



Corporate Agribusiness and America's Waterways



**The Role of America's Biggest Agribusiness
Companies in the Pollution of our
Rivers, Lakes and Coastal Waters**



Corporate Agribusiness and America's Waterways

**The Role of America's Biggest Agribusiness
Companies in the Pollution of our
Rivers, Lakes and Coastal Waters**



Written by:

Tony Dutzik, Travis Madsen and Elizabeth Ridlington, Frontier Group
John Rumpler, Environment America Research & Policy Center

November 2010

Acknowledgments

Environment Maryland Research & Policy Center thanks Stacy James, water resources scientist at the Prairie Rivers Network and Michele Merkel, Chesapeake regional coordinator for the Waterkeeper Alliance, for their review of this report. Thanks also to Luke Metzger of Environment Texas Research & Policy Center, and Rob Kerth, Ben Davis and Susan Rakov of Frontier Group for their editorial support.

Environment Maryland Research & Policy Center thanks the Town Creek Foundation and the McKnight Foundation for making this report possible.

The authors bear responsibility for any factual errors. The recommendations are those of Environment Maryland Research & Policy Center. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or those who provided review.

© 2010 Environment Maryland Research & Policy Center

Environment Maryland Research & Policy Center is a 501(c)(3) organization. We are dedicated to protecting our air, water and open spaces. We investigate problems, craft solutions, educate the public and decision-makers, and help the public make their voices heard in local, state and national debates over the quality of our environment and our lives. For more information about Environment Maryland Research & Policy Center or for additional copies of this report, please visit www.environmentmaryland.org/center.

Frontier Group conducts independent research and policy analysis to support a cleaner, healthier and more democratic society. Our mission is to inject accurate information and compelling ideas into public policy debates at the local, state and federal levels. For more information about Frontier Group, please visit www.frontiergroup.org.

Cover photos: Manure spreader: Tim McCabe, USDA Natural Resources Conservation Service; cattle feedlot: USDA Natural Resources Conservation Service; corn field and ethanol plant: Jim Parkin, istockphoto.com; hog waste lagoon: Bob Nichols, USDA Natural Resources Conservation Service.

Layout: To the Point Publications, www.tothepointpublications.com

Table of Contents

Executive Summary	4
Introduction	8
Big Agribusiness: A Big Polluter of America’s Waterways	10
Agribusiness is Polluting America’s Waterways	10
Corporate Agribusiness as an Environmental Threat	12
Pollution from Corporate Agribusiness: Killing America’s Waterways . . .	17
Big Chicken: Perdue, Tyson, Pilgrim’s Pride and the Fouling of Treasured American Waterways	17
The Hog Bosses: Smithfield, Cargill and the Environmental Toll of Pork Production . .	23
Beef Factories: Pollution from JBS and Cargill Processing Plants	29
Dairy Dangers: Factory Farms and the Death, Rebirth, and “Redeath” of a Great Lake	31
King Corn: ADM and the Gulf of Mexico Dead Zone	33
Policy Recommendations	38
Notes	42

Executive Summary

Pollution from agribusiness is responsible for some of America's most intractable water quality problems – including the “dead zones” in the Chesapeake Bay, Gulf of Mexico and Lake Erie, and the pollution of countless streams and lakes with nutrients, bacteria, sediment and pesticides.

Farming is not an inherently polluting activity. But today's agribusiness practices – from the concentration of thousands of animals and their waste in small feedlots to the massive planting of chemical-intensive crops such as corn – make water pollution from agribusiness both much more likely and much more dangerous.

The shift to massive corporate agribusiness operations is no accident. It is largely the result of decisions made in the boardrooms of some of the world's largest corporations. When it comes to

agricultural pollution of America's waterways, therefore, the problem begins at the top. Major agribusiness firms are directly or indirectly responsible for the degradation of many American waterways, and must be held accountable for stopping that pollution and cleaning up the mess.

Big agribusiness is a major polluter of America's waterways.

- Agriculture contributes to making more than 100,000 miles of rivers and streams and 2,500 square miles of inland lakes too polluted to sustain important uses such as swimming, fishing, drinking, or the maintenance of healthy populations of wildlife.
- The past several decades have seen major changes in the nation's agricultural system that have increased the power of agribusiness firms and magnified the potential for pollution:

- **A few companies now control America's food system.** The four largest firms in each sector produce 72 percent of the nation's beef, 63 percent of the nation's pork and 57 percent of the nation's chicken – giving those companies vast control over the agricultural marketplace and the practices farmers use to raise food. In addition, key agribusiness industries such as chicken and pork production have moved to a vertically integrated model that gives giant corporations nearly complete control over the production process from an animal's birth to the delivery of processed meat to store shelves.
- **Agribusiness firms have reshaped how America produces its food.** Through vertical integration, control of agricultural markets, and their power to influence public policy, big agribusiness firms have reshaped how America produces its food. Since 1993, for example, the share of the nation's milk cows on large farms of 200 cows or more increased from 31 percent to 67 percent. Similar shifts toward concentrated animal feeding operations (CAFOs) have taken place in the chicken and pork industries, magnifying the potential for pollution of nearby waterways. Meanwhile, agribusiness-supported policy changes have fueled massive planting of chemical-intensive corn for ethanol, corn syrup and animal feed, further contributing to pollution of waterways.

As demonstrated by the case studies presented in this report, giant corporate agribusiness firms are at

the center of some of the nation's most severe water pollution problems.

- Chicken farming produces vast amounts of nutrient-laden poultry litter that can pollute local waterways.
 - **Perdue's** operations on the Delmarva Peninsula contribute to the persistent problems with algae blooms and low dissolved oxygen in the Chesapeake Bay. The 568 million chickens produced on the Delmarva Peninsula each year – many of them raised by Perdue's contract farmers in the region – produce more than 1.1 billion pounds of chicken litter annually. When nutrients from chicken manure find their way into the bay, they contribute to the algae blooms that leave only 12 percent of the Chesapeake Bay with adequate levels of dissolved oxygen during the summer months.
 - Pollution from **Tyson Foods** and other chicken producers has led to the degradation of water quality in the Illinois River in Arkansas and Oklahoma. There are 2,800 poultry farms in the Illinois River watershed, which produce as much waste as would be produced by 10.7 million people – much of which is spread on agricultural land without treatment. Excessive pollution from phosphorus and other nutrients has triggered algae blooms that affect water quality in the river.
 - A chicken processing plant operated by **Pilgrim's Pride** (now owned by the Brazilian firm, JBS) is the largest source of nitrogen pollution that has contributed to water quality problems in northeast Texas' Lake o' the Pines. The lake – a prime recreational re-

source for its region – has suffered in recent years from fish kills, algae blooms and beach closures. The Pilgrim's Pride plant is a repeat violator of its Clean Water Act discharge permits.

- Concentrated hog farming operations have damaged waterways from North Carolina to the Midwest.
 - Waste from hogs owned by **Smithfield Foods** and other major hog producers has degraded water quality in North Carolina's Neuse River, which has experienced a series of massive fish kills in recent years. The 3 million hogs in the Neuse River basin are responsible for half of the phosphorus and a third of the nitrogen finding its way into the waterways of the Neuse River basin. These nutrients fuel algae blooms that starve the river of oxygen and can trigger fish kills.
 - Despite decades of evidence that the Illinois River in Illinois is suffering from nutrient pollution and is a major source of nutrients to the Mississippi River and the Gulf of Mexico, agricultural giant **Cargill** is intensifying its factory pork farming operations in the area and has released increasing amounts of nitrate pollution from its slaughterhouse along the Illinois River. That slaughterhouse is one of three Cargill-owned facilities to rank among the nation's top 20 dischargers of toxic chemicals to waterways in 2008. Nitrate pollution from the slaughterhouse has increased tenfold since 1998.
- Massive beef processing facilities add to the environmental toll of agribusiness operations.
 - Brazilian food colossus **JBS** has quietly become one of the nation's top beef producers. In so doing, it has inherited a legacy of environmental pollution. The company recently paid a \$1.9 million fine for pollution from its rendering plant located along Pennsylvania's Skippack Creek, which triggered a series of fish kills. Pennsylvania environmental officials regularly found excessive amounts of E. coli, ammonia, phosphorus and other pollutants in the creek downstream of the plant.
- The dramatic shift to factory dairy farming is polluting local waterways and contributing to the re-emergence of old water quality problems.
 - The emergence of factory dairy farms – driven by consolidation in the milk industry and the efforts of companies such as **Vreba-Hoff** – has had disastrous environmental results in Michigan and Ohio, where pollution from those farms has polluted local waterways and may be contributing to the re-emergence of the dead zone in Lake Erie.
- Massive production of chemical-intensive corn – driven by public policies that subsidize corn production – is wreaking havoc on waterways, including the Gulf of Mexico.
 - No company has played a larger role in creating the nation's modern corn economy than **Archer Daniels Midland**, which has used its political clout to win policies that subsidize corn production, promote the manufac-

ture of high-fructose corn syrup, and encourage the use of ethanol as a fuel. These policies have led to the planting of an additional 12.1 million acres of corn – an area twice the size of Maryland – since 2001. Industrialized corn production is highly dependent on chemical fertilizers and pesticides, and is the number one source of nitrogen pollution that fuels the growth of the dead zone in the Gulf of Mexico.

Federal and state governments should take immediate steps to protect America’s waterways from pollution from corporate agribusiness – and to restore our already-polluted waterways to health. Specifically, they should:

- Ban the worst practices, including the creation of new CAFOs and agricultural practices such as the over-application of fertilizer that lead to pollution of waterways.
- Guarantee Clean Water Act protection to all of America’s waterways.
- Hold corporate agribusiness responsible for its pollution by clarifying that corporations that own animals

are legally responsible for the waste they produce.

- Enforce existing laws by requiring agribusiness operations to meet specific limits on pollution where necessary to restore a polluted waterway to health, requiring CAFOs that discharge to waterways to obtain water pollution permits for their operations, and ensuring that state governments properly implement the Clean Water Act.
- Give environmental laws real teeth by beefing up inspections and ensuring that repeated or serious violations of water pollution laws are met with real penalties, not slaps on the wrist.
- Ensure environmental transparency by giving citizens access to detailed information about CAFOs and other agribusiness facilities in their communities, including information about discharges of pollution to the environment.
- Encourage better agricultural practices and consider systemic reforms to ensure that American agriculture delivers safe, healthy food without destroying our waterways.

Introduction

“Cultivators of the earth are the most valuable citizens. They are the most vigorous, the most independent, the most virtuous, and they are tied to their country and wedded to its liberty and interests by the most lasting bonds.”¹

– Thomas Jefferson

“I hope we shall ... crush in its birth the aristocracy of our moneyed corporations.”²

– Thomas Jefferson

The idea that American agriculture would one day be dominated by “moneyed corporations” would have been unthinkable to Thomas Jefferson – the man who, more than any other American, defined the nation’s farmers as the paragons of republican virtue.

Over the last several decades, however, Jefferson’s independent yet community-minded “cultivators of the earth” have

been eclipsed by a few, large, often multinational corporations in deciding how America’s food will be produced. In towns where family farmers once gathered to make decisions that shaped the future of their communities, today it is often the case that the most important decisions are made in corporate boardrooms hundreds of miles away – or even on another continent.

The shift to corporate agribusiness has done more than change the nature of American farming; it has also triggered an environmental crisis. Thomas Jefferson’s Monticello home sits near the Rivanna River, which flows into the James River and ultimately the Chesapeake Bay – an important and once ecologically vital waterway that has been degraded over the course of decades by agricultural pollution, in particular waste from corporate chicken farming. The Chesapeake is not alone – from the Gulf of Mexico to the Great Lakes – and in countless lakes and streams in between – pollution from agricultural activities is fueling algae blooms, threatening wildlife and fouling drinking water supplies.

That pollution is the result of an agricultural system that increasingly produces the nation's meat on farms that pack thousands of animals onto small plots of land, producing waste on the scale of entire cities and making pollution of nearby waterways a near-certainty. It is a system that increasingly feeds those animals with corn planted in vast plots across the nation – corn that requires pesticides and fertilizers, some of which wash into our waterways, to thrive.

It is also a system that is largely molded to the design, and designed to the benefit, of a few massive corporations, one in which family farmers still participate, but in which they are increasingly vulnerable and lack the independence that Jefferson once praised.

Four decades ago, Americans were confronted by an environmental crisis of a similar scale – the massive water pollution problems caused by industrial dumping into our nation's rivers, streams and lakes. Those problems were so intense that the Cuyahoga River caught fire and nearby Lake Erie was considered “dead.”

At the time, few Americans waxed poetic about the wholesomeness of the neighborhood sewage treatment plant,

or rhapsodized about the republican virtues of the steel mill. Instead, we acted on the principle that no one – especially not powerful, well-resourced corporations – has the right to pollute our waterways with impunity and endanger the public's health and our natural resources. We took action, and while the job of stopping industrial pollution is far from done, we've made tremendous progress.

Today, however, corporate agribusiness giants hide behind the wholesome image of the American family farmer to evade responsibility for their pollution. Archer Daniels Midland, Cargill, Perdue, Tyson, Smithfield – these are among the corporations whose actions have contributed to the devastation of American waterways. They are also corporations with vast resources to implement better, more sustainable ways of producing America's food.

The time has come to hold corporate agribusiness accountable for its pollution of our environment – just as Americans a generation ago did with industrial polluters. It is up to Americans to insist on better practices that repair the damage already done, and eliminate the massive burden that agricultural pollution inflicts on our waterways.

Big Agribusiness: A Big Polluter of America's Waterways

Farming is not an inherently polluting activity. On the contrary, many farmers take stewardship of the land and the environment as a sacred trust.

However, as agriculture in America has increasingly adopted the structures and methods of industrial production, it has become a major polluter. In this section, we review the data on pollution from agribusiness, document the trend toward greater concentration in industrial agribusiness, and show how the shift to industrial agribusiness has magnified the environmental impact of food production.

Agribusiness Is Polluting America's Waterways

Corporate agribusiness³ imposes a heavy – and growing – toll on America's

waterways. From the dead zones in the Gulf of Mexico, the Chesapeake Bay and Lake Erie to the pollution of countless local rivers, streams and lakes with nutrients, fertilizers and pathogens, the impact of agribusiness on the nation's waterways is severe.

According to the U.S. Environmental Protection Agency (EPA), pollution from agriculture contributes to poor water quality in more than 100,000 miles of rivers and streams in the United States, along with 2,500 square miles of lakes and 2,900 square miles of estuaries.⁴ These waters are so polluted that they are unsafe for fishing, swimming, or the maintenance of healthy populations of wildlife.

These figures greatly understate the impact of agribusiness pollution on America's waterways, since they include only waterways whose quality has been

assessed by state governments and those for which a cause of pollution was listed. Only 26.5 percent of America's river and stream miles and 42 percent of our lakes by area have been fully assessed for their water quality.⁵

The problems extend to America's coastal waters, where the number of documented areas of low dissolved oxygen – often called “dead zones” because oxygen levels are too low to support marine life – has increased from 12 in 1960 to 300 today. This includes the dead zone in the Gulf of Mexico, which covered a record area of roughly 8,000 square miles in 2008. The increase in coastal dead zones has coincided with the expansion of industrial agribusiness in the United States.⁶

Typically, agricultural pollution finds its way into waterways through runoff from farm fields or discharges from subsurface tile drainage systems, which carry pollution from farm fields into nearby waterways. Animal waste from factory farms, for example, might be sprayed on nearby fields and wash off into a nearby river, carrying bacteria and polluting nutrients with it. Or, pesticides applied to fields might wash off into waterways and impact the plants, animals, and humans that use that water.

In addition, concentrated animal feeding operations (CAFOs) also have the potential to pollute via direct discharges of manure from leaking, ruptured or overflowing manure lagoons. Finally, industrial facilities that process farm outputs into consumer products – from slaughterhouses to ethanol plants – may also discharge pollutants into waterways.

Major forms of agricultural pollution include:

Nutrients: Industrial agribusiness relies on heavy application of fertilizer containing nutrients such as nitrogen and phosphorus to promote crop growth.

