**Coupling a global climate scenario, general circulation models and lake models to partition uncertainty in the projected thermal budget of a northern oligotrophic lake**

Due to human activities, freshwater ecosystems around the globe are increasingly changing. Clear water, or oligotrophic, lakes provide critical ecosystem services such as drinking water yet are experiencing relatively abrupt and severe water quality problems attributed to climate change and land development. Because of this, new tools to predict future water quality are vital to improve the management of oligotrophic lakes and combat water quality degradation. In this project, the focus of my research will be Lake Sunapee, an oligotrophic lake in New Hampshire and important drinking water source.

In order to better understand the impacts associated with the future climate change scenario representative concentration pathway (RCP 8.5), four general circulation models (GCM) will be used to model lake temperature with the five lake models within LakeEnsemblR (LER), a novel tool containing five distinct lake models. Using a 30+ year historical dataset from Lake Sunapee, parameters will be calibrated, and baselines will be created for each GCM. GCM climate data will then be forced through the calibrated LER and the anomalies between GCM’s will be compared using 30-year intervals up to 2099. Metrics of interest from this LER output will include thermocline depth, length of stratification, thermocline strength, and ice coverage. An array of compiled outputs including parameter distributions, water column output, and anomaly values will subsequently be used to partition uncertainty across the climate models, parameters, lake models, total forecast and climate scenario.

This project will be multifaceted in its outcomes: first, the outputs of the LakeEnsemblR models will give insight into the future of Lake Sunapee given certain climate conditions. This will provide desired insights to managers and homeowners residing at Lake Sunapee, who are greatly interested in mitigating the impacts of climate change on their lake in order to maintain its community-wide and personal values. Second, this project will lead to novel insights revolving around the modelling itself. Because all models have inherent uncertainty, whether that be revolving around future temperature projections, global circulation methods, or water column properties, it is important for researchers to understand how much uncertainty is present and where that uncertainty is coming from. Because this project contains multiple models at multiple steps, the ability to compare both vertically and horizontally is possible and extremely useful. These insights will be relevant to researchers and modelers carrying out similar climate change impact studies in order to mitigate future negative impacts.

The OVPRI Covid-19 guidance will be adhered to during this project, as all data has been collected and no in-lab research will be required. Work on this project will be computer based, using modelling techniques and previously collected data and therefore guidelines such as physical distancing and mask wearing are not applicable.