



Environmental Concerns in Midwest Agricultural Landscapes

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Key Concerns

- **Water Quality**
 - Nutrients
 - Local
 - Regional
- **Agricultural Drainage**
- **Human Health**
- **Wildlife Habitat**

Nutrients and Water Quality

- Ecological Impacts--algal blooms
 - Can create toxins that move up the food chain
 - Harm aquatic life by blocking sunlight and clogging fish gills
 - Create dead zones where aquatic life must move or die
- Economic Impacts
 - Tourism
 - Fishing and shellfish industries
 - Property values
 - Recreation
 - Drinking water treatment
- Local and downstream effects



Water Quality –Rivers and Streams

Nitrogen and phosphorus are by far the most widespread chemical contaminants.

40% of river and stream length has high levels of P and 28% has high levels of N.

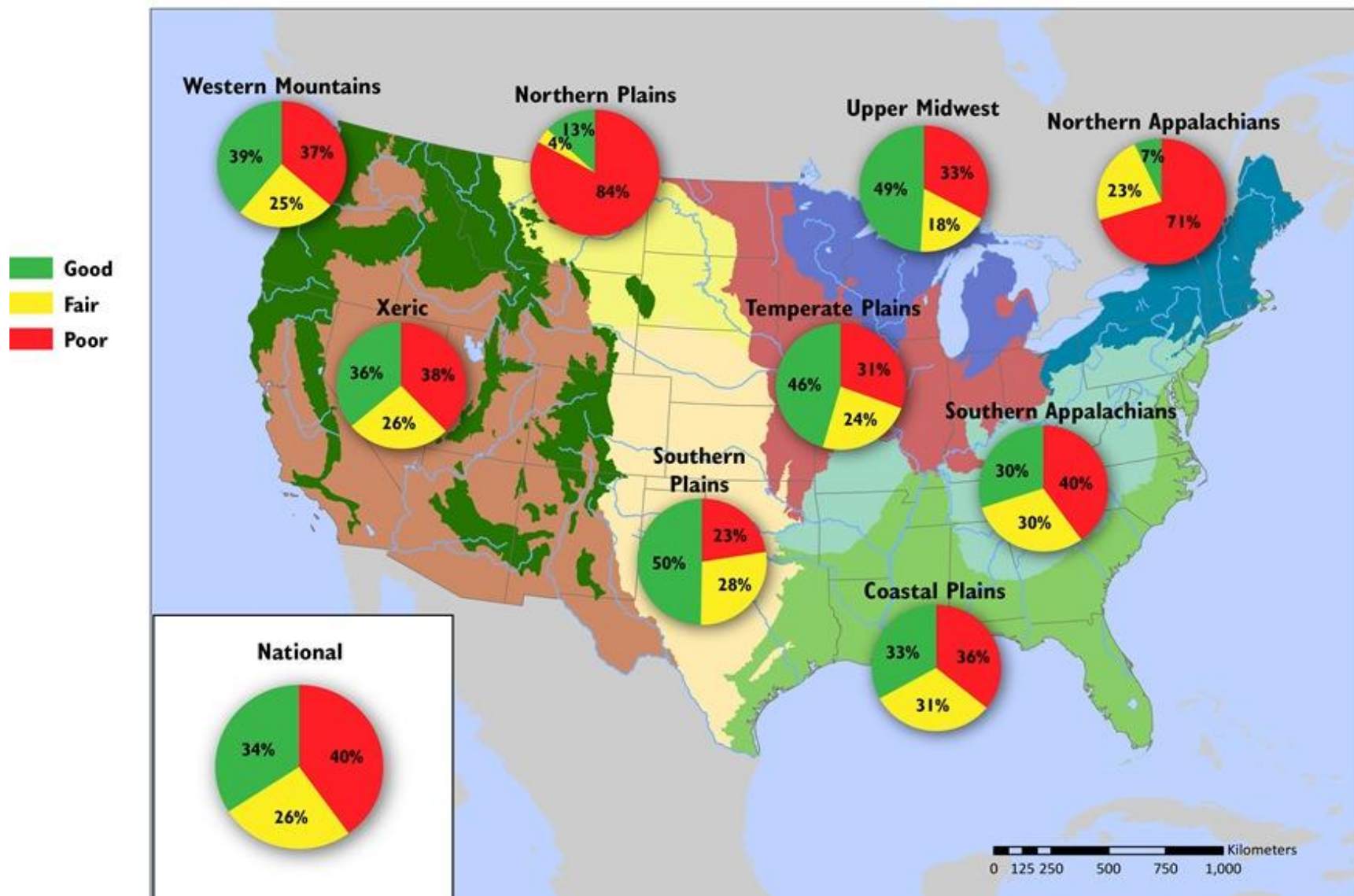


Poor biological condition (for macroinvertebrates) is 50% more likely with high P and 40% more likely with high N.

