

Investigating Anthropogenic Perturbations on Carbon Cycling in an Urbanized Tropical Estuary

ABSTRACT

The proposal is co-funded by OISE, EPSCoR and GEO programs.

This IRES project will support US students and provide international education, training and research in marine geochemistry and carbon cycling in a tropical estuary (Douala Estuary) in the Atlantic coast of Cameroon, West Africa. During this study, faculty and students from the University of Delaware, a PhD granting institution and Fort Hays State University, a non-PhD granting institution will partner with faculty and students from the University of Douala and the University of Yaound 1 in Cameroon. Over the next three years, 9 undergraduates and 3 MS students will travel to Cameroon to conduct hands-on, field-based research that is focused on investigating the effects of agriculture, urbanization, industrial and shipping activities on carbon cycling in the Douala Estuary. The objectives are to (1) document pollution in the water column and sediments and (2) assess if and how the human activities and pollution affect carbon dioxide production in water column and sediments. Data acquired by the students will provide important information to assess the role of the Douala Estuary in carbon cycling and provide valuable information to model the movement of carbon at the local, regional and even global scale.

This IRES project will provide undergraduate and graduate students with the opportunity to conduct faculty mentored, hands-on research in an apprenticeship-type model. Different aspects of the project will form the basis of undergraduate research topics and graduate student theses. A goal of our IRES program is to attract underrepresented minority students and mentor them to develop self-confidence, independent and critical thinking skills necessary to excel in a research and in careers in the geosciences. By interacting with Cameroonian peers, the US students will enrich their cultural experience, build personal and professional networks and establish relationships that will form the core of future international research collaborations. The results of the students' projects will provide scientific input that will be useful for designing sustainable management programs for the use and protection of estuarine resources.

Carbon in estuaries are an integral part of the global carbon cycle. The US Carbon Cycle Research Program identified carbon contributions from estuaries to the atmosphere as a critical area for research. Much research on carbon cycling has been conducted in estuaries in temperate regions. To date, there are no studies of carbon cycling in tropical estuaries of Africa and even less is known about how agriculture, urbanization, industrial and shipping activities polluting these estuaries affect the carbon cycle. Few estuarine studies are based in Africa, despite the high human population along the coast and extensive human alteration of estuarine ecosystems. The US Carbon Cycle Research Program identified carbon sources and fluxes to and from estuaries as a critical area for research because estuaries link

the terrestrial, ocean and atmospheric carbon reservoirs. Yet, the role in local, regional or even global carbon cycling from tropical estuaries in sub-Saharan Africa which receive far greater amounts of organic carbon and pollutants compared to temperate and high latitude estuaries is unknown. To fill this knowledge gap, for six weeks and over a three-year period, US students and their Cameroonian peers will conduct field based research to elucidate how anthropogenic activities (agriculture, urbanization, industrial and shipping) that pollute the Douala Estuary with nutrients (e.g., nitrates) and metals (Cadmium) affect carbon cycling in the water column and sediments. The anticipated results of this project will provide important information to assess the role of the Douala Estuary in carbon cycling and provide valuable data for carbon cycling modelling at the local, regional and even global scale. Students will test the hypothesis that anthropogenic pollution in the Douala Estuary increases bio-productivity in the water column and sediments, alters the cycling of carbon and increases the flux of carbon dioxide to the atmosphere.

By interacting with Cameroonian peers, the US students will enrich their cultural experience, build personal and professional networks and establish relationships that will form the core of future international research collaborations. Finally, the results of student projects will provide scientific input that is useful for designing sustainable management programs for the use and protection of estuarine resources.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.