

Planning for Future Change: Michigan's Statewide E. coli TMDL

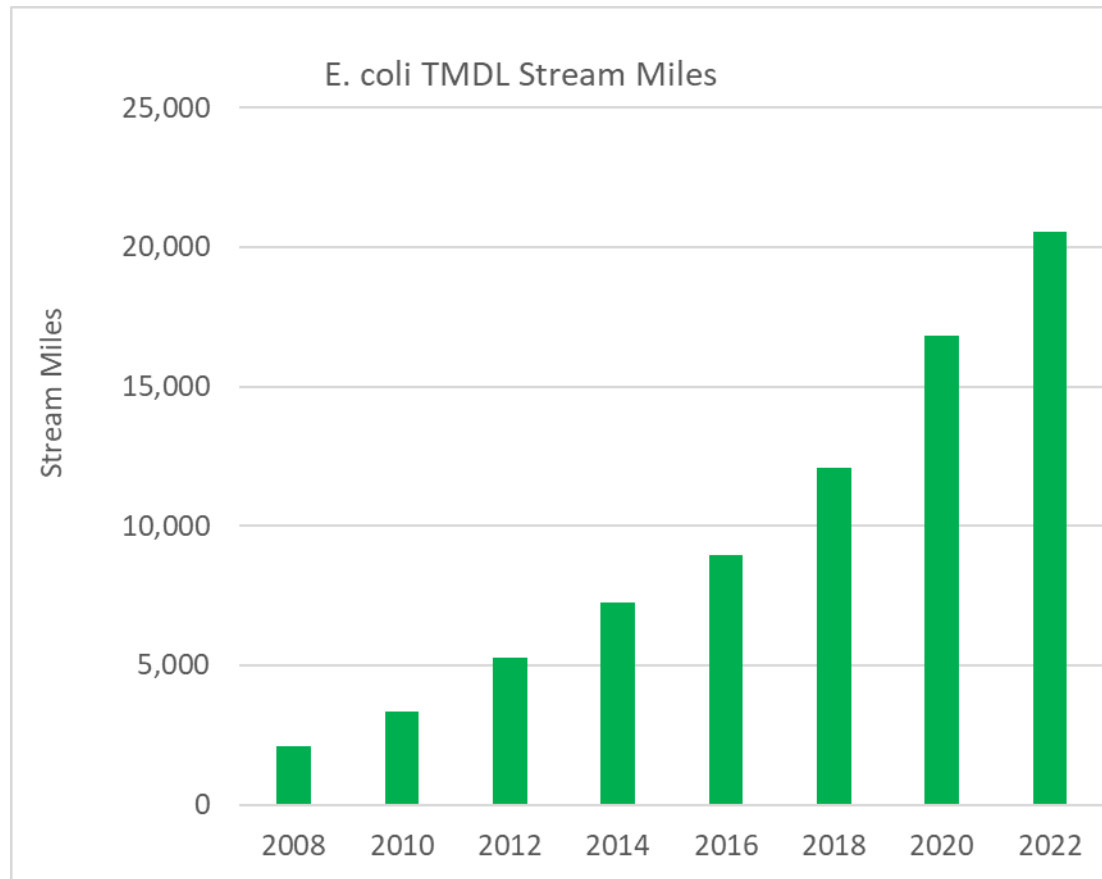
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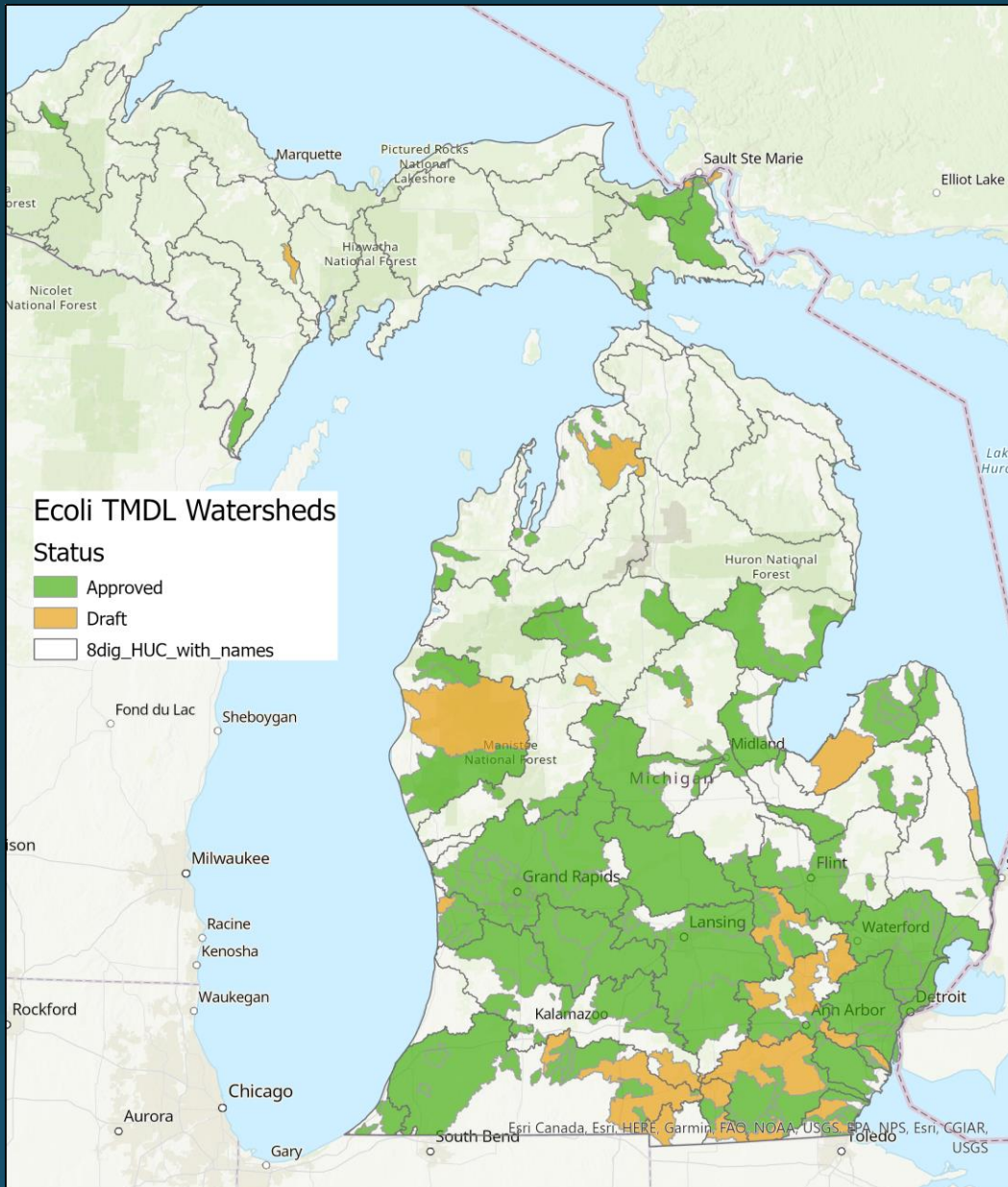
Environment, Great Lakes and Energy

