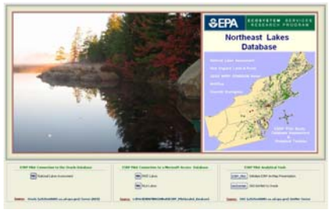
I. Introduction

Northeastern lakes provide valuable ecosystem services that benefit residents and visitors. As part of the U.S. EPA Ecosystem Services Research Program we are developing a database to explore the association between lake condition and the provisioning of ecosystem services. This database provides unique identification numbers for over 28,000 geographically referenced lakes and allows us to combine data from the National Lakes Assessment, the New England Lakes and Ponds Survey, the USGS SPARROW model, aircraft based hyperspectral data of select lakes, as well as other datasets. These data include standard physical-chemical measures of water quality and subjective assessments of, for example, the appeal and perceived biotic integrity of lakes.

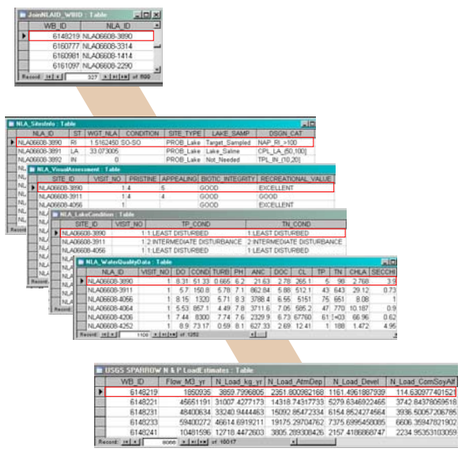
This poster provides detail on the database, the tools we are developing to take advantage of the database, and how we hope to serve both to potential end users.

II. Northeast Lakes Database



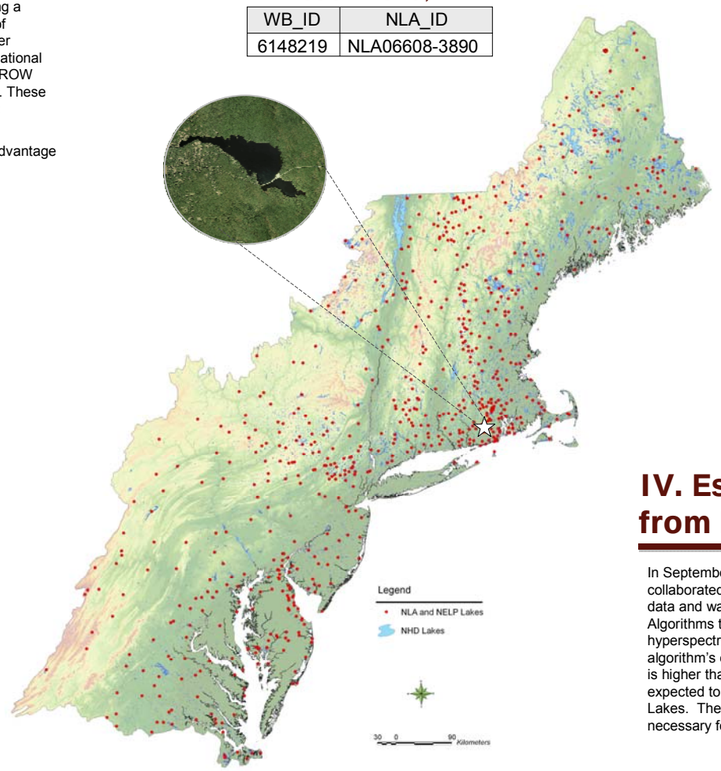
- Locations of over 28,000 lakes from NHDPlus for HUC Regions 1 & 2 (Maine to the Chesapeake Bay)
- Ability to include additional non-NHD lakes
- Each lake given a unique identifier (WB_ID)
- Lakes Identifiers linked to monitoring data from the National Lake Assessment, New England Lakes, and Ponds Survey, and the USGS SPARROW model.
- Additional data from Federal, State, Local, and volunteer monitoring programs to be added.

