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## FACT SHEET: The Environmental, Public Health, and Social Impacts of Pig Factory Farming

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**HUMANE SOCIETY  
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## **An HSI Factsheet**

# **The Environmental, Public Health, and Social Impacts of Pig Factory Farming**

Since the mid-20th century, small, extensive farms have given way to massive, commercial pig production facilities.<sup>1</sup> In 2009, more than 1.3 billion pigs were raised and slaughtered globally.<sup>2</sup> Between 1980 and 2000, though world pork production nearly doubled, there was a decrease in the total number of farms.<sup>3</sup> Large industrial farm animal production facilities, or factory farms, that often confine thousands of pigs indoors,<sup>4</sup> are becoming more widespread throughout the world, particularly in developing countries.<sup>5</sup> Factory farms are now responsible for more than half of all global pork production.<sup>6</sup>

A significant implication of the shift toward factory farms has been the “movement of large numbers of animals from pastures and open-air lots into confined spaces with no grass or vegetation for grazing.”<sup>7</sup> Factory farms may have particularly severe implications for animal welfare, including the intensive confinement of farm animals in enclosures that prevent them from moving comfortably or expressing most basic natural behaviors.<sup>8</sup> Around the world, millions of breeding sows (female pigs) in industrial systems are confined in 0.6-0.7 m (2.0-2.3 ft) by 2.0-2.1 m (6.6-6.9 ft)<sup>9</sup> gestation crates for nearly their entire lives. These crates are about the size of the animals’ bodies, denying the sows the ability to exercise, turn around for months on end,<sup>10</sup> or perform other integral, instinctual, and natural behaviors, including rooting, foraging, nest-building, and grazing.<sup>11</sup> In addition to causing tremendous animal suffering, factory farms degrade the environment<sup>12</sup> and negatively impact public health<sup>13</sup> and rural communities.<sup>14</sup>

### **Environmental Degradation**

In 2006, the Food and Agriculture Organization of the United Nations (FAO) published “Livestock’s Long Shadow: Environmental Issues and Options,” its landmark report assessing the impacts of animal agriculture. The FAO concluded that “the livestock sector emerges as one of the top two or three most significant contributors to the most serious environmental problems, at every scale from local to global.”<sup>15</sup>

Some of these environmental problems, and associated public health dangers, result from the increased geographic clustering of farm animal populations worldwide.<sup>16,17</sup> For example, in 1992, 45% of Brazil’s pig population occupied just 5% of the country’s area. By 2001, the proportion of pigs housed on this same land area had grown to 56%.<sup>18</sup> An equally concerning trend involves a parallel shift in pig production towards more highly populated urban areas.<sup>19,20</sup>

### **Water Pollution**

The FAO has noted that, “[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.”<sup>21</sup>

Much of the environmental damage caused by industrial pig production facilities is due to the volume and content of animal waste, and the consequent challenges of storage and disposal.<sup>22</sup> Pigs produce four times more waste than human beings<sup>23</sup> and “one animal facility with a large population of animals can easily equal a small city in terms of waste production.”<sup>24</sup> While traditional farming systems combine animal agriculture with crop

agriculture, thereby balancing the number of animals with the crops' ability to absorb the animals' manure, at industrial farm animal production facilities, the amount of manure typically exceeds the ability of the surrounding land to absorb it. Waste from pig factory farms is often stored in lagoons or pits,<sup>25,26</sup> which have been known to leak or break, contaminating nearby water sources with excess nitrogen and phosphorous, pathogens, and other pollutants that are found in the manure.<sup>27</sup> The minimally treated (or even untreated) waste is also often sprayed on nearby fields, potentially contaminating water, soil, and air.<sup>28</sup>

In 2006, Mexico's National Commission for Water (La Comisión Nacional del Agua, CONAGUA) estimated that only 20% of the waste water originating from pork production in Mexico is treated.<sup>29</sup> In their 2006 visit to Perote Valley, home to the highest concentration of pig factory farms in the country,<sup>30</sup> the Mexican Congress Commission on the Environment and Natural Resources also observed that “[a]reas for disposal of waste and pig manure [were] not far enough from water sources” at visited pig factory farms. In fact, various studies carried out by CONAGUA have shown contamination of Perote Valley aquifers from fecal bacteria.<sup>31</sup>

