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Story: How Many Lives Does a Lake Have?
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Meat has never been cheaper.

Last fall, my local grocery ran a Thanksgiving special on turkeys — 29 cents a pound if I bought $30 worth of goods to go with it. But that cheap meat comes at a price.

In late summer of 2010, Sodus Bay, a shallow embayment of Lake Ontario, turned bright green with a thick scum. No one there had ever seen anything like it. Within days, the New York State Health Department had posted warnings to avoid swimming and any ingestion of the bay's water. Anger, angst, indignation and protests from cottage owners, anglers, boaters, business owners and other bay users followed.

This is an accumulation of filamentous algae. When the algae is torn loose and rots offshore, it uses oxygen and can cause botulism on the lakes.

The cause of their alarm was an intense bloom of toxic blue-green algae. As public swim beaches were closed and dead fish and rotting vegetation washed up in front of $400,000 homes, another community awakened to the true costs of “cheap” food, and the industrialization of farming across North America.

A two-hour drive to the west, Lake Erie experienced similar blooms. This was the Great Lake declared dead 40 years ago only to be brought back to life by the Clean Water Act of 1972.

But the Lake Erie is getting sick again.

Scientists such as Ken Wagner of the Environmental Protection Agency and Robert Howarth of Cornell University warn that within a few years we may soon be writing its obituary along with that of Lake Ontario's inshore waters, dozens of other smaller lakes and thousands of miles of streams and rivers from California to Vermont. Our waters are becoming sick partly because of changing agricultural practices.

Large industrial factory farms, also known as concentrated or confined animal feeding operations, or CAFOs, feed thousands of animals or tens of thousands of birds in huge warehouse-like buildings and produce massive amounts of manure and other waste that can pollute waterways. Poultry, hogs and beef or dairy cows are fed largely or exclusively on grain-based prepared feed, often grown on another farm and then imported to the animal holding area. The animals produce tons of excrement, which must be disposed of on surrounding crop lands.

This snow-and manure-covered field slopes downward and will likely drain into nearby water sources. To reduce environmental impact, farmers can avoid spreading manure in the winter, especially on hills.

Because there isn't enough acreage to absorb all the waste, many of these large-scale farming operations routinely over-apply manure on their fields. Some of the waste, which contains pathogens, antibiotics and endocrine system disrupting chemicals, either soaks into the soil to contaminate aquifers or runs off into waterways, killing fish and potentially spreading disease.

Across the country, surface-and ground-water sources alike are at risk from excess manure spreads.

According to its website, the Environmental Protection Agency, or EPA, estimates that pathogens such as E. coli are responsible for 35 percent of the nation's impaired river and stream miles and says that factory farms are one of the most common sources. Nitrate contamination in excess of federal drinking water standards, much of it from agricultural runoff, is estimated to have impacted 24 percent of America's groundwater supplies, according to EPA data. Nitrates are carcinogenic and have other adverse health impacts. And the problem of nitrates in water supplies is getting worse.

For a century, state and federal government agencies and university researchers have urged and subsidized farmers to become more efficient. Farmers responded. Agriculture, like many other businesses, has consolidated at an accelerating rate since the 1960s. According to the Journal of Dairy Science, the number of dairy farms in New York decreased by about 37 percent, from 13,000 herds in 1990 to 8,200 herds in 1999. The result is today's CAFO, an energy and capital intensive endeavor that confines thousands of cows or pigs or tens of thousands of chickens in warehouse-sized buildings.

These livestock operations nationwide generate more than three times as much waste as people do, according to EPA estimates. The Citizens' Environmental Coalition and the Sierra Club report that a single dairy farm with 3,000 milking cows near my home in upstate New York produces four times as much waste as the city of Syracuse. Yet most factory farms lack any sort of waste-treatment facilities comparable to those that treat human sewage.
Excess manure also causes water-quality problems by acting as a fertilizer. In water, as on land, fertilizer causes plant growth. The result often is thick mats of water weeds that clog shallows and make boating and swimming impossible. When the vegetation dies off, decay uses the oxygen in the water. Then fish and other aquatic animals, including the tiny water fleas and insect larvae that are the base of the food chain, also die. Sometimes “dead zones” result.

