave and other legislated benefits." Women have less ability to enter into contract farming arrangements and, De Schutter continues, unless the contract farming "framework respects women's rights and is gender sensitive, it will undermine gender equality."¹⁹¹

Nonetheless, contract farming in the chicken and egg sectors has spread across India. It is most successful in western and southern parts of the country, with around 90 percent of poultry farmers around cities like Bangalore and Hyderabad

part of contract-farming systems.¹⁹² Small-scale or backyard poultry producers are rarely able to enter into contract agreements, since they lack the initial capital needed to invest in large-scale operations.

The contract-farming system, and the overall intensification and consolidation of the poultry industry in India, have also been criticized because many women who tended small flocks of birds have been sidelined. The industry is seeking to re-cast itself as offering the possibility of greater gender equality and income for women. Through one pilot effort, rural women are paid to administer poultry vaccines, an initiative modeled on a similar program in Bangladesh.¹⁹³



LIVE MARKETS AND FOOD PARKS

Despite the intensification of production methods, an estimated 90 percent of chicken meat in India is processed by hand and a large majority of chickens are bought at live (also called wet) markets. In big cities where slaughterhouses within city limits have been discouraged or banned, consumers are adapting to buying frozen or chilled chicken.¹⁹⁴ Producers and retailers are betting that the trend among more affluent Indians of shopping in supermarkets and superstores, which offer air-conditioned alternatives to traditional open-air markets along with a variety of refrigerated products, including meat, dairy, and eggs, will continue.

Retail prices for processed meat are higher than those of live markets, reflecting increased costs for labor, electricity, water, refrigeration, and packaging. Consumption of processed meat in India is still low—only 2.2 per cent of the total, according to Harish Bagla of the Amrit Group, which produces animal feed and processed meats, and runs breeding farms and hatcheries. However, it is growing at a fast clip—150 per cent a year—and is expected to corner a significant share of India's market for meat in coming decades.¹⁹⁵

The Indian government is encouraging the shift to processed and packaged meats and other foods. In 2007, it approved an integrated plan to boost India's food processing sector. The Ministry of Food Processing Industries announced that 500 "mega-food parks" would be established across the country for which poultry meat and eggs, as well as fruits, vegetables, and dairy products, would be collected from surrounding farms and then processed, packaged, and shipped to market.¹⁹⁶



A poultry worker gathers eggs at a battery-cage facility in Haryana.

CONTINUED EXPANSION?

Although India's chicken and egg sectors are extending their scale and reach, they face constraints. One is a lack of basic infrastructure like refrigeration, transportation, processing facilities, and storage.²¹⁴ Another is meeting growing domestic demand for feed grains, particularly maize. India's poultry producers use 20 million metric tons of feed each year.²¹⁵

The industry has been asking for government assistance to grow more maize domestically. "In the last two to three years we are not getting proper rains," Surendra S. Dhull, chief executive officer of Skylark Hatcheries, one of India's largest producers of chicken meat and eggs, said in 2008. "Due to that we are facing a huge problem [with feed] grain."²¹⁶

India also exports increasing amounts of maize and soy meal for use as livestock feed abroad. Such exports are a factor in rising domestic feed prices, making it harder, according to Ricky Thaper of the Poultry Federation of India, for Indian egg and chicken producers to develop large-scale export industries, despite India's advantage of low-cost production. Thaper expects the price of feed grains in

India to rise along with growing global demand for animal products.²¹⁷

"[T]here is huge demand for corn-based feed," according to Shashi Kapur of the poultry federation. "The government should ensure enough domestic availability, and then think of exports." The poultry industry is asking the government to set export quotas to guarantee domestic supplies.²¹⁸

A third constraint—affecting domestic and export markets—is avian flu (H5N1).²¹⁹ After H5N1 decimated chicken populations in Maharashtra state's Nandurbar district in 2006, the government attempted to stop its spread by restricting imports of meat products, birds, and pigs from countries where H5N1 had been documented.²²⁰

However, additional cases occurred, and avian flu penetrated the poultry sector in West Bengal, Assam, and Sikkim in 2008 and 2009, with 11, 18, and 152 outbreaks respectively.^{221 222} These are extremely costly—not only in the loss of human and animal lives,

but also to the agricultural economy, and particularly small producers. In West Bengal alone, nearly four million chickens were culled as a result of the flu, many from small, backyard operations.²²³

"Whenever there is a bird flu news in India, demand is reduced automatically," says Vikram Yadav of Godrej, the largest Indian supplier of feed for poultry and cattle.^{224 225} "Farmers have to pay a huge loss for any such outbreaks." He describes the aftermath in 2008. Demand for eggs and chicken meat was reduced by more than half, egg exports were banned, and the domestic price of eggs fell by 40 percent.²²⁶ The fear of avian flu has led some Indian poultry farmers to abandon the business; others, facing thin profit margins, have further increased production—adding more birds—to hedge their risk. Some Indian producers have expressed concern that H5N1 may provide an opening for multinational agribusinesses to capture more of the Indian market.

In 2010, confirmed cases of avian flu rattled India as well as Myanmar, Nepal, and Bangladesh.²²⁷ In February 2011,

INSIDE THE INDIAN EGG INDUSTRY

In Haryana, the fourth largest egg-producing state in India, battery-cage egg facilities range in size roughly from between 10,000 and 150,000 hens, and mainly supply consumers in Delhi. Hens arrive as day-old chicks from hatcheries. They begin laying eggs when they are about six months old, and live until they reach about 18 months, after which they are sent to slaughter. Their meat is usually sold for a lower price than that of chickens bred specifically for meat. The Indian military is one large buyer of this “spent” layer-hen meat.

The sheds are usually multi-story brick structures, with rows of chickens stacked on top of each other in wire cages. When one enters the shed, the smell of ammonia from the birds’ wastes is intense; the vocalizations of the hens can also be heard. Many of the birds have lost plumage and have sores on their bodies, the result of rubbing against the sides of their cages, unable to move freely or spread their wings.

“De-beaking,” the removal of a piece of the birds’ beaks, is common and is usually done on the tenth day and the tenth week of the hens’ lives. As in industrialized countries, male chicks from egg hatcheries are not used by the egg industry. In some cases they may be sold to backyard producers, but large numbers are killed right after they hatch.

The practice of forced molting, depriving hens of food and light (and sometimes water) to trick their bodies into laying more eggs, was a standard practice on Indian poultry farms. But in early 2011, the Animal Welfare Board of India ordered all farms to discontinue forced molting, judging it a violation of India’s Prevention of Cruelty to Animals Act.

Although these egg facilities are industrial-style factory farms, unlike in similar operations in the U.S. or Europe, watering, feeding, egg collection, and temperature controls aren’t automated. Workers—many from poorer states like Uttar Pradesh and Bihar who live on the grounds with their families—do each of these tasks manually. Their children sometimes help out, usually because their parents cannot afford to send them to school. On a visit to one large farm, a young girl in a school uniform was collecting eggs.

Average salaries at egg-producing facilities are low: about 3,000 rupees a month, less than U.S.\$65. Several of the owners

complained that labor is increasingly hard to find because workers are opting to seek jobs with fewer hours and higher pay. Worker health and safety standards are generally inadequate, with no biosecurity. Workers do not wear masks to shield themselves from dust, particulate matter, or strong odors. They have little to no protection on their feet, and often operate the farms wearing sandals or barefoot.

At the egg operations, the hens’ wastes pile up on-site. The

manure is sold to farmers for use on crops, but can also be carried away with rainwater run-off onto adjacent rice fields and drainage channels. One egg facility was particularly dirty. Rats foraging for feed outnumbered the hens. Water and waste run-off drained offsite into an approximately 1 km (.6 mile) stretch of land next to the highway, where a road-lane expansion project was planned. Environmental regulations are generally minimal. Residents of villages nearby have lodged complaints with the government about waste from facilities,

which are addressed on a case-by-case basis.

Curiously, a number of the owners of large egg operations are pure vegetarians who do not consume eggs themselves. When asked why they joined the poultry sector, the response was straightforward: it was a good business investment. The industry in India operates with minimal government oversight, no taxes are levied, and there are no national regulations on operations.

Many of India’s larger-scale egg operations started in the late 1980s and early 1990s. At that time, feed costs were low and profits high. More recently, however, the egg industry has been facing a number of problems. With rising prices for feed, shortages of labor, increases in the threat of disease, and public health scares around bird flu in particular, profits are dwindling. In egg-producing areas of Haryana, several large-scale egg facilities have shut down.

The remaining ones appear to be at a crossroads. Some of the owners want their children to be educated and pursue another profession, not to enter the poultry business. Others expressed the view that the only way to remain viable is to expand their businesses and raise even more hens; still others may be opting to leave the field entirely. ■



In India, between 140 and 200 million egg-laying hens are kept in battery cages, like on this factory farm in Haryana.