Some Background

- Statewide E. coli TMDL was started in 2016 and approved by the USEPA in 2019
- We update it by adding newly discovered impaired waters “concurrent” with each Integrated Report.



Scope of the Problem



- About 76,000 miles of rivers, and we estimate that **half** are impaired by E. coli
- 29% of our river miles are assessed for Total Body Contact (TBC) designated use
- 27% of our total river miles are impaired by E. coli



Target

- Concentration Based with the target being equal to the WQS
 - Daily during summer **300 cfu/100 ml**
 - Daily during winter **1000 cfu/100 ml**
 - 30-day during summer **130 cfu/100 ml**

Photo: E. coli monitoring in the Paw Paw Watershed.

Critical Conditions

- Critical Conditions (baseflow and heavy rain / high flow)
- WQS applies under all conditions



Photo: Flooding in metro Detroit.

Margin of Safety

- Margin of safety is implicit, due to uncertainty with growth and decay of bacteria
- This works to our benefit with Climate Change too (that wasn't really planned)

Photo: Cold Creek emptying into Crystal Lake.

“Planning
for Future
Change”

Not a required part of
the TMDL, but in a
'forever document' it
felt important

Climate drives changes
in land use/cover, so it
was more than just
climate change

“Planning for Future Change”

Politics are important in government

- Michigan is a “Purple” state.
- I did not know the personal beliefs of our leadership during the development of this TMDL.
- Stick to the facts, avoid controversial discussion of what causes climate change.

