A look at recent trends in interdisciplinary environmental and sustainability (IES) education in the United States, including IES education demand, diversity, and curriculum design.

The Center for Environmental Education Research (CEER) of the National Council for Science and the Environment (NCSE) conducts ongoing research to better understand the structure, function, and curricula of interdisciplinary environmental and sustainability (IES) education and research programs in the United States. For the purposes of CEER research, baccalaureate and graduate IES degree programs are defined as those that focus on coupled human-nature systems using a broad approach. These include degree programs named environmental science(s), environmental studies, sustainability, environmental policy, environmental management, and natural resources, as well as degrees focused on specific domains, such as coastal science and policy, water resources, energy, and climate. Degrees with a primary focus in a traditional discipline or professional field, such as conservation biology, natural resource economics, or sustainable agriculture, are not included, nor are degrees with a more narrow natural resources management focus, such as forestry or fisheries management.

NCSE is a not-for-profit organization that specializes in programs that foster collaboration between the diverse institutions and individuals creating and using environmental knowledge—including research, education, environmental, and business organizations, as well as governmental bodies at all levels. It hosts an annual conference and global forum on science, policy, and the environment and serves as secretariat for four U.S. professional organizations for environmental and sustainability academics: the Association for Environmental Studies and Sciences, the Council of Environmental Deans and Directors, the Council of Energy Research and Education Leaders, and the Community College Affiliate Program.

NCSE initiated its extensive education research program in 2003 with a study designed to understand IES degree program academic leaders’ perspectives on ideal curriculum design for baccalaureate and graduate degree programs. Ongoing studies have resulted in a series of reports on the identity of the field, baccalaureate and graduate programs, sustainability and energy programs, community college programs, interdisciplinary tenure and promotion, curriculum design, program leadership and administrative structures, and institutes and centers at research universities. Upcoming studies and reports focus on IES learning outcomes and core competencies, interdisciplinary program assessment, and partnerships.

CEER studies reveal a number of trends in IES education. These include rapid and continuing growth in the number of degree programs offered (a response to increasing student and workforce demands), expanding diversity in the types of programs offered, three general approaches to curriculum design, an upturn in the prominence of IES education on campuses, and increasing engagement of partners, including internal partnerships (e.g., sustainability offices) and external partnerships (e.g., community, not-for-profit, governmental, and...
business organizations), in addition to partnerships with other academic units across campus. Due to space constraints, three of these trends are discussed here: demand for IES education, diversity in IES education, and approaches to undergraduate curriculum design.

**Demand for IES Education**

Student demand for IES education has been growing rapidly since the 1990s. NCSE’s 2012 survey found that 64% of baccalaureate programs reported positive growth trends, as did 30% of master’s programs and 23% of doctoral programs.8 Most others reported steady enrollments. The average number of students enrolled in IES programs increased by 49% for undergraduate programs and 15% for master’s programs, while doctoral program enrollment remained steady.

The number of IES programs also continues to expand dramatically. The 2012 survey revealed that three-quarters of existing IES programs were created after 1990, with almost half emerging since 2000 (see Figure 1). In just four years (2008–2012), the number of college and universities offering IES programs increased by 29%, the number of academic units/administrative programs by 37%, and the number of degrees by an astounding 57%. Significant increases between 2010 and 2012 indicate this trend will continue, especially at larger schools.

The increase in demand for IES education is aligned with strong job opportunities for graduates. A 2008 study identified the size of the environmental protection industry as comprising 2.6% to 3.9% of state GDP, corresponding to 2.9% to 4.9% of total state jobs.11 A significant proportion of the environmental jobs market is in the public administration sector (38–47%), while another 16–29% is in private sector professional, scientific, and technical services. The remainder is spread across all sectors. The study also found that the environmental sector is more resilient or “recession-proof” in economic downturns.

The U.S. Department of Labor predicts a 15% increase in the number of environmental scientist and specialist positions between 2012 and 2022, higher than the average for life, physical, and social science occupations (10%) and for all occupations (11%).12 A recent study shows that college graduates in environmental fields (natural resources and environmental science) have some of the lowest unemployment rates compared with other majors, while environmental science graduates have a lower unemployment rate than majors in other physical and life sciences.13

**Diversity in IES Education**

One of the defining characteristics of IES programs is their diversity, both in the types of programs offered and in their administrative structures. The 2012 census found the largest proportion of IES programs’ names, 40%, includes the term environmental science(s) (see Figure 2).3 Another 25% includes the term environmental studies, while natural resources comprise 11%. The growth in
sustainability programs brings this group to 8%, tied with policy programs.

