LEHIGH UNIVERSITY

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OIA Doctoral Travel Grant for Global Opportunities DTG-GO

1 message

cdl215@lehigh.edu <noreply@qemailserver.com> Fri, Sep 15, 2017 at 4:23 PM
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Someone has applied for DTG-GO

Recipient Data:
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Response Summary:

First Name
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College of enrollment
College of Arts and Sciences

Major field of study
Earth and Environmental Sciences

Faculty advisor name
Zicheng Yu

Do you currently have a university assistantship or fellowship? If yes, choose the correct box below.
Teaching assistant

Are you currently funded by an external organization? If yes, choose the correct box below.

Choose the type of activity
Conducting Research/Scholarly Work

Title
Peat formation under dynamic topography in Tierra del Fuego, Chile

Location and Dates of Program/Conference
Karukinka Park, Chile - January 8-22 2018

AbstractPlease provide a 3 - 5 sentence abstract (no more than 250 words) that clearly describes what is proposed and how the proposed experience will enhance the applicant's education significantly. Please note: This abstract must be suitable for use in a media release if the proposed activity is funded.

The peatland ecosystems of Tierra del Fuego, Chile exist under a delicate balance of boundary conditions. Westerly winds delivery precipitation to this island on the Southern tip of the Andes producing conditions that favor peat accumulation. These high-latitude deposits of carbon may be under threat from rapidly changing climate. However, it is not well known how the dynamic topography—due to fluvial geomorphologic changes—has altered those conditions over the last few millennia. Here we propose a study to further our understanding of the geomorphic controls on peatland initiation, and carbon accumulation. I will utilize a multi-disciplinary approach to answer the question of how landforms and landscape-scale processes such as erosion and watershed expansion affect peat formation. My approach will focus on modeling the physical parameters of watersheds that are dynamically changing over millennial time-scales, and determine the factors that may be influencing peat accumulation. Then I propose to test those results with peat-carbon accumulation rates, and peatland depth probe measurements, derived from field sampling. This work will require geographic information systems analysis of digital elevation models, as well as physical samples analysis from study sites in Chile. This research could lead to a better understanding of what controls peat formation in dynamic landscapes worldwide.

Detailed proposal of research/scholarly workIn no more than 1000 words, describe the objectives and approach of your proposed research activity. Make clear how it relates to your immediate and long-term doctoral goals. Include a time-line for preparing for and completing the proposed activity.

The organic matter stored in peatlands, worldwide, is a major portion of the C-storage of the biosphere. High-latitude deposits are of interest, as projected future warming threatens to alter the boundary conditions that allow peat to accumulate possibly reducing carbon stocks and exacerbating global climate change. Areas such as Tierra del Fuego (Chile) are under greater threat as there are steep climate and ecosystem gradients. Mountains approach tree-line at only 500-600 m elevation, and peatlands fill valleys in the south and west within 75 km of the Seno Almirantazgo and up the tributaries of one of the main rivers systems, the Rio Grande. East of this zone of peat formation the landscape transitions to grasslands emplaced on meandering stream-terraces, with intermittent peatlands adjacent to the large stream network. Despite recent research into the carbon accumulation in high-latitude ecosystems, not much is known about the response of these peat forming ecosystems to stream hydrologic changes that are forced by climate or fluvial geomorphologic transitions.

The climate in this region is driven by westerly winds bringing moisture from the South-Pacific, precipitating over the more westerly parts of the island. Complicating this highly heterogenous landscape is the tectonically active southernmost extension of the Andes mountain range, with summits reaching over 1,000 m. Initial research shows fluvial geomorphology may be responsible for creating accommodation space in valleys. Modeling watershed incision parameters shows that glacially-carved valleys, now filling with sphagnum moss peatlands, may be expanding over millennial time-scales to capture higher elevation forested hillslopes and plateaus. This study will focus on the intersection of climate and stream morphology and its impact on carbon accumulation and peatland formation.

Karukinka Park, privately owned by World Conservation Society (WCS), located in Chilean Tierra del Fuego provides the perfect natural experiment to understand these processes. The abundant peatlands, steep topography and park infrastructure allow research to be done on this subject that would require extensive travel and greater time-in-field if conducted in similar landscapes elsewhere. Combined with this, the goal of the park is to better understand their carbon stock story, and how to best conserve this natural resource. Working with the WCS in Karukinka Park will give me the ability to network with worldwide-NGOs to symbiotically advance scientific research.

The objectives of this study are to better understand the carbon dynamics in Karukinka Park, Tierra del Fuego. In order to achieve this over-arching goal, first I will (1) attempt to determine, with remote sensing, the physical parameters that drive peat accumulation, (2) derive detailed peat-based chronology of carbon dynamics and paleoclimate in Tierra del Fuego, Chile, and (3) examine the response of peat-forming ecosystems to past climate or geomorphological changes, and infer how this may have affected C-stocks.

The approach of this study is to use the combination of fluvial geomorphology combined with peat-based paleo-proxy. Using Geographic Information Systems (GIS) mapping tools, I will identify peatlands in stream systems that are undergoing more rapid watershed expansion, and those with systems that have been stable for longer periods of time. In order to tease apart the effects due to climate and those due to watershed-level factors my approach will be to derive a detailed peat-based proxy. Therefore, this study will require travel to Tierra del Fuego, and I will use peat-coring methods standard for our lab to analyze the history of the study sites, while collecting essential field data to ground-truth GIS products. Field methods to measure carbon accumulation and stock will include; depth-probe measurements (25-30) at peatlands in pre-determined watershed areas. Additionally, peat-coring at proposed sites (3-5) with material transported to Lehigh for carbon accumulation rate determination. This will require the use of high-resolution age-depth models obtained using carbon-14 dating, paleoecological study of peatland species changes through time, and stable isotope analysis for hydroclimate reconstruction in study area watersheds.

This research is directly related to my proposed course of study for my PhD dissertation in Paleoclimate/Paleoecology. My current work is focused on the response of high-latitude carbon-rich ecosystems in Antarctica to climate changes over the last two millennia. Currently I have produced one manuscript that is in being re-submitted to Quaternary Science Reviews, in which I analyze the history of ecosystem response to changing climate on different hillslope aspects in Antarctica. This proposed study—to answer my main question on how sensitive high-latitude peat-forming ecosystems respond to climate and geomorphic changes over millennial time-scales—will serve as the third manuscript I will compose

as well as the final chapter for my dissertation.

The time-frame for completion of this study will be in the last year of my PhD research. This project will require 1-2 months of GIS analysis of topography utilizing existing tools developed in Fluvial and Tectonic Geomorphology (EES-412) to choose proposed study sites. Coordination with WCS Karukinka office would be required, with proposed field work to occur over 10 days (on site Tierra del Fuego). This will include 5 days of peatland probe measurements and ground-truthing the feasibility of peatlands study sites. Then a further 3-4 days for peatland site coring. Finally, 1 day of sample preparation for travel back to Lehigh. The field work will require 2 days travel to, and 2 days travel from Punta Arenas, Chile. Lab work is expected to take 2 semesters (Spring and Summer 2018), with manuscript and dissertation preparation continuing to the Fall 2018. With project finalization no later than Spring 2019.

Total budget. Enter numbers only, no currency signs.

4000

Funds secured from other sources. Please list each source and the amount below. Enter numbers only, no currency signs.

EES GIC Research Grant = 1500 (Lab cost only)

GSS Travel Grant = 75

Remaining balance. Enter numbers only, no currency signs.

2425

Amount you are requesting as a DTG-GO grant. Enter numbers only, no currency signs.

1500

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