Do Iowa Residents and Farmers Care about Improving Water Quality and Reducing Harmful Algal Blooms? Results from Two Household Surveys

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Acknowledgments

Executive Summary

Nutrient pollution from agricultural non-point source runoff is one of the most critical water resource issues in the United States today. The establishment of the Mississippi River/Gulf of Mexico Hypoxia Task Force to address hypoxia in the Gulf of Mexico led to the creation of the 2013 Iowa Nutrient Reduction Strategy. However, implementing these efforts is costly and requires significant federal and state funding. For example, in 2018, Iowa Governor Kim Reynolds' first legislation provided $282 million over 12 years to fund edge-of-field and in-field infrastructure projects designed to meet nutrient reduction strategy goals and to fund projects to improve the quality of Iowa's surface water, ground water, and drinking water.

Understanding the economic benefits from reducing nutrient pollution is essential to justify these investments and determine the direction of conservation programs. This policy brief uses recent results from two household surveys in 2019 and 2020 to gauge Iowans' perceptions and attitudes toward water quality issues and associated policies. Iowa Water Center grants funded both surveys.

Iowa State University's Center for Survey Statistics and Methodology conducted the surveys in summer 2019 and summer 2020. The data collection process followed Dillman's mixed-mode (web/mail) survey design. The first wave of the survey targeted the general public and received a total of 858 completed surveys during the data collection period, a response rate of 28.7%. The second wave of the survey targeted farmers in the Boone and North Raccoon River watersheds and received a total of 493 surveys during the data collection period, a response rate of 49.4%. Major findings from the two surveys are as follows:

- Farmers believe water quality is less of a concern than the general public.
  - Thirty-two percent of the public and 55% farmers think Iowa's water quality is good or very good.
  - Half of the general public and 30% of farmers think algal blooms are very harmful.
  - Thirty-five percent of the general public and 26% of farmers are concerned about nitrates in drinking water in their neighborhood.
- Iowans increasingly regard harmful algal blooms as an important issue.
  - Sixty percent of respondents have seen algal blooms at least once in person.
  - Fifty-eight percent of Iowa general public is at least somewhat aware of algal blooms in Iowa's lakes.
  - Twenty percent of the general public has no awareness of algal blooms in Iowa's lakes.
- The knowledge of and views about the Iowa Nutrient Reduction Strategy is somewhat mixed and differs between farmers and the general public.
  - Sixty percent of the general public and 32% of farmers think agriculture (manure + fertilizer) is the biggest source of excessive nutrients in Iowa's lakes.
  - More than 60% of the general public and 20% of farmers have no familiarity with the Iowa Nutrient Reduction Strategy.
  - Forty-seven percent of farmers agree or strongly agree that the strategy is a feasible plan to reduce nutrients, 42% are neutral or do not know.
  - Nearly 40% of the general public has no familiarity with the hypoxic zone in the Gulf of Mexico.

- The majority of the general public, but only 22% of farmers, consider a special sales tax on all fertilizer the most appropriate way to fund lake protection programs in Iowa.
- Thirty percent of farmers chose a recreational fee as the best way to fund the Iowa Nutrient Reduction Strategy.

Survey Implementation

In the summers of 2019 and 2020, Iowa State University's Center for Survey Statistics and Methodology (CSSM) conducted two waves of surveys to understand perceptions of Iowa farmers and general public about water quality in Iowa's waterways and their attitudes toward waterway improvement programs. The data collection process followed Dillman's mixed-mode (web/mail) survey design (Dillman et al. 2014). As part of the survey development, CSSM conducted six cognitive interviews with Iowa residents of varying ages and education to obtain feedback on survey questions.

The first wave of the survey targeted the general public. CSSM purchased a sample of 3,000 Iowa household addresses,[1] proportional by county, from Dynata and randomly selected 200 households to pilot the survey and ensure responses were appropriate for the survey questions. On July 22, 2019, CSSM sent an invitation letter describing the purpose of the survey and encouraging participation, and a $2 bill, to the remaining 2,800 households. On August 12, 2019, CSSM sent a survey packet to 2,417 non-responders with deliverable addresses from both the pilot and the main samples. The survey packets contained a cover letter, paper survey, and a postage paid return envelope. On August 20, 2019, CSSM mailed a reminder postcard to 2,416 non-responders. As table 1 shows, we received a total of 858 completed surveys (363 web/495 mail), a response rate of 28.7%, during the data collection period (July 22–December 19, 2019).

