

Program Title: Environmental Science Program, Bachelor of Science Degree

Program Colleges: College of Arts & Sciences and College of Health & Human Sciences

Year of Review: 2010-2011

Program Director: Laura E. DeWald
ldewald@wcu.edu, 227-2478
Environmental Science Program Office: 231 Natural Science
Cullowhee, NC 28723

Environmental Science Undergraduate Program Review Executive Summary

The Environmental Science (ES) degree is an interdisciplinary program supported, administered, and taught by faculty with expertise in environmental sciences from five disciplinary areas across two colleges: biology, geology, natural resources conservation and management, environmental health, and chemistry. A program director, Laura DeWald, and five faculty, make up the Environmental Science Executive Committee, that ‘runs’ the program. This relatively new program, now in its seventh year, developed from a core of strength in environmental sciences at WCU. Two key principles guided its formation: 1) the ES program would be unique and not duplicate existing programs, and 2) it would be high quality to serve the educational and career goals of our students. Although simple, these principles led to the development of the curricular framework and organizational structure that still persist. Today, the ES program is past its nascent roots. It is a growing, student-focused program, strongly aligned with the University’s mission, especially those related to environmental sustainability. The program is supported by dedicated faculty, and offers students an integrative educational experience that culminates with an intensive service-learning capstone focused on environmental sustainability.

We welcome constructive feedback on topics fundamental to any program review, such as, Are we serving our students and mission as best we can? Is our curriculum appropriate? Is our organizational framework and relationship of disciplines with strength in the environmental sciences appropriate? Are we using our faculty, institutional, and regional resources effectively? To help focus the review, a summary of program strengths, and weaknesses and questions is shown below.

Strengths

- ES faculty are dedicated to the program and students. They have expertise in environmental sciences and come from a wide variety of disciplinary backgrounds.
- A growing, loyal, energetic student body, possessing high levels of volunteerism.
- An emerging theme of sustainability in the environmental science curriculum supports the University mission and defines a unique niche. This theme is best developed in the senior capstone experience.
- The ES curriculum includes a rich array of environmental science courses that are unique among many programs in environmental science. This provides ES students with a diversity of experiences not possible with other environmental majors at WCU or most other universities. Especially notable is the inclusion of coursework in environmental health so that students understand how the environment affects human health.

Weaknesses/Questions

- Is the emerging theme of sustainability appropriate for our program? How can we build upon and strengthen this emphasis? What course work and/or student experiences would help?

- Our students and, to some degree the program, lack identity. This is most important to the students, who would benefit from a strong student community common to many science programs. What resources (space?), events, course work, or other would help improve the community identity?
- Only ½ of one faculty position is directly appointed to the ES program. Although the executive committee is very stable, we question whether the current structure best supports the program, students, and faculty. We seek input and suggestions related to organizational support for the ES program that maintains its links with other science programs.

Standard 1. The purpose of program reflects and supports the mission and strategic vision of Western Carolina University and the mission of its Colleges

The purpose of the Environmental Science (ES) program as stated in the original planning document is to support students in pursuit of developing the expertise, skills and techniques necessary for sustainable use of, and evaluation and remediation of human effects on the environment, and to reinforce WCU's role as a center for environmental research and teaching in the Southern Blue Ridge area and the Great Smoky Mountains National Park. We have achieved this by developing an interdisciplinary BS degree program in ES that emphasizes natural and applied sciences. Nearly all of the coursework in the curriculum is from the Colleges of Arts & Sciences and Health & Human Sciences. Majors complete advanced course work across the sciences including biology, chemistry, geology, natural resources conservation and management, and environmental health.

The ES program is aligned strongly with WCU's mission, Quality Enhancement Plan (QEP) goals, and the UNC strategic planning initiatives (UNC-Tomorrow) through its integrative educational approach, service learning capstone, and focus on environmental sustainability (*see Standard 1 Appendix* for copies of WCU mission and relevant portions of WCU strategic plan). Western Carolina University views itself as a regionally engaged university and the ES faculty and students represent this goal. Direction #6 of the WCU 2008-2013 Strategic Plan states that "Western will expand its focus on education and research tied to environmental sustainability with particular emphasis on biodiversity and land use resources". Our ES graduates are uniquely skilled at integrating biological, chemical, geological, natural resource conservation and management, and environmental health content and concepts to address complex environmental sustainability problems. Students are additionally able to effectively promote sustainability through their technical and communication skills, both as professionals and citizens. In addition, our ES students are actively engaged with the campus and regional community through their capstone course and through the wide variety of opportunities provided by the diverse faculty from five degree programs that support the ES program. The environmental scholarship these faculty bring into the classroom through the teacher-scholar model helps students understand different approaches to addressing environmental problems.

The strength of the 6-year-old ES program is its interdisciplinary blending of environmental courses from several distinctly different science programs throughout WCU. Environmental Science students create unique assemblages of courses to create individualized curricula designed to meet interdisciplinary and program goals. The ES degree does not duplicate existing programs at WCU, and the deliberate integration across many diverse disciplines makes our ES majors distinct from graduates of other ES programs at regional peer institutions and across the UNC system. Finally, integrative ES capstone projects are consistent with WCU QEP objectives because they bring together skills mastered during the first three years of undergraduate education, and provide engagement and service to WCU and the regional community.

