THE PEW ENVIRONMENT GROUP

BIG CHICKEN

Pollution and Industrial Poultry Production in America

Cover photos, from left: David Harp, Robert Bennett/AGStock Images, David Harp
Chesapeake Bay Bridge: Michael Lutzky/The Washington Post/Getty Images

July 27, 2011

Chicken, once a distant third to beef and pork, is now the most popular meat in the United States. The average American eats almost 84 pounds of chicken a year, more than twice the amount eaten in 1970.

The American poultry industry has matched this change in appetite with an exponential increase in production. In 2007, for instance, 8.9 billion chickens were raised and sold as food in the United States, a jump of more than 1,400 percent since 1950. At the same time, chicken farms have mushroomed in size; by 2006, a typical operation produced an average of 605,000 birds in vast buildings of 20,000 square feet or more. Meanwhile, the number of individual farms raising chickens for food has plummeted by 98 percent in just over half a century. This transformation of the industry has been accompanied by an environmental challenge: In many cases, these large poultry farms pose major pollution problems for regional communities.

The Pew Environment Group's new report, "Big Chicken: Pollution and Industrial Poultry Production in America," describes how the industrialization and consolidation of the poultry business have concentrated production in what is now known as the Broiler Belt. In this area, which extends from eastern Texas through the southeastern United States and north to Maryland and Delaware, chickens outnumber people by as much as 400 to 1.

The waste produced by these concentrated poultry operations raises serious concerns about treatment and disposal, particularly along the shores of the largest estuary system in the United States, the Chesapeake Bay. The 523 million chickens produced each year in just Maryland and Delaware generate roughly 42 million cubic feet of chicken waste—enough to fill the dome of the U.S. Capitol about 50 times, or almost once a week.

Traditionally, farmers have managed this manure by spreading it on fields. But the combination of industrial-level production and the diminishing amount of cropland in these two states has resulted in more manure than crops can use, and the excess flows untreated into the streams and rivers that feed into the Chesapeake.

"Big Chicken" examines 50 years of data to take a fresh look at industrial poultry production and to make policy recommendations for managing chicken waste to mitigate its toll on our land and water. For more information about this serious problem, I encourage you to visit us at *www.PewEnvironment.org/BigChicken.*

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The Pew Campaign to Reform Industrial Animal Agriculture

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Source Information

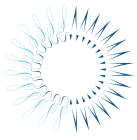
Broiler numbers and acreage were taken from the U.S. Department of Agriculture's Census of Agriculture, a five-year survey of American farms. Data were gathered from the most recent Census of Agriculture (2007) and from 2002, 1997, 1992, 1987, 1982 and 1978, for each state and for each Maryland and Delaware county. For a historical perspective, Pew also gathered data at the state level from the 1950 Census of Agriculture. For each state and county, data were gathered from each of the censuses under the following categories: Broilers and Other Meat-Type Chickens Sold; Broiler Operations With Sales; and Total Cropland, which includes cropland harvested, cropland used only for pasture or grazing, cropland idle or used for cover crops or soil improvement but not harvested and not pastured or grazed, cropland on which all crops failed or were abandoned, and cropland in cultivated summer fallow.

In some instances, USDA does not disclose the number of operations with sales at the state and/or county level so as not to identify individual farms within an area. This absence of data does not signify that the state or county is not a potential home to broilers or broiler operations. States or counties in which these data were not disclosed are not represented on the relevant maps, however.

State population data cited in the report are taken from the U.S. Census Bureau's 2010 Census.

The Pew Environment Group

The Pew Environment Group is the conservation arm of The Pew Charitable Trusts, a nongovernmental organization that works globally to establish pragmatic, science-based policies that protect our oceans, preserve our wildlands and promote clean energy.



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Pollution and Industrial Poultry Production in America

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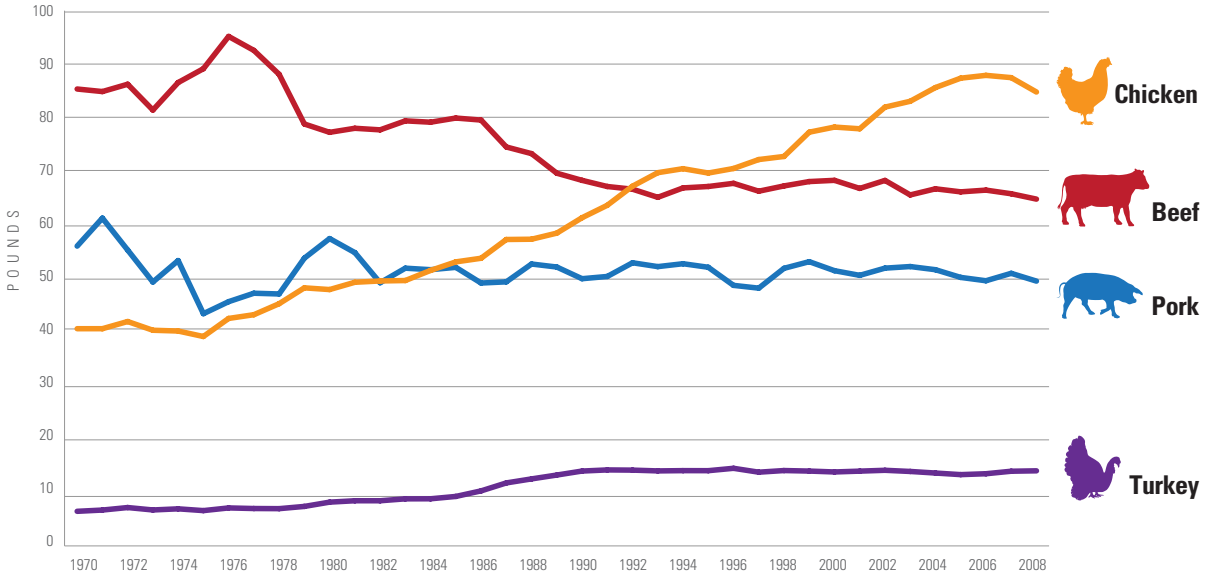
OVERVIEW

In nuggets, wings or strips, destined for the grill or cooked in the store, chicken is an American favorite. According to the American Meat Institute, chicken has become the No. 1 source of meat consumed by Americans, surpassing beef and pork by a significant margin.[1]

This shift in demand has been accompanied by a major change in how and where chickens are produced in the United States. As poultry consumption has grown, the number of businesses that raise the animals has dropped significantly, and the nature and geography of those operations have also changed.

In just over 50 years, the number of chickens produced annually in the United States has increased by more than 1,400 percent while the number of farms producing those birds has dropped by 98 percent. In 2011, a historically small number of operations, controlled by even fewer meat processing companies, known as integrators, dominates the production of American chicken. The size of individual operations has grown just as dramatically, and now the typical broiler chicken—a chicken raised for its meat—comes from a facility that produces more than 600,000 birds a year. These large-scale operations occupy a limited geographic area known as the

U.S. Per Capita Meat Consumption



Source: USDA Economic Research Center, Food Availability Data System, Feb. 1, 2010.
http://www.ers.usda.gov/Data/FoodConsumption/FoodAvailSpreadsheets.htm#mtpcc.

Photo: David Harp

» Broiler chickens on the Delmarva Peninsula often spend their short lives in cavernous buildings.

American Broiler Belt. In many instances, they pose difficult environmental challenges for nearby and downstream communities.

Industrial poultry operations generally dispose of broiler waste by spreading it on open fields or cropland. However, many of them have little cropland associated with their facilities. As a result, an increasing number of farms and counties have more manure than can be used by local crops, and pollution problems occur when excess nutrients from manure are washed off the land and into local streams, rivers and other bodies of water. Nowhere has this problem of concentrated poultry production and manure-associated pollution become more evident than in the Chesapeake Bay region.