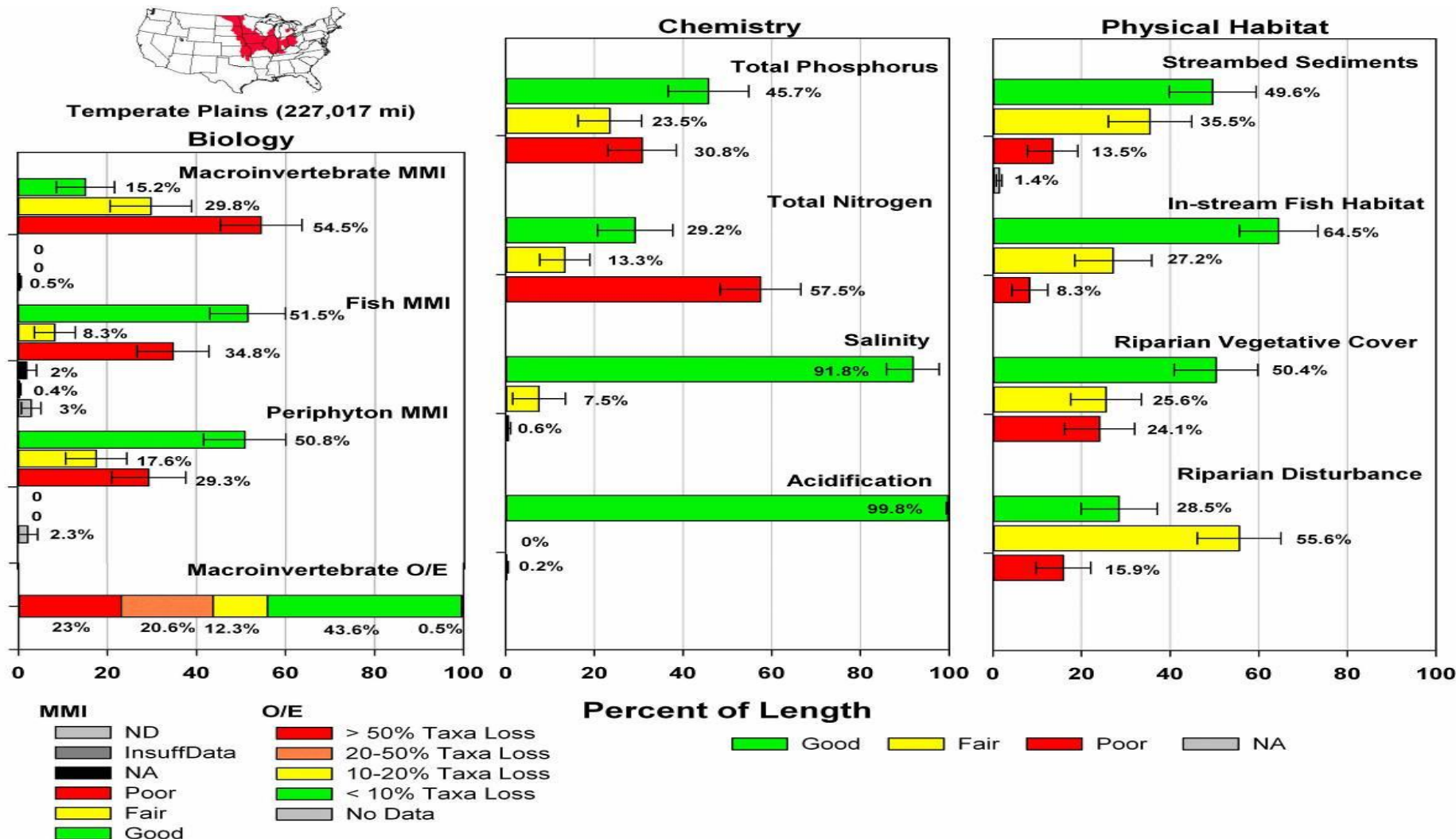
National Rivers and Streams Assessment

(draft 2013)