Primary strengths of the ES program are that: (1) ES majors gain interdisciplinary knowledge and skills to address complex abiotic and human and nonhuman biotic problems related to environmental sustainability; (2) ES majors are exposed to a wide variety of faculty and student perspectives from taking courses in distinctly different degree programs; (3) ES students achieve

the QEP outcomes of solving complex problems, communicating effectively and responsibly, and integrating information from a variety of contexts in an interdisciplinary way.

Primary weaknesses of the program are: (1) Delivery of social aspects of environmental sustainability are not as strong as biological and physical sciences; (2) Dispersal of majors across a diversity of courses makes it difficult for students to develop a sense of identity or community associated with ES (many ES majors do not know who their ES peers are); (3) Other than the ES Program Director, ES Executive Committee members who administer the ES program have no formally designated responsibilities or evaluation with regard to their contributions to the ES program (their primary obligations and responsibilities are to their own Academic Departments); (4) The ES program lacks visibility (a problem common to interdisciplinary programs); (5) Faculty and programming changes occurring across two colleges and five degree programs contributing to the program makes curriculum monitoring difficult.

Standard 2. The program engages in ongoing, systematic planning that is reflective of the University's strategic priorities

The BS degree in ES has not undergone external review since the degree program was created by a diverse group of WCU faculty and began accepting students fall semester 2004. The current goals and objectives for the ES program are those developed as part of the original planning process: 1) providing a specialized education which will make graduates competitive for entry level positions in the environmental field; 2) using curricula in traditional science programs to deliver a program attuned to the specialized needs of existing job markets; 3) preparing students for entry into specialized graduate programs in environmental science. A vision statement created in 2007 is in *Standard 2 Appendix* and indicators of program success began to accrue when transfer students first graduated in May 2007 and students starting as freshman graduating beginning in May 2008. As part of the self study process and ongoing development of the QEP for ES, the ESEC has developed learning outcomes that support the goals and objectives of QEP and the ES program. These learning outcomes will guide future curricular change and provide benchmarks for assessment.

The new learning outcomes are that ES students will:

1. Gain basic science knowledge and technical skills
2. Develop critical thinking, reading and writing skills
3. Develop effective oral and written communication skills
4. Develop skills to solve complex problems
5. Gain understanding of the basic relationships between the environment and people through studying the:
 - a. impacts humans have on environmental sustainability
 - b. impacts the environment has on humans
 - c. policies that affect environmental sustainability
6. Be able to analyze and interpret basic environmental data
7. Develop competencies in the field by gaining:
 - a. knowledge about the natural world in a field setting
 - b. skills using field equipment and sampling techniques

8. Develop competencies in the laboratory through use of instruments and techniques to quantify chemicals applicable to environmental problems
9. Gain an interdisciplinary perspective toward environmental sustainability through integrating information from a variety of contexts
10. Clarify purpose and values through designing a student-specific curriculum plan of upper level courses that relates to their career goals.

The ESEC has been assessing the program since it began, and this assessment has been used to adjust the curriculum and program following discussion and consensus by the ESEC. The required math course (an introductory survey of calculus) was too general and was not meeting program needs. The Department Head of Math & Computer Science met with the ESEC to explain the different calculus options and the ESEC changed the minimum requirement per his recommendation to the more theory based, in depth pre-calculus course. Both introductory ES courses were originally taught during fall semester of a student's first year and two years ago the ESEC spread these courses across the freshman year (ES101 fall, ES150 spring semester). The goals were to create a longer continuous time for ES faculty and students to interact during the students' first year at WCU with the goals of promoting retention and developing a sense of community among the ES cohort that would prevail until graduation. The ESEC asked Dr. Dixie McGinty (WCU Educational Leadership) to facilitate a student feedback session after the first semester ES150 was taught. Results of this assessment were used to improve this complex, interdisciplinary team-taught course. The ES capstone (ES495) was moved from the spring to the fall semester so that seniors could participate in the spring undergraduate research expo organized by the WCU Honors College, and so that ES students could present research at the National Conference on Undergraduate Research that occurs during spring semester. Other changes to the ES program include reducing the total number of credits to 120 to align with university credit hour goals for degree programs, and the ESEC has worked on strengthening the 2-year course plan required of all ES majors.

In addition to curriculum assessment, the ESEC revised the ES Annual Faculty Evaluation and Tenure, Promotion and Reappointment (AFE-TPR) document to be consistent with the Boyer Model of scholarship recently adopted by WCU. As a new degree program, the ES program submitted a required progress report to the UNC system, and in January 2011 the ES program completed a short self assessment report addressing centrality to WCU's mission, internal demand, productivity, quality, and cost effectiveness. The ESEC, Dean and College of A&S reviews of this latter document rated ES as a high priority program.