A water testing program carried out by North Carolina's State Health Department found elevated levels of nitrates in wells of neighbors of intensive pig production facilities.<sup>32</sup> Intensive pig production in Southeast Asia has also been implicated in the flow of surplus nutrients and minerals into the South China Sea.<sup>33</sup> 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.<sup>34</sup> The same study reported a variety of negative environmental and public health impacts resulting from the proliferation of large pig farms in the area.<sup>35</sup>

### **Water Scarcity**

In addition to its role in water pollution, raising animals for food contributes to water scarcity in numerous ways. Globally, the farm animal sector uses significant amounts of the water available to humans.<sup>36</sup> The growth in farm animal production is projected to increase strain on water resources, particularly due to the high water demand involved in growing animal feed.<sup>37</sup>

Farm animals also require water for hydration, and at industrial operations—to clean enclosures (e.g. cages, stalls, pens) and sheds, to dispose of waste, and to cool the animals.<sup>38</sup> Processing animal products also requires large volumes of water and can result in significant amounts of wastewater.<sup>39</sup> Water levels in the aquifer that sits under the Perote Valley in Mexico, for example, have reportedly declined precipitously since industrial pig production first took hold in the region in the mid-1990s.<sup>40</sup>

### **Public Health:**

Factory farm manure contains a number of components of concern to human health, including heavy metals and pathogenic bacteria, and may emit volatile gases.<sup>41</sup> Numerous studies have shown adverse physical and mental health effects from ammonia (NH<sub>3</sub>), hydrogen sulfide (H<sub>2</sub>S), and nuisance odors originating from industrial pig factory farms, on both factory farm workers as well as people in neighboring communities.<sup>42</sup> In fact, rural communities located at less than two kilometers from geographically clustered pig operations could “be exposed to ammonia levels up to 40 times greater than average ambient concentrations.”<sup>43</sup>

Reports of adverse human health effects associated with odors from industrial pig production facilities have been recorded by numerous studies in the United States.<sup>44,45,46</sup> Eye, nose, and throat irritation, headache, nausea, diarrhea, cough, chest tightness, palpitations, shortness of breath, stress, and drowsiness are some of the most frequently reported problems.<sup>47</sup> People suffering from asthma or allergies complain that the odors exacerbate their existing illness.<sup>48</sup> Another study conducted in the U.S. state of North Carolina reported a significantly higher incidence of mental health symptoms, including increased levels of tension, depression, anger, fatigue, and confusion, amongst residents living near industrial pig production facilities, in comparison to a control group.<sup>49</sup> See [HSI's Fact Sheet: Human health impacts of odors from industrial farm animal production facilities](#) for more information.

To accelerate weight gain and prevent disease in the stressful and unhygienic conditions characteristic of these industrial settings, many factory farms feed farm animals classes of antibiotics critical to human medicine. Antibiotic-resistant bacteria at pig factory farms can transfer by air from the animals to laborers and others who live near the operation.<sup>50,51</sup> Because the animal's digestion does not degrade all of the drugs, residues of antibiotics may also be transferred to the environment when manure is spread over agricultural land,<sup>52,53</sup> and have been found in ground and surface water near pig factory farms.<sup>54</sup> Studies have shown that retail pork products can also expose consumers to antibiotic-resistant bacteria.<sup>55</sup> The use of antibiotics in farm animal production contributes to antibiotic resistance in humans,<sup>56</sup> and a study of airborne concentrations of resistant bacterial forms at pig factory farm operations found that bacteria were recovered inside and outside the facilities at concentrations that could cause a potential human health hazard.<sup>57</sup> By fostering antimicrobial resistance in pathogens, factory farms create new challenges for physicians trying to treat human disease.<sup>58</sup>

## **Social Costs**

A 2010 report 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.<sup>59</sup> Furthermore, the report concluded that "a new [US] \$5 million investment in contract production would generate 40-50 new jobs but would displace approximately three times that number of independent hog farmers."<sup>60</sup> Examples of this loss of livelihood for independent pig farmers can be seen in countries throughout the world.

