

WATERBODY CHECK-UP: MONITORING & ECOLOGICAL MODELING TO EVALUATE RISK OF PREVENTABLE HEALTH PROBLEMS

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ABSTRACT

Need to Identify Waterbody Values at Risk of HAB

- Freshwater harmful algal blooms (HAB) represent a growing problem.
- Beyond odor and undesirable appearance, cyanobacteria HAB release toxins harmful to animals and to humans.
- Economic impacts of HAB are high on recreation, tourism, property values, business survival, drinking water treatment, and public health.
- HAB lake closures cause recreational and boating loss greater than \$1 billion per year with a similar magnitude of losses to property values (Dodds et al., 2009).
- Risk to aquatic species linked to eutrophication (caused by high phosphorus and nitrogen) and HAB leads to plans with annual expenditures of \$44 million to protect the biodiversity (Dodds et al. 2009).
- Change is non-linear – waiting until the problem is felt results in a response that is too late to prevent severe damage.

OBJECTIVE

Check-Up

The objective is to develop a conceptual “check-up” approach that can be easily applied to a broad range of monitoring data in waterbodies to evaluate the status and predict risk of approaching a catastrophic tipping point into conditions that will support and sustain recurrent HAB.



Source of algae photo: Lake Improvement Association

PROBLEM

Epidemic of Cyanobacterial Bloom Damage

- For 2009-2010: 11 recreational water outbreaks affecting 61 people, in addition to animal illness or death, were attributed to cyanobacterial toxins associated with HAB (CDC, 2014).
- High phosphorus level, often of agricultural origin, is necessary for HAB; other synergistic factors include: temperature, light, flow rates (pool or lake turnover rates), pH, metals, and biotic interactions.
- HAB in one lake resulted in economic losses of about \$200 million; see below for value lost in 900 sq. ft. condominium.



Year	GLSM \$ Per Square Foot	Indian Lake \$ Per Square Foot
2005	\$151	\$159
2011	\$100	\$163
Δ Value	-34%	+3%

METHODS

Systematic Waterbody Check-up

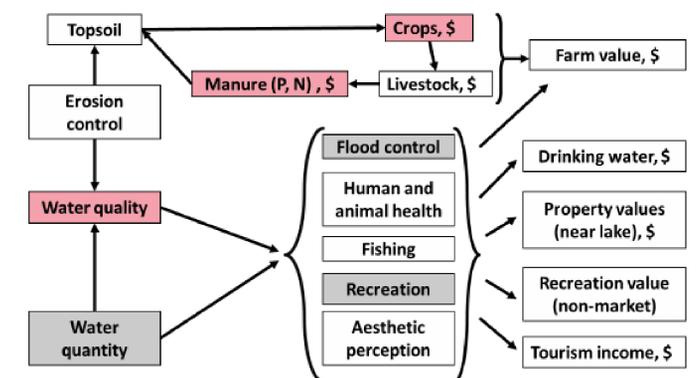
The approach includes selection of relevant ecological, species, and/or ecosystem service targets; developing corresponding conceptual models of key factors impacting the target outcomes; monitoring key factors in regional waterbodies; and converting conceptual to mathematical models for the ecoregion. Scenario and sensitivity analysis can then be performed.



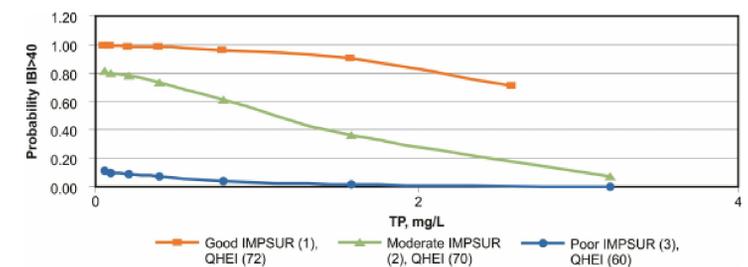
Waterbody Health Warnings



- Develop conceptual model and monitor important factors.



- Develop mathematical ecological model, perform scenario analysis, and interpret synergies on likelihood of HAB.



CONCLUSIONS

- HAB represent a significant economic and health threat to communities and individuals.
- Interacting conditions likely to create catastrophic HAB problems can be identified using the systematic approach presented here.
- Identification of risk can enable timely action to prevent costly HAB.