TECHNOLOGY, INTERNATIONAL INVESTMENT, AND THE MARKET FOR FEED

The technologically centered spirit and optimism of India's poultry industry are conveyed in *Poultry Express*, a newsletter that reports on poultry feed, incubators, cooling systems, and biocides (antimicrobials to fight disease). *Poultry Express* also advertises regional poultry trade shows, where agribusinesses, both domestic and foreign, display the latest technological advances. At "Poultry India 2009," 12,500 visitors from across Asia, the Middle East, Africa, North America, and Europe flocked to Hyderabad and toured nearly 200 exhibits spanning feed manufacturing, biosecurity, and numerous investment opportunities.¹⁹⁷

India's expanding production and consumption of animal-based foods, including chicken meat and eggs, has attracted international interest and investment. In 2008, Tyson acquired a 51 percent stake in Godrej. Its sales of feed earn the company U.S.\$500 million a year.¹⁹⁸ Godrej also sells fresh chicken under the "Real Good Chicken" label, in addition to numerous other products such as furniture, personal care items, and consumer goods.¹⁹⁹ Annual earnings from the joint venture, which includes two plants in Mumbai and Bangalore with a combined processing capacity of 60,000 chickens a day, are estimated at U.S.\$50 million. The Godrej-Tyson plants are supplied by a network of contract farmers.²⁰⁰

"Poultry production and consumption is growing in India," Tyson international president Rick Greubel said in announcing the deal with Godrej, "and we believe the timing is right for us to bring our expertise and resources to this emerging market."²⁰¹

In 2006, the International Finance Corporation (IFC), part of the World Bank Group, invested U.S.\$11 million to help Suguna increase its network of contracted breeding farms and hatcheries for poultry production, and the capacity of its feed mills. According to Suguna, the IFC's investment was made to facilitate "expansion and developing international competencies . . . a perfect match of IFC's focus to enhance rural productivity and Suguna's vision of Energizing Rural India" [capitals original].²⁰² Lars Thunell, then IFC executive vice-president, extolled the export potential of Indian poultry and the 11,000 contract-farming jobs made possible by the IFC's investment.²⁰³

India's market for livestock feed is valued at Rs. 200 million (U.S.\$44.8 billion) and has been expanding at a brisk pace,

in line with the creation of chicken, eggs, and dairy products. In 2010, domestic demand for compound animal feed reached 68 million metric tons, 50 percent higher than in 2008.²⁰⁴ In 2008, Suguna opened what it has said is the largest feed mill in Asia, in Hoskote in Karnataka state.²⁰⁵

About half of commercial livestock feed in India is comprised of maize. Other ingredients include soy, *bajra* (pearl millet), de-oiled rice bran, broken rice, maize gluten, as well as MBM (meat and bone meal from other farmed animals), fish meal, and wheat.²⁰⁶ India now apportions as much as 60 percent of its maize harvest, and a rising percentage of its soybean harvest, to animal feed, mainly for chickens, but also for some cows and pigs.²⁰⁷ More high-yielding exotic breeds and crossbreed cows in India's dairies are adding to demand for commercial feed and, as a result, for grain and oil meals like soy, too.

India's expanding animal-feeds market has attracted the interest of leading U.S. and European grain, feed, and oilseed producers. ADM (Archer Daniels Midland), Cargill, and Louis Dreyfus, among others, are all active in the country. Cargill, which began operations in India in 1987, has become the main exporter of oil meals, including soy, for animal feed.²⁰⁸ It also provides feed for domestic dairy, beef, poultry, and pork production as well as India's aquaculture industry.²⁰⁹

ADM is engaged in India in both the animal feed and biodiesel sectors. The company owns two oilseed processing plants in Maharashtra and Karnataka, each with a capacity to crush a thousand metric tons of seeds a day and refine 200 metric tons of oil.²¹⁰ Louis Dreyfus supplies processed chicken, packaging for dairy products, as well as seeds, dried fruits, and processed vegetables.²¹¹ It has also leased several plants to crush soybeans, and is one of India's top five processors of soy.²¹²

With respect to the government's support for and international investment in the industrialization of India's livestock sector, Dr. Nitya Ghotge of ANTHRA says: "It makes sense that [they are promoting it] because they keep saying there is a growing middle class that needs to be fed, and that the only way they can be fed is through industrial systems." But, she continues, "You use an argument like this to substantiate a certain direction. . . . The people who push the commercial livestock are the people who have commercial interests."²¹³ ■

bird flu was found on a duck farm in Tripura state in India's northeast. Three thousand ducks on the farm were killed, as were all poultry within a 3-kilometer (1.9 mile) radius.²²⁸

RAISING, EATING OTHER LAND ANIMALS

In addition to chickens, cows, and buffalo, India has significant populations of goats, sheep, and pigs being raised for meat and milk. India has the second largest goat population in the world after China's, 140 million, as well as 70 million sheep.²²⁹ Goats and sheep in India are still mainly free-ranging.

While still small, exports from India of sheep and goat meat are mostly tracing an upward trajectory.²³⁰ In 2008, India exported 37,000 metric tons of sheep meat. Goat meat exports, however, were lower than in previous years, just 27 metric tons, compared to 572 metric tons in 2006.²³¹ Most of the meat is sold in the Gulf.

India also has 14 million pigs, including international breeds like white Yorkshire, Hampshire, and Landrace.²³² The governments of Indian states and union territories operate more than 150 breeding farms for pigs, with pig-rearing and pork consumption centered in northern India.²³³ In Punjab, the state government is encouraging farmers to begin pig operations, as well as embark on the farming of turkeys.

Some observers expect that pork production in India will expand and intensify, although the Federation of Indian Animal Protection Organizations (FIAPO) suggests that the industry is unlikely to become fully industrialized because of social, cultural, and religious norms that inhibit pig consumption.²³⁴ For example, most Muslims do not eat pork.

Ducks, traditionally kept by rural farmers in southern and eastern parts of the country, are also valued as sources of food (mainly eggs) and income. Industrial-scale duck operations have begun in Tamil Nadu.²³⁵ And a growing number of farms in Andhra Pradesh and Tamil Nadu include emus, promoted as adaptable to Indian climates and resistant to various diseases. The birds are raised for their meat and eggs as well as their feathers, skin, nails, and even egg shells.²³⁶ In Tamil Nadu, VC Emu Farms has opened an all-emu restaurant that features emu grilled sausage, emu dragon fries, and emu *biryani*.²³⁷



India has the second largest goat population in the world, 140 million, and 70 million sheep.

FOOD HABITS CHANGING

Not only are Indians eating more processed and packaged foods, they are also consuming more U.S.-style fast food.²³⁸ Hamburgers, pizza, and breaded and fried chicken are increasingly popular. But in a nod to Indian mores and tastes, Western fast-food chains in India offer many more vegetarian options than they do in other countries. And often, like McDonald's, their menus have no beef or pork products to appeal to India's Hindu and Muslim communities alike (Muslims are about 13 percent of India's population).²³⁹

McDonald's began operations in India in 1996 through a joint venture. It now has 160 outlets in cities across the country, with plans for expansion, including to smaller cities and rural areas, as well as along the highways that connect Indian metropolises. "We are sowing seeds for our future growth," says Vikram Bakshi, managing director of McDonald's India.^{240 241}

U.S. chicken giant KFC has more than 70 locations in 13 Indian cities. Along with its standard fried chicken menu, KFC offers a vegetarian burger and "veg rice meals."²⁴² Yum! Brands, KFC's parent company, expects to have 1,000 outlets, including 500 KFC's, by 2015 in large and medium-sized Indian cities, despite the rocky start it had when it entered India in 1995.²⁴³ Its first outlet, in Bangalore, in India's "Silicon Valley," faced protests by farmers concerned about what they see as the liberalization and corporatization of Indian agriculture; the poor treatment of the chickens;



U.S. fast-food corporations are expanding in India.

and charges that the chicken was fried in pork fat, anathema to most Muslims. (“Quit India” and “Stop Playing Fowl” were among the slogans protestors used.)²⁴⁴

In 2010, Yum! opened India’s first Taco Bell, also in Bangalore. Half of the Mexican-inspired menu is vegetarian. As with most fast-food corporations, Yum! Brands sees success in India’s large market as critical to its growth and future profits.²⁴⁵ Domino’s Pizza has the largest number of stores in India of any U.S. fast-food chain—300 and counting.²⁴⁶ U.S.-based Pizza Hut is also gaining market share, with 140 outlets in 34 cities.²⁴⁷ Three are pure vegetarian, including one in Mumbai, on upscale Marine Drive.²⁴⁸

Some Indian fast-food chains are 100 percent vegetarian, like Bikanervala and Haldiram; others feature non-veg items. Republic of Chicken’s Western-style chicken drumsticks cooked Indian-style have proved popular with urban customers in a number of Indian cities. At the same time, Indian “street food,” largely vegetarian, like *chhole bhature* (chickpeas and fried bread) and *aloo chat* (fried snacks made of potatoes, usually served with chutney, yogurt, and spices) remains popular and is available at thousands of small, street corner or roadside kiosks, known as *dhabas*.

India is atypical in that vegetarian menu items often lead fast-food sales. For example, vegetarian foods account for an estimated 50–65 percent of McDonald’s sales volume, and 60 percent of Pizza Hut’s. This is also mainly true for homegrown Indian purveyors of fast food, such as Nirula’s,

which has 60 restaurants in north India. Half of its revenue comes from sales of vegetarian menu items.²⁴⁹ (Nirula’s introduced burgers and pizzas but concluded, based on flagging sales, that its customers were not very interested.)

In India, fast food is not the mass phenomenon it is in most industrialized countries, since relatively few Indians can afford to eat it on a regular basis. “The prospect of seeing fast food such as burgers and pizzas being the staple diet for lower classes will not likely be the case, as it is perhaps in Western societies, due to the contrast in affordability,” a blogger wrote on the Indian site Desiblitiz.com.²⁵⁰

Nonetheless, prospects of a globalized “fast-food culture” have caused consternation among some in India who worry about the effects on public health, the environment, animal welfare, and Indian cuisine, values, and identity. In *The Hindu*, one of India’s English-language national newspapers, D. Balasubramanian lamented the scene in a typical mall in Hyderabad:

It has a 4-movie multiplex theatre, surrounded by 40-odd fast food kiosks and 20-odd shops . . . not one of them sells traditional Indian meals or snacks. And the mall, like 20 others in the city, is filled with thousands of youngsters who obviously have enough to spend . . . this mall and fast food culture is expanding explosively across India. This too is part of the globalization of India, a part that causes great concern about the health of its citizens.²⁵¹

“In the wake of commercialization, the [Ghaziabad, in Uttar Pradesh] city markets are flooded with pizza, burgers, noodles, and hot dogs, which are of foreign origin and contain a lot of fat,” Rohit Srivastava wrote in *Merinews*, a platform for citizen journalism. “People have somewhat forgotten about our Indian food[s], which are balanced, tasty, and far superior to these junks.”²⁵²

THE HEALTH OF A NATION

Chronic conditions like obesity, diabetes, and heart disease, often called diseases of affluence, are rising in India, potentially exacerbating social inequalities as the health system also struggles to treat conditions that most often result from poverty, such as malaria, malnutrition, infant and maternal mortality, tuberculosis, and HIV/AIDS.