In the Philippines, for example, 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.<sup>61</sup> Growth in demand for pig products has not translated into growth in market share for small holders in the Philippines.<sup>62</sup> In 2004,<sup>63</sup> Smithfield Foods, the largest pig producer in the world, set up pig factory farms in the rural counties of Timis and Arad in Romania. According to a New York Times article, in the four years following Smithfield's entry, there was a 90% drop in pig farmers, from over 477,000 in 2003 to only 52,100 in 2007, with Smithfield employing only about 900 people in the country.<sup>64</sup> Similarly, in Mexico, while the industrialization of the pig sector resulted in a rise in domestic production,<sup>65</sup> there was also a drop in the number of small commercial pig farms in the country.<sup>66</sup> Many of the pig factory farms in Mexico are now vertically integrated and "owned by firms involved in every stage of the production process, from hog-raising to the packaging, sale and distribution of pork products."<sup>71</sup> Unable to compete with large factory farms, many small-scale producers have had to exit the industry.<sup>67</sup> The industrialization of Mexico's pig industry has harmed small commercial producers, decreasing their share of the Mexican pig market.<sup>68</sup>

In 2008, the Pew Commission on Industrial Farm Animal Production released the results of a 2.5-year investigation<sup>69</sup> into the problems associated with industrialized animal agriculture. The commission concluded that:

Research consistently shows that the social and economic well-being of rural communities benefits from larger numbers of farmers rather than fewer farms that produce increased volumes. In rural communities where fewer, larger farms have replaced smaller, locally owned farms, residents have experienced lower family income, higher poverty rates, lower retail sales, reduced housing quality, and persistent low wages for farm workers.... In fact, industrialization actually draws investment and wealth away from communities with [industrial farm animal production] facilities.<sup>70</sup>

## **Conclusion**

The Pew Commission determined that industrial farm animal production poses unacceptable risks to public health, the environment, and animal welfare.<sup>71</sup> A key recommendation of the Pew Commission's report was to

phase out the most inhumane production practices on industrial farm animal production facilities, including the confinement of pregnant sows in gestation crates, in order to reduce risks to public health and improve animal well-being.<sup>72</sup> The hundreds of millions of pigs raised around the world for meat in today's industrial animal agribusiness industries are not the only ones who suffer from factory farming. Employees and individuals who live near these facilities are also impacted by today's animal agriculture systems. In addition to impairing water and air quality in surrounding areas, factory farms threaten public health, jeopardize the ability of independent family farms to stay in business, and diminish quality of life in rural communities. The animal agribusiness sector must be held accountable for its many deleterious impacts, and changes in animal agricultural practices must be achieved.

***Humane Society International (HSI) and its partner organizations together constitute one of the world's largest animal protection organizations — backed by 11 million people. For nearly 20 years, HSI has been fighting for the protection of all animals through advocacy, education, and hands-on programs. Celebrating animals and confronting cruelty worldwide — On the web at [hsi.org](http://hsi.org).***

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<sup>1</sup> MacDonald JM and McBride W. 2009. The transformation of U.S. livestock agriculture: scale, efficiency, and risks. U.S. Department of Agriculture, Economic Research Service, bulletin 43. [www.ers.usda.gov/Publications/EIB43/](http://www.ers.usda.gov/Publications/EIB43/). Accessed May 1, 2011.

<sup>2</sup> Food and Agriculture Organization of the United Nations. 2010. FAOSTAT Statistical Database. <http://faostat.fao.org/default.aspx>. Accessed April 30, 2011.

<sup>3</sup> Cameron, R. 2000. A Review of the Industrialization of Pig Production Worldwide with Particular Reference to the Asian Region. [http://www.fao.org/ag/againfo/resources/en/publications/agapubs/awi\\_concept\\_pig\\_product.pdf](http://www.fao.org/ag/againfo/resources/en/publications/agapubs/awi_concept_pig_product.pdf). Accessed May 2, 2011.

<sup>4</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 33. <http://www.ncifap.org/bin/e/j/PCIFAPFin.pdf>. Accessed September 12, 2011.

<sup>5</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 9.

<sup>6</sup> Food and Agriculture Organization of the United Nations. 2009. The state of food and agriculture: livestock in the balance (Rome, Italy: FAO, p. 27). <http://www.fao.org/docrep/012/i0680e/i0680e.pdf>. Accessed April 26, 2011.

