Project Summary

Intellectual Merit.—The proposed research seeks to better understand lakes in the context of regional and global biogeochemical cycles, specifically the carbon cycle. Inland waters are estimated to emit green house gasses sufficient to offset the terrestrial carbon sink. Further, inland waters are estimated to store more carbon in their sediments than the world's oceans. Despite this evidence, most large-scale analyses of carbon cycling do not consider inland waters. Improved understanding the role of lakes in regional and continental scale carbon cycling requires accurate descriptions of the size-distribution of lakes to up-scale biogeochemical measurements. The proposed work will use a fractal geometric framework to derive the theoretical size-distribution of lakes. The theoretical size-distribution of lakes is one of the most fundamental but unresolved aspects of limnology and this should lead to more accurate enumerations of small lakes that are poorly resolved in geographic data. The proposed work will also use novel statistical methods, based on geographically weighted regressions, to delineate lake regions with homogenous biogeochemical scaling relationships. These scaling relationships describe how biogeochemical processing varies with lake size. Biogeochemical scaling relationships likely vary geographically and delineating individual study regions is likely to improve the accuracy of up-scaling relative to procedures based on a single global scaling relationship. This work will also provide new insights into the geographic sales of variability of aquatic biogeochemical processes while also informing sampling for future up-scaling studies.

Broader Impacts.—Global limnology, a sub-discipline of limnology, seeks to better understand the role of lakes in global biogeochemical cycles with the goal of making limnology relevant to the public in an era of intense focus on global scale environmental issues. Global limnology is a new field and there currently is a significant opportunity to impact it through the development of new theories and methodologies. The proposed work will develop a theoretical basis and methodological advancements for global limnology. Project results will be presented at international conferences and detailed in submissions to peer-reviewed journals.

The Nordic Research Opportunity stands to substantially benefit the Graduate Fellow Applicant (GFA). The GFA will receive mentoring on limnological research methods from the Nordic host and attend lectures and seminars in the host's academic department. This participation will improve GFA's understanding of fundamental limnology, particularly aquatic biogeochemistry. The GFA's home department provides only minimal opportunity for interaction with other limnologists and the proposed international collaboration will provide the GFA with an opportunity to develop a network from which to seek future research opportunities including possible postdoctoral positions.