Child malnutrition accounts for more than one-fifth of India’s overall disease burden.²⁵³ At the same time, approximately 30 percent of Indian adolescents aged 10–15 from high economic brackets living in cities are overweight, and urban adolescents are much more likely to be overweight

than those in rural areas.²⁶⁰ In addition, the 2005–06 National Family Health Survey found that 15 percent of Indian women aged 15–49 were overweight or obese, as were 12 percent of men ages 15–49, with rates significantly higher in urban than rural areas.²⁶¹

Fifty million Indians now have diabetes, which is linked to diets high in fats and sugars, and that number is set to reach 87 million by 2050.²⁶² Diabetes trends in India are “absolutely frightening,” according to Nikhil Tandon, professor of endocrinology at the All India Institute of Medical Sciences.²⁶³ “Young people who are the drivers of the economy, who are the protectors of their family, are going to be lost,” according to Prathap Reddy, a cardiologist and founder of a large Indian network of private hospitals. Diabetes, he added, is “a major health catastrophe that’s facing Indians.”²⁶⁴

The Economist’s Intelligence Unit calculated that India paid the highest price for diabetes of any country, 2.1 percent of GDP a year, when formal medical care and lost productivity are combined. (By comparison, annual GDP costs of diabetes in China were 0.6 percent, and in the U.S., 1.2 percent.)²⁶⁵ Some medical doctors cite India’s genetic and social history as a cause: generations of poverty, malnutrition, and intense physical labor may make people who adopt high-calorie diets and sedentary lifestyles more likely to develop diabetes or heart disease.²⁶⁶

In 2008, India’s health minister, Dr. Anbumani Ramadoss, accused Western fast food and traditional fried Indian street food, along with alcohol, smoking, and drugs of presenting serious health risks to India’s youth.²⁶⁷

GRAIN REALITIES

India’s export of feed grains and oil meals (which include soybean meal, rapeseed, rice bran, and castor seed) are growing. In 2008, maize was India’s fourth largest commodity export in value (at U.S.\$780 million) and second in quantity (3.5 million metric tons). Soybean meal (or cake, created when soil oil is separated from the bean) was India’s third highest earning export commodity, valued at about U.S.\$2 billion, and the largest by volume, at just over 5 million metric tons. (India also exports soy oil.) Rice, third in quantity, remains India’s top export earning commodity—bringing in U.S.\$2.6 billion in 2008—about half a billion more dollars than soybean cake did.²⁷⁵

Between 1998 and 2008, the number of hectares in India planted with maize and soybeans increased steadily, by nearly 35 and 50 percent respectively. As of 2009, farmers in India grew maize on about 8 million hectares (ha) (19.8 million acres/ac), and soybeans on nearly 10 million ha (24.7

FOOD SECURITY AND THE FUTURE

In July 2011, India’s parliament and prime minister agreed on a national food security bill after a long and fractious debate. As a result, as part of the national public distribution system (PDS), 75 percent of India’s population, or about 900 million people defined as living below the basic poverty line (BPL), will be able to buy cheaper food grains at government-run “fair price” shops. Families will be legally entitled to a 25 kg (55.2 lb) bag of rice or wheat each month for Rs. 3 (U.S.\$0.07) per kilogram.²⁵³

Secretary of Agriculture P.K. Basu said he was confident Indian producers could supply the estimated 60–70 million metric tons of food grains required by this new national food security act.²⁵⁴ The PDS has, however, been criticized by many in Indian civil society for years as inefficient, rife with corruption, and not very good at getting low-cost food to those who really need it.

The National Advisory Council, established by the Indian government to interface with civil society, had recommended that 90 percent of Indians have access to subsidized food. Food minister K.V.Thomas countered that to provide this the government would have to buy 35 percent of all food grain produced domestically. That, Thomas warned, could drive up prices and cause shortages. (The government currently buys about 30 percent of India’s food grain for subsidized resale to Indians with low incomes.)²⁵⁵

Output of coarse grains in India has been static, leading some analysts to warn that imports will be necessary. “Our government’s neglect of this sector may lead us to imports, just like pulses and vegetable oils,” according to P. C. Kesavan, a distinguished fellow at the M. S. Swaminathan Research Foundation.²⁵⁶

Simultaneously, demand for course grains, once eaten almost exclusively by people with low incomes, is rising among some middle class Indians, who increasingly view sorghum, *bajra*, and millet as health promoting.²⁵⁷ This may encourage increased plantings of these crops. But demand from livestock producers may also rise. About 10 percent of India’s coarse grains are used for livestock feed.²⁵⁸ ■

VEGETARIAN IDENTITIES

A visitor to India will invariably be asked before a meal, “Veg or non-veg?” Over centuries vegetarianism in India has represented a range of identities and values—a sign of greater spiritual awareness; a unique cultural strength; a commitment to a broad, encompassing code of ethics; ecological consciousness; physical purity; superiority in India’s centuries-old caste system; and a political tool.²⁶⁸ Some well-to-do vegetarians in Mumbai today live in all-vegetarian apartment complexes.²⁶⁹

In pre- and post-colonial India, vegetarianism was invoked as a matter of national pride, a value that set India apart from other nations. The mother of Mohandas Gandhi, a Jain, was influential in Gandhi’s return to being a vegetarian after eating meat for a time while living in the U. K. Gandhi’s vegetarianism was intrinsic to his efforts to free India from British colonial rule and his commitment to the principles of non-violence expressed in *satyagraha*. For him, being a vegetarian was a reaction to the idea that eating meat, as the British colonizers did, meant power.²⁷⁰

While much of the vegetarianism in India has a religious basis, particularly for Hindus and Jains, meat-eaters have always also existed in India. Now, as in the past, a family’s or individual’s financial circumstances—not religion, ethics, or cultural association—may be the determining factor in whether or not they are vegetarian, or how often they eat meat.

For many among the upwardly mobile, meat eating confers a sense of liberation—the ability to choose many aspects of their lives that were denied to their grandparents or parents. As in other regions of the world, meat in India can also connote success and economic status. Such associations challenge long-standing social precepts in Indian society, including those associated with Gandhi, who put a high value on frugality and self-reliance, as well as vegetarianism.

A 2006 survey found that more women in India than men were vegetarian; that 37 percent of people older than 55 were vegetarian compared to 29 percent of those 25 or younger; and that 30 percent of Indian vegetarians eschew eggs but consume dairy products. The number of vegans, who do not eat or use any animal products, was not polled.²⁷¹

Positive associations of vegetarianism with environmentalism—and Indian identity—have entered the current public discourse in India. In 2009, the environment minister, Jairam Ramesh, suggested that if people in other countries stopped eating beef, global warming could be slowed as methane emissions declined from a potentially smaller population of cows.²⁷²

That same year, Shashi Tharoor, a member of India’s parliament and a former United Nations under secretary-general, declared: “Our society has since times immemorial placed virtue on frugal ways and on extracting the very least from nature. It is not a coincidence that a large percentage of our people are vegetarian.” This is, Tharoor continued, the result of



Indians realizing that “vegetarianism is a lifestyle that demands less from our planet.”²⁷³

And Rajendra Pachauri, who chairs the Intergovernmental Panel on Climate Change (IPCC), the lead international agency charged with assessing climate change, has urged individuals that can to reduce meat consumption as one of a set of lifestyle changes individuals can make to slow global warming. Pachauri, an Indian engineer, economist, and vegetarian who also heads the New Delhi-based Tata Energy Research Institute (TERI), has said: “In terms of immediacy of action and the feasibility of bringing about reductions in a short period of time, it clearly is the most attractive opportunity. Give up meat for one day [a week] initially, and decrease it from there.”²⁷⁴ ■

million ac). India's largest crop, rice, is grown on 42 million ha (104 million ac), followed in area by wheat, which is planted on nearly 28 million ha (69 million ac).²⁷⁶

The anticipated effects of climate change in India, such as rising heat and aridity, will reduce further the size of grazing land and make growing fodder crops, as well as maize and soybeans, more difficult.^{277 278} Water shortages—combined with increased domestic demand—will likely force India to end grain exports in coming years. By 2050, India, which has prided itself on being self-sufficient in grain production, may have to import as much as a quarter of the rice, maize, and wheat it needs.²⁷⁹

Currently, India is Asia's second largest producer of maize, after China.²⁸⁰ Maize in India is eaten by people, made into livestock feed, and used by industries, i.e., starch manufacturers. About half of the maize consumed each year, 8.5 million tons, is used for feed; the starch industry uses 1.2 to 1.4 million tons; and the rest is used for food.²⁸¹

When harvests are depressed, as for example by the weak 2009 monsoon, India does not produce enough maize to fulfill both domestic and international demand. In 2009, the government reduced maize exports. (It also reluctantly opened its doors to imports of rice.)²⁸² Exports of maize in 2010 were also lower due to the lack of rain in 2009.²⁸³ But in early 2011, Indian sales of maize for animal feed surged. The price was U.S.\$30 a metric ton lower than those of Latin American producers, a distinct market advantage. Vietnam and Malaysia were the main buyers.²⁸⁴

Soybeans are an increasingly popular crop in India. Madhya Pradesh is India's "soy bowl," with 60 percent of the country's soybean production.²⁸⁵ Farmers are attracted by the prices they can obtain and growing markets for its use in animal feed in India and other Asian nations.²⁸⁶ In 2010–11,

an estimated 76 percent of the oil meal India produces will be used in livestock feed.²⁸⁷

In 2007, India was the fourth largest global exporter of soybeans (following big soy producers Argentina, Brazil, and the U.S.).²⁸⁸ In March 2011, India's soybean meal exports, recovering from the lack of rain in the 2009 monsoon, were 3.4 million metric tons, up 80 percent over the year ending in March 2010 (but still not reaching the high level of exports in 2003); soybean meal accounted for 75 percent of India's oil meal exports. Imports by China of Indian oil meals—for use in livestock feed—totaled half a million metric tons for the year ending March 2011, accounting for 11 percent of India's total oil meal exports.