In freshwater, these can promote the growth of Botulina bacteria that sometimes produce one of the most potent naturally occurring neurotoxins known. According to the New York State Department of Conservation and the U.S. Geological Survey, an outbreak of botulism killed tens of thousands of birds and many fish on Lakes Erie and Ontario in 2006.

Fish-eating birds like the merganser (pictured) and the loon were hit hard on Lake Ontario in fall 2006.

Too much animal waste in water also promotes the growth of one-celled blue-green algae, also known as cyanobacteria, that sometimes produce toxins as they cloud the water with green slime. In 2010, Lakes Erie and Ontario experienced intense blooms of a blue-green algae in late summer that closed beaches because of high levels of a liver toxin called microcystin.

The various toxins that blue-green algae might produce could be deadly, though humans rarely ingest enough to suffer more than stomach upsets, rashes or skin blisters. Toxins can persist in the water and can be difficult to filter out. In 1996, in one highly unusual case that focused international attention on algae toxins, water used for dialysis in a Brazilian hospital had been filtered and purified, yet more than 50 patients suffered liver failure and and a number died from algal toxin poisoning.

These algae have long been known to produce toxins that sickened and occasionally killed livestock that drank from farm ponds and dogs that swam in polluted lakes or bays. But blue-green algae blooms appear to be increasing in size and frequency in recent years, according to Greg Boyer, chemistry department chair at the State University of New York. At least some of the increase is due to agricultural runoff from manure-laden fields.

In 2010, a combination of warm summer weather and ample fertilizer inputs caused blue-green algae outbreaks in Lakes Ontario and Erie and in dozens of smaller inland lakes across the Midwest. Ohio's Grand Lake Saint Marys made headlines with its spectacular green slime topped with white foam, while reactive phosphate inputs to Lake Erie from the Sandusky and Maumee Rivers last summer were at an all-time high since the start of a Heidleberg College tributary monitoring program that began in 1975.

By late summer, European MERIS satellite imagery showed two-thirds of the lake's western basin was covered by an algae bloom. Phosphates, along with nitrates, are the main fertilizers in manure that promote plant growth. Corn, used extensively as animal feed in industrialized agriculture, is especially problematic.

Howarth, an oceanographer who has studied nitrate pollution for decades, said, “Corn is particularly 'leaky' as a crop for losing nitrogen.” In a recent Internet post, he wrote that the fertilizer used on Midwestern cornfields is the principle culprit responsible for the Gulf of Mexico's dead zone, a huge swath of ocean devoid of fish and shellfish. Although no crop can

absorb all the fertilizer applied to it, corn is especially wasteful. Its shallow roots use only the nitrogen in the top few inches of soil, and unlike most plants, corn takes up nitrogen for only two months of the year.

Howarth said, “(Typically), a quarter or more of the nitrogen fertilizer (applied to corn) is wasted, running off the fields and into rivers and streams...” Unless we take action, he and many other researchers only see the problem getting worse. Coastal dead-zone areas impacted by runoff are rapidly increasing in number and size. “We now have over 150 of them distributed worldwide,” he said. Oxygen-depleted areas have been linked to the sharp declines of several major coastal fisheries, according to the UN News Centre.

Green slime and dead zones in lakes, rivers and coastal areas aren't the only problems associated with agricultural runoff from factory farms. Antibiotics, one of modern medicine's greatest assets in treating disease, are threatened by the rise of resistant bacteria. Increasing evidence points to agricultural practice as a big part of the problem.