Photo: Lynn Betts, USDA Natural Resources Conservation Service.



Drainage ditches in the Midwest carry nutrient-laden water into larger rivers and ultimately major waterways such as the Mississippi River and Gulf of Mexico.

Whether in the form of manufactured fertilizer or manure, nutrients can be washed off the land into surrounding waterways, where they can fuel the growth of algae, depleting waterways of oxygen and sometimes triggering fish kills. At the most extreme end of the scale, nutrient runoff can lead to the creation of marine dead zones, as in the Chesapeake Bay, where a section of the bay becomes oxygen deprived each summer as a result of algae blooms. Certain nutrients, such as nitrates, can also render water unsafe to drink when they are present in high enough concentrations.

Sediment: Sediment pollution results from overgrazing, certain tillage practices, and from water management practices that allow rainfall to run off land too quickly, carrying valuable topsoil with it. Washed into rivers and streams, soil can cloud the water and diminish the light received by aquatic plants. It also settles in the stream, disrupting ecosystems by filling in spawning grounds or otherwise altering the streambed, and clogs the gills of fish and other aquatic animals.

Sediment also provides one vehicle for many other agricultural pollutants, embedded in particles of soil, to wash into waterways.⁷

Pathogens: Animal waste contains bacteria and viruses that are harmful to humans and animals. When animals are kept in concentrated environments like CAFOs, large volumes of pathogen-bearing waste are produced. These wastes can find their way into waterways through accidental spills, ruptures or flooding of manure storage lagoons, or runoff from the spraying of farm fields with liquid manure. Pathogens can render water unsafe for human consumption or use, contaminate shellfishing areas, and contribute to fish kills and other ecosystem damage.⁸

Pesticides: Chemicals applied to kill unwanted plants and animals on cropland can wash into waterways, rendering that water unsafe for human consumption and use and threatening aquatic plants and animals. Pesticides can also contaminate fish and shellfish, rendering them unsafe for human consumption.

Corporate Agribusiness as an Environmental Threat

How did we get to the point where the production of our food became such a threat to our water?

The root of the problem is the industrialization of agriculture in the United States, a development that has been advanced over the course of the last several decades by major agribusiness corporations.

Practiced poorly, even traditional forms of farming can create problems for waterways, while there are ways to minimize – and in some cases eliminate – the threat of industrial agribusiness operations to our water. But the methods of food production used in industrial

agribusiness make environmental impacts far more likely through their reliance on chemical-dependent monoculture crops and concentrated animal feeding operations.

Control of America's system of food production has become increasingly concentrated in the hands of a few large corporations, which in turn have helped reshape the way America produces food, often to the detriment of our environment.

A Few Corporations Control America's Food System

Agribusiness firms have emerged as among the nation's richest and most powerful corporations. Archer Daniels Midland ranks 27th on the Fortune 500 list of largest U.S. companies, with \$69 billion in annual revenue, followed by Tyson Foods (84th), Smithfield Foods (163rd), ConAgra (178th) and Dean Foods (208th).⁹ Other agribusiness corporations would rank highly on the list if they were U.S.-based publicly traded companies. Cargill, for example, is privately held, but would rank in Fortune's Top 20.¹⁰

The consolidation of agribusiness in the United States has been dramatic. For example, the top four firms in each sector now slaughter 72 percent of the nation's beef and 63 percent of the nation's pork, while producing 57 percent of the nation's broiler chickens.¹² Even agricultural markets that had once been local or regional in scope are becoming increasingly consolidated. Fewer than 200 companies now own 95 percent of the laying hens in the United States, compared with 2,500 companies in 1987.¹³

The same consolidation has taken place among the companies that process the nation's grain harvest. As of 2002, the four largest firms accounted for 54 percent of the nation's flour milling and 69 percent of wet corn milling.¹⁴

Moreover, some companies – such as Tyson, Cargill and JBS – have established dominant positions in several sectors of the agricultural economy. Tyson, for example, is one of the top five firms in chicken, pork and beef production, and also mills its own grain to feed its poultry. Cargill is known primarily for grain processing, but is also a major producer of poultry, pork, eggs, oilseeds, sugar and biofuel.

How Corporate Agribusiness Is Reshaping America’s Food System

Only a few of the firms mentioned above are directly engaged in raising crops or tending animals. So how are these companies contributing to the environmental crisis caused by agricultural water pollution?

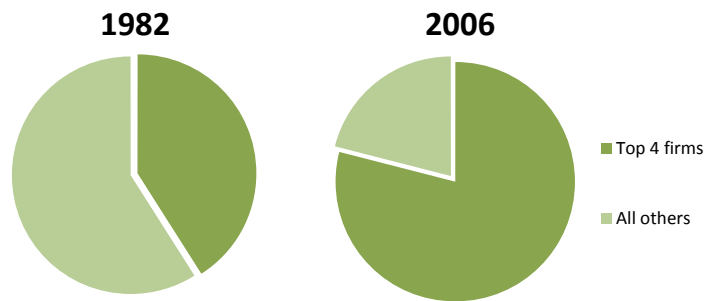
There are several tools major corporations have used to reshape America’s agricultural system into one that is reliant on environmentally damaging factory farming and chemical-intensive production of crops such as corn.

Vertical Integration

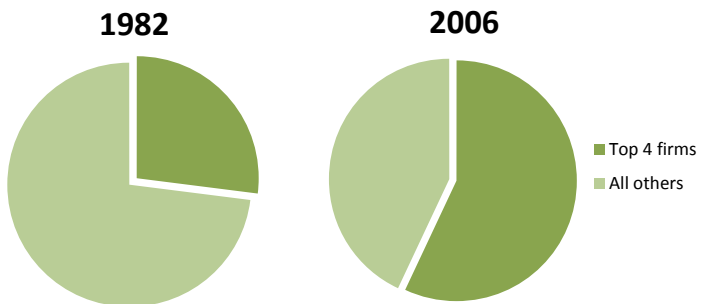
Over time, some corporate agribusiness firms have moved from acting as the middlemen between farmers and consumers to controlling larger shares of the process of producing, processing and distributing America’s food. In a few sectors – especially the chicken and pork industries – “vertically integrated” corporate agribusiness firms now control virtually the entire food production process, from the genetic manipulation of seeds and livestock, through crop and livestock production, processing, and marketing of final product to the consumer. One vertically integrated pork producer, Smithfield Foods, describes vertical integration as controlling the process “from squeal to meal.”¹⁵

Figure 1. Share of Production by Four Largest Firms in Various Agricultural Sectors¹¹

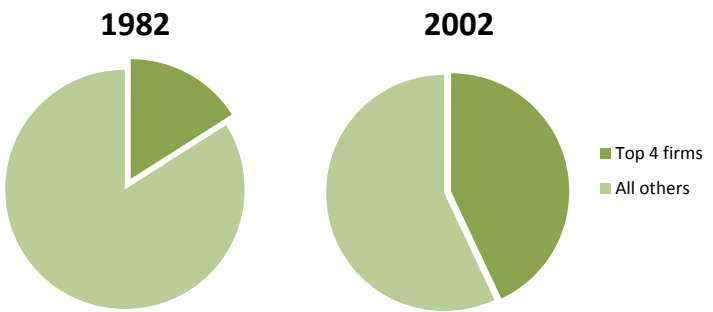
Beef



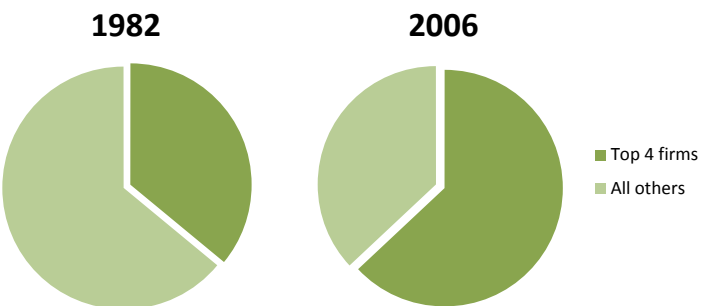
Chicken



Milk



Pork



In the vertically integrated model, the only portion of the process that occurs “out of house” is the raising of animals from youth to slaughter. This happens to be the part of the process with the greatest potential environmental impacts. Nominally independent growers raise animals under contract with agribusiness corporations – contracts that typically contain strict conditions detailing how the grower must raise and feed the animals. The “arm’s length” arrangement between the grower and the corporation, however, means that while the corporation owns the animals, it can disclaim responsibility for proper disposal of the waste those animals produce, shifting that burden of environmental compliance to the growers.

The result is an arrangement that is the best of both worlds for the integrated agribusiness firm. It can ensure the production of standardized, low-cost meat without bearing the risk of owning and operating its own facilities. It can also disclaim responsibility for the environmental damage caused by the rearing of its livestock. It is little surprise that the model has come to dominate the chicken and pork industries – fueling the proliferation of factory farms and their associated environmental impacts – and is making inroads in other sectors of agribusiness.

Market Power

Even in areas of agribusiness in which independent farmers still play an important role, corporate agribusiness giants can attain enough market power to effectively dictate the prices farmers receive for their goods. “Monopsony” and “oligopsony” are the economic terms for a situation in which only one or a few potential buyers exist for a given product, giving those buyers the ability to dictate the price a seller may receive.

The consolidation of agribusiness has reduced the number of potential buyers for certain products. In the dairy industry, for example, one firm, Dean Foods, has emerged as a dominant player with 38 percent of the nation’s fluid milk market.¹⁶ In certain regional markets, the company – along with the leading dairy cooperative, Dairy Farmers of America (DFA) – controls an even greater share of the market.

Farmers in several regions of the country have alleged that large companies such as Dean and major cooperatives such as DFA have used their market power to control and manipulate the milk market, resulting in lower prices paid to farmers for their milk.¹⁷ Indeed, in 2008, DFA was forced to pay a \$12 million penalty to settle allegations of market manipulation by the U.S. Justice Department.¹⁸ Farmers in both the Northeast and Southeast have filed class action lawsuits charging efforts by Dean, DFA and others to manipulate milk markets.¹⁹

What does market power have to do with the environment? By driving down the prices farmers receive, and leaving farmers with few options for selling their products, major agribusiness corporations create economic conditions that make it nearly impossible for small, independent operators to survive. Large, concentrated dairy operations have somewhat lower costs of operation – at least when the environmental and public health impacts of their pollution are not included in the equation.²⁰ But more importantly, they are likelier to have the financial resources and access to capital that would enable them to survive a brief but sharp decline in commodity prices, such as the steep drop in milk prices that occurred during 2009. As a result, small, family operations are replaced over time with massive factory farms with outsized environmental impacts.

Public Policy Changes

Agribusiness corporations also reshape the food system through their influence over public policy. Major corporations have multiple avenues – including campaign contributions, lobbying expenditures, and personal relationships with policy-makers – to influence public policy. Through public policy, agribusiness firms can create markets for their products, gain public subsidies, or evade environmental responsibility – all of which shift the balance of what crops are produced and how, leading to environmental impacts.

Concentrated Farms Lead to Concentrated Environmental Impacts

In rural areas of America, homeowners typically dispose of household sewage in septic tanks. This system works only because population density is low. But the same system that works well, for example, in rural upstate New York would be an environmental and public health disaster if it were applied in New York City.

The same thing is true of waste from animals. In the past, most animal farming was widely dispersed across the landscape, mitigating the impact of manure on waterways and providing a helpful source of fertilizer to farmers. The transition to corporate agribusiness, however, has helped bring about a wholesale shift toward concentrated animal feeding operations (CAFOs), which produce vast amounts of nutrient and bacteria-laden manure – sometimes in volumes that approach the sewage production of small cities – on small plots of land.

Concentrated animal feeding operations confine hundreds to thousands of animals in small areas, where they are largely fed on commodity grain produced far away, usually grown with the aid of

manufactured fertilizers (and subsidized by taxpayers). The manure from these animals is often stored in open-air lagoons and later spread on land, nominally as fertilizer. However, over-spreading of manure is common – and in some places, given the vast volume of manure produced in particular watersheds, inevitable – resulting in manure washing into waterways, bringing nutrients and pathogens with it.

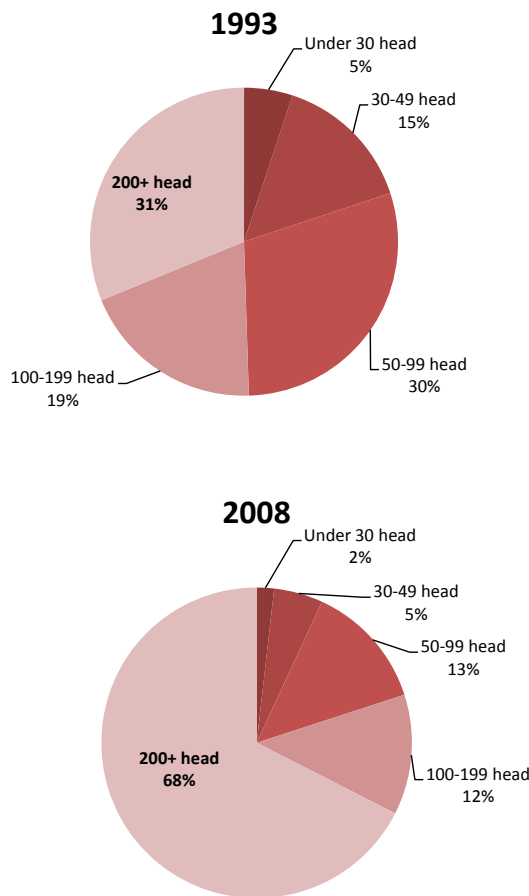
At the other end of the cycle, the conversion of vast areas of land to corn or soy production – both for the production of animal feed and other products – requires the input of large amounts of chemical fertilizers and pesticides, which also can find their way into waterways.

The transition from small farms to CAFOs has occurred with lightning speed. Between 1987 and 2007, for example, the United States lost more than half of its dairy farms and nearly 70 percent of its pig farms, with an increasing share of production taking place on the very largest farms – often CAFOs with hundreds to thousands of animals at a single site.²¹ In 1987, it took more than 16,000 hog and pig farms to produce half of the nation's sales. By 2007, the same share of sales was produced by just over 1,700 farms.²²

In the dairy industry, the number of farms with 50 or fewer milk cows fell from more than 104,000 in 1992 to just under 34,000 in 2007 – a decline of roughly two-thirds. Over roughly the same period (1993 to 2008), the share of the nation's milk cows in herds of 200 cows or greater more than doubled, from 31 percent to 67 percent.²³ (See Figure 2, next page)

Between 1987 and 2007, the United States lost more than half of its dairy farms and nearly 70 percent of its pig farms.

Figure 2. Share of the Nation's Milk Cows by Herd Size²⁴



Vertical integration has also magnified the impact of the trend toward larger farms by encouraging the tendency of certain types of agricultural production to cluster together in compact regions of the country.

The propensity of similar industries to cluster in a small area has existed for centuries, from the steel mills of Pittsburgh to the auto manufacturers of Detroit to the high-tech businesses of Silicon Valley. By clustering together, industrial producers share access to support services and a trained labor force.

The industrialization of agribusiness leads to similar concentrations.²⁵ The eastern shore of Maryland and northwest Arkansas are to chickens what Iowa is to corn, which is what eastern North Carolina is to pork. These areas not only have lots of farms, but they also possess the slaughterhouses, grain mills and other forms of infrastructure that make factory farming possible. Unfortunately, these concentrations also further magnify the environmental impact of factory farming on local waterways.

Specialization of farming in a particular area also undermines the potential benefits of diversified farms. On a traditional, diversified farm, the waste created on one part of the farm is used as a productive input on another – for example, the manure from a pig might be used to fertilize a crop, the inedible waste from which would then be fed back to the pig. Industrialized farming, by contrast, relies on artificial fertilizer to produce grain in large monocultures, which are then fed to animals at CAFOs, which then produce manure which is often overapplied to nearby farm fields – a process that creates the potential for large-scale pollution at several points in the process.