China is the fourth largest buyer of Indian oil meals after Japan, Vietnam, and South Korea.²⁸⁹ But its purchases may increase. In 2011, the Indian Embassy in Beijing coordinated a meeting between Indian exporters of oil meals and other feed components and representatives of Chinese agribusinesses to explore ways of expanding trade.²⁹⁰

Many Indian farmers have planted soybeans in an effort to pay off recurring debts. However, if the rains falter, their fields—largely rain fed, not watered by irrigation—can fail. Soybeans require 2,300 cubic meters of water for every ton produced, almost twice the amount of water needed to produce a ton of wheat. (A ton of maize requires 450 cubic meters of water.)²⁹¹

The 2009 summer monsoon offers an object lesson. Overall, in 2009–10,

18.6 percent less rain than average fell in India; out of 36 meteorological subdivisions in 2009–10, one experienced excess rainfall, 14 had normal rainfall, and 21 received insufficient rainfall.²⁹² A mass failure of summer crops, including rice, soybeans, sugarcane, and cotton ensued, leading to soaring food prices and growing farm debt.

Agrarian communities throughout India struggled to



Women and children bundle grain after a harvest.

The anticipated effects of climate change in India, such as rising heat and aridity, will reduce further the size of grazing land and make growing fodder crops, as well as maize and soybeans, more difficult. Water shortages—combined with increased domestic demand—will likely force India to end grain exports in coming years.

make ends meet: selling off more livestock than usual despite record low prices; removing children from school to save school fees; skipping meals they could no longer afford; and taking on more debt, often at exorbitant interest rates. Suicide among farmers, a phenomenon that has bedeviled rural India since the 1980s, peaked, with farmers exhibiting growing despair over their livelihoods and futures.²⁹³ An estimated 200,000 Indian farmers took their own lives between 1997 and 2010, according to government statistics.²⁹⁴

LAND PRESSURES AND LAND ELSEWHERE

Deforestation to clear land for pasture, fodder extraction, expanding agricultural cultivation of crops in forests and on grazing lands, and the widespread use of pesticides and fertilizers to grow crops like maize and soybeans are all contributing to rising rates of soil erosion, salinization, alkalization, pollution, and desertification in India.²⁹⁵

Hunger for land for both crops and livestock is also a primary cause of biodiversity loss. India is one of 17 countries defined as “mega diverse.” However, up to 10 percent of its flora and fauna are considered threatened, and some species, like its iconic tigers, are on the verge of extinction.²⁹⁶

Up until 1980, India’s forests were being destroyed at a rate of 144,000 hectares (356,000 ac) a year, due to logging and expansion of agriculture.²⁹⁷ Though the country has been gaining forest cover since 1981, this has been primarily in the form of tree plantations—namely eucalyptus, teak, and pine rather than

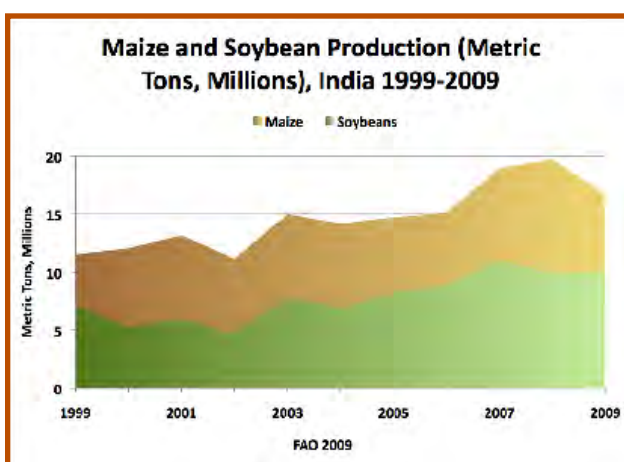
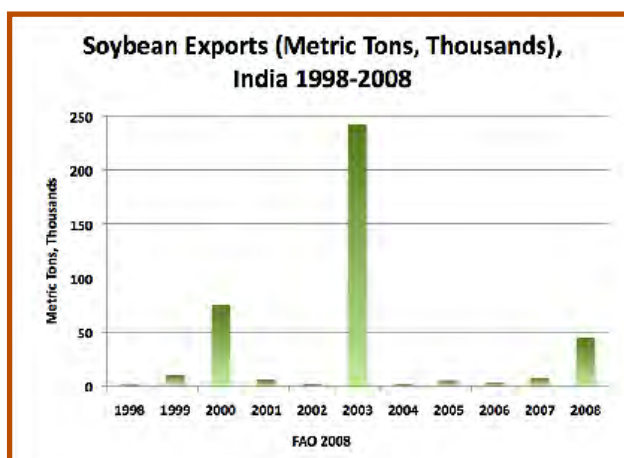
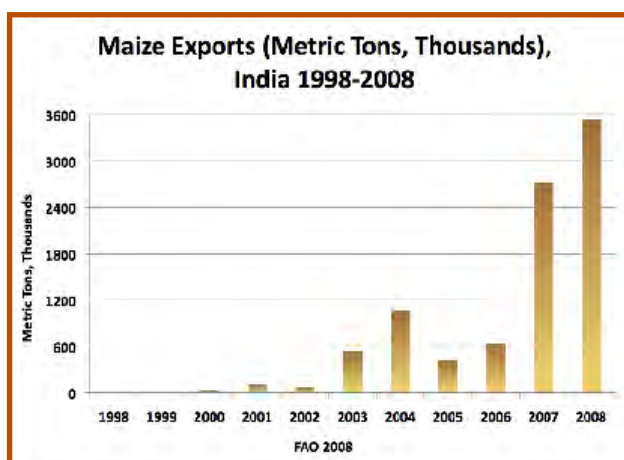
natural forest—which fail to address biodiversity losses or restore degraded land as effectively as native species.²⁹⁸

The lack of land for agriculture has led Indian producers to secure long-term leases on land or purchase it outright in other countries, like

their counterparts in China, South Korea, and Saudi Arabia, among others. Africa is a focal region: Indian agribusinesses have completed agreements for cultivation of rice, sugarcane, palm oil, lentils, vegetables, and maize in Kenya, Madagascar, Mozambique, Senegal, and Ethiopia for export back to India. A majority of this maize is for livestock feed.²⁹⁹ Low-interest loans by the Indian government have encouraged many of these land deals, as have the preferential terms for food or feed ingredients imported from countries where Indian agricultural producers have made investments.

Ethiopia, in the Horn of Africa, has leased or sold land to many countries, but a large majority, about 80 percent, has been secured by Indian entities, according to Ethiopia’s minister of agriculture. As many as 80 Indian companies have leased or bought hundreds of thousands of hectares of Ethiopian land, with the acquisition of more in the pipeline.³⁰⁰ As a result, India has become Ethiopia’s largest foreign investor.³⁰¹

During a 2011 visit to India, Tefera Derbew, Ethiopia’s agriculture minister, offered to lease Indian producers an additional 1.8 million ha (4.44 million ac), an area nearly half the size of the agricultural land in Punjab state, which is known as “India’s granary.”³⁰²



Some development and food security organizations and experts in India and elsewhere have charged that India, a former British colony itself and the world's most populous democracy, is practicing a brand of neo-colonialism by securing land in countries that may have authoritarian governments or large numbers of people experiencing food deficits.³⁰³ India's minister of agriculture, Sharad Pawar, has refuted the criticism. Of the land deals he has said, "It's business, nothing more."³⁰⁴

RAINS THAT DON'T FALL

India is the world's largest consumer of fresh water and user of groundwater.³⁰⁷ India and China, with less than 10 percent of the world's available water between them, support one-third of the world's population.³⁰⁸ But water shortages as a result of climate change, urbanization, population growth, and the water needs of agriculture and food production represent significant challenges to continued rapid economic growth across Asia in coming decades, according to a 2009 UN report on water and development.³⁰⁹

The report notes with concern the rising consumption of meat, eggs, and dairy products in fast-growing developing countries, which are, "much more water-intensive than the simpler diets they are replacing."^{310 311} Dairy, egg, poultry, and beef production require substantial amounts of water for pasture, to grow feed and fodder, to clean and cool facilities, and for the animals to drink.

