The industrialization of animal agriculture: Implications for small farmers, rural communities, the environment, and animals in the developing world

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Abstract
The livestock sector is rapidly industrializing, particularly in developing or emerging economies, where most of the growth in meat production is projected to take place (OECD-FAO, 2011). Approximately 80 percent of the growth in this sector is already in the form of industrial farm animal production (Steinfeld et al, 2006). Worldwide, industrial systems account for approximately two-thirds of egg and poultry meat production and over half of pork production (FAO, 2007), with developing countries producing approximately half of the world's industrial pork and poultry (Steinfeld et al, 2006a). At the same time, there is increasing consolidation of holdings in the farm animal sector (Steinfeld et al, 2006b; FAO, 2009). Between 1980 and 2000, global pork production nearly doubled, with a decrease in the total number of farms and an increase in larger facilities raising 1000 or more pigs (Cameron, 2000). In India, six large poultry companies account for nearly 40% of the egg industry (Rattanani, 2006). In addition to such concentration, farm animal production is becoming geographically clustered (FAO, 2009). Between 1992 and 2001 the proportion of pigs housed on 5% of Brazil's land area rose from 45% to 56% (Steinfeld et al, 2006). It is important to evaluate these trends for impacts on social and development goals. For example, a 2010 study found that animal agriculture alone will help push the planet to the brink of several sustainability boundaries (Pelletier & Tyedmers, 2010). Industrial animal agriculture has been shown to threaten the environment due to waste management challenges (Pew, 2008) (U.S. EPA, 2003). The economic concentration in the farm animal sector been shown to push small farmers out of the market and reduce employment opportunities (McLeod et al, 2009, Ikerd, 2004). This paper will analyze peer-reviewed studies, government data, and industry reports in order to better understand the impact of these structural changes on environmental sustainability and household food security in developing countries.

1. Changing Structure of Farm Animal Production

Evaluating the impacts of industrialized animal agriculture on human communities, the environment, and animals requires an understanding of the global trends towards industrialization. By 2050, meat and milk production is expected to approximately double from 1999–2001 levels (Steinfeld et al, 2006a). Most of that growth in production is taking place in developing countries (Steinfeld et al, 2006a), which are projected to account for about 78% of the increased meat production between 2011 and 2020 (OECD-FAO, 2011). Much of that growth will also be in the form of industrial farm animal production (IFAP). By the end of the 20th century, IFAP was increasing worldwide six times as fast as grazing systems and twice as fast as traditional mixed farming systems (Verge et al 2007). Worldwide, industrial systems now account for approximately two-thirds of egg and poultry meat production and over half of pig meat production (FAO 2007). Based on calculations by the Food and Agriculture Organization (FAO) of the United Nations, developing countries produced approximately half of the world's industrial pork and poultry by 2006 (Steinfeld et al, 2006a).

1.2 Defining Industrial Farm Animal Production

In this paper, industrial farm animal production (IFAP) facilities are defined as those that concentrate thousands, or often even hundreds of thousands of farmed animals along with their waste, on a limited land area, frequently in cages, crates, and pens. This corresponds to the United States Environmental Protection Agency (EPA) definition of an animal feeding operation (US EPA 2012).

According to the EPA, "Animal Feeding Operations (AFOs) are agricultural operations where animals are kept and raised in confined situations. AFOs congregate animals, feed, manure and urine, dead animals, and production operations on a small land area. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures, fields, or on rangeland" (US EPA, 2012). Facilities that confine animals for at least 45 days in a 12-month period, in a confinement area lacking grass or other vegetation during the normal growing season, are designated as AFOs. The EPA offers a more specific classification of these facilities, defining them as small, medium, or large Confined Animal Feeding Operations (CAFOs).