As the stories in the next section describe, the shift toward industrial agribusiness has too often resulted in the degradation of critical waterways that Americans depend on for recreation, drinking water, and the preservation of healthy populations of wildlife.

Pollution from Corporate Agribusiness: Killing America's Waterways

Big Chicken: Perdue, Tyson, Pilgrim's Pride and the Fouling of Treasured American Waterways

The chicken industry is an example of the consolidation of the agribusiness industry and its impacts on the environment.

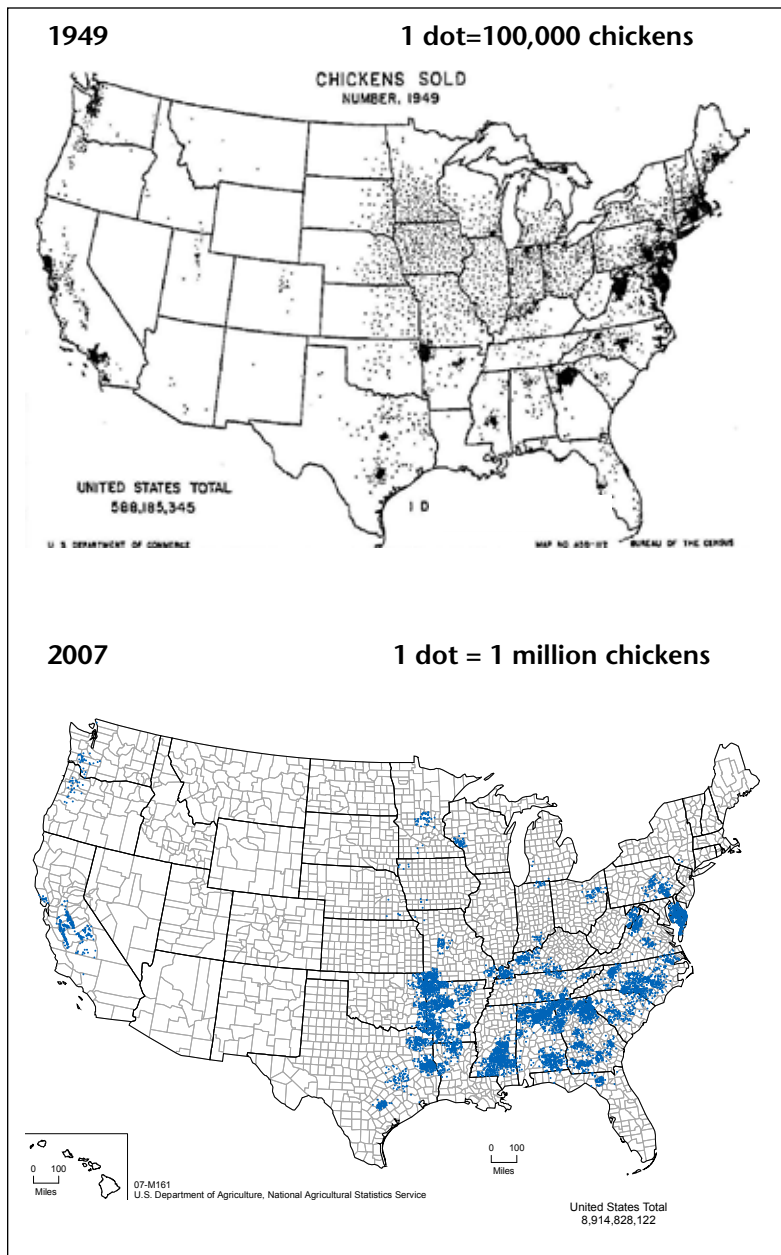
Control of the chicken industry is highly concentrated among a few massive corporations – four firms produce 57 percent of the chicken that finds its way to American tables.²⁶ It is vertically integrated, with firms such as Tyson and Perdue controlling virtually every aspect of the production process – hatching chicks, operating feed mills, and slaughtering, processing, and distributing the final product. While the chicken growers who raise chicks to adulthood are nominally independent, firms such as Tyson and Perdue sign restrictive

contracts with those growers that give the companies great control over their farmers' operations.

Those contracts typically leave small, undercapitalized growers – rather than mighty corporations such as Tyson, Perdue and Pilgrim's Pride – with the responsibility for properly disposing of animal waste. Growers, however, have little opportunity to negotiate better terms for their work, since growers in a particular area who choose not to contract with a major agribusiness firm may have few other options for marketing their product.

Over the past half-century, chicken farming has become increasingly concentrated in large operations, clustered in small areas of the country. Whereas in the middle of the last century, chicken farms dotted the Midwest and existed up and down the Northeast coast, today, the production of chickens for meat (as op-

Figure 3. Chickens Sold by County, 1949 and 2007²⁷



posed to for eggs) is highly concentrated in the southeastern United States and Chesapeake Bay region. (See Figure 3.)

Raising large numbers of chickens in a small geographic area concentrates the production of “chicken litter” – phosphorus-laden manure mixed with sawdust or other bedding material. When the amount of chicken litter exceeds the amount that can be beneficially applied to crops in a particular region, the result is often pollution of local waterways.

The Chesapeake Bay, the Illinois River in Arkansas and Oklahoma, and Lake o’ the Pines in Texas are three examples of American waterways that have been severely damaged by pollution from chicken farming conducted by corporate agribusiness.

Perdue and the Chesapeake Bay

Perdue is the third largest producer of chickens in the nation, with annual sales of \$4.6 billion.²⁸ Through its vertically integrated system, Perdue produced and processed more than 600 million chickens in 2007.²⁹

Based in Salisbury, Maryland, Perdue is one of several large chicken producers with major operations on the Delmarva Peninsula on the eastern shore of Chesapeake Bay. The Chesapeake Bay is one of America’s most storied waterways. As the nation’s largest estuary, and one of the most productive estuaries in the world, the Chesapeake is an important natural resource, serving as a home for more than 3,600 species of plants and animals, as well as a cornerstone of both the mid-Atlantic economy and the region’s culture.³⁰

For decades, however, the bay has been under threat. As long ago as 1983, a congressionally mandated report found that the bay suffered from nutrient pollution, a decline in seagrasses, pollution

from toxic chemicals, and overfishing.³¹ While the problems facing the Chesapeake are complex, many of them can be traced back to agricultural activities – particularly chicken farming – in the bay’s vast watershed.

Chicken manure contains phosphorus, nitrogen and other chemicals, such as arsenic (which is an additive in some chicken feed).³² During its 47-day lifespan, a typical chicken being raised as a broiler produces 2 pounds of chicken litter (manure mixed with sawdust and bedding material).³³ The 568 million chickens produced by all chicken companies on the Delmarva Peninsula thus generate an estimated 1.1 billion pounds of chicken litter each year.³⁴

Pollution from chicken litter can find its way into the Chesapeake Bay in a number of ways. Manure that is left in uncovered piles can be washed into nearby waterways in a heavy rain.³⁵ In addition, the chicken litter that is produced in great volumes at poultry farms is typically disposed of by spreading it on nearby crops as fertilizer.³⁶ Unfortunately, however, over-application of chicken litter to farm fields can result in the fields becoming over-saturated with phosphorus, resulting in the runoff of phosphorus to nearby waterways and eventually the bay.

The 1.1 billion pounds of chicken litter the industry produces each year would, if spread evenly on the 8.5 million acres of agricultural land in the bay watershed, represent 129 pounds of litter per acre.³⁷ The amount of phosphorus in chicken litter generated in four counties on Maryland’s Eastern Shore, for example, far exceeds the amount that can be used by crops in those counties.³⁸

Nutrient pollution can even reach the bay via the air. Animal waste such as poultry manure produces airborne emissions of nitrogen-containing am-

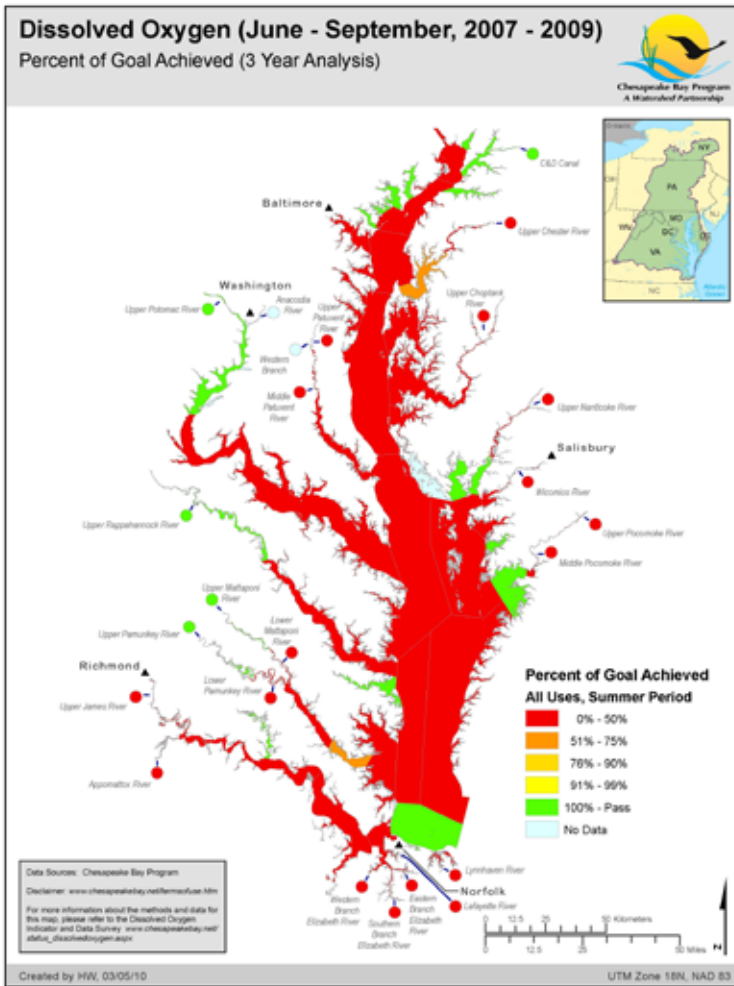
monia, which can fall into rivers and the bay with the rain.

Nutrients such as phosphorus and nitrogen fuel the growth of algae in the water, triggering algae “blooms” that flourish briefly and then die, consuming oxygen as they decay. As a result, levels of dissolved oxygen in the water drop below the concentration needed to support fish, crabs and oysters. Animals that are able to flee leave these areas of low dissolved oxygen; those who can’t escape suffer through the stress of inadequate oxygen, making them more prone to disease, or may suffocate if oxygen levels fall too low (hence the name “dead zone”).

The chicken industry is a prime contributor to pollution of the bay. According to the Chesapeake Bay Program, a state and federal joint effort to study the bay, 26 percent of phosphorus pollution and 17 percent of nitrogen pollution in the bay comes from excessive animal waste in agricultural areas.³⁹ Another 19 percent of phosphorus pollution and 15 percent of nitrogen pollution comes from chemical fertilizers applied to cropland. Because the majority of the grain produced on Maryland’s Eastern Shore is sold for chicken feed, some of this chemical fertilizer pollution can be attributed to chicken production.⁴⁰

The result of this pollution is serious degradation to the Chesapeake Bay ecosystem. From 2007 to 2009, only 12 percent of the Chesapeake Bay had sufficient levels of dissolved oxygen in the summer.⁴¹ (See Figure 4, next page.) The National Oceanic and Atmospheric Administration (NOAA) describes the Chesapeake Bay as “highly eutrophic,” meaning that it is highly susceptible to nutrient-fueled algae blooms that deprive the waterway of oxygen.⁴²

Figure 4. Most of the Chesapeake Bay Fails to Meet Dissolved Oxygen Goals in the Summer⁴³



In addition to consuming oxygen in the water and creating dead zones, algae blooms can block sunlight that aquatic grasses need to survive. Without sunlight, the grasses die, triggering other problems for the Bay's ecosystem. Roots of grasses are no longer available to hold sediment in place, increasing the risk that oysters will be buried in silt. Blue crabs and fish such as menhaden, herring, shad, and white perch lose hiding places and a place to shelter their young. And the grasses are no longer available to re-

plenish dissolved oxygen levels as they photosynthesize. In 2009, 86,000 acres in the bay were covered with grass, less than half the amount of grass needed for a healthy bay.⁴⁴

Years of summertime dead zones, overfishing, and the death of submerged aquatic vegetation have taken their toll on the bay's aquatic animals. Populations of rockfish, or striped bass, have dropped so much that Maryland and Virginia both imposed moratoria on the fishery in the late 1980s. The moratoria have since been lifted, but catch levels remain low. Oyster and soft shell clam populations have declined to a fraction of their historic levels, while the federal government officially declared the blue crab fishery a disaster in 2009, granting emergency aid to the industry.⁴⁵

Despite the clear problem of excessive chicken litter in the bay watershed and the consequences of this for fish, shellfish and the bay's ecosystem, Perdue denies responsibility for the waste produced by its chickens, grown by farmers working under strict contract with the company.⁴⁶ However, in a preliminary ruling in a lawsuit naming both Perdue and a contract farmer for allowing manure to pollute a tributary of the Chesapeake Bay, a judge agreed to keep Perdue as a defendant, potentially responsible for the pollution.⁴⁷ The Clean Water Act, under which the lawsuit was filed, applies to owners or operators of facilities that discharge or propose to discharge to waterways, with the definition of "owner or operator" applying to "any person who owns, leases, operates, controls, or supervises a source [of pollution]."⁴⁸

Holding Perdue and other chicken producers in the Chesapeake Bay region accountable for their pollution is the first step toward cleaning it up, and restoring the bay to health.

Tyson and the Illinois River of Arkansas and Oklahoma

The Illinois River begins in northwestern Arkansas before traveling through eastern Oklahoma and eventually feeding the Arkansas River. Designated by the state of Oklahoma as a scenic river, the Illinois River is an important recreational resource for the region – each year, an estimated 180,000 people canoe, kayak or raft on the river, while another 350,000 engage in other forms of outdoor recreation.⁴⁹

In recent years, however, water quality has declined along the Illinois River and in Tenkiller Lake, a reservoir that is fed by the river. Decreased water clarity, algae blooms and instances of low dissolved oxygen have become more frequent.⁵⁰ Portions of the Illinois River and several tributaries are so polluted with pathogens from animal feeding operations and other sources that they are no longer safe for swimming.⁵¹ There is even evidence that the number of people who float the river has declined.⁵²

The Illinois River and other rivers in eastern Oklahoma and northwestern Arkansas are in trouble largely because of nutrient pollution from the area's thousands of chicken farms. The Illinois River watershed includes 2,300 poultry farms in Arkansas and another 500 in Oklahoma.⁵³ Oklahoma's Attorney General estimates that the waste produced by chickens in the Illinois River watershed is equal to that which would be produced by 10.7 million people – more than the combined human population of the entire states of Oklahoma and Arkansas.⁵⁴ Unlike human waste, however, it receives no treatment.

While several chicken producers operate in the region, the industry is dominated by Springdale, Arkansas-based Tyson Foods. Tyson Foods and its subsidiaries produce 20 percent of the nation's

chicken – 41 million chickens a week, or 2 billion per year – as well as 22 percent of its beef and 18 percent of its pork.⁵⁵ Tyson feeds its chickens an estimated 23 billion pounds of feed each year, most of it corn and soybean meal.⁵⁶

Many of the region's chicken farms are located near Tyson's Arkansas headquarters. Indeed, four counties in northwest Arkansas produce 315 million broilers under contract per year, more than are produced annually in all but six states.⁵⁷

The massive concentration of chicken production in a small area imposes a heavy toll on the environment, particularly water quality.