Just the 'Facts' on Climate Change

- **Great Lakes Integrated Science and Assessments (GLISA) – University of Michigan**
 - 11% increase in precipitation between 1900 and 2012
 - 2°F increase in temperature (same years) and longer growing season
 - Increased intensity and magnitude of large rain events
- **Office of the Great Lakes report: Water Strategy**
 - Office was created by Governor Rick Snyder and the report was directed by him as well
 - Concluded that our infrastructure was not designed with large storms in mind
 - In fact our older cities were not planned with sewage disposal in mind at all (Combined storm and sewage systems)

Just the 'Facts' on E. coli in Michigan

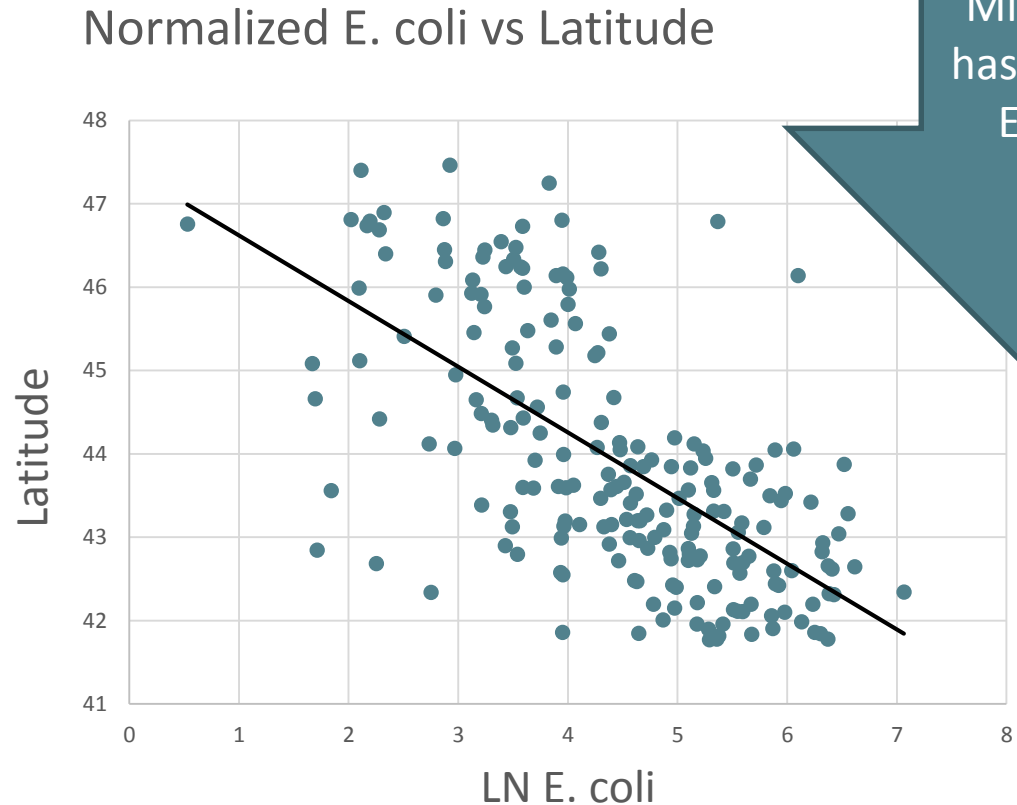
- Because this was a statewide TMDL, we needed to discuss E. coli in general (site specific data is provided in the Appendices)
- Why not use our statewide probabilistic data set?

Just the 'Facts' on E. coli in Michigan

- 50 sites per year, total of 200 unique sites
- Each site monitored 4 times (May, July, September and November)
- Water temperature
- Did NOT have flow
- Delineated watershed and used GIS for
 - Watershed size,
 - Land cover,
 - 2010 census (housing units and population),
 - lost wetlands, and
 - Agricultural census (livestock populations)

What causes high *E. coli* in Michigan?