Between 80 and 90 percent of water withdrawals in India are for agriculture.³¹² Vegetarian diets require an average of 2.6 cubic meters of water per person per day, according to

a study by researcher Shama Perveen at the Indian Institute of Management in Kolkata. The diet of an average person living in the U.S., containing much higher quantities of poultry, beef, and dairy, uses more than twice as much water: 5.4 cubic meters a day.³¹³

With almost 50 percent of India's farmland dependent on the annual monsoon, the effects of weather disruptions could be severe and sustained. "Rain-fed agriculture in marginal areas in semi-arid and sub-humid regions is mostly at risk," in India, according to Jacques Diouf, director of the FAO. Up to 125 million metric tons of India's rain-fed cereal production could be lost due to the effects of climate change,

he added, equivalent to about 18 percent of total production.³¹⁴

Nearly half of India's land-mass is drought-prone, according to India's environment ministry.³¹⁵ The monsoon is also critical for re-charging groundwater, the source of 80 percent of farm irrigation and water supplies in India's rural areas. "Water is everything for us," Amar Singh,

a farmer in Rajasthan, an arid state where groundwater is essential to agriculture, told the BBC in 2011.³¹⁶

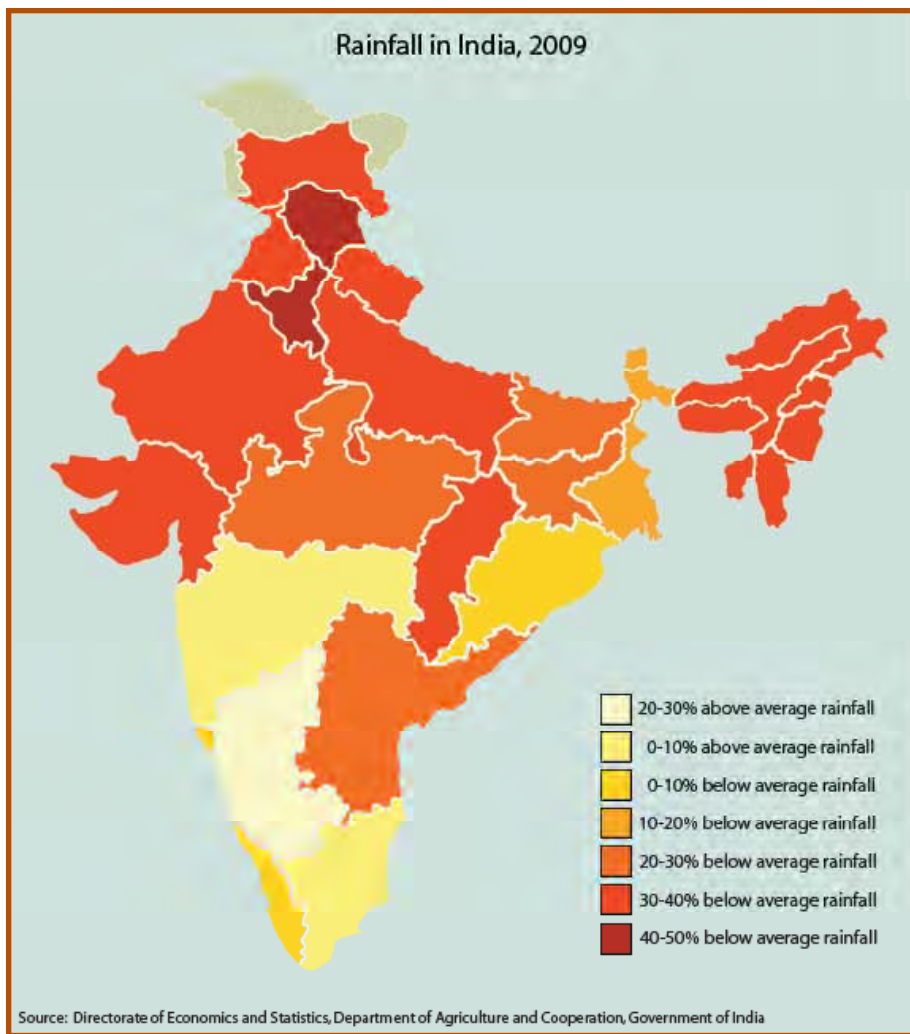
In 2009, Andhra Pradesh, a major

producer of poultry, eggs, dairy, beef, and maize, and Madhya Pradesh, where most of India's soybeans are grown, each experienced between 20 and 30 percent less rainfall than normal during the annual monsoon. In Haryana, a large state producer of poultry, rainfall hit a record low, with volumes 41 percent below average.³¹⁷ In 2009, Uttar Pradesh, the main agricultural producing state in the Ganges river basin, with large output of dairy products and beef, received on average 36 percent less rainfall than usual.³¹⁸



Meghalaya state contains some of the rainiest parts of India. However, deforestation, among other ecological factors, has led to a decreased volume of annual rainfall.

Water shortages as a result of climate change, urbanization, population growth, and the water needs of agriculture and food production represent significant challenges to continued rapid economic growth across Asia in coming decades, according to a 2009 UN report on water and development.



Water from an estimated 20 million boreholes provides India's farmers with 60 percent of their irrigation requirements.³²³

But supplies are under growing pressure. Water levels in key agricultural-producing regions of north India fell an average of 1.6 inches (4.1 cm) a year between 2002 and 2008, according to research led by Matthew Rodell at the U.S. NASA Goddard Space Flight Center, the equivalent of 26 cubic miles of groundwater. Such overdraws have resulted in salt-water contamination of fresh water, leading farmers to drill deeper and pay more to secure water.³²⁴

Groundwater levels in the Krishna, Kaveri, and Godavari basins are expected to be reduced by 50 percent by 2050. The most severe reduction in water levels in river basins will occur by 2050 in the Krishna basin: a 30–50 percent drop is expected in water flowing back to catchment areas, stemming from a 20 percent decline in rainfall. Conversely, the Mahanadi

By 2030, India's water requirements will increase to 1.5 trillion cubic meters (m³) (396 trillion gallons), "driven by domestic demand for rice, wheat, and sugar for a growing population, a large proportion of which is moving toward a middle-class diet," concludes a report by the 2030 Water Resources Group, a consortium of the IFC, the McKinsey consulting agency, and a number of corporations.³¹⁹

Agriculture in India will require a large majority of this, 1.195 billion m³ (315 billion gallons). India's current annual water supply is 740 billion m³ (195 trillion gallons). As a result, by 2030, India's river basins, including some with the largest human populations, including the Ganga and the Krishna, are likely to experience severe shortfalls, "unless concerted action is taken," according to the 2030 Water Resources Group report.³²⁰

GROUNDWATER AND IRRIGATION

Due to the seasonal and at times unpredictable nature of the monsoon, the area of agricultural land in India that is irrigated has increased nearly threefold since 1950.^{321 322}

river basin will experience increased flooding as the effects of climate change intensify.³²⁵

Maharashtra and Karnataka are key agricultural producing states in the Krishna basin: Maharashtra is a center of beef, buffalo, sheep, poultry, egg, and soy production; while Karnataka, which lies within the Krishna, Kaveri, and Godavari basins, has significant numbers of sheep and plantings of maize. Irrigation supplies 90 percent of the water in each state.³²⁶

"2050 is a very frightening sort of picture," according to A. K. Bajaj, chairman of India's Central Water Commission.³²⁷ A background paper prepared for a conference on India and water security held in 2009 at Columbia University in the U.S. summarized the situation this way: "Of all major nations, India faces the most serious resource and environmental challenge in the modern era. India, with nearly a sixth of all people in the world, most still mired in poverty, faces an unprecedented [water] crisis in the next two decades."³²⁸

SHORTAGES AND VIRTUAL WATER

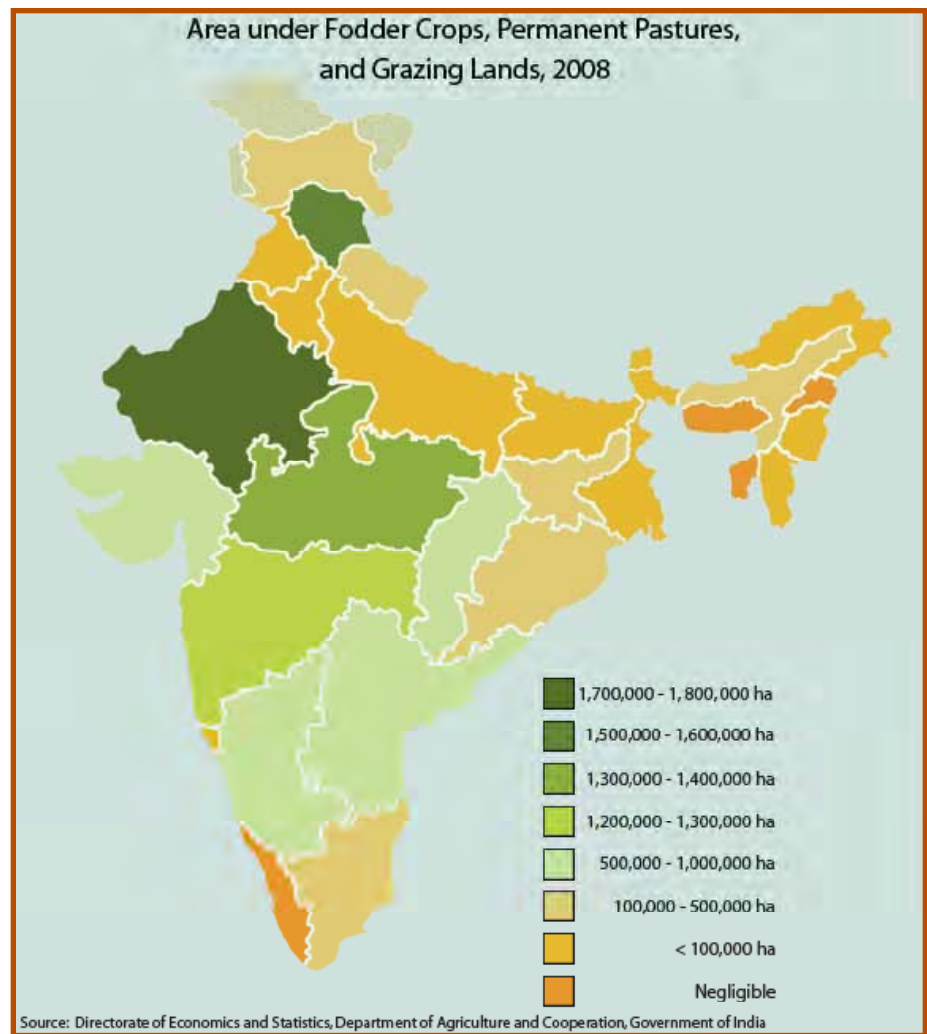
Predicted changes to agriculture in India as a result of climate change will vary depending on the region and the crop, according to the Indian Agricultural Research Institute. A two percent increase in temperature will reduce grain yields in most areas, but regions with higher productivity, such as northern India, will be less drastically affected. Reduced yields will be highest in areas with rain-fed crops. Climate change is also likely to alter the areas suited for crop production by shifting current boundary lines. Warmer regions are expected to experience the greatest crop losses.³²⁹