The poultry industry has evolved into a streamlined system of industrial mass production. But the requirements for responsible waste treatment and disposal have not kept pace, and today's 600,000-bird production factories continue to be regulated like the small family farms they no longer resemble. Unless the inadequate policies and practices that govern industrial poultry production are reformed, environmental challenges will grow as broiler production continues to rise.

The Pew Campaign to Reform Industrial Animal Agriculture recommends the following changes:

- **Caps on total animal density.**
- **Shared financial and legal responsibility for proper waste management between farmers and corporate integrators.**
- **Monitoring and regulation of waste transported off concentrated animal feeding operation (CAFO) sites.**
- **A requirement that all medium and large CAFOs obtain Clean Water Act permits.**

Industrial poultry production presents a host of concerns not addressed in this report. These include the overuse of antibiotics, pollution caused by egg production, air quality problems and the relationship between large corporations and contract farmers. The Pew Charitable Trusts will examine some of these issues in future reports.

MORE CHICKEN, FEWER FARMS

During the early part of the 20th century, chickens were raised on small farms throughout the United States, and their meat was principally a byproduct of the egg industry. However, production of broilers—young chickens raised specifically for meat—nearly tripled between 1940 and 1945,[2] in part because poultry, unlike beef, pork, veal and lamb, was not rationed during World War II. The availability of chicken encouraged consumption, as did research and technology developments that allowed the emerging broiler industry to expand rapidly.[3]

As the industry took hold, independent feed mills, hatcheries, producers and butchering plants traded with one another in a system of open, often local markets. Farmers raising chickens for meat would sell to those who offered the best prices. In 1950, more than 1.6 million farms spread across the country were growing chickens for American consumers. By 2007, fully 98 percent of those chicken farms were gone, despite the fact that Americans were consuming even more chicken—more than 85 pounds per person per year, according to the U.S. Department of Agriculture (USDA).[4] Over that same period, broiler sales jumped by 8 billion birds, or more than 1,400 percent.

Photo: Jane Thomas

» These poultry houses are a short distance from the Chester River on Maryland's Eastern Shore.

A FRENZY OF CONSOLIDATION

As commercial opportunities for chicken meat sales expanded, the structure of the industry began to change. By the early 1940s, a few feed dealers who wanted to broaden the market began extending credit to farmers raising chickens and then accepting payment when the birds were sold to processing plants. These types of arrangements marked the beginning of a consolidation process in which a single entity gained control over various aspects of poultry production. In the early years of this "vertical integration," feed store owners held a level of control at the front end of poultry production. A short time later, the meat processing companies took control further along the production chain. Today known as integrators, such companies now control virtually all aspects of the business, from breeding of chicks, through processing and retailing, and often transporting a wide range of poultry products to grocery stores and restaurants.

Photo: David Harp

» Chickens are processed for market at a Delaware plant.

In the past, as now, an integrator would attempt to ensure a supply of chickens sufficient to keep larger and larger processing plants running close to or at capacity. But rather than raising the chickens, integrators contracted with individual growers to manage their flocks.

By the mid-1950s, the broiler industry had transformed from an open-market system to one that would come to define industrial animal production: extensive vertical integration, based almost exclusively on contracts with farmers for raising the birds.[5] According to the USDA, 95 percent of broiler producers in 1950 were independent; five years later, the number of independent growers had plummeted, accounting for only 10 percent of broiler production. At that point, 88 percent of broilers were produced under contract, and 2 percent were produced in company-owned broiler facilities.[6]

In pursuit of further efficiencies and profits, integrators engaged in a frenzy of consolidation throughout the 1950s and 1960s. Many of the independent poultry-producing businesses closed or were bought out by the integrators. These larger entities could coordinate production at each stage to avoid either overproduction or shortages and could purchase medicine, equipment and other supplies at bulk discounts.

Photo: David Harp

» Newly hatched chickens don't yet fill a Delmarva poultry house. As they grow, they will fill it wall to wall.

DIMINISHING OPTIONS FOR CONTRACT GROWERS

Today, integrators generally breed their own chickens, not only to achieve the desired level of quality and characteristics that allow rapid weight gain with minimal feed, but also to produce birds of a uniform size that can be slaughtered, packaged and processed by machine rather than individually cut and prepared. The integrator chooses when to deliver chicks to a contract grower and when to collect grown birds for delivery to a processing facility.

Contracts between the integrators and individual growers typically specify that the integrators provide the chicks, the feed and veterinary services as well as other management direction. The growers provide the labor and chicken houses built to integrators' specifications and generally are responsible for water and fuel for heating, management of manure, and disposal of other waste, including dead birds.[7]

Under common contract terms, the grower does not own or sell the birds and is not paid on a straightforward measure of weight and quality. Instead, the grower is paid for services and must follow the integrator's directions as stipulated in the contract and provided by the integrator's field staff. Although the grower may hold a mortgage on poultry houses in the range of a quarter million dollars or more, the contract frequently lasts only as long as it takes to raise a flock of chickens—in some cases, a matter of weeks.[8] Numerous integrators compete for broiler sales in the national retail food and restaurant market, but one firm often will dominate a growing region or territory. Growers rarely receive multiple competitive contract offers.[9]

BIGGER AND FASTER

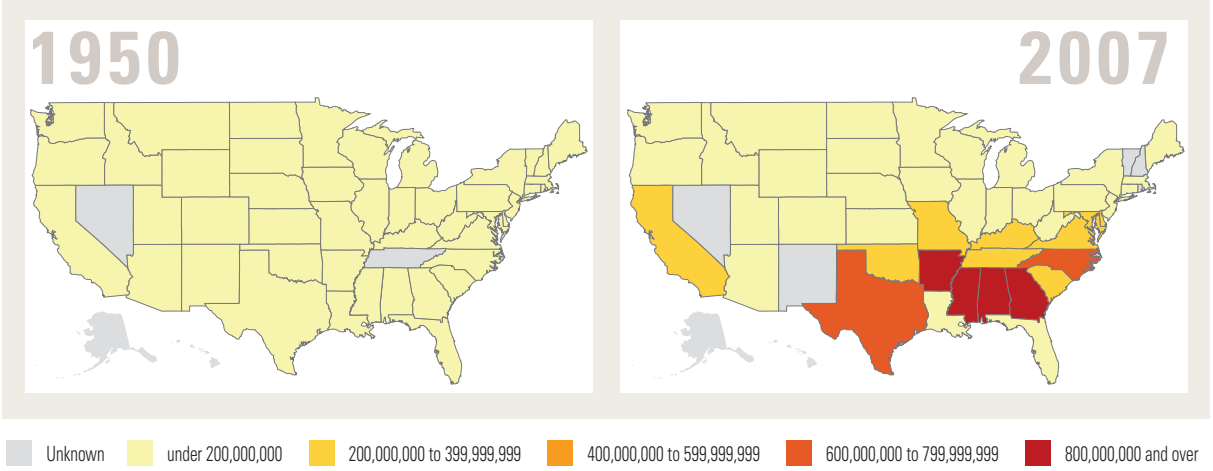
In just over 50 years, the number of chickens produced annually in the United States has increased by more than 8 billion birds—a 1,400 percent increase—while the number of broiler farms has plummeted from more than 1.6 million in 1950 to just over 27,000 in 2007, a 98 percent decline. These seemingly conflicting statistics result from the shifting of poultry production from traditional farms to an industrialized system of processing plants served by massive growing operations that produce not only more chickens, but bigger chickens at a faster rate.

