

PROGRAM MODIFICATION PROPOSAL FORM

Name of Institution: Lander University

Briefly state the nature of the proposed modification (e.g., adding a new concentration, extending the program to a new site, curriculum change, etc.): Adding a new concentration, Forensic Science, to the Environmental Science Program

Current Name of Program (include degree designation and all concentrations, options, and tracks): B.S. degree in Environmental Science

Proposed Name of Program (include degree designation and all concentrations, options, and tracks): B.S. degree in Environmental Science, Forensic Science emphasis

Program Designation:

- | | |
|---|--|
| <input type="checkbox"/> Associate's Degree | <input type="checkbox"/> Master's Degree |
| <input checked="" type="checkbox"/> Bachelor's Degree: 4 Year | <input type="checkbox"/> Specialist |
| <input type="checkbox"/> Bachelor's Degree: 5 Year | <input type="checkbox"/> Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA) |
| <input type="checkbox"/> Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.) | |

Does the program currently qualify for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes
 No

If No, should the program be considered for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes
 No

Proposed Date of Implementation: Fall 2019

CIP Code: 030104

Current delivery site(s) and modes: Lander University Main Campus (Site Code: 50401)

Proposed delivery site(s) and modes: Traditional/face-to-face

Program Contact Information (name, title, telephone number, and email address): Daniel L Pardieck, Professor, Coordinator for the Environmental Science Program, 864-388-8132, dpardieck@lander.edu

Institutional Approvals and Dates of Approval:

- | | |
|-------------------------------------|-------------------|
| 1. Undergraduate Programs Committee | April 11, 2018 |
| 2. Curriculum Committee | April 19, 2018 |
| 3. Faculty Senate | April 25, 2018 |
| 4. University President | December 17, 2018 |
| 5. Board of Trustees | December 17, 2018 |

Background Information

Provide a detailed description of the proposed modification, including target audience, centrality to institutional mission, and relation to strategic plan.

This modification to the Environmental Science major will allow students to focus on coursework that will prepare them for careers with environmental forensics components, such as determining or confirming environmental liability in working for government agencies, consulting firms or industry. The goal of this emphasis is to allow students to develop strong analytical skills and an understanding of the legal framework for this type of science. For example, students will be required to take a microscopy course (*Microscopical Methods*) that will allow them to test trace evidence without destroying it. These skills are integral when cases are consistently retried and evidence retested with new methods; traditionally, environmental science classes do not focus on maintaining the integrity of the sample after analysis. This course is the first undergraduate course that focuses on microscopy with polarized light of its kind to be offered in a public university in the state of South Carolina. A course focused on toxicology (*Toxicology*) provides instruction related to environmental law and regulation, as well as determination of sources and effects of toxic chemicals in the environment.

The Environmental Science: Forensic Science program aligns closely with the goals of the university as a “high-demand and market-driven program”. The program is expected to attract students interested in essentially any and all environmental science professions and career tracks, and not just those who plan to work specifically as environmental forensic technicians or scientists. For example, many environmental scientists, including those who are at the entry level, perform Phase I and Phase II investigations of sites for a variety of reasons, from due diligence for land or facility purchases to determining whether closed or operating sites have environmental challenges that may require remediation. The skills and knowledge learned in the proposed program are most helpful in those types of investigations.

Students entering this emphasis will include current Environmental Science students in the program at Lander University and high school graduates in the region, state and beyond with an interest in Environmental Science, Forensic Science, or other related disciplines. Other prospective students include professionals working in related disciplines who wish to enhance their skills and/or career advancement opportunities, as well as transfer students from two year technical programs seeking to complete bachelor degrees in this discipline/program.

See “Assessment of Need” sections for details about how the present and future job market demands Forensic Science skills.

