The Iowa Policy Project
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***EXECUTIVE SUMMARY***

# Scum in Iowa's Water

## *Dealing with the Impact of Excess Nutrients*

**By Andrea Heffernan and Teresa Galluzzo**

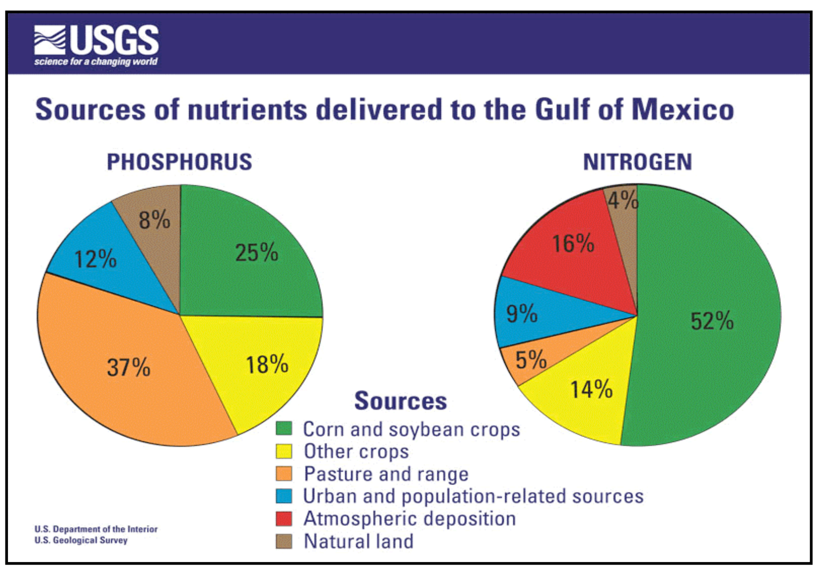
Iowa's approximately 93,000 farms comprise 86 percent of the state's total land area. Trends in agriculture have led to tandem growth in the use of synthetic fertilizers and herbicides in corn and soybean production, and application of nutrient-rich animal manure, both of which contribute to runoff into Iowa waterways. Likewise, lawn fertilizers produce runoff into waterways, which also receive effluent from wastewater treatment plants. In all cases, these processes introduce excess amounts of phosphorus and other nutrients to Iowa waterways, resulting in proliferation of a blue-green algae known as cyanobacteria.

### *What are Cyanobacteria?*

Cyanobacteria have become increasingly common in Iowa waterways. Cyanobacteria are a form of bacteria present in various aquatic environments and when conditions are favorable for them — abundant nutritional sources, adequate sunlight and temperature — cyanobacteria can reproduce rapidly and form high-density blooms.[1] Some blooms, known as cyanobacterial harmful algae blooms, will produce and release toxins. These harmful algae blooms contaminate waterways and are harmful to wildlife and humans that come into direct contact with contaminated water. When the blooms occur in drinking water sources, they can also cause difficulties in water treatment.

Nitrogen and phosphorus serve as the primary nutritional sources for cyanobacteria. These nutrients enter waterways through agricultural runoff (row crop and animal production), lawn fertilization and wastewater treatment effluent. Agriculture sources contribute 80 percent of the total phosphorus and 70 percent of the total nitrogen delivered to the Gulf of Mexico (see figure). Iowa is one of nine states responsible for contributing over 70 percent of nitrogen and phosphorus pollutants to the Gulf.[2] That means these nutrients occur in excess quantities in Iowa and as a result, cyanobacteria are a threat to water quality for many Iowa lakes and rivers.

**Figure 1. Farms are Primary Source of Phosphorus, Nitrogen in Mississippi River Basin**




*Source: U.S. Geological Survey*

### *Health Effects*

A number of health effects are associated with exposure to (recreating in or drinking) water contaminated with harmful cyanobacteria for people and animals. Health effects associated with exposure include skin irritation; trouble breathing; allergic responses; stomach and intestinal illness; liver damage; neurotoxic reactions such as tingling fingers and toes.[3] Cyanobacterial toxins have also been implicated in animal and human deaths.[4]

### *Water Treatment*

The American Water Works Association recommends alternate drinking water treatment processes be used if cyanobacterial cell counts exceed 15,000 cells/ml. Even when the concentrations of cyanobacteria organisms reach levels of 10,000 cells/ml, water treatment processes can be complicated. Altering water treatment processes results in increased energy and water consumption, as well as an overall increase in operating costs. Capacity is also reduced during times when levels of cyanobacteria are above the 10,000 cells/ml. Further, the altered treatment processes may cause objectionable tastes and odors.

### *Cyanobacteria in Iowa*

Cyanobacteria are found in several Iowa waterways, including those that provide our drinking water. The Des Moines Water Works, which provides drinking water to the largest number of Iowans, reported levels of cyanobacteria in their source waters reaching well above10,000 cells/ml in 2008 and 2009. Most elevated levels remained between 20,000 to 50,000 cells/ml, but some reached as high as 80,000 cells/ml.

