Title: Expanding models of lake trophic state to predict cyanobacteria in lakes.

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Background/Question/Methods:

Cyanobacteria are a primary taxonomic group associated with harmful algal blooms in lakes. As such understanding the drivers of cyanobacteria presence has important implications for lake management and for the protection of human and ecosystem health. Chlorophyll *a* concentration, a measure of the biological productivity of a lake, is one such driver and is largely, although not exclusively, determined by nutrient inputs. As nutrient inputs increase, productivity increases and lakes transition from low trophic state (e.g. oligotrophic) to higher trophic states (e.g. eutrophic). These broad trophic state classifications are good predictors of ecosystem health and the potential for ecosystem services/disservices (e.g. recreation, aesthetics, fisheries, and harmful algal blooms). Thus, our existing models of trophic state might used to predict cyanobacteria. We test this idea and compare the performance of two models of trophic state (as determined by chlorophyll *a* concentration). Model 1 estimates trophic state with nutrients alone and model 2 uses nutrients plus landscape composition. We use random forest modeling to determine the out of bag (OOB) error for both models to compare the error associated with each variable. Lastly, we use the best model to compare presence/absence of several cyanobacteria taxa relative to trophic state.

Results/Conclusions:

Our preliminary results suggest that Model 1 (nutrients alone) has an OOB error rate of 42.0%. Model 2 (nutrients plus landscape variables) improves the OOB error rate to 36.1%. Both Nitrogen and Phosphorus were found to be important and, of the landscape variables, percent agriculture, percent developed, and percent forest explained the most additional variation. Expanding these preliminary results to include cyanobacteria taxa indicates that cyanobacteria are significantly more likely to be found in highly eutrophic lakes. These results suggest that predictive models of lake trophic state may be improved with additional information on the landscape surrounding lakes and that those models provide additional information on the presence of potentially harmful cyanobacteria taxa.