

THE WORLD IS WAKING UP TO THE IMPACTS of the consumption-driven expansion of intensive animal farming on global warming, natural resources, public health, independent farmers' livelihoods, and animal welfare. This attention, however, is not yet sufficient to the scale of the problem. This discussion paper examines the "triangle of industrial animal agriculture" that connects the world's biggest players in the meat and feed industries: the United States, China, and Brazil. It then analyzes the dynamics shaping this "meat triangle," compares the forces driving livestock and feed crop intensification in the three countries, and provides recommendations for greater sustainability, with a focus on "delegitimization."

Having thrived in industrialized regions since the conclusion of World War II, the modern livestock industry, especially intensive animal farming (also known as "factory farming"), is posing considerable challenges for climate change, environmental and public health, farmers' livelihoods, and animal welfare. Considering alarming scientific data being generated and rising public awareness, policy-makers are under pressure to cut the industry's greenhouse gas (GHG) emissions, regulate the discharge or disposal of waste, improve animal welfare, and strengthen enforcement to guarantee a safe and sustainable supply of products.

Looking at the global dynamics of "factory farming," the United States (U.S.), China, and Brazil emerge as big players. They form three points of a triangle: the U.S. is a major exporter of mature industrialized livestock

production chains; China is a rapidly growing economy with a huge appetite for livestock products; and Brazil is a country with intensifying conflicts between the economic returns of increasing livestock- and feed-centered agricultural production and the need to protect some of Earth's most ecologically important ecosystems.

Given the realities of finite natural resources and the necessity of ensuring environmental resilience, it is clear that conventional, capital- and resource-intensive industrialization will not lead to the sustainable development of agriculture. Despite this, different drivers in the three nations have pushed, and are still pushing, for intensive development of animal agriculture and consequent large-scale production of feed crops along the trajectory seen in the industrialized world, with inadequate precautions and regulations.

In terms of the social and environmental challenges posed by intensive animal farming, each of the three nations' current responses are short-sighted and perfunctory. It is possible that because the huge demand for and industrialization of animal production are so locked together both are perceived as normal and inevitable. In order to reverse the over-consumption of livestock products in developed (industrialized) countries, and to prevent or limit similar negative consequences in developing (industrializing) countries, delegitimizing the over-consumption of animal products and factory-farming practices merits serious discussion.

This paper explores the social and environmental impacts of meat over-consumption and the underpinnings of the factory-farm model, and presents ideas for, and examples of, what is needed for a transition toward more sustainable production and consumption.

The Meat Triangle

The U.S., China, and Brazil are the three biggest players in the global meat market. Because intensive livestock production requires large amounts of feed crops, dynamic interactions between and among the three nations around meat production also greatly influence the exploitation of natural resources used to produce crops used for animal feed (principally soybeans and corn).

Producers and Consumers

The U.S. represents the modern model and "success" of industrial agriculture, in which huge capital investments and the pursuit of labor productivity result in a highly intensified and mechanized food system. Today, the U.S. is the world's top beef producer and the second largest pork producer. In 2014, the U.S. produced 11.1 million metric tons of beef and 10.4 million metric tons of pork, comprising 18.6% and 9.4% of world production, respectively.¹ A large majority of U.S. meat is produced in highly concentrated industrial operations, i.e., factory farms,

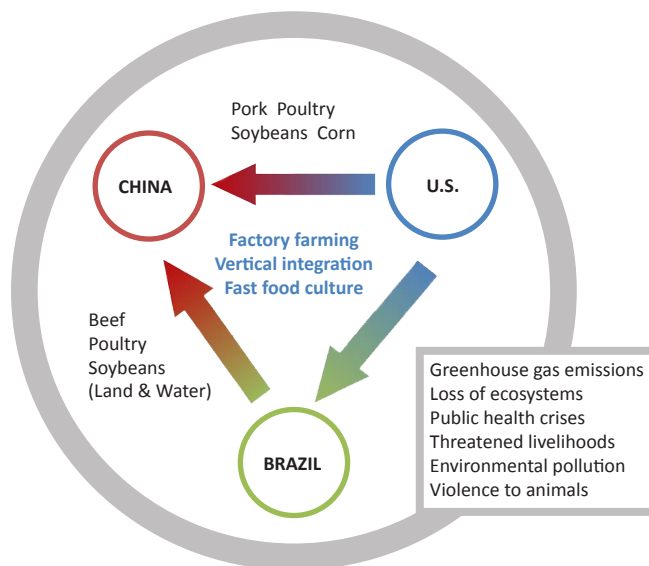
which have vast capacity. One "farm" can, in the case of chickens raised for meat, confine tens of thousands to hundreds of thousands of birds in one facility, or, for pork production, thousands of pigs. Turning farms into factories has helped the U.S. achieve huge agricultural yields, producing at low cost and high "efficiency" with regard to time, if not energy or environmental efficiencies, and has made the country one of the world's largest producers and exporters of both meat and feed crops.