Total Phosphorus

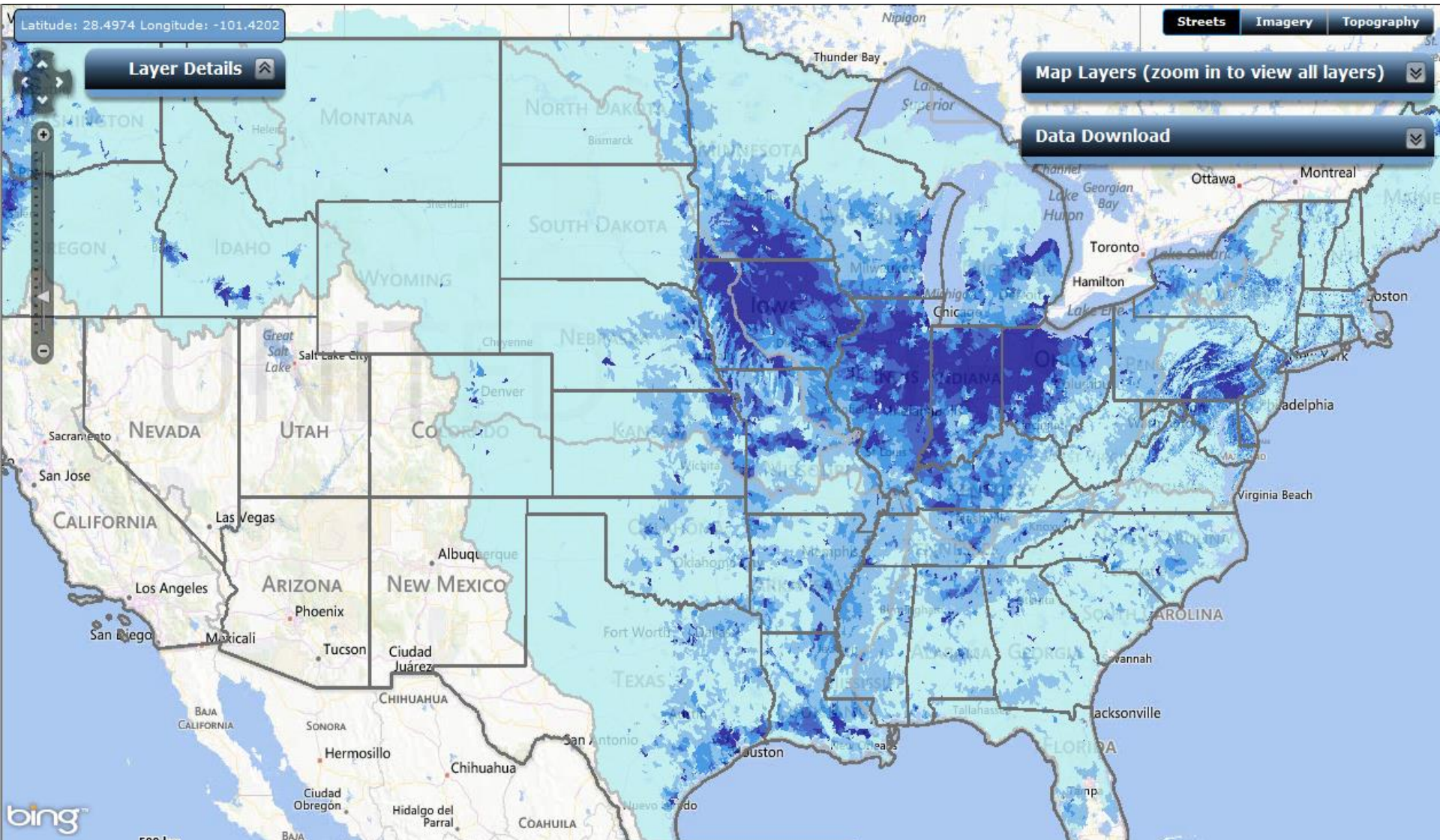


National Rivers and Streams Assessment

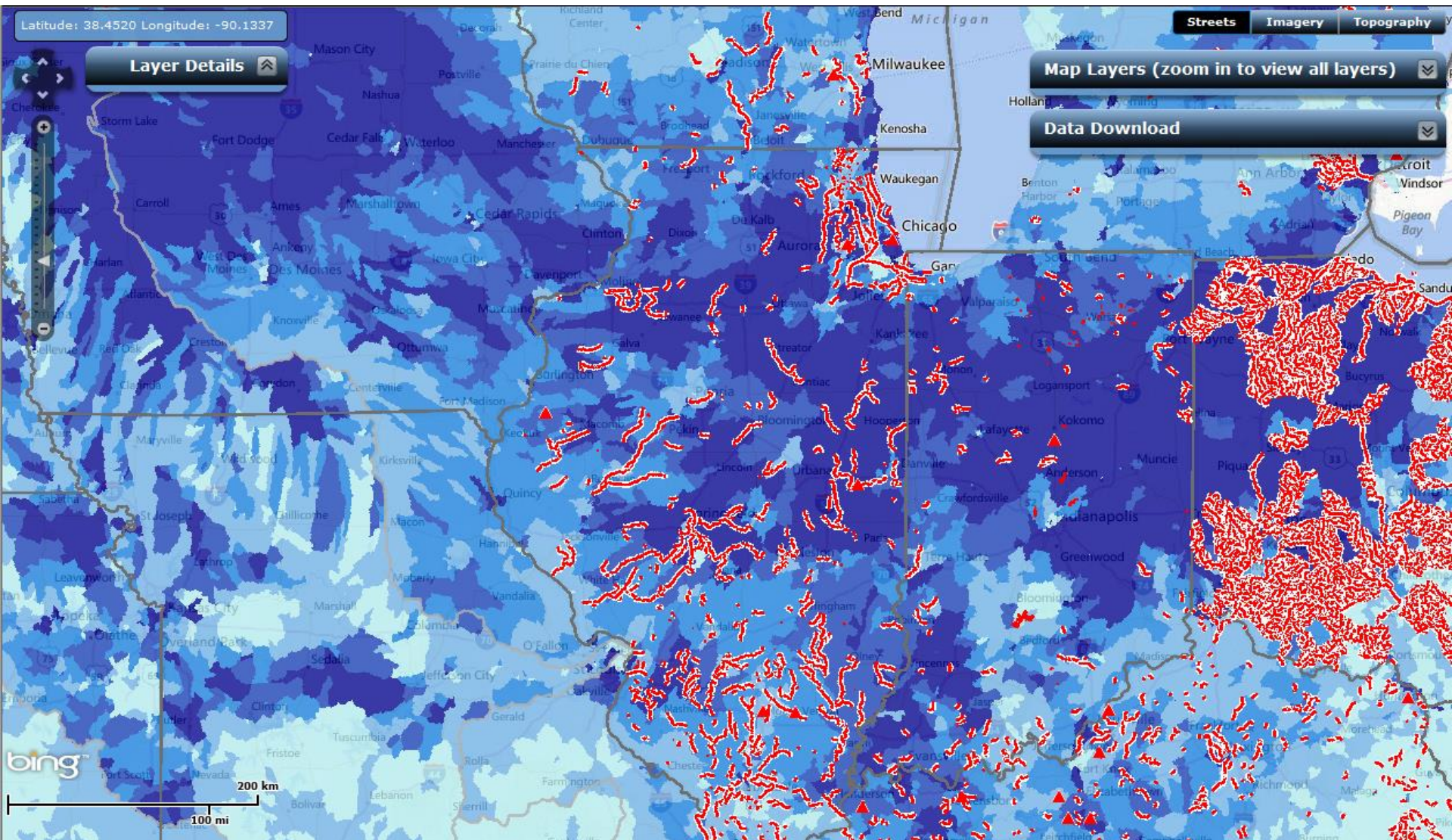


NRSA survey results for the Temperate Plains ecoregion (EPA/NRSA 2013). Bars show the percentage of river and stream length within a condition class.