Water quality problems abound in Tyson Country. In eastern Oklahoma, nutrient pollution of the Illinois River became so bad that the Oklahoma Attorney General's office filed suit against Tyson Foods and other chicken processors to reduce the over-application of poultry litter in the region.⁵⁸ Not far away, simi-

Photo: Aaron Latty



The scenic Illinois River flows through Arkansas and Oklahoma. It is one of many waterways in the region that are adversely affected by pollution from the region's thousands of chicken farms.

lar water quality problems have affected Grand Lake o' the Cherokees. The lake is an important recreational resource, attracting boaters, jet skiers, fishing enthusiasts and families seeking to take a break from mid-summer heat. The lake had once been known for its high water quality, but since the 1980s, Grand Lake has experienced algae blooms, which deprive the lake of oxygen needed to support healthy populations of fish and maintain a balanced ecosystem. Parts of the lake itself – and many of its tributaries – are considered “impaired” for aquatic life due to low levels of dissolved oxygen.¹⁹³

Chicken manure is a big contributor to the water quality problems at Grand Lake. In 2004, the state of Oklahoma estimated that nearly 19,000 tons of chicken litter is applied to land in the watershed each year, with roughly 27 percent of those applications exceeding the amount of phosphorus that the land can safely absorb.⁵⁹ Chicken litter spread just in the Oklahoma part of the watershed is suspected of supplying as much as 189,000 pounds of phosphorus each year to the waterways of the Grand Lake watershed.

Tyson was also linked to the pollution of Oklahoma's Lake Eucha and Lake Spavinaw – the sources of drinking water for the city of Tulsa. Pollution from poultry waste in those watersheds had become so severe that it had spawned algae growth in the lakes, leading to taste and odor problems in drinking water and forcing the city of Tulsa to upgrade its treatment methods at public expense. A 2003 settlement in Tulsa's lawsuit against Tyson and other chicken producers required the companies to transport some chicken waste out of the watershed, a move that has reduced phosphorus loading to the lakes.⁶⁰

Pollution from chicken waste fouls local waterways, but it also has more far-reaching effects. The Arkansas River

basin – which drains the poultry-intensive areas of northwestern Arkansas, southern Missouri and Oklahoma – is responsible for 4.3 percent of the phosphorus pollution reaching the Gulf of Mexico from the Mississippi and Atchafalaya rivers, and is the fastest-growing source of phosphorus to the gulf.⁶¹ As a result, pollution from Tyson and other chicken producers contributes to ecological problems in the Gulf of Mexico.

The fate of the Illinois River will be a telling indicator of the future of waterways nationwide affected by chicken waste. Oklahoma's lawsuit against chicken processors in the region is now pending in federal court.

However, the chicken industry has already won one round of the fight. Oklahoma Attorney General Drew Edmondson, who filed the lawsuit to protect the Illinois River, was recently upset in his bid for the Democratic nomination for governor. His opponent won narrowly after receiving more than \$20,000 in last-minute donations from executives at Tyson Foods and other regional poultry producers.⁶²

Pilgrim's Pride (JBS) and Texas' Lake o' the Pines

Lake o' the Pines is located in the northeast corner of Texas, about 15 miles northwest of Marshall and about 20 northeast of Longview. The lake provides many opportunities for recreation, with camping, boating, hunting, fishing and bird watching, including the ability to see wintering bald eagles.⁶³ The lake also provides drinking water for a number of northeast Texas cities including Longview.⁶⁴

However, the lake has been plagued with pollution for at least a decade. According to the Texas Commission on Environmental Quality (TCEQ), the lake suffers from excess nutrient input which

contributes to “turbid water, episodes of low dissolved oxygen concentration, floating algal blooms, taste and odor problems [and] fish kills.”⁶⁵ In 2002, pollution led to the deaths of more than 9,000 fish.⁶⁶ During the summer of 2010, high levels of *E. coli* – bacteria linked to animal and human fecal matter – led to beach closures on the lake, costing area business thousands in lost revenue from recreational visitors to the lake during the 4th of July weekend.⁶⁷

Chicken farming is a big business in the Cypress Creek watershed that contains Lake o’ the Pines. An estimated 99 million chickens are produced in the region annually – one out of every four produced in Texas.⁶⁸ The vast majority of the chicken litter produced in the watershed – approximately 229 million tons per year, is spread on farm fields in the region, at rates of one to five tons per acre.⁶⁹

Lake o’ the Pines is also affected by discharges of nutrients from industrial facilities, the largest of which is the Pilgrim’s Pride chicken processing facility, which discharges into Tankersley Creek, a tributary of Lake o’ the Pines. The TCEQ identifies the facility as the source of “88 percent of the total phosphorus and 73 percent of the total nitrogen contributed from permitted dischargers in the watershed.”⁷⁰ Indeed, the Pilgrim’s Pride facility is estimated to contribute more total nitrogen to Lake o’ the Pines than the millions of pounds of chicken litter spread on local farm fields.⁷¹

With net sales totaling \$7.1 billion in 2009, Pilgrim’s Pride Corporation is one of the largest chicken companies in the United States and Mexico and is ranked 317th on the Fortune 500 list of largest U.S. corporations.⁷² The company has been part of the consolidation of the chicken industry, purchasing rival brand Gold Kist in 2007. However, debt load from the Gold Kist acquisition resulted in Pilgrim’s Pride filing for bankruptcy

protection in 2008. In 2009, the Brazilian company JBS purchased a majority share of Pilgrim’s Pride, adding to its string of recent acquisitions in the United States. (For more on JBS, see page 29.)

For decades, Pilgrim’s Pride has repeatedly and egregiously violated its water quality permits, polluting local waterways.⁷³ It was also in 2007 the largest discharger of toxic substances to Texas waterways, releasing more than 1.5 million pounds of toxic pollution into Tankersley Creek.⁷⁴

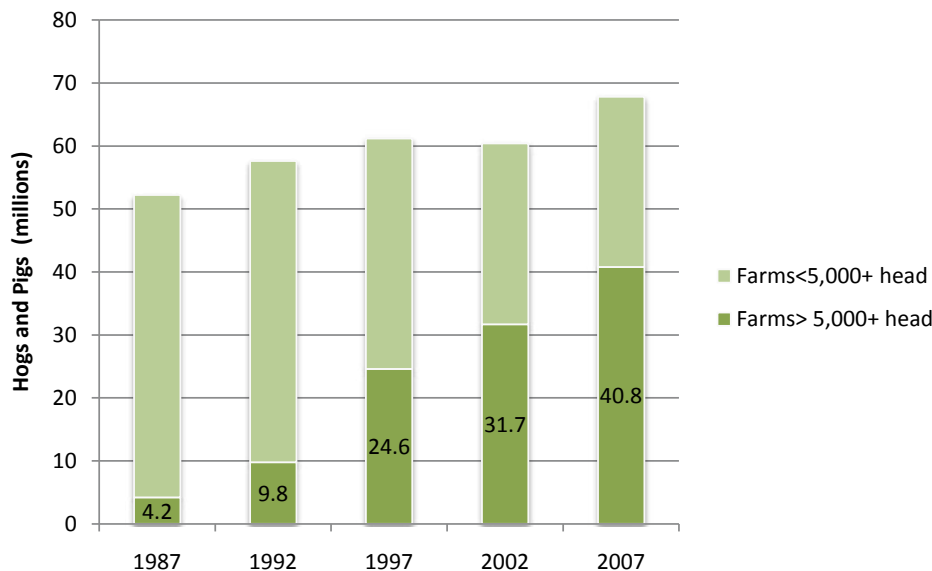
The company’s recent environmental performance suggests that little has changed. Over the last three years, the company has frequently exceeded its limits for permitted releases of ammonia, and is listed by the U.S. EPA as having been in non-compliance with Clean Water Act requirements every quarter from the third quarter of 2007 to the first quarter of 2010.⁷⁵ In 2010, the TCEQ fined Pilgrim’s Pride \$43,700 for a string of violations of clean water laws.⁷⁶

The Hog Bosses: Smithfield, Cargill and the Environmental Toll of Pork Production

The pork industry, like the chicken industry, has become highly consolidated and increasingly vertically integrated, with just a few large firms dominating the industry. The shift to more intensive methods of pork production has also left a legacy of pollution stretching from the ecologically important estuaries of North Carolina to the rivers of the Midwest.

Pork production has historically been centered in America’s Corn Belt – particularly Iowa. In recent years, however North Carolina has emerged as a major pork producing region, with the number of hogs and pigs in the state doubling between 1987 and 1992 and doubling

Figure 5. Increase in Share of Hogs and Pigs on Large Farms⁸⁰



again – to more than 10 million – by 2007.⁷⁷ In addition, there has been a nationwide shift toward larger hog farms. In 1987, less than 10 percent of the nation’s hogs and pigs were raised on very large farms of 5,000 animals or more. By 2007, more than 60 percent of America’s hogs and pigs were raised on these very large farms.⁷⁸ Over that span of time, the number of hogs and pigs raised on the very largest farms increased nearly 10-fold, from 4.2 million to 40.8 million.⁷⁹

Cargill and Smithfield Foods are two of the nation’s largest pork producers. Each company has a legacy of water pollution from its pork production operations.

Smithfield Foods and the Neuse River

The Neuse River traverses 248 miles on its way from central North Carolina to Pamlico Sound. The Neuse is not only an important ecological and recreational resource in its own right, but it also feeds

some of the nation’s most important and productive coastal estuaries.

Recently, however, the Neuse has become better known for the degradation it has experienced as a result of runoff from eastern North Carolina’s many concentrated animal feeding operations. The group American Rivers has listed the Neuse as among the nation’s 10 most endangered rivers in 1995, 1996, 1997 and 2007.⁸¹

The Neuse has been the site of several massive fish kills. The largest to date occurred in 1995, when more than 1 billion fish in the Neuse died. Scientists traced the cause to a toxic organism called *pfisteria*.⁸² A reporter at the Charleston, S.C. *Post and Courier* wrote that the microorganism “drugs schools of fish and sucks off their skin, sometimes leaving behind millions of carcasses with blood-red sores and holes the size of half dollars.”⁸³ Studying the organism, Dr. JoAnn Burkholder, director of the Center for Applied Aquatic Ecology at North Carolina State

University, found that it tended to thrive in nutrient-loaded waterways, polluted by sewage or runoff, “especially runoff from the state’s massive hog farms,” as noted by the *Post and Courier*. She told the paper that “pfiesteria has always been here, but we’ve been adding tons of nutrients to our estuaries, and we’ve slowly tipped things in favor of it. Pfiesteria is a sign of an estuary that’s out of balance.”⁸⁴

Fish kills slowed during the years of drought in the early 2000s, but picked up again in years with heavy rains. The latest fish kill happened in August 2009, when the Neuse Riverkeeper estimated that 100 million fish died.⁸⁵ The fish kill was concentrated in the brackish waters in the lower Neuse estuary, which the state’s Department of Natural Resources rates as having impaired water quality.⁸⁶

Water quality in the Neuse declined severely following the boom in hog farms in the region. In the 1980s and 1990s, Smithfield Foods – the world’s largest producer of pork – began a strategy of consolidation and vertical integration in the hog industry, acquiring competing slaughterhouses and buying hog farms, or entering into restrictive contracts with growers.⁸⁷ Through the strategy, Smithfield endeavored to control the production process from “squeal to meal” – or from birth to marketing of the final product.⁸⁸

Vertical integration dramatically increased Smithfield’s presence in North Carolina. Today, Smithfield is the leading owner of hogs in the state’s coastal plain, which is home to about 2,500 hog confinement buildings containing 10 million animals – a five-fold increase since the 1980s.⁸⁹ The Neuse River watershed itself contains more than 450 confined hog feeding warehouses holding more than 3 million hogs.⁹⁰ Just south of the watershed, Smithfield processes hogs at the world’s largest pork slaughterhouse, opened in 1992 in the town of Tar Heel.⁹¹

Those 10 million hogs generate as much fecal waste as 100 million humans⁹² – or roughly the entire human population of the United States west of the Mississippi River. Typically, Smithfield’s hog farming subsidiaries or contract hog growers collect hog manure and urine from the confinement building and store it in a nearby open-air lagoon. The companies then spray nearby fields with liquid waste, nominally as fertilizer.

Photo: Socially Responsible Agriculture Project, www.sraproject.org.



Smithfield Foods disposes of hog waste by spraying the untreated, liquid manure on fields using a manure spraying system like that pictured here.

However, the excessive spraying of waste disrupts the nutrient balance in the watershed. Application of liquid hog manure to nearby fields tends to exceed the ability of the land to safely absorb all of the nutrients. Moreover, cattle graze on the Bermuda grass grown on many sprayfields, effectively re-depositing the nutrients from the hog waste as manure and urine, instead of removing it from the system.⁹³ After storms, these excess nutrients run off of the sprayfield, con-

taminating groundwater and increasing nutrient levels in surface waterways.⁹⁴

Smithfield-style concentrated hog warehouses are perpetuating nutrient overloading in the Neuse River watershed. In 2006, Dr. Burkholder and a group of her colleagues published a study of nutrient loading in the Neuse River estuary from 1993 to 2005. They found that:

- Confined hog feeding warehouses produce more than half of all estimated phosphorus loading in the watershed, and more than a third of all nitrogen loading.⁹⁵
- The river was in a “eutrophic” (nutrient-overloaded) state, with periodic bursts of activity by algae and other microorganisms stimulated to grow in “blooms” by excess levels of nutrients carried into the river by rainfall.
- Ammonia loading increased by 500 percent over the study period. The scientists suspected hog operations as

the most likely source. Lagoon and sprayfield waste disposal systems add ammonia to both land and the air, where it can be washed into the river during storms.

- Dissolved oxygen levels decreased by 9 percent in the total water column – and decreased by close to 20 percent in the deepest waters. This is indicative of nutrient-driven overgrowth of algae and plants, which consume oxygen when they decompose, reducing the ability of the water to support a healthy and diverse community of wildlife.⁹⁶

In response to the problems caused by Smithfield’s hog manure lagoons and sprayfields, in 1997 the North Carolina General Assembly imposed a moratorium on the construction of new sprayfields, or the construction or expansion of new hog confinement warehouses larger than 250 animals.⁹⁷ The moratorium contained loopholes, however, which enabled hog farmers to add half a million animals, building 73 new hog farms and expanding 25 in the decade after the moratorium was passed.⁹⁸

To protect its operations in North Carolina, in 2000 Smithfield entered into a voluntary agreement with the state’s attorney general to fund a \$15 million research project into better methods of waste disposal and to implement any methods found to be both environmentally advantageous and cost effective.

In its 2010 regulatory filings, the company notes that “none of the technologies evaluated under the Agreement were found to be economically feasible for existing farms” and that it plans to continue using the lagoon and sprayfield waste disposal system in the state.⁹⁹ This is despite the fact that North Carolina is offering (through 2011) to cover 90 percent of the cost of a new system, up

Photo: Bob Nichols, USDA Natural Resources Conservation Service



Waste from North Carolina’s hog farms is typically stored in liquid manure lagoons.

to \$500,000, for each farm that commits to installing better waste treatment.¹⁰⁰ In 2008, the state made the moratorium on new lagoon and sprayfield systems permanent. Smithfield Foods noted in 2010 that “the moratorium limits us from expanding our North Carolina production operations.”¹⁰¹ While the moratorium will help to keep the problem from getting worse, the challenge of managing Smithfield’s huge impact on water quality in the Neuse River watershed and other key waterways in North Carolina remains.

Cargill and the Illinois River of Illinois

The Illinois River in Illinois (not to be confused with the Illinois River in Arkansas and Oklahoma, see page 21) flows more than 270 miles from the northeastern corner of the state to the Mississippi River, draining more than 40 percent of the state’s agricultural land and acting as the navigational connection between Lake Michigan and the Mississippi River.

The Illinois River exemplifies many of the water quality problems imposed by large-scale corporate agriculture. For generations, sediment from farm fields has choked the Illinois River. Peoria Lake – a broadening of the Illinois River adjacent to the city of the same name – has lost 68 percent of its volume since 1903.¹⁰² A comprehensive study by the U.S. Geological Survey in the late 1990s found that the lower Illinois River basin had among the highest concentrations of nutrients in the United States, including levels of nitrate in some locations that exceeded public health standards for drinking water.¹⁰³

The massive flow of nutrients into the Illinois River also has impacts far downstream. The state of Illinois is the leading contributor of both nitrogen and



The Illinois River is a leading contributor of nutrient pollution to the Mississippi River and the Gulf of Mexico.

phosphorus to the Gulf of Mexico via the Mississippi River, with the Illinois River serving as a main carrier of that pollution.¹⁰⁴

There is no one company or activity that is solely responsible for the pollution of the Illinois River. Scientists believe that the major source of nitrogen to the Illinois River is drainage from row crops such as corn and soybeans, with discharges from sewage treatment plants also a significant contributor.¹⁰⁵ However, given the decades of warnings about the polluted condition of the Illinois River and other waterways in the state, the first step would appear to be to not make matters worse.