Table 1. 2019 Iowa General Public Survey Response Rate

Sample	3000	
Not Eligible	13	0.4%
Eligible Sample	**2987**	
Returned by USPS	448	15.0%
Refused	24	0.8%
No Response	1632	54.6%
Completed Surveys	**858**	**28.7%**
Online	363	42.3% (363/858)
Paper	495	57.7% (495/858)

The second wave of the survey targeted farmers. On July 9, 2020, CSSM sent the survey invitation letter and $2 bill to 1,000 farmers living in the Boone and Raccoon River watersheds.[2] On July 20, CSSM sent a survey packet containing a cover letter, paper survey, and a postage paid return envelope to 893 non-responders with deliverable addresses. On July 28, CSSM mailed a reminder postcard to 856 non-responders. As table 2 shows, from July 11 to September 25, 2020, we received a total of 480 completed surveys (186 web/294 mail), a response rate of 48.1%.

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[1] We classified a total of 13 cases as "not eligible" because the sampled person is deceased or no longer lives in Iowa, resulting in an eligible sample of 2,987 Iowans.

[2] We classified a total of three cases (0.4% of 1000) as "not eligible" because the sampled person is deceased.

Table 2. 2020 Iowa Farmer Survey Response Rate

Sample	1000	
Not Eligible	3	0.4%
Eligible Sample	**997**	
Returned by USPS	7	0.7%
Refused	5	0.5%
No Response	505	50.7%
Completed Surveys	**480**	**48.1%**
Online	186	38.8% (186/480)
Paper	294	61.3% (294/480)

To the best of our knowledge, this is the first statewide survey focusing on citizens' perceptions, attitudes, and preferences about nutrient pollution and associated programs. Wittock et al. (2015) conducted a survey of 2,080 Iowans about their general view of water quality, but only one question in the survey explicitly relates to nutrient issues. The 2018 Iowa Farm and Rural Life Poll surveyed farmers' use of soil and water conservation practices, but did not collect information about perceptions and attitudes toward water quality and nutrient issues (Arbuckle 2018). The Iowa Nutrient Reduction Strategy (INRS) was released in 2012 with the goals of addressing nutrient issues and positively impacting not only water in Iowa, but in the entire Mississippi/Atchafalaya River basin. Tang et al. (2018) and Hoque and Kling (2016) provide back-of-the-envelope estimates of the economic benefits associated with the nitrogen reduction and conservation practices in INRS; however, so far there is no formal assessment regarding public views on the program, which has cost hundreds of million dollars since its inception. The 2020 Impaired Waters List prepared by the Iowa Department of Natural Resources shows that more than 67% of lakes and reservoirs in Iowa are impaired, which is up from 57% on the 2016 list. Therefore, our study provides some of the first insights for improving the delivery of program information to the public, which is necessary for enhancing public engagement.

The results of our study also shed new light on the economic benefits of reducing nutrient pollution in the Mississippi/Atchafalaya River basin, especially how the benefits are distributed across local and downstream areas. To our knowledge, Parthum and Ando (2020) is the only study that explicitly addresses how local citizens make trade-offs between local and downstream water quality benefits stemming from nutrient reduction programs. However, Parthum and Ando (2020) based their findings on a survey of citizens in the Upper Sangamon River Watershed in Illinois. Therefore, our study contributes to the academic literature by gauging the water quality benefits from nutrient reduction using a statewide citizen survey.

Information on Respondents: Iowa's General Public vs. Farmers
This section summarizes general respondent information as well as information associated with respondent lake use and drinking water. As not all respondents that returned the survey answered all questions, we calculate the summary statistics of each question or variable based on the valid number of responses to each question or variable.

Sociodemographics

Table 3 summarizes respondents' sociodemographics by survey wave. Respondents to the general public survey are younger, have a higher ratio of females, and fewer are employed when compared to farmer respondents.

Table 3. Summary Statistics of Sociodemographic Variables

	General Public		Farmer	
Variables	**Mean**	**N**	**Mean**	**N**
% Female	42.65%	816	10.62%	471
Age	58.78	809	63.1	463
Household Size	2.43	809	2.28	468
Number of Children under 12	0.30	813	0.19	460
Number of Children between 12 & 17	0.22	809	0.15	462
% Some College or Above	77.97%	817	75.96%	470
% Employed	57.32%	820	81.82%	473
% Retired	38.29%	820	16.70%	473

Lake Use

Table 4 summarizes respondents' lake use behaviors. More than 90% of respondents have visited a lake in Iowa—61% of the general public visited some lakes in the summer of 2018, and 73% of farmers visited some lakes in the summer of 2019.

