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Unsafe levels of phosphorous, bacteria at 39 state beaches

Increased drainage delivers nutrients from iowa fields without cover crops

BY TOM CULLEN

Phosphorous loadings into Iowa's waterways aren't getting any lighter, thanks to wetter weather.

Around 80% of Iowa's landscape is devoted to farmland, most of which is uncovered outside of the growing season. And there's little evidence that's changing substantially with a half a percent of Buena Vista County's acreage in winter cover.

Phosphorous levels are attributed to agricultural activity because it doesn't naturally occur in Iowa water, says Steve Kalkhoff, a hydrologist with the U.S. Geological Survey. Stream monitoring of the Cedar and Des Moines rivers dating back to the early 1900s indicate nitrate and phosphorous were virtually non-existent before fertilizer applications ramped up in the 1970s.

He said nutrient levels can be attributed, roughly, to fertilizers, which are derived from nitrogen and phosphorous.

"Fertilizer sales have been flat since 1980, and nutrient transport's been basically at an equilibrium," Kalkhoff said. "That's a rough proxy for saying landscape use is basically at an equilibrium."

In 2017, the latest year for which data was available, 24,000 tons of phosphorous left the Iowa landscape to the Mississippi River. Chris Jones, a hydrologist with the Iowa Water Center, told The Storm Lake Times the amount hasn't fluctuated much since 2000.

The only thing that's changed is a steady increase in drainage, to move a significant increase of precipitation — about 1% per year — from the landscape to streams, correspondingly getting faster and wider.

That means more phosphorous is leaching during spring and fall flushes to surface waters.

Phosphorous is a vital issue for the Gulf of Mexico, which can't sustain aquatic life because it's choked by a dead zone, comprised of heavy concentrations of phosphorous and nitrate, that is the size of New Jersey and growing every year.

With high phosphorous levels nearly ubiquitous — it's being detected at USGS gauges from Sac City to Van Meter on the Raccoon River — scientists are only left with questions as to what conditions phosphorous will foster.

To Jones, who maintains a regular water quality blog, it's an easy prediction: algal blooms, which plagued 12 state-owned beaches over the last two years, will become more frequent. Thirty-nine Iowa beaches are impaired by bacteria fostered by phosphorous concentrations.

"You have the following assumptions: you have the same amount of phosphorous and greater stream flow," Jones said. "Of course you'll have more algal blooms."

But algal blooms, themselves, aren't one in the same. Some can be large, like the red tide that swept from the southern coast of Alabama to the Florida Keys last year. That one caused a spate of marine deaths in the area. Others can be small, short-lived and are every bit as toxic. In 2017, Des Moines Water Works detected microcystin levels — toxic byproducts of blue-green algae fostered by high phosphorous levels — above World Health Organization's guidelines, and issued a boil advisory.

Environmental Working Group has started a project to track algal blooms and their effects through news reports and state clearinghouses, but there isn't a federal database to track them. The State of Iowa monitors them through a patchwork of municipal drinking water systems and the Iowa Department of Natural Resources' beach advisories and ambient water quality monitoring program.

The DNR's data isn't considered sufficient for research purposes. DNR Lake Monitoring Program Coordinator Dan Kendall told The Times the DNR's data is considered "an advisory to the public," and has little bearing on the number and size of algal blooms in the state.

Roger Bruner, supervisor of water quality monitoring for the DNR, told The Times the number of beach advisories issued in connection with increased microcystin levels has decreased to around six per year over the last five years.

"Generally speaking, nutrient levels are high in our springs, which have gotten cooler and wetter," Bruner said. "There's a theory out there that we're seeing less blooms because of those conditions in the spring and early summer."

Outside of high nutrient levels, increased sunlight, low stream flow and high temperatures are generally considered conducive to algal blooms.
But a Times survey of scientists studying the issue said the research is unclear as to the frequency, toxicity and magnitude of algal blooms into the future. Jones was fairly certain they'll become more frequent. Temperatures, especially in the nighttime, and precipitation are rising in the Midwest thanks to climate change. That means there'll be more episodes when a surplus of water suddenly becomes ambient on a hot summer day.

But even if they become more frequent—the DNR's Bruner contests that assertion — it's unclear as to whether they'll become more toxic. That's a question that's salient in the minds of administration at Des Moines Water Works. An algae bloom is concerning, but an algae bloom that releases microcystins over 30 micrograms per liter triggers its treatment plant into an emergency. Microcystins, even at trace levels, are considered extremely hazardous when consumed or during contact. Water treatment facilities have no answer on how to filter out the toxins, which is why their systems shut down rather than begin filtration processes. The City of Toledo, Ohio, shut down its water supply in August 2014 because an algal toxin in Lake Erie reached an intake.

And in 2017, DMWW detected cylindrospermopsin at its intake at the Saylorville Reservoir, a microcystin researchers thought was only native to subtropical climates, but was found in Des Moines.

George Bullerjahn, a researcher at Bowling Green State Univesity studying the instance of toxic algal blooms across the Midwest, told The Times the current research into algal blooms hasn't yielded a predictive indicator toward biomass or toxicity.

"Basically, the only question the research has answered to this point is that these things are rare, and sometimes, toxic," Bullerjahn said. "Algal blooms are complex ecosystems, where there's an interplay between toxic and non-toxic phenotypes."

When asked about the continued persistence of algal blooms, Bullerjahn said the main predictive indicator is phosphorous levels, which are near areas of concentrated agricultural activity. The only trend he's deciphered

is that blooms are becoming more frequent in northern areas. Last year, there was a report of a bloom along Lake Superior, which was thought to be too cold to for an algae bloom.

He said climate change is making the research less clear, not more.

“The question we have is whether what types of blooms we’ll see,” Bullerjahn said. “And we can generally guess they’re in heavily concentrated ag areas.”