Students will be expected:

- *To demonstrate analytical skills that can be applied in a laboratory or field position*
Coursework in general, organic, and analytical chemistry, geology, environmental science, general biology, ecology and limnology laboratories and field experiences develop the skills necessary to obtain and excel in introductory laboratory and field positions.
- *To demonstrate the ability to test evidence without negatively impacting its integrity*
The microscopy course provides students with the methods to test trace evidence while maintaining its integrity such that it can be used again if a case is reopened. This approach is different in scope from traditional chemistry and environmental science courses that often completely consume an analyte over the course of the test.
- *To demonstrate an understanding of how evidence collection influences the results of different analyses of that evidence*
The forensic science course provides students with the ability to learn about the evidence collection techniques that aim to obtain reliable samples, as well as the protocols that govern the chain of custody. In particular, it examines how evidence collection and analysis is governed by the laws of South Carolina and what standard practices exist to guide the investigator.

List the objectives of the modified program. (1500 characters)

To that end, the program will be expected:

- *To provide authentic lab and field experiences that simulate job responsibilities*
Labs will be incorporated that allow students to practice the techniques and protocols they can expect to use daily in career positions. These labs will be incorporated in existing courses (*Microscopical Methods, General Chemistry, Analytical Chemistry, Geology, Ecology and Limnology*).
- *To broaden the breadth of the department by incorporating non-destructive chemical testing of materials utilizing microscopical methods.*
This program makes use of an existing course that focuses exclusively on techniques that allow for investigation and analysis of samples without negatively affecting their integrity.
- *To incorporate sampling techniques into laboratory experiences*
Labs will be incorporated in existing courses (*Criminalistics, General Chemistry, and Instrumental Analysis*) that allows students to obtain their own samples to test, as well as to assess how the collection methodology affects the integrity of those samples.
- *To incorporate case studies and other activities demonstrating the interpretation of environmental information from a forensics perspective*
Case studies and activities will be incorporated in lab and lecture sections of several existing Environmental Science courses (*Introduction to Environmental Science, Environmental Geology, and Hydrogeology*).

Assessment of Need

Provide an assessment of the need for the program modification for the institution, the state, the region, and beyond, if applicable.

The market for graduates possessing a B.S. in Environmental Science with a Forensic Science Emphasis is quite broad, and by no means confined to professions specific to forensic science such as forensic science technicians. In fact, the knowledge and skills associated with this proposed program have very broad application across environmental and related sciences.

The U.S. Bureau of Labor Statistics and Career One Stop both indicate that the job growth for environmental scientists and related professions are above average to average for all professions, between 11% and 15% net growth over the next decade, approximately. There are approximately 420 people employed in South Carolina in 2016 in the category Environmental Scientists and Specialists, the description that is closest to the description of many environmental scientists who could benefit well from a degree in this emphasis. Environmental Science is an interdisciplinary area with a significant number of career or job opportunities. Some of the relevant positions researched in preparing this proposal include environmental scientists and specialists (the 420 indicated above), environmental compliance inspectors (3,450 employed in SC in 2016), soil and water conservationists (270 in SC in 2016), hydrologists (120 in SC in 2016), park naturalists (270 in SC in 2016), environmental restoration planners (420 in SC in 2016), brownfield redevelopment specialists (4160 in SC in 2016), site managers (included in previous 4160), geoscientists excluding hydrologists and geographers (180 in SC in 2016) and natural sciences managers (490 in SC in 2016). This list by no means exhausts the types of opportunities that students graduating with a degree from the proposed program may have and successfully compete for.

More specifically, the U.S. Bureau of Labor Statistics' Occupational Outlook Handbook (<http://www.bls.gov/ooh/media-and-communication/home.htm>) indicates that there are 110 forensic science technicians working in South Carolina, and the average pay (\$47,450) is on par with the average income in the state. The same Bureau document indicates that nationwide opportunities for forensic science are growing (16.8% between 2016 and 2016) more than twice the national average for all occupations (7.4% from 2016 to 2026), too: projections from Career One Stop initiative indicate the field should be about 20% larger in 2020 as compared to the size in 2010.