<sup>7</sup> Ponette-González, AG and Fry M. 2010. Pig pandemic: Industrial hog farming in eastern Mexico. Land Use Policy 27: 1107-1110.

<sup>8</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 33.

<sup>9</sup> Commission of the European Communities. 2001. COM(2001) 20 final 2001/0021 (CNS) Communication from the Commission to the Council and the European Parliament on the welfare of intensively kept pigs in particularly taking into account the welfare of sows reared in varying degrees of confinement and in groups. Proposal for a Council Directive amending Directive 91/630/EEC laying down minimum standards for the protection of pigs.

- 
- <sup>10</sup> Commission of the European Communities. 2001. COM(2001) 20 final 2001/0021 (CNS) Communication from the Commission to the Council and the European Parliament on the welfare of intensively kept pigs in particularly taking into account the welfare of sows reared in varying degrees of confinement and in groups. Proposal for a Council Directive amending Directive 91/630/EEC laying down minimum standards for the protection of pigs.
- <sup>11</sup> Stolba A and Wood-Gush DGM. 1989. The behaviour of pigs in a semi-natural environment. *Animal Production* 48:419-25.
- <sup>12</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 23, 25.
- <sup>13</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 17.
- <sup>14</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 9.
- <sup>15</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. xx. [www.virtualcentre.org/en/library/key\\_pub/longshad/A0701E00.pdf](http://www.virtualcentre.org/en/library/key_pub/longshad/A0701E00.pdf). Accessed April 29, 2011.
- <sup>16</sup> Food and Agriculture Organization of the United Nations. 2009. The state of food and agriculture: livestock in the balance, p. 4.
- <sup>17</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. 262. <ftp://ftp.fao.org/docrep/fao/010/a0701e/a0701e00.pdf>. Accessed October 2, 2011.
- <sup>18</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, pp. 57-58.
- <sup>19</sup> Food and Agriculture Organization of the United Nations. Pollution from industrialized livestock production.
- <sup>20</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. 33.
- <sup>21</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. xxii. Accessed February 4, 2012.
- <sup>22</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 23. <http://www.ncifap.org/bin/e/j/PCIFAPFin.pdf>. Accessed January 6, 2011.
- <sup>23</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 29. Accessed January 26, 2011.
- <sup>24</sup> United States Environmental Protection Agency. 2004. Risk Assessment Evaluation for Concentrated Animal Feeding Operations. EPA/600/R-04/042. p. iv. <http://nepis.epa.gov/Adobe/PDF/901V0100.pdf>. Accessed January 4, 2011.

- 
- <sup>25</sup> American Public Health Association. 2003. Precautionary Moratorium on New Concentrated Animal Feed Operations. <http://www.apha.org/advocacy/policy/policysearch/default.htm?id=1243>. Accessed February 4, 2012.
- <sup>26</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p. 23. Accessed October 7, 2011.
- <sup>27</sup> Mallin MA and Cahoon LB. 2003. Industrialized Animal Production – A Major Source of Nutrient and Microbial Pollution to Aquatic Ecosystems. *Pollution and Environment* 24(5): 369-385.
- <sup>28</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p.11.
- <sup>29</sup> Novelo, MR and Borges, CE, et al. 2009. Estimación del potencial contaminante de las granjas porcinas y avícolas del estado de Yucatán. *Ingeniería* 13-2: 13-21.
- <sup>30</sup> Ponette-González, AG and Fry M. 2010. Pig pandemic: Industrial hog farming in eastern Mexico. *Land Use Policy* 27: 1107-1110.
- <sup>31</sup> *Gaceta Parlamentaria*. March 17, 2006. pp. 65-6.
- <sup>32</sup> Wing, S, Cole D, and Grant G. 2000. Environmental Injustice in North Carolina's Hog Industry. *Environmental Health Perspectives* 108 (3):225-231. p. 225.
- <sup>33</sup> Huynh TTT, Aarnink AJA, Drucker A, Versteegen MWA. 2006. Pig Production in Cambodia, Laos, Philippines, and Vietnam: A Review. *Asian Journal of Agriculture and Development* 4(1): 69-90. p. 69.
- <sup>34</sup> Catelo, MAO, Dorado MA, and Agbisit E Jr. 2001. "Backyard and Commercial Piggeries in the Philippines: Environmental Consequences and Pollution Control Options". EEPSEA Research Report No. 2001-RR6. Ottawa, Canada: International Development Research Centre. <http://www.p2pays.org/ref/13/12938.pdf>. Accessed July 6, 2011.
- <sup>35</sup> Catelo, MAO, Dorado MA, and Agbisit E Jr. 2001. "Backyard and Commercial Piggeries in the Philippines: Environmental Consequences and Pollution Control Options". EEPSEA Research Report No. 2001-RR6. Ottawa, Canada: International Development Research Centre. Accessed July 6, 2011.
- <sup>36</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. xxii. <ftp://ftp.fao.org/docrep/fao/010/a0701e/A0701E00.pdf>. Accessed February 15, 2012.
- <sup>37</sup> Rosegrant MW, Ringler C, Zhu T. 2009. Water for Agriculture: maintaining food security under growing scarcity. *Annual Review of Environment and Resources* 34:205-222. p. 207.
- <sup>38</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, pp. 128-129.
- <sup>39</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. 130. Accessed September 20, 2011.
- <sup>40</sup> Ponette-González, AG and Fry M. 2010. Pig pandemic: Industrial hog farming in eastern Mexico. *Land Use Policy* 27: 1107-1110.