2002 Nitrogen Yields



2002 N Yields, Impaired Waters

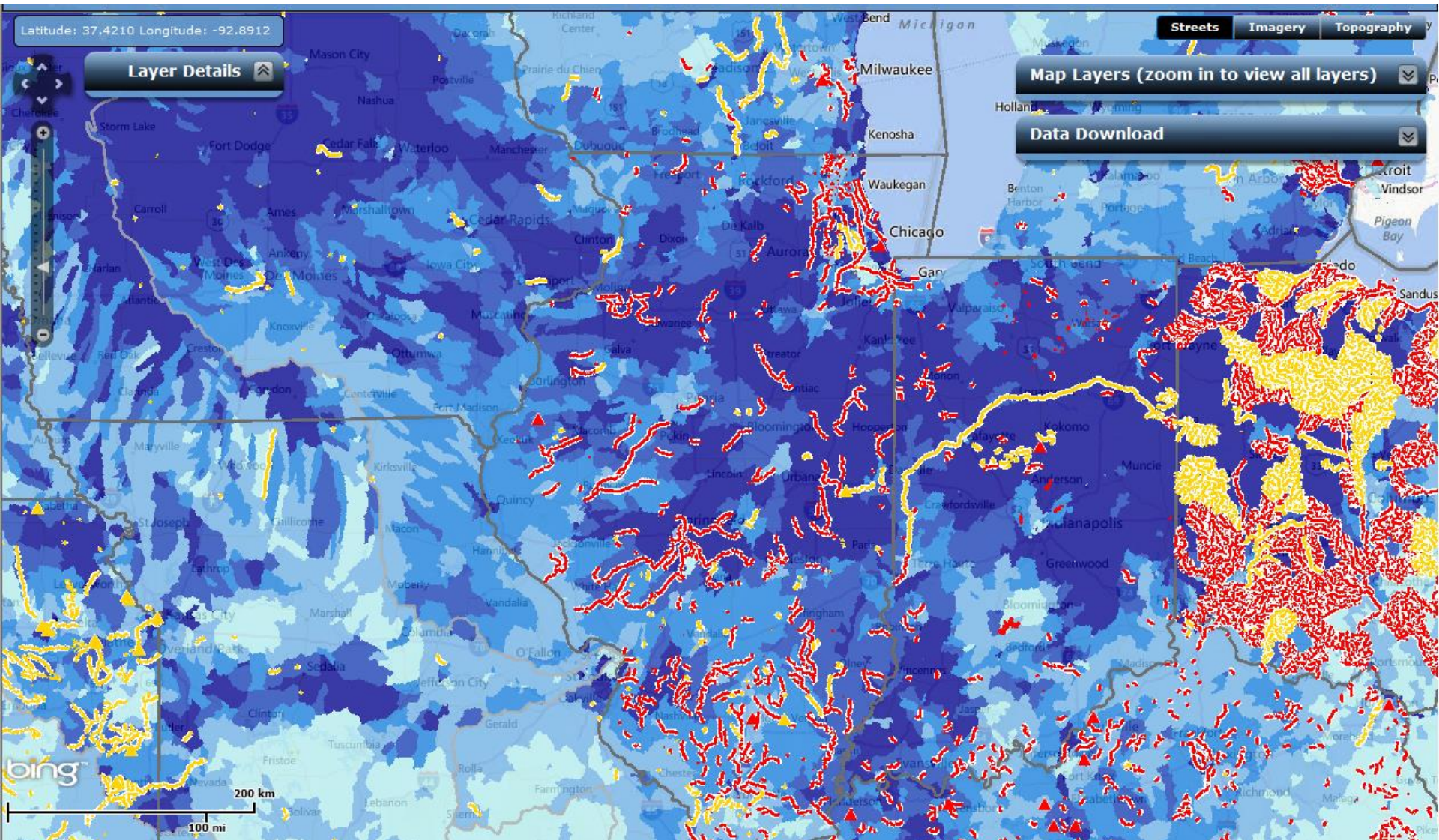


US EPA's Nitrogen and Phosphorus Data Tool

Darker blue = higher N yields

Red = impaired water body

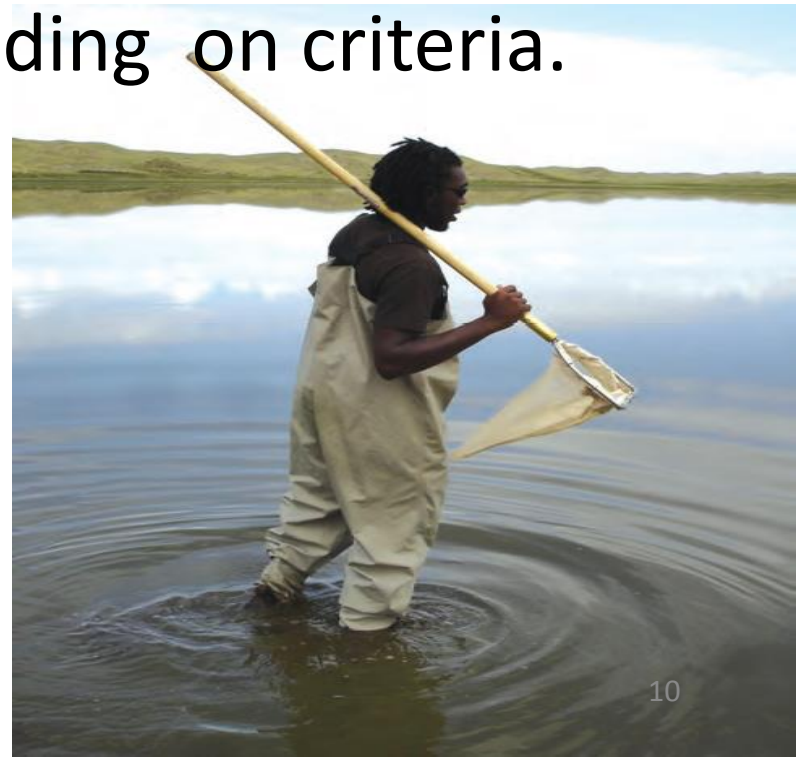
2002 N Yields, Impaired Waters & TMDLs



Water Quality-- Temperate Plains

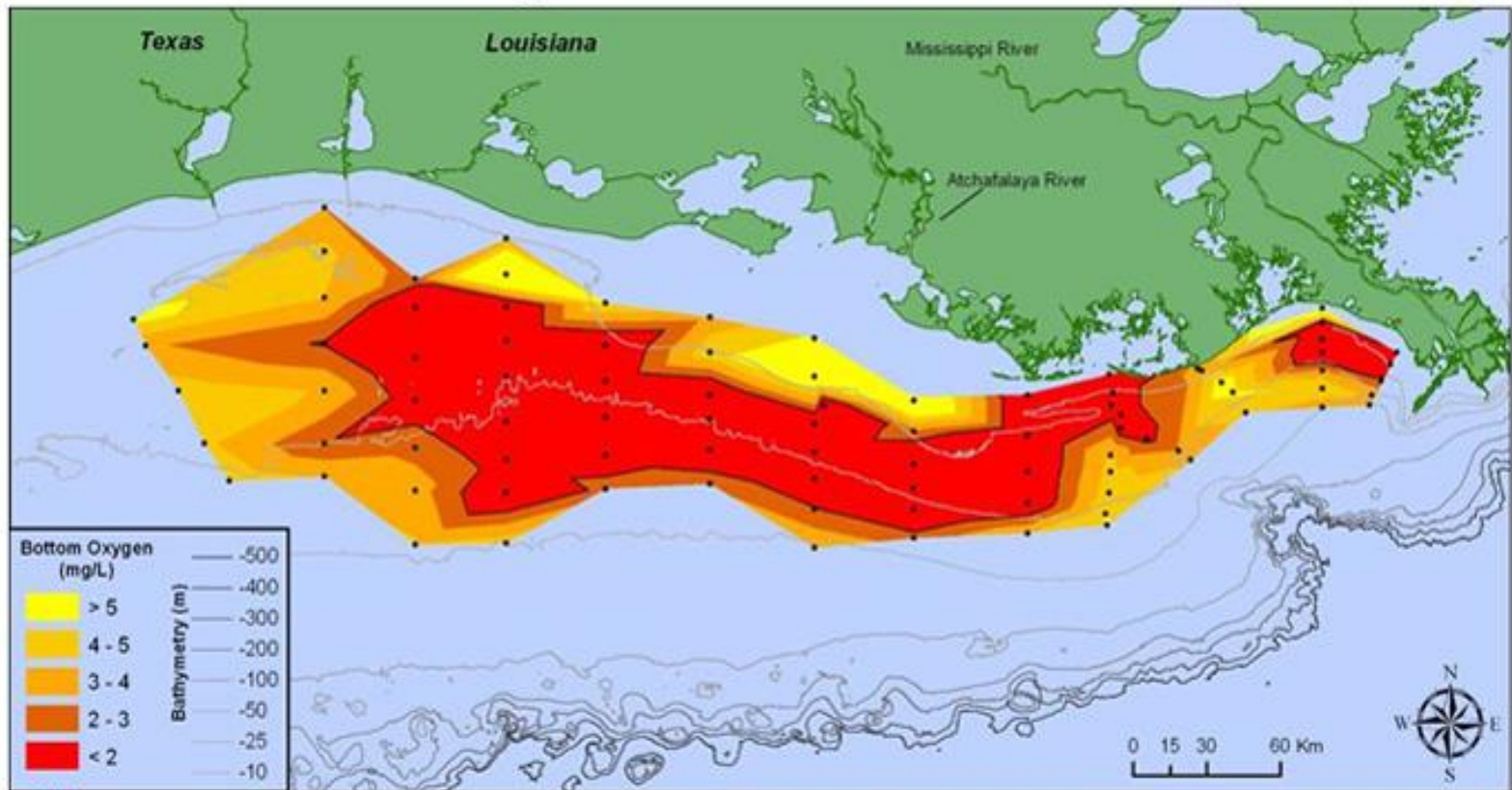
EPA National Lakes Assessment (2010)