In addition to meeting the definition of an AFO, CAFOs meet the criteria for a large, medium, or small CAFO (US EPA, 2012). A facility is designated as a large CAFO based on the number of animals confined. A large pig CAFO, for example, confines 2,500 or more pigs weighing over 25 kg, or 10,000 or more pigs weighing less than 25 kg. A large chicken CAFO utilizing a liquid manure handling system confines 30,000 animals or more; the minimum number of chickens required for this designation increases if an alternative manure management system is employed (US EPA, 2012).

Medium and small CAFOs confine fewer animals, but may have been cited by the EPA as a significant contributor of pollutants; medium sized CAFOs may allow the animals or their waste to come in contact with surface water (US EPA, 2012). More detailed definitions of CAFOs, and size classifications for additional species, can be found on the EPA website (US EPA, 2012).

While these classifications were developed in the United States, they can be used to describe IFAP facilities worldwide.

1.2 Economic Concentration in the Farm Animal Sector

In addition to the increasing concentration of animals and their waste, there is increasing concentration of holdings of farm animal populations in developing countries (FAO, 2009) (Steinfeld et al, 2006b). For example, globally, between 1980 and 2000, pork production nearly doubled, with a decrease in the total number of farms and an increase in larger facilities raising 1000 or more pigs (Cameron, 2000).

Country-specific examples of this trend are readily apparent in Latin America and Asia. In the Philippines, although the number of commercial pig farms and pigs per farm increased between 1991 and 2002, the number of pig producers (full-time and part-time) decreased (Costales et al, 2007). In Brazil, approximately 40% of the market for broiler chickens is supplied by just four integrators (De Haan et al, 2001). The number of milk producers in Brazil fell by approximately 23% between 2000 and 2002, while maintaining the same volume of milk production (Delgado et al, 2008). In India, a 2006 industry estimate suggested that six large poultry companies accounted for nearly 40% of India's egg industry (Rattanani, 2006).

1.3 Geographic Concentration in the Farm Animal Sector

Not only is the farm animal sector becoming concentrated in fewer hands in developing and emerging economies, the facilities themselves are becoming more geographically clustered (FAO, 2009). In Brazil, these high levels of geographical concentration can be seen in the pork and poultry industries. For example, in 1992, 78% of Brazil's hen population occupied just 5% of the country's area. By 2001, the proportion of hens housed on this same land area had grown to 85% (Steinfeld et al, 2006a). The percentage of Brazil's pig population confined on just 5% of the nation's land area rose from 45% to 56% during the same time period (Steinfeld et al, 2006a).

As discussed next, these shifts towards increased economic and geographic concentration in the farm animal sector have significant impacts on the structure of labor and employment, particularly in rural areas.

2. Shifting patterns of ownership and employment

This section presents available research from the United States, Mexico, and India, which suggest that small farmers and rural laborers may be disadvantaged by the industrialization of farm animal production. The trends towards economic concentration in the farm animal sector indicate that large scale producers dominate the industry. Small farmers generally exit the market (McLeod et al, 2009).

A 2004 report from the University of Missouri on the economic impacts of industrialized pig production estimated that if industrialized pig production facilities replaced independent farms producing the same amount of animals, approximately two pig farmers would be left without a job for each new job created (Ikerd, 2004). The industrialization of farm animal production in Mexico has reduced the number of small farmers and their participation in the market (Ponette-Gonzales & Fry, 2010). Increased levels of intensification in egg and chicken meat production have also been shown to decrease the number of women involved in small-scale poultry keeping in the developing world (Gueye, 2005).

The few small or mid-size farmers who continue to farm will likely do so by adopting industrial farm animal production practices, and by becoming contract farmers to large corporations (McMichael, 2001). The corporations supply company-owned animals, feed, and transportation, but the growers, who likely own the land, must construct company buildings according to the corporations' own specifications (Wing et al, 2000). Growers are also typically responsible for managing the animals' waste (Pew, 2008), and therefore the controlling companies may have no financial obligation to control or rectify pollution from these facilities. In countries including India (Karunakaran, 2005) and the United States (Pew, 2008), complaints are emerging about inequities in the contract system.