WB_ID	NLA_ID
6148219	NLA06608-3890



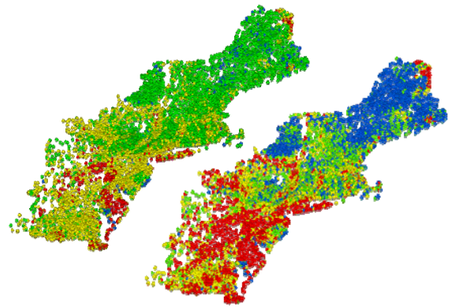
Beach Pond, RI

WB_ID	NLA_ID
6148219	NLA06608-3890



III. Ecosystem Services Productions Functions

- National Lake Assessment data for 152 Northeastern lakes used to model relationship between observed Chlorophyll *a* concentration, subjective measures of recreation potential, and USGS SPARROW estimates of Nitrogen & Phosphorus loads.
- Model results used to estimate Chlorophyll *a* concentration and recreation potential for >14,000 lakes



Predicted Chlorophyll *a*

- < 2 µg/l
- < 7 µg/l
- < 30 µg/l
- > 30 µg/l

Recreation Potential

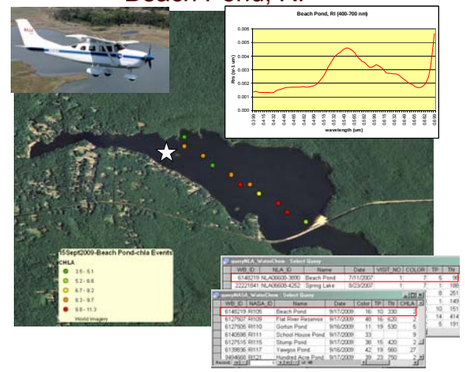
- Excellent
- Good
- Fair
- Poor

Recreation Potential	Weight
Aesthetic Appeal	2
Disturbance	1
Biotic Integrity	1
Recreational Value	2
Swimmability	2
Microcystin Detection	-2

IV. Estimation of [Chlorophyll *a*] from Hyperspectral data

In September 2009 the New England States, EPA, and NASA collaborated on the simultaneous collection of airborne hyperspectral data and water chemistry samples from 55 New England Lakes. Algorithms to estimate parameters such as Chlorophyll *a* from the hyperspectral data are currently being developed. The uncorrected algorithm's estimate of Chlorophyll *a* in Beach Pond (mean = 8.1 µg/l) is higher than measured values. The algorithm performance is expected to improve when properly parameterized for Northeastern Lakes. The Northeast Lakes database will provide the monitoring data necessary for model improvement and validation.

Beach Pond, RI



V. Next Steps

As we continue develop to the database our obvious next steps are to build useful tools that take advantage of the rich data available to us. We plan to provide web access to:

1) the full database

2) analytical tools and scripts

3) tools for mapping lake ecosystem services, and

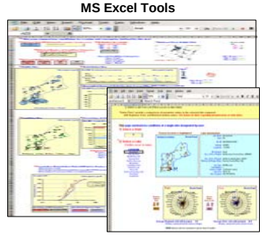
4) provide the ability for users to incorporate their own databases with the data and tools we provide.

These efforts will provide managers and researchers a better understanding of links between management decisions affecting nutrient fluxes and selected ecosystem services; support other novel research questions such as examining the link between ecological condition and human health; and provide the means for others to replicate our results and adapt our approaches and analyses in novel ways.

To accomplish these goals we will:

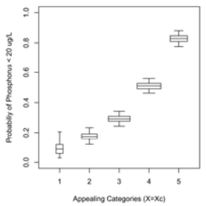
- Meet with federal and state partners to refine our existing tools and/or develop new tools that would provide the most benefit to the end users. We will be doing this in the coming years through face-to-face meetings

MS Excel Tools



- Develop prototype tools, based on our past work, such as using MS Excel to analyze data and R to look at Conditional Probabilities

Conditional Probability with R



ArcGIS Server

- Provide access to the data and tools through user friendly web-based interfaces such as ArcGIS Server and SAS Internet that will also allow users to include their own data into the analyses and tools developed for this project

SAS Internet