- 21% of lakes are eutrophic, and 45% are hypereutrophic.
- Between 17 and 24% of lakes are in good biological condition, depending on criteria.
- Lakeshore habitat is good in 56% of lakes, even with moderate to high levels of human lakeshore disturbance in 60% of lakes.



Gulf of Mexico Hypoxic Zone

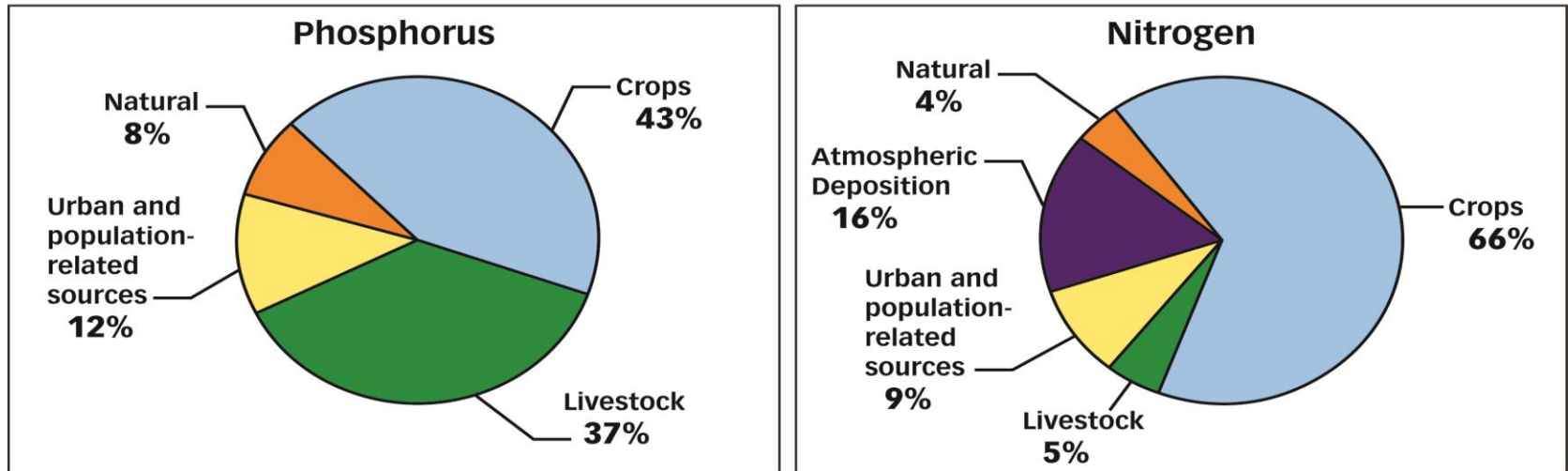
Bottom-water dissolved oxygen across the Louisiana shelf from July 22-28, 2013



Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

Gulf of Mexico

Gulf of Mexico nutrient sources



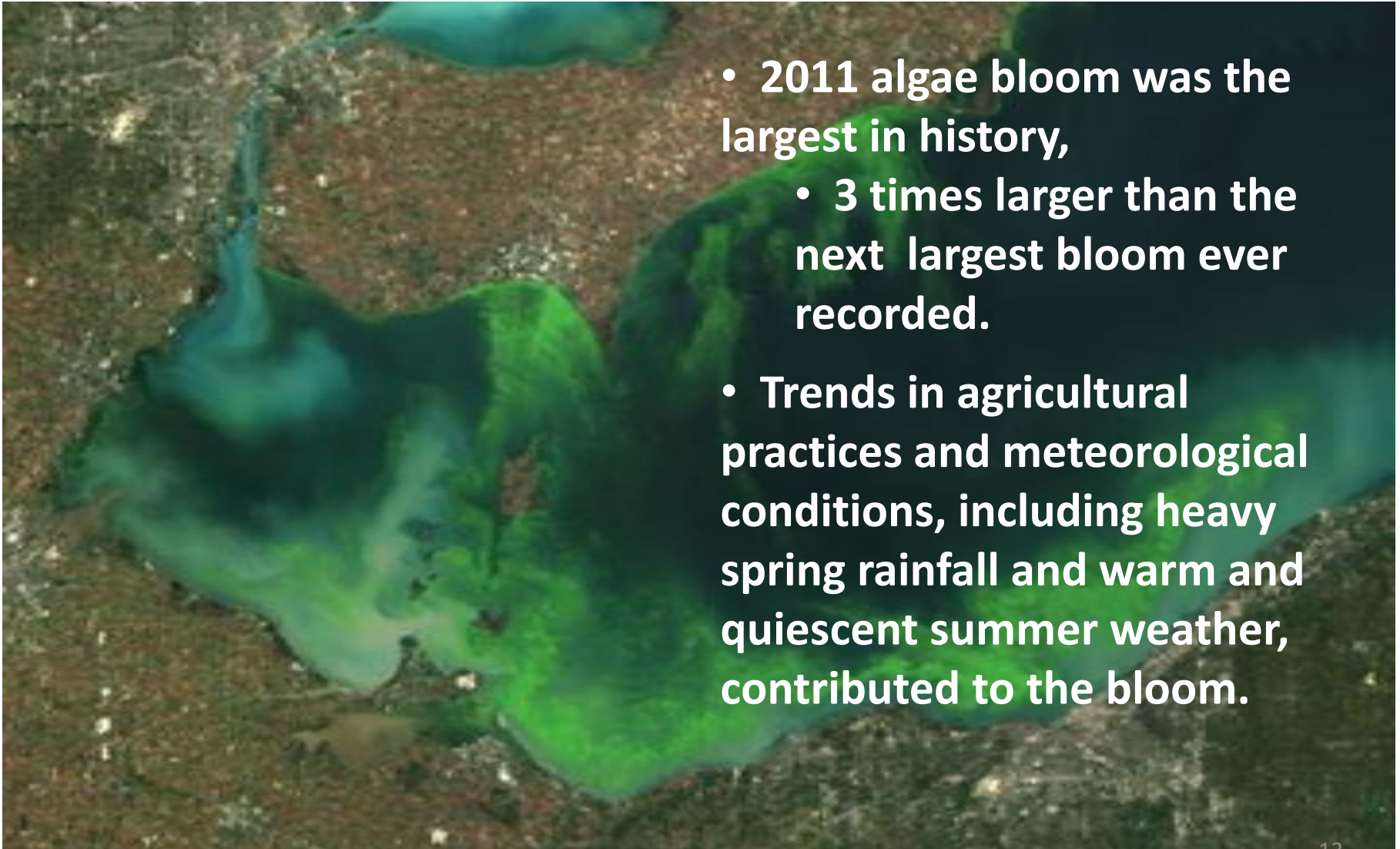
- Hypoxia Task Force

45% reductions needed in both N and P to meet goal of five-year running average size of the hypoxia zone to less than 5,000 square kilometers by 2015.

- Nitrate Trends in Mississippi River Basin (USGS 2014)

- Nitrate concentrations in the Mississippi River outlet increased by 12% between 2000 and 2010.
- Iowa and Illinois Rivers had decreasing nitrate concentrations, but these were overshadowed by increases in the upper Mississippi and Missouri Rivers.

2011 Western Lake Erie Basin



- 2011 algae bloom was the largest in history,
 - 3 times larger than the next largest bloom ever recorded.
- Trends in agricultural practices and meteorological conditions, including heavy spring rainfall and warm and quiescent summer weather, contributed to the bloom.

Great Lakes

- International Joint Commission -- Lake Erie
 - Agricultural operations (fertilizer/manure) are a major source of P.
 - Most loadings occur during spring snowmelt and heavy rainstorms.
 - Recommendations
 - Reduce total P to the Maumee R. by 39%.
 - Reduce total P to western/central basins by 46%.
 - Reduce dissolved reactive P loads by 78%
- Great Lakes Restoration Initiative Draft Action Plan II goal
 - Reduce nutrient loads from agricultural watersheds.
 - Reduce harmful algal blooms, leading to beach closures, dead zones, human health effects, drinking water impairments, and loss of recreational opportunities.



