Assessing the Impact of Cyanobacterial Harmful Algal Blooms on Drinking Water Intakes Across the United States

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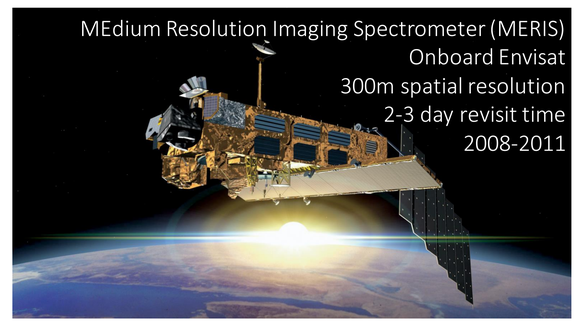
Introduction

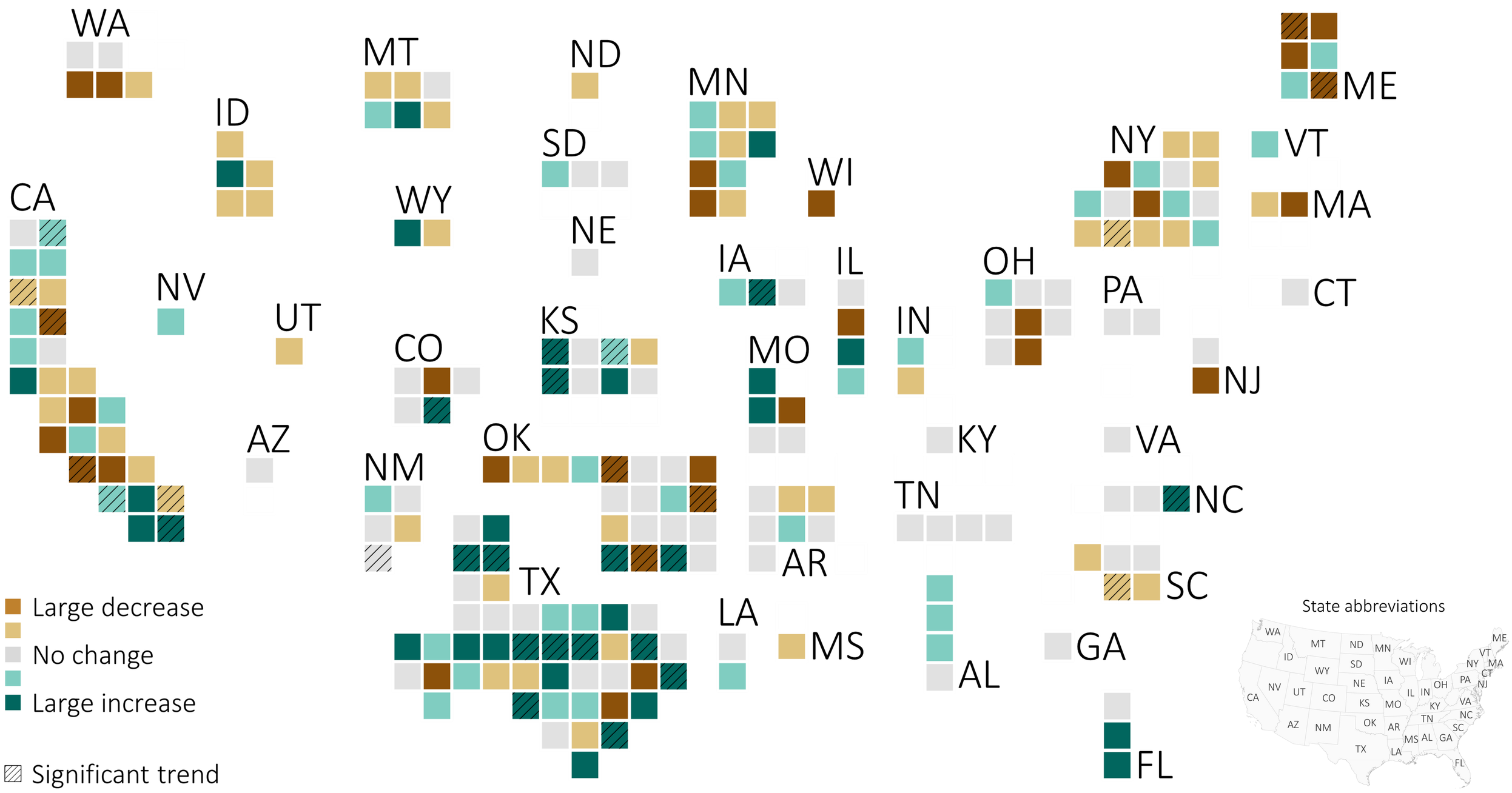
Cyanobacteria, or blue-green algae, is the most common form of freshwater algae. Contaminated drinking water can impact human health. This project assesses changes in cyanobacteria concertation at drinking water intakes across the continental U.S.