Table 4. Lake Visits and Activities

	General Public		Farmer	
Variables	**%**	**N**	**%**	**N**
% Ever visited a lake in Iowa	91.30%	851	94.55%	495
% Visited a lake in Iowa last year (of those have ever visited a lake in Iowa)	60.96%	771	73.29%	468
Typical activities when visiting lakes				
Fishing	44.79%	777	44.02%	777
Swimming and/or beach use	38.74%	777	32.69%	777
Boating with motor	34.23%	777	44.66%	777
Jet skiing, water skiing, or tubing	9.27%	777	17.74%	777
Canoeing, kayaking, or sailing	21.11%	777	19.66%	777
Wildlife and/or scenery viewing	40.41%	777	36.32%	777
Trail use (hiking, running, or biking)	37.71%	777	29.06%	777
Relaxing, picnicking, or barbequing	44.92%	777	50.00%	777
Camping	24.45%	777	20.51%	777

Drinking Water

Tables 5a and 5b summarize the share of respondents relying on private wells for drinking water and whether they consider nitrates in drinking water a concern where they live. As expected, considerably more farmers rely on private wells for drinking water. Still, only 26% of farmers consider nitrate a concern in their drinking water, compared to 34% of the general public. Note that more than one-quarter of the general public are unsure if nitrates in drinking water are a concern.

Table 5a. Whether Households Primarily Rely on Private Wells for Drinking Water

	Yes	No
General Public (N = 840)	15.24%	84.76%
Farmer (N = 485)	61.86%	38.14%

Table 5b. Whether Respondents are Concerned about Nitrates in Drinking Water in their Neighborhood

	Yes	No	Not sure
General Public (N = 838)	34.37%	34.37%	27.21%
Farmer (N = 487)	26.08%	65.30%	8.62%

General Perception of Water Quality of Iowa Lakes

Tables 6a and 6b summarize respondents' familiarity with water quality issues and the perceived water quality of Iowa's lakes. More farmers (73%) consider themselves to be at least somewhat familiar with water quality issues in Iowa's lakes than the general public (56%) does. Also, 55% of farmers rate water quality as good or very good, while only 32% of the general public does so.

Table 6a. Familiarity with Water Quality Issues in Iowa's Lakes

	Not at all familiar	Slightly familiar	Somewhat familiar	Very familiar	Extremely familiar
General Public (N = 849)	18.73%	25.68%	43.82%	10.72%	1.06%
Farmer (N = 492)	7.52%	19.72%	53.86%	16.67%	2.24%

Table 6b. Overall Rating of Water Quality in Iowa's Lakes

	Very Poor	Poor	Fair	Good	Very Good
General Public (N = 820)	2.93%	17.20%	47.68%	30.73%	1.46%
Farmer (N = 486)	0.82%	6.58%	37.86%	51.03%	3.70%

Awareness and Knowledge of Nutrient Issues in Iowa

Tables 7a and 7b summarize respondents' familiarity with nutrient issues in Iowa's lakes and beliefs about the major source of nutrients in Iowa's lakes. Among the general public, 18% consider themselves very or extremely familiar with nutrient issues in Iowa's lakes, while 32% of farmers do so. Furthermore, 26% of the general public says they have no familiarity with the issue, while only 5% of farmers respond similarly. On the other hand, more than 60% of the general public believes that agriculture is the major source of nutrients in Iowa's lakes, and, not surprisingly, only 32% of farmers believe so.

Table 7a. Familiarity with Excessive Nutrients Issue in Iowa Lakes

	Not at all familiar	Slightly familiar	Somewhat familiar	Very familiar	Extremely familiar
General Public (N = 792)	25.51%	24.87%	31.57%	15.91%	2.15%
Farmer (N = 492)	5.49%	15.85%	46.34%	28.66%	3.66%

Table 7b. Respondents Opinions on Primary Source of Excessive Nutrients in Iowa's Lakes

	Agriculture	Stormwater	Municipal wastewater	Industrial wastewater	Not sure	Other
General Public (N = 836)	60.17%	5.98%	2.15%	2.27%	24.76%	4.67%
Farmer (N = 483)	32.09%	26.29%	6.63%	2.28%	22.57%	10.14%

Awareness, Beliefs, and Knowledge of Algal Blooms

Tables 8a–8d summarize respondents' awareness, beliefs, and knowledge of algal blooms in Iowa's lakes. Interestingly, although fewer farmers (55%) have seen algal blooms in person than the general public (61%), more farmers (30%) say that they are very or extremely aware of algal blooms than does the general public (24%). Notably, 19% of the general public has no awareness of algal blooms in Iowa's lakes. In terms of knowing the main nutrient that causes algal blooms, only 15% of farmers and 32% of the general public say phosphorus is more likely the cause, which current evidence shows is the correct answer (Liu et al. 2020). Still,

half of the general public believes algal blooms are very or extremely harmful, while only 31% of farmers consider them so.