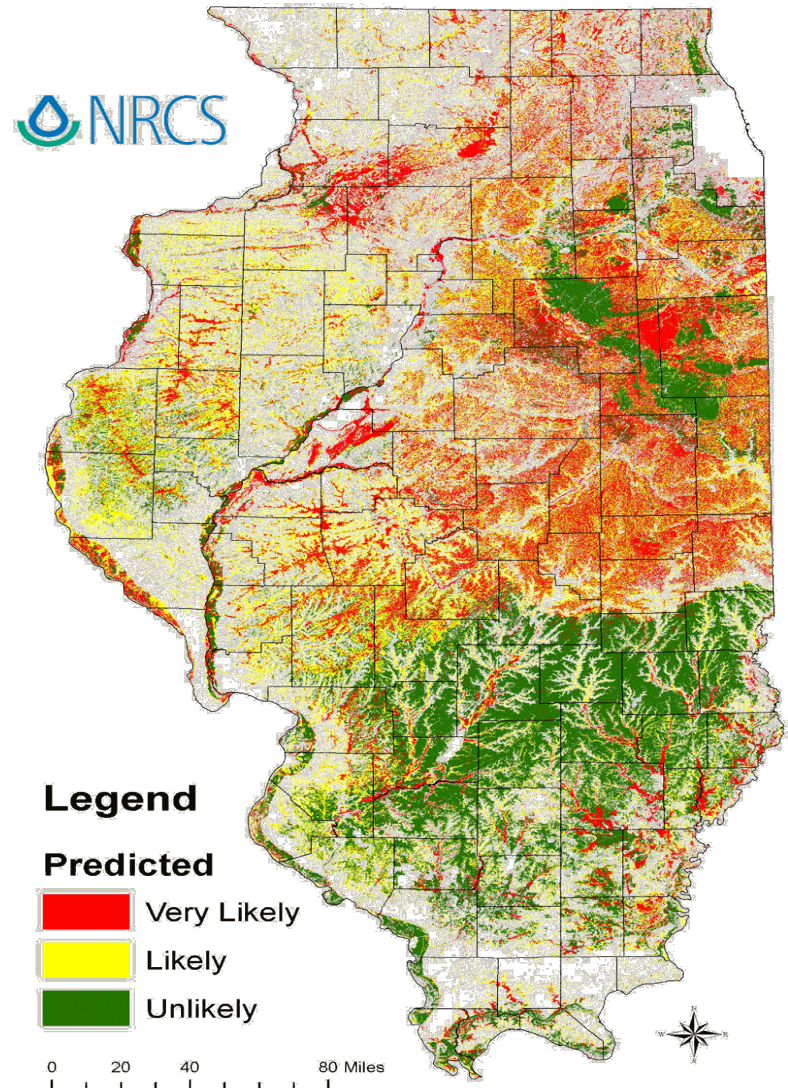
Agricultural Drainage

- Much of the nitrate that enters the Mississippi River comes from tile drains in the Midwest.
- Tile drainage has increased substantially in the past few years as new land is brought into crop production and drainage intensity is increased on existing cropland .

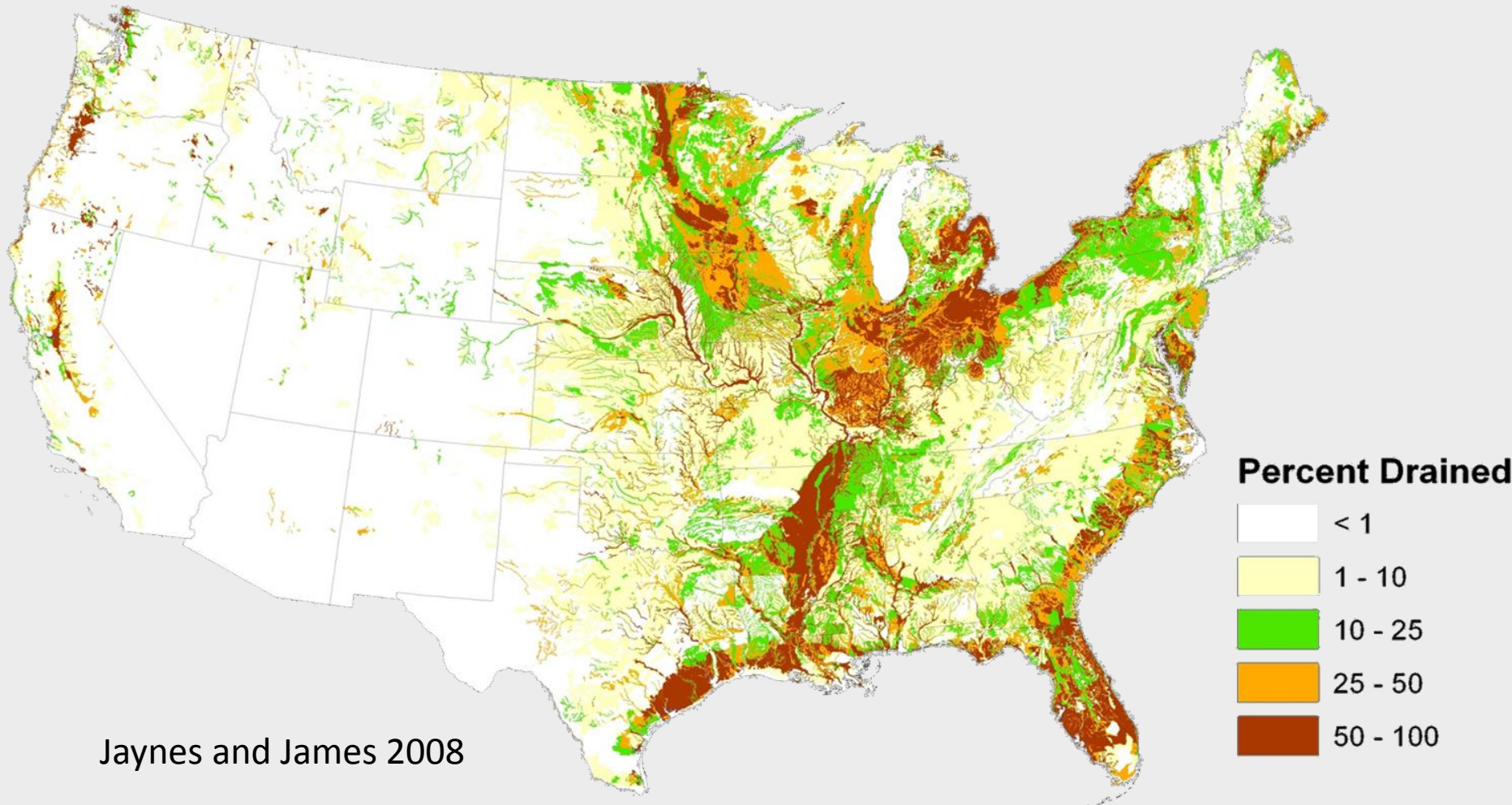


Drainage Estimates

- The extent of tile drains is poorly known.
- Percentage of cropland drained
 - Ohio and Indiana – 50%
 - Illinois – 35%
 - Iowa – 25%
- State drainage estimates -- USDA ARS
 - Illinois 15 - 48%
 - Indiana 14 - 46%
 - Iowa 15 - 29%
 - Minnesota 10 – 22%
 - Ohio 12 – 33%
 - Wisconsin 3 - 17%