- 
- <sup>41</sup> American Public Health Association. 2003. Precautionary moratorium on new concentrated animal feeding operations. Policy number 20037.
- <sup>42</sup> Ponette-Gonzalez, Alexandra G. and Matthew Fry. 2010. Pig pandemic: Industrial hog farming in eastern Mexico. *Land Use Policy* 27: 1107-1110. p.1109.
- <sup>43</sup> Wilson SM and Serre ML. 2007. Examination of atmospheric ammonia levels near hog CAFOs, homes, and schools in Eastern North Carolina. *Atmospheric Environment* 41: 4977-4987.
- <sup>44</sup> Schiffman SS, Bennett JL, 2001. Raymer JH. Quantification of odors and odorants from swine operations in North Carolina. *Agricultural and Forest Meteorology* 108: 213-240. p. 214.
- <sup>45</sup> Wing S, Wolf S. 2000. Intensive livestock operations, health, and quality of life among Eastern North Carolina residents. *Environmental Health Perspectives* 108(3): 233-238. p. 233.
- <sup>46</sup> Thu K, Donham K, Ziegenhorn R, Reynolds S, Thorne PS, Subramanian P, Whitten P, Stookesberry J. 1997. A control study of the physical and mental health of residents living near a large-scale swine operation. *Journal of Agricultural Safety and Health* 3(1):13-26.
- <sup>47</sup> Schiffman SS, Walker JM, Dalton P, Lorig TS, Raymer JH, Shusterman D, Williams CM. 2000. Potential health effects odor from animal operations, wastewater treatment, and recycling of byproducts. *Journal of Agromedicine* 7: 7-81. p. 8.
- <sup>48</sup> Schiffman SS, Walker JM, Dalton P, Lorig TS, Raymer JH, Shusterman D, Williams CM. 2000. Potential health effects odor from animal operations, wastewater treatment, and recycling of byproducts. *Journal of Agromedicine* 7: 7-81. p. 14.
- <sup>49</sup> Schiffman SS, Sattely Miller EA, Suggs MS, Graham BG. 1995. The effect of environmental odors emanating from commercial swine operations on the mood of nearby residents. *Brain Research Bulletin* 37: 369-375.
- <sup>50</sup> Barrett JR. 2005. Airborne bacteria in CAFOs: transfer of resistance from animals to humans. *Environmental Health Perspectives* 113(2): A116-7.
- <sup>51</sup> Chapin A, Rule A, Gibson K, Buckley T, and Schwab K. 2004. Airborne Multi-drug Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation. *Environmental Health Perspectives*. p. 17.
- <sup>52</sup> Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. 143.
- <sup>53</sup> Sarmah AK, Meyer MT, and Boxall ABA. 2006. A global perspective on the use, sales, exposure pathways, fate and effects of veterinary antibiotics (VAs) in the environment. *Chemosphere* 65(5): 725-759.
- <sup>54</sup> Chapin A, Rule A, Gibson K, Buckley T, and Schwab K. 2004. Airborne Multi-drug Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation. *Environmental Health Perspectives* <http://www.sraproject.org/wp-content/uploads/2007/12/airbornemultidrugresistantbacteria.pdf>. p. 8. Accessed January 30, 2012.
- <sup>55</sup> Chapin A, Rule A, Gibson K, Buckley T, and Schwab K. 2004. Airborne Multi-drug Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation. *Environmental Health Perspectives*. p. 6.
- <sup>56</sup> American Public Health Association. 2003. Precautionary moratorium on New Concentrated Animal Feed Operations.