Yet, an increase in pollution is exactly what has happened at a pork slaughterhouse run by Cargill, Inc. along the Illinois River, while the company’s plans to expand its hog-farming operations in Illinois could result in additional damage.

Cargill has been, along with ADM (see page 33), a major player in the development of the modern corn economy that

has contributed to nutrient pollution of the Illinois River and other American waterways. As of the late 1990s, Cargill was the second-largest producer of high-fructose corn syrup, trailing only ADM.¹⁰⁶ The company also owns two ethanol production plants, in Iowa and Nebraska.¹⁰⁷

Cargill's activities reach into many sectors of the agricultural economy. The company produces, processes and markets beef, poultry, eggs, oilseeds, sugar and many other food ingredients. It produces salt and steel and even has a financial services branch engaging in futures trading and risk management.¹⁰⁸

For most of the last decade, *Forbes* magazine has ranked Cargill as the largest privately held company in America, rivaled only by Koch Industries.¹⁰⁹ If Cargill were publicly owned, it would rank in the top 20 of the Fortune 500. In 2009, the company brought in more than \$110 billion in sales, earning a profit of more than \$3 billion.¹¹⁰

In Illinois, Cargill Meat Solutions' Beardstown facility, which discharges into the Illinois River, has the capacity to slaughter up to 18,000 head of pigs per day.¹¹¹ It is also, according to the U.S. EPA's Toxic Release Inventory, the second-largest industrial discharger of toxic chemicals to waterways in the state of Illinois and 13th largest industrial discharger in the United States, dumping more than 3 million pounds of toxic chemicals into the Illinois River during 2008.¹¹²

Virtually all of the plant's toxic releases were in the form of nitrates, which are produced when wastewater contaminated with blood or other slaughterhouse waste is discharged into waterways.¹¹³ Nitrate releases not only have the potential to foul drinking water supplies, but also add to the problem of nutrient pollution in the Illinois and Mississippi rivers and the Gulf of Mexico. Nitrate discharges from

the plant have increased tenfold since 1998, and have totaled more than 3 million pounds per year since 2005.¹¹⁴

The Beardstown pork processing plant isn't the only Cargill facility that has polluted waterways. Indeed, the Beardstown plant is one of three Cargill facilities to rank among the nation's top 20 industrial dischargers of toxic substances to rivers, streams, lakes and coastal waters in 2008.¹¹⁵ In July 2000, a Cargill Pork factory in Missouri (which has since been closed) dumped untreated hog waste into the Loutre River, killing more than 50,000 fish along a five-mile stretch.¹¹⁶ The company agreed to pay a \$1 million fine for the incident, and one of its employees was sentenced to five months in jail.¹¹⁷

About a quarter of the hogs processed at the Beardstown plant, along with Cargill's other major slaughterhouse in Ottumwa, Iowa, are raised by farmers under contract with Cargill.¹¹⁸ This vertical integration arrangement is similar to that employed by Tyson and Perdue in the chicken industry and Smithfield Foods in the pork industry.

In recent years, Cargill has sought to expand its contract hog farming operations in Illinois and other Midwestern states. According to one published account, the company sought to add as many as 30 hog farms in western Illinois, northern Missouri and southern Iowa – a move that would both extend the company's control of the supply chain and reduce transportation costs.¹¹⁹

Illinois' lax laws governing the establishment and regulation of CAFOs are making the company's job easier. In 2009, for example, a new contract hog farm opened in Sangamon County, Illinois, with a capacity to house more than 3,700 hogs. Neighbors of the facility filed a lawsuit seeking to block the facility. However, the farm's owner successfully argued that Illinois law allowed him to

proceed with construction without even a public hearing by claiming that the massive new facility was just an “expansion” of his previous 40-cow dairy farm.¹²⁰

Pork CAFOs, like other concentrated animal feeding operations, have a long history of non-compliance with clean water laws. A survey by the Illinois EPA found that 58 percent of swine CAFOs surveyed had at least one regulatory violation in 2009.¹²¹

Continued expansion of concentrated hog farming operations in Illinois by Cargill and other firms – coupled with rising pollution from hog processing facilities – threatens to exacerbate the nutrient pollution problems already faced by the Illinois River and waterways downstream.

Beef Factories: Pollution from JBS and Cargill Processing Plants

Unlike the production of chicken or pork, where individual firms control the entire production process from an animal’s birth through its appearance in the supermarket, the beef industry has long avoided vertical integration. Historically, independent ranchers have been responsible for breeding cattle and raising them to adolescence, at which time they are sold to feedlots – often large, factory-scale operations similar to other factory farms. At the feedlot, cattle are “finished” to slaughter weight by feeding them a diet of grain, and are then sold to beef packers, who slaughter the animals and process them for sale to consumers.

Packers have long been the most powerful players in the beef market, and their power has grown in recent years. Today, four companies slaughter 72 percent of the nation’s beef, compared with 30 percent in the 1960s.¹²² Beef packers have also taken the first steps into vertical inte-



Photo: bluebird13, istockphoto.com

Waste from slaughterhouse operations can be responsible for significant water pollution problems, including the routine discharge of nitrates and ammonia into rivers and streams.

gration by owning some cattle themselves or contracting with cattle producers. The four largest packers now obtain 40 percent of their cattle through arrangements other than the wholesale market, compared with 20 percent in 1986.¹²³ By owning or contracting for their own cattle, packers have the ability to exert greater control over the marketplace and possibly to manipulate markets.

Cattle ranching and feedlot operations have the potential to contribute to water pollution. But the most direct way to see the impact of large agribusiness firms is to review the track record of water pollution at beef slaughterhouses and packing plants.

JBS and Pennsylvania’s Skippack Creek

Located northwest of Philadelphia, Skippack Creek feeds the Perkiomen River, an important natural resource that provides drinking water and recreational opportunities for the regional population. Skippack Creek flows into the Perkiomen

just three miles above its junction with the larger Schuylkill River – a source of drinking water for more than 1.7 million people.¹²⁴

Along the banks of Skippack Creek lies a slaughterhouse now owned by the Brazilian firm, JBS, which processes about 2,000 cattle a day, producing 180 million pounds of boxed beef and 17 million pounds of ground beef per year.¹²⁵ The plant also renders leftover slaughter waste, including animal fat, bone and blood, along with kitchen grease from area restaurants, to create raw materials for manufacturing other products, including animal feed.¹²⁶

For decades, the plant was operated by Moyer Packing Co. before it was acquired by Smithfield, and then by the Brazilian-based firm, JBS. JBS is still an unfamiliar name to many American consumers, but acquisitions such as its purchase of the Pennsylvania plant have quietly made the company the world's largest beef producer and exporter.¹²⁷ In the United States, JBS purchased Swift & Company in 2007, then followed up by purchasing the poultry operations of Pilgrim's Pride and the beef processing operations of Smithfield Foods.¹²⁸ If the U.S. Justice Department hadn't intervened on antitrust grounds, JBS would have also bought the National Beef Packing Company, then the fourth-largest beef producer in the United States.¹²⁹

JBS now controls nearly a quarter of the U.S. beef processing market (tied for first), 22 percent of the U.S. poultry processing market through its majority ownership of Pilgrim's Pride (first), and more than 10 percent of the U.S. pork processing market (third).¹³⁰ In the United States, JBS owns 12 slaughterhouses, 11 cattle feedlots, more than 30 poultry processing plants, a hide tannery, and nearly two dozen regional distribution centers.¹³¹ In the United States, the company has the capacity to slaughter and package nearly

30,000 cattle, nearly 50,000 hogs, more than 7 million birds, and more than 4,000 sheep into meat products every day.¹³²

As JBS has snatched up agribusiness companies in the United States, it has also inherited a legacy of water pollution left behind by those companies. The pollution of Skippack Creek caused by the former Moyer packinghouse is just one example.

According to a complaint filed by the U.S. Environmental Protection Agency and the Pennsylvania Department of Environmental Protection against JBS in 2008, the plant used outdated equipment and regularly discharged water pollution into the Skippack Creek in excess of permitted amounts – and sometimes without even having a permit.¹³³ Excessive amounts of *E. coli*, ammonia, phosphorus, oil and grease were found in the creek downstream of the rendering plant.¹³⁴

In 2007, JBS's facility along Skippack Creek ranked as the 10th-largest industrial source of toxic pollution discharged to rivers in Pennsylvania that year by weight.¹³⁵ The company's rendering plant dumped more than 314,000 pounds of pollutants into Skippack Creek that year.¹³⁶

The plant also experienced periodic major pollution events that triggered fish kills.¹³⁷ In August 2007, an equipment failure allowed untreated, ammonia-filled wastewater to enter the creek, causing the levels of dissolved oxygen in the water to fall drastically, killing on the order of 10,000 fish along a full mile of the creek.¹³⁸ Lynda Rebarchak, a spokeswoman for the Pennsylvania Department of Environmental Protection, told the *Allentown Morning Call* that the spill was "one of the biggest we've seen in the region in recent years."¹³⁹ Another 15,000 fish died in spills in December 2007 and June 2008.¹⁴⁰

Facing an enforcement lawsuit under the federal Clean Water Act, JBS agreed in June 2010 to pay a \$1.9 million fine and build a \$6 million wastewater treatment plant at the facility.¹⁴¹

As JBS consolidates its purchases in the United States, the company faces a choice: continue the environmentally damaging practices of its predecessors, or turn over a new leaf. Residents of eastern Pennsylvania hope the company will choose the latter course.

Cargill and Colorado's South Platte River

The South Platte River is one of the great rivers of the American West, draining thousands of square miles of forests and grasslands on its way from the eastern flank of the Rocky Mountains, through the city of Denver, and across the Great Plains of Colorado and Nebraska. The South Platte is the principal source of water for communities and agriculture in Colorado's eastern plains.¹⁴²

In the mountains, fishermen consider the South Platte to be a gold medal trout stream, filled with trophy-sized rainbow and brown trout. But by the time the South Platte leaves Denver, its entire volume can consist of treated sewage discharge at times of low flow, with elevated levels of nutrients including nitrates, phosphorus, and ammonia.¹⁴³ Nutrient levels in the lower reaches of the South Platte often exceed U.S. EPA guidelines for controlling algae blooms and oxygen depletion, and the waterway does not support the full range of life that would exist in a clean river.¹⁴⁴

The Cargill Meat Solutions slaughterhouse in Fort Morgan, 80 miles downstream of Denver, is a major contributor to the problem. The plant processes 5,000 head of cattle and generates 1.5 millions of gallons of wastewater per day.¹⁴⁵ During normal operations, this plant emits massive amounts of pollution into the South Platte River. In fact, according to the Environmental Protection Agency's Toxics Release Inventory, this facility emits more raw pounds of toxic pollution

to waterways than any other industrial facility in Colorado, and is in the top 20 nationwide.¹⁴⁶

Over the 10 years from 1999 to 2008, the Cargill Meat Solutions slaughterhouse injected more than 27 million pounds of nitrate compounds into the South Platte River – more than 2 million pounds per year.¹⁴⁷

Cargill's plant has also polluted the waterway with bacteria. In 2004 and 2005, the Fort Morgan slaughterhouse released more *E. coli* bacteria into the South Platte River than allowed by permit. In November 2009, a federal judge fined the company \$200,000 for the violations, and the Environmental Protection Agency negotiated upgrades to the company's wastewater treatment facility.¹⁴⁸

Dairy Dangers: Factory Farms and the Death, Rebirth, and "Redeath" of a Great Lake

The resurrection of Lake Erie was once considered to be one of the signal accomplishments of the modern environmental movement. Considered to be a "dead lake" in the late 1960s, by the 1980s Lake Erie was once again supporting thriving populations of fish – thanks in large part to reductions in the flow of phosphorus to the lake.

Strong environmental regulations played a key role in restoring Lake Erie to health. Phosphorus was banned from detergents, sewage treatment plants upgraded their operations, and the use of streamside buffers and better agricultural practices reduced nutrient runoff from farms.

Once a success story, however, Lake Erie is back in trouble again. The dead zone in the lake has not only returned but continually worsened in recent years. During the summer of 2010, massive blooms of cyanobacteria – or blue-green

Photo: T. Archer, NOAA Great Lakes Environmental Research Laboratory



A harmful algae bloom covers the waters of the western basin of Lake Erie. Algae blooms have become more common in recent years – reversing decades of progress in the restoration of the lake.

algae – occurred in the western basin of Lake Erie. Scientists suspect that algae blooms and the associated depletion of oxygen may be responsible for declining populations of sport fish such as walleye and yellow perch in the lake.¹⁴⁹

The cause of the reemergence of the dead zone has been puzzling. Total phosphorus loading to the lake has typically been at or below the target level set by the United States and Canada to prevent algae blooms and oxygen depletion in the lake. A recent state task force in Ohio estimated that agriculture – when measured statewide – is in “phosphorus balance” for the first time in many years. And indeed, overall, the number of farm animals in the state has been on the decline.¹⁵⁰ All of these factors would seem to suggest that agribusiness is not a major contributor to the reemergence of the dead zone.

Over the last few years, however, scientists have discovered that, while total phosphorus loads to the lake have held steady, there has been a sharp increase in flows of dissolved reactive phosphorus

(DRP), which is particularly readily absorbed by plants, into the lake. Flows of DRP in two key western Lake Erie tributaries have increased significantly since the mid-1990s and are now higher than they were in the mid-1970s, when efforts to reclaim Lake Erie began in earnest.¹⁵¹

At the same time as DRP flows to Lake Erie have increased, Ohio and its neighboring states have experienced a dramatic shift from small-scale to factory-scale farming operations, with a particularly profound shift in the dairy industry. Between 1992 and 2007, the state of Ohio shed more than half of its small dairy farmers, while the percentage of the state’s dairy herd on farms of 200 cows or greater increased from 6.7 percent in 1993 to 36 percent in 2007.¹⁵²

In northwestern Ohio, southeastern Michigan and parts of Indiana, the past two decades have seen a proliferation of large, factory-style dairy operations, many of which can be traced back to a single firm called Vreba-Hoff Dairy Development.

Vreba-Hoff was founded by immigrants from the Netherlands and opened its first dairy in Michigan in 1997. After meeting financial success with its own dairies, the company began acting as a consultant, luring dozens of other dairy farmers from the Netherlands to set up factory-style dairy CAFOs in Ohio, Michigan and Indiana.¹⁵³

Ohio, Michigan and Indiana were considered attractive locations for dairy CAFOs at the time because of their lenient environmental regulations. Before the economy (and milk prices) collapsed in 2008, the company helped to broker the construction of more than 41 facilities in the three states.¹⁵⁴

In Michigan, the two dairies directly owned by Vreba-Hoff have a long his-

tory of environmental violations. The Michigan Department of Natural Resources and the Environment (DNRE) found that the dairies discharged waste to surface waters at least 49 times between 2001 and 2009.¹⁵⁵ In response to enforcement action by the state environmental agency, the dairies installed a waste treatment system to reduce the impact of their waste on local waterways. However, the system did not operate as expected and the company continued to spray its manure on local fields in quantities well above those permitted by the state. Vreba-Hoff has also failed to pay penalties related to its past environmental violations.¹⁵⁶ In October 2010, the DNRE asked a state court judge to reduce the number of cows that could be housed at the facilities until the dairies' discharges meet state standards.¹⁵⁷

Many of the dairies that Vreba-Hoff helped establish in the region have also run afoul of environmental laws. A southeastern Michigan group has documented more than 1,000 confirmed violations of environmental and other laws by dairy operations, many of them operated or established by Vreba-Hoff.¹⁵⁸ Similar patterns of violations have occurred at farms in Indiana and Ohio.¹⁵⁹

Is the manure produced on concentrated dairy farms run by companies like Vreba-Hoff partially responsible for the re-emergence of Lake Erie's dead zone? The scientific jury is still out, but there is good reason for concern.

