How does human land use surrounding lakes and ponds alter their role as a carbon source or sink in the global carbon cycle?

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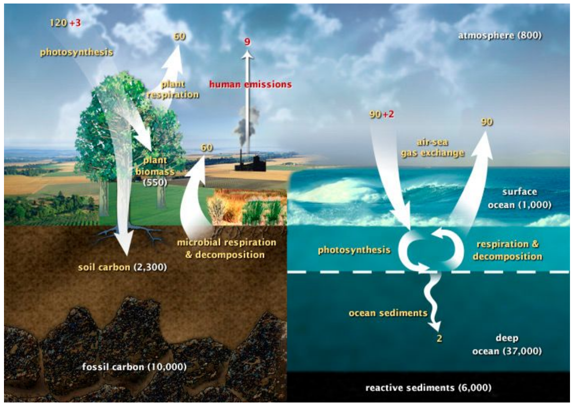

Figure 1. Current global carbon cycle without inland waters integrated into model. https://earthobservatory.nasa.gov/features/CarbonCycle

Motivation

There is little data on the complex processes that control the carbon fluxes in lake ecosystems since they were considered irrelevant in the global carbon budget. Recently researchers began to include inland waters in carbon budgeting(Figure 2) and place importance on inland waters as carbon sinks (Cole et. al 2007). Not only are the natural processes not understood but little is known about how human land use affects the nutrient cycling. More research is needed to understand the relationship between land use and carbon cycling as agricultural lands will likely increase and the role of lakes in the carbon cycle might increase. We need a more accurate global carbon budget in order to effectively understand and combat climate change (Downing 2009).

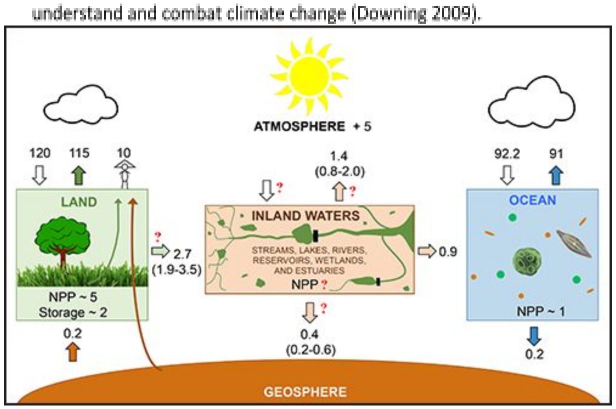

Figure 2. Updated carbon cycle including inland waters but missing key processes https://eos.org

Background

Little research has been conducted on the role of lakes as carbon sources and sinks as a part of the global carbon cycle. Lakes are usually lumped in with terrestrial ecosystems or only thought of as pathways to oceans(Figure 1) although they play a unique role that strongly influences the global carbon cycle. Even though inland waters only cover a small percentage of earths surface they bury a surprisingly high amount of carbon relative to their size, estimated to be about 70x10^6 t/a (Einsele 2001) and bury more C in sediments than the entirely of the oceans (Batin et al. 2009). The carbon cycle in lakes is incredibly complex and can be changed by anthropogenic influences such as intensive agriculture erodes soil which transports sediments, terrestrial OC, and nutrients inland where the lakes directly store C or eutrophication consequently increases aquatic productivity (Heathcote and Downing 2012).

Figure 4. Lake sediment core samples. Molly McKnight www.usda.gov

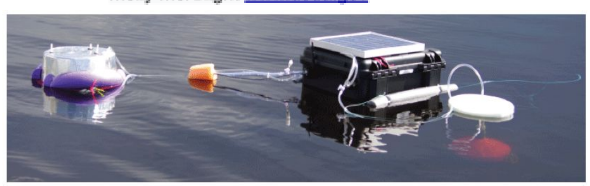

Figure 5. Floating static gas chamber https://hess.copernicus.org/articles/24/3417/2020/

Hypothesis

There is a correlation between anthropogenic land use surrounding inland water and carbon fluxes.

Anthropogenic land use surrounding inland water leads to higher carbon burial due to higher aquatic productivity resulting from eutrophication. Increasing levels of eutrophication will increase changes in carbon burial as human land use changes as seen in Figure 3

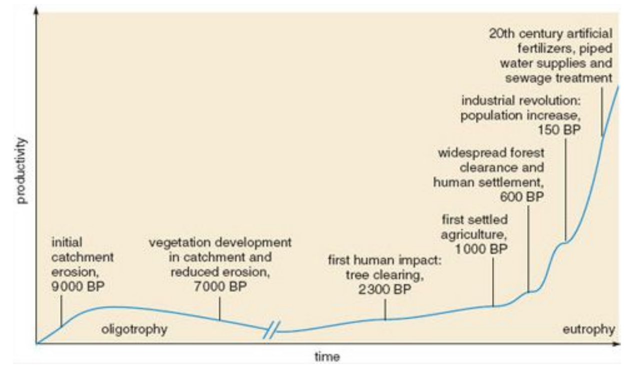

Figure 3. Effects of anthropogenic influences on lake productivity www.open.edu

Study design

We propose to focus on lakes and ponds across Chittenden county across a variety of land use landscapes including forests, urban, and agriculture. Carbon fluxes will be determined using floating static gas chambers(Figure 5) to measure carbon gas emissions and sediment core samples(Figure 4) to measure OC that has been deposited. High quality satellite imaging will be used to determine the primary land use surrounding the water.

Intended analysis

The carbon fluxes entering or leaving the water systems will be compared against the surrounding land use. Since our independent variable (land use) is categorical ad our dependent variable (carbon fluxes) is continuous we will use ANOVA see the extent of correlation between our variables

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