

## **Culturally Relevant Ecology, Learning Progressions, and Environmental Literacy**

Our Mathematics and Science Partnership focuses on enhancing environmental literacy in K–12 schools and beyond through research on student and teacher learning, professional development informed by the research, and institutional reform. We work at the critical education juncture of middle school through high school (grades 6–12). The project connects the research strengths in the environmental sciences and education of our partner universities and sites within the NSF-funded Long Term Ecological Research (LTER) Network with K–12 teacher professional development in science and mathematics of our partner schools. The program takes advantage of the local and regional partnerships between the universities and the K–12 districts and provides a common research framework and professional development model. As such, site-based research and professional development are implemented and coordinated within a network. Our work emphasizes a core set of environmental issues defined by researchers within the LTER network, alignment of those issues to state science and mathematics content standards, research on student and teacher understanding of principles underlying the environmental issues, and the development and implementation of professional development and instructional strategies that are informed by this research. Partnership between K–12 and higher education and engagement of each in the others' activities, institutions, and cultures are key elements to approach and success.

Our research on the effectiveness of our work includes longitudinal studies of teacher and student performance on standardized tests, longitudinal qualitative studies on student and teacher understanding of science content and process, learning progressions–based research on student and teacher understanding of science content, and learning progression–informed teaching strategies and professional development activities. The early longitudinal studies focused on the effectiveness of multi-year academic year and summer immersion and enrichment programs targeting first generation and low-income students funded by the USDE. Students who participated in the program for two or more years exhibited significant gains in ACT scores, and were more likely to graduate from high school and matriculate to college compared with non-participants. Teachers demonstrated an increased level of engagement with higher education. Current work is focusing on student understanding of key concepts and instructional strategies to increase content knowledge, and effective modes of engagement between K–12 and higher education to meet these ends.

We have conducted our research and implemented our modes of engagement in a variety of school settings (e.g., rural, urban, small schools) with diverse students. Specific examples of engagement include partnering STEM graduate student with K–12 teachers in their classrooms following the NSF GK–12 model, providing research internships for K–12 teachers, establishing a teacher-in-residence program for teacher sabbaticals at the universities, developing graduate programs for teachers and adopting options within existing graduate programs to facilitate engagement of STEM graduate students and faculty with K–12, and redefining outreach at the universities to include engagement with the K–12 community.

Information about our programs can be found at [www.nrel.colostate.edu](http://www.nrel.colostate.edu), [www.lertnet.edu](http://www.lertnet.edu), and <http://edr1.educ.msu.edu/EnvironmentalLit>.