There has been a tremendous increase in the number of sustainability degree programs (from 13 in 2008 to 141 in 2012) and interdisciplinary energy programs (zero in 2008 to 37 in 2012). Other new types of emerging programs include those focused on environmental/sustainability systems, those with an international or global focus, and those that combine engineering and environmental science. The census also reveals a trend toward more degree programs focused on specific themes or problem-solving domains, such as community, environment, and development, and coastal and watershed science and policy.

The findings also indicate a trend toward more IES master’s degree programs. The number of master’s degrees increased by 68%, compared with 57% for bachelor’s degrees and 35% for doctoral degrees. A number of master’s programs have received a Professional Science Master’s designation.14

IES Program Curriculum Design

Two national surveys, conducted in 2009 and 2012, gathered nationally representative data that was used to explore views on ideal curricula and information on current curricula.2,8 The surveys asked IES program leaders to rate the importance of 41 knowledge and 38 skills areas for what they view as the “ideal” curriculum for each of the IES degrees their program offers, as well as the emphasis each area currently receives.

The ratings data were analyzed using social science statistical techniques and reveal three broad approaches to ideal undergraduate IES curriculum design, labeled Natural Systems Emphasis, Social Systems Emphasis, and Sustainability Solutions Emphasis based on the knowledge and skills components each emphasizes. Similar analyses of the graduate program data reveals two approaches to ideal curriculum design, similarly

IES degrees are offered in a variety of administrative locations, including a traditional disciplinary department or school; an IES department, school, or college; an IES center or institute; a program that spans multiple departments, one or more colleges, or an entire institution; or a program operated by a consortium of campuses or institutions. The majority of IES degrees are housed within disciplinary units or are programs that span disciplinary units.
labeled **Natural Systems Emphasis** and **Sustainability Solutions Emphasis**.

The Natural Systems Emphasis approach emphasizes knowledge of the natural sciences and technical research and analysis centered on laboratory and field research skills. The Social Systems Emphasis approach emphasizes social sciences knowledge and collaborative engagement skills. The orientation for this model is societal and institutional change with a public awareness focus and an emphasis on economics, policy, and governance processes. The Sustainability Solutions Emphasis approach is systems-oriented and encompasses a broad range of knowledge and skills. It places the highest emphasis on systems, built environment (including engineering and technology), and multiple sustainability knowledge areas (environmental, social, governance, business), as well as collaborative engagement, informatics, and systems thinking skills.

The Sustainability Solutions Emphasis approach is the most common ideal for IES undergraduate programs and represents 37% of those included in the survey, while the Natural Systems Emphasis represents 34% and the Social Systems Emphasis 29%. The Sustainability Solutions Emphasis is more prevalent for graduate degree programs, representing 66% of the sample. Degrees aligned with the Social Systems Emphasis tend to be younger than those aligned with the other two groups (71% were established since 2000 vs. 49% of Natural Systems Emphasis and 48% of Sustainability Solutions Emphasis degrees). There is a relationship between degree names and types and the three approaches, but it is not statistically significant.

Figure 3 shows a framework for understanding the diversity of undergraduate IES programs in the United States. All IES programs share a core identity focused on key characteristics of the field (problem-solving for sustainability), but statistically fall into one of the three broad curriculum design approaches discussed above. These approaches are distinguished from each other on two dimensions: emphasis on natural science versus social science/humanities and emphasis on understanding problems versus developing sustainability-oriented solutions.

**Summary**

In summary, IES programs are evolving, expanding, and gaining more prominence at colleges and universities across the United States. Many, if not most, programs are working closely with employers...
and other regional partners to design curricula that prepare students for a wide diversity of environmental and sustainability professions, including the emerging careers of the future. IES programs fulfill a unique niche in higher education by preparing professionals trained in interdisciplinary systems approaches for understanding complex problems and developing innovative solutions.

References