U.S. Broiler Farms: What They Produce

	1950	1978	1987	1997	2007
Farms[10]	1,636,705	31,743	27,645	27,737	27,091
Chickens	581,038,865	3,062,154,490	4,361,975,630	7,366,526,456	8,914,828,122

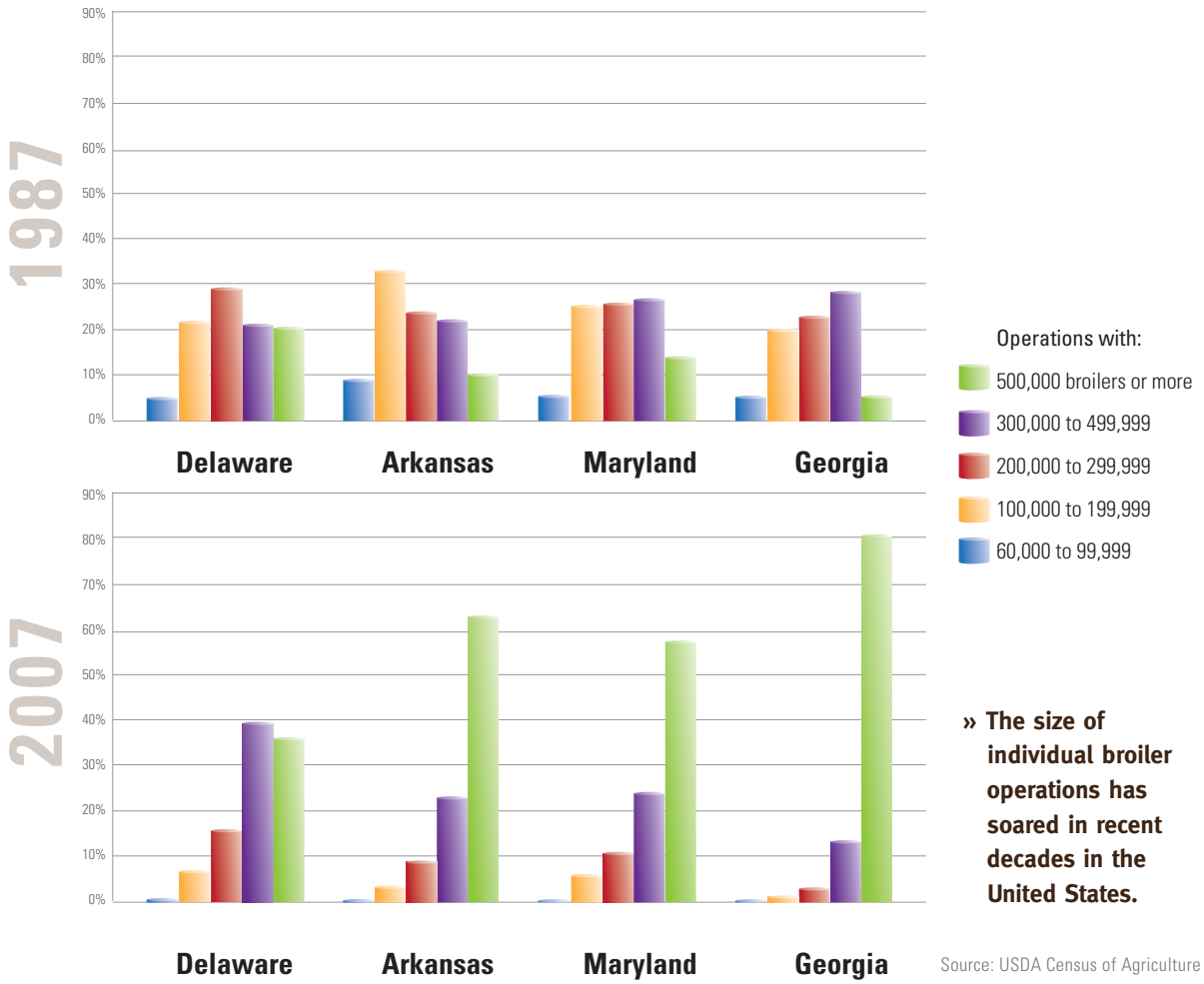
Source: USDA Census of Agriculture

Numbers of Broiler Chickens Per State—1950 and 2007



Source: USDA Census of Agriculture

Percentage of Broiler Operations by Size—1987 and 2007



» The size of individual broiler operations has soared in recent decades in the United States.

Source: USDA Census of Agriculture

Today, the number of birds raised by a single industrial poultry operation is staggering. According to a USDA report, the typical broiler in 2006 came from an operation that produced about 605,000 birds a year, compared with an operation producing 300,000 birds a year in 1987. The same report noted that whereas a typical chicken house built in the 1960s was about 12,750 square feet, newer houses average more than 20,000 square feet, and large houses built in 2005 and 2006 were larger still—up to 36,000 square feet. Increasingly, individual growers rely on multiple houses, and many carry large mortgages to pay for the initial investment and to finance upgrades required by new contracts.[11]

With the development of these large-scale concentrated animal feeding operations (CAFOs), barnyards have virtually disappeared, and many of today's broiler operations have little land associated with them, other than land for the chicken houses and access roads. A 2009 USDA report noted that one-third of modern broiler operations have no associated cropland.[12] This lack of associated cropland can have a profound impact on pollution and waste management.

GEOGRAPHIC CONSOLIDATION

As vertical integration of broiler production was developing in the early 1950s, the poultry industry began to form a distinctive geographic footprint. Development of poultry regions was driven by a desire to limit the transportation costs for chicks, feed and live broilers[13] and, according to some agricultural historians, by a cultural acceptance of the evolving contracting practices in some areas.[14] By the late 20th century, most broiler farms were under contract to a single nearby processor.[15] Today, virtually all commercial broiler production is carried out under contract, generally within 25 to 35 miles of processing and feed mills.[16]

The Delmarva Peninsula on the Eastern Shore of the Chesapeake Bay, with its proximity to large markets in New York and Philadelphia, became one of the first major poultry centers.[17] During World War II, the poultry facilities in this slice of Delaware, Maryland and Virginia focused on feeding the troops, so the industry began to grow and consolidate elsewhere. In the Southern states, cotton-weary land, a ready supply of low-wage workers, a history of sharecropping and a landscape of small, privately owned parcels of land made the region prime for contract broiler production.[18] Thus developed the Broiler Belt, an area extending from eastern Texas through Arkansas, Alabama, Georgia and much of the Southeast and north to Maryland and Delaware.

Today, the Broiler Belt has areas where chickens far outnumber people. Delaware, for example, produces roughly 270 chickens per person; Mississippi, 275; and Arkansas, 400.

State	2007 Broilers (sales in head)	Percent of U.S. Total
Georgia	1,398,912,031	16%
Arkansas	1,171,556,369	13%
Alabama	1,016,230,625	11%
Mississippi	823,427,574	9%
North Carolina	781,416,896	9%
Texas	616,299,999	7%
Kentucky	309,769,263	3%
Maryland	296,373,113	3%
California	280,512,754	3%
Missouri	279,937,641	3%
Virginia	249,184,367	3%
Delaware	246,098,878	3%
Oklahoma	242,228,335	3%
South Carolina	236,209,584	3%
Tennessee	206,132,684	2%

Source: USDA Census of Agriculture

BIG CHICKEN, BIG WASTE

The geographic consolidation of the broiler industry, which is more pronounced in certain regions of the Broiler Belt, such as northern Georgia, northern Alabama, eastern Maryland and southern Delaware, has advantages for meat processors but also carries a serious downside. As the USDA noted in a 2003 report, "Ever-growing numbers of animals per farm and per acre have increased the risk of water pollution."[19]

The pollution problem has its roots in a simple combination of biology, geography and arithmetic. As broiler production increases, so does the production of the industry's major waste product: chicken manure. Broiler litter—the mix of manure and bedding taken out of broiler houses—must be disposed of. Although possible uses for the litter, from biofuel to cattle feed,[20] have been explored over the years, the majority is still handled as it was decades ago: It is spread on farm fields to enrich soil and fertilize crops.[21]

High in nutrients needed by crops, particularly nitrogen and phosphorus, broiler litter can be

Continued on Page 11

Photo: Robert Bennett

» Chicken manure is piled in a field in Sussex County, Del., where it will be spread as fertilizer for crops.