Even though animal agriculture in the U.S. is already heavily industrialized, factory farms continue to expand, as do the meat and feed sectors overall. Between 2002 and 2012, the number of animals on the biggest factory farms in the U.S. jumped by 20%, research by the U.S.-based organization Food & Water Watch concluded, using data from the United States Department of Agriculture (USDA). These facilities had at least 500 cows, for beef

or dairy production; 1,000 pigs; 100,000 egg-laying hens; or 500,000 chickens raised for meat (and sold in a year). Some factory farms and feedlots, which are used for beef production, are considerably larger.²

According to the USDA, increased U.S. meat exports led domestic consumption of meat to drop during the early 2010s. But as production increases and the global economy recovers, both U.S. meat exports and domestic consumption are projected to grow throughout the next decade.³

In China, as the economy continues to expand, living standards for hundreds of millions of people have risen and, alongside this, the appetite for animal products also has increased. Trying to meet domestic demand, China became the world's largest importer of soybeans, used for livestock feed, in 2000,⁴ and the top meat producer in 2009.⁵ In 2014, China produced 56.7 million metric tons of pork and 6.9 million metric tons of beef, representing 51.3% and 11.5% of world production, respectively.⁶ This rapid growth is closely related to the country's deliberate



This graphic shows the main dynamics of the triangle: key commodities traded, U.S.-driven "system" exports (center, blue), and the ensuing impacts (box) shared by all three countries.

expansion of intensive animal farming facilities, part of an effort to catch up with the livestock production model now standard in the U.S. and other industrialized countries.

However, with restricted natural resources domestically—especially water—to meet the demand for meat, China is also heavily importing meat and live animals from other countries. During the first half of 2013, Hong Kong became the largest export market for Brazilian beef.⁷ In the same year, Shuanghui International, China’s meat giant now named WH Group, purchased the U.S.’ biggest pork producer, Smithfield Foods; some analysts called this acquisition China’s “latest food land grab.”⁸

By the end of 2014, mainland China had imported 417,000 metric tons of beef and 761,000 metric tons of pork while Hong Kong had imported 646,000 metric tons of beef and 347,000 of pork. Together, China and Hong Kong ranked first in 2014 among beef- and pork-importing countries.⁹ China does not import beef from the U.S. directly, although Hong Kong does. In 2003, the Chinese government imposed a ban on U.S. beef imports due to concerns about U.S. cases of mad cow disease. But “huge amounts” of beef from the U.S. continue to enter mainland China through Hong Kong, according to a U.S. trade official.¹⁰ And the ban itself may not endure given the U.S.’s interest in exporting more agricultural products and China’s in ensuring a consistent domestic supply of meat.

Brazil is the world’s largest poultry meat and soybean exporter, the second largest beef exporter, and the fourth largest pork exporter.¹¹ Currently, more than 40 percent of Brazil’s soybean harvest is crushed domestically to create soybean meal, half of which is used in the country as animal feed. Most of the rest is exported. According to long-term projections, both production and exports of Brazilian soybean meal (the solid residue that remains after crushing the beans for soybean oil, which also is usually used as animal feed) will grow. Domestic consumption also shows an upward trend, suggesting a further expansion of the animal agriculture industry in Brazil.¹²

Even as Brazil benefits economically from rising global and domestic demand, cattle ranching and soybean cultivation have resulted in the country’s loss or depletion of much of its “real gold”: abundant freshwater resources and the biodiversity and biomass of the Amazonian rainforest and the Cerrado, the Brazilian grassland region that spans more than two million square kilometers across the middle of the country. Both of these regions provide invaluable ecosystem services of global importance.¹³ These include local and regional climate regulation (temperature and precipitation, principally through Brazil’s forest cover), sequestration of climate-warming carbon dioxide, generation of fertile soil, and prevention of erosion and desertification, to name just a few.¹⁴

Table 1: Percentages of Production Exported, 2012–13

%	<i>Beef</i>	<i>Pork</i>	<i>Broiler*</i>	<i>Soybeans</i>	<i>Soymeal</i>
Brazil	18.8	17.8	28.3	46.2	50.7
China	0.5	0.5	3.1	2.0	1.7
U.S.	9.5	21.8	19.7	45.3	21.3

Source: United States Department of Agriculture (USDA)

**Chickens raised for meat*

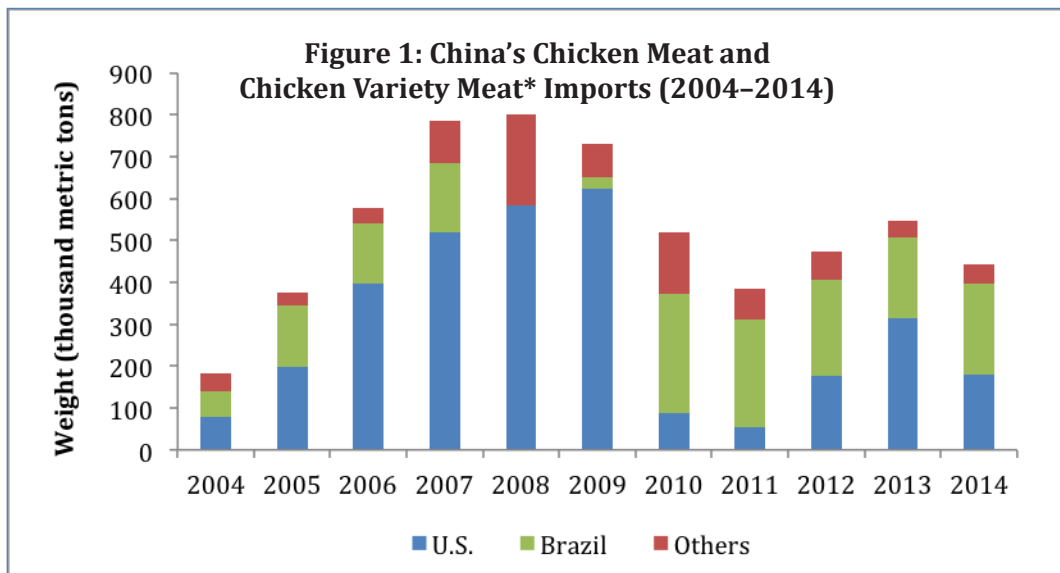
The Flow: Meat and Feed

Similar to the U.S., a large percentage of the products of intensive agriculture in Brazil, including pork, poultry meat, and animal feed (soybean and soymeal), is for export. In contrast, China only exports a

small fraction of these products (Table 1).¹⁵ Its imports of meat, however, are growing rapidly.