Factory farmers routinely feed large amounts of antibiotics to overcrowded, stressed animals to promote growth and faster weight gain. A recent FDA report estimates 80 percent of the total use of antibiotics in the U.S. is agricultural. Some of the pharmaceutical doses fed are not absorbed and end up in manure. When spread on fields, new antibiotic-resistant strains of bacteria can arise. Various bacteria in the environment readily exchange their genetic material, a fact that has been known for decades.

But the significance of this to human health has become clearer as the number of resistant strains of bacteria has increased rapidly, and the pipeline of new types of antibiotics has gone dry. There are now bacteria in hospitals that are resistant to nearly all available antibiotics.

At the same time, the practice of routinely feeding antibiotics actually promotes the development of resistant strains of bacteria within the hog, steer or bird being fed them because the relatively low dose doesn't kill the toughest bacteria. The "super bug" survivors then pass on their resistance to other bacteria. Sometimes, genetic traits move between completely unrelated bacteria within humans. A normally harmless microorganism found in the gut can pass antibiotic resistance to a much more dangerous population of bacteria living on skin that can readily infect wounds.

So-called nontherapeutic use of antibiotics on the farm has been tagged by numerous scientists and medical practitioners as posing a grave risk to human health. Some have gone so far as to term it a public-health crisis. The possibility of a “post-antibiotic era” is very real. The young cancer patients under treatment, diabetics and other people with compromised immune systems are especially vulnerable to diseases once easily treatable with antibiotics. We may see a time when once again, as in the 19th century, diseases like pneumonia or urinary-tract infections now routinely treated with antibiotics will become killers.

Humans can come into contact with resistant bacteria by eating meat, eggs or other foods contaminated with them, or they can be exposed to super bugs that have escaped to the environment through manure spreading, water pollution, insects or wind-borne dust. Researchers have also found resistant bacteria in factory farm workers can be transferred to other people.

CAFOs use commercially prepared feeds to fatten their hogs, steers or broilers, and various resistant bacteria such as Salmonella and E. coli have been found in feed samples. One study that looked at the various protein components of chicken feed documented antibiotic-resistant strains of bacteria in 85 percent of the ingredients.

Three months after the algae bloom on Sodus Bay had faded away, a crowd of dairymen, Farm Bureau members, unhappy farm neighbors and waterfront homeowners filled the auditorium of a former elementary school. They had come to hear Barbara Sha Cox, a nationally known activist from Indiana, speak about living with CAFO farming. The former dairy herd owner and retired nurse said to the group: “The right to farm is not the right to harm. Farming can't be up there on a pedestal, it has to be subject to regulations just like other businesses.”

She was referring to right-to-farm laws that various states enacted in the 1980s after suburban sprawl led to conflict between farmers and homeowners offended by noise, smell and pesticide use. Today's industrialized CAFOs are far larger and more polluting than farms of 30 years ago, yet they remain exempt from many local and state laws under right-to-farm legislation, according to a report from the Citizens' Environmental Coalition and the Sierra Club. CAFOs are also exempt from many federal water-quality regulations that are imposed upon much smaller sources of industrial pollution and subject only to state level oversight and inspection.

Often, according to environmentalists and unhappy farm neighbors suffering from stenches and polluted wells, state regulation proves to be inadequate. In my region of New York, for example, one inspector has to cover an 11-county area and typically spends a few hours checking records and the physical operations of farms that may be several thousand acres in size.

Large farms can reduce pollution by adopting sensible manure-spreading practices that avoid applying animal waste on frozen ground or before heavy rains on slopes. Effective buffer strips of permanent vegetation next to waterways and other measures to trap runoff and nutrients also greatly reduce pollution. However, such practices add time and cost to the farming operation. Past government subsidies have encouraged better manure-disposal practices, but funds are limited. And despite vigorous opposition from farm lobbies, many environmentalists believe regulation of industrialized farming would be more effective at cutting pollution than subsidies.