Standard 3. The program provides and evaluates a high quality curriculum that emphasizes student learning as its primary purpose

See *3.1 Standard3 Appendix* for a copy of the curriculum from the WCU undergraduate catalog. Syllabi for courses that are taken by a majority of the ES students are in *3.3 Standard 3 Appendix*. The curriculum can be summarized by competency categories where students take one or more courses in each category listed:

1. Foundations in Environmental Science

- (a) Basic science competency: introductory science courses in Biology, Chemistry, Geology, Environmental Science and Math (25 total credits)
- (b) Geographic Information Systems Competency (3-4 credits)
- (c) Environmental Health Competency (3-4 credits)
- (d) Environmental Policy Competency (3 credits)
- (e) Environment and Society Competency (3 credits)

2. Advanced Study in Environmental Science

- (a) Quantitative Methods Competency (3 credits)
- (b) Advanced Environmental Science Competency (3-4 credits)
 - 1) Field and Natural Environmental Science Competency (3-4 credits)
 - 2) Analytical/Instrumentation Competency (3-4 credits)
- (c) Advanced Studies Upper Level Electives (18-19 credits)
- (d) ES Capstone (3 credits)

The curriculum was designed to provide students with a basic foundation in the general sciences and “competency areas” important to developing an interdisciplinary understanding of environmental sustainability. Advanced study categories provide depth in understanding and measuring environmental sustainability. Courses in the original ES curriculum were selected and placed into competency areas based on the catalog description of the course. There are 69 credits required for the major and students must also complete 42 credits in Liberal Studies (WCU general education). The total credit requirement for the degree is 120. Other than 100-level courses in the Foundations Category [1(a) in the list above] required for all majors, there is significant flexibility in course selection. This was designed to allow students to create individualized curricula to achieve their educational and career goals while still meeting the interdisciplinary and program goals of the ES BS degree.

There is a list of suggested upper level elective courses students can choose from, but students are free to select courses outside this list. Students complete a 2-year plan of upper level coursework that is approved by the ESEC to ensure the suite of courses selected has appropriate rigor and meets the goals of the ES curriculum (*see 3.2 Standard3 Appendix*). These 2-year plans require students to identify their career goals and the basic qualifications needed to attain these goals (from job descriptions students can find). Students list the courses they plan to take in each of their four remaining semesters (along with alternatives) and they must describe why these particular courses will help them achieve their educational and career goals. The 2-year plans are a degree requirement and are expected to be submitted to the ESEC for approval prior to a student completing their last 60 credits at WCU. Many of the upper level courses at WCU are offered only once per academic year or only every other year (*see 3.4 Standard 3Appendix* for frequency of course offerings). The plans help students design a curriculum around when courses are offered, help balance student course loads, and provide a mechanism of quality control within a highly flexible curriculum. The plans are scrutinized by the ESEC to ensure they do not represent a less rigorous version of another degree (e.g., “geology light”), and that the plans reflect the interdisciplinary goals of the ES program. Some students develop thematic plans such as aquatic sustainability where they select courses in biology, geology, chemistry, environmental health (ENVH) and natural resource conservation and management (NRCM) related to water. Other students choose to focus their courses to provide additional depth to the interdisciplinary

breadth of their degree. Often these students accumulate enough credits to minor in another discipline.

All but three courses in the curriculum are provided by other degree programs throughout WCU. The three ES-specific courses provide “book ends” to the curriculum, beginning with two freshman level courses: Careers and Issues in Environmental Science (ES101 = 1 credit) and Introduction and Approaches to Environmental Science (ES150 = 4 credits including a 3-hour lab once per week). At the other end of the curriculum is the senior-level capstone course: Senior Seminar in Environmental Problems (ES495 = 3 credits). ES101 provides majors, non-majors and undeclared students opportunities to explore environmental careers and degree programs offered at WCU that prepare them for these careers. The course serves partially as a recruiting tool for non-majors or undeclared students into ES and other degree programs related to the environment such as geology or NRCM. At the end of the course, students desiring an interdisciplinary approach remain or become ES majors while students who want more depth choose a major where they can focus within an environmental discipline. ES150 is a team-taught course with members of the teaching team representing each of the major disciplines contributing to the ES program. Each discipline is represented by one or more faculty who teach(es) a unit illustrating their disciplinary approach to environmental problems. Students in ES150 practice critical thinking and technical report writing throughout the course, and take-home essay exams require students to synthesize and integrate across disciplines units to address complex environmental problems. The ES495 capstone is an open-ended environmental sustainability problem that the entire class works on as a group. The project is selected by the instructor and is set up to meet WCU service-learning goals and QEP goals. Projects have included an energy audit for the UNC Highlands Biological Station, an energy audit for four small businesses in the neighboring town of Dillsboro, a carbon footprint assessment for a private middle/high boarding school in Georgia, work on the Sustainability Tracking and Assessment Ranking System (STARS) for WCU, and an assessment of recycling at WCU. All projects include data collection and analysis, and development of recommendations to improve environmental sustainability. A strong positive outcome of ES495 is recommendations from the students are being implemented to improve environmental sustainability by all of the “clients” of the capstone projects listed above.

Prerequisite knowledge and skills needed for most upper level courses throughout the five disciplines contributing to the ES degree are provided by the 100-level basic science “foundation courses” in category 1(a) listed in the curriculum outline on page 5. However, there are many upper level courses where ES majors lack prerequisites specific to the disciplinary flow of a particular degree program. Instructors generally allow ES majors to enroll in their courses without these discipline-specific prerequisites because the ES students typically have equivalent knowledge or experience from coursework in another discipline. An analysis of grades achieved in all upper level courses by ES students who have graduated (or will graduate May 2011) indicates that for the most part ES students are successful in upper level courses across diverse degree programs despite lacking disciplinary prerequisites. Discussion and development of strategies for improving student success in courses where the ESEC has seen consistently poor performance is ongoing. One challenge faced by ES students is that most of the upper level biology courses require two 200-level prerequisites that if strictly enforced make upper level

courses unavailable to ES majors who would not have taken the prerequisites unless they were completing a minor in biology.

