Environmental Science major assessment report
Fall 2016

Submitted by:
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Dr. Kevyn Juneau, Assistant Professor of Environmental Science and Conservation

The Environmental Science major (the program) prepares students to become interdisciplinary scientists who understand the complexities of environmental systems and processes and have the training to solve difficult environmental problems. Environmental scientists face increasingly complex challenges including environmental management, water quality and quantity issues, and sustainable development in the context of global change.

Mission: Our mission is to help prepare students to be productive, creative, ethical, engaged citizens and leaders with an informed global perspective.

Figure 1: Venn diagram illustrating the interdisciplinary field and potential career paths of students in Environmental Science.¹

¹ Quality Assurance Agency for Higher Education: www.qaa.ac.uk.
Environmental Science relies on technical analysis to direct actions that address environmental issues. Environmental Science is truly an interdisciplinary major that brings multi-dimensional thinking to bear on projects that preserve, remediate, enhance, and restore ecosystem functions and values. At its core, Environmental Science seeks to solve pressing problems involving how humans and nature can coexist in a mutually beneficial and sustainable manner. Environmental Science graduates receive a well-rounded, multidisciplinary education that integrates chemistry, physical geosciences, biology, mapping sciences, quantitative analysis, management, and sustainability and prepares them for a wide variety of academic and professional career paths after graduation (figure 1).

Assessment Activities (September 2013-2016)

Assessment cycle:
Because of recent changes to program prioritization and program audit and review schedules on campus the Environmental Science program now uses a three-year assessment cycle (year=academic calendar year). All Environmental Science faculty members participate in the assessment process and preparation of Assessment Plans and Reports. Additionally, every 6 years the Program is Audited by the Program Audit Review Committee. Internal and external stakeholders described below inform the assessment plan/process via feedback in the form of surveys, discussions, etc. There is no formal external accreditation process for the Environmental Science major [Rubric Section 1a]. The most recent Assessment Plan was produced in 2013 (and now 2016). An audit review was conducted in 2013. However, the most recent Assessment Report was written in 2007. These two documents and the feedback received in response to them form the basis of our discussion of program updates and change in this report.

Environmental Science majors develop skills to meet program, Department Faculty, and College of Agriculture, Food, and Environmental Science (CAFES) criteria and expectations. During this report cycle, program faculty engaged environmental science majors as internal stakeholders through assessment in courses and through informal feedback during advising and out-of-classroom mentoring. Program faculty meet regularly to discuss program goals and improvements, such as new course offerings or out-of-classroom experiences that increase student engagement and retention (e.g., courses focused on limnology, biogeochemistry, or environmental modeling and movie nights, guest speakers, program field trips, or social activities respectively). Program faculty also regularly discuss program issues with Plant and Earth Science Department colleagues as well as faculty from across campus in departments as varied as Chemistry, Biology, Agricultural Economics, Geography, English, Teacher Education, and Stage and Screen Arts. For example since beginning her position in the fall of 2013 Dr. Coleman Wasik has established working relationships with colleagues in Chemistry to access instrumentation otherwise unavailable to environmental science students; exchange departmental expertise through presentations at chemistry afternoon seminars; develop analytical
methods in the environmental science laboratory; and discuss the possibility of more coordination between chemistry and environmental science curriculum. Environmental Science faculty were also heavily involved in sustainability activities on campus during this report cycle such as professional development opportunities (e.g., the Kinnickinnic Project), development of a sustainability curriculum on campus, and bringing in Mark Klapatch (half-time campus Sustainability Coordinator) to speak in program courses about sustainability issues on campus. [Rubric Section 1d]

External stakeholders for the Environmental Science program include entities who directly employ our graduates such as private businesses, public environmental and natural resource management agencies, environmental research organizations, and graduate programs in environmental science and related fields. Environmental Science faculty come to the program with extensive experience in consulting and state-of-the-science research institutions. Furthermore, through their prior work experiences, program faculty developed strong networks across public agencies and academic institutions. These networks are nurtured by faculty through their continued communications and interactions with colleagues, attendance at conferences, and participation in large research initiatives. For example on his sabbatical in 2013-2014 Dr. Keen worked with colleagues at Summit Envirosolutions to learn about new trends in the consulting field, access the latest equipment, and acquire new technical skills. Drs. Juneau and Coleman Wasik have attended several professional meetings and conferences to present research results (e.g., Society for Freshwater Science, Water Resources Conference, International Acid Rain Conference, Upper midwest Invasive Species Conference, among others) and have published in peer reviewed journals (e.g., JGR-Biogeochemical Cycles, Science of the Total Environment, Environmental Science and Technology, PLOSOne, Invasive Plant Ecology and Management, Journal of Integrated Pest Management). The program also considers communities and citizens who require access to clean water, productive soils, forests, clean air, and ecosystems to be external stakeholders. Program faculty perform service to community through public presentations (e.g., at the public library water day in 2015, UWRF homecoming), program sponsored events (e.g., National Moth Week), participation on boards and in working groups (e.g., the City of River Falls POWERful Choices! advisory group and St. Croix Summit Planning Committee) and volunteer work (e.g., interpretation at the Como Zoo and Conservatory, volunteer as scientist-mentors at high- and middle-schools). In this report cycle external stakeholders have been engaged informally in program assessment, primarily through face-to-face discussion and email communication. However, the desirability of our graduates is illustrated by their success in obtaining employment after graduation with organizations as varied as the Minnesota Pollution Control Agency, the Metropolitan Council, the Science Museum of Minnesota, Pace Analytical Services, and the Student Conservation Association. [Rubric Section 1e]