Ohio's Lake Erie Phosphorus Task Force recently concluded that "there are changes in agriculture having an effect on the delivery of [dissolved reactive phosphorus] to Lake Erie."¹⁶⁰ Among those changes are shifts in tillage practices – including the widespread adoption of no-till farming, changes in drainage practices, and changes in how Ohio farmers fertilize their crops. The task force report notes that "it is apparent that some frac-

tion of the farming community is either over-applying or applying [phosphorus] without proper consideration to the timing or methods of application."¹⁶¹ Over-application or mis-application of manure often results in phosphorus finding its way into rivers, streams and lakes.

In addition, much of the growth in dairy CAFOs in the basin – particularly those established by Vreba-Hoff – has been in the watershed of the Maumee River, which drains parts of northeastern Indiana, southeastern Michigan and northwestern Ohio before flowing into Lake Erie at Toledo. Levels of DRP in Maumee River are now at their highest levels since at least 1975.¹⁶²

Citizens rallied to save Lake Erie once before. But it is becoming apparent that saving it again will require taking action against the proliferation of factory farms in the region, and holding existing factory farms accountable for cleaning up the pollution they cause.

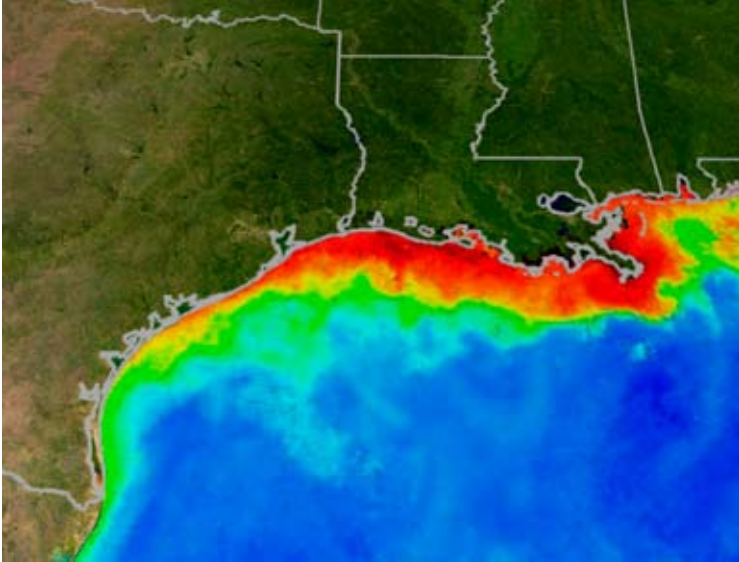
King Corn: ADM and the Gulf of Mexico Dead Zone

The Gulf of Mexico is home to a half-billion dollar fishery, as well as a vital tourism industry. The vast BP oil spill in the Gulf during 2010 caused immeasurable damage to the Gulf's ecosystems. But long before the BP spill, the Gulf of Mexico was in serious jeopardy.

Each year, the Gulf of Mexico develops an oxygen-depleted dead zone roughly the size of Massachusetts – one of the largest dead zones in the world.¹⁶³ The occurrence of such dead zones in the United States has increased 30-fold since 1960, along with the expansion of industrial agribusiness.¹⁶⁴

The culprit in the formation of the dead zone is the massive flow of nutrients from the Mississippi River and its tributaries.¹⁶⁵ As those rivers pass through

Photo: NASA/Goddard Space Flight Center Scientific Visualization Studio



This image, generated by NASA, shows the shape of the dead zone in the Gulf of Mexico in 2004. The dead zone, a region of low dissolved oxygen levels, is caused by runoff of nutrients into the Mississippi River basin. Excess nutrients fuel the growth of algae blooms, which decompose, consuming oxygen from the water and threatening the health of the half-billion-dollar fishery in the Gulf.

America's agricultural heartland, they carry nitrogen and phosphorus downriver to the Gulf of Mexico. Those nutrients in turn drive the growth of algae blooms. When the algae die and decompose, the process consumes oxygen dissolved in the water. Once oxygen levels fall enough, the water becomes unable to support life – creating a dead zone.

No crop has greater responsibility for nutrient pollution of the Gulf of Mexico than corn. And no company is more responsible for the development of America's corn economy than Archer Daniels Midland.

Corn plays an important role in the formation of the Gulf dead zone. The dead zone is caused by algae blooms fueled by nutrients – nitrogen and phosphorus – that are carried downstream into the Gulf from the Mississippi River. Corn

and soybeans are responsible for more than half of the nitrogen and a quarter of the phosphorus that finds its way into the Gulf.¹⁶⁶ The National Research Council of the National Academy of Sciences has found that corn is “the major source of total nitrogen loading to the Mississippi River.”¹⁶⁷ The NRC also found that:

- Nitrate concentrations in rivers are the highest in the Corn Belt in the Midwestern United States, where nitrogen fertilizers are applied in the greatest amounts.
- Depending on rainfall levels, on the order of 15 to 36 percent of the nutrients applied to a corn plantation in the Midwest end up in downstream rivers and lakes.¹⁶⁸

Adding to the challenge is the fact that much of America's corn is grown in parts of the Midwest that use subsurface tile drainage, which improves agricultural productivity by lowering the water table by draining water into ditches. Recent research suggests that intensive farming of fertilized crops on tile-drained land is an important contributor to nitrogen pollution in the Mississippi River and Gulf of Mexico.¹⁶⁹

These problems are exacerbated by the fact that American farmers now plant more corn each year than they did in the early 2000s. In 2010, American farmers planted an additional 12.1 million acres of corn – an area twice the size of Maryland – compared with 2001, adding additional strain from nutrient pollution to waterways in America's heartland and the Gulf of Mexico.¹⁷⁰

Why are American farmers planting so much corn? The answer is not necessarily to provide Americans with nutritious food. Rather, it is a response to federal policies that have encouraged the use of corn-based ethanol as a vehicle fuel, increased the amount of high-

fructose corn syrup in American diets, and provided a cheap source of grain that has fueled the growth of concentrated animal feeding operations.

One of the companies that has been most influential in crafting America's corn economy – and that has benefited most from its emergence – is Archer Daniels Midland, or ADM.

ADM is the leading processor of corn – a crop that covers much of the farmland in America's Midwest. ADM produces animal feed, ethanol fuel, and high-fructose corn syrup. With the partial exception of animal feed, all of these are markets for corn that did not exist 50 years ago and would likely not exist today were it not for federal policies. Ethanol, corn-based sweeteners and other corn “bioproducts” accounted for nearly \$1 billion in profit for ADM in 2008.¹⁷¹

With its enormous size, substantial market power, and weighty political clout, ADM has created a public policy and economic environment that encourages many Midwestern farmers to grow corn in massive, factory-scale plots. The corn market in the United States owes its current shape to three ADM-supported policies – federal subsidies for corn farmers, support for ethanol production, and protection for the domestic sugar market.

Subsidies for Corn Production

In the 1970s, ADM was run by a politically connected executive, Dwayne Andreas, who became well known for contributing hundreds of thousands of dollars to political campaigns across the ideological spectrum. From 1989 to 2010, Archer Daniels Midland contributed more than \$8 million to political campaigns.¹⁷²

Andreas told the *Washington Post* in 1996 how he and ADM consultant Martin Sorkin worked with Vice President Hubert Humphrey and Illinois Senator

Everett Dirksen to draft legislation that allowed the federal Food for Peace program to sell processed food and not just raw ingredients. He said, “It changed the whole world, because now it was the products we [at ADM] sell, not the products we buy.”¹⁷³

Andreas was also one of the earliest promoters of the idea of selling agricultural surpluses to Communist nations, an idea that was finally implemented – to ADM's great benefit – by the Nixon administration in 1972.¹⁷⁴ Those sales – especially the \$700 million sale of grain to the Soviet Union – set the stage for a sea change in agricultural policy in the United States that gave a major boost to ADM's profitability.

Since the New Deal, the federal government had worked to stabilize farm prices by keeping grain out of the market during years of bumper crops using a variety of mechanisms, including financial incentives for farmers to keep land out of production and to store excess grain as well as direct federal purchases of surplus crops. The 1972 grain sales to the Soviet Union, however, coupled with a poor harvest in the United States and other factors, created a temporary grain shortage that sent supermarket prices through the roof.¹⁷⁵

To prevent future shortages, the Nixon administration and Congress shifted U.S. agricultural policy to encourage – rather than discourage – the surplus production of grains such as corn. To prevent a collapse in prices, the 1973 Farm Bill allowed the Department of Agriculture to pay farmers directly when market prices for their crops fell below their production costs. For example, if corn costs \$3.50 a bushel to produce, federal policy allows farmers to sell (and processors such as ADM to purchase) that corn at \$2.50 a bushel on the open market, with the difference made up through a check paid directly to the farmer by the

federal government.¹⁷⁶ While ADM does not receive the money directly, the subsidy greatly benefits the company by encouraging farmers to plant as much corn as possible – thereby assuring a flow of cheap inputs for processors such as ADM. Earl Butz, the secretary of agriculture under the Nixon administration and a leading advocate for the 1973 Farm Bill, famously urged farmers to “plant fencerow to fencerow,” and to “get big or get out.”¹⁷⁷

This was a major shift in farm policy, and the subsidy persists today. Between 1995 and 2009, corn drew nearly \$76 billion in federal subsidies – more than any other crop.¹⁷⁸ These payments ensure cheap inputs for factory hog farms and feedlots, while helping huge grain processors like ADM to engineer lucrative markets for processed food ingredients and ethanol.

Protection for the Domestic Sugar Market

In his book, *Against the Grain*, author Richard Manning describes how ADM financed a lobbying effort that resulted in policies designed to protect the American sugar industry from international competition – allowing ADM to cut into the domestic sugar market with its corn-based sweeteners.¹⁷⁹

In the 1970s, ADM developed a process for manufacturing high fructose corn syrup by “wet milling” corn. The company planned to market this product as a food additive in place of sugar, increasing sales and profits. The only obstacle to this plan was that the market price for sugar was cheaper than the price for which ADM could produce corn syrup.¹⁸⁰

Instead of finding a cheaper way to make corn syrup, Andreas and his team came up with a strategy to make sugar more expensive – thereby enabling ADM to compete in the sweetener

market. As described by Manning, ADM helped to finance a lobbying effort by Florida sugarcane growers to protect themselves from international competition. The campaign succeeded. In 1982, Congress imposed a cap on the import of foreign sugar, which raised the price of sugar two- to three-fold above the world market price.¹⁸¹ Suddenly, ADM’s corn syrup product became competitive, prompting processed food and beverage manufacturers to switch from sugar to cheaper corn syrup.

Today, corn-based sweeteners are now the leading additive in processed foods and beverages. The average American today eats about 50 pounds of high fructose corn syrup per year – up from almost none in 1975.¹⁸² Without ADM, and the protectionist sugar policies that persist today, there would be no market for corn-based sweeteners. These policies contribute to the pressure on Midwestern farmers to grow large amounts of corn.

Ethanol Subsidies

ADM found that demand for high fructose corn syrup decreased in the winter and increased in the summer, driven by changes in public demand for sweetened beverages. Looking for a way to capitalize on the excess production capacity created by this pattern, ADM settled on ethanol – and particularly ethanol from corn – which it could manufacture through the same wet milling process used to make corn syrup.

According to the *New York Times*, “ADM spent nearly three decades pushing relentlessly for the use of ethanol in gasoline, lobbying Congress and the White House and rousing farmers.”¹⁸³ In a report called “A Case Study in Corporate Welfare,” the Cato Institute relates how CEO Andreas approached President Carter in 1978 with a plan to promote U.S. energy independence through a tax break on ethanol, achieved in the Energy



Federal subsidies and targets for ethanol production have pushed American farmers to plant an additional 12 million acres of corn compared with a decade ago.

Tax Act passed later that year.¹⁸⁴ In 1979, Carter added support for ethanol by creating a loan guarantee program for new ethanol plants and put a tariff on Brazilian ethanol made from sugar.

Support for corn ethanol has continued. In the 2005 Energy Bill, Congress renewed huge tax incentives for ethanol production, and ordered producers to refine 7.5 billion gallons of the fuel per year by 2012, in the name of reducing dependence on foreign oil.¹⁸⁵ Achieving this mandate will require the planting of an estimated 3.7 million additional acres of corn in the United States.¹⁸⁶

Over the past several decades, ADM's ethanol profits have risen along with government subsidies for the fuel – which now exceed 50 cents per gallon.¹⁸⁷ ADM's advocacy efforts have ensured

that American ethanol largely comes from corn rather than sugar, a cheaper raw ingredient.¹⁸⁸ As a result, farmers face increasing pressure to plant ever-larger corn plantations on available land across the Midwest.

By using its political influence, ADM has profited immensely. As a result, federal taxpayers now subsidize the growth of the dead zone in the Gulf of Mexico.

Policy Recommendations

Control of America's system of food production has become increasingly concentrated in the hands of a few large corporations, which in turn have helped reshape the way America produces food, often to the detriment of our environment. In particular, the industrial concentration of livestock operations – from the grain it demands to the manure it produces to the processing of its end-products – has taken a severe toll on our nation's waterways.

Fortunately there are important steps that local, state and federal governments can take immediately to reduce the threat corporate agribusiness poses to waterways.

1. Ban the worst practices. States such as North Carolina as well as local governments around the nation have adopted moratoria on the opening of new CAFOs. While

enforcement of these moratoria has varied, there is an urgent need to put the brakes on the expansion of CAFOs until key questions regarding their impacts on the environment and public health are addressed and effective systems are put in place to ensure that CAFO pollution does not poison America's waterways.

In addition, states should impose outright bans on the worst corporate agribusiness practices, including the winter spreading of manure in cold-weather states, which dramatically increases the potential for runoff into rivers and streams.

2. Guarantee protection to all of America's waterways. A core protection of the federal Clean Water Act is that discharges of pollution to our waterways are strictly limited in permits written to ensure clean water. However, a series of

court decisions, culminating in the U.S. Supreme Court's 2006 decision in the case of *Rapanos v. United States*, have threatened to strip this protection from thousands of intermittent and headwaters streams and isolated wetlands across the country. Consequently, where CAFOs or other industrial agribusiness operations begin dumping pollution into one of these unprotected waters, the U.S. EPA would have little ability to stop them. Already, EPA reports that more than 500 enforcement cases have been compromised because of this new legal loophole.¹⁸⁹ Either Congress or federal agencies can rectify this problem by clarifying that the Clean Water Act protects all of America's waterways. Significantly, the Farm Bureau and several agribusiness interests have been among the most vocal opponents of legislation to close this loophole.

3. Hold corporate agribusiness responsible for its pollution.

Vertically integrated poultry and pork firms have been allowed to gain the benefits of control over the production process while disclaiming responsibility for the pollution their animals produce. Various legal efforts around the country are making headway in establishing these firms' legal responsibility for keeping pollution from their animals out of our waterways, but the issue is so clear-cut that there should be no ambiguity. State and federal law should clearly assign joint and several liability for the waste produced at contract farm operations to vertically integrated firms. This simple clarification of legal responsibility will provide vertically integrated firms with a powerful incentive to invest in

the pollution controls necessary to keep animal waste out of our waterways.