Students entering the ES program as freshman can within eight semesters (*see 3.6 and 3.7 in Standard 3 Appendix*). A few students have or are doing a double major (3 students with ENVH, 2 with Geology, 1 with NRCM) and many attempt a minor. Minors (completed or attempted) include Biology, Geology, NRCM, ENVH, Chemistry, Geography, Philosophy, Political Science, and Professional Writing. Students who transfer into the program may need more time to complete degree requirements if they have not already completed 100-level foundations.

The WCU Liberal Studies (General Education) program ensures that ES majors are exposed to arts and music, humanities, history, social sciences, foreign culture and other disciplines that enrich their education and provide practice critical reading, writing, and communication and math skills. We encourage ES students to spread their Liberal Studies course requirements across their eight semesters to balance their workload among the laboratory-based courses associated with most upper level science courses. These laboratory-based courses require additional student time in class and writing technical reports summarizing the scientific investigations conducted during the laboratories. ES majors are most successful when they take only two or occasionally three lab-based courses per semester and use Liberal Studies courses to fill out their schedules.

Despite multiple course choices within the competency categories, assessment of courses taken by the 16 students who have graduated and 7 who plan to graduate May 2011 reveals some courses are selected very rarely, and some courses appear unsuitable for ES majors based on student performance (see summary below). Currently, all courses in the curriculum are being reviewed and will remain in the curriculum or will be removed, and other courses added. Criteria for inclusion in the curriculum are based on alignment of the course objectives and content with the goals of the ES program and the new ES learning outcomes developed as part of the self study and QEP development. Transcripts from the 16 students who have graduated and 7 who plan to graduate May 2011 were assessed and the following trends are described below.

Environmental Health Category

Nearly 50% of ES students select ENVH310 (Water Quality) to fulfill their Environmental Health competency and all achieved a “B” grade or better. For students who did not select ENVH310, half enrolled in Principles of Epidemiology (ENVH470) and the remaining were split roughly evenly between ENVH375 or 440. Of the four courses in the Environmental Health category, grades were the poorest (B- and C’s) in ENVH470.

Environmental Policy Category

Nearly the same number of students selected ENVH458 (Environmental Regulation and Law) as NRM442 (Natural Resource Policy and Administration) for their Environmental Policy course. Students performed slightly better in NRM442 than in ENVH458 (63% versus 45%, respectively, with B- or better grades). Only one student attempted Environmental Economics (ECON310) and the student failed the course and did not repeat it. The lack of enrollment by ES students in ECON310 is likely due to its previously infrequent offering and a prerequisite course.

Environment and Society Category

The Environment and Society course selected by students was relatively evenly divided among four of the five choices. Only 2 students enrolled in ANTH351 (Environmental Anthropology) likely because it has been offered less frequently than the other courses in this category. Compared to the other five competency categories in the curriculum, ES students generally performed the best in the Environment and Society category with 20 of the 23 students earning a “B-“ or higher grade. This suggests that despite bias in the curriculum toward physical and biological science, the ES majors have the ability and/or motivation to excel in a human-oriented course(s) which is an indicator that our students can achieve an interdisciplinary perspective.

Quantitative Methods Category

Nearly all ES majors take BIOL467 (Biostatistics) to fulfill their quantitative methods competency. Only five students have taken CHEM232 (Quantitative Analysis) and three of these students received a “D” grade. The only ES student who earned an “A” in this course had a minor in chemistry. More courses need to be identified for inclusion in this category.

Field and Natural Environmental Science Category

Of the four course options in the Field and Natural ES category, more than 90% of the students selected GEOL305 (Soils and Hydrology) with about 50% of the students earning a “B” grade or better. Of the other courses in this category, GEOL305 is a pre-requisite to GEOL405 so students only take GEOL405 as part of their upper level electives. BIOL434 (Terrestrial Ecology) is no longer offered and BIOL435 (Aquatic Ecology) is difficult for ES students to get into because of competition for seats and the two 200-level biology prerequisite courses that are not particularly appropriate for ES majors. Additional courses need to be identified for inclusion in this category.

Analytical and Instrumentation

Three of four students select CHEM330 (Aquatic Chemistry) in this category and the remaining take CHEM461 (Environmental Chemistry). Performance in CHEM330 varies relatively evenly from A through D grades. No students have taken the two instrumental analysis choices because they require a better chemistry background than ES majors typically have and thus are probably not appropriate. The laboratory component has been eliminated from CHEM461 so this course no longer meets the learning outcomes for this category. Additional courses need to be identified for inclusion in this category.

Upper Level Electives

Four of the 23 students have fulfilled most of their upper level electives through special programs: two students attended the University of North Carolina at Chapel Hill’s Institute for the Environment semester at the Highlands Biological Field Station. This is an 18-credit hour intensive resident field experience where students take field-based environmental ecology courses and conduct environmental research projects. One of the ES students in this program analyzed anaerobic digestion for the Jackson County Green Energy Park landfill facility for her research project and the other student conducted a herpetological inventory and monitored water quality. Two other ES students fulfilled most of their upper level electives through the International Program at WCU. One student attended a university in Australia and the other attended a university in New Zealand. In both cases, the environmental courses these students

took overseas were equivalent in learning outcomes for upper level environmental electives at WCU, and both students were engaged in research during their international experience.