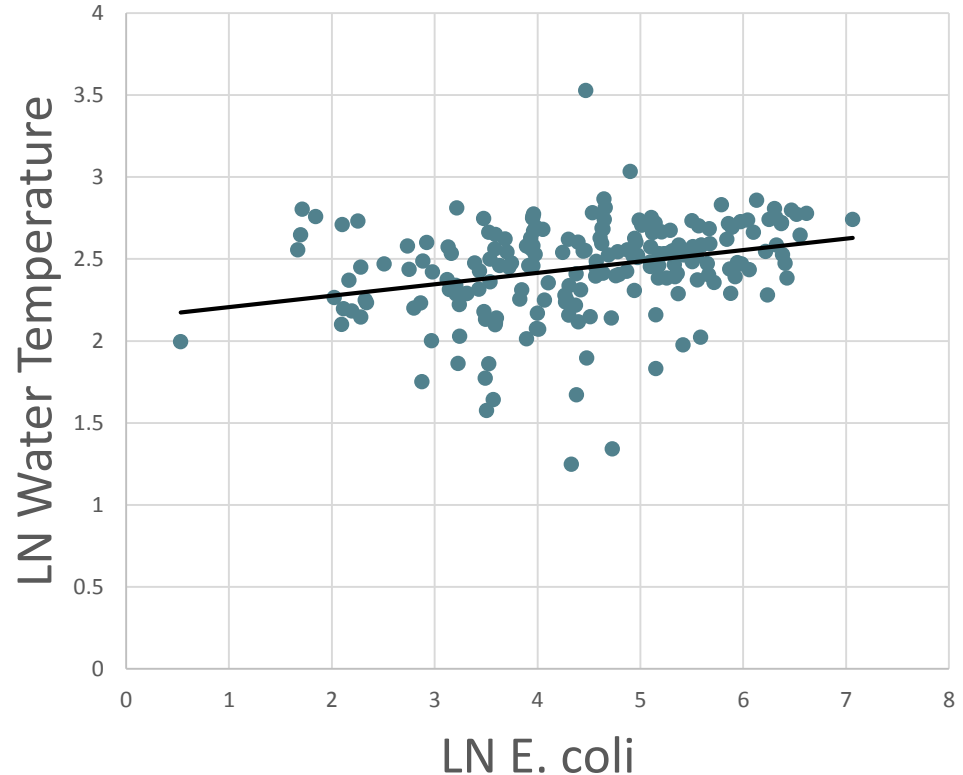
- Latitude had the strongest correlation with *E. coli*.
- But latitude is not a cause of *E. coli*



What causes high E. coli in Michigan?

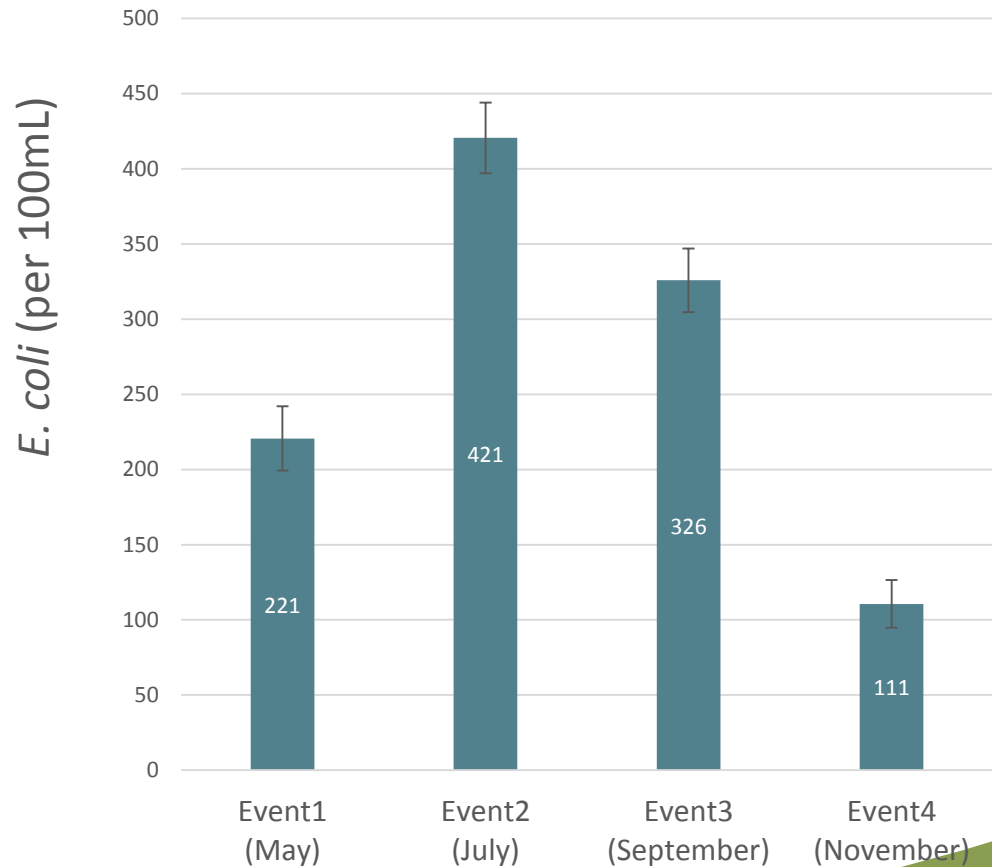
Temperature had a weak but statistically significant relationship with E. coli ($r=0.3$).