Table 8a. Whether Respondents Have Seen Algal Blooms

	Yes, only once	Yes, 2 or 3 times	Yes, more than 3 times	No, never
General Public (N = 837)	22.58%	15.05%	23.78%	38.59%
Farmer (N = 487)	8.62%	20.33%	25.87%	45.17%

Table 8b. Awareness of Algal Blooms in Iowa's Lakes

	Not at all aware	Slightly aware	Somewhat aware	Very aware	Extremely aware
General Public (N = 844)	19.19%	23.58%	33.29%	19.79%	4.15%
Farmer (N = 494)	9.31%	19.64%	41.09%	26.72%	3.24%

Table 8c. Opinions on Likely Nutrient Cause of Algal Blooms in Iowa's Lakes

	Nitrogen	Phosphorous	Not sure	Both
General Public (N = 831)	29.96%	14.80%	53.19%	2.05%
Farmer (N = 483)	29.40%	31.88%	34.99%	3.73%

Table 8d. Opinions on Harmfulness of Algal Blooms to Iowa's Lakes

	Not at all harmful	Slightly harmful	Somewhat harmful	Very harmful	Extremely harmful
General Public (N = 807)	2.73%	9.17%	37.67%	40.89%	9.54%
Farmer (N = 482)	2.48%	12.72%	41.66%	36.31%	6.83%

Opinions on the Importance of Water Quality Issues

Tables 9a–9e summarize the perceived importance of water quality issues in general and specifically in Iowa's lakes. About two-thirds of the general public considers reducing nutrients in Iowa's waterways and not sending nutrients downstream to other states as very or extremely important, while less than half of farmers share the same opinion. The majority of the general public says the waterway improvements presented in tables 9b, 9c, and 9d are very or extremely important, especially reducing nitrogen and phosphorous by 45%;

however, those numbers are significantly lower among farmers. No more than 40% of farmers consider any of the improvements to be very or extremely important.

Table 9a. Importance of Reducing Nutrients in Iowa's Waterways

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
General Public (N = 849)	1.57%	7.99%	24.33%	42.98%	23.12%
Farmer (N = 492)	1.92%	12.37%	42.22%	36.25%	7.25%

Table 9b. Importance of not Sending Nutrients Downstream to Other States

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
General Public (N = 849)	1.47%	6.97%	24.04%	41.83%	25.69%
Farmer (N = 492)	2.77%	12.15%	40.72%	36.89%	7.46%

Table 9c. Importance of 20% Increase in Average Water Clarity in Iowa's Lakes

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
General Public (N = 824)	1.94%	10.19%	28.88%	37.38%	21.60%
Farmer (N = 480)	3.96%	15.63%	46.04%	28.13%	6.25%

Table 9d. Importance of 45% Reduction in both Nitrogen and Phosphorous in Iowa's Lakes

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
General Public (N = 823)	1.70%	6.56%	20.05%	43.01%	28.68%
Farmer (N = 477)	3.35%	16.14%	40.46%	30.19%	9.85%

Table 9e. Importance of No/Minimal Algal Blooms or Scum

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
General Public (N = 817)	1.35%	6.98%	20.81%	41.37%	29.50%
Farmer (N = 473)	3.81%	15.01%	43.55%	29.18%	8.46%

Awareness and Perception of the Iowa Nutrient Reduction Strategy

Tables 10a–10c summarize the awareness and perceptions of the INRS. Sixty-five percent of the general public is not at all familiar with the INRS. Among farmers, 20% are not at all familiar with the INRS and only 23% are very or extremely familiar. Forty-eight percent of the general public and 46% of farmers somewhat or strongly agree that the INRS is a feasible plan to reduce nutrients in Iowa's waterways. In terms of the most appropriate way to fund the INRS or similar water-quality improvement programs, 52% of the general public say taxing fertilizer is the best way, but, not surprisingly, only 22% of farmers say so. Still, 26% of the general public and 30% of farmers consider a recreational fee the best way to collect more resources to protect Iowa's lakes.