Industrialization may also reduce the need for on-farm labor (Durrenberger & Thu, 1996) (Ikerd, 2004). The University of Missouri study found that ten small-scale farmers collectively producing 12,000 feeder pigs per year can create eight full-time positions, while a single industrial farm animal facility producing the same number of pigs employs 2.5 people (Ikerd, 2004). In Mexico, the industrialization of the farm animal sector has meant fewer agricultural workers are needed and salaries are typically lower than average (Ponette-Gonzales & Fry, 2010).

The next section explores the impact of such structural changes in the animal agriculture sector on patterns of food consumption, specifically the consumption of animal source foods (ASF), and nutritional status.

3. Shifting nutritional requirements and disparities in consumption

On a macro-scale, IFAP has resulted in dramatic rises in egg, meat, and milk production. "Animal agriculture has achieved 'warp speed' growth over the last 50 years, with intensification resulting in an almost logarithmic increase in numbers" (Pew, 2008). This has led to increased consumption of eggs, meat, and milk for certain segments of the global population, particularly those in industrialized countries, as well as higher income, urban consumers in developing countries. However, a review of data from South Asia and Latin America suggests that the industrialization of animal agriculture has failed to improve nutritional outcomes amongst marginalized and low income populations.

3.1 "Over-nutrition"

Developing countries where IFAP is expanding may no longer require an overall increase in the consumption of ASF amongst all segments of their populations, as a significant proportion of their populations are already meeting or exceeding their energy requirements. Ironically, many developing countries with high levels of hunger and malnutrition now simultaneously bear the burden of an obesity-related public health crisis (Prentice, 2006) (Shafique et al, 2007), with the number of overweight women exceeding the number of underweight women in most developing countries (Mendez et al, 2005).

For example, 24% of urban Indian adults are now overweight (Mehta et al, 2007), and approximately the same percentage of urban children in New Delhi are overweight or obese (Bhardwaj et al, 2008). Throughout Latin America, the prevalence of overweight/obesity amongst adult women is greater than 50% (WHO, 2011); and the prevalence of overweight amongst adult men in this region is greater than 40% in all countries except Haiti (WHO, 2011).

In the 1990's, trade liberalization in Central America reduced the cost of meat production by lowering barriers for the import of cheap animal feed from the United States. In addition to possibly pushing local corn farmers out of the market, this resulted in significant increases in meat production and consumption, and contributed to a dietary shift from a largely plant-based diet to one high in animal products. This shift has been implicated in the region's rising epidemic of obesity and related diseases (Thow & Hawkes, 2009).

In his article on changing diets in China, Dr. Barry Popkin, one of the world's foremost authorities on rising obesity rates in developing countries (UNC, 2011), warns, "[c]urrent agriculture development policy in many developing countries focuses on livestock promotion and does not consider the potential adverse health consequences of this strategy….[T]he potential adverse health effects linked with an increased ASF intake should no longer be ignored" (Popkin & Du, 2003).

3.2 Under-nutrition

As noted above, despite the growing epidemic of overweight and obesity related illness in the developing world, malnutrition also remains rampant: a fact that highlights the gross inequalities in nutrition both among and within countries. Despite increased world food production in the last few decades, the global effort to meet the Millennium Development Goal of reducing hunger by half by 2015 now appears beyond reach (UNCTAD, 2011). "The current system of industrial agriculture (and related international trade), productive as it has been in recent decades, still leaves 1.3 billion people under-nourished and poverty stricken, 70 per cent of whom live in rural areas" (UNCTAD, 2011).