Satellite Data

The cyanobacterial index (CI) was quantified from a spectral shape algorithm centered at 681 nm to quantify the cyanobacterial abundance within each pixel. At a 300 m spatial resolution, 229 waterbodies contain a drinking water intake.



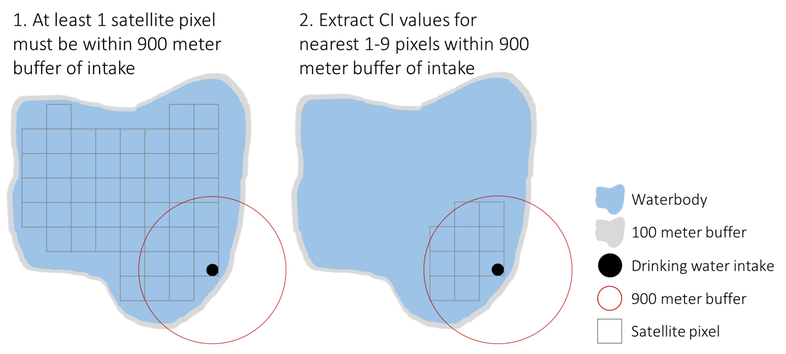
Changes in Cyanobacteria for Large U.S. Lakes Containing Drinking Water Intakes (2008-2011)



Trend results indicating changes in monthly cyanobacteria concentration (CI) for 2008-2011. Each square represents a U.S. lake that contains a drinking water intake. Lakes are grouped by state with a legend for state abbreviations on the left (note, abbreviations for states that do not contain a waterbody with an intake are excluded). The color of the square indicates change with brown representing decreased CI and green representing increased CI. Hatches represent statistically significant trends ($p \leq 0.05$).

Analyzing Cyanobacteria Concentration

Edge pixels & those containing snow/ice, clouds discarded → Satellite data aggregated to weekly composites → CI extracted as described in conceptual diagram (right) → Average monthly CI calculated for extracted pixels within each waterbody that contain an intake → Seasonal Mann-Kendall applied to determine if cyanobacterial abundance changed → Seasonal Sen Slope calculated to quantify change



Conceptual diagram illustrating data extraction at each intake.

Results

- 502 (16%) U.S. drinking water intakes can be analyzed for cyanobacteria concentration using 300 meter satellite imagery
- Identifying intakes with increased CI can allow effective resource prioritization
- Of 2,321 large waterbodies across the U.S., 229 contain a resolvable intake
  - 78 (34%) lakes increased in CI , 20 significantly
  - 78 (34%) lakes decreased in CI, 11 significantly
- Regional patterns are weak, if any. However, the Southwest and Central Plains have more significant trends with several lakes significantly increasing in CI

Future Analyses

- Launch of Sentinel-3A and 3B provides annual data from 2017-present
  - Similar spectral characteristics of the Ocean and Land Colour Instrument (OLCI) will allow for additional trend analyses in the future
- Compare trends in CI to changes in environmental or management decisions

Acknowledgements

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www.epa.gov/cyanoproject