One of the Indian government's primary responses to water shortages has been to build more large dams and divert more rivers. In the period between 1992 and 2004, for example, the government built some 200 large and medium-sized irrigation projects, yet the area of land under irrigation shrank by 3.2 million ha (7.9 million ac). Inter-state rivalries have challenged such efforts.³³⁰

Between 1963 and 2007, the area of irrigated, harvested land in South Asia increased by 119 percent, growing from 37 million hectares to 81 million hectares (91.4 million ac to 200 million ac). But between 2007 and 2050, the area of land with irrigation in the region is expected to increase by far less: just 6 percent, to 86 million hectares (212 million ac).³³¹

Lower levels of rainfall and the drying up of glacier-fed rivers—already well underway as the Himalayan glaciers melt, a consequence of global warming—will make irrigation of food and feed crops in India more costly. Researchers expect that in the short-term glacier melt will increase the flow of India's western rivers, including the Indus. But over the long term, the net effect will be negative, ultimately decreasing river flow by between 30 to 50 percent.³³²

The Indus' waters were divided between India and Pakistan through a 1960 treaty. Pakistan, experiencing rapid population growth, water shortages, and greater reductions



in the availability of Indus waters than India, is urging that the treaty be revised.³³³

With the water table falling, drilling tube wells for irrigation also will become more difficult. Lower volumes of annual rainfall will also reduce recharges of groundwater, making irrigation more challenging (and more expensive). In some regions in India's northwest, removal of groundwater exceeds its replacement by more than 50 percent.³³⁴

Irrigation also has climate impacts, through the release of greenhouse gases. The energy used for groundwater irrigation in India is responsible for 16–25 million metric tons of CO₂ a year, accounting for 4–6 percent of India's annual emissions of GHGs.³³⁵

While systems for water capture are increasing in parts of India, the growing number of intensive systems in the upper catchment areas of Indian river basins is resulting in decreased runoff and less freshwater being available to users downstream.³³⁶ Deteriorating water quality across India also reduces the supply of accessible water, already challenged by over-withdrawal of groundwater.³³⁷

With water shortages expanding in many regions along with uncertainty about changes to the global climate, the concept of “virtual water” is gaining ground. Also known as embedded or hidden water, it refers to the water used in producing a good or a service. A country’s net virtual water trade is determined by the amount of water embedded in the products it imports and exports. India is among the

world’s leading net exporters of virtual water, in food and other products. Each ton of beef produced, for example, requires 16,000 cubic meters (4.2 million gallons) of water, the equivalent virtual water content of a ton of microchips.³³⁸ Within its major livestock-related exports in 2007—soybean cake, buffalo meat, and maize—India exported in excess of 20 billion cubic meters of water.³³⁹

A VISIT TO AN INDIAN PIGGERY IN A TIME OF SWINE FLU

In the town of Ganaur in the state of Haryana, a number of battery-cage egg-laying facilities, once housing up to 25,000 birds each, have been abandoned. Outbreaks of avian flu in India have caused prices and demand for chicken and eggs to fluctuate considerably. For some farmers in Ganaur, the losses have been significant, leading many to leave the industry.

Others, though, sought new opportunities. In 2005, one farmer converted his egg-laying facility into a pig-producing operation or “piggery.” Initially, he housed 300 pigs on the site but now has more than 900. The owner related his view that while the chicken and egg industries in India were volatile, his pig business had grown and was stable. His pigs are sold for slaughter and consumed in New Delhi.

While India’s Muslim community largely abstains from pork, the piggery owner in Ganaur said that Christians as well as some Hindus eat pig meat. In addition, the growing number of foreign nationals and students in Delhi also often consume pork. Pork is sometimes mixed with mutton from sheep and sold in markets to unwitting customers; it’s also said that this happens with beef from illegally slaughtered cows.

The pigs in the facility were mostly nursing mothers and their offspring, along with a few so-called “service males.” A breeder sow will go through four to five pregnancies over the course of 30 months, after which she will be sold for meat. The piglets are weaned after two months and then eat dry feed, consisting of rice, maize, and sometimes soy. After about nine months, when they reach 90 to 100 kgs (198 to 220 lbs) they are sold.

As for the pigs’ waste, the owner said that farmers pick it up for use as fertilizer. However, the piggery did not have a sewer system or a waste-containment facility, so it is likely that the wastes also end up with rainwater run-off in open drainage channels and fields close by.

All the pigs are transported and killed manually, since there are no pork-processing plants in this region. It will take

several people to hold the pig down and tie her legs with rope. Her head will then be cut off—a slow process. The pig’s stomach is then opened, her intestines removed, and her body cleaned, butchered, and then sold by the kilogram.

Coincidentally, the visit to this piggery occurred on the same day in August 2009 that swine flu claimed its first human fatality in India. As the number of cases of swine flu grew, hospitals swarmed with patients, stores ran out of surgical masks, many schools closed as a precaution, and even India’s film industry, Bollywood, was affected. Film shoots were cancelled and stars curtailed their travel abroad.

Sales of pork suffered, too. “Following the swine flu deaths, a panic

has gripped the public,” Kiran Hariprasad Pardeshi, president of the Pork Sellers’ Association, told the Mid-Day newspaper: “Big restaurants and hotels are not buying pork because people are too scared to eat [it]. As a result, sales have declined by 60 percent.”³⁰⁵ In June 2011, human swine-flu infection was confirmed in three cities in Maharashtra: Mumbai, Pune, and Nashik.³⁰⁶ ■



Some former poultry farmers are now raising pigs, like on this farm in Ganaur, near New Delhi.



Water pollution by the livestock industry, like from this outflow pipe at a battery-egg facility in Haryana, is just beginning to enter the public's consciousness.

WATER POLLUTION AND ENERGY USE

The by-products of animal agriculture—animal wastes and run-off from pesticides and fertilizers used on feed crops—enter India's rivers, streams, and groundwater. These organic and inorganic pollutants contribute to the contamination of an estimated 70 percent of India's surface water and an increasing percentage of its groundwater, according to a 2009 report by the Ministry of Environment and Forests.³⁴⁰

Production of meat resulted in 3.5 million tons of wastewater in 2007. That is nearly 100 times as much wastewater as India's sugar industry generates and 150 times more wastewater than the manufacture of fertilizer creates.³⁴¹ The reality of water pollution by the livestock industry is just beginning to enter the public's consciousness, says Smita Sirohi of the NDRI.³⁴²

Shortages of power, water, and a lack of technical expertise prevent India from treating as much as 87 percent of its sewage.³⁴³ Approximately 700 million Indians lack access to sanitation, and most human wastes receive little or no treatment.³⁴⁴ Treating livestock waste is not a national priority. Nonetheless, both are public health concerns. According to India's environment ministry, "Inadequate treatment of human and animal wastes also contributes to [the] high incidence of water-related diseases in the country."³⁴⁵

The Yamuna river, the largest tributary of the Ganges river, runs through Haryana, one of India's largest egg-producing states, and Uttar Pradesh, a significant producer of buffalo and milk. In some stretches, the river is "so heavily exploited that broad swaths of riverbed lie naked and exposed to the sun for much of the year," writes journalist Richard Conniff. "In other places, the river is a sudsy, listless morass of human, industrial and agricultural wastes."³⁴⁶

SHELTERING INDIAN DAIRY COWS

On an August morning, a truckload of cows arrived at the Gopal Gausadan. The *gausadan* (cow house) is one of the large, government-funded *gaushalas* (cow shelters) that surround New Delhi. Gopal Gausadan houses roughly 2,500 cows. The Municipal Corporation of Delhi (MCD) has been rounding up "stray" cows on city streets, microchipping them, and then transporting them to shelters like this. A few hundred cows arrive at Gopal Gausadan every month.

Since cow slaughter is illegal in most of India, "spent" dairy cows—those no longer producing sufficient quantities of milk, along with their male calves—may be discarded onto city streets. They can be seen foraging through garbage, struggling to survive. Illegal dairy operations in New Delhi, which may number in the thousands, are also responsible. Many of the wandering cows on the streets belong to such dairies, which sell milk at low prices to people living in New Delhi's slums.

When the cows arrive at Gopal Gausadan, staff record the microchip number of each one before releasing them into a large shed where other cows rest. When Gopal Gausadan was first established in 1994, the government gave it 85 acres (34.4 hectares) of land. In 2006, however, 65 acres (26.3 hectares) were taken back and allocated to a government reforestation project, as compensation for site clearings during the construction of Delhi's new metro (subway). As a result of the *gausadan's* land area being reduced so severely, the cows can no longer graze freely. Instead, they are fed fodder bought daily at a local market.