Table 10a. Familiarity with the Iowa Nutrient Reduction Strategy

	Not at all familiar	Slightly familiar	Somewhat familiar	Very familiar	Extremely familiar
General Public (N = 839)	64.84%	19.67%	11.80%	2.98%	0.72%
Farmer (N = 486)	20.16%	19.75%	37.24%	18.93%	3.91%

Table 10b. Opinions Whether the Iowa Nutrient Reduction Strategy is Feasible for Reducing Nutrients in Iowa's Waterways

	Strongly disagree	Somewhat disagree	Neutral or Don't know	Somewhat agree	Strongly agree
General Public (N = 822)	3.04%	3.65%	51.46%	27.49%	14.36%
Farmer (N = 250)	4.00%	7.60%	42.00%	34.40%	12.00%

Table 10c. Opinions on Appropriate Funding for the Iowa Nutrient Reduction Strategy and Similar Programs

	A fee on residential and business water bills	A recreational fee for use of parks	A special sales tax on fertilizer (for both agricultural and household uses)	Another way
General Public (N = 784)	8.80%	25.51%	52.04%	13.65%
Farmer (N = 443)	19.64%	30.47%	21.67%	28.22%

Awareness and Knowledge of Gulf of Mexico Hypoxic Zones

Tables 11a–11c summarize respondents' awareness and knowledge of hypoxic zones. Forty-percent of the general public has no familiarity with the issue, and more than one-third do not know what would happen to the Gulf of Mexico hypoxic zone if nutrients in Iowa's lakes reduced by half. In addition, 31% and 46% of the general public and farmers, respectively, believe that the size of the Gulf of Mexico hypoxic zone would not change because of fewer algal blooms in Iowa lakes.

Table 11a. Familiarity with Gulf of Mexico Hypoxic Zone

	Not at all familiar	Slightly familiar	Somewhat familiar	Very familiar	Extremely familiar
General Public (N = 667)	39.88%	19.34%	26.24%	11.54%	3.00%
Farmer (N = 389)	18.51%	19.02%	38.05%	19.28%	5.14%

Table 11b. How 50% Nutrient Reduction in Iowa's Waterways Would Affect the Gulf of Mexico Hypoxic Zone

	Much smaller	Slightly smaller	No effect	Slightly larger	Much larger	Don't know
General Public (N = 741)	16.73%	39.14%	8.37%	0.27%	0.27%	35.22%
Farmer (N = 251)	13.15%	45.82%	19.12%	0.00%	0.00%	21.91%

Table 11c. How fewer Beach Closures due to Algal Blooms in Iowa Lakes Would Affect the Gulf of Mexico Hypoxic Zone

	Much smaller	Slightly smaller	No effect	Slightly larger	Much larger	Don't know
General Public (N = 522)	7.85%	25.29%	30.84%	1.92%	0.57%	33.52%
Farmer (N = 460)	3.91%	23.91%	45.65%	1.30%	0.22%	25.00%

Conclusions

Nutrient pollution is one of the most pressing environmental and public health issues in Iowa, the Corn Belt, and the United States as a whole. This report summarizes findings from two recent waves of a statewide survey of 1,351 Iowans in 2019 and 2020 on their perceptions, knowledge, and attitudes toward nutrient pollution and the Iowa Nutrient Reduction Strategy. Results show that the Iowa general public regards impaired water and algal blooms as important issues, while farmers believe water quality in Iowa is less of a concern. For example, 55% of farmers consider Iowa's water quality to be good or very good, but only 32% of the general public shares the same perception. Still, a large portion of the general public is not aware of the policies and the impacts of nutrient pollution at the regional or national scale. More than 60% of the public is not familiar with the Iowa Nutrient Reduction Strategy, and nearly 40% is not familiar with the Gulf of Mexico hypoxic zone, which is the one of the key reasons for establishing state nutrient reduction programs.

There are also discrepancies between the general public and farmers in terms of opinions on the causes of nutrient pollution and the best approach to address the issue. For example, 60% of the general public, but only 32% of farmers, think manure and fertilizer from agriculture is the primary source of excessive nutrients in Iowa's lakes. Moreover, 52% of the general public, but only 22% of farmers, think a special sales tax on all fertilizer is the most appropriate way to fund programs that can protect Iowa's lakes.

Overall, our findings point out the need for improving education on water quality and the associated policies and programs. Our findings can be useful to better design, promote, and implement such programs.

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