A job search of the American Academy of Forensic Science website (<https://webdata.aafs.org/public/jobs/postings.aspx>) yielded 110 job advertisements at varying leadership levels. Current job openings range from a Forensic Scientist in a toxicology lab, to Research Associate positions, to Crime Scene Investigator positions, to Evidence Processing Specialist positions; these jobs are located throughout the southeast region and the entire country. There were also a number of advanced positions available, such as Medical Examiners, Lab Supervisors, and Faculty positions at universities such as Virginia Commonwealth University, Western Carolina University, and Western New England University. Our program will allow students to develop the skills necessary for these entry level positions, as well as prepare them for post-secondary education should they desire to pursue the advanced positions.

Transfer and Articulation

Identify any special articulation agreements for the modified proposed program. Provide the articulation agreement or Memorandum of Agreement/Understanding.

No transfer or articulation agreements for this program modification are identified.

Description of the Program

Projected Enrollment						
Year	Fall Headcount		Spring Headcount		Summer Headcount	
	New	Total	New	Total	New	Total
2019-2020	2	2	1	3		
2020-2021	2	5	1	6		
2021-2022	3	9	1	10		
2022-2023	3	13	1	14		

Explain how the enrollment projections were calculated.

The first assumption in making the calculations is that about one-quarter of current Environmental Science majors will be interested in pursuing this new concentration (this has been confirmed by discussions with current students in the program). This is consistent with the proportion of current Environmental Science majors who are also pursuing minors in Chemistry and is consistent with expressed interests of the current majors. It is typical for the Environmental Science program to pick up two new students or so during spring term, so an assumption is made that one of those will be interested in pursuing the new concentration. Similar ratios for graduates of the program and concentration are projected for the total numbers in the last two rows. Students do not normally take summer courses in the current major, except occasionally and as needed.

Curriculum

Attach a curriculum sheet identifying the courses required for the program.

DEGREE: BACHELOR OF SCIENCE
MAJOR: ENVIRONMENTAL SCIENCE
EMPHASIS: ENVIRONMENTAL FORENSICS

Credit Hours

GENERAL EDUCATION REQUIREMENTS (For approved courses see the [General Education section.](#))

A. Humanities and Fine Arts (6 hours selected from 2 different disciplines)	6
B. Behavioral and Social Perspectives (6 hours selected from 2 different disciplines) ANTH 104 or PSYC 101 or SOCI 101 Behavioral and Social Perspective course	3 3
C. Scientific and Mathematical Reasoning (7 hours selected from different disciplines, 1 lab science required) MATH 211 PHYS 201 or PHYS 211	3 4
D. Core Academic Skills (13 hours) ENGL 101 ENGL 102 MATH 123 or MATH 141 Foreign Language LINK 101	3 3 3-4 3 1

FALS 101 (15 FALS-approved events)	0
E. General Education Electives	
CHEM 111	4
Δ CHEM 381 or ES 390	3
A sufficient number of additional General Education Electives must be taken to meet a total of 42 hours of General Education Requirements. (Select from categories A, B, or C; Global Issues and Cultures; Foreign Language; or courses approved for category E)	
Δ Global Issues and Cultures: Students are required to take at least one of these courses prior to graduation.	
TOTAL GENERAL EDUCATION REQUIREMENTS	42

MAJOR PROGRAM CORE REQUIREMENTS

BIOL 111	4
BIOL 306	4
BIOL 415	4
CHEM 112	4
CHEM 221	4
CHEM 330	5
CHEM 420	3
ES 301	4
ES 302	4
ES 310	3
ES 407 or ES 490	3
GEOL 111 or PSCI 112	4
GEOL 405	3
PSCI 499	3

MAJOR PROGRAM EMPHASIS REQUIREMENTS

CHEM 101	3
CHEM 260	3
CHEM 360	3
Choose two of the following:	6-8
BIOL 213	
BIOL 303	
BIOL 312	
BIOL 421	
CHEM 222	
CHEM 301	
CHEM 331	
ES 390	
POLS 308 or POLS 313 or SOCI 363	