Examination of upper level courses (300-level [junior] and 400-level [senior]) taken by ES students who have graduated or plan to May 2011 indicates students are taking courses across disciplines. Six students took courses in 5 different disciplines, seven students took courses in 4 different disciplines, and six students took courses in 3 different disciplines. Therefore, not only do the student's 2-year degree plans reflect the interdisciplinary goals of the program, the students are achieving these goals. Another illustration of the interdisciplinary accomplishments of the ES curriculum is the relatively even dispersal of ES graduates (and those expecting to graduate in May) across upper level science disciplines: 17 students enrolled in Biology courses, 17 in ENVH courses, 16 in Geology courses, 13 in NRCM courses, 8 students in Chemistry courses. In addition, 3 students took Philosophy and Religion (PAR) courses, 2 students took MATH courses, and 1 student each took Anthropology, Sociology, Communications, Elementary Education and Science Education courses to fulfill their upper level electives. The total SCHs ES graduates and those planning to graduate May 2011 have contributed to all upper level courses (competency area courses plus electives) are: ENVH = 222, BIOL = 127, CHEM = 113, GEOL = 152, GEOG = 40, NRCM = 111, PAR = 36, ANTH = 12, and SOC = 24.

The assessment of course selection and student performance revealed some problems with the competency categories. In addition, many new courses have been added to WCU's course catalog since the beginning of the ES program and some courses now listed in the ES curriculum are no longer taught. As noted earlier, the syllabi for courses currently in the curriculum are being assessed to ensure their objectives and content are consistent with the new ES learning outcomes. All new courses being considered for inclusion in the curriculum will also undergo this process. Courses no longer offered will be deleted and courses within competency categories where ES students have had limited success may be moved to electives. The alignment of the original curriculum with the new learning outcomes is described below. Note that critical thinking; reading; and writing skills, effective communication (oral and written) skills, and skills to solve complex problems are reinforced throughout the curriculum.

In addition to course addition/deletion, a 1-credit discussion-based seminar focused on sustainability literature is being discussed by the ESEC for inclusion in the curriculum. This course would be taken by the students twice; once as a sophomore and once during the junior year. The goal is to bring majors together to strengthen ES identity and sense of community, provide additional opportunities to include more social science and policy into the curriculum, and to help students complete their 2-year plans in a timely manner. These two credits would be pulled from the upper level electives. The ESEC is interested in hearing thoughts from the review team about this idea given the impacts this course would have on faculty workloads, student schedules, upper level course choices, etc.

Alignment of curriculum and program learning outcomes

| Old Category Title | New Category Title | New Learning Outcomes |
|------------------------------------|---|--|
| <u>Foundations in ES</u> | <u>Science and Technical Foundation</u> | |
| Introductory Science Courses | Introductory Science Courses and Geographic Information Systems | Students will gain basic science knowledge and technical skills in biology, geology, chemistry, calculus, and geographic information systems |
| Geographic Information Systems | | |
| Environmental Health | Relationship of Environment and People Foundation | Students will gain knowledge about (a) impacts of humans on environmental sustainability, (b) impacts of the environment on humans, and (c) policies that affect environmental sustainability. Students will practice technology and skills needed to measure (a) and (b) |
| Environmental Policy | | |
| Environment and Society | | |
| <u>Advanced Study in ES</u> | <u>Advanced Study in ES</u> | |
| Quantitative Methods | Quantitative Competency | Students will be able to analyze and interpret data |
| Field & Natural ES | Field Competency | a) Students will gain knowledge about the natural world in a field setting b) Students will gain skills in field equipment and sampling techniques |
| Analytical/Instrumentation | Laboratory Competency | Students will gain knowledge about using laboratory instruments and techniques to quantify chemicals applicable to environmental problems |
| Upper Level Electives | Upper Level Electives and Capstone | Students will gain advanced knowledge and skills to address environmental sustainability in an interdisciplinary way |

The degree program began accepting students in the Fall of 2004. Two students who were transfers into the program graduated in the Spring 2007, 14 others have graduated since then, and seven students are expected to finish Spring 2011. As described earlier, assessment has been ongoing since the program began in 2004, with full programmatic assessment of desired student learning outcomes occurring regularly as students began to graduate. An example program assessment tool is a directed final journal assignment in the capstone course where students reflect on what they have learned and achieved in the ES program. Finally, an updated (draft) program assessment plan for the ES QEP document has been completed (*see 3.8 Standard 3 Appendix for a summary*).