In much of Latin America, the incidence of malnutrition is higher in indigenous children relative to the national average (Hall & Patrinos, 2005) (Rivera et al, 2003). The growth in Latin America's farm animal sector in the 1990s (FAO, 2012) had not been accompanied by significantly improved nutritional or economic outcomes for these households by the early part of the 21st century (Hall & Patrinos, 2005). A 2005 study on poverty amongst indigenous peoples in Latin America concluded that “[p]overty rates changed little for indigenous people over the 1990s, and where poverty declined, progress was slower for indigenous peoples” (Hall & Patrinos, 2005). Further, the prevalence of malnutrition amongst indigenous children remains extremely high relative to the general population (Hall & Patrinos, 2005).

South Asia is home to the largest number of malnourished people in the world, despite India and other nations in the region maintaining surplus food stocks (Zehr, 2001). The increase in egg and poultry meat production in India, specifically, has failed to equitably increase the intake of ASF by the poorest communities. Rapid industrialization of India’s poultry sector has put it amongst the top egg and chicken meat producers in the world (Clements, 2010) (Government of India, 2011). Over the past 50 years, egg and chicken meat production in India has been radically transformed from a largely backyard activity to a massive agro-industry (Mehta & Namibiar, 2008). By the 1990s, production and consumption of poultry meat in India was growing by as much as 15% annually (Landes et al, 2004).

However, by the start of the 21st century, people in the lowest income quintile in rural areas were still consuming fewer than 10 eggs per capita per year; average per capita consumption in urban areas was nearly five times greater, with higher income urban consumers likely consuming significantly more eggs as the average urban consumer (Mohanty & Rajendran, 2003). This is notable because the prevalence of underweight children amongst the Indian population is higher in rural areas than in urban areas, and the prevalence of underweight children is approximately 60% in the lowest wealth quintile (World Bank, 2006). Moreover, during the 1990s, while commercial poultry production continued to expand in India (Landes et al, 2004), the urban-rural and inter-income-quintile inequalities in nutritional status widened throughout India (World Bank, 2006).

Such inequities should lead agriculture and nutrition programmers to ask why current modes of agricultural production have failed to appropriately meet nutritional objectives, and what types of agricultural programs and systems best meet the needs of food insecure persons in developing countries.

Eggs, meat, and milk can offer a valuable source of nutrition for food insecure households in developing countries, particularly for children. Further, farm animals can also provide a variety of other supports to approximately 70% of the world’s rural poor, including pastoralists, mixed farmers, and landless peoples (Anderson, 2003). In countries that bear the double burden of under-nutrition and obesity, under-nutrition is greater in rural areas (Wang et al, 2002) (UNICEF, 2011) (Mendez et al, 2005).

While urban residents purchase almost all their food from the market, rural dwellers acquire 60% of their food from their own production (McMichael, 2001). Furthermore, to these rural households, the value of farm animals extends beyond measures of quantity of meat, egg, and milk production. Around the world, the rural poor use farm animals as a means of acquiring cash income, saving and accumulating assets, as a food source, and as insurance against health or other financial crises (Millar & Photakoun, 2007) (Anderson, 2003) (Holmann et al, 2005). Integrated into a larger agricultural system, animals provide inputs and services for crop production (Miller & Photakoun, 2007) (Anderson, 2003) (Holmann et al, 2005). This multi-purpose view of farm animals is well adapted to low-input, free-range systems managed by the rural poor. IFAP, on the other hand, is not designed to meet the complex needs of the rural poor, suggesting that the industrial system may not effectively increase ASF intake in this population.

Further, as noted in the previous section, IFAP has the potential to reduce income earning opportunities in rural areas. Where IFAP reduces incomes in rural communities, food security and nutrition may be jeopardized. Studies from the United States (Huddleston-Casas et al, 2008) (Alaimo et al, 2001) suggest that low income households have higher rates of food insecurity, and research from developing and emerging economies highlights a positive correlation between rural employment/income and food security (Van der Veen & Gebrehiwot, 2011), and mothers' earnings and child nutrition (Luke & Xu, 2011).