4. Enforce existing laws. Existing clean water laws give the state and federal governments several powerful tools to address pollution from agribusiness. Often, however, these tools are left unused. Specifically, governments should:

- a. Require agribusiness operations to implement mandatory, enforceable, numeric reductions in nutrient runoff or other forms of pollution as part of comprehensive plans (known as Total Maximum Daily Loads, or TMDLs) to meet water quality standards in specific waterways. The U.S. EPA is scheduled to finalize the TMDL for the Chesapeake Bay, and the Bay states' plans to implement it, by the end of 2010. The open question is whether the states' plans will be strong enough to rein in agribusiness pollution – including the 1.1 billion pounds of chicken litter generated annually by the demands of Perdue and other agribusiness operations on the Delmarva Peninsula.
- b. Issue water pollution permits for all CAFOs that discharge or propose to discharge to waterways, including those which, upon inspection, demonstrate a likelihood of discharging to a waterway. These permits set legal limits for the amount of pollution that CAFOs may discharge to local waterways. But while permitting is at the core of the Clean Water Act's system for regulating pollution from large facilities, as of early 2008, less than half of the nation's CAFOs had permits.¹⁹⁰

States generally bear the responsibility for enforcing the Clean Water Act, and should be required to issue permits that are strong enough to protect local waterways from pollution.

- c. Guarantee uniform enforcement across states. Historically, agribusiness firms have expanded their operations in parts of the country with lax environmental standards – undermining the mission of the Clean Water Act, which is to assure clean water for all Americans. The U.S. Environmental Protection Agency should ensure that states take sufficient action to prevent agribusiness pollution, or withdraw enforcement authority from states that persistently refuse to do so. There are signs that this is beginning to occur: a recent EPA investigation found that the state of Illinois failed to issue required permits to CAFOs, has failed to adequately inspect CAFOs to determine their compliance with environmental laws, and has failed to ensure that CAFOs that violate the law return to compliance or pay appropriate penalties.¹⁹¹ The U.S. EPA has laid out specific criteria Illinois must meet in order to retain its authority to enforce the law.

5. Give environmental laws real teeth. Even when agribusiness firms are caught in the act of polluting our waterways, the penalties and enforcement actions to which they are subject fail to deter future pollution or compensate for the additional profits received as a result of skirting environmental laws. Firms such as the Vreba-Hoff dairies in Michigan (see page 31) can compile a decade-long record of environmental viola-

tions and still remain in business. To provide a real deterrent to pollution from corporate agribusiness, state and federal governments should beef up enforcement by adding additional inspectors and enforcement officers, and create tough penalties for major or repeated violations of environmental laws, including mandatory minimum penalties and bans that prevent repeat violators of environmental laws anywhere in the nation from securing new permits.

6. Empower local communities.

Several states limit the ability of local zoning boards to ban or impose conditions on factory farming operations. Since local communities bear the brunt of factory farm operations, they should have the authority to prohibit or limit them – as they would with most other land use/zoning decision in most states. States should eliminate any provisions or policies that limit the authority of local governments to regulate land use related to factory farm operations.

7. Ensure environmental transparency.

In 2008, the U.S. Government Accountability Office issued a report concluding that “no federal agency collects accurate and consistent data on the number, size and location of CAFOs.”¹⁹² The lack of information about CAFOs makes it virtually impossible for citizens to assess their impact on the environment or their compliance with environmental standards. With creation of the Toxics Release Inventory in 1987, the United States ensured that citizens were given access to information about the discharge of toxic chemicals in their neighborhoods. Given the tremendous damage caused by discharge of nutrients, bacteria,

pesticides and other pollutants from agribusiness operations, there is no reason why they should be subject to any less transparency. The federal government should devise systems to provide the public with more information about pollution from agribusiness operations.

8. Encourage better practices. The flip side of tightening enforcement of environmental laws is encouraging farmers to implement better practices that are less damaging to the environment. Federal and state governments, acting in cooperation with farming organizations and the extension services of land-grant universities, should provide outreach, information, and resources to help farmers implement practices that reduce the flow of polluted runoff to America's rivers and streams. This incentives-based "best practices" approach has proven to be inadequate as the cornerstone of the nation's effort to address agribusiness pollution, but it remains an important element of any program to ensure that farmers are aware of better ways to produce crops and are able to implement those solutions quickly.

9. Look for systemic solutions. At the root of the water pollution problem caused by agribusiness is a system of food production that is heavily subsidized by the public and controlled by only a few firms. Public subsidies have arguably shifted America's food system to one that is less beneficial both for Americans' health and our waterways, and facilitated the emergence of massive agribusiness firms with tremendous control over the marketplace. State and federal governments should consider deeper policy changes that

shift the nation to a more sustainable system of food production for the future. The Department of Justice is currently reviewing anti-trust concerns within the agribusiness sector, and Congress is expected to take up the Farm Bill in 2012.

Notes

1. Letter from Thomas Jefferson to John Jay, 1785, as quoted in Eyer Robert Coates, Sr., *Thomas Jefferson on Politics and Government*, downloaded from etext.virginia.edu/jefferson/quotations/jeff1320.htm, 20 September 2010.
2. Letter from Thomas Jefferson to George Logan, 1816, as quoted in Eyer Robert Coates, Sr., *Thomas Jefferson on Politics and Government*, downloaded from etext.virginia.edu/jefferson/quotations/jeff1320.htm, 20 September 2010.
3. There are many potential definitions of “agribusiness.” The term is sometimes used as a generic description for business-oriented farms, or as a catch-all term for the entire agriculture sector of the economy, including businesses that manufacture or supply products used on farms. In this report, we mean the term “agribusiness” to refer to agricultural production carried out at a large scale. “Agricultural production” includes not only the raising of plants or animals on the farm itself, but also the processing of raw materials from farms into consumer-ready products. There are other economic actors – such as food retailers – that have potentially great impacts on how food is produced in the United States, but we do not address those actors in this report. “Large scale” is an inherently subjective term, but can be interpreted to refer to production at an industrial scale.
4. U.S. Environmental Protection Agency, *Watershed Assessment, Tracking, & Environmental Results: National Summary of State Information*, downloaded from iaspub.epa.gov/waters10/attains_nation_cy.control, 10 September 2010.
5. Ibid.
6. Executive Office of the President of the United States, Office of Science and Technology Policy, Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health, *Scientific Assessment of Hypoxia in U.S. Coastal Waters*, September 2010.
7. U.S. Environmental Protection Agency, *Protecting Water Quality from Agricultural Runoff*, February 2003.
8. U.S. Environmental Protection Agency, “5.11: Fecal Bacteria,” in *Monitoring and Assessing Water Quality*, downloaded from water.epa.gov/type/rsl/monitoring/vms511.cfm, 10 September 2010.
9. Fortune, *Fortune 500: 2010 List*, downloaded from money.cnn.com/magazines/fortune/fortune500/2010/full_list/, 17 September 2010.
10. Based on 2009 revenues of \$115 billion from Cargill, *Five-Year Financial Summary*, downloaded from www.cargill.com/company/financial/five-year/index.jsp, 17 September 2010, and comparable revenue figures from Fortune, *Fortune 500: 2010 List*, downloaded from money.cnn.com/magazines/fortune/fortune500/2010/full_list/, 17 September 2010.
11. Government Accountability Office, *Agricultural Concentration and Agricultural Commodity and Retail Food Prices: Briefing for Congressional Staff*, 24 April 2009.
12. Ibid.
13. Lyndsey Layton, “As Egg Producers Consolidate, Problems of Just One Company Can Be Far-Reaching,” *Washington Post*, 24 August 2010.
14. See note 11.
15. Smithfield Foods, *Smithfield Foods 2001 Annual Report*, undated.
16. “Fitch Assigns Initial IDR of B+ to Dean Foods; Outlook Stable,” *Business Wire*, 24 August 2010.
17. Patricia Breakey, “Franklin Farmers File Lawsuit,” *Oneonta Daily Star*, 16 June 2010.
18. “DFA and Two Former Execs Hit with \$12 Million Penalty,” *Farm and Dairy*, 17 December 2008.
19. See note 17.
20. Higher costs: James M. MacDonald, William D. McBride and Eric J. O’Donoghue, “Low Costs Drive Production to Large Dairy Farms,” *Amber Waves*, September 2007.
21. See note 11.
22. Ibid.
23. U.S. Department of Agriculture,

Agricultural Statistics 2009, 2009, as well as *Agricultural Statistics* annual reports for 1994, 1999, and 2004.

24. *Ibid.*

25. Concentration of various livestock industries has increased in states since the mid-1970s: Chantal Line Carpentier, Deepananda Herath and Alfons Weersink, Winrock International, *Environmental and Other Factors Influencing Location Decisions of Livestock Operations*, 2005.

26. See note 11.

27. U.S. Department of Agriculture, National Agricultural Statistics Service, 2007 *Census of Agriculture*, 4 February 2009; U.S. Department of Agriculture, *U.S. Census of Agriculture 1950: Agriculture 1950: A Graphic Summary*, 1952.

28. Third largest: WATT Poultry USA, February 2010, as cited in Delmarva Poultry Industry, *Facts About Maryland's Broiler Chicken Industry*, August 2010. Eastern U.S.: "Perdue Is First and Only Chicken Company to Receive USDA Process Verified Seal," *PRNewswire*, 10 February 2010; \$4.6 billion from Perdue, *About Us*, downloaded from www.perdue.com/company/about/index.html, 28 October 2010.

29. Dale Keiger, "Farmacology," *Johns Hopkins Magazine*, June 2009.

30. Chesapeake Bay Program, *Bay FAQ*, downloaded from www.chesapeakebay.net/bayfaq.aspx?menuitem=14589#care, 17 September 2010.

31. Chesapeake Bay Program, *Bay History*, downloaded from www.chesapeakebay.net/bayhistory.aspx?menuitem=14591, 17 September 2010.

32. Arsenic: Bette Hilleman, "Arsenic in Chicken Production," *Chemical and Engineering News*, 9 April 2007.

33. U.S. Poultry and Egg Association, *Industry FAQ*, downloaded from www.poultryegg.org/faq/faq.cfm, 2 September 2010.

34. 568 million chickens from Delmarva Poultry Industry, Inc., *Look What the Poultry Industry Is Doing for Delmarva*, January 2010. Some of this chicken production, particularly in Delaware, does not occur in the Chesapeake

Bay watershed, but the vast majority occurs in counties that are inside the watershed.

35. See, for example, U.S. Environmental Protection Agency, *EPA Orders Two Virginia Farms to Cease Unpermitted Waste Discharges to the Shenandoah River* (press release), 2 June 2010.

36. Chesapeake Bay Foundation, *Manure's Impact on Rivers, Streams and the Chesapeake Bay: Keeping Manure Out of the Water*, 28 July 2004.

37. 8.5 million acres: Chesapeake Bay Program, *Bay Barometer: A Health and Restoration Assessment of the Chesapeake Bay and Watershed in 2008*, March 2009.

38. Caitlin Kovzelove, Tom Simpson and Ron Korcak, Water Stewardship, *Quantification and Implications of Surplus Phosphorus and Manure in Major Animal Production Regions of Maryland, Pennsylvania and Virginia*, February 2010.

39. Chesapeake Bay Program, *Sources of Phosphorus Loads to the Bay and Sources of Nitrogen Loads to the Bay*, downloaded from www.chesapeakebay.net, 2 September 2010.

40. Delmarva Poultry Industry, *Facts About Maryland's Broiler Chicken Industry*, August 2010.

41. Chesapeake Bay Program, *Dissolved Oxygen*, downloaded from www.chesapeakebay.net/status_dissolvedoxygen.aspx?menuitem=19675, 2 September 2010.

42. S. Bricker, et al., National Oceanic and Atmospheric Administration, *Effects of Nutrient Enrichment in the Nation's Estuaries: A Decade of Change*, 2007.

43. *Ibid.*

44. Virginia Institute of Marine Science, *Bay Grasses Up, But Below Goal*, 28 April 2010.

45. Chesapeake Bay Program, *Maryland Receives Federal Aid to Help Blue Crab Industry*, January 2009; and National Oceanic and Atmospheric Administration, *NOAA Approves \$10 Million Disaster Assistance Grant for Virginia Watermen*, 19 May 2009.

46. "Denies responsibility," see: *Memorandum, U.S. District Court for the District of Maryland, Assateague Coastkeeper, et al. v. Alan and Kristin Hudson Farm, et al.*, 20 July 2010.

47. *Ibid.*

48. 33 U.S.C. 1316 (a)(4)

49. Oklahoma Scenic Rivers Commission,

Oklahoma State University and National Park Service, *The Illinois River Management Plan 1999*, December 1998.

50. Oklahoma Conservation Commission, *Illinois River Watershed Monitoring Program, National Monitoring Project: Post-Implementation Monitoring Summary Report – Year 2, Evaluation of Post-Implementation Monitoring*, July 2007.

51. U.S. Environmental Protection Agency, *2008 Waterbody Report for Illinois River*, downloaded from iaspub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=&p_au_id=OK121700030010_00&p_cycle=2008&p_state=OK, 17 September 2010.

52. Justin Juozapavicius, “Expert: Recreation on Illinois River Has Declined,” *Seattle Times*, 10 November 2009.

53. James S. Tyree, “Waste Worries, Ag, AG Square Off,” *Tahlequah Daily Press*, 15 June 2006.

54. Oklahoma Office of the Attorney General, *AG Sues Poultry Industry for Polluting Oklahoma Waters* (press release), 13 June 2005.

55. Tyson Foods, *Fiscal Year 2009 Fact Book*, undated.

56. Average chicken: 5.62 pounds, feed to weight ratio: 1.92 = 10.8 pounds of feed per chicken, 442.8 million pounds of feed per week, 23 billion pounds of feed per year. Ibid.

57. Based on data from U.S. Department of Agriculture, National Agricultural Statistics Service, *2007 Census of Agriculture*, downloaded from www.agcensus.usda.gov, 13 May 2010.

58. See note 54.

59. Oklahoma Conservation Commission, *Watershed Based Plan: Grand Lake (Oklahoma Portion) For Control of Nutrients, Sediment and Fecal Bacteria*, updated August 2004.

60. Ibid.

61. Richard B. Alexander, et al., “Differences in Phosphorus and Nitrogen Delivery to the Gulf of Mexico from the Mississippi River Basin,” *Environmental Science and Technology*, 42: 822-830, 2008. Supplemental materials available from U.S. Geological Survey at water.usgs.gov/nawqa/sparrow/gulf_findings/index.html.

62. Robert J. Smith, “Poultry Firms Back

Askins in Oklahoma Governor Run,” *Arkansas Democrat-Gazette*, 30 July 2010.

63. U.S. Army Corps of Engineers, *Lake o’ the Pines*, downloaded from corpslakes.usace.army.mil/visitors/projects.cfm?Id=M205850, 25 October 2010.

64. Glenn Evans, “Lake o’ the Pines Beaches Remain Closed for E. coli,” *NewsJournal* (Longview, Tex.), 22 June 2010.

65. Texas Commission on Environmental Quality, *One Total Maximum Daily Load for Dissolved Oxygen in Lake o’ the Pines*, 7 June 2006.

66. Ibid.

67. Bob Hallmark, “Businesses Struggle After Beach Closings at East Texas Lake,” *KLTV.com*, 12 July 2010.

68. See note 65.

69. Ibid.

70. Ibid.

71. Ibid.

72. *Fortune*, “Fortune 500: 317. Pilgrim’s Pride,” downloaded from cnmoney.eu/magazines/fortune/fortune500/2010/snapshots/884.html, 25 October 2010.

73. Consumers Union, *Animal Factories: Pollution and Health Threats to Rural Texas*, May 2000.

74. Tony Dutzik, Piper Crowell and John Rumpler, Environment America Research & Policy Center, *Wasting Our Waterways: Toxic Industrial Pollution and the Unfulfilled Promise of the Clean Water Act*, Fall 2009.

75. U.S. Environmental Protection Agency, *Enforcement and Compliance History Online: Detailed Facility Report: Pilgrim’s Pride Mount Pleasant, Texas*, downloaded from www.epa-echo.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=110000598844, 25 October 2010.

76. Texas Commission on Environmental Quality, *Executive Summary: Enforcement Matter, Docket No. 2009-1337-IWD-E, Pilgrim’s Pride Corporation*, downloaded from www7.tceq.state.tx.us/uploads/eagendas/Agendas/2010/4-14-2010/1337iwd.pdf, 25 October 2010.

77. U.S. Department of Agriculture, National Agricultural Statistics Service, *2007 Census of Agriculture*, 4 February 2009, and similar reports for previous years.