Standard 4. Program has sufficient faculty resources to meet its mission and goals

It is difficult to define who comprises the “Environmental Science faculty” because many WCU faculty teach courses and/or conduct research related to environmental problems. However, not all these faculty contribute to the ES program. For the purposes of this self study, a subset of faculty was identified (see list below) who more clearly represent “ES Associated Faculty” based on (1) their service on the ESEC, (2) being a member of the ES150 teaching team, and/or (3) teaching 300-level or higher course that a majority of the ES students take. Although most ES students take one or both of the PAR courses in the curriculum, the current instructor is non-tenure track and thus the person teaching these courses is not listed among the faculty below. However, a tenure track position has been created for an Environmental Ethics faculty member in the Philosophy and Religion Department and a search is underway. The person who fills this position will likely be added to the list below because s/he sees a majority of ES students in PAR333 (Environmental Ethics) and/or PAR330 (American Wilderness Ethics/Aesthetics).

| <u>Faculty Member</u> | <u>Home Department*</u> | <u>Program in Home Department</u> |
|-----------------------|-------------------------|-----------------------------------|
| Mark Lord | GNR | Geology |
| Ben Tanner | GNR | Geology |
| Peter Bates | GNR | NRCM |
| Ronald Davis | GNR | NRCM |
| Brian Kloeppe | GNR | NRCM |
| Cynthia Atterholt | Chemistry & Physics | Chemistry |
| Scott Huffman | Chemistry & Physics | Chemistry |
| Beverly Collins | Biology | Biology |
| Thomas Martin | Biology | Biology |
| Phillip Kneller | SHS | Environmental Health Sciences |
| Burton Ogle | SHS | Environmental Health Sciences |
| Brian Byrd | SHS | Environmental Health Sciences |
| Tracy Zontack | SHS | Environmental Health Sciences |
| Laura DeWald | GNR and Biology | NRCM, Biology |

*College of Arts and Sciences: GNR = Geoscience/Natural Resources Department, NRCM = Natural Resources Conservation and Management program, Biology, Chemistry & Physics. College of Health and Human Sciences: SHS = School of Health Sciences.

Faculty listed above are full time, and tenured or tenure-track whose credentials are consistent with SACS standards in terms of degrees, work experience, honors and awards, and achievements that promote effective teaching and productive scholarship. This list of faculty includes 1 Full Professor, 8 Associate Professors (two tenure track, the remaining tenured), and 4 tenure track Assistant Professors. Two of the Associate Professors and one Assistant Professor are currently undergoing evaluation for promotion and/or tenure. Ten faculty are male, four are female, and all are Caucasian. Summaries of the credentials, sponsored research activities and the CV's of these faculty are listed in 4.1, 4.2, 4.3 and 4.4 of Standard 4 in the appendices.

Only the ES Program Director (DeWald) has FTE's associated with the ES program. Her position is 50% ES, 25% NRCM in the GNR Department and 25% in the Biology Department. All other faculty listed have full time appointments in their respective Departments and they are

evaluated according to their respective home department collegial review documents (annual faculty review [AFE] and tenure, promotion and reappointment [TPR]). These documents require faculty demonstrate continuing growth as professional practitioners, teachers and scholars using the Boyer Model of scholarship. The ES Program Director is evaluated with an AFE/TPR document specific to ES (*see 4.5 Standard 4 Appendix*). In general, faculty teach 9 credit or 12 contact hours per semester with course releases associated with being a Program Director (3 credits per semester) or Department Head (50% release).

Dr. Ford, Dean of the College of Arts & Sciences is working on a document to formalize responsibilities and evaluation processes for faculty who are associated with interdisciplinary programs such as ES. Until this is completed, contributions to the ES program from the “ES Associated Faculty” are not evaluated and perhaps undervalued in their annual faculty reviews and TPR processes. Faculty service on the ESEC may be particularly undervalued by faculty home departments given that the ESEC essentially functions as a “Department”.

Although the faculty are not very diverse from a demographic standpoint, they represent a variety of disciplines and specialties within disciplines that ES students benefit from. Some of the disciplines focus more on scholarship of discovery (Chemistry, Biology, Geology) while others excel in the scholarship of application (NRCM, ENVH). Regardless, faculty practice the teacher-scholar model and regularly attend and present research at regional and national conferences in their field. The Biology and Chemistry Programs have a MS degree and their faculty are engaged with both graduate and undergraduate teaching and research. Faculty from other departments contributing to ES (Geology, NRCM, ENVH) work primarily with undergraduates. All faculty teaching courses in the contributing disciplines regularly engage ES students along with their majors in research and practitioner activities that are supported by the QEPs of the contributing programs.

WCU provides professional and pedagogical development opportunities for faculty through the Coulter Faculty Center, funds to support travel to conferences (Chancellor’s Travel Fund, Faculty Center Microgrants Fund), funds to support research (Faculty Research Grants, Hunter Scholar Award), and instructional improvement grants and QEP grants.

Standard 5. The program attracts, retains, and graduates high quality students

There were no recruiting efforts prior to fall 2004 when the ES program began accepting majors. The program has steadily grown from 0 in 2004 to 26 majors in 2007, 33 in 2008, 41 in 2009 and 43 majors in 2010. Sixteen students have earned a BS in ES with the first graduates in May 2007 (2 students). One student each graduated Dec. 2007 and May 2008. Eight students graduated during 2009 and four in 2010. Seven students are expected to graduate May 2011. There is no ES minor, nor are there concentrations or certificates within the ES program. Majors who desire depth in addition to their interdisciplinary ES breadth do so by completing a minor in any one of the many opportunities available on campus. In the Fall 2010 and Spring 2008, ES495 enrollments were 8 and 6 students, respectively. Trend data on total ES SCH generated is: 2006-2007 = 88, 2007-2008 = 63, 2008-2009 = 129, 2009-2010 = 124.