NUTRIENTS IN THE WATER: Too Much of a Good Thing

Nutrients such as nitrogen and phosphorus cycle naturally through the environment in various forms and—at the right levels in the right places—help sustain plant and animal life. They can cause serious degradation of water resources, however, when excessive amounts enter lakes, rivers, estuaries and other bodies of water.

Excess nutrients in water set off a chain reaction called eutrophication that starts with acceleration of algae growth and can lead to serious loss of aquatic life, beach closures, shellfish contamination and dramatic seasonal dead zones. The algae may be noxious or even toxic, and its presence on the water surface can block sunlight and lead to loss of important underwater grasses that provide habitat for fish and other organisms. The algae's decomposition, in turn, uses up oxygen needed to sustain aquatic life.

Dissolved oxygen is one important measure of the health of a water body. If oxygen levels drop too low, fish, crabs and other living things will be affected, experiencing growth or reproductive impairments or even death. The problems with low dissolved oxygen can be most pronounced in deeper waters and often occur during summer months, at the same time that shallow waters become too warm for some species. The amount of nutrients reaching U.S. waters has increased dramatically over the past 50 years.[27]

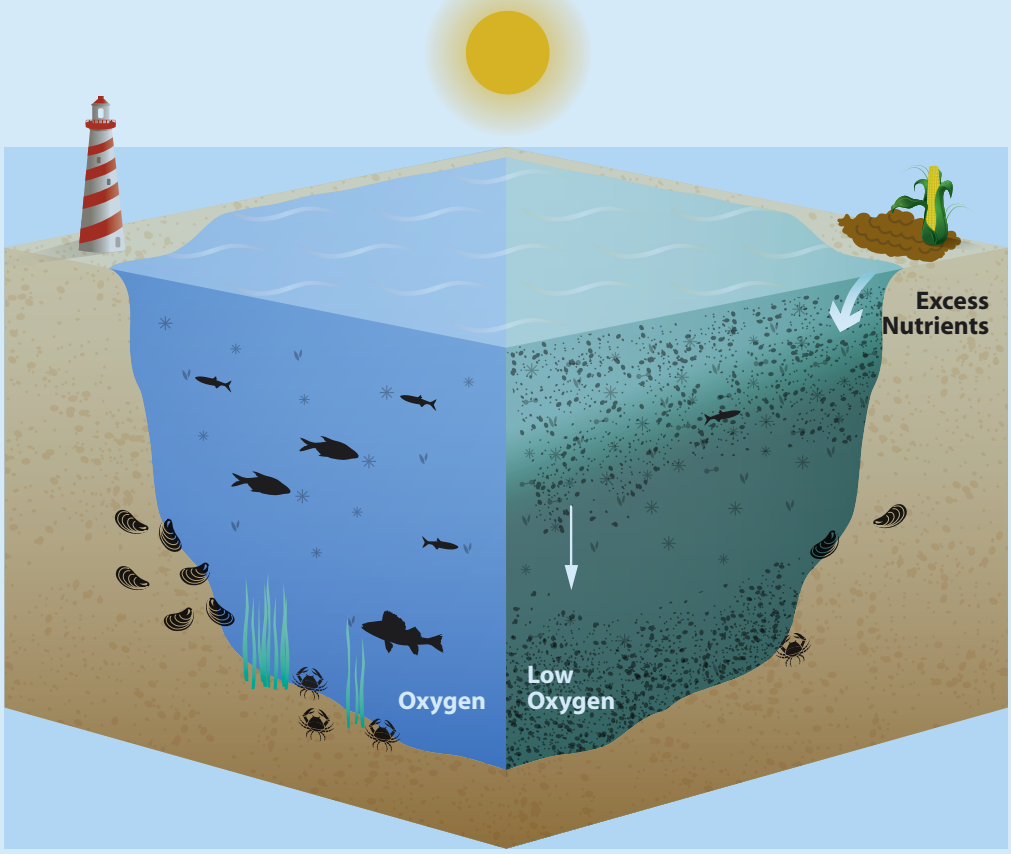


Illustration: Berces Design

» **Excess nutrients in chicken manure can run off farm fields into the water, leading to algae growth, oxygen depletion and loss of aquatic life.**

Continued From Page 9

an effective fertilizer. But when overused, poorly managed or inappropriately timed, the nutrients in poultry manure can cause significant water quality problems.

All livestock manure contains nitrogen and phosphorus, but poultry manure often has a higher nutrient content than other types of manure, and those nutrients may not be present in the proportions needed by crops. Broiler litter frequently contains phosphorus and nitrogen in similar ratios,[22] but many crops require far less phosphorus than nitrogen. When farmers follow long-standing practices and apply broiler litter based on a crop's nitrogen needs, they over-apply phosphorus.

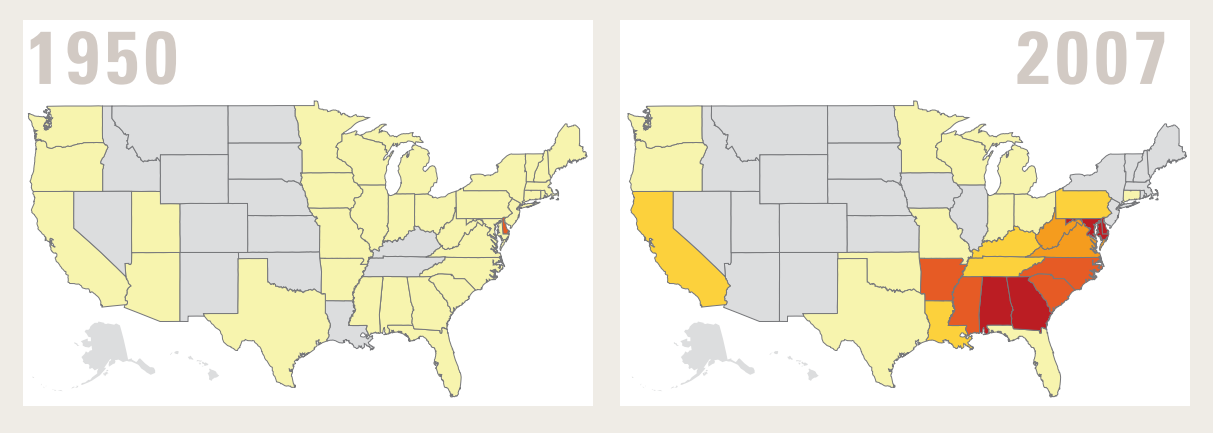
For many years, agricultural experts suggested that such overapplication was not a serious problem, because phosphorus moves into water mainly by being attached to sediment. Effective erosion control practices, they reasoned, could keep excess phosphorus on the land. After years of studying the movement of nutrients in the environment, however, scientists now know that a buildup of excess phosphorus in the soil can eventually result in additional phosphorus release into water.[23]

Depending upon soil and other environmental factors, some practices employed to keep nutrients from running off the land in rainstorms simply route those pollutants into groundwater and from there to receiving streams.[24] Research indicates that this may be the case in certain coastal areas, including the Chesapeake Bay region, where nearly half of the nitrogen flowing into the bay from nontidal streams comes from groundwater, and where well monitoring shows increasing levels of nitrates in deeper groundwater.[25] In 2011, the National Academy of Sciences noted that soil phosphorus on the Delmarva Peninsula is an order of magnitude greater than what crops need.[26] This "legacy phosphorus" associated with broiler litter application, warned the report authors, can mean trouble for the bay for years to come.

