Training a diverse STEM workforce to measure and model energy, water, and carbon budgets

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The need to recruit and retain underrepresented minorities in science, technology, engineering, and mathematics (STEM) is a national security issue impacting U.S. governmental agencies of the 21st century. The overarching goals of this proposed project are to: 1) build climate and environmental science programs at Lincoln University of Missouri (LU) to ensure long term training and research collaboration between LU and Oak Ridge National Laboratory (ORNL), 2) train a diverse STEM workforce including hands-on research experiences at the Missouri Ozarks AmeriFlux site (MOFLUX) and ORNL, and 3) foster career development of students from underrepresented groups in ORNL's Terrestrial Ecosystems Sciences Scientific Focus Area (TES-SFA). To achieve these goals, four specific project objectives include: (i) prepare LU undergraduate and graduate students to conduct novel independent scientific research by mentoring through research projects at MOFLUX, (ii) development of student-friendly learning materials and training modules to streamline hands-on student research activities at MOFLUX, (iii) developing and delivering case study curricula for physical hydrology and geographic information systems (GIS) courses at LU, and (iv) providing LU students with an immersive experience at ORNL where they will attend a short course focused on measuring and modeling ecosystem processes, meet with TES-SFA scientists, and tour lab facilities. Graduate students will lead a journal club to equip students with fundamental background information to set the stage for hands-on research activities at MOFLUX. Hands-on research activities at MOFLUX will involve data collection and maintenance of an existing network of six weather stations deployed within the footprint of the MOFLUX tower. Students will analyze and synthesize data collected from weather stations with MOFLUX data streams. Science-based information (i.e. data) and lessons learned from research activities at MOFLUX will be used to develop geoscience case study curricula for physical hydrology and GIS at LU. To deepen and broaden students' research experiences, select LU students will visit ORNL to undergo training in environmental systems science and learn about research activities within the TES-SFA and other ORNL research areas. When students visit ORNL, they will be trained on the theory and practice of ecosystem monitoring and modeling. Taken together, the ORNL workshop is designed so that students will develop a range of skills relating to making measurements and modeling. As a capstone graduate experience, graduate students will attend Fluxcourse at the University of Colorado Mountain Research Station at Niwot Ridge, USA. Additionally, a DOE RENEW session proposal will be submitted to American Geophysical Union (AGU) where RENEW students across the U.S. will be invited to share their research findings and experiences. Results will also be disseminated to a diverse network of students and faculty at 1890 Association of Research Directors (ADR) Symposium held annually at LU. Data collected and curriculum developed will be shared with other HBCUs and MSIs and made publicly available with citable DOIs on DOE's Environmental Systems Science Data Infrastructure for a Virtual Ecosystem (ESS-DIVE).