TOTAL MAJOR PROGRAM REQUIREMENTS 67-69

ADDITIONAL ELECTIVES 8-11

TOTAL FOR BS DEGREE 120

*Students anticipating graduate studies in environmental science are strongly encouraged to choose MATH 141. Coursework must include at least 30 hours earned in 300 or above level courses, of which 12 hours must be in the major. See 4-year major guides for recommended order in which to take courses

Curriculum Changes

Courses Eliminated from Program	Courses Added to Program	Core Courses Modified
None are eliminated from the Environmental Science Major program	CHEM-101 Introduction to Criminalistics and Forensic Science	ES 301/ES 302 Introduction to Environmental Science – Addition of Environmental forensics case studies
	CHEM-260 Microscopical Methods	ES 310/GEOL 405 – Addition of Environmental forensics case studies involving soil and/or water contamination.
	CHEM-360 Toxicology	
	The following courses were added to the list of Major Electives: BIOL 312 Genetics POLS 308 Introduction to Law POLS 313 Judicial Process SOCI 363 Environmental Sociology	

New Courses

List and provide course descriptions for new courses.

No new courses are added with this proposed program modification. All courses are currently available at Lander University.

Similar Programs in South Carolina offered by Public and Independent Institutions

Identify the similar programs offered and describe the similarities and differences for each program.

No Environmental Science based forensics programs or concentrations were found in the state of South Carolina. This proposal, if approved, would be the first such program in the state. All forensics related programs that have been located are either Crime Scene Investigation or similar certificate programs in two technical colleges or concentrations associated with Chemistry Degrees. The following are the programs in the state most similar to that in the proposal.

Program Name and Designation	Total Credit Hours	Institution	Similarities	Differences
Chemistry with Forensic Chemistry Concentration	120	Newberry College	<ul style="list-style-type: none"> • Students receive a robust chemical education, including general, inorganic, organic, and physical chemistry coursework and labs. • Forensics coursework is coordinated by former crime lab professionals. 	<ul style="list-style-type: none"> • Students learn about microscopic techniques to assess trace evidence in Lander’s microscopy course; this includes analysis of biological and inorganic samples. • Environmental science and geology based subject matter and case studies are incorporated into the curriculum at Lander. • More biology focused material in the Lander University curriculum
Forensic Science	120	Southern Wesleyan University	<ul style="list-style-type: none"> • Students receive a robust chemical education, including general, inorganic, organic, and physical chemistry coursework and labs. • Students learn about microscopic techniques to assess trace evidence; this includes analysis of biological and inorganic samples. 	<ul style="list-style-type: none"> • Students at Southern Wesleyan take coursework in anatomy, physiology, and molecular biology. The proposed emphasis at Lander University will have a stronger chemistry, environmental science and geology focus.
Crime Scene Investigation Certificate	30	Trident Technical College	<ul style="list-style-type: none"> • Students are trained to assess a crime scene to determine causality and responsible parties. • Students learn the technical writing skills associated with public administration communications. 	<ul style="list-style-type: none"> • Trident offers a certificate; the proposed emphasis would result in a bachelor of Science degree in Environmental Science. • Trident’s program is housed in the Department of Criminal Justice; the proposed emphasis would be an Environmental Science program in both administration and focus.

ACS Forensic Chemistry degree track	123	Winthrop University	<ul style="list-style-type: none"> Students receive a robust chemical education, including general, inorganic, organic, and physical chemistry coursework and labs 	<ul style="list-style-type: none"> Lander students learn about microscopic techniques to assess trace evidence in Lander's microscopy course; this includes analysis of biological and inorganic samples. Lander students are required to take Microscopy and Toxicology courses as well. Lander electives include Public Administration and Judicial Process options. The focus of Winthrop's program is on Chemistry. Lander's program includes advanced courses and focus in Biology (Ecology and Limnology), Environmental Science and Geology.
Crime Scene Investigation Certificate	31	Technical College of the Low Country	<ul style="list-style-type: none"> Students are trained to assess a crime scene to determine causality and responsible parties. Students learn the technical writing skills associated with public administration communications. 	<ul style="list-style-type: none"> Trident offers a certificate; the proposed emphasis would result in a bachelor of Science degree in Environmental Science. Trident's program is housed in the Department of Criminal Justice; the proposed emphasis would be an Environmental Science program in both administration and focus.