While the government funds this *gaushala*, it also generates its own revenue. It runs a small dairy, even though it cares for cows discarded by the dairy industry. For most of the day, 40 or so cows are separated from their calves so that more milk can be collected for sale. Distilled cow urine is also sold as a medicinal product. "Nectar of urine" is said to have curative properties for a wide range of ailments. The cows from whom urine is collected at the *gausadan* are chained in the same spot for five to six hours each day.

As in most *gaushalas*, the mortality rate at Gopal Gausadan is very high. In the *gaushala's* quarantine shed, sick cows lie on the ground. Three to four cows die each day, almost 120 every month. When autopsies are performed, plastic bags are found in the stomachs of nearly all of them, likely a result of their days on the streets, rummaging for food in trash. In 2009, New Delhi banned the use of thin plastic bags, as have other cities in India. However, polyethylene strips still litter the landscape.

Another MCD truck comes and takes the dead cows away. Their skin and bones will be used in leather and other products. ■

A POULTRY BARON AND CAGE-FREE EGGS

Surendra S. Dhull of Skylark Hatcheries, a self-described “poultry baron,” started his egg operations in 1979 with layer-hen parent stock from France and the Netherlands. He is the biggest poultry producer in north India, and by his estimation, the fifth largest in India. Even though Dhull was one of the earliest adopters of the factory model of production for chickens and eggs in India, he wants to move to cage-free operations.

Dhull has already converted his commercial egg-laying systems from battery cages to cage-free. He now houses 100,000 birds on each farm in ten sheds (10,000 birds in each) using the “deep litter” method. The birds’ droppings, combined with organic material, form the litter that lines the floor of the sheds, which over time, combined with the scratching of the hens’ feet, becomes compost.

Dhull’s reasons for the change are economic: he believes consumers will pay a premium for “cage-free” eggs. Cage-free eggs, however, may look dirtier than those collected from hens in battery cages, and this can actually depress their prices. As in other countries, many “cage-free” poultry operations in India, although they lack battery cages, are still essentially factory farms with thousands of birds housed together in indoor sheds.

Dhull did not use forced molting in his operations and a national ban on it has now come into force on the grounds of animal cruelty. Again, his reasons for not doing so were economic—it’s better to start with a new set of hens, he says. Dhull also does not use antibiotics in his hens’ feed. Removal of a piece of the birds’ beaks, usually on the tenth day and tenth week of the hens’ lives is, however, a common practice in both battery-cage and cage-free operations like Dhull’s.

Converting battery-cage facilities to cage-free requires more labor; to collect the eggs, or money, for automated systems. Finding people willing to work long hours for low wages on poultry farms has become more difficult. Consumer education is also a challenge. “Consumers don’t know the difference between caged and

cage-free,” says Nitin Goel, former corporate marketing manager for Humane Society International (HSI-India). Most Indian consumers, according to Goel, believe that the majority of India’s eggs come from backyard producers, not large-scale facilities.

To further complicate the matter, many producers put whatever label they want on their eggs, such as “bird flu-free,” even though there

is no such certification; “natural,” indicating the eggs are from hens—and not machines; or “vegetarian,” if the feed is vegetarian or if the eggs are not fertilized. Some Indians believe that brown eggs are *desi* (traditional to South Asia), while white eggs are foreign.

Even though Skylark has been a success, Dhull wonders about the long-term prospects for chicken-meat and egg production in India, given the costs of feed, fuel oil, and what climate change may bring, including higher temperatures and reduced rainfall. More birds may succumb to heat stress and global warming will affect the yields of feed crops.

Industrial operators are likely to add more climate controls to their facilities to blunt the effects of warmer temperatures. While these may protect the birds and their productivity, they will also require and consume more energy. Another concern producers like Dhull have is the large amount of waste industrial poultry and egg operations create and the continued viability of spreading it on nearby fields. ■



Eggs stacked, ready for transport in Haryana.

Producing meat, eggs, and dairy products on a industrial scale requires electricity for lighting, heating, and cooling, and then for slaughtering, processing, packaging, and refrigeration or freezing. India's national electricity grid is already strained as individuals compete feverishly with industry for power; 40 percent of India's households still lack electricity.³⁴⁷

A multi-year study of industrial animal agriculture in the U.S. by an inter-disciplinary commission sponsored by the Pew Charitable Trusts concluded that systems of industrial animal agriculture:

depend on abundant freshwater resources and on inexpensive fossil fuels for energy. As supplies of both become scarce, their rising costs raise questions about the sustainability of the current production process. Sustainability will require new approaches that use less water and energy. . . .³⁴⁸

"The real infrastructure India needs is the ecological infrastructure for food security and water security," according to physicist and activist Vandana Shiva, founder of the Research Foundation for Science, Technology and Ecology in New Delhi, and Navdanya, a network of Indian organic farmers and community seed banks.³⁴⁹

FOOD ON THE MOON?

"No indigenous culture—not China or India—has fed grain to animals. Animals have fed on what humans could not eat," Shiva has said. She has questioned the viability of intensive animal agriculture in India given the grain and the water required and the effects on the livelihoods of small farmers.

"Global agribusiness, which makes huge money out of the feed industry, is creating this pressure while destroying what I would call the 'real free economy'—the free-range cattle, the free range chicken—and replacing it with prison factories for animals."³⁶⁵

Ghotge observes: "[In] industrial systems a few people control all the assets that were once controlled by a large population. So basically, socially, environmentally, and economically it is all wrong."³⁶⁶

In 2008, a diplomatic schism occurred when then U.S. president George W. Bush, addressing the issue of rising global food prices, said of India: "When you start getting wealth, you start demanding better nutrition and better food. And so demand is high, and that causes the price to go up." Many senior Indian government officials, policy analysts, and media outlets reacted with anger and disbelief.³⁶⁷

"If Indians start eating like Americans, the world would have to grow food on the moon," Devinder Sharma, chairperson of the Forum for Biotechnology and Food Security in New Delhi, said at the time.³⁶⁸ A cartoon

published in the *Times* of India soon after Bush made his comments showed overweight American tourists "watching emaciated Indian men rummaging for leftover food in a trash heap." "No wonder we're having food shortages back home in the States," the cartoon's caption read, "these guys in India have started eating way too much."³⁶⁹

In his speech to the World Vegetarian Congress, held in India in 1957, India's then president, Rajendra Prasad, observed that: "[N]o doubt that within the foreseeable future, it will be impossible to increase the land under cultivation.



Butchers working at an open meat market in Kolkata.



A farmer and cows plow a field in Andhra Pradesh.

THE MANDATE OF AHIMSA

With the concept of *ahimsa*, or non-harm, at the center of Hinduism and Jainism, the Indian subcontinent has a long tradition of animal welfare. Both Jains and Hindus support shelters for cows (*gaushalas*) and other animals (*pinjrapoles*). Not harming or killing sentient beings is also a major precept of Buddhism, which began in India before spreading across Asia and beyond.

India also has a national legal framework for animal welfare. The constitution enshrines care for the environment and other species, as well as the welfare of all beings, human and non-human, as “fundamental duties.” Article 51A states, “It shall be the duty of every citizen of India— ... (g) to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.”³⁵⁰

The Prevention of Cruelty to Animals Act became law in 1960 to stop animals from experiencing unnecessary pain or suffering. The act created the Animal Welfare Board of India to advise the government on animal welfare laws, ensure such laws are enforced, and promote animal welfare across the country. The twenty-eight members of the board represent federal and state government ministries, academia, and civil society organizations.³⁵¹

The onset in India of industrial animal agriculture is posing challenges to these legal structures as well as long-held Indian tenets of belief and behavior. This has led Indian and international animal welfare organizations to seek to focus greater policy-maker and public attention on farmed animals, particularly those in intensive systems of production. The Animal Welfare Board of India is also increasingly active on livestock issues.

When the government announced in 2011 that foreign direct investment for intensive livestock farming could have full foreign ownership, the Animal Welfare Board and the Humane Society International-India (HSI-India) asked the Ministry of Commerce and Industry to rescind the order and forbid all foreign investment in intensive confinement systems that violate India's Prevention of Cruelty to Animals Act.³⁵²

In 2011, the India office of U.S.-based People for the Ethical Treatment of Animals (PETA-India) released a video of Indian livestock operations that documented routine abuse in the housing, transportation, and slaughter of cows, chickens, pigs, sheep, and

goats. The video shows newborn calves tethered without water; cows and buffalo being beaten getting onto or out of transport trucks; pigs and goats in slaughterhouses, their throats cut with dull knives, bleeding to death; and even animals being processed while still conscious.³⁵³

With their legal slaughter constrained but demand for beef rising, cows regularly travel great distances to reach slaughterhouses, often crossing state lines or even borders. Long, overland treks by truck or foot without food or water are common; cows' eyes may be rubbed with chili peppers to keep the exhausted animals moving. PETA-India has documented truck journeys that result in broken legs, ribs, pelvises, and horns—and up to half of the cows dying in transit.³⁵⁴ Transport of cattle by rail in India has been banned, the result of a campaign led by the New Delhi-based NGO People for Animals, chaired by Maneka Gandhi, a former government minister and member of the Gandhi political dynasty.

