Finding Common Ground: Creating an Integrated School of Geology, Sustainability, and Environmental Sciences and Studies

Northern Arizona University’s two-year old School of Earth Sciences and Environmental Sustainability (SESES) contains geology, environmental and sustainability degree programs including traditional undergraduate and graduate geology, environmental sciences and environmental studies programs and more recent and innovative graduate programs. The goals of SESES are to provide high quality field-based training in pre-professional BS and MS degrees in Geology and Environmental Sciences and Studies, to implement our new PhD in Earth Sciences and Environmental Sustainability, and to explore new concepts to apply the physical and social sciences to sustainability studies. We are using the design and implementation of the new PhD to reconsider how to improve our curricula school-wide, how to incorporate more sustainability learning outcomes in all our degrees, and how to reduce redundancy in physical sciences offering between the geology and environmental programs in the school. In this effort, we are utilizing a university-wide program providing substantial resources and support from the university assessment office to help interested academic units remap and redesign their curricula.

The strength of our school stems from our well-regarded and popular curricula spanning two programmatic areas: Geology and Environmental Sciences/Studies. Our Geology BS and MS degrees focus on a classic set of geology courses (physical and historical geology, mineralogy, petrology, sedimentology/stratigraphy, structure, to a final set of extensive field geology problems) with a strong emphasis on field, communications, and geospatial information skills. The 30-year old BS in environmental sciences has an eight-course core with an additional required emphasis area in geology, mathematics, biology, chemistry, administration and policy, communication, or management. The BS or BA in environmental studies was initiated five years ago and requires some of the same core courses, but instead of an additional disciplinary concentration requires a focus in: Globalization and Environmental Change, the Southwest, or Sustainability, Community and Diversity. More recent curriculum development resulted in graduate programs with sustainability foci (MS in climate science and solutions, revamped MA in Sustainable Communities, MS in environmental sciences and policy, PhD in earth sciences and environmental sustainability).

SESES has 25 full-time teaching faculty with active to very active research, publication and sponsored projects portfolios. All of these faculty plus five affiliated faculty from other NAU academic programs provide teaching and advising support for the 700+ undergraduate and graduate majors in the School. Eleven of these faculty support the ENV programs. Five of these faculty had split appointments or research programs split between the geology and environmental programs before the school was formed. Our environmental faculty have very strong research experience involving integration of physical and biological sciences (e.g. our ecologists include a soil ecologist and a biogeochemist, our ecological economist co-teaches energy resources and policy).

Three major challenges exist for our school. The first involves more complete integration of the two programs within our School. It may be an overstatement to say that faculty and students from the ENV side have a broader academic perspective and value the inclusion of a wider range of disciplines more than folks on the GLG side; however, priorities and values clearly differ across the School. We are all committed to focusing on the grand challenges common to both the GLG and ENV programs and recognize that this commitment is essential to the successful of our School. We are optimistic that the additional challenges we face will help to draw us together. The second challenge is implementation of the new, interdisciplinary PhD, which will involve faculty from engineering, chemistry, and physics and astronomy as well as from within our school. Faculty from across SESES, and from other units in our College of Engineering, Forestry, and Natural Sciences, have worked for several years to develop a comprehensive, detailed plan for the PhD, which should reduce these challenges to manageable levels, given the new faculty promised as part of the degree plan approval.

The final challenge is the need to apply these same types of efforts from our PhD planning to the redesign of our undergraduate degree programs. We recognize the need to provide not just theoretical foundations and problem-based learning centered on earth and environmental issues, but also to provide solutions-based learning including adaptation to and mitigation of these issues; to enhance resilience, diversity and sustainability of linked natural and social systems; and to discover, develop and manage geologic resources.

To address the need for a sustainability curriculum for undergraduates, we chose to refocus our undergraduate environmental curriculum. Creating new, sustainability-based learning outcomes made possible the renovation of the undergraduate environmental studies and sciences programs without creating a new degree program. We are now determining how our redesigned curriculum can interface with our existing coursework both within and outside the School. We are starting to identify competencies in sustainability we want our ENV degree programs to develop in our students, which may include: analyze and solve sustainability problems and explore less desirable future conditions that would occur without action; anticipate and prepare for future sustainability challenges; and create and enact opportunities for sustainability (how to get from current to more sustainable conditions).

We will continue to focus on skills (mapping, GIS, statistical analysis, effective written and oral communication, small group projects) and disciplinary content (foundations and applications of geology, ecology, hydrology, atmospheric sciences and systems science) that we have found effective in professional careers in the environmental and earth sciences.