Faculty

State whether new faculty, staff or administrative personnel are needed to implement the program modification; if so, discuss the plan and timeline for hiring the personnel. Provide a brief explanation of any personnel reassignment as a result of the proposed program modification.

There will be no new faculty, staff or administrative personnel required to implement this program. Nor will any faculty, staff or administrative personnel need to be reassigned.

The Departments of Physical Sciences and Biology already possesses the necessary expertise required for the proposed coursework. For example, one individual has nearly 30 years of experience in public and private forensic labs utilizing non-destructive microscopical methods. Another faculty member possesses a Ph.D. in environmental toxicology. A third has had broad experience in environmental science, including more than 15 years performing site Phase I, Phase II, and remediation investigations and/or management for industry and consulting. The third faculty member possesses a master degree in Environmental Science, Ph.D. in hydrogeology, a postdoc in Environmental Engineering and has coordinated the Environmental Science Program at Lander for more than 15 years. All courses in the proposed program are already offered at Lander University and have a capacity that can accept additional students into existing sections without putting additional stress on the faculty or resources.

Resources

Identify new library, instructional equipment and facilities needed to support the modified program.

Library Resources: The Larry A. Jackson Library has been dedicating their College of Science and Mathematics resources to expanding the toxicology holdings over the past three years. Many forensic resources are already among the holdings. This includes film and text resources that cover forensic science, DNA analysis, psychology, and others. For example, the Elton B. Stephens Co (EBSCO) e-books database allows access to a number of e-texts with publication dates as recent as 2015. This will allow our students remote access to up-to-date information.

Access to databases such as Academic Search Complete, Applied Science and Technology Full Text, and PubMed have already been supporting learning across campus; their efficacy can now be expanded to include this emphasis. The attached budget for the program provides financial support over the next five years for additional library resources. The Library may pursue access to journals such as the Journal of Forensic Science and The Microscope. New purchases will be focused on obtaining additional resources for microscopy and criminalistics. Books for the library to purchase might include Handbook of Forensic Science Edited by Richard Saferstein; Criminalistics, An Introduction to Forensic Science by Richard Saferstein; Polarized Light Microscopy by McCrone, McCrone, and Delly; Handbook of Chemical Microscopy, Volume II by Emile Chamot and Clyde Mason; The Particle Atlas, Volume I (Principles and Techniques) by Walter McCrone and John Delly; and The Microscopical Characters of Artificial Inorganic Solid Substances by Winchell and Winchell.

Equipment: Instructional equipment required by the proposed program, which includes polarized light microscopes for the microscopy lab, are available. The university already owns the necessary glassware and instructional resources for the criminalistics and toxicology courses. Some increased expenditures associated with reagents for the microscopy lab are expected; however, lab fees can easily cover these costs. The nature of the non-destructive microscopy methods course also allows us to reuse and recycle these reagents over time, so their cost is not significant.

Facilities: No new facilities are required to support this program. All essential facilities are currently available at Lander University.

Impact on Existing Programs

Will the proposed program impact existing degree programs or services at the institution (e.g., course offerings or enrollment)? If yes, explain

Yes

No

Financial Support

Estimated Sources of Financing for the New Costs						
Category	1st	2nd	3rd	4th	5th	Total
Tuition Funding ¹	26,750	58,850	101,650	144,450	144,450	476,150
Program-Specific Fees ²	90	180	300	420	420	1410
Special State Appropriation	0	0	0	0	0	00
Reallocation of Existing Funds	0	0	0	0	0	0
Federal, Grant, or Other Funding	0	0	0	0	0	0
Total	26,840	59,030	101,950	144,870	144,870	477,560
Estimated New Costs by Year						
Category	1st	2nd	3rd	4th	5th	Total
Program Administration and Faculty and Staff Salaries ³	0	0	0	0	0	0
Facilities, Equipment, Supplies, and Materials	90	180	300	420	420	1410
Library Resources	120	120	120	120	120	600
Other (specify)	0	0	0	0	0	0
Total	210	300	420	540	540	2010
Net Total (i.e., Sources of Financing Minus Estimated New Costs)	26,630	58,730	101,530	144,330	144,330	475,550

¹ Estimated using headcount students x \$5,350 (tuition for full-time, in-state students) in fall and spring.

