A CHINA ENVIRONMENTAL HEALTH PROJECT RESEARCH BRIEF

Environmental Health and China's Concentrated Animal Feeding Operations (CAFOs)

February 28, 2007

This research brief was produced as part of the China Environment Forum's partnership with Western Kentucky University on the USAID-supported China Environmental Health Project

By Linden Ellis

Many of China's environmental crises—from industrial contamination to desertification—have become government priorities and made news around the world. One serious pollution issue that is not yet heavily prioritized or making headlines is the waste produced in the country's 14,000 factory farms (a.k.a. concentrated animal feeding operations, CAFOs) that threaten the environment and human health.[1] In 2003, it was estimated that 90 percent of animal farms in China lacked any kind of pollution controls and less than 10 percent had conducted any form of environmental impact assessment (EIA).[2] China's CAFOs produce 40 times more nitrogen pollution and 3.4 times the solid waste of industrial factories. Besides emitting solid waste that degrades the land and water, CAFOs create choking air pollution. These problems underscore the need for stricter regulation of CAFOs.[3] and highlight an area for greater international cooperation with China, as many countries struggle with similar waste problems. Of global concern is the fact such factory farms have been associated with the spread of pandemic human diseases, such as Avian Influenza.

CAFOs and total livestock have expanded rapidly in China since 1990 as incomes and demand for meat have risen. Strikingly, 80 percent of the large- and medium-sized CAFOs are located near major cities on the east coast—closer to the market—rather than in rural areas where manure could be spread on land. Notably, in some rural areas with highly polluting CAFOs, some local governments have created subsidies and partnered with industry and communities to build large-scale biogas digesters that turn the manure into energy to fuel the factory and supply the surrounding farm communities, as well as create an odorless fertilizer.[4]

Growing Threat to Water Resources

Only about five percent of animal waste is treated in China.[5] Excess waste from over saturated fields, with naturally high levels of nitrogen and phosphorus, ends up primarily in water, where it poses a number of human and environmental health threats. Heavy rains or accidents can cause lagoons where liquefied animal waste from CAFOs is stored to break or leak into the surrounding soil and watersheds, releasing dangerous levels of trace metals and bacteria into drinking and irrigation water. Health affects include contracting bacterial infections, such as e-coli and salmonella, as well as increasing the risks of cancer, miscarriage, and "blue-baby syndrome."

Water Ecosystems

Waste from CAFOs is already severely impacting the water quality of the Yangtze River. In China's three largest lakes—Dianchi, Chaohu, and Taihu—agricultural runoff is responsible for 70, 60 and 35 percent, respectively, of the pollution.[6] The growing level of organic pollution from CAFOs is also blamed for the toxic algae blooms, called red tides, which have affected much of the east coast of China since the 1990s. The People's Daily stated that as of the year 2000, the country had suffered $240 million in direct damages from red tides.[7] Other types of algae blooms also increase with the increased nutrient content of the water, which can create vast "dead zones" in lakes, rivers, and coastal waters where almost nothing can survive in the low levels of dissolved oxygen. The resulting mass die offs of fish and plants throughout the ecosystem exacerbate biodiversity losses and food insecurity.[8]

Information on the amount of hormones present in the animal waste in China is scarce. However, experts believe that the prohibitive cost has probably kept usage lower than in developed nations for the time being.[9] Such hormones are used heavily in some feeds at U.S. CAFOs to increase weight gain in livestock. At least one study suggests that hormones in runoff from U.S. CAFOs have led to serious reproductive repercussions in freshwater fish populations.[10]

Water Overuse

China's growing water scarcity, currently a quarter of the world's per capita supply average, should encourage researchers to consider water conservation and recycling options for CAFOs. In addition to supplying the animals with drinking water, water is required for washing carcasses, pens, and liquefying waste. According to Danielle Nierenberg, author of Happier Meals: Rethinking the Global Meat Industry, eight ounces of beef can require up to 25,000 liters of water.[11]

Choking on the Air

Besides generating a "distinct" and often overpowering unpleasant odor, air emissions from CAFOs contain several airborne pollutants, such as hydrogen sulfide, ammonia, and endotoxin, which can pose threats to workers within the compounds and to residents of the surrounding communities. Workers face risk of chronic upper respiratory diseases such as asthma, bronchitis and acute lung infection, as well as the possibility of death from asphyxia or respiratory arrest. Studies conducted in the United States show that community residents within a two-mile range of a CAFO experienced greater risk of respiratory diseases.[12]

Land Degradation

Heavy Metal Case Study: Arsenic

Animal farm manure produces a considerable amount of heavy metals that are damaging to food and environmental safety. One metal of particular concern is arsenic, which is traditionally fed to animals, especially poultry and swine, to enhance the red coloring of the meat, help control disease, and increase weight gain. One study of pig farms in the Beijing area, conducted by Yan-xia Li and Tong-bin Chen, predicted that pig manure alone could potentially raise the levels of arsenic in Beijing's topsoil to the maximum permissible level within 93 years.[13] In their study of 29 CAFOS surrounding Beijing, all had some level of arsenic in the manure, with two producing more than the legal ceiling (=75 mg/kg) of arsenic. Once applied to soil, carcinogenic arsenic in manure converts to its inorganic form,

which is water-soluble and regularly seeps into drinking water. Thus, even before the arsenic exceeds emission standards it could threaten human health and the environment.