Normalized E. coli vs Water Temperature

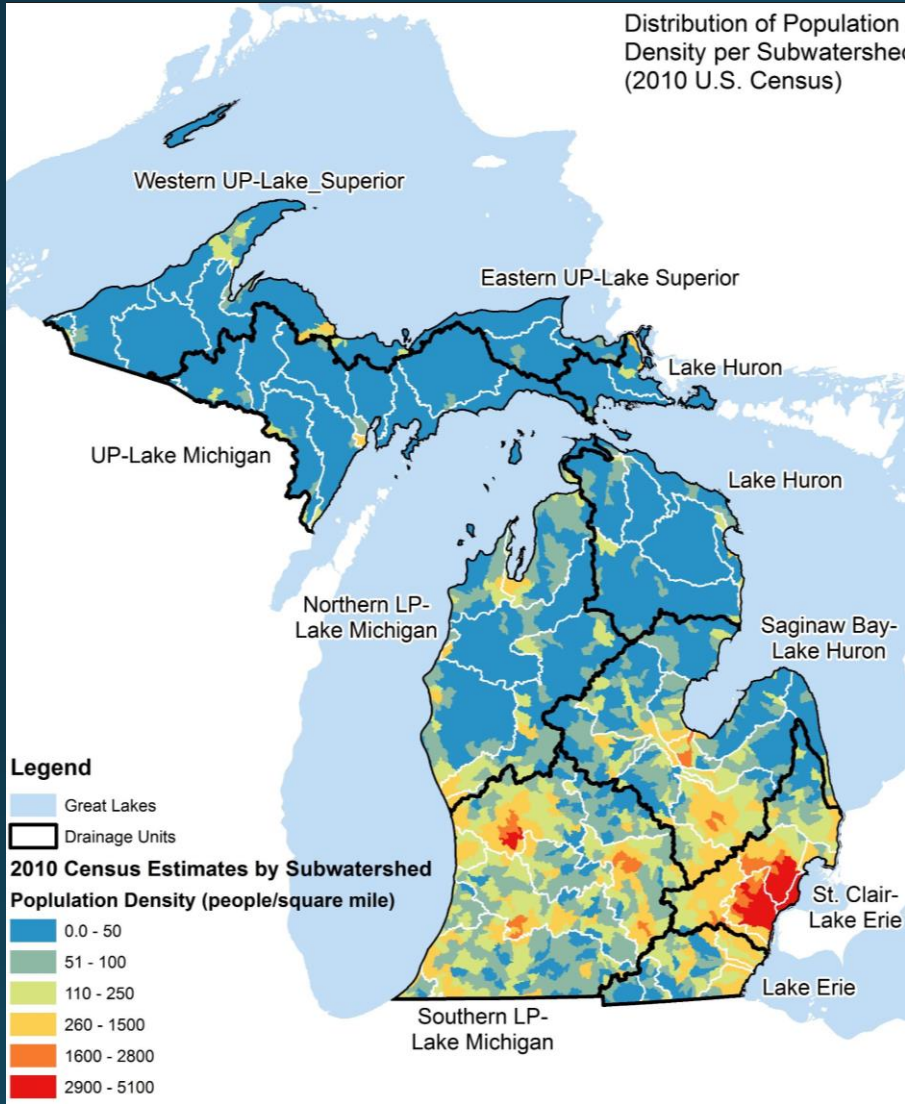


- Despite the overall weak relationship between water temperature and *E. coli*, our July event clearly had the highest *E. coli*
- July has a few characteristics:
 - Hot and Dry
 - Water table is low (less dilution?)
- July-August are peak times for swimming in the Great Lakes

