

Using Hyperspectral Aircraft Remote Sensing to Support Ecosystems Services Research in New England Lakes and Ponds

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Northeastern lakes and ponds provide important ecosystem services to New England residents and visitors. These include the provisioning of abundant, clean water for consumption, agriculture, and industry as well as cultural services (recreation, aesthetics, and wilderness experiences) which enhance local economies and quality of life. Less understood, but equally important, are the roles that these lakes play in protecting all life through supportive services such as nutrient cycling. Excesses of nitrogen and phosphorus can lead to eutrophication, toxic cyanobacteria blooms, decreased biodiversity, and loss of ecosystem function leading to a reduction in the availability and delivery of ecosystem services.

In this study, we examined how variations in lake nutrient concentrations and phytoplankton pigment concentrations correlated with changes in the potential to provide cultural ecosystem services. Using a NASA Cessna 206 aircraft, hyperspectral data were collected during late summer 2009 from 55 lakes in New Hampshire, Massachusetts, Connecticut, and Rhode Island over a 2 day period. From the spectral data, algorithms were created which estimated concentrations of chlorophyll *a*, phycocyanin, and colored dissolved organic matter. The remotely sensed estimates were supplemented by *in situ* chlorophyll *a*, total nitrogen, total phosphorus and lake color data from 43 lakes sampled by field crews from the New England states.

The purpose of this research is to understand how variations in lake nutrient concentrations and phytoplankton pigment concentrations correlate with changes in availability of cultural ecosystem services in the surveyed lakes. This dataset will be combined with information from the EPA National Lake Survey (2007), the EPA New England Lakes and Ponds Survey (2008) and the USGS SPARROW model to explore the association between lake condition and the provisioning of ecosystem services on a regional scale. Under the EPA Ecological Services Research Program (ESRP), this information will provide managers and researchers with a better understanding of links between management decisions affecting nutrient fluxes and impacts on selected ecosystem services.