Soil Contamination

Today, most Chinese farmers depend on chemical fertilizers as opposed to animal manure. For example, according a report from China Watch, in Zhejiang Province only 6.2 percent of manure from CAFOs is applied to farmland. This is partially due to the sheer amount of waste produced by CAFOs, each animal requiring approximately three acres of spreadable-land.[14] However, the waste still poses a threat because undistributed waste from CAFOs is concentrated in lagoons or vast holding tanks, where accidents can, and do, occur resulting in massive pollution of the surrounding land and water.

In addition, too much nutrient released from CAFOs can reduce crop yields since plants divert more energy to absorbing nitrogen. Airborne nitrogen—95 percent of the nitrogen in manure exposed to air—settles onto ground as far as 80 to 160 kilometers from the CAFO. Fast growing, high nutrient using plants tend to dominate the landscape, out competing slower growing plants and lowering wild plant diversity.[15]

The Debates over CAFOs and Disease

Disease, and fear of disease, is a huge driving factor for CAFO reform. Particularly with regards to avian influenza, research on the safety of CAFOs is still being debated. The desire to improve disease prevention and monitoring of CAFOs has led to a push in China and abroad away from small-scale, integrated, more environmentally sound animal husbandry, to large CAFOs with few high-value breeds. For example, in response to bird flu outbreaks, China has required that all poultry be confined, which essentially eliminates small-scale farms and family chicken coops—hurting many rural poor. Promoting large CAFOs is based on the theory that confined animals are better monitored and their owners better informed on safe animal management. The opposing view is that large CAFOs actually play an active role in both the development and the spread of pandemic human diseases such as bird flu. Dr. Michael Greger, author of *Bird Flu: A Virus of Our Own Hatching*, details this argument. Part of the concern related to the spread of disease is the use of antibiotics in CAFOs to increase weight gain and reduce stress-related deaths among livestock. Many studies have shown that significant amounts of antibiotics pass through the animals and into the surrounding environment.

Bacteria

Bacteria are also heavy in manure, particularly CAFO manure because of the stress the animals endure. E-coli and salmonella are food borne and among the most dangerous to humans. They can be passed to humans when untreated manure is applied to vegetable crops. However, Streptococcus suis, a bacteria that causes meningitis both to pigs and human handlers, is one of particular importance in China. For example in one publicized case, forty people died of Streptococcus suis in Sichuan Province in 2005, which Deputy Minister of Commerce Huang Hai said "was found to have direct links with the foul environment for raising pigs."[16] Rural citizens are mainly impacted by CAFO waste and they are the most vulnerable due to limited resources to afford the often substandard healthcare available.

Policies to Address CAFO Waste

In 2003, SEPA issued "Discharge Standards of Pollutants for Livestock and Poultry Breeding" that specify the minimum distance between CAFOs and residential areas and water supplies.[17] The standards focus on COD and BOD5 emissions and odor control, but neglect the issue of trace metals in the manure.[18] Another law (GB284-84) limits ceiling of arsenic in human sewage applied to farmland to =75 mg/kg.[19]

Linden Ellis is the project assistant in the China Environment Forum. She will be publishing a fuller analysis of environmental health and CAFOs in China in the upcoming China Environment Series *issue 9 (October 2007). She can be reached at linden.ellis@wilsoncenter.org.*

[1] Nierenberg, Danielle. (2005). WorldWatch Paper #171: Happier meals: Rethinking the global meat industry. "Country Study #3: China." Page 38.
[2] Wang, Xiaoyan. "(2003). "Diffuse pollution from livestock feeding in China." Diffuse Pollution Conference, Dublin, 3B: Agriculture.
<http://www.ucd.ie/dipcon/docs/theme03/theme03_08.PDF>
[3] Nierenberg. (2005).
[4] Lei Xiong. (December 12, 2006). "China needs a new type of livestock revolution." ChinaWatch, Online at: <http://www.worldwatch.org/node/4772>
[5] Wang, Xiaoyan. (2003). Greenhouse, Ben. (2006). "Industrial agriculture and renewable energy in rural China." China Environment Series (Issue 8).
[6] Lei Xiong. (2006).
[7] Ibid
[8] "China Closely Monitoring Red Tide." People's Daily. July 14, 2000. Online at: <http://english.people.com.cn/english/200007/14/eng20000714_45459.html>
[9] Wang, Xiaoyan. (2003).
[10] Based on an interview with David Brubaker.
[11] Orlando, Edward F., et al. "Endocrine-Disrupting Effects of Cattle Feedlot Effluent on Aquatic Sentinel Species, the Fathead Minnow." Environmental Health Perspectives, March 2004, Vol. 112 Issue 3, p353-358
[12] Danielle Nierenberg. (2005). Page 26.
[13] Iowa State University and The University of Iowa Study Group. "Iowa Concentrated Animal Feeding Opperations Air Quality Study." February 2002. Online at: <http://www.public-health.uiowa.edu/ehsrc/CAFOstudy/CAFO_1.pdf>
[14] Li, Yan-xia & Chen, Tong-bin. (2005). "Concentrations of addictive arsenic in Beijing pig feeds and the residues in pig manure." Resources, Conservation and Recycling, Vol. 45, Issue 4, December, Pages 356-367.
[15] Nierenberg, Danielle. "Toxic Fertility." World Watch, March/April 2001, WorldWatch Institute.
[16] Ibid.
[17] Xinhua News Agency, (November 4, 2005). "China drafts, revises laws to safeguard animal welfare." Online at: <http://news.xinhuanet.com/english/2005-11/04/content_3729580.htm>
[18] Wang, Xiaoyan. "Diffuse Pollution from Livestock Feeding in China." Diffuse Pollution Conference, Dublin 2003. 3B: Agriculture. Online at:

<http://www.ucd.ie/dipcon/docs/theme03/theme03_08.PDF>
[19] Li and Chen.