The ES majors are primarily Caucasian and male. On average, females represented approximately 35% of the majors and less than 3% are ethnic minorities (Native American or Black). Although the ES program growing its number of majors is relatively small, not unlike many ES programs throughout the US (and within the UNC system). High School teachers, counselors, and students and their parents focus on disciplinary careers and college degrees because they are unaware of interdisciplinary options. Until recently, even employers did not appreciate the value of interdisciplinary degrees. This lack of awareness is changing rapidly and enrollment in WCU's ES program will benefit from the increased attention and recognition that interdisciplinary programs are now getting by employers and prospective students. The ES program could accommodate about 80 majors without requiring significant resource additions.

There are no admission requirements for the ES program separate from overall admission to WCU. Of the 23 students who have graduated or plan to in May 2011, 14 are transfers into the ES program from institutions outside of WCU. This proportion is consistent with current majors. The overall average GPA of the 16 students who have graduated is 2.92. This GPA value is biased toward grades in upper level coursework due to the high proportion of transfers whose lower level coursework grades do not count toward their WCU GPA (*see Standard 5 Appendices* for details on student data).

Freshman and transfer students meet with Mary Lockey in the WCU Advising Center and with the Program Director to set up their initial course schedules. From 2004-2007 the Program Director advised all ES majors to facilitate curriculum and program assessment. With one person meeting with all the majors, curriculum trends were immediately evident. For example, a specific sequence of foundation courses was developed based on assessment of student success. Since majors began graduating, new students are assigned equally among ESEC members to accommodate the increasing advising load and to meet the desire of ESEC members to be more involved in ES advising.

Getting new freshman and new transfer students to see their assigned faculty advisors instead of the Program Director has been a challenge. This reluctance is likely related to greater familiarity with the Program Director who teaches ES101 that all new ES majors take, and confusion by the Advising Center about sending ES majors to "non ES departments" such as Biology for advising. WCU has an "Advising Day" once per semester prior to course registration for the upcoming semester. All meetings and classes are cancelled so that a majority of advising can occur on this day. In addition to advising, the ES program uses this day to have some type of activity where majors can come together including lessons in using degree audit, finding summer employment and resume building, having the Director of International Programs present information about study abroad, or providing information about developing the required 2-year plans. Advising day provides a rare occasion for ES majors from freshman through seniors to meet together in one place. In addition, the ES juniors and seniors provide freshman and sophomores with "unofficial advice" about what has or has not worked for them in terms of their success at WCU. Although the ES majors really like these advising day programs, they may be counterproductive at encouraging new students to see their faculty advisor because students seem to want to hang out with other ES majors versus leaving to meet with their advisors. Effective use of Advising Day for promoting a sense of community among majors while also getting the new majors to their faculty advisors on that day needs more exploration.

Degree audits that students run themselves and the 2-year plans help students monitor their progress toward their degree. The 2-year plan is a degree requirement and is introduced to students in ES150 (spring semester) where they prepare their first draft as a class assignment. The final plan is due to the ESEC prior to advising day when students have 60 credit hours left in their curriculum. As previously discussed, the 2-year plans are important to assessment of the interdisciplinary goals and rigor of the ES individualized degrees. Although students realize the value of the 2-year plan once they have completed it, getting students to write meaningful plans in a timely manner is an ongoing challenge. The ESEC has discussed creating a benchmark in degree audit as a mechanism to help with timely compliance with this requirement. We have also developed a rubric so that students can self-assess their document to ensure it will meet expectations of the ESEC.

As previously described, one goal for moving the capstone (ES495) from the spring to the fall of a student's senior year was to allow ES students to take advantage of presentation opportunities that occur during spring semester. We have seen immediate achievement of this goal. The entire Fall 2010 ES495 class will be presenting their project at the Honor's College Undergraduate Research Expo. In addition, one member of ES495 will be representing the group and presenting the project at the National Conference on Undergraduate Research in Ithaca NY in March 2011. In addition to the capstone, students interested in individualized research can take independent study research credits in all of the disciplines that contribute to the ES program, and these credits can count toward meeting upper level elective requirements. ES majors who plan to attend graduate school (3 have attended, 4 more have declared that as a goal) understand that additional research experience will help them be competitive for research assistantships in MS programs. Thus far, ES students who desire to do research have been included in opportunities available to majors in other disciplines. Student research projects have included modeling, monitoring, and managing water and air quality, micro-algae bio-fuels research, and land risk evaluation associated with slope ordinances. Two students have completed co-operative work internships with Department of Energy laboratories in TN and WA. As previously noted, two students have also conducted research as part of their study abroad and two students participated in research through the UNC Institute for the Environment semester at the Highlands Biological Station. Finally, one student developed a biodiesel project at a local community college that was subsequently incorporated into the school's automotive technology program.