Program faculty are very active in engaging students in out-of-classroom research experiences. Over the past 3 years faculty have advised and mentored numerous student researchers (e.g., Dr. Coleman Wasik and her students have received 5 awards from the UWRF Office of Undergraduate Research,
Scholarly, and Creative Activities [URSCA] and Dr. Juneau has received 1). These students have produced posters, presentations, reports, and publications during out-of-classroom experiences that include Semester Abroad Europe, Internships, and Undergraduate Research. Students who apply themselves to these out-of-classroom experiences often attain mastery of learning outcomes 1, 3, and 5 (see below) by applying their knowledge of environmental systems and processes to design research projects that they present to peers and environmental science professionals. External stakeholders interact with these students at regional and national professional meetings (e.g., the St. Croix River Research Rendezvous, the St. Croix Summit, Geological Society of America conference, Upper Midwest Invasive Species Conference, among others) and also guide future research projects through their feedback on posters, presentations, etc. [Rubric Section 1f]

Changes to Learning Outcomes and Assessment (2013-2016):

Due to faculty turnovers and additions in this report cycle, learning outcomes were carefully reviewed. No significant changes were made to learning outcomes, but each outcome was better defined with sub-outcomes in the most recent 2016 Assessment Plan (Appendix D) in order to give students more concrete descriptions of what the skills they can expect to develop as they pursue an environmental science major and to more clearly align with assessment artifacts that have been revised by new faculty. Artifacts 2, 5, and 6, which are used to assess learning outcomes 2 and 4; 3 and 5; and 1, 3, and 5 respectively, have changed as a result of Dr. Coleman Wasik developing new assignments to better reflect emphases in her core courses. For example, artifact 2 is administered in Environmental Policies and Administration (ESM 303); students write 2 argumentative essays in which they argue in favor of environmental policies that they do and do not personally support using evidence and self-criticism. Artifact 5 is administered in Environmental Sustainability (ESM 220); students develop and present a project idea based on their learning over the semester that would make the UWRF campus and community more sustainable. Artifact 6 is administered in Environmental Analysis (ESM 413); students produce a standard operating procedure, such as might be used by state-of-the-science labs, for a piece of instrumentation in the environmental science laboratory space. These particular changes reflect Dr. Coleman Wasik’s experiences in the private sector as a hiring manager in an internationally respected, environmental science laboratory as well as her interdisciplinary graduate training in Water Resources Science. [Rubric Section 1g]

Alignment of learning outcomes with UWRF Strategic goals: [Rubric Section 1h]

Distinctive Academic Excellence

The Environmental Science major is a dynamic, academically rigorous program demonstrating distinctive academic excellence in a number of ways. Coursework includes a firm foundation in basic sciences combined with the practical hands-on application of knowledge required to prepare students for successful careers [LO1, LO3]. Using the Kinnickinnic River and surrounding lands along
with modern laboratory equipment, students develop critical, practical skills needed by environmental scientists [LO3, LO5]. Students often work in groups to monitor real-world situations and consider possible solutions [LO2, LO4]. Students are active in undergraduate research projects and presenting research at professional meetings [LO5]. An example of how our courses intertwine real-world environmental and agricultural issues is the new Explore Your Watershed (ESM 389) course, which recruits students from environmental science and crop science majors and engages them in current issues in land-use decision-making and sustainable development in the local community. Faculty members support distinctive academic excellence by obtaining professional certifications (e.g. Certified Ecologist- Ecological Society of America, Assistant Laboratory Animal Technician, Professional Geologist-Wisconsin Department of Safety and Professional Services) and being actively engaged in professional research activities that lead to publications in scientific journals and invited presentations at professional meetings [LO3, LO5]. Faculty members bring the results of these activities into the courses they teach, adding interest and relevance to course content. Coming out of this educational program our graduates are finding success in obtaining quality positions with both private and governmental sectors or attending graduate school. The content in the UWRF Environmental Science program reflects the same high caliber standards as programs in other well known four-year comprehensive universities; however, our program is unique in that it has strong ties with the agriculture programs in the College, and because of the faculty’s backgrounds, it also emphasizes hands-on field research, laboratory experience and management, and consulting that are not highlighted in other Environmental Science programs.

Global Education and Engagement
Many environmental science problems are global in nature and solutions require global cooperation and scientific efforts. Coursework and other experiences in the Environmental Science program emphasize not only the local and regional but also the global aspects of environmental science issues and their solutions [LO2, LO4]. Many students are advised to take the course Geological Destinies of Nations, where resource utilization and environmental changes are a focus of that course. In addition, Environmental Science students are strongly encouraged to participate in Education Abroad and/or other international experiences. Faculty members are involved with the UWRF Semester Abroad: Europe (SA:E) program, where students complete independent research projects in a European country of their choice. Faculty members have served as Project Advisors for Environmental projects in Europe, and also as Group Leader for the SA:E program. A number of students have participated in other Education Abroad experiences, such as Wisconsin In Scotland and International Traveling Classroom (in Europe) [LO2]. A new course covering tropical environmental issues is actively being developed in collaboration with staff at the the Forfar Field Station and the Bahamas Forestry Unit in Andros Island, Bahamas and is anticipated to be taught summer 2017. Faculty members are currently involved in regional, national, and international research collaborations.
Innovation and Partnerships

Our faculty are closely attuned to private firms and governmental agencies involved in the environmental field. Class projects often involve assessing impacts of actual land use changes that allow collaboration with resource management organizations and agencies. Internships are encouraged and widely available [LO5]. Faculty members have devoted considerable time doing research and building relationships within the private consulting industry in the area, as well as with government and nonprofit organizations such as the MN and WI Department of Natural Resources, MN Pollution Control Agency, Science Museum of Minnesota, National Park Service, and US Geological Survey. With the recent acquisition of new analytical equipment, the program has developed a student-driven, fee-for-analysis service for partners in land management, agricultural production, and water resource protection sectors [LO5]. This new analytical service is designed to fund equipment maintenance and provide students with professional laboratory experience and networking opportunities. Partnerships have also resulted in support for the university. Our program received donations (equivalent to approximately $45,000) of glassware, analytical equipment and instrumentation (multiparameter sondes, high performance liquid chromatography analyzer), and materials to install and sample groundwater wells. Field water-temperature monitoring probes, pressure transducers, current meters, and other field instruments have been provided (on loan) by the US Geological Survey, Summit Envirosolutions, and the St. Croix Watershed Research Station for teaching and student research projects. Environmental data sets have been obtained or provided by the City of River Falls, City of Minneapolis, St. Croix County Land & Water Conservation Department, and the Wisconsin Department of Natural Resources so students can use real-world data collected and managed by professionals in the field [LO5]. Students also learn about and perform specialized environmental analyses at nationally recognized environmental laboratories such as the St. Croix Watershed Research Station and the Limnological Research Center at the University of Minnesota.