Out of Balance

Compared with commercial fertilizers, nutrient-rich litter can be a less expensive alternative for fertilizing cropland or turf, but its management has proven to be particularly challenging. As a result, broiler litter in the Broiler Belt is a

Number of Broiler Chickens Per Acre of Cropland—1950 and 2007

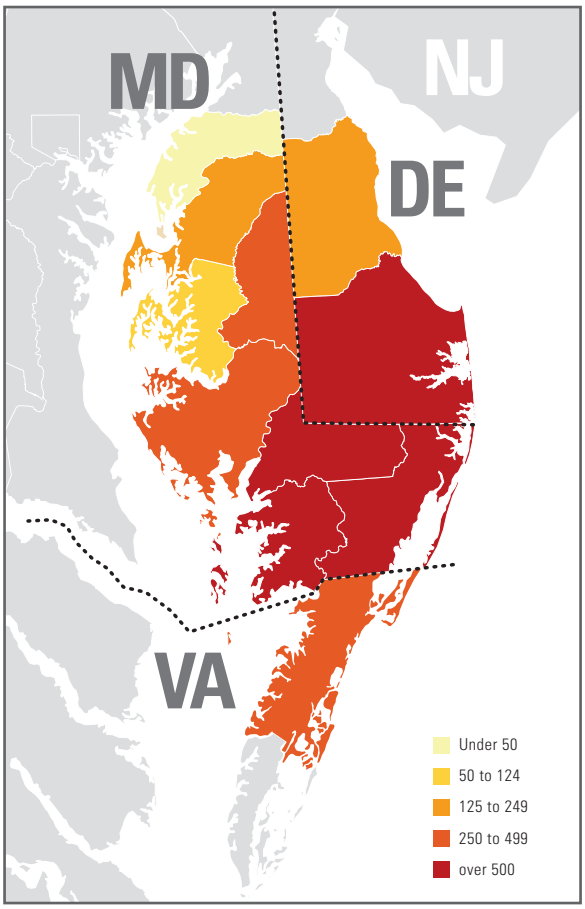


Source: USDA Census of Agriculture

product in serious oversupply, in many instances becoming a liability rather than an asset.[28] Still, individual growers—not the large, well-capitalized integrators—remain primarily responsible for managing the litter and its disposal.[29]

Broiler and manure production on the Delmarva Peninsula is a case in point. Although the Delmarva is no longer the country's top broiler producing region, Delmarva growers raise large numbers of broilers and produce massive amounts of waste in smaller areas with limited cropland than do their southern counterparts.

Density of Broiler Chickens Per Acre of Cropland on Delmarva, 2007



Source: USDA Census of Agriculture

The density of chickens in Maryland and Delaware is strikingly high. In 2009, the two states produced 523.4 million broilers—6 percent of the entire country's production on less than 0.5 percent of its landmass.[30] Assuming that 1,000 broilers produce roughly 81 cubic feet of litter,[31] the 2009 broiler population for the two states generated over 42 million cubic feet of litter—enough to fill the U.S. Capitol dome nearly 50 times.[32]

Looking more specifically at cropland, where much of the manure will go, the disparity appears even greater. Delaware is on the extreme end of this scale with a reported 423,773 acres of cropland and 246.1 million broilers sold in 2007, or 581 chickens per acre of cropland. By comparison, Arkansas, with 8.4 million acres of cropland, produced 1.2 billion broilers in 2007, or about 140 chickens per acre of cropland.

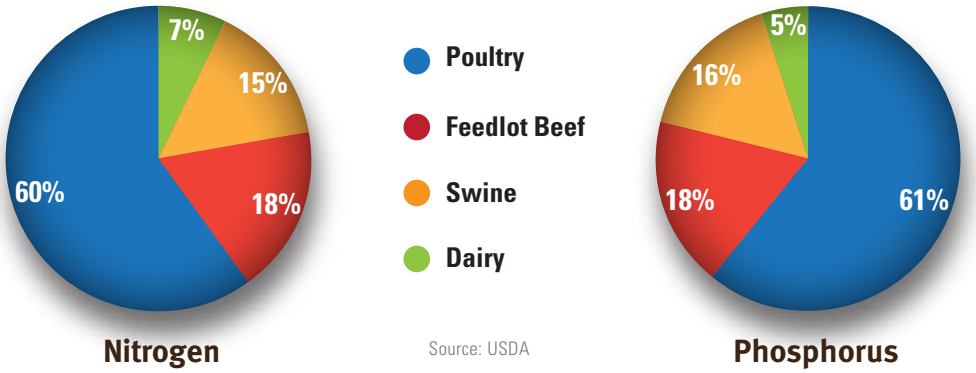
Unintended Consequences

Rough calculations of per-acre manure volume are not necessarily indicative of pollution issues, but agricultural experts have warned of a growing problem of excess manure.

In 2000, the USDA published an extensive analysis of trends in the generation of livestock manure, determining levels of "excess manure" nutrients at the farm and county levels.[33] This analysis covered the years from 1982 to 1997, and while it has not been updated with the most recent agricultural census data, even at that time it raised serious concerns about the unintended consequences of agricultural consolidation.

The USDA report showed that small and medium-size livestock farms were being "replaced by large operations at a steady rate," that livestock populations had become "more spatially concentrated in high-production areas" and that poultry had the highest densities compared

Excess Nutrients: Where They Come From



with all livestock for all years. The analysis also showed a "dramatic increase" in poultry density between 1982 and 1997. More importantly, the report linked the spatial concentration to "increased problems with the use and disposal of animal waste" and found that such problems had become more widespread with the shift to fewer but larger livestock operations.

With access to data on farm animal numbers, information on manure characteristics and more specific information on types of cropland, the USDA researchers analyzed the nutrient needs of local crops. That approach allowed them to estimate the ability of farmland to effectively utilize the manure nutrients. They found that an increasing number of farms and counties had more manure than could be used by local crops, and of the 1.5 billion pounds of excess nutrients found on farms, more than half were associated with poultry.[34]

As the USDA pointed out, poultry manure generally contains two to four times more nutrients than is contained in manure of other livestock types,[35] and 40 percent of U.S. broiler production occurs on farms without any crop acreage.[36] In fact, the USDA said, the poultry sector, which accounts for only 15 percent of the total number of confined animal operations, produces the most total nutrients of any livestock sector.[37]

Poultry and Pollution

Nutrients are found not only in broiler litter and other livestock manure, but also in commercial fertilizers, municipal wastewater discharges, storm water and even runoff from forested land. As a result, the question of how much pollution is directly tied to animal manure, let alone broiler litter, is not easy to answer. Although it is clear that no one to date has a definitive estimate of poultry's share of pollution, it is also clear that major poultry-producing regions show evidence of water quality impacts.

