Committee Member,

I aim to enroll at Colorado State University to become quantitatively literate. J. Liu's numerical approach to flow in porous media and P. D. Shipman's experience advising graduate research motivates this application. At CSU, I would design and implement numerical methods to model aquifers in the Pacific Northwest. Upon attainment of a master's degree, I plan to complete a Ph.D. and enter an ecological industry.

Here are two descriptions of my research interests.

Sediment Transport In Idaho's Treasure Valley, farmers use a network of reservoirs and canals to suspend and divert the Boise river. To understand how this irrigation regime sweeps up and transports material, I would model water's energy in flood irrigated fields. Constrained by agricultural machinery and topography, I would search for furrow patterns that minimize water's turbidity. As a related project, I would consider canal geometries that interrupt high-velocity flows.

Ground Water Contamination The Army's December decision to not grant an easement for the Dakota Access Pipeline encourages me to research contaminant diffusion. In contribution to an environmental impact statement, I would (i) model geomorphic stress on the pipeline and (ii) consider the effects of a leak in regions of stress. I imagine the first item, characterizing tension in surrounding media, to be accessible as an inverse problem. I would approach the second item, assessing diffusion from an uncertain source, with a modified finite element method.

I share two examples of my relevant research experience.

Galois Theory & Fuchsian Equations Following Michio Kuga's analysis of Fuchsian-type differential equations, I parameterized the solution space of the hypergeometric equation. For interesting cases, I found the monodromy representation at singular points. I presented my method, its history and a potential application to fluid flow at The College of Idaho's 2016 student research conference.

Igneous Dikes in Scotland Relying on N. L. Bowen's *The Evolution of the Igneous Rocks*, I modeled the cooling of plagioclase feldspar magma. I proposed that my geology abroad group in Scotland visit Glen Sligachan, a significant site for Bowen's field observations. On June 4^{th}, noticing rough shards of buoyantly exposed olivine lodged within dense clusters of plagioclase crystals, we validated Bowen's hypothesis that molten plagioclase carried partially solidified mafic minerals into the crust.

Consider my candidacy for a teaching assistantship. I here summarize what has prepared me to teach.

Tutoring & Grading I tutored calculus students one-on-one and graded physics coursework. I guided small groups through problems in elementary electromagnetism. I heard out my peers in introductory topology and posed constructive questions. As a Heritage Scholar at The College of Idaho, I led discussions in colloquium. In seminar, I organized half-hour workshops on the logistic equation and the heat equation. I also delivered an hour presentation on epidemiological modeling.

Time Away from School Over the last year, I volunteered on a ranch outside of Stuttgart and worked at a refugee resettlement office in Houston. These experiences refined my teaching ability. For example, while I learned LaTeX for mathematical exposition, with it, I have created bus guides and applications for indigent health-care. As a second example, while I was exposed to guided problem solving (G. Polya) and inquiry based learning (R. L. Moore) in college, I have applied these pedagogies across language barriers. I plan ahead, relax in person, and invite questions.

Presently, I am a fellow in the Texas Episcopal Service Corps and employed as a refugee medical care intern. I work on a small team to provide intensive case management for refugees with complex medical conditions during their first year in the United States. In this work, I help limited English proficiency clients navigate one of the nation's densest health-care bureaucracies, I coordinate health plans to ensure coverage of medical services, and I accompany clients to safety nets (e.g., shelters and food pantries) in emergency situations.

I am confident that I would contribute formidably to your program. Thank you for your consideration.

Respectfully,
Colton Grainger