“Best management practices should be considered part of the cost of doing business," said Cox, who has been active for years on CAFO issues. "Look at what it costs to clean up old brownfields and underground storage tanks. The cost to the taxpayers (is) staggering because the proper regulations were not in place then. We should not burden the future generations with these costs. Water is critical to life, and we must leave our children and grandchildren with water that is not polluted.”

Cox also said that before building their facilities, all large industrialized farms should be required to post a bond or otherwise establish a fund for cleanup costs should they go bankrupt as other industries now must do. The EPA has gradually begun moving to greater regulation of industrial farms. In December 2010, a program to limit pollution from farm fields within the watershed of the Chesapeake Bay began in six states.

Several environmental groups have tried to nudge federal regulation along. A lawsuit filed in 2009 by the Natural Resources Defense Council, the Sierra Club and the Waterkeeper Alliance resulted in an agreement to expand federal oversight with new EPA regulations for CAFOs to be released this spring and finalized in May 2012. The regulations specify that the EPA collect more data on how large CAFO operations dispose of their animal waste. This would be the first step in determining if additional federal regulation is needed.

Until recently, the hidden costs of factory farming have been largely ignored in the U.S., but consumers and regulators are beginning to push farmers to adopt methods of raising animals that produce less pollution and human-health risk. In 2006, the European Union banned the use of antibiotics as growth promoters in agriculture, and New York and Pennsylvania have recently introduced similar legislation to restrict routine use of antibiotics on farms.

New York Rep. Louise Slaughter, a former microbiologist, sponsored similar legislation in last year's session of the House of Representatives. The bill died, but in March 2011 she and cosponsors reintroduced H.R. 965 to limit antibiotic use for growth promotion in farming.

The marketplace is also slowly responding to concerns about factory farming's impact on human health and the environment. Pasture-fed beef has gained a toe hold in the U.S. marketplace, as new methods and forage systems are being introduced to make grass-fed meat more competitive with factory-farm meat.

Grass-fed cows on smaller dairy farms generally pose less problem than CAFOs in large part because the farm grows its own food and the fields can absorb the manure.

According to a farm trade magazine, Allen Williams, a consultant to the business, said, “Grass-fed beef production really has gone from a minuscule industry in the '90s to a thriving billion-dollar industry now.” He estimated that the U.S.-based part of the business has grown twentyfold in just 10 years.

Unfortunately, the dairy pork and chicken business lags behind and continues to rely heavily on row crops for feed, though a small number of farmers are serving niche markets with free-range chicken and pasture-raised pork, and recent organic dairy standard changes mandate substantial grass intake for cows.

The eat local “meet your meat” movement that seeks to shorten the food chain between producers and consumers has also raised awareness of the costs to human health and the environment from factory farming. The trend has helped grow demand for free-range chicken,

eggs and pork. Direct sales to consumers at farm markets, through community supported agriculture buying groups, or from on-farm sales, has increased markedly in the past five years.

The USDA reported a 16 percent increase in the number of farm markets from 2009 to mid-2010. In North Carolina, where only one producer was a registered farm-to-consumer meat seller in 2002, there are now more then 300 such registered meat sellers. The recent growth of “winter” farm markets in the Northeast and on the West Coast has helped fuel sales of fresh and frozen free-range meat, and mobile slaughterhouses have begun to relieve the bottleneck posed by the few small meat processors that have survived industry consolidation.

In her presentation to the farmers and their neighbors in the Sodus Bay watershed, Cox said, “Common sense and consideration would go a long ways towards easing bad feelings between agriculture and country neighbors.” Along with that, those of us who eat meat, eggs and dairy products need to consider the true costs of our food.

Cox said: “When a shopper looks at the price per pound on the meat wrapper, what they do not see are the subsidies that the taxpayers have paid and the cost of cleaning up polluted waters. Farmers may own the land, but they don't own the watersheds. They belong to everyone. We all have a stake in our food production system. The food we eat affects the water we drink.”