4. Environmental impact of changes in farm animal sector

As ecological sustainability is critical to food production and consumption (Global Environmental Change and Food Systems, undated), an evaluation of animal agriculture's changing structure must include a discussion of its impacts on the environment, which are significant. While some of these environmental impacts emanate from farm animals in general, and not just from those in industrial systems, they are discussed here because industrial systems allow for the existence of large populations and concentrations of farm animals.

Farm animal production also encompasses feed grain production, which requires substantial inputs of water, land, and energy (Steinfeld et al, 2006a). The growth in farm animal production is projected to increase strain on water resources, particularly due to the high water demands involved in growing animal feed (Rosegrant et al, 2009). Globally, land is also becoming a scarce resource (Lambin and Meyfroidt, 2011), and animal agriculture already constitutes the largest anthropogenic use of land worldwide (Steinfeld et al, 2006a). As in the case of water, a significant percentage of this land is diverted to produce feed for farm animals (Steinfeld et al, 2006a). In developing countries, the use of feed concentrates grew over 150% from 1980-2005 (FAO, 2009), most likely due, in part, to a rise in IFAP. This suggests that the industrialization of feed crop production is linked to IFAP, which is reliant on a steady source of cheap feedstuffs (Bartley et al, 2007).

4.1 Land use and degradation

Approximately 33% of total arable land is used to produce feed crops, in addition to vast areas of forested land that is clear-cut to graze or grow feed for farmed animals (Steinfeld et al, 2006a). Globally, more than 60% of corn and barley, and over 97% of soymeal, are fed to farm animals (Steinfeld et al, 2006a). The vast majority of previously forested land in the Amazon is either used for grazing or feedcrop production (Steinfeld et al, 2006a).

The animal feed from this deforested land is destined for nations across the world. For example, China has increased its import of soy from Brazil, in response to increasing demand for meat products domestically (Nepstad et al, 2006). Brazil exported approximately 9.2 million tons of soy to China between January and May 2011, accounting for approximately 68 percent of Brazil's sales in soy during that time period (Macauhub, 2011).

Deforestation and other forms of land degradation have a profound impact on the planet's ability to sustain vital agricultural resources and produce food. The pollution of aquifers, deforestation-related climate change, and the depletion of water resources resulting from the soil's reduced ability to hold water (due to alteration of soil texture or loss of vegetative cover), are all potential impacts of land degradation (Steinfeld et al, 2006a).

4.2 Water scarcity and pollution

In addition to its role in land use and degradation, rising farm animal populations, facilitated by IFAP, may exacerbate water scarcity. Raising animals for food requires substantially greater quantities of water than raising plants for human consumption. Numerous studies suggest that the rising consumption of ASF will further strain the world's freshwater resources (Mekonnen & Hoekstra, 2012) (Liu & Savenije, 2008) (Rockstrom, 2003).

Farm animals require water for hydration. But an increasing amount is needed—particularly at industrial operations—to clean enclosures (e.g. cages, stalls, pens) and sheds, to dispose of waste, and for cooling animals (Steinfeld et al, 2006a). Processing animal products also requires large volumes of water and can result in significant amounts of wastewater (Steinfeld et al, 2006a).

Examples of animal agriculture's impact on water availability can be found in Latin America and Africa. Water levels in the Perote-Zalayeta aquifer in Mexico have reportedly declined precipitously since industrial pig production first took hold in the region in the mid-1990s (Mendez & Timoteo, 2009). Rapidly increasing demands for meat and other animal products in Africa's urban centers has also been implicated in water and land scarcity (Herforth, 2010), further jeopardizing food security in the region.

Not only are water supplies shrinking, but the farm animal sector is also increasingly polluting the available water. According to the FAO, "[t]he livestock sector…is probably the largest sectoral source of water pollution, contributing to eutrophication, 'dead' zones in coastal areas, degradation of coral reefs, human health problems, emergence of antibiotic resistance and many others" (Steinfeld et al, 2006a). A 2001 estimate by the World Bank suggested that approximately 100,000 square kilometers in the developing world were already "threatened by severe nutrient loading at that time, causing eutrophication of waterways and subsequent damage to aquatic ecosystems" (World Bank, undated).