China’s imports of chicken meat more than doubled, from 182,874 metric tons in 2004 to 442,528 metric tons in 2014, with a peak (to date) in 2007–2008, when these imports reached 799,000 metric tons (Figure 1). The U.S. and Brazil are the dominant suppliers, together comprising over 70% of China’s total chicken meat imports. In 2014, only 10% of chicken meat imported to China came from countries other than the U.S. and Brazil.¹⁶

China is producing half of the world’s pork, but despite this, domestic production can hardly meet domestic demand. In recent years, the country began importing pork, and the growth rate is astounding. According to the USDA, China’s pork imports nearly tripled between 2009 and 2014, and are projected to grow by another 25% over the next five years, exceeding 1.2 million metric tons in 2020.¹⁷ In just two years, from 2009 to 2011, exports to China of U.S. pork and pork variety meat (hearts, livers, and heads, among other body parts) surged tenfold, from



Source: Ministry of Commerce, China

*Including hearts, livers, and feet, among other body parts

76,581 metric tons to 800,674 metric tons, comprising 59.3% of China's total pork imports in 2011 (Figure 2). Although restrictions on ractopamine, a feed additive that produces leaner meat commonly used in U.S. pork production, have suppressed pork imports from the U.S. since 2013,¹⁸ the U.S. remains China's biggest pork supplier.¹⁹

For pork and poultry meat, domestic production in China still far surpasses imports. But it has been some time since the same was true for soybeans, one of the major commodity crops (along with corn, also called maize) used to feed animals in factory farms. China is the world's largest producer and consumer of soybean meal, as well as the largest importer of whole soybeans. China's soybean imports in 2013/14 reached 70.4 million metric tons, 5.8 times its domestic production of soybeans, which totaled 12.2 million metric tons.²⁰ Again, the U.S. and Brazil are the major suppliers, comprising over 85% of China's total imports (Figure 3).²¹

Projections to 2024/25 estimate imports of soybeans then will be 8.7 times the size of domestic production, almost equivalent to the combined soybean export capacity of the U.S. and Brazil expected in 2024/25.

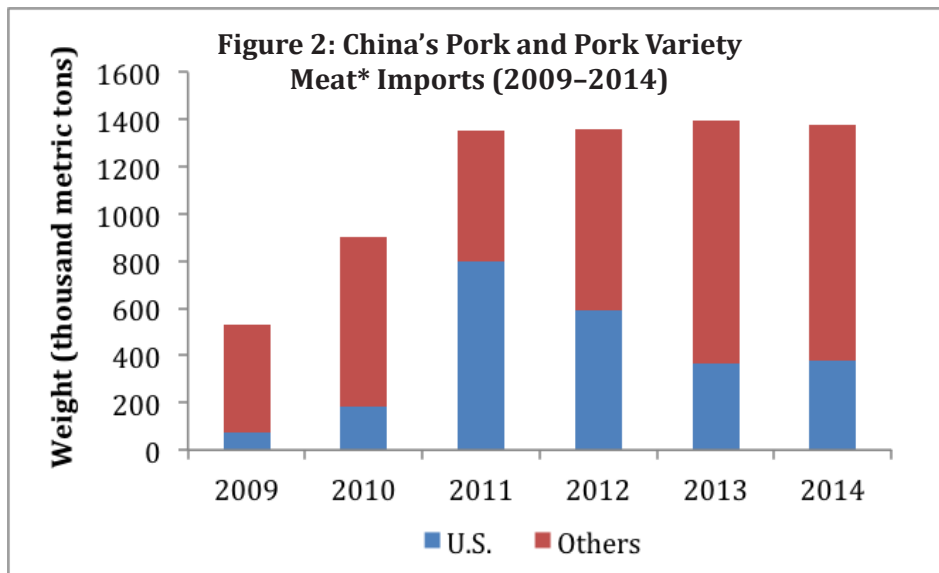
In 2013/14, the vast majority, or 85.7%, of soybeans consumed in China were used to produce soybean oil and soymeal, rather than being eaten by people directly through soy products such as tofu; this percentage, too, is projected to climb, to 89.9% in 2024/25.²²

The only certainty is that if the demand for meat (along with dairy products and eggs) keeps growing, and factory farming is the chosen method to meet that demand, pressures on the environment and natural resources to produce feed crops will become effectively unbearable.

How will countries continue to supply enough animal feed as intensive livestock operations (also called Concentrated Animal Feeding Operations or CAFOs) continue to expand? The answer could be through newly cultivated arable land or reclaimed land, genetic

technology, or methods that could significantly increase the unit productivity of feed crops or of the animals consuming them.

The only certainty is that if the demand for meat (along with dairy products and eggs) keeps growing, and factory farming is the chosen method to meet that demand, pressures on the environment and natural resources to produce feed crops will become effectively unbearable. To many, this situation seems inevitable. But before any conclusions are reached, it is important to first look back and see how the U.S., China, and Brazil got to this point.