Action plans from previous reports: [Rubric Section 1i]

No specific action plans were identified in the 2007 assessment report. Plans identified in the 2013 Program Audit Review include filling the open faculty position, engaging more students in undergraduate research, exploring curricular connections with other majors in CAFES, revising and updating current curriculum, promoting the program in high schools, creating new courses, revising the Environmental Science Assessment Plan, and expanding internship opportunities. The program has made progress on each of these strategic plans.

The position vacated by Dr. Laine Vignona was filled by Dr. Jill Coleman Wasik. Dr. Coleman Wasik worked for a private non-profit, academic research laboratory for 12 years before coming to UWRF. She oversaw 4 laboratories, coordinated sample analyses in support of major, multidisciplinary research initiatives, and managed her own research projects. As a result she has extensive contacts
within regional public agencies and universities. She also completed a Preparing Future Faculty program as part of her Ph.D. and held an adjunct position at UWRF prior to beginning her position. In addition to the open 1.0 FTE position, the Environmental Science program obtained another 0.5 FTE position in 2014 and hired Dr. Kevyn Juneau in 2015. Prior to his employment at UWRF, Dr. Juneau was a visiting Assistant Professor of Biology at Alma College and an Adjunct Professor at Gogebic Community College where he developed and taught 5 different classes in the Natural Sciences. He was a postdoctoral researcher in the Limnology and Biogeochemical labs at Michigan Technological University. Dr. Juneau also worked in the Toxicology Laboratory at Wyeth Pharmaceuticals Research and Development branch (now Pfizer R&D) where he ran drug safety and metabolism analyses (e.g., pharmacokinetic and pharmacodynamic, acute and chronic toxicity, mutagenicity and carcinogenicity, and teratogenicity assays). There he was trained in Federal Good Laboratory Practices (GLP) standards and promotes these standards to undergraduate research students.

As described above Environmental Science faculty have made undergraduate research an emphasis over the past 3 years, successfully leveraging funding through URSCA. Furthermore Dr. Coleman Wasik, in cooperation with PES department colleagues, has received 2 large grants (UW System Undergraduate Research and Discovery Grant, and USDA NIFA Capacity Building Program for Non-Land Grant Colleges of Agriculture Grant) since 2014 that have supported undergraduate research and internships. Dr. Juneau has been an active member of the Ecological Research as Education Network (EREN)-a nationwide network of collaborators at primarily undergraduate institutions (PUI) that integrate quality research projects into class curricula or implement collaborative research between undergraduates at a variety of PUIs with the intention of publishing the results in high-impact scientific journals. Dr. Juneau is Co-PI on one EREN project that started in 2016, Senior Personnel-Faculty Associate on one project, and participant on three other projects, all of which rely on undergraduate student involvement.

More work remains to be done to reach out to area high schools. However, Dr. Coleman Wasik is collaborating with an informal science education program at the Science Museum of Minnesota through her USDA-NIFA grant that reaches into Twin Cities middle and high schools. One project outcome is to recruit more young people, especially those underrepresented in STEM fields, to agriculture and environmental science programs at UWRF. Dr. Juneau has been awarded a two year fellowship as part of the PlantingScience-Digging Deeper project (NSF Award 1502892), to work with high school science teachers throughout the country to help improve science curricula and pedagogy to make inquiry based learning a stronger focus in primary education. Dr. Juneau has also served as a science fair project scientist-mentor for underrepresented students attending middle school in a low socio-economic school district in eastern Kentucky.

Drs. Juneau and Coleman Wasik have updated and revised courses that they inherited from their predecessors according to their own professional experiences and observations of trends in the field of environmental science. Dr. Juneau has created a new Forest Restoration course and a new Forestry
Methods course to replace Woodlot Management. Although these courses directly support the Conservation and Environmental Planning major, they are directed electives for Environmental Science majors and have strong Sustainability components. Dr. Coleman Wasik is co-teaching a new course funded by her USDA-NIFA grant that explores land use in the local watershed. This course could be further developed into a new watershed management course after the grant period.

The Environmental Science Assessment Plan was significantly revised to be more complete. Learning outcomes were clarified, the assessment cycle was better defined, and artifacts were updated and revised as necessary.

Finally, work continues to renew and expand internship opportunities for students. As described above, program faculty maintain their networks as a means of connecting students to opportunities. Some UWRF internship opportunities have developed as a result of grant funding. Faculty also subscribe to job boards as a way to be aware of internship opportunities in the field as well as the changing skill requirements of employers.

Assessment Activity Results (September 2013-2016)

Direct assessment results are presented in Tables 1-4 in Appendix A. Overall the results of the direct assessment indicate that the average student in environmental science courses demonstrates competency or mastery of the learning outcomes assessed by program artifacts. The final course grade data presented for artifact one demonstrate that students are becoming proficient with:

1. Analyzing components, processes, and functions of Earth’s complex environmental systems [LO1] a major focus of and ESM 105 (82.43 +/- 2.25% SE), ESM 220 (83.73 +/- 3.91% SE), ESM 412 (79.64 +/- 4.32% SE), ESM 413 (85.03 +/- 1.60% SE). [Appendix A Table 1]

Final course grades and specific artifact scores within certain core Environmental Science courses demonstrate that the average student is developing competency in:

2. Evaluating the role that human actions and policies play in changing environmental systems [LO2] as assessed in ESM 303 (artifact 1 = 85.59 +/- 1.17%SE; artifact 2 = 85.55 +/- 2.15%SE) and ESM 220 (artifact 1 = 83.73 +/- 3.91%SE; artifact 6 = 85.40 +/- 4.65%SE) [Appendix A Tables 1]