In Georgia, for example, University of Georgia researchers found in 2002 that 13 counties in the state had excess phosphorus in the soil. Of those, 10 were areas where poultry was concentrated.[38] Less than a decade earlier, only four counties had been identified as having excess phosphorus. A 1999 study by the U.S. Geological Survey (USGS)

Photo: David Harp

» Chicken houses and soybean crops share space on a farm on Maryland's Eastern Shore.

found high levels of phosphorus in Georgia's West Fork Little River, again in areas with intensive poultry production.[39]

Another area where broiler growth and concentration have been accompanied by water pollution problems lies in northwestern Arkansas and eastern Oklahoma. In the Eucha and Spavinaw watersheds within this poultry-rich region, nearly 44 million chickens were produced in roughly 2,450 chicken houses in 2010.[40] Here as elsewhere, the waste disposal practice has been for broiler litter to be spread on cropland. Over time, this led to major problems with algal blooms, which in turn degraded drinking water supplies. When voluntary measures to curb out-of-control nutrient pollution failed, Tulsa and its Metropolitan Utility Authority, which supplies drinking water to Tulsa and more than a dozen other cities, went to court for relief.[41]

With strong evidence of water problems linked to overapplication of poultry manure on area cropland, the city and the utility were able to reach a settlement that altered common practices.[42]

Today, new requirements for nutrient management planning have been put in place in the watershed, including lower limits on the amount of phosphorus that may be applied to the land, along with a court-supervised program of soil testing and monitoring as well as tracking of manure shipments. Because excess nutrients had already built up in the environment, however, water quality has not improved to the extent anticipated.[43] In fact, in 2005, the Oklahoma attorney general sued 14 Arkansas poultry companies seeking compensation for damage to the Illinois River.[44]

THE CHESAPEAKE BAY FRONT AND CENTER

On the eastern edge of the Broiler Belt, problems with overapplication of manure and the buildup of pollutants in the environment have come to the fore in a tense public debate.

Seven states, the District of Columbia and the Environmental Protection Agency (EPA) are working together to restore the Chesapeake Bay with a precedent-setting but controversial "pollution diet" for the nation's largest estuary. The livestock industry, including the poultry industry, is arguing against a recent uptick in the pace of cleanup efforts and the involvement of federal regulators in protecting the bay.

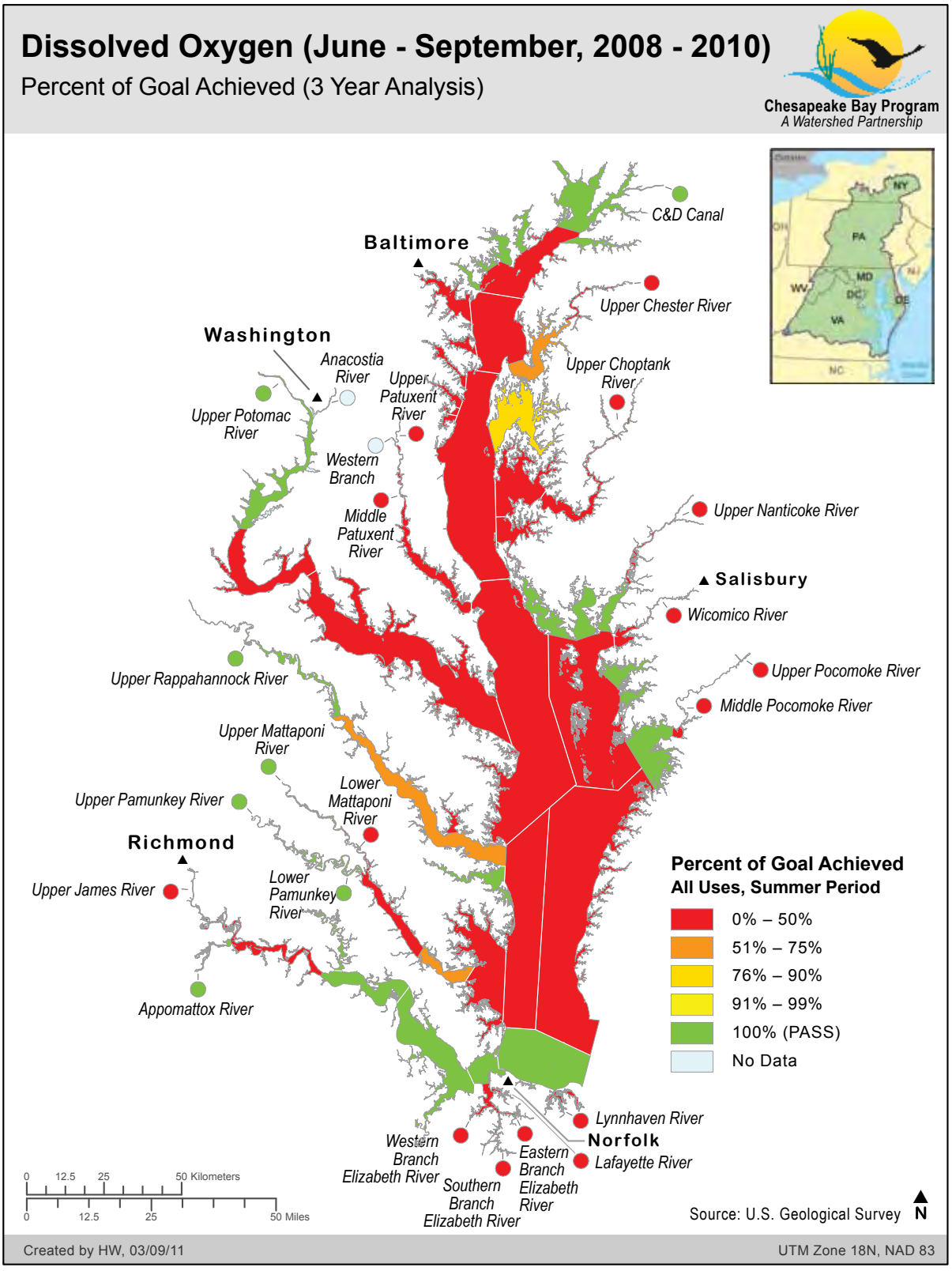
More than two decades ago, scientists recognized that dramatic reductions in the discharge of nutrients and sediment would be required to stem the loss of Chesapeake Bay resources such as rockfish, blue crabs and oysters and to reverse a trend of increasingly large seasonal dead zones. Scientists studying the bay also determined the dissolved oxygen levels required to sustain its living resources, with specific goals set for different areas, such as fish spawning and nursery locations, open water and shellfish areas.

Despite a prolonged and wide-ranging cleanup effort, nutrient reduction goals have not been reached, and the bay still shows the effects of excess nutrients. An analysis of biological monitoring data indicates that more than half of the streams in the watershed are rated as "poor" or "very poor," bereft of snails, insects and other low-level organisms critical to a healthy aquatic

Photo: Paul Souders/PhotoLibrary

» Annapolis, Md., is a popular gateway to the Chesapeake Bay, the nation's largest estuary.

» **The red color in the map below indicates the portions of the Chesapeake Bay with low dissolved oxygen levels in summertime.**



environment.[45] In 2009, the percentage of tidal tributaries and bay segments meeting dissolved oxygen goals was under 12 percent.[46] (The red color in the map on the opposite page indicates the portions of the Chesapeake Bay with low dissolved oxygen levels in summertime from 2008 to 2010.)

Agriculture is by no means solely responsible for all of the bay's problems, but despite years of voluntary and taxpayer-subsidized programs to curb farm-generated pollution, agriculture remains a significant source of the bay's nutrients.[47] In May 2010, the EPA reported that an estimated 19 percent of excess nitrogen and 26 percent of excess phosphorus were directly linked to animal manure in the watershed.[48] Because there is no comprehensive water quality monitoring for runoff from manured cropland, the specific estimates, generated by a sophisticated and widely reviewed bay model, are subject to some debate, but one conclusion remains clear: Agriculture, particularly animal agriculture, will have to do more to protect the bay.

According to a new USDA report, the vast majority of bay cropland fertilized with manure is not being managed properly to reduce the loss of manure nutrients to the environment.[49] This report, assessing the impact of agricultural conservation practices, found that roughly 38 percent of cropland in the watershed is fertilized with manure and that those acres have, on average, twice the nitrogen runoff of acres not being fertilized with manure. The same report also found that phosphorus losses were particularly high for cropland receiving manure.