Source: Ministry of Commerce, China

*Including hearts, livers, and heads, among other body parts

Drivers of Industrialization

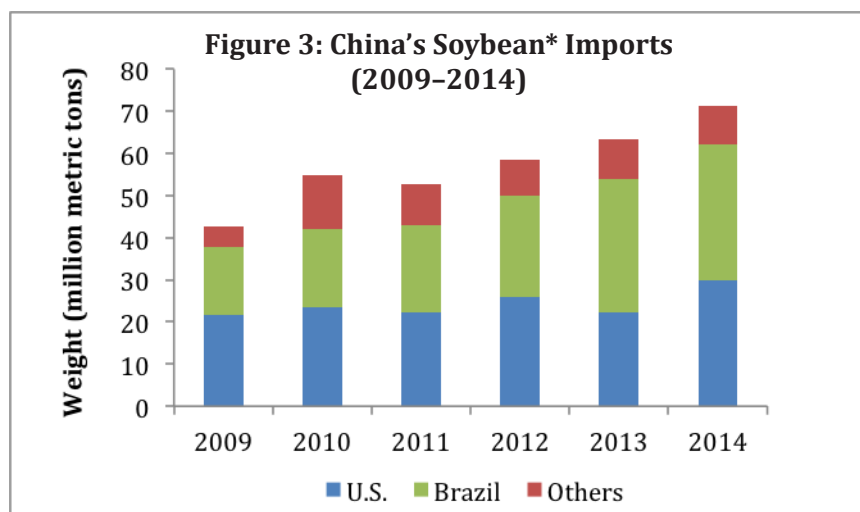
If the question is asked, What determines the factory-farming development tracks in the U.S., China, and Brazil?, “demand” seems to be the obvious driver. However, unique economic and social features in each country tell different stories.

“slaughter weight” quickly) while preventing disease. Because such practices were more costly than the previously used, non-industrial methods, the industry became increasingly capital-intensive. As a result, large corporations with significant financial resources emerged as the most competitive in animal production.²³

U.S.: The Power of Mature Capitalism

The industrialization of animal farming in the U.S. began after World War II ended. The addition of vitamins and antibiotics to animal feed and water made it possible for large numbers of animals to be confined indoors, eat a grain-based diet (in an effort to address a post-war corn surplus), and grow at a desirable rate (i.e., reaching

During this period of expansion, vertical integration emerged and became a predominant pattern in the management of factory farming in the U.S. Big food corporations *integrate* seed or feed producers, farm supply companies, farmers—who become “growers” under a typical production contract—product processors, and distributors, *vertically* up and down the supply



Source: Ministry of Commerce, China

*Whole soybeans

chain to maximize profit and avoid risks. These big players, such as U.S.–based agribusinesses Cobb, Cargill, and Tyson, are also called “integrators.”^{24,25} Vertical integration appeared initially in the U.S. in the broiler or “meat chicken” sector in the 1950s, and then spread to pork and cattle production.²⁶

In a 2008 study “CAFOs Uncovered,” Doug Gurian-Sherman, a senior scientist at the U.S.–based non-government organization the Union of Concerned Scientists, discussed the positive feedback loop of large integrators’ expansion. Driven by the generally higher economic efficiency of CAFOs, integrators make contracts with producers in favor of large farms and control the processing plants that meet federal inspection requirements. Smaller producers and processors that fail to enter into contracts with integrators therefore lose market share. Even if they produce at a competitive cost, it is difficult for them to gain access to regulator-approved slaughterhouses and other processing facilities.

So as the small players drop out or merge with the big players through vertical or horizontal integration, concentration is exacerbated, and the market is increasingly controlled by fewer, larger corporations.²⁷ With their increased market strength and dominance, the integrators are able to influence policy-making and policy implementation in favor of their bottom lines. Subsidies are a key case in point.

In 2012, U.S. government subsidies for livestock, soybeans, and corn were US\$ 58.7 million, \$1.5 billion and \$2.7 billion, respectively, according to the U.S.–based Environmental Working Group.²⁸ Government subsidies for feed crop farmers make the price of feed grain low enough for big integrators to turn a profit. Furthermore, they “pass the buck” on environmental impacts like pollution and GHG emissions: the contractors, not the integrators, are responsible for waste management and receive government subsidies for waste management compliance.²⁹

Such subsidies seldom benefit small-scale or pasture-based animal producers (or, for that matter, producers

of vegetables, legumes, and fruit), and the anti-competitive situation is difficult to change. The Grain Inspection, Packers & Stockyards Administration (GIPSA) within the USDA is the federal authority charged with overseeing the processor industry. In 2000, GIPSA was accused of violating anti-competition regulations. Yet, even after reaching an agreement with the Government Accountability Office and the USDA’s Office of Inspector General to improve its practices, implementation of reforms didn’t happen.

Feedback loops create multiple benefits for integrators, including strong government support. This favors intensive production, further hindering smaller producers. In his study, Gurian-Sherman concluded that under the current system, “anti-competitive practices against smaller and independent animal producers are unlikely to be prevented.”³⁰

In just a few decades, as the U.S. agricultural economy lost its competitive character, food corporations’ marketing efforts also successfully got consumers accustomed to the dominance of large integrators such as Cargill and Tyson, without necessarily being aware of the downsides, or even the existence of, factory farming. In other cases, consumers in the U.S. have come to believe that concentration is an efficient, essential, or even inevitable form of livestock and feed production.