3. Designing and implementing environmental research and monitoring programs in natural and/or built environments [LO3] as assessed in ESM 413 (artifact 1 = 85.03 +/- 1.60% SE; artifact 5 = 90.77 +/- 1.16% SE) [Appendix A Tables 1 and 3]

4. Assessing the technical and social complexities of sustainable development [LO4] as assessed in ESM 220 (artifact 1 = 83.73 +/- 3.91%SE; artifact 6 = 85.40 +/- 4.65%SE) and ESM 303 (artifact 1 = 85.59 +/- 1.17%SE; artifact 2 = 85.55 +/- 2.15%SE) [Appendix A Tables 1 and 4]
5. Using professional skills of practicing environmental scientists [LOS] as assessed in ESM 413 (artifact 1 = 85.03 +/- 1.60% SE; artifact 5 = 90.77 +/- 1.16% SE) [Appendix A Tables 1 and 3]

Because these artifacts are snapshots of the performance of individuals in a course who are becoming acquainted and proficient with particular skills there are no strong year-to-year trends in the data. Rather the main relevant trend in the data is consistency from course to course and year to year in bringing students to a particular level of proficiency. Some year to year variation in the data can be explained by new faculty modifying course assessment documents and better aligning course content and assessment. Artifact means in individual year with high standard deviations were frequently the result of a few individuals earning very low grades, usually as a result of not formally dropping courses that they had stopped attending.

Student satisfaction with courses is generally high with students agreeing or strongly agreeing to the questions posed by surveys (Appendix B, Table 1). One difficulty with using online course surveys is that the participation rates are much lower than in class surveys and so the results can be skewed by those individuals who were most motivated to fill out the online surveys. This is reflected in higher standard deviations for the online format. Again the trend in the data is one of consistency. Students appear to enjoy and see benefit in environmental science courses. [Rubric Section 2c]

Surveys administered to graduating seniors in the program demonstrate that students believe that the program has made them proficient in each of the stated program learning outcomes (Appendix B, Table 2). This indicates that there is good alignment between program learning outcomes and the content and skills developed in environmental science courses. [Rubric Section 2c]

Out-of-classroom experiences provide students with another opportunity to master program learning outcomes. Because students receive more individualized attention from faculty mentors, particularly during research experiences, and because students share the results of their out-of-classroom work with peers and future colleagues students usually attain a level of higher degree of mastery over learning outcomes than is possible in classes. Examples of student work as a results of these experiences are appended to this document in Appendix C.

No alumni surveys were conducted in the most recent reporting cycle. [Rubric Section 2d]

No formal professional assessment was conducted in the most recent reporting cycle; however, the comments from the external reviewer consulted for the Program Audit Review in 2013 are considered in the Action Plan section below. [Rubric Section 2e]
Program Strengths  [Rubric Section 3a]
The program has a rigorous curriculum that, in addition to the applied technical and analytical skills the students gain, provides students the critical thinking skills necessary to solve environmental issues, make environmentally sound, well informed management decisions, and be productive members of society. This is due to the interdisciplinary nature of the program and the focus on systems thinking. The program has embraced the UWRF Sustainability initiatives, and as a result of faculty participation in the Kinnickinnic Project and membership in the Sustainability Pedagogy Discussion group, we’ve incorporated more of and improved delivery of the social and economic components of Sustainability in the curricula, while also continuing to provide a strong, well developed environmental protection component.

Unlike many other Environmental Science programs, the program’s faculty at UWRF has also taken the initiative to provide more research-focused, inquiry based learning opportunities, both infused into courses and provided as out-of-classroom experiences. Group research projects are implemented by students for demonstration (e.g., effects of copper on plant growth), while other projects are run by students in-class at UWRF that are then combined with data from nationwide collaborators such as members of the Ecological Research as Education Network (e.g., OakMAST project, TurtlePop) or Citizen Science project collaborators (EpiCollect: Roadkill survey) to be published in high-impact scientific journals or presented at regional and national conferences.

Undergraduate research is encouraged and promoted by the program’s Faculty, who have been successful at obtaining internal and external funding for student research. Upon completion, our student researchers have the opportunity to present at regional and national conferences and are competitive in poster contests.

Students in the program have the opportunity to use analytical technologies commonly used by professionals and researchers in both the field and laboratory. The technologies students are exposed to range from portable water sampling probes to benchtop chemical analytical equipment. These technologies are used in classes for inquiry based learning activities and laboratory projects and also used for undergraduate research projects.

The program, being interdisciplinary in nature, has strong connections and actively collaborates with other departments. Unlike most other Environmental Science programs in the country, we are housed in the College of Agriculture, Food, and Environmental Science; therefore, we have a unique and intimate connection with a variety of agriculture programs. This allows us to reach an audience that is not reached at other Universities.
The Environmental Science Faculty are actively engaged in professional development around diversity and inclusivity, pedagogy, and sustainability. The faculty have participated in both internal professional development (e.g., faculty workshops on racism, intrinsic biases, and diversity, participation with the UWRF Sustainability Pedagogy Group, among others) and external programs [e.g., participation in the Science Teachers Learning through Lesson Analysis (STeLLA) workshop with the Biological Sciences Curriculum Study (BSCS), Colorado Springs, CO].

Program Constructive Criticism [Rubric Section 3a]
One struggle the program faces is student retention. There is a general perception that the major requires difficult classes, particularly physics, chemistry, and calculus. We intend to undertake an initiative to improve retention rates by attempting to: 1) change the student culture in the major so there is more sense of community and thus a more apparent support system between students and 2) rephrase the anticipated outcomes of the program when speaking to prospective students or advising current students to more accurately reflect Environmental Science by highlighting both the field and laboratory components of the program, rather than dismissing the field component.