Conditions in most commercial dairy operations run counter to India's ethical traditions and legislation regulating the treatment of non-human animals, including the Prevention of Cruelty to Animals Act and state cow-protection laws. An undercover investigation by PETA-India documented cows in India chained by the neck in narrow stalls unable to move naturally. Since on-site waste disposal systems rarely exist in Indian dairies, cows and buffalo often live surrounded by their own wastes and, as a direct outcome, often experience skin and hoof diseases and tuberculosis. Even though the death of cows from infection is common, the animals' carcasses are sold for meat or leather in markets catering to lower-income Indians.³⁵⁵

In August 2011, at the request of the Federation of Indian Animal Protection Organizations (FIAPO), the Animal Welfare Board of India issued a statement of concern about the large dairy planned in Andhra Pradesh, on the grounds of animal welfare and potential risks to the environment. “In such mega-dairies, cows are mostly kept indoors with little access to natural surroundings,” the Board wrote. “Cows farmed intensively like this are bred to produce unnaturally large amounts of milk which can make them more susceptible to health problems.”³⁵⁶

The welfare of chickens in industrial facilities has also been



Cows are often transported over long distances to slaughterhouses.

subject to greater scrutiny. HSI-India is also working to improve farm-animal welfare, including advocating an end to the use of battery cages to house laying hens and encouraging cage-free poultry operations. The campaign has secured commitments from a number of Indian hotels, restaurants, and chefs to purchase eggs only from cage-free operations.³⁵⁷

While the birds still experience privations, cage-free facilities offer welfare improvements. "Cage-free hens generally have 250 percent to 300 percent more space per bird and are able to act more naturally than caged hens," according to HSI-India. And although they cannot go outside, cage-free hens "are able to walk, spread their wings and lay their eggs in nests—all behaviors denied to hens confined in battery cages."³⁵⁸

FIAPO is also working to improve conditions for chickens raised for meat and laying hens. The Federation has asked the Indian government to ensure that the poultry industry reduces the stocking density of chickens on industrial farms. It has also requested an end to the practice of breeding chickens to produce unnaturally large numbers of eggs, or grow unnaturally quickly, both of which can cause physical discomfort and compromise the birds' immune systems, making them more vulnerable to infections, including avian flu.³⁵⁹

In 2008, in the midst of an avian flu outbreak, PETA-India released undercover video from inside large chicken- and egg-producing facilities in West Bengal. It showed birds crowded into small cages or on the floors of sheds, living amid their own wastes—conditions that could contribute to the flu's spread. In response, Madan Maity, chair of the West Bengal chapter of the National Egg Coordination Committee, told the BBC: "The Indian poultry sector is one of the best managed ones in this region. Our practices are often compared to those in developed countries." His statement may have been read with some irony by critics of the factory-farming model in India as well as in industrialized countries.³⁶⁰

PETA-India also shot undercover footage at a Venky's poultry operation. According to PETA, the space was so crowded that birds had to "push and shove each other to reach food," and live

birds had to walk over the corpses of dead ones. PETA-India urged Yum! Brands, KFC's corporate parent, to demand improvements in animal welfare from all of its suppliers, including Venky's.³⁶¹

The practice of forced molting—depriving hens of food and light for up to two weeks so they lay more eggs—had become common on Indian poultry farms. (Some hens were also deprived of water for one to two days.) After the forced molt, hens can lose up to 35 percent of their body weight, according

to N. G. Jayasimha, HSI-India's campaign manager. In 2011, the Animal Welfare Board of India ordered all farms in the country to discontinue forced molting, which, the Board said, violated the Prevention of Cruelty to Animals Act.³⁶² The Pew Commission on Industrial Farm Animal Production, in a multi-year review of animal agriculture in the U.S., acknowledged the stress animals in intensive confinement experience and framed their welfare as a matter of ethics:

This dilemma can be summed up by asking ourselves if we owe the animals in our care a decent life. If the answer is yes, there are standards by

which one can measure the quality of that life. By most measures, confined animal production systems in common use today fall short of current ethical and societal standards.³⁶³

Environmental concerns about intensive livestock production are also getting greater attention. FIAPO has established a program on animal agriculture and climate change, and the Indian Youth Climate Network (IYCN) is also working to make the connection between food production and global warming better known. IYCN, with support from HSI-India, has run a video production contest for Indians to explore the ecological impacts of their food choices, including for climate change.³⁶⁴ HSI-India and FIAPO have conducted joint workshops on the intersection of factory farming, global warming, animal welfare, and human health. ■



Dairy cows who no longer produce enough milk may be abandoned and left to survive on the streets of Indian cities.

Increase in yield per unit of land has also conceivably a limit.” He urged consideration of “whether cereals or meat can be more economically grown on the land,” and continued: “It is therefore a very lucky and fortunate coincidence that our vegetarianism, limited though it may be, reduces tremendously the pressure on land, which is already being felt in many parts of the country.”³⁷⁰

CONCLUSION & RECOMMENDATIONS

In many developing and developed nations alike, industrialization of animal agriculture is seen as an attractive and necessary method of achieving food security and increased standards of living. However, this process has considerable costs and risks, many of which are externalized or postponed to a later date. These include the very real impacts on the global climate, intensive use of resources like water and land, pollution, concentration of the means of production, marginalization of small- and medium-sized farmers, risks to equitable access to food for all, and negative consequences for animal welfare.

As the effects of global warming become more evident in erratic weather, changing rainfall patterns, and rising temperatures and the need for sustainable, equitable food systems becomes more pressing with population growth, intensifying pressures on ecosystems, and widespread hunger, the inevitability of intensive animal agriculture is being assessed more stringently. The question of whether the Western model can or should be replicated in the global South is asked with growing urgency.

The Pew Commission observed that: “U.S. agricultural production will need to transition to much more biologically diverse systems, organized into biological synergies that exchange energy, improve soil quality, and conserve water and other resources. . . .”³⁷¹

The same, of course, could be said for India, or any country. India stands at a crossroads. With more 500 million cows, buffalo, goats, sheep, pigs, billions of chickens produced each year; 600 million farmers; and 1.2 billion people, the competition in India is on for fresh water, land, and food.

Globalization and high rates of economic growth are transforming parts of the country, even as development needs—for schools; health care; clean water; housing; and sufficient, nutritious food—remain immense. Issues of economic and social equity are taking on greater prominence in

India’s public discourse, and can provide a lens through which to assess realities of food production and food availability.

India has not embraced intensive animal agriculture to the same degree as other large, emerging economies. Plant-based foods remain staples of Indian cuisine. A new model, one that puts priority on sustainability, equity, and *ahimsa*, for both people and animals, could forestall the significant ecological and social costs of factory farming and address the essential task of ensuring food security and equity.

In line with its increasingly important role in the global economy and geopolitics, and as the world’s largest democracy, India has a chance to forge a new path and

not simply follow the development model of the industrialized world.

Drawing on the facts and analysis presented in this paper, the following recommendations are made to Indian policy-makers and civil society:

As an increasingly important player in the global economy and geopolitics and the world’s largest democracy, India has a chance to forge a new path and not just follow the development model of the industrialized world.

- **The government needs to intensify a national conversation about how India sees its relationship with food, the use and distribution of resources, its role in the global livestock economy, animal welfare, and the cultures of vegetarianism.** The government should make it a national priority to ensure food security for all Indians through access to a varied, nutrient-dense, plant-based diet, with a particular focus on addressing extremely high rates of child malnutrition.
- **The government ought to provide incentives to promote cultivation of and ensure equitable access to foods that provide key nutrients**, like leafy greens and pulses, which require less water than soybeans or feed grains to produce, and are more resilient to the anticipated effects of climate change.
- **The government, with civil society participation, should establish a national task force** that has regional input (comprised of government-agency staff, researchers, academics, advocates, and community representatives) to assess the current state of the livestock sector and its relationship to climate change, resource use, and population dynamics. The task force should then develop a comprehensive national plan for creating a low-carbon, less water-, land-, and chemical-intensive, and more equitable food production system to meet current

and anticipated needs to the year 2050.

- **The government ought to ensure that water pollution and land degradation, other natural resource impacts, and greenhouse gas emissions are no longer “external” to the livestock industry’s balance sheet, but rather priced fairly and fully paid for.**
- **The government should put a priority on development of less resource-intensive industries** than livestock and feed-grain production and their export. Incentives should be provided to target both foreign and domestic investment to these sectors in a sustainable manner. In addition, government policies and financial incentives for industrial production of meat, eggs, or dairy products, and factory farming systems, ought to be ended for domestic and international entities. The government needs to reconsider its commitment to further industrialization of the livestock sector and accelerated production of animal-based products, along with grains and oil meals for use in feed domestically and for export markets.
- **The government should pass a national law(s) on animal welfare** that would end the abuses and cruelty inherent in factory-style production facilities. The Animal Welfare Board of India could play an important role here, including in soliciting input from the Indian public. Such a law(s) would put India in the global vanguard and also reflect the embedded value of *ahimsa*.
- **The government should adopt development and agricultural policies that focus on ensuring sustainable livelihoods—and food security—in rural regions.** Such policies do not have to consign farmers to operating at subsistence levels on small plots of land; they can include medium-sized enterprises and means of sharing risks and return, such as cooperatives.
- **The government and civil society—including envi-**



Gopal Gausadan, a government-funded cow shelter outside of New Delhi

ronmental, food security, anti-poverty, small farmer, women’s, and animal welfare organizations—should participate in serious, wide-ranging national and state-level dialogues on food production, livestock, sustainability, and equity that would assist in development and implementation of national and regional government policies. Such a forum could also contribute to increasing public awareness of this complex and critical set of issues.

- **The government, with participation from a range of civil society groups, ought to launch a national public education effort** to encourage healthy eating among adults and children based on traditional, plant-based regional cuisines, with a view to advancing food security and reversing the growth in chronic, diet-related conditions like obesity, diabetes, hypertension, and some cancers.
- **Civil society organizations working on environmental, food security, rural development, gender, agricultural, or animal welfare issues should seek opportunities to work more effectively together to counter the growth of intensive animal agriculture** in India, offer alternatives to it, and seek opportunities to exchange information and strategies with NGOs in other parts of the world; similarly, such NGOs in industrialized and developing nations should forge closer ties with their counterparts in India.

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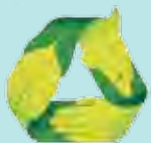
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