China: From Politics to Market

The emergence and development of intensive animal farming in China was accompanied by a series of institutional transformations. Right after the founding of the People’s Republic of China in 1949, land reform equalized the distribution of land among farmers. However, such a private peasant economy could not meet the demands of nationwide industrial development. In 1953, the government introduced cooperative farming and a state monopoly on agricultural products, mainly to scale up the supply of these products and to achieve rapid national capital accumulation for the country’s economic development.³¹ This later led to the creation of a collective economy and the establishment of people’s communes.

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Animal farming carried out through agricultural cooperative teams (where farmers, still owning their land, could utilize farming resources more efficiently through cooperation) and people's communes (which replaced private ownership of land and resource with public ownership) could be seen as an early attempt at concentrated animal farming. Cattle were mainly used as draft labor; only pigs and chickens were farmed on a larger scale.

Political enthusiasm and absolute obedience to instructions from the central government led to the scaling up of pig and chicken production, rather than any localized, scientific planning. This mindset governed agricultural production and distribution in China in general and was only rethought after the Great Famine took tens of millions of lives between 1959 and 1961. The collective animal farms were also unable to sustain themselves and faded out during this period.

The 1960s saw a recovery of family farming in China due to a policy adjustment by the central government. In the 1970s, the Cultural Revolution resulted in a push for another boost to collective farming, focusing on pigs. The rapid growth of larger farms holding more than 100 pigs ("Hundred Head") or fifty pigs ("Half a Hundred Head") were recorded in several local chronicles.^{32,33,34,35}

The Reform and Opening Up process, beginning in 1978, was a huge turning point in China's development, introducing a market economy to the socialist society. It also marked the end of strong political intervention in agriculture. China adopted the Household Contract Responsibility system for agriculture in 1978, and implemented the practical version of the system, or the Household Contract system, in 1982. Different from the integrator-contractor relationship that began appearing in the U.S., the contract system represented the return of the contractual relationship between small farmers and the collectives. Animals raised in collective farms were distributed to farm staff. Specialized pig-farming households receiving government subsidies appeared in the mid-1980s. Their farms usually held around 100 pigs.

The Opening Up policy encouraged development of the "free market" and promoted urbanization. In 1989, the

government launched the "Shopping Basket Project" to meet the growing demand for vegetables, fruits, and animal products in urban areas. During the 1990s, large-scale agricultural "production bases" thrived in suburban areas. Industrialized production methods and facilities were introduced to scale up output. For example, Shenzhen, a major trade port on China's south coast, was among the first cities to develop factory farms that could house more than 10,000 pigs or 100,000 chickens.

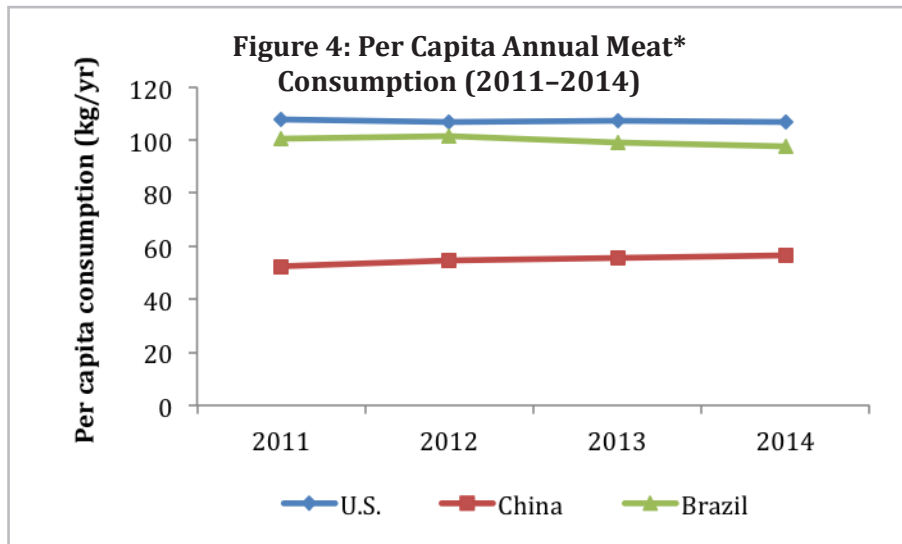
From 1992 to 2000, annual pig production in Shenzhen grew by 50%, from 620,600 to 930,200. The livestock industry accounted for 54% of the city's agricultural output value in its peak year, 1995. By comparison, this percentage was 31.5% ten years earlier in 1985, and only 12.2% in 1979.³⁶ As demand grew, the spread and localization

of intensive animal farming practices was seen as both necessary and positive, and it appeared among goals set in agricultural development plans at all levels of governance in China.