Student recruitment has been an issue because of strong competition from other institutions including those within UW System and those nearby in Minnesota; however, we have the unique opportunity to attract students that are interested in both agriculture and environmental science. In the future we plan to highlight this unique relationship between the Environmental Science program and the Agriculture programs housed in CAFES. The program’s faculty have made it a priority to collaborate more with local primary educators with the intention of recruiting more local students. Dr. Coleman Wasik’s current project has a goal to recruit more young people from High and Middle schools in the Twin Cities, especially those underrepresented in STEM fields, to agriculture and environmental science programs at UWRF.

The program’s faculty have noticed a pattern with limited student engagement possibly due to limited social activities for the students. We are undertaking an initiative to improve the sense of community between the students and faculty within the program. Drs. Coleman Wasik and Juneau developed and ran the pilot KinniBlitz (see below) and will continue doing so into the future.

Aging field and lab equipment had become a limitation for some of the activities we are able to undertake in the program. Maintenance and replacement of equipment are limited by funding. Even though we have been able to demonstrate the use of various types of field equipment, the data collected by many of them are unreliable and do not provide real-life, student collected data that can be further analyzed in the classroom or take-home activities and assignments. We feel that collection and analysis of data by our students is a high-impact activity that may provide higher conceptual retention than activities utilizing data collected elsewhere by others.
The lack of a full-time Lab Manager has also impacted our ability to prepare and undertake high-impact learning experiences in the classes and labs. Due to the FTE faculty’s course loads, we are unable to adequately prepare the number of activities we would like to implement in our courses. A full-time Lab Manager that would prepare materials and lab activities would lessen the faculty’s time commitment to preparation, so we could focus on developing content and more hand-on activities. A full-time Lab Manager would also provide routine maintenance on equipment resulting in less deterioration and attrition of the equipment. A full-time Lab Manager would also keep track of supplies (e.g., chemicals and disposables like gloves, filter papers, etc.) order necessary supplies for classes and research and supervise activities in the laboratory.

The Environmental Science Program has space constraints for laboratory needs, especially in support of out-of-classroom research needs for undergraduate and faculty projects. The program currently shares research space with other programs and there is limited room for benchtop laboratory equipment, storage of supplies and portable equipment, and benchtop work space. Our major concern with shared space is the lack of security for the laboratory. The Environmental Science Program also does not have a designated classroom Laboratory for Environmental Science classes that other programs have available.

The connections between the program and business and industry has room for improvement. Although the program has strong ties with academic and private research facilities and institutions, consulting firms, and state and federal agencies, we need to build a network and connections with local and regional businesses and industries.

**Actions to Maintain/Improve Learning Outcome Performance by Individual Outcome**[Rubric Section 3b,g]

A graduate of the Environmental Science program will be able to:
1: Analyze components, processes, and functions of Earth’s complex environmental systems
2: Evaluate the role that human actions and policies play in changing environmental systems
3: Design and implement environmental research and monitoring programs in natural and/or built environments.
4: Assess the technical and social complexities of sustainable development.
5: Use professional skills of practicing environmental scientists

Although certain knowledge in environmental science stays constant over time (e.g., Manning’s equation, partition coefficients, and Liebig’s Law of the Minimum) our understanding of the global system and the myriad elements and interconnections within that system is changing rapidly [LO1]. As a result Environmental Science Faculty need to be well versed in foundational concepts and stay current as our understanding of the world and our place in it evolves. Furthermore the cross-disciplinary nature of the field requires Faculty that can also connect environmental issues to the organization of global social and economic structures [LO2, LO4]. Program Faculty participate in professional development
and scholarly activities described above (e.g., conference attendance, research, pedagogy workshops, etc.) as a means of keeping on top of changing ideas and new information in the field of environmental science and how best to help students develop familiarity and facility with that knowledge and accompanying skills. Through engagement with professional communities and constant review of course materials the Faculty maintain student performance for the LOs stated above. Furthermore Faculty currently use external stakeholders (guest speakers in classes and after class) [LOS] and out-of-classroom experiences (class field trips and fieldwork) [LO3, LO5] to introduce real-world nuance into classes and support LOs.

**Actions to Maintain/Improve Out-of Classroom Experiences for Majors** [Rubric Section 3c,g]
KinniBlitz: The KinniBlitz is a 24-hour continuous environmental monitoring undertaking where Faculty and Environmental Science Students and those interested in the program collect environmental data for a period of 24-hours. Drs Juneau and Coleman Wasik piloted the idea the first weekend of fall semester 2016. They will take lessons from this pilot to further develop the activity in future years.

A Facebook page would be useful to the Environmental Science program so that faculty can communicate timely information about jobs, events, and new knowledge in the field to students, alumni, prospective students, external stakeholders and others interested in the program.

**Actions to Maintain/Improve Indirect Student Assessment** [Rubric Section 3d,g]
Faculty will continue to seek out campus and community events to increase our outreach presence. For example, Coleman Wasik served as the faculty host for the St. Croix Summit in spring of 2016 and she and Juneau will serve again in spring 2017. They will seek out opportunities for students to get involved in the planning and facilitation of this annual meeting on campus.

**Actions to Maintain/Improve Indirect Alumni Assessment** [Rubric Section 3e,g]
See discussion of Facebook page development above.

An alumni survey will be sent out in the next reporting cycle to get feedback on program alignment with current and future trends in skill sets required by employers.