Tile Drainage Networks



Jaynes and James 2008

Human Health Concerns

- Recreation--toxins from algal blooms
- Nitrates in drinking water
 - Contaminated drinking water supplies
 - Rate of nitrate violations in community water systems has **doubled over past 7 years.**
 - Increased treatment costs
 - Disinfectant by-products



Nitrate in Drinking Water

- Maximum Contaminant Level is 10 mg/L
- Public Supplies
 - 2013 Des Moines Raccoon R. 24 mg/L, Des Moines River 18 mg/L
 - 2013 Cedar Rapids – Cedar River 18.5 mg/L
- USGS 2013 streams exceeding MCL
 - IA-72% , MN-66%, IL-31%.
- Private Wells
 - 4.4 % of wells above MCL
 - Wells in relatively intense agricultural areas exceeded nitrate MCL in 25% of samples.
- Treatment options
 - drinking water plants— blending, reverse osmosis
 - Options for private wells—bottled water



Wildlife Habitat--Grasslands

- Tall grass prairie in Corn Belt virtually extinct.
- 70% of mixed grass prairie converted to agricultural lands.
- Grassland bird species are experiencing rapid population declines--primarily due to habitat loss.

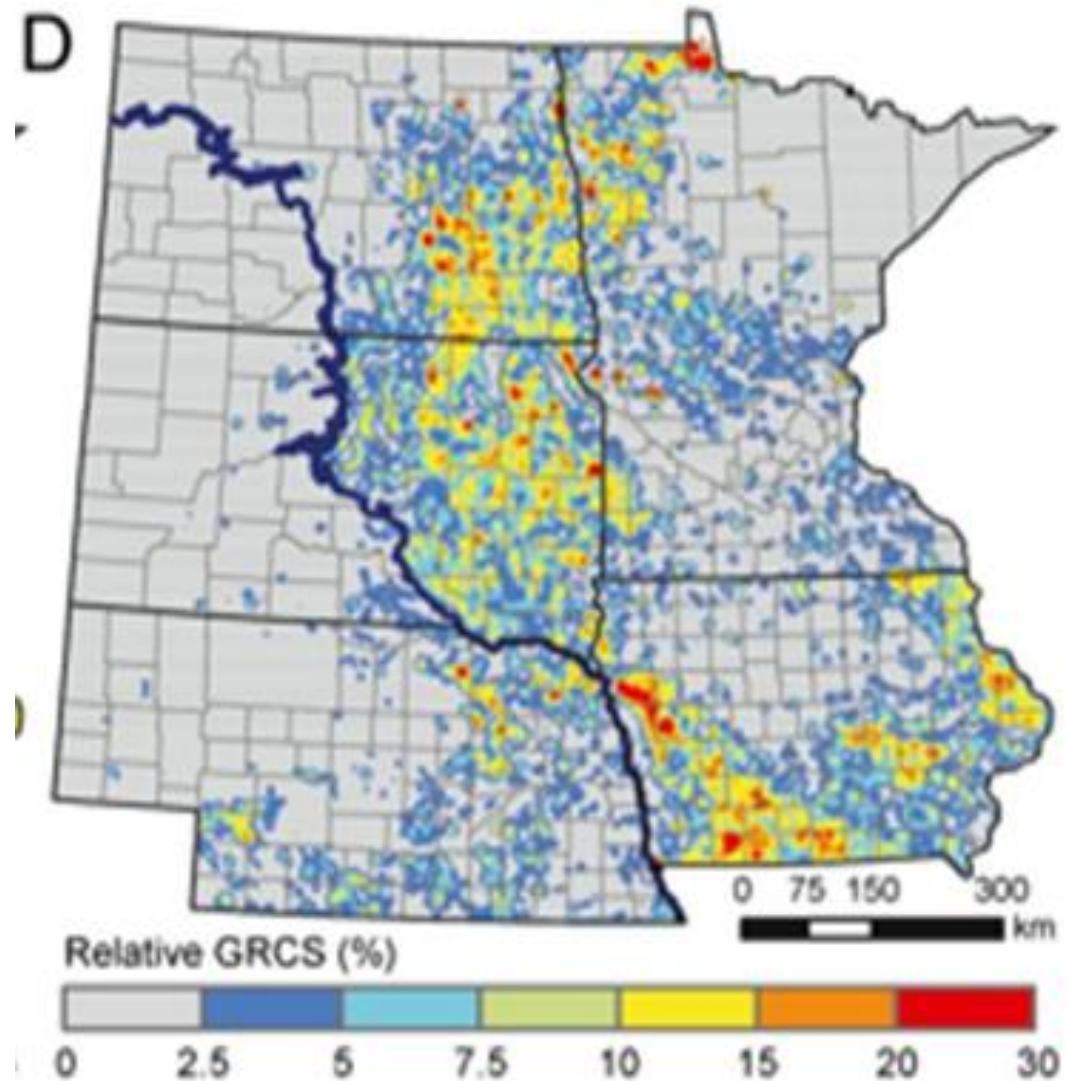


Western Corn Belt 2006-2011

- Rate of grassland conversion -1 to 5.4% annually (net decline of over 1.3 million ac of grasslands)
- Corn/soybeans expanding into marginal lands.

Land Cover/Land Use Change in Western Corn Belt

(D) Relative change rate from grassland in 2006 to corn or soybeans in 2011.



Wright C K , and Wimberly M C PNAS 2013;110:4134-4139

PNAS

Wetlands

Habitat

- **Prairie Pothole Region-- 40% to 90% of native wetlands have been drained, primarily for agricultural production.**
- **2006-2011 grassland conversions concentrated near wetlands in Western Corn Belt.**
- **More than 75% of both the breeding and wintering distributions of Black Ducks, Blue-winged Teal, Pintails, and Wood Ducks are on private wetlands.**

Water

- **Wetlands provide flood mitigation, coastal buffering, ground water replenishment, improved water quality, and recreation.**