

Northeastern lakes: tradeoffs between aesthetics and the attenuation of anthropogenic reactive nitrogen.

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Historically, lakes have played a major role in the industrial, agricultural, and urban development of the northeastern United States though the provisioning of fresh water and hydropower. Although lakes continue to be important sources of freshwater, technological changes have reduced dependence on water as a source of power. Expanding populations and increases in affluence have raised the demand for cultural ecosystem services such as the provisioning of recreational, housing amenity, and existence value benefits from lakes. At the same time, lakes are also valued for the dilution, processing, and transport of anthropogenic wastes such as reactive (fixed) nitrogen from agricultural & urban runoff, sewage, vehicle emission etc. The proportion of reactive nitrogen attenuated through denitrification and plant uptake can be estimated based on models derived from published lake studies. For northeast lakes, estimated nitrogen removal rates are high (median = 20-40%) but these numbers need verification. The use of lakes to process nitrogenous waste may conflict with cultural uses as these are highly influenced by people's perception of water quality and aesthetics. We use data for actual and perceived water quality from the 2007 EPA National Lake Assessment and nutrient concentration estimates from the draft USGS SPARROW model for New England and the Mid-Atlantic regions to model lake aesthetics. Random forest modeling indicates that reactive nitrogen concentration is an important predictor of lake aesthetics and their potential to deliver cultural ecosystem services. We evaluate the changes in cultural and nitrogen removal services predicted to occur under various nitrogen reduction and increase scenarios for northeastern lakes.