An analysis of nutrient trends in the bay by the USGS shows modest yearly declines in nutrients overall but increasing levels of nutrients along two river segments, including the Choptank on Maryland's Eastern Shore.[50] This river, which runs through the Delmarva poultry region, shows increasing levels of nitrogen, which may be attributable in part to the leaching of manure pollutants into groundwater that feeds the river. Such a buildup in the groundwater could deliver pollutants to rivers and streams for years to come, as occurred in other areas, such as the Suwannee River Basin of Florida.[51]

A Lagging Regulatory Response

In theory, large livestock facilities have been regulated under the Clean Water Act for more than a quarter of a century. In practice, the regulatory impact of the law on the broiler industry and its enormous waste generation has been minimal at best, even in sensitive watersheds such as the Chesapeake Bay.

The modern-day Clean Water Act is widely credited with helping achieve dramatic reductions in water pollution across the country. Although the 1972 law's ambitious goals of "zero discharge" and "fishable, swimmable waters" have not been achieved in many areas, the quality of U.S. waters has improved dramatically from the days before the law, when fish kills were commonplace and an oil slick floating on Ohio's Cuyahoga River burst into flames.[52]

Many environmental policy analysts say the workhorse of the Clean Water Act has been the National Pollution Discharge Elimination System (NPDES) permit program, the section of the law that requires permitting or licensing of discrete or "point sources" of pollution.[53] Those permits, which may include specific limits on the concentration of pollutants associated with a facility, frequently compel the use of certain cleanup or control technologies and foster application of what amounts to good housekeeping practices to prevent violations of permit terms.

There is also broad agreement, echoed forcefully in a recent report from federal and state water regulators,[54] that the law's approach to diffuse or

Photo: David Harp

» Populations of blue crabs in the Chesapeake Bay have suffered from pollution related to sediments and nutrients flowing into the bay.

"non-point" pollution sources, such as cropland runoff, has been far less effective. In many bodies of water, uncontrolled non-point pollution now dominates pollutant flows and remains the primary obstacle to cleanup.

Although the law designates CAFOs as point sources, it also specifically exempts "agricultural stormwater" from the permitting requirements. In essence, then, large livestock operations have been given a unique and arguably ineffective dual regulatory status: regulated as point sources for waste in broiler houses and storage areas, but treated differently when that same waste runs off the cropland where it is applied.

In the mid-1970s, the EPA, in keeping with the approach used for other pollution sources, issued industry-specific regulations for CAFOs. These rules addressed leaks and spills from the storage of liquid manures in production areas but did not address management of manure used to fertilize crops. They also specifically excluded poultry facilities, such as most broiler operations, that manage and store manure in a dry state.

In 2003, the EPA issued regulations to cover dry-manure broiler operations and move toward addressing the issues of land application of manures. Finalized in 2008, the regulations called for permitting of large dry-manure broiler operations and other CAFOs and, for the first time, set requirements for land application of manure generated by those facilities. Growers, but not integrators, were required to address management of animal production areas, properly handle the storage of both wet and dry manure and, again for the first time, develop and follow nutrient management plans to control the loss of nitrogen and phosphorus from the fields where manure was applied. The latter requirement applied only to land "under the control" of the permit holder, and manure that left the facility was not subject to the permit requirements.

Implementation of the rule has been less than seamless. The EPA has no nationwide inventory of CAFO operations,[55] and court rulings have complicated efforts to ensure that all operations likely to create water quality problems are, like many other businesses managing waste, covered by permits.[56] The National Chicken Council, several of the large integrators and others have resisted efforts to require Clean Water Act permits or place new restrictions on land application of manure. Today, it is unclear just how many facilities will actually be subject to enforceable permits.

Multiple Strategies, Modest Results

Over the years, a variety of other efforts outside the Clean Water Act have been put in place to deal with pollution from poultry operations and other CAFOs.

Virginia, for example, passed legislation in 1999 requiring poultry operations with more than 20,000 broilers to acquire special state permits and implement nutrient management plans for

manure application.[57] Those plans were to be based on crop needs for phosphorus rather than the traditional and more permissive approach of nitrogen-based application rates. Virginia's broiler litter transport incentive program now subsidizes the movement of modest amounts of broiler litter outside the Chesapeake Bay watershed.[58]

In Maryland, a broader state transport assistance program covers a variety of livestock manures and provides special assistance to poultry growers in four lower Eastern Shore counties on the Delmarva.[59] Funding for the Maryland program derives in part from general appropriations and contributions from integrator companies.[60]

Delaware, likewise, uses federal and state funding along with money from some integrators to move manure out of certain areas that lack sufficient cropland. In 2009, the program, which cost approximately $850,000, subsidized the relocation of roughly 65,000 tons of manure from operations that could not use the waste as fertilizer.[61] About 15 percent of the program costs were picked up by the poultry integrators.

In 1997, after an outbreak of the toxic marine organism *Pfiesteria* killed thousands of fish and sickened several watermen and others,[62] Maryland took action to address the excess nutrients that appeared to be a catalyst for the costly episode. The Maryland Water Quality Improvement Act requires nearly all manure users to develop plans for the appropriate use of nutrients.[63] Recent reports from the state indicate a high level of compliance with the initial submittal requirements but noncompliance related to updating and implementing the plans.[64] Delaware followed suit with plan requirements in 1999, phasing in the mandate for plans from 2002 to 2007.[65]

In these bay states and elsewhere, many individual farmers have also taken voluntary action to control pollution. Many rely on federal

Photo: David Harp

» Chickens are caught to be placed in cages for transport to a processing facility in Delaware.

Photo: David Harp

» Chicken litter is removed from a poultry house. Most chicken litter is used as fertilizer on cropland.

funding to build manure storage sheds, plant cover crops, retire highly erodible lands and create vegetative buffers between fertilized fields and water courses. All of those efforts, without question, have made useful incremental improvements, but they have not achieved the dramatic reductions in nutrients long hoped for. As the report of the EPA's state and federal Nutrient Innovations Task Group noted in 2009, livestock agricultural practices remain one of the largest sources of nutrient pollution nationwide.[66]

Time for a New Approach

The problems of manure management are not new—they have evolved alongside a growing industry that now occupies pockets of the nation's Broiler Belt with intense production. Associated problems have been seen for decades in areas from the Illinois River to the Chesapeake Bay, and during that time, policymakers have looked for practical solutions but often met harsh resistance from the poultry industry. The result of that tension is chicken production that has outpaced environmental management.

For the Chesapeake, in particular, the USDA's recent assessment report may be the most telling. Despite a multitude of programs and more than two decades of education, the USDA finds that essentially every acre of farmland in the Chesapeake Bay watershed fertilized with animal manure requires better management.[67] According to the report, manure was applied to crops at the wrong time on roughly 84 percent of acreage. The rate of manure application, according to the USDA, was inappropriate on approximately 70 percent of the acreage for nitrogen and 81 percent for phosphorus.

In our view, these striking deficiencies point to the fundamental and unresolved issue: too much manure in too small an area, a problem that appears to be growing across the Broiler Belt. It will only worsen if USDA projections for growth in poultry production are accurate and if regulatory controls do not catch up. The Pew Environment Group believes that the time to meet that challenge is now, and the place to begin is an area where there is a deep understanding of water resource threats, a long-standing commitment to restoration, and a history of multi-agency cooperation. The Chesapeake Bay should be priority number one.

Photo: David Harp

» A pond near a chicken operation on Maryland's Eastern Shore is covered with algae, a problem in many areas because of excess nutrients.

