Tracking Manure Management of Confined Operations in the Maumee Watershed

Jeffrey Kast

Harmful Algal Blooms: State of the Science: Toledo, OH

9/13/18
Manure Receiving Blame for Lake Erie HABs

COMMENTARY
It’s the manure, stupid

BY KEITH C. BURRIS | COLUMNIST FOR THE BLADE
Published on July 17, 2015 | Updated 7:56 a.m.
Toledo Blade

Dairy farms taking a toll on Great Lakes, waterways

Bob Gross, Times Herald  Published 6:15 p.m. ET April 23, 2016
Times Herald

Dairy Farm Pollution Fuels Lake Erie’s Toxic Algae

By Emily Cassidy, Research Analyst
TUESDAY, MAY 3, 2016
Environmental Working Group

The Great Lakes Are Being Poisoned By Poop

Posted By Jack Lessenberry on Wed, Jun 7, 2017 at 12:03 pm
Cleveland Scene Weekly
Agriculture = Main Source of Phosphorus in the Maumee River Watershed

Ohio EPA, 2016
Manure Application Impacts?

1) Manure management: amount known vs. unknown?

2) How is manure managed?

3) Amount of Phosphorus reaching Lake Erie from manure sources?

2015 CAFFs
- Swine (n=23)
- Dairy (n=19)
- Poultry (n=6)
Amount of Manure Management that is Known vs. Unknown
CAFF vs. Non-CAFF Livestock In Ohio

**CAFFs**

- >700 dairy cows
- >2,500 swine more than 55 lbs
- >10,000 swine less than 55 lbs
- >82,000 laying hens

**Non-CAFF Livestock**

- ~80% of swine
- ~80% of cattle
- ~25% of poultry

70% of Manure Phosphorus
Most CAFF Manure Phosphorus is Managed Through D&U

<table>
<thead>
<tr>
<th>CAFF Type</th>
<th>Distributed P$_2$O$_5$ (lbs)</th>
<th>% CAFF P$_2$O$_5$ Generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swine</td>
<td>380,000</td>
<td>34</td>
</tr>
<tr>
<td>Cattle</td>
<td>1,700,000</td>
<td>63</td>
</tr>
<tr>
<td>Poultry</td>
<td>4,500,000</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>6,600,000</td>
<td>-</td>
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</table>

78% of CAFF Manure Phosphorus
Manure Management of CAFFs
Liquid Manure Application Generally Followed Stated Permit Plans
Majority of CAFF Controlled Acreage Receiving Manure had STP less than Tri-State Recommendations

- 2014: 64% of acres less than 50 ppm Bray P1
- 2015: 69% of acres less than 50 ppm Bray P1
Amount of Phosphorus Reaching Lake Erie from Manure Sources
Field-Scale Maumee SWAT Model

Improvements to better represent manure application practices in the Maumee

- CAFO generated manure constrained closer to facility
- Variability in manure application timing
- Local nutrient compositions
Simulated Spring P Contribution of Manure Applications is less than 40%

Total Phosphorus

Dissolved Reactive Phosphorus

Baseline
Remove Phosphorus from Manure

Scenario

Baseline
Remove Phosphorus from Manure

Scenario
Conclusions

1) Amount of manure management that is known vs. unknown?

Management of a majority of manure in the Maumee River watershed is not reported to ODA or publicly-available

◦ ~70% of P generated by livestock are from non-CAFF operations
◦ ~78% of P generated on CAFFs is planned to be distributed through D&U

2) Manure Management of CAFFs?

When CAFFs in the Maumee River watershed apply manure on fields under their control (owned or rented), they are following guidelines to minimize nutrient runoff
Conclusions

3) Amount of Phosphorus reaching Lake Erie from manure sources?

Watershed modeling results demonstrate that when phosphorus in manure is removed as a source, watershed loads reaching Lake Erie decrease by 11% for Total Phosphorus, and 13% for Dissolved Reactive Phosphorus.

Manure application BMPs will be needed to be used in conjunction with other BMPs to reach downstream water quality targets (i.e., 40% reduction goal).
Agriculture is Main Source of Phosphorus in the Maumee River Watershed

Ohio EPA, 2016

Scavia et al., 2016

Multiple studies show non-point/agricultural sources of phosphorus to be the dominant sources of phosphorus loading to Lake Erie from Maumee River watershed.
Manure Transport of Manure on CAFF Controlled Fields

Manure P₂O₅s Planned to be Applied on CAFF Controlled Fields

- 0%, 3,245 lbs
- 37%, 1,039,349 lbs
- 66%, 760,055 lbs

Average Distance to Field Under CAFF Control (miles)

- Swine: 1.43 miles
- Dairy: 1.91 miles
## Scenario and Sensitivity Analyses

<table>
<thead>
<tr>
<th>Scenario/Sensitivity Analysis</th>
<th>TP % Change from Baseline</th>
<th>DRP % Change from Baseline</th>
<th>TN % Change from Baseline</th>
<th>% Acres Affected</th>
<th>% Liquid Manure Affected</th>
<th>% Solid Manure Affected</th>
<th>% Manure P Affected</th>
<th>Corn Yield Rate % Change from Baseline</th>
<th>Soy Yield Rate % Change from Baseline</th>
<th>Wheat Yield Rate % Change from Baseline</th>
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</thead>
<tbody>
<tr>
<td>No Phosphorus in Manure</td>
<td>-11.2</td>
<td>-13.3</td>
<td>0.0</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
<td>No Phosphorus in Fertilizer or Manure</td>
<td>-59.0</td>
<td>-76.6</td>
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<td>100</td>
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<tr>
<td>All Incorporated</td>
<td>-4.4</td>
<td>-6.5</td>
<td>-0.2</td>
<td>42.6</td>
<td>38.8</td>
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<td>40.6</td>
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<td>Application on Growing Corn</td>
<td>0.0</td>
<td>-1.5</td>
<td>-1.5</td>
<td>24.5</td>
<td>26.0</td>
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<td>26.2</td>
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<tr>
<td>Extend Mercer County Ban</td>
<td>0.2</td>
<td>0.6</td>
<td>-0.3</td>
<td>15.9</td>
<td>14.7</td>
<td>15.2</td>
<td>15.1</td>
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<tr>
<td>No Irrigation</td>
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<td>-0.1</td>
<td>-0.4</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>62.8</td>
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Future Research Required...

How is manure produced from non-regulated livestock managed?

How is manure managed in Distribution and Utilization?

What BMPs can be promoted in conjunction with manure incorporation reduce nutrient discharge from the watershed and move closer to the GLWQA reduction targets