- 
- <sup>57</sup> Gibbs SG, Green CF, Tarwater PM, and Scarpino PV. 2004. Airborne antibiotic resistant and nonresistant bacteria and fungi recovered from two swine herd confined animal feeding operations. *Journal of Occupational and Environmental Hygiene*. 1(11): 699-706.
- <sup>58</sup> Greger, M. 2007. The Human/Animal Interface: Emergence and Resurgence of Zoonotic Infectious Diseases. *Critical Reviews in Microbiology* 33: 243-299.
- <sup>59</sup> Ikerd JE. 2004. The Economic Impacts of Increased Contract Swine Production in Missouri: Another Viewpoint. p.7. <http://web.missouri.edu/ikerdj/papers/con-hog.htm>. Accessed May 28, 2011.
- <sup>60</sup> Ikerd JE. 2004. The Economic Impacts of Increased Contract Swine Production in Missouri: Another Viewpoint. p.7.
- <sup>61</sup> Costales A., Delgado C, Catelo MA, et al.. 2007. Scale and Access Issues Affecting Smallholder Hog Producers in an Expanding Peri-Urban Market: Southern Luzon, Philippines. International Food Policy Research Institute, Washington, D.C; International Livestock Research Institute, Nairobi; University of the Philippines Los Baños-College of Economics and Management, Laguna. p. 3. [http://www.ifpri.org/sites/default/files/publications/rr151\\_0.pdf](http://www.ifpri.org/sites/default/files/publications/rr151_0.pdf). Accessed October 1, 2011.
- <sup>62</sup> Costales A, Delgado C, Catelo MA, et al.. 2007. Scale and Access Issues Affecting Smallholder Hog Producers in an Expanding Peri-Urban Market: Southern Luzon, Philippines. International Food Policy Research Institute, Washington, D.C; International Livestock Research Institute, Nairobi; University of the Philippines Los Baños-College of Economics and Management, Laguna. p. 2.
- <sup>63</sup> Smithfield. [http://www.smithfieldfoods.com/our\\_company/our\\_family/SmithfieldPROD.aspx](http://www.smithfieldfoods.com/our_company/our_family/SmithfieldPROD.aspx). Accessed March 30, 2012.
- <sup>64</sup> The New York Times. 5 May 2009. A U.S. Hog Giant Transforms Eastern Europe. <http://www.nytimes.com/2009/05/06/business/global/06smithfield.html>. Accessed March 29, 2012.
- <sup>65</sup> Batres-Marquez SP, Clemens RL, and Jensen HH. 2007. Mexico's changing pork industry: The forces of domestic and international market demand. *Choices* 22(1): 7-12.
- <sup>66</sup> USDA-ERS. 1999. Mexico's Pork Industry Structure Shifting to Large Operations in the 1990's. *Agricultural Outlook*.
- <sup>67</sup> Batres-Marquez SP, Clemens R, and Jensen HH. 2006. The changing structure of pork trade, production, and processing in Mexico. MATRIC Briefing Paper 06-MBP 10. p.11.
- <sup>68</sup> USDA-ERS. 1999. Mexico's Pork Industry Structure Shifting to Large Operations in the 1990's. *Agricultural Outlook*.
- <sup>69</sup> Pew Commission on Industrial Farm Animal Production. 2008. Pew Commission says industrial scale farm animal production poses "unacceptable" risks to public health, environment. Press release issued April 29.
- <sup>70</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America. p. 49.
- <sup>71</sup> Pew Commission on Industrial Farm Animal Production. 2008. Pew Commission says industrial scale farm animal production poses "unacceptable" risks to public health, environment. Press release issued April 29.

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<sup>72</sup> Pew Commission on Industrial Farm Animal Production. 2008. Putting meat on the table: industrial farm animal production in America, p.85.