**Actions to Maintain/Improve Indirect Professional Assessment** [Rubric Section 3f,g]
As part of the upcoming Program Audit and Review an external review panel will be invited to critique the program and make suggestions for improvement.
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<thead>
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<th>Action to be taken</th>
<th>Lead Person</th>
<th>Completion date</th>
<th>Dissemination to</th>
<th>Review/follow-up activity</th>
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<td>Further develop Kinni Blitz</td>
<td>Coleman Wasik Juneau</td>
<td>September 1, 2017</td>
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<td>January 31, 2017</td>
<td>CAFES, PES</td>
<td>Incorporate panel feedback in PAR and program faculty meetings</td>
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### Appendix A. Direct Assessment Results

Table 1. Artifact 1 Results 2013-2016

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<th>Course</th>
<th>Year</th>
<th>Semester</th>
<th>Mean Midterm Exam</th>
<th>SD midterm Exam</th>
<th>Mean Final Exam</th>
<th>SD Final Exam</th>
<th>Mean final grade %</th>
<th>SD final grade %</th>
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**Table 2. Artifact 2 Results 2013-2016**

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**Table 3. Artifact 5 Results 2013-2016**

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Appendix B. Indirect Assessment Results

Table 1. Student Course Satisfaction Survey Results 2015-2016

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*Question 1: The instructor displayed thorough knowledge about the material being taught.
Question 2: The instructor treated me fairly.
Question 3: The objectives/learning outcomes for the course were clear.
Question 4: I felt comfortable asking questions and/or expressing opinions.
Question 5: The instructor was available for meetings and consultations.
Question 6: The required tests, quizzes, projects, papers, reports, and other activities allowed me to demonstrate my learning.
Question 7: The instructor provided effective and timely feedback regarding exams, quizzes, and other assignments.
Question 8: Course concepts were presented in ways that helped my learning.
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<td>2</td>
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<td>Demonstrate an understanding of human actions and policies affecting the environment.</td>
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<td>3</td>
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<td>3</td>
<td>Understand the design and implementation of research and environmental monitoring techniques.</td>
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<td>Demonstrate an understanding of the complexity of the technical and social aspects of sustainability.</td>
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<td>5</td>
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<td>5</td>
<td>Demonstrate an understanding of professional practices and ethics.</td>
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Appendix C. Examples of Out-of-Classroom Experience Products

Mass Balance Analysis of Nutrients in Two Shallow Reservoirs of the Kinnickinnic River in River Falls, Wisconsin

Shane Farrell1, Jill K. Coleman Wazik1, James E. Almendinger2

Abstract

The concentration of nutrients in surface waters can significantly affect the productivity and health of aquatic ecosystems. Understanding the processes that influence nutrient transport is essential for effective management of these systems. This study investigates the mass balance of nutrients in two shallow reservoirs located in the Kinnickinnic River basin in Wisconsin.

Introduction

The reservoirs were sampled twice a month from May to July 2014. Samples were collected from the outlet and inlet of each reservoir. Nutrient concentrations were determined using standard analytical methods. The data were analyzed to assess the nutrient balance and the impact of external loads.

Methods

Samples and water quality parameters were measured at the following sites: site 1 is the outlet of Lake George, site 2 is the outlet of Lake Louise, and site 3 is the outlet of Lake Louise. Water samples were collected using Niskin bottles and analyzed for total phosphorus, total nitrogen, and chlorophyll-a.

Results

- Total phosphorus concentrations were highest at the inlet of Lake Louise, while they were lowest at the outlet of Lake George.
- Total nitrogen concentrations were highest at the outlet of Lake Louise and Lake George, whereas they were lowest at the inlet of Lake Louise.
- Nutrient removal rates were calculated for the two reservoirs, showing significant nutrient removal in both systems.

Conclusion

The reservoirs act as nutrient sinks, effectively reducing nutrient loads to the downstream river. The efficacy of nutrient removal is influenced by the hydrological conditions and the nutrient load entering the reservoirs.

Questions

- How do sediment and nutrient levels change as they enter and exit the reservoirs?
- How does discharge affect sediment and nutrient movement in the reservoirs?
- How do sediment and nutrient levels change throughout a summer?

Acknowledgements

Funding for this study provided by an Undergraduate stipend and internships grant from the Department of Undergraduate Research, Scholars, and Creative Activity at UW-River Falls. Special thanks to Michelle Nordenup, Erin Hillig, and Erin Mortensen for their assistance.
Investigating Potential Trout Refugia in the Kinnickinnic Watershed: An Initial Survey of Water Quality in Kelly Creek
Shane Farrel, Jill K. Coleman Wasik, & Kent Johnson

Abstract

The Kinnickinnic River is an important water resource for both the River Falls community and the greater St. Croix River watershed. Spread out over 20 miles, the Kinnickinnic River has a wide range of habitat that relies on its diverse water quality. Of particular biological importance are the populations of brown trout and native Brook trout in the area that require cold water and good water quality to survive and reproduce. Designated a Coldwater Trout Stream, the Kinnickinnic River holds a naturally spawning population of trout that is an important source of food for both. A portion of its watershed is protected by a no-stake land trust. However, improper land management of unpaved roads bordering Kelly Creek and changing climate could threaten water quality in this key tributary and its potential to serve as a stable refuge for native trout populations.

Introduction

The Kinnickinnic River is an important water resource for both the River Falls community and the greater St. Croix River watershed. Spread out over 20 miles, the Kinnickinnic River has a wide range of habitat that relies on its diverse water quality. Of particular biological importance are the populations of brown trout and native Brook trout in the area that require cold water and good water quality to survive and reproduce. Designated a Coldwater Trout Stream, the Kinnickinnic River holds a naturally spawning population of trout that is an important source of food for both. A portion of its watershed is protected by a no-stake land trust. However, improper land management of unpaved roads bordering Kelly Creek and changing climate could threaten water quality in this key tributary and its potential to serve as a stable refuge for native trout populations.

Methods

Samples and water quality parameters were collected utilizing the following sites (Figure 1): from March to August.
1. Sample Site: Spring head of Kelly Creek (Figure 2).
2. Site 1: Main branch, about 500 meters downstream from the spring site. Site 1 and 2 were measured at the spring site and the sites 1 and 2. Conductivity, dissolved oxygen, and TSS levels were measured in the field. Water samples were collected and analyzed for nitrate nitrogen, total phosphorus, total suspended solids, and total suspended solids. Discharge was measured by push-pull flow meter.

Questions

- How does water quality change between the spring head of Kelly Creek, downstream reach of the creek, and the main stem of the Kinnickinnic River?
- How does water quality in Kelly Creek change in response to high discharge events such as snowfall?
- How do current levels change at Kelly Creek during snow melt?