CONCLUSION
AND RECOMMENDATIONS

Today's poultry industry has evolved into a system of streamlined manufacturing, processing and sales, allowing for mass production. This concentrated production has led to a chronic and growing problem of excess manure that, if left unsolved, will continue to cause deterioration of the Chesapeake Bay and its surrounding communities. Some approaches, including subsidizing transport of broiler litter, have addressed the symptoms of these problems but do not offer a permanent solution.

Poultry processors can no longer hide behind the image of the family farm when it comes to regulatory action. A new vision is needed to guide industrial animal agriculture in reforming its practices, respecting the environment and overhauling its relationship with contract growers. To prevent further degradation of the Chesapeake Bay watershed and to ensure progress on restoring the bay's ecosystem, the Pew Campaign to Reform Industrial Animal Agriculture recommends the following:

1 **There must be a balance between waste generated by CAFOs and the amount of cropland available for its disposal. The pollution issues raised by regional concentration clearly indicate that, in areas of extreme density (such as the Delmarva Peninsula), caps on total animal density should be part of the solution in the absence of new programs to manage the manure in ways other than simple land application.**

2 **Industrial animal agriculture, particularly the broiler industry on the Delmarva Peninsula, should bear its share of the responsibility for nutrient pollution reduction, assuming the financial and legal obligations of proper waste management. To achieve this, growers and integrators should assume responsibility for adhering to carefully crafted and effective Clean Water Act permits.**

Photo: David Harp

3 **The EPA and the states should develop a permit program for management of manure transported off CAFO sites. The permit program should include careful coordination and monitoring across watersheds when more than one state is involved.**

4 **To prevent unintended and unmanaged pollutant discharges from CAFOs, the bay states should require all large and medium-size operations to obtain Clean Water Act permits. States in the Chesapeake watershed and the EPA should proceed with the existing cleanup agreement and timeline. Congress should continue to fully fund the cleanup program and reject efforts to stymie the process.**

Finally, Pew urges that regulations applied to industrial animal agriculture in the Chesapeake Bay region be considered for application to this industry nationwide. By leveling the regulatory playing field, public officials can put a stop to the industry's often-repeated threat to move operations to states with minimum pollution safeguards. These threats serve only to undermine efforts to protect water supplies and rural communities, and to force elected officials and policymakers to establish "race to the bottom" standards that benefit no one.

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GLOSSARY

Agricultural storm water: For regulating concentrated animal feeding operations (CAFOs), the Environmental Protection Agency (EPA) defines agricultural storm water as a precipitation-related discharge of manure, litter or process wastewater from land areas under the control of a CAFO, where the manure has otherwise been applied according to a site-specific nutrient management plan that ensures appropriate agricultural use of the associated nutrients.

Algal bloom: A rapid increase in the growth of plantlike organisms in a freshwater or marine environment. Impacts may vary, with some blooms causing serious environmental damage and threatening public health.

Broiler Belt: A geographic area in the United States with a high concentration of broiler chicken production, currently extending from eastern Texas through Arkansas, Alabama and Georgia and much of the Southeast and north to Maryland and Delaware.

Broiler chicken: Young chickens, sometimes called fryers, raised primarily for meat production.

Broiler house: The structure in which broiler chickens are raised.

Broiler litter: A form of poultry waste taken from the floors of broiler houses that includes a layer of bedding material such as wood shavings, straw, sand or sawdust mixed with spilled feed, feathers, manure and urine. "Cake," the top layer of broiler litter, is generally removed after every flock; full house litter cleanouts may be done periodically, sometimes yearly.

Concentrated animal feeding operations (CAFOs): For purposes of Clean Water Act implementation, the EPA uses two important definitions:

- Animal feeding operations (AFOs) confine animals for 45 days or more in a 12-month period in an area that does not produce grass or other vegetation during the normal growing season.
- Concentrated animal feeding operations (CAFOs) are a small subset of AFOs, with distinctions based primarily on size and pollution discharges. Only CAFOs are subject to regulation as point sources under the Clean Water Act.
- A broiler operation is considered large, and therefore regulated as a CAFO, if it has a capacity of 30,000 birds or more and uses liquid manure management, or if it has a capacity of 125,000 birds or more and uses dry manure management. Medium-size facilities may be regulated as CAFOs depending upon their design, operation and management. Smaller facilities are regulated on a case-by-case basis if regulators determine that a pollution problem exists.

Contract grower or grower: In the context of this report, a person who agrees to grow broilers for an integrator. Generally, the grower provides labor, housing and equipment. The grower may also supply power and heat and may care for the broilers according to the integrator's specification. The contract grower does not own the poultry but is usually responsible for management of manure and dead birds.

Dead zone: An area of water that cannot support aquatic life because oxygen is absent or at a very low level.

Delmarva Peninsula: The area where parts of Delaware (three counties), Maryland (nine counties) and Virginia (two counties) converge between the Atlantic Ocean and the Chesapeake Bay. Maryland's portion of this area is also referred to as its Eastern Shore.

Eutrophication: A process in which a body of water becomes enriched with a high concentration of nutrients, especially phosphates and nitrogen. These nutrients promote the growth of algae; as the algae die and decompose, high levels of organic matter deplete the water of available oxygen.

GLOSSARY

Geographic concentration: In the context of this report, the location and number of broiler growing operations and related facilities, such as breeding operations, feed mills and processing plants, within a geographic area.

Groundwater: The water below the earth's surface that is found within the pore spaces and cracks between particles of soil, sand, gravel and bedrock.

Grower: See contract grower.

Integrator: Commonly refers to the poultry-processing companies that have financial interests and decision-making power over multiple phases of the poultry production process. See vertical integration.

Nitrates and nitrites: Nitrogen-oxygen molecules that nitrogen can create in water. High levels of nitrates in drinking water can pose a serious threat to the health of humans, particularly infants. See also nitrogen.

Nitrogen: A nonmetallic element that is essential to life and moves through the environment in a complex cycle, transforming into a number of chemical forms, including organic nitrogen, ammonium, nitrite, nitrate and nitrogen gas. Nitrogen is critical to plant growth, but excess nitrogen in water can contribute to algal blooms, unhealthy levels of nitrates in drinking water and other water-quality problems.

Non-point source pollution: Under the Clean Water Act, water pollution that originates from diffuse sources. Non-point source pollution is often caused when rain or snow-fed runoff picks up natural and human-made pollutants (including those from agricultural activities) and deposits them in lakes, rivers, wetlands, coastal waters and groundwater.

NPDES permits: Permits issued according to EPA's National Pollutant Discharge Elimination System (NPDES) program, which was authorized by the Clean Water Act and prohibits the discharge of point source pollution into U.S. waters except in compliance with a special permit issued by EPA, a state or a tribal government.

Phosphorus: An element essential for biological life and critical to plant growth. Found in the earth, water and all living organisms, phosphorus cycles through the environment and in excess amounts can cause eutrophication in freshwater and marine environments.

Point source pollution: Under the Clean Water Act, pollution from any confined and discrete conveyance, such as a pipe, ditch, well, CAFO or vessel, from which pollutants are or may be discharged. The term does not include agricultural stormwater discharges and return flows from irrigated agriculture.

Poultry: In the context of this report, broiler chickens.

Processor: A business that manages and operates a plant that slaughters and eviscerates poultry and often performs other functions of production, processing and marketing.

Vertical integration: In the context of this report, coordination or ownership by a single entity of production, processing, marketing and distribution. In broiler production, it involves contracting for "grow-out" services to raise flocks of chicks to processing weight. Many poultry companies are vertically integrated across the full range of broiler production phases and own breeder flocks, hatcheries, feed mills and processing plants. Ancillary services such as building and equipment supplies, transportation, fuel and financing may also be affiliated with the operation.

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