The emerging market also attracted investment from multinational agribusinesses that exported Western-style confinement facilities and management patterns to China. In 2001, the year China became a member of the World Trade Organization and agreed to allow foreign companies to operate inside its borders, Tyson established poultry operations in the country; in 2008, it began to produce chickens in its own facility.³⁷ Tyson has been working toward 100% vertical integration and set a goal of processing 3 million birds a week (or 156 million a year) in China by the end of 2014.³⁸ Because it is difficult to perform typical contract farming in China due to the number, small size, and scattered distribution of family farms, as their business expands multinationals like Tyson tend to build large facilities they control directly. A typical Tyson poultry operation in China confines about 20,000 birds at a time.³⁹

Marketing by multinationals, especially fast food companies, also has contributed to the growing demand for meat in China. Sales of fast food in China reached US\$ 108 billion in 2014, with about 10% of these sales taking place at U.S.-branded fast food chains, which are numerous.⁴⁰

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Source: USDA and Population Reference Bureau

*Includes beef, veal, pork, and broiler chicken meat

As meat imports have increased, conflicts in exporting countries between communities living near production facilities, where environmental and health problems already exist, and producers have been intensified.

As a major pork supplier to China, the U.S. is not an exception. In the state of North Carolina, for instance, where industrial pig farms are numerous and highly concentrated, community complaints about pollution from the large lagoons where manure is stored have been amplified by concerns that such operations would expand to provide more pork for export to China after Shuanghui (now WH Group) acquired Smithfield. Communities fear increased air and water pollution from pig waste, higher rates of pollution-related diseases, and lower property values.⁴¹

Brazil: Exportable Resources with Easy Access

Abundant natural resources and a favorable climate have allowed Brazilian agriculture to be extremely productive. In recent decades, emerging economies, including Brazil, have experienced a growing demand for meat products. In order to seize the commercial opportunity, intensive pig and poultry farming have developed rapidly in the southern states of Brazil, and are expanding northward.⁴²

Following the pattern of commercialization of the livestock sector in the U.S., vertical integration in Brazil first emerged in the poultry sector in the 1960s.⁴³ Local companies such as Sadia and Perdigão provided batches of day-old chicks, together with feed, technology, and

veterinary assistance, to contract farmers (growers).⁴⁴ An integrated system was later adopted for pig production in 1990, and has fueled the growth of large, industrial pig farms in Brazil.⁴⁵

During the same period, attracted by cheap labor, seemingly abundant natural resources, and a favorable investment environment, multinational integrators—especially U.S.-based food giants—entered Brazil. Cobb, a poultry breeding company well-established in the U.S., was among the first when it began to develop ventures in the country in 1960.⁴⁶ Tyson set up shop in Brazil in 2008 and began to expand poultry operations.⁴⁷ Commercial poultry and pig production by these multinational agribusinesses in Brazil were targeted almost exclusively at export markets.⁴⁸

The Brazilian government has encouraged commercial agriculture in general, including intensive animal production. According to the national Agriculture and Livestock Plan 2013/14, in 2012/13 a rural credit of Brazilian *real* (R\$) 89 billion (US\$ 43.8 billion) was directed towards commercial and industrialized agriculture production. In comparison, R\$ 8.4 billion (US\$ 4.1 billion) was allocated to smaller-scale cooperative farming (Procap-Agro and Prodecoop) or farms using low-carbon practices (Programa ABC) such as reforestation or organic agriculture.

The 2013/14 Plan raised credit levels for commercial agriculture to R\$ 97.6 billion (US\$ 48.1 billion), a 9% increase. Credit for cooperative and low-carbon agricul-

NEW POLICIES ON MEAT CONSUMPTION IN CHINA

In China, a recent policy directive suggests a deliberate effort by the central government to adjust the country's food consumption patterns. Compared to both the U.S. and Brazil, China's per capita annual meat consumption is about half (Figure 4). This could be seen as an advantage in a potential "green leapfrog," as the society's "meat addiction" is not as deep as it is in the U.S. Public health officials and social groups in China have been calling for a wiser diet, and are seeing some progress. In January 2014, the State Council, the chief administrative authority, issued the "Outline of the Program for Food and Nutrition Development in China (2014–2020)." It states that per capita meat consumption should be 29 kilograms per year, nearly 50% lower than the current level. Meanwhile, the Outline also suggests an increase in the proportion of beef and lamb in China's meat supply, which may reflect bottlenecks to increasing pork production and shifting consumption patterns in cities.^{52a} The effects of such policies will be felt inside and outside China's borders, particularly by the domestic and global animal agriculture industry.

ture increased to R\$ 11.6 billion (US\$ 5.7 billion), a 38% rise. But the gap between the two is still substantial.^{49,50} The government also has invested directly in the meat sector, promoting CAFOs and meat processing facilities.⁵¹

One of the issues specific to Brazil is that cattle ranching—generally, extensive systems, along with a growing number of feedlots that can hold thousands of cows—and the expansion of monocultures of soybeans planted for animal feed, are eroding some of the world's most precious, biodiverse ecosystems: the Amazonian rainforest and the Cerrado, the Brazilian grassland. The degradation of these ecosystems translates into loss of biodiversity; increased emissions of GHGs from the release of carbon dioxide that is stored in trees, other vegetation, and soil; and an undermining of the carbon sequestration capacity of Earth as a whole.⁵²

The remaining Amazonian forests are already affected by the changing climate. They were once a vast "carbon sink," helping regulate Earth's temperature. But in March 2015, 93 researchers reported in the journal *Nature* that

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in the decade of the 2000s, above-ground biomass (i.e., not soils) in the Amazon decreased by 33% compared to levels in the 1990s. This was the result of trees dying off more quickly, and is likely a consequence of increased carbon dioxide concentration in Earth's atmosphere. Drought in the region also played a role, but that, too, can

be seen as an outcome of global warming.⁵³ Interestingly, the researchers found that the trees in the plots they studied tended to grow faster and die younger as they "ate" more carbon dioxide, a phenomenon similar to the "fattening" and

early death of industrially farmed animals.