There are plenty of relevant summer jobs available to ES majors who choose to take advantage of these opportunities. Students have obtained summer work with a variety of private and public organizations such as the US Forest Service, US Park Service, NC State Parks, NC Cooperative Extension, NGO conservation organizations such as the Land Trust of the Little Tennessee and RTCAR (Revitalization of Traditional Cherokee Artisan Resources), private environmental consulting firms, and the USFS Coweeta Hydrological Laboratory among many others. ES majors tend to be active volunteers throughout WCU and the local communities, volunteering to monitor water quality, coordinating recycling for local restaurants and serving on steering committees such as the Sylva Community Garden that grows organic vegetables for the local soup kitchen. The Program Director keeps an email list of all majors and anytime a relevant volunteer activity or job opportunity arises, all of the majors receive notice about it. ES students routinely have a booth at the Western Regional Science Fair where Middle and High School

students can calculate their Ecological Footprints. ES students have also participated in Earth Day events, cleanup events on the local rivers, and serve as “student ambassadors” who meet with prospective students at WCU Open House and other recruiting events on campus.

The ES website helps recruit students and the Program Director gets roughly 10 inquiries per year directly from prospective students who have visited the website (2929 “hits” during 2010). The Environmental Stewardship Club was created by ES students but has not been active for the past few years. There are many campus clubs that do environmental activities and thus compete with the ES club for student membership such as the “EcoCats”, NRCM club, Biology club, etc. However, the new ES majors have been inquiring about getting the ES Club going again so there may be a cadre of students who will revive it.

A retention challenge for the ES program is lack of sense of community, identity, and visibility for the ES majors. After their freshman year, ES majors may not see each other in courses again for several semesters and students have expressed concerns about feeling isolated. As previously noted, the ESEC has been discussing creating a 1-credit seminar course for majors to regularly bring ES students together prior to the capstone course. Recently, a small room was acquired in the Natural Science building to provide a place ES majors can interact with each other. The ES program has not yet found development opportunities to support scholarships specific to ES students. However, this does not appear to be a factor in recruiting or retaining students. In general, ES majors come to WCU because of its location, smaller class sizes, and students desire the flexibility and interdisciplinary nature of the ES degree program.

Standard 6. The Program has an administrative structure that facilitates achievement of program goals and objectives

All decision-making, planning and implementation of the ES program is conducted by the ESEC who meets relatively regularly throughout the year with more frequent meetings when the workload is higher. The ESEC includes administrators (Chemistry/Physics and GNR Department Heads and the NRCM Program Director) so it is easy for the ESEC and ES Program Director to stay up-to-date on University- and College-level issues that could affect the ES program. In addition, the ES Program Director attends Biology Dept. meetings, NRCM Program meetings and GNR Dept. meetings to ensure she has the latest information regarding her responsibilities to these other degree programs.

Previously, the ES Program Director underwent three annual faculty evaluation and tenure/promotion/retention (AFE-TPR) reviews (Biology Dept., GNR Dept. and ES Program). The new ES AFE-TPR document specifies one evaluation committee for the Program Director consisting of representatives from the ESEC, Biology and GNR Departments, with the Department Head of the home department (Chemistry & Physics in this case) also providing feedback. The Department Heads where the ES Program Director has teaching appointments (GNR and Biology) can also provide feedback if they choose to.

Only the ES Program Director is evaluated with regard to the ES program. The rest of the ESEC faculty are evaluated only within their home departments and these evaluations do not

specifically include their contributions to the ES program. There is thus little accountability for ESEC faculty. Fortunately, the ES faculty are strongly dedicated to the ES program so it has not been a problem. Concerns from the degree programs contributing to ES are represented by the faculty from those disciplines on the ESEC. As noted previously, Dr. Ford, Dean of Arts and Sciences is working on a governance document that would put greater formality and accountability for faculty participating in interdisciplinary programs such as ES. The ES program does not have an alumni board although there is a Facebook Page for ES seniors and alumni. Students provide input through course evaluations and in the journals they keep as part of the capstone. The Program Director has an open door policy (as do most faculty at WCU) and students generally feel comfortable expressing concerns directly to the Program Director.

Standard 7. Program has adequate resources to meet its goals and objectives

The modest budget for the ES program is administered through the Chemistry/Physics Department. Although it has been flat (or reduced) since the beginning of the ES program, it has been adequate to support the program. Most of the budget in the first few years was allocated to new equipment such as office equipment, computers and development of recruiting materials for the ES program. Once the ES QEP is finished, additional funds to support capstone projects can be applied for.

The only administrative support for the ES program is through the Administrative Assistant for the Chemistry/Physics Department. Although the individuals who have held this position are very competent, the administrative workload for the Chemistry/Physics Dept. is very high. Thus, most of the ES administrative work is done by the ES Program Director. Offices, classrooms and laboratories used by ES “Associated Faculty” and majors are in the Natural Science (NS), Stillwell (ST) and Moore buildings. Moore and NS are relatively old and inadequate to support the technology and research needs of faculty and students. However, all classrooms are equipped with a computer and electronic projector and network connectivity in the classrooms is generally good. The Environmental Health program currently in Moore will occupy space in a new building under construction. Stillwell was renovated in 2008 and facilities are up-to-date. A 2009 capital improvement plan included a request for a new science building which was ranked 7th in priority but its current status is unknown and unlikely to be a priority given North Carolina’s large budget deficit. The Hunter library resources for ES are excellent and have expanded for past few years through increasing electronic access to a large number of relevant journals.

The ES program is highly efficient and extremely cost effective relative to the number of majors, and it is ranked as a high priority program at WCU. As the ES program continues to grow, additional staffing and resources (such as “coding” a laboratory or classroom to dedicate to ES) may be needed to maintain the current quality of the program.