78. Ibid.
79. Ibid.
80. Ibid.
81. North Carolina Office of Environmental Education, *Neuse River Basin*, downloaded from www.ee.enr.state.nc.us/public/ecoadress/riverbasins/neuse.150dpi.pdf, 17 September 2010.
82. Tony Bartelme, "Scientists Track the 'Phantom'," *The Post and Courier (Charleston, SC)*, 1 September 1996.
83. Ibid.
84. Ibid.
85. Rick Dove, North Carolina Riverkeepers and Waterkeeper Alliance, *Fish Kills of the Neuse*, downloaded from www.riverlaw.us/fishkills.htm on 29 July 2010.
86. Impaired: North Carolina Department of the Environment and Natural Resources, Division of Water Quality, *Final Neuse River Basinwide Water Quality Plan*, July 2009, Chapter 10.
87. Smithfield Foods, *A Look Back at the Smithfield Foods History*, downloaded from www.smithfieldfoods.com on 13 July 2010; David Barboza, "Goliath of the Hog World; Fast Rise of Smithfield Foods Makes Regulators Wary," *New York Times*, 7 April 2000.
88. Lewis Little, president of Smithfield Packing Company, commented in the company's 2001 annual report that "vertical integration gives us control over our pork products from squeal to meal." See note 15.
89. Leading owner: Neuse Riverkeeper Foundation, *Hogs and CAFOs*, downloaded from www.neuseriver.org/neuseissuesandfacts/hogsandcafes.html on 27 July 2010. Hog farm and animal quantities: Rick Dove, *Statement of Richard Dove Community Representative*, Testimony before the United States Senate Committee on Environment and Public Works, 6 September 2007.
90. JoAnn Burkholder, et al., "Comprehensive Trend Analysis of Nutrients and Related Variables in a Large Eutrophic Estuary: A Decadal Study of Anthropogenic and Climatic Influences," *Limnology and Oceanography* 51: 463-487, doi: 10.4319/lo.2006.51.1_part_2.0463, 2006.
91. Smithfield Foods, *A Look Back at the Smithfield Foods History*, downloaded from www.smithfieldfoods.com on 13 July 2010.
92. Rick Dove, Neuse Riverkeeper emeritus, quoting Dr. Mark Sobsey, professor of environmental sciences and engineering at the University of North Carolina School of Public Health, in North Carolina Riverkeepers and Waterkeeper Alliance, *Real Hog Facts*, downloaded from www.riverlaw.us/realhogfacts.html on 26 July 2010.
93. Robbin Marks, et al., Natural Resources Defense Council and Clean Water Network, *America's Animal Factories: How States Fail to Prevent Pollution from Livestock Waste*, December 1998.
94. JoAnn Burkholder, et al., "Impacts of Waste from Concentrated Animal Feeding Operations on Water Quality," *Environmental Health Perspectives* 115: 308-312, doi: 10.1289/ehp.8839, 14 November 2006.
95. See note 90.
96. J. Walker, et al., "Trends in Ammonium Concentration in Precipitation and Atmospheric Ammonia Emissions at a Coastal Plain Site in North Carolina, U.S.A." *Environmental Science and Technology* 34: 3527-3534, 2000.
97. Margaret Lilliard, "Permanent Phase-Out of Swine Farm Waste," *Associated Press*, 26 July 2007.
98. Associated Press State and Local Wire, "Despite Moratorium, More Hog Farms Built in N.C. in Past 10 Years," *The Charlotte News & Observer*, 23 March 2007.
99. Smithfield Foods, *Form 10-K*, Securities and Exchange Commission Document 1-15321, 18 June 2010.
100. See note 97.
101. See note 99.
102. Environmental impacts: Bob Iverson, *Silt: A Problem Turned Solution?*, downloaded from www.istc.illinois.edu/special_projects/il_river/iverson_siltarticle.pdf, 20 September 2010; "68 percent" U.S. Army Corps of Engineers, *Peoria Lake Habitat Rehabilitation and Enhancement Project*, downloaded from www.mvr.usace.army.mil/EMP/hrep/PeoriaLake.htm, 20 September 2010.

103. G.E. Groschen, et al., U.S. Geological Survey, *Water Quality in the Lower Illinois River Basin, Illinois*, 1995-98, 2000.
104. See note 61.
105. Mark B. David, Laurie E. Drinkwater and Gregory F. McIsaac, "Sources of Nitrate Yields in the Mississippi River Basin," *Journal of Environmental Quality*, 39:1657-1667, 2010.
106. C. Robert Taylor, "Hiding the True Extent of Concentration and Market Power with Partial Ownership and Strategic Alliances," *Agriculture & Resource Policy Forum*, July 2002.
107. Renewable Fuels Association, 2010 *Ethanol Industry Outlook: Climate of Opportunity*, February 2010.
108. Cargill, *Our Businesses: Five Major Business Segments*, downloaded from www.cargill.com/company/businesses/index.jsp on 27 August 2010.
109. Andrea D. Murphy and John J. Ray, "America's Largest Private Companies," *Forbes*, 16 November 2009.
110. Cargill, *Five-Year Financial Summary*, downloaded from www.cargill.com/company/financial/five-year/index.jsp on 27 August 2010.
111. Cargill Meat Solutions, *Beardstown, IL*, downloaded from www.cargillmeatsolutions.com/about_us/tk_cms_about_loc_pork_il.htm, 20 September 2010.
112. See note 74.
113. "Virtually all": U.S. Environmental Protection Agency, Envirofacts database, *Form R Report for Cargill Meat Solutions Corp., Beardstown, IL, for TRI Reporting Year 2007*, downloaded from oaspub.epa.gov/enviro/tri_formr_partone_v2.get_details?rpt_year=2007&fac_id=62618XCLCRRR1BO&ban_flag=Y, 5 November 2010.
114. U.S. Environmental Protection Agency, Envirofacts database, *Toxics Release Inventory Report for Cargill Meat Solutions*, TRI ID 62618XCLCRRR1BO, downloaded from www.epa.gov/enviro/facts/tri/index.html, 20 September 2010.
115. See note 74.
116. Jim Suhr, "Ex-Cargill Manager Given 5 Years," *Associated Press*, 16 August 2002.
117. Ibid.
118. Rick Jordahl, "Be the First to Arrive," *Pork*, 1 September 2009.
119. Associated Press, "Corporate Hog Farms Grow, and Raise a Stink," *Msnbc.com*, 31 March 2006.
120. Dusty Rhodes, "Buckhart Hog Operation Opens While Neighbors Fume," *Illinois Times*, 18 March 2009.
121. Illinois Environmental Protection Agency, *Illinois EPA Livestock Program 2009 Livestock Facility Investigation*, undated.
122. 72 percent: Government Accountability Office, *Agricultural Concentration and Agricultural Commodity and Retail Food Prices: Briefing for Congressional Staff*, 24 April 2009; 30 percent: Western Organization of Resource Councils, *Banning Packer Ownership of Livestock: Myths & Facts*, October 2007.
123. John D. Anderson and Darren Hudson, "Acquisitions and Integration in the Beef Industry," *Policy Issues*, Agricultural & Applied Economics Association, September 2008.
124. Matt Birkbeck, "Montco Beef Plant to Pay \$2 Million Fine," *Allentown Morning Call*, 17 June 2010.
125. Julia Terruso, "Montgomery County Beef Processor to Pay \$2 Million for Polluting," *The Philadelphia Inquirer*, 17 June 2010.
126. Ibid.
127. JBS USA, *JBS USA Reinforces Commitment to Food Safety through Creation of Food Safety and Quality Advisory Team* (News Release), 3 March 2010.
128. Swift: JBS USA, *Swift Celebrates 150 Years of Meat Industry Excellence: Gus Swift's Legacy of Meat Industry Innovation Lives On* (News Release), 24 June 2005; Smithfield: Jakon Hays and Maureen Watts, "Company Timeline," Smithfield: *The Virginian-Pilot*, 18 February 2009; "JBS Said To Be Considering Smithfield Takeover, Increasing Pace Of Consolidation In Meat Sector," *Business Monitor International*, *BMI Americas Food and Drink Insights*, 1 August 2010.
129. "JBS Said To Be Considering Smithfield Takeover, Increasing Pace Of Consolidation In Meat Sector," *Business Monitor International*, *BMI Americas Food and Drink*

- Insights*, 1 August 2010; "JBS Packerland Parent Ends Bid for National Beef," *The Business Journal of Milwaukee*, 20 February 2009. February 2009.
130. See note 55.
131. See note 127.
132. *Ibid.*
133. See note 125.
134. *Ibid.*
135. Marilyn S. D'Angelo, "Two Companies Responsible for Bulk of River Pollution," *Philadelphia Business Journal*, 6 November 2009.
136. *Ibid.*
137. Daniel Patrick Sheehan, "Moyer Packing Spill Cause of Fish Kill," *Allentown Morning Call*, 23 September 2006; Frank Devlin, "Errant Ammonia Release Killed Fish," *Allentown Morning Call*, 24 July 2002; Julia Terruso, "Montgomery County Beef Processor to Pay \$2 Million for Polluting," *The Philadelphia Inquirer*, 17 June 2010.
138. Brian Callaway, "MoPac Rendering Plant Likely to be Fined over Wastewater that Killed 10,000 Fish," *Allentown Morning Call*, 14 August 2007; Pennsylvania Department of Environmental Protection, *MoPac Rendering Plant Wastewater Spill Causes Mile-Long Fish Kill in Skippack Creek* (News Release), 10 August 2007.
139. Brian Callaway, "MoPac Rendering Plant Likely to be Fined over Wastewater that Killed 10,000 Fish," *Allentown Morning Call*, 14 August 2007.
140. See note 125.
141. *Ibid.*
142. United States Geological Survey, *Water Quality in the South Platte River Basin: Colorado, Nebraska, and Wyoming, 1992-95, 1998*.
143. *Ibid.*
144. *Ibid.*
145. "Cargill Fined for Water Violations," *Fort Morgan Times*, 16 November 2009.
146. See note 74.
147. U.S. Environmental Protection Agency, *Toxics Release Inventory*, report for TRI Facility #80701XCLCR1505E, February 2010; available at www.epa.gov/triexplorer/.
148. "Cargill Fined \$200,000 over Wastewater Violations," *The Associated Press State and Local Wire*, 13 November 2009.
149. Ohio Environmental Protection, *Ohio Lake Erie Phosphorus Task Force Final Report*, April 2010.
150. *Ibid.*
151. *Ibid.*
152. See note 23.
153. Julie M. McKinnon, "Vreba-Hoff Local Dairy Firm Plans No More Bankruptcies," *Toledo Blade*, 3 August 2010.
154. Vreba-Hoff, *Frequently Asked Questions*, downloaded from www.vrebahoff.com/HTML/faqs.htm, 17 September 2010.
155. At the time, the Michigan DNRE was known as the Michigan Department of Environmental Quality.
156. Michigan Department of Environmental Quality, *Vreba-Hoff Dairy - June 2010 Update*, 19 July 2010.
157. Dennis Pelham, "Vreba-Hoff Dairies Await Court Decision," *Daily Telegram* (Adrian, Mich.), 2 October 2010.
158. Environmentally Concerned Citizens of South Central Michigan, *Confirmed Violations/Discharges from CAFOs and Liquid-System Livestock Operations to Bean/Tiffin Watershed and River Raisin Watershed*, downloaded from www.nocafos.org/violations.htm, 17 September 2010.
159. Ohio: Ben Sutherly, Mike Wagner and Laura A. Bischoff, "Lucrative Megafarm Market Lures Europeans," *Dayton Daily News*, 6 December 2002; Indiana: Carla Knapp, "Controversial Dairy Planned for Carroll County," *Logansport (Ind.) Pharos-Tribune*, 21 October 2007.
160. See note 149.
161. *Ibid.*
162. *Ibid.*
163. Mark Schleifstein, "Dead Zone as Big as Massachusetts along Coast of Louisiana and Texas, Scientists Say," *New Orleans Times-Picayune*, 3 August 2010.
164. See note 6.
165. U.S. Environmental Protection Agency, Mississippi River Basin Watershed Nutrient Task Force, *Hypoxia 101*, downloaded from www.epa.gov/owow_keep/msbasin/hypoxia101.htm, 5 November 2010.

166. See note 61. Supplemental materials available from U.S. Geological Survey at water.usgs.gov/nawqa/sparrow/gulf_findings/index.html.
167. U.S. National Academy of Sciences, National Research Council, *Water Implications of Biofuels Production in the United States*, National Academies Press, 2008.
168. S.A. Miller et al, "Use of Monte Carlo Analysis to Characterize Nitrogen Fluxes in Agroecosystems," *Environmental Science and Technology* 40: 2324-2332, 2006.
169. See note 105.
170. National Corn Growers Association, *The 2010 Crop – Iowa*, downloaded from www.iowacorn.org/User/Docs/The%202010%20Crop-%20IA.pdf, 17 September 2010.
171. Securities and Exchange Commission, *Archer Daniels Midland Form 10-K for the Fiscal Year Ended June 30, 2010*, 27 August 2010.
172. Center for Responsive Politics, *Open Secrets: Archer Daniels Midland*, downloaded from www.opensecrets.org, 22 August 2010.
173. Peter Carlson, "Chairman Across the Board," *Washington Post*, 14 July 1996.
174. Harold Henderson, "Supermarket to the World," *Illinois Issues*, May 2001.
175. Clifton B. Luttrell, Federal Reserve Bank of St. Louis, *The Russian Wheat Deal – Hindsight vs. Foresight*, October 1973.
176. Tim Weiner, "Dwayne's World; Influence of Archer-Daniels Is Wide as Well as Deep," *New York Times*, 16 January 1996.
177. As quoted in Michael Pollan, *The Omnivore's Dilemma: A Natural History of Four Meals*, 2006.
178. Environmental Working Group, *Farm Subsidy Database*, downloaded from farm.ewg.org/progdetail.php?fips=00000&progcode=corn, 28 October 2010.
179. Richard Manning, *Against the Grain*, (New York, North Point Press), ISBN: 9780865476226, 2004 as described in Tom Philpott, "A Speculation about Why ADM's HFCS Business Is Booming," *Grist.org*, 10 May 2006.
180. Ibid.
181. Ibid.
182. U.S. Department of Agriculture, Economic Research Service, *High Fructose Corn Syrup: Estimated Number of Per Capita Calories Consumed Daily, by Calendar Year* (Excel workbook), updated 26 October 2010.
183. Alexi Barionuevo, "A Bet on Ethanol, With a Convert at the Helm," *New York Times*, 8 October 2006.
184. James Bovard, Cato Institute, *Archer Daniels Midland: A Case Study in Corporate Welfare*, 1995.
185. See note 183.
186. Susan Powers, Rosa Dominguez-Faus and Pedro Alvarez, "The Water Footprint of Biofuels Production in the USA," *Biofuels* 1: 255-260, 2010.
187. See note 183.
188. Ibid.
189. U.S. Environmental Protection Agency, *Memorandum from Granta Y. Nakayama to Benjamin Grumbles RE: OECA's Comments on the June 6, 2007 Memo, Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Clarabell v. United States*, 4 March 2008.
190. U.S. Environmental Protection Agency, "EPA Targets Clean Water Violations at Livestock Feeding Operations," *Enforcement Alert*, 10(2), March 2009.
191. U.S. Environmental Protection Agency, Region 5, *Initial Results of an Informal Investigation of the National Pollutant Discharge Elimination System Program for Concentrated Animal Feeding Operations in the State of Illinois*, September 2010.
192. U.S. Government Accountability Office, *Concentrated Animal Feeding Operations: EPA Needs More Information and a Clearly Defined Strategy to Protect Air and Water Quality from Pollutants of Concern*, September 2008.
193. U.S. Environmental Protection Agency, *Section 303(d) List Fact Sheet for Watershed Lake o' the Cherokees*, downloaded from iaspub.epa.gov/tmdl_waters10/huc_rept.control?p_huc=11070206&p_huc_desc=LAKE%20O%27%20THE%20CHEROKEES&p_cycle=2008, 10 November 2010.