In the 1960s, the expansion of intensive poultry production in southern Brazil increased domestic demand for soybeans. During the following decades, selective breeding by Brazilian farmers and genetic technologies from the U.S. have allowed soybeans, a temperate crop, to be cultivated successfully in the tropics.⁵⁴ The impetus behind this was to make the most of the potential for the cultivation of arable land in Brazil, including in both the Amazon and the Cerrado. The resulting increase in acreage planted and yields have been immense.

Soybean production in Brazil more than doubled from 38 million metric tons in 2000 to 87 million metric tons in 2013/14.⁵⁵ A growing percentage of the soybeans planted in Brazil are genetically modified, pesticide-resistant strains (e.g. Round Up Ready, produced by Monsanto),⁵⁶ and China is the largest export destination.^{57,58}

To boost agricultural development, the Brazilian government promoted the “frontier mentality” for decades, encouraging farming and cattle ranching in the country’s forested interior, including much of the Amazon. Since 1989, it has allowed frontier farmers to clear up to 50% of their declared forest within the Legal Amazon region (the socio-geographic division located in north-west Brazil). The national Forest Code, amended in 1996, restricted deforestation to 20% of the forest within the Legal Amazon. However, the lack of incentives for compliance, practical guidance, enforcement capacity, and policy certainty, together with corruption and high monetary rewards for clearing forests to make way for crop and livestock production, rendered the Code largely ineffective.⁵⁹ A new Forest Code adopted in 2012 introduced conservation measures, but the Code also lowered forest restoration requirements for landholders, and protections for the Cerrado region were generally weak.⁶⁰

Taking advantage of a combination of factors, including poorly implemented forest codes, government support for commercial agriculture, and rapidly growing markets overseas, multinationals in Brazil have been able to boldly expand and industrialize crop production. They have converted readily available natural resources into profitable products at low cost and shipped them to high-value export destinations. Although global campaigns against “Amazon beef” and more recently, “Amazon soy,” have seen progress, illegal clearing of forest and cultivation of soybeans have not ended in the forest region. At the same time, countries near Brazil like Paraguay are, without attracting much regional or international attention, experiencing similar social and environmental deprivations related to the rapid expansion of the soy and cattle frontiers.⁶¹

Response to Global Capitalization

The global industrialization and capitalization of animal agriculture are manifested in the meat triangle. The U.S. model of integration easily found its place in Brazil and has thrived there. Although the export of this model to China has encountered some obstacles, construction of large facilities by national and international agribusinesses is picking up speed with government policy support.

But the triangle is not stable. It is not hard to foresee that the externalized costs of factory farming—including pollution, ecosystem degradation, GHG emissions, negative impacts on livelihoods and rural communities, chronic public health crises (the result of environmental pollution

and the rapid Westernization of diets), violence to farmed animals, and potential social instability—will put increasingly heavy burdens on consumers, producers, and even on those who choose not to produce or consume factory farmed products (or any animal products at all).

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factory-farmed products (or any animal products at all).

Is Concentration Inevitable?

Compared with aiming to bring about a paradigm shift, recommendations that justify and seek to improve existing factory farming practices may seem more practical. However, the effectiveness of such recommendations in solving the urgent challenges enumerated above is limited in the face of reality.

With stricter regulation, for example, technological innovations, if scaled up immediately, might be able to cut emissions and discharges from animal agriculture. They might even remediate polluted soil and water to acceptable levels. With new laws, integrators might be required to pay more attention to growers’ livelihoods and animal welfare. Nonetheless, each of these would also require stronger enforcement of such laws and regulations. This is a deeply rooted problem for big developing countries like China and Brazil.

Conversely, a country that embodies mature capitalism, like the U.S., is under huge pressure from big food corporations to put in place and maintain policies favorable to their interests and to ensure their access to export markets. It is also uncertain whether the mainstreaming

of a transition towards more sustainable livestock production could happen soon enough to avoid environmental—especially climate—and social disasters.

From an economic perspective, it is likely that the “invisible hand” of the market will play its role, pushing for animal farming methods to evolve—and probably for the demand for animal products to fall—as the costs of energy and other relevant natural resources like water and land, to name just two, rise. In 2001, the World Bank published a livestock strategy that suggested the Bank reverse its commitment to support large-scale intensive animal production in developing countries, and promote a “people-centered,” more sustainable approach, because the old approach was “simply too costly.”⁶² Although this strategy was never fully implemented, the views it expressed found strong footing in the work of many researchers and civil society organizations seeking to document the often hidden environmental, social, and ethical costs of intensive animal farming and to bring about significant changes.

In a paper discussing capitalization in the U.S. agricultural sector, rural sociology professors

William Heffernan and Mary Hendrickson write, “Perhaps the major difference between economists and other social scientists such as sociologists is that most economists see the evolving system as inevitable. . . . Sociologists believe the current [economic] system [favoring intensification and consolidation of farm systems] was put in place by humans and can be changed.”⁶³

The changes needed cannot be made by just a few. Given the growing body of research and experience demonstrating that the capital-intensive factory-farming model does not fit on this small planet, it is extremely important that policy-makers at all levels, academics from different fields of study, farmers and agribusinesses, as well as the general public, be more aware of the current system and its consequences. They will need to work together to identify real solutions that are adapted to countries’ unique social structures, natural resource endowments, and long-term development needs.

Delegitimizing Meat Over-Consumption?