One specific example of IFAP-related water pollution is found in Southeast Asia. Intensive pig production in Southeast Asia has been implicated in the flow of surplus nutrients and minerals into the South China Sea (Huynh et al, 2006). A study conducted in a pig producing region of the Philippines reported that the majority of commercial and small-scale pig producers dump waste directly into streams and other waterways (Catelo et al, 2001). The same study reported a variety of negative environmental and public health impacts resulting from the proliferation of large pig farms in the area (Catelo et al, 2001).

4.3 Climate Change Exacerbated

In addition to its roles in land degradation and water pollution, the farm animal sector is a significant contributor to the production of the three most important greenhouse gases (GHGs) influenced by human activity (Forster et al, 2007) (Steinfeld et al, 2006a), and, as farm animals' numbers grow, their emissions are also likely to grow (USDA, 2004). Based on expected demand, farm animal production alone is projected to emit over two-thirds of the amount of GHGs considered sustainable by 2050 (Pelletier & Tyedmers, 2010). The climate changing effect of animal agriculture will have profound implications for food security (Halweil, 2005). For example, the International Panel on Climate Change warns that warming temperatures could result in food shortages for 130 million people across Asia by 2050 (IPCC, 2007).

Thus, the industrialization of farm animal production has, and will continue to have, significant repercussions for human communities. Another impact of industrial farm animal production, receiving growing attention worldwide, is the welfare of animals.

5. Animal Welfare in Industrial Farm Animal Production Systems

Each year 67 billion land animals (FAO, 2012), along with a much larger number of aquatic animals (Mood, 2010) (FAO, 2006), are raised for meat, eggs, and milk. These farm animals—sentient, complex, and capable of feeling pain and frustration, joy and excitement—may suffer myriad assaults to their physical, mental, and emotional well-being within IFAP facilities.

The impacts of industrial farm animal production on the welfare of all farm animal species are too numerous to be discussed in any detail in this paper (please see Humane Society International's white paper on the Welfare of Intensively Confined Animals*, and The Humane Society of the United States' report on the Welfare of Animals in Meat, Egg, and Dairy Industries† for more information). Since the industrialization of the pig and egg sectors has taken root throughout the developing world (FAO, 2007), a brief discussions of some of the welfare concerns for intensively confined egg-laying hens and breeding sows has been included below.

5.1 Egg Laying Hens

Globally in 2009, nearly 1.2 trillion table eggs were produced by approximately 6.3 billion hens (FAO, 2012). There are no reliable assessments of the percentage of laying hens confined in battery cages worldwide. The International Egg Commission (IEC) estimates that 85% of egg production comes from caged systems (UEP, 2010). However this figure does not include backyard egg production (van Horne, 2011), which can be significant in many developing countries (Branckaert & Gueye, 1999). The IEC reports 100% percent of commercial production in India and Brazil is caged (UEP, 2010). However, according to media reports, a number of retail outlets in both countries have adopted cage-free procurement policies, and purchase their eggs exclusively from commercial-scale cage-free egg producers (Sharma, 2010) (IndiaPRWire, 2011). Still, it is clear that an increasing number of producers around the world are turning to intensive IFAP systems (Verge et al, 2007), which now account for approximately two-thirds of egg and poultry production globally (FAO, 2009).

The most commonly used cages hold 5-10 birds (Bell, 2002). An industrial egg production facility may contain hundreds or thousands of cages, lined in multiple rows, stacked 3-5 tiers high. On average, each caged hen is allotted 432.3 cm2 of floor space (UEP, 2008) (Fraser et al, 2001) -- less than a single sheet of A4-sized paper.