Cyanobacteria have been reported in other municipal drinking water sources, however utility managers have asked to remain anonymous. Often times utility managers are unsure how to proceed or what information to communicate to customers when there are water quality problems with the source supply. Further, utility mangers do not have to report the presence of cyanobacteria because they are not a regulated contaminant.

### *Monitoring, Reporting and Regulation*

The Environmental Protection Agency has not established formal guidelines or regulation mechanisms for cyanobacteria or cyanobacterial toxins. Due in part to lack of regulation for cyanobacteria and cyanotoxins, no standardized detection method has been established nor has a best available technology emerged for removing toxins from drinking water.[5]

Iowa Water Quality (WQ) Standards also do not regulate cyanobacteria, likely due to the lack of federal regulation. Because the current Iowa WQ Standards have no criteria established in regards to cyanobacteria, the Iowa Department of Natural Resources (DNR) has not developed an assessment/listing methodology specific to cyanobacteria and there are no current plans by the DNR to add such a criterion to Iowa WQ Standards.[6]

The DNR does consider high levels of cyanobacteria in waterbodies a potentially serious water quality issue and will utilize the narrative WQ criterion protecting against “nuisance aquatic life” to rank cyanobacteria levels in lakes.[7] The DNR does note that lakes with the highest levels of cyanobacteria are already Section 303(d) impaired due to trophic state index[8] values for chlorophyll-*a* that suggest impairment. Lakes with very high levels of chlorophyll-*a*, and thus very large algal populations, are assessed as violating Iowa’s narrative water quality standard protecting against “aesthetically objectionable conditions” that can limit use of the lake for swimming, boating, and other beneficial uses.[9] While such lakes are added to Iowa's Section 303(d) list of impaired waters, this does not necessarily result in action to improve their quality.

### *Cyanobacteria and Climate Change*

Observed and forecasted effects of climate change will likely impact cyanobacterial blooms. Three of the changes anticipated for Iowa[10] could lead to increased cyanobacterial blooms:

- Heavy downpours are predicted to increase in frequency and intensity and will result in increased runoff as soils are unable to absorb vast amounts of precipitation over short periods. Increased runoff will contribute to nutrient concentrations in nearby waterways.
- Water and air temperatures are expected to increase. As water temperatures increase, the likelihood of bloom formation increases as well.
- Growing seasons are also expected to lengthen, possibly resulting in increased crop yields. However, the increases in insects and weeds that are also predicted, will likely result in greater applications of fertilizers, pesticides and herbicides, again contributing to the over abundance of nutrients in our waterways.

### *Recommendations*

Reducing excess nutrients from entering our waterways from all sources is the number one step toward controlling the proliferation of cyanobacterial blooms. Limiting the amount of synthetic fertilizers and manure applications to farm fields would likely have the greatest impact on total reduction of excess nutrients entering Iowa waterways. Voluntary conservation practices structured on incentive-based payments do not ensure an efficient use of resources designated to reduce nutrient loading.[11] So while agricultural conservation practices have benefits, voluntary conservation techniques alone will not adequately address nutrients in Iowa waters. Capping the amount of fertilizer and/or manure that can be applied to agricultural fields to levels appropriate for maximum crop yield will have far-reaching effects on nutrient reduction.

A number of agricultural-related nutrient management programs can be employed to control the number of nutrients entering Iowa waterways:

- Manure Management — match nutrients in animal feed to the animal's nutritional requirements to eliminate excess phosphorus in animal waste in addition to testing the nutrient content of manure and soil before applying manure to farm fields.[12]
- Riparian Buffers — buffers separate waterways from adjacent land uses through the planting of shrubs, trees and other plants with extensive root systems.[13] The buffers reduce the volume of nutrients entering waterways in addition to keeping water shaded, which results in cooler water temperatures and a less hospitable environment for cyanobacteria.
- Precision Farming — tailors nutrient inputs to specific plots within a field. Farmers tests soils to determine the appropriate amount of fertilizer needed on a plot by plot basis.[14]
- Conservation Agriculture — focuses on a reduction in tillage, retention of crop residue, and the use of crop rotation, all done in a cumulative manner. Benefits include a reduction in soil loss, greater water and nutrient retention in soils, reduced soil erosion, water runoff and the need for synthetic fertilizers.[15]

### *Conclusion*

Regulatory standards for cyanobacterial levels should be adopted. However, the real solution for reducing this harmful contaminant is limiting the amount of phosphorus and nitrogen from both agricultural and urban areas that reach Iowa waters. State policy should strike at the source to address cyanobacteria and their negative environmental and health effects. Iowa should take such actions to protect its water and citizens.

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[2] Alexander, R.B., et. al. (2008). Differences in phosphorus and nitrogen delivery to the Gulf of Mexico from the Mississippi River Basin. *Environmental Science and Technology, 42, 822*.

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[7] Ibid.

[8] Carlson's trophic state index is an index used by the EPA and Iowa DNR that measures the total weight of biomass in a given body of water.

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