Over-consumption is probably the biggest contributor

to unsustainable development. In the meat and feed industry, over-consumption is worsened by various factors, including some generally seen as positive. These include continued economic growth and the marketing efforts of profit-oriented food companies, and sometimes, as researchers have pointed out in the case of China, “consumption in revenge” for food shortages in the past.⁶⁴ Today, the consequences of over-consumption and factory farming call for a transition away from a meat-centered diet. “Delegitimization” of meat over-consumption and factory farming could facilitate this urgently needed transition.

In a chapter in the Worldwatch Institute’s “State of the World 2013” on curbing global fossil fuel consumption, environmental and political science scholars point out that delegitimizing fossil fuels represents a reconceptualization and reevaluation of humanity’s relationship with oil, gas, and coal.⁶⁵

The same, we can conclude, is needed for the livestock industry. This is not to condemn food companies, regulators, or everyone who consumes or over-consumes animal products for the negative

impacts of intensive production (although they do, of course, have some responsibility for the current situation). The point of delegitimization is not to divide the “good people” from the “bad people,” but rather to recognize that what the majority once took as normal, or even “net beneficial,” has turned out to be “net detrimental” and needs to be reconceived.⁶⁶

Beijing’s official ban on smoking in public spaces for a healthier public environment, put in place in 2015, is an example of delegitimization of a product (tobacco) once sold, consumed, and marketed at will, notwithstanding its health, environmental, and social effects. As societies comprised of moral beings with advanced knowledge in ecological sciences, economics, sociology, and ethics we should be capable of choosing development pathways for food and agriculture that are less harmful to current and future generations—of human beings and other species, as well as ecosystems.

Vision is essential. Around the world, people are increasingly aware of the impacts of meat over-consumption

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and the unsustainable means of meat production, and are acting to shift practices and policies. Civil society organizations, entrepreneurs, and individuals can be quick responders to new questions about the prevailing model of resource-intensive economic “progress.” Their often small size and flexibility enable them to “be the change” more easily, and their adaptability to varied conditions allows their actions to be effective and influential at local levels as well as more broadly.

The Meatless Monday concept, for example, is going global. Initiatives in the U.S. and Brazil, as well as Green Monday campaigns in China, are gaining social acceptance through the amplification effect of celebrities and the participation of a growing number of schools, hospitals, and municipalities.^{67,68} Founded in 2009, U.S.-based vegetarian food company Beyond Meat aims to reduce global meat consumption by 25% by 2020 through plant-based, meat alternative products.⁶⁹ Farmers’ markets are becoming more popular in the U.S., along with interest in food sourcing, organic farming practices, and localized economies. In Brazil, the number of ecological and organic food producers is also growing.⁷⁰ And in China, community-supported farms are thriving near big cities, promoting direct trade between consumers and farmers and avoiding the intervention of food companies or supermarkets.

These examples are all part of the process of “globalization from below,” contrasting with the capital-driven “globalization from above.” Although the former calls for change from the “bottom,” support from all parts of society, including those from “above,” is needed to achieve a successful delegitimization. Policy-makers with a vision of sustainable development for a nation, a province or state, or a city, should try to promote consumption styles that match long-term development visions.

Conclusions

Countless creative ideas exist that policy-makers can embrace. Supporting interdisciplinary research activities can facilitate fact-based goal-setting and long-term planning. Internalization of social and environmental externalities is a key component of the delegitimization of meat over-consumption. Stricter regulations and policy instruments such as subsidies and tax incentives could be applied to regulate corporations’ behavior, reveal the hidden costs of factory farming, and encourage greater consumption and production of plant-based foods. Public education endorsed by the government on intensive animal farming and its social, environmental, and

ethical impacts can be useful, too, since it not only raises public awareness but also sends signals to businesses and encourages new approaches.

Large and diverse countries like the U.S., China, and Brazil often find it difficult to put forward national policies that can be implemented effectively without localization. In addition, complex institutional systems and a lack of communication can lead to contradictory messages from governments. Yet, current realities require significant shifts in our agricultural and food systems, and countries need to work together to meet the meat challenge, both nationally and globally.

The dynamics of the meat triangle also suggest that the flow of meat products and feed among the U.S., China, and Brazil is sensitive to fluctuations in demand. This provides some hope that if the delegitimization of meat over-consumption and factory farming practices gains greater momentum, production patterns will change accordingly. As the over-consuming countries begin to wake up from the dream of “consume as much as one wishes,” consciously take environmental and social limits into consideration, and apply technologies in a people- and Earth-oriented manner, new possibilities of sustainable development will unfold.

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Brighter Green produced a short documentary film highlighting some of the topics addressed in this paper, "What's For Dinner?" (2014), that focuses on China. To learn more about the film, how to watch it, and to access an interactive viewing guide, visit the film's website (English and Chinese): www.wfdinner.com

Brighter Green also has published a number of policy papers and produced short documentary videos on related topics that may be of interest to readers of "The Triangle," including:

- "Beyond the Pail: The Emergence of Industrialized Dairy Systems in Asia"
- "Skillful Means: The Challenges of China's Encounter with Factory Farming" (policy paper, summary and video in Chinese)
- "Cattle, Soybeanization, and Climate Change: Brazil's Agricultural Revolution" (summary and video in Portuguese)
- "The Environmental and Social Impacts of Unsustainable Livestock Farming and Soybean Production in Paraguay" (co-published with the Global Forest Coalition)
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