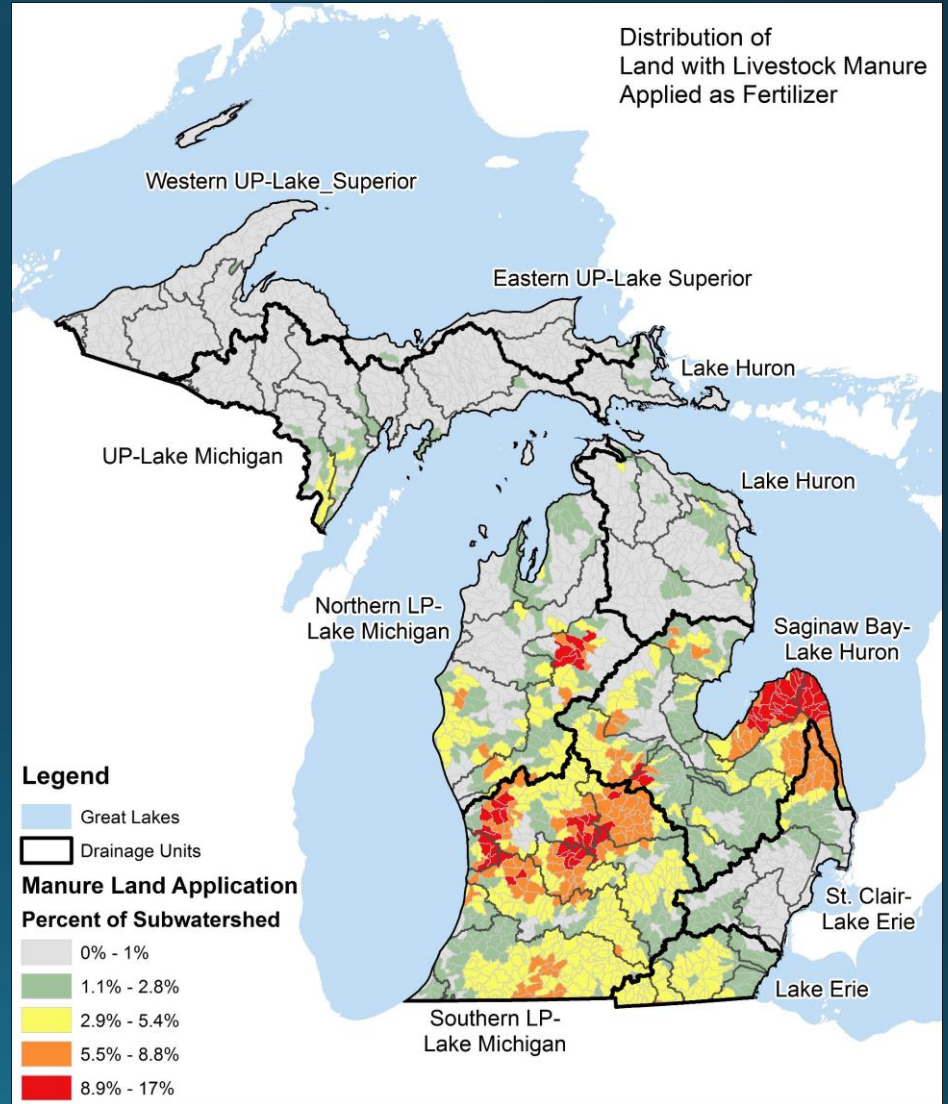
Mean of *E. coli* by month (*E. coli* per 100mL)



Distribution of Population Density per Subwatershed (2010 U.S. Census)