² Fee for Microscopy course (CHEM 260) - \$30 per student, per semester

³ No new course sections or new hires will be required, so no new expenses anticipated.

Budget Justification

Provide a brief explanation for all new costs and sources of financing identified in the Financial Support table.

Costs:

The proposed program will make use of current faculty and involves available seats in already existing courses at Lander University. It is not anticipated that additional sections of the courses in the program or additional hires will be required in the foreseeable future.

Students in the microscopy class (CHEM 260) will require reagents to analyze. These costs are included in the “Facilities, Equipment, Supplies, and Materials” area and calculated at \$30 per student, per semester.

New library journals and books will be required. The costs associated with obtaining new library resources is already factored into the Library’s budget and the Library has already prepared to begin purchasing resources for this program.

Sources of Funding:

A laboratory fee is customary for courses that require students to use reagents and analytes. CHEM 260 (Microscopical Methods) is currently being taught without a lab fee, but a lab fee will be added to cover the costs associated with the new labs added to the course.

As the program attracts new students to the forensics emphasis, we anticipate an increase in tuition funding. The tuition projections were determined using the projected enrollment table (page 5 of this proposal) and the current tuition at Lander University (\$5,350 per semester for full-time, in-state students).

Evaluation and Assessment

Program Objectives	Student Learning Outcomes Aligned to Program Objectives	Methods of Assessment
To demonstrate analytical skills that can be applied in a laboratory or field position	Acceptable or higher score on rubric assessing that outcome on proposal project.	Proposal rubric in PSCI 499 (Capstone Seminar) each spring semester.
To demonstrate the ability to test evidence without negatively impacting its integrity	Acceptable or higher score on rubric assessing that outcome on proposal project.	Proposal rubric in PSCI 499 (Capstone Seminar) each spring semester.
To demonstrate an understanding of how evidence collection influences the results of different analyses of that evidence	Acceptable or higher score on rubric assessing that outcome on proposal project.	Proposal rubric in PSCI 499 (Capstone Seminar) each spring semester.

Will the proposed modification impact the way the program is evaluated and assessed? If yes, explain.

This will not substantially change the assessment of the environmental science program; rather this would be a small expansion of the assessment.

Yes

No

Students provide data for assessment when they participate in the capstone seminar (PSCI-499) course through the completion of a new proposal project, where they investigate a new question in their field of interest, and propose a way to go about answering this question. This allows assessment of student mastery of the material in the major and evaluation of their communication skills (via written and oral components of the project). The addition of this emphasis would not change the format of the assessment, but it would broaden the scope from the current applications in environmental science to include applications in environmental forensics.

Will the proposed modification affect or result in program-specific accreditation? If yes, explain; and, if the modification will result in the program seeking program-specific accreditation, provide the institution's plans to seek accreditation, including the expected timeline.

Yes

No

We intend to pursue accreditation by the Forensic Science Education Programs Accreditation Commission (FEPAC). Programs that have pursued undergraduate program accreditation by this body include SUNY Albany, Loyola University at Chicago, Ole Miss, Penn State, Texas A&M universities; there are no South Carolina colleges that possess accredited programs. We would pursue this accreditation once all of the coursework has been established at the university and students are enrolled in the new program. Lander would be eligible for accreditation from FEPAC so long as we maintain our accreditation with SACSCOC.

Will the proposed modification affect or lead to licensure or certification? If yes, identify the licensure or certification.

Yes

No

Explain how the program will prepare students for this licensure or certification.

If the program is an Educator Preparation Program, does the proposed certification area require national recognition from a Specialized Professional Association (SPA)? If yes, describe the institution's plans to seek national recognition, including the expected timeline.

Yes

No