This severe space restriction prevents the birds from fully performing the bulk of their natural behaviors, including nesting, perching, dust-bathing, scratching, foraging, exploring their environment, running, jumping, flying, stretching, wing-flapping, and even freely walking . Additionally, the severe restriction of physical movement leads to poor foot condition (Tauson & Abrahamsson, 1996), and metabolic disorders, including disuse osteoporosis (Norgaard-Nielsen, 1990) and liver damage (Leeson, 2007).

All countries in the European Union were supposed to phase out the use of barren battery cages by 2012 (European Union, 1999) and several states within the United States have moved to restrict battery cage confinement of egg-laying hens (California, 2008) (Michigan, 2009) (Ohio, 2011a), but these systems are still common throughout the rest of the world.

5.2 Breeding sows

Female pigs may suffer from a similar form of intensive confinement in industrial farm animal production facilities. Pregnant sows are frequently confined in gestation crates or sow stalls, which measure

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* An HSI Report: The Welfare of Intensively Confined Animalsin Battery Cages, Gestation Crates, and Veal Crates. http://www.hsi.org/assets/pdfs/welfare-of-intensively-confined-animals-international-word-sept-4-08.pdf

† An HSUS Report: The Welfare of Animals in the Meat, Egg, and Dairy Industries. http://www.humanesociety.org/assets/pdfs/farm/welfare_overview.pdf

approximately 0.6 m wide by 2.13 m long (McGlone, 2009). As this is not sufficiently larger than the size of the animal herself, these crates prevent the sow from turning around or making many other postural adjustments (Anil et al, 2002) (Marchant & Broom, 1996).

Sows in gestation crates have higher basal heart rates (Marchant et al, 1997), and frequently suffer injuries from repeatedly rubbing against the bars of their enclosures and from standing or lying on barren flooring (Anil et al, 2002). They have also been found to experience a higher rate of urinary tract infections (Scientific Veterinary Committee, European Commission, 1997).

Crated sows also exhibit numerous abnormal behaviors, or stereotypies, indicative of severe psychological stress. Stereotypies are repetitive behavioral patterns, common in intensively confined animals (Mason & Rushen, 2006), that can result from frustration and attempts to cope with stress (Mason and Latham, 2004). Common stereotypies of crated sows include repetitively biting the bars of the crate, and sham-chewing (chewing with nothing in their mouth) (Bergeron et al, 2006). Crated sows also tend to become unresponsive over time, (Barnett et al, 2001) (Broom, 1986) a behavioral disorder that scientists have linked to depression (Scientific Veterinary Committee, European Commission, 1997).

All E.U. member states are set to phase out the use of sow stalls by 2013 (European Union, 2001) and several states within the United States have moved to restrict the use of sow stalls (Florida, 2002) (Arizona, 2006) (Oregon, 2007) (Colorado, 2008) (California, 2008) (Maine, 2009) (Michigan, 2009) (Ohio, 2011b).

The decisions of governments and major multinational corporations (including Burger King and Unilever) in Europe and North America to phase out the use of battery cages and gestation crates may be the start of an international movement away from these intensive confinement systems. Therefore, it may be economically prudent for new agribusiness ventures in the Global South to move directly to higher welfare housing systems, by-passing the caged and crated housing systems now being phased out in more industrialized nations.

6. Conclusion

In 2006, the Pew Commission on Industrial Farm Animal Production produced a report outlining the impacts of industrial farm animal production on human health, the environment, animal welfare, and rural communities in the United States. The Pew Commission warned that, in the developing world, the known costs of industrial farm animal production systems “may be exacerbated by institutional weaknesses and governance problems” (Pew, 2008). Additional research and studies are required in the major emerging and developing economies where the farm animal sector continues to rapidly industrialize, in order to paint a more conclusive picture of the impacts of IFAP on people, animals, and the environment. In the meantime, investments and supports in the farm animal sector must include detailed ex-ante assessments of impacts on animal welfare, the environment, human health, and rural communities.

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