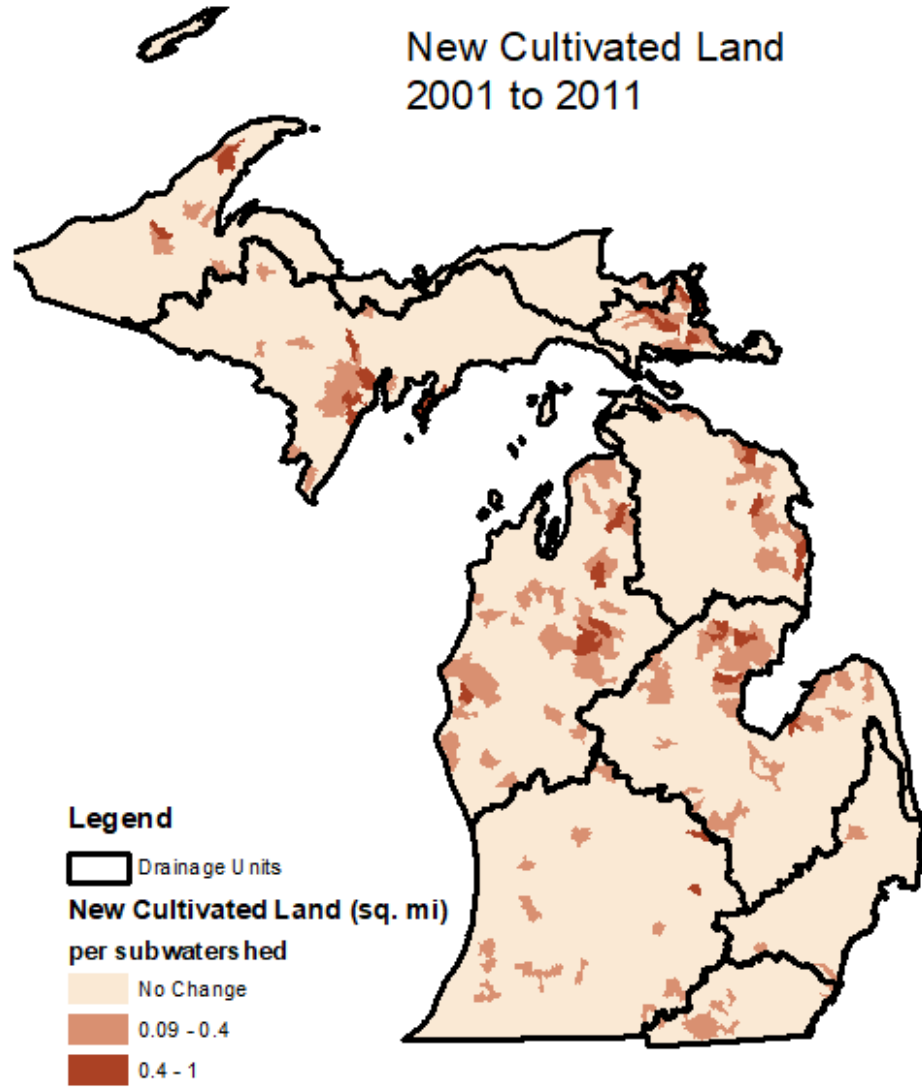


Distribution of Land with Livestock Manure Applied as Fertilizer



Agriculture is
expanding northward

New Cultivated Land 2001 to 2011



What impacts can we expect?



- E. coli is highest during July (hot and dry), that type of weather may last longer
- Agriculture will likely continue to move northward too

Photo: Algae in a stream with low water levels.

What impacts can we expect?

- Less forest and natural areas to 'soak up' and filter pollutants
- Loss of riparian buffers
- Manure land application in new areas
- Lower water table is possible – less **dilution of pollution** in the summer:
 - Water withdrawals for irrigation may increase,
 - Field tiles lower the water table



Photo: Sediment loss from a heavy rain on a freshly planted field.

TMDL Implementation

- NPDES permits
 - Requiring both setbacks and vegetated buffers for **CAFO manure land-application fields**. In TMDL watersheds they must be wider. But, this is being contested.
 - **Municipal Separate Storm Sewer Systems (MS4s)** with *E. coli* TMDLs must conduct wet weather first flush monitoring as well as dry weather outfall screening.



Photo: "Clean" storm water from a CAFO

TMDL Implementation

- Nonpoint Source Program Plan
 - BMP design criteria for storm events will be reevaluated periodically
 - Consideration of plant hardiness zone changes in BMP plantings
- Encourage conservation in undeveloped areas



Photo: Goose deterrent buffer at Chrysler Beach

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