Results

- Discharge in Kelly Creek increased by 40% following large summer storm events.
- The Spring Site temperatures were lower and more stable than downstream sites, and show a seasonal minimum in late May.
- Site 1 and 2 experience lower temperatures during snow melt and higher temperatures during storm events.
- Site 2 shows greater temperature fluctuation than site 1.
- Nitrate levels increase along a downstream gradient under baseflow conditions.
- The spring site has negligible levels of total phosphorus and total suspended solids.
- The outlet site supplies a significant portion of total phosphorus and total suspended solids measured at the downstream sites.
- Total phosphorus and total suspended solids levels were greater during peak discharge of the snowmelt event.

Conclusion

- The Spring Site supplies a constant load of nutrients to Kelly Creek, but very little total phosphorus or suspended sediments.
- The inlet site captures primarily overland flow and carries higher phosphorus and sediment loads than the local groundwater.
- Temperature over the summer is within the optimal temperature range for brook and brown trout during baseflow, but breaks the upper limit at 18°C (Mullen, 1985) during summer storm events.
- Temperature changes at the Spring Site show a delayed response to seasonal changes in air temperatures.
- Temperature variability was at Site 1 and 2 is caused by a combination of daily air temperatures, seasonal water patterns, and the average temperature of surface runoff from the watershed.

Acknowledgments

Acknowledgments for this study were provided by the University of Wisconsin-Superior, the Kinnickinnic River Land Trust, and the River Falls Chapter of Trout Unlimited.
Initial Assessment of Amphibian Use of Seasonal Pool Habitats in the Kinnickinnic Watershed

Samantha Gryzbowski

Introduction/Background/Statement of the Problem:
Wetlands are a very integral part of our ecosystems. Due to the expansion of development and agriculture we have lost and have continued to lose wetlands. Development and agriculture can also degrade remaining wetlands. Because wetlands provide many beneficial services to humans and the environment, such as filtering water and providing habitat for an array of species, it is important to monitor and assess the condition of wetlands in the landscape. One type of wetland is the seasonal pool, also termed vernal pool or ephemeral pond. These pools can be found in the Kinnickinnic watershed where they play an important role of habitat and breeding grounds for species such as frogs, salamanders, and an array of invertebrates. However, seasonal pools are not a common feature in the Kinnickinnic watershed, and the pools that are present may be threatened by and has high amounts of agricultural use in the basin. Thus it is important to make an assessment of the pools, their integrity, and density of the species that utilize them. My project will focus mainly on the amphibians that make early spring use of the pools: wood frogs, spring peepers, western chorus frog, and the American toad. Previous studies have shown that the frogs’ permeable skin makes them a good indicator species of ecosystems health and they are and early emerging species that utilize the pools upon snowmelt.

Significance of the Project
This project will be significant because it will assess the use and integrity of vernal pools in the watershed, which is information we are currently lacking. It will also help determine the health of the ecosystem and amphibian population in the area. The data collected and analyses performed in this project also have the potential to act as a stepping stone that will lead to many other research opportunities, as well as supplement ongoing ecosystem research in the basin. In addition this project is of significance to me because it is a great opportunity for me to gain experience. This type of experience would be beneficial to me personally and professionally. This is because of my passion for the environment and its inhabitants and my aspiration to a career that relates to environmental conditions and biology, hence my majors conservation and biology.

Objectives
The proposed projects goals will be aimed at answering the following:
· What is the integrity of the snow melt ponds in the watershed?
  o Do they contain pollutants? If so, what pollutants and in what amounts?
· What is the density of the amphibian populations being addressed, wood frogs, spring peepers, western chorus frog, and American toad?
· Is there a difference in the use of the snow melt pools because of its habitat location?
  o Example: Snow melt pools in a forested area compared to prairie, past farmland, etc.
The amount of canopy cover in the forested areas will also be taken into consideration.

What is an appropriate and effective way of determining where to find the snow melt pools?

Research Methods and Timeline:
The methods used for this project will be based off of successful methods that have been done by those in the field with vernal pool and amphibian experience. Such methods include site surveying every 3-4 days of representative vernal pools in the watershed. These sites will be found searching the national wetlands inventory, maps, and talking with people and organizations that are very familiar with the area such as the Kinnickinnic River Land Trust, Professor John Wheeler, and the Department of Natural Resources. A road survey will be developed in collaboration with Professor Joseph Gathman. By initially listening for frog calls from roads I will be able to identify where frogs are congregating in a large area of the watershed. Visits to these sights on private lands would be sought through contact with the Kinni River Land Trust and the owners of the property. Digital recorders have been shown to successfully make estimates of frog populations based on the imaging of recorded sound waves may be deployed to further study abundance and diversity of frog species at particular sites. Trap lines would be set up if the data gathered from the recorders was not sufficient to make an analysis. These methods would allow for a population density assessment of the wood frog, spring peeper, western chorus frog, and American toad populations.

Water samples from each site would be collected using clean collection techniques and samples will be analyzed in the Plant and Earth Science laboratories. Water samples will be analyzed for nutrients and pesticides in order to assess the chemical integrity of the pools in the watershed and identify potential impacts on the frogs and their habitats.

The timeline for the project is as follows:

- End of January until snow melt
  - Learning calls of the targeted species
  - Determining locations of possible snow melt pools
  - Once possible locations are determined:
    - details of the road survey scheme hashed out
    - the best way of getting to the pools determined
    - best and most efficient research methods finalized based on pool locations
- Snowmelt until mid-May
  - Road surveys start
  - Find the snow melt pools
  - Amphibian population data being gathered via recorders or trap lines
  - water samples collected and tested
  - analysis of data collected
· Mid-May until end of May
  o Write up and poster completion

* I estimate working about ten hours a week on this project with the majority of the hours occurring between the time frame of snowmelt and mid-May.

Dissemination Plan:
Upon the completion of research and compilation of the results in poster and paper form, the results will be presented at the St. Croix River Research Rendezvous in October 2015 first. My work will be viewed by others with interest in the area of study. Secondly I will also present at the Fall Gala of that year where members of the University of Wisconsin River Falls community can view my findings. Finally this research will be included in the database underdevelopment by the Kinni Watershed Consortium and will be made available through their proposed web portal.

Detailed Budget:

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The stipend cost will cover the hours worked per week with the most hours anticipated to be spent in the field gathering data and performing the in lab analysis. The $400 for supplies would be split among three categories. Gas used during the road survey would account for $100, $150 toward field gear in support of survey efforts, and the final $150 would be in support of supplies for lab analyses.
Appendix D. Environmental Assessment Plan

Environmental Science Major

Assessment Plan

Prepared by:
Dr. Kerry Keen, Professor of Environmental Science and Geology, current Assessment Coordinator for Environmental Science
Dr. Jill Coleman Wasik, Assistant Professor of Environmental Science
Dr. Kevyn Juneau, Assistant Professor of Environmental Science and Conservation

Version: September 14, 2016

Overview

Environmental Science was approved by the Board of Regents in March 2000 as a new major at the University of Wisconsin-River Falls. This major prepares students to become interdisciplinary scientists who understand the complexities of environmental systems and processes, and have the training to solve difficult environmental problems. Environmental scientists face increasingly complex challenges including environmental management, water quality and quantity issues, and sustainable development in the context of global change.

Environmental Science involves skills such as: designing and implementing field monitoring programs; correctly using, calibrating, and maintaining sophisticated field and laboratory instrumentation; compiling, mapping, and analyzing data; communicating results to colleagues, managers, politicians, and the public; critical thinking, planning, and follow through to effectively complete environmental projects; working successfully in teams; managing technical staff and budgets; writing complex proposals.

Environmental Science relies on technical analysis to direct actions that address environmental issues. As a discipline, Environmental Science is still evolving. It integrates chemistry, physical geosciences, biology, mapping sciences, quantitative analysis, management, and sustainability. Environmental Science is truly an interdisciplinary major that brings multi-dimensional thinking to bear on projects that preserve, remediate, enhance, and restore ecosystem functions and values. At its core, Environmental Science seeks to solve pressing problems involving how humans and nature can coexist in a mutually beneficial and sustainable manner.

Mission: Our mission is to help prepare students to be productive, creative, ethical, engaged citizens and leaders with an informed global perspective.
Coursework: The Environmental Science Major is a rigorous program that includes a firm foundation in chemistry, math, physics, and hands-on training that falls in line with the UWRF mission to prepare students to be productive, creative, ethical, and well informed, engaged leaders. The goal of this major is to provide students with the necessary foundation to pursue either a general or specialized career in the multidisciplinary field of environmental science. This goal is accomplished through a curriculum that provides a core of essential courses, as well as courses chosen to prepare the student for a specific academic area. The core coursework provides students with the skills necessary to carry projects from initial concept to completion with an emphasis placed on critical thinking and innovation. In these classes, students also develop analytical skills using modern field and laboratory instrumentation, where they can reinforce their understanding of environmental science systems. The Kinnickinnic and nearby watersheds are ideal venues and are extensively used for demonstration and class projects allowing students to work individually and in groups to evaluate real-world problems and consider possible solutions. Experimental design, project development, and proposal writing are included in many of the core classes. Elective courses allow for as broad or specific a focus as desired integrating math, chemistry, physics, geology, hydrology, atmospheric science, soil science, biology and geospatial data analysis, and courses from a variety of departments, such as Plant and Earth Science, Agricultural Engineering Technology, Biology, Chemistry, Geography, and Physics. In addition to the course work, students are encouraged to complete an optional internship to enhance the acquisition of knowledge, skills, and experience to begin a career in the environmental sciences. The program not only prepares students for careers immediately upon graduation, but the students are well prepared to enter a graduate program in Environmental Science and related disciplines. [Above shows how to enhance assessment story and help non-program members better understand the major/options/emphases.]

The United States Department of Labor’s Bureau of Labor Statistics (BLS) defines environmental scientists and specialists as those who use their knowledge of the natural sciences to protect the environment and society. Environmental scientists may spend most of their time in offices or laboratories, but they are also often involved in design and implementation of field sampling and on-going monitoring programs. According to the BLS, employment of environmental scientists and specialists is projected to grow by 11 percent from 2014 to 2024, faster than the average for all occupations, and the median annual wage for environmental scientists and specialists was $67,460 in May 2015. Heightened public interest in the hazards facing the environment, as well as the increasing demands placed on the environment by population growth, are expected to spur demand for environmental scientists and specialists.

Increased demands on the natural resources of the planet, as well as increased need for environmental protection and restoration, have created opportunities for well-trained individuals in the field. Depending on their specializations students graduating with a degree in Environmental Science can use their broad training in the physical and chemical science to

pursue employment as: Agricultural Scientists (2015 median pay $62,470; 5% growth predicted), Atmospheric Scientists including Meteorologists (2015 median pay $89,820; 9% growth predicted), Chemists or Material Scientists (2015 median pay $72,610; 3% growth predicted), Conservation Scientists and Foresters (2015 median pay $60,220; 7% growth predicted), Environmental Engineering Technicians (2015 median pay $48,650; 10% growth predicted), Geoscientists (2015 median pay $89,700; 10% growth predicted), Hydrologists (2015 median pay $79,500; 7% growth predicted), Microbiologists (2015 median pay $67,550; 4% growth predicted), Natural Sciences Managers (2015 median pay $120,160; 3% growth predicted), Occupational Health and Safety Specialists (2015 median pay $70,210; 4% growth predicted), High School Teachers (2015 median pay $57,200; 6% growth predicted), Water and Wastewater Treatment Plant and System Operators (2015 median pay $44,790; 6% growth predicted). Our graduates have found employment with consulting firms; federal, state, and local government agencies, private industry, and research laboratories.

Venn diagram illustrating the interdisciplinary field and potential career paths of students in Environmental Science.³

⁴ Quality Assurance Agency for Higher Education: www.qaa.ac.uk.
A graduate with an undergraduate degree in *Environmental Science* will be able to:

1. Analyze components, processes, and functions of Earth’s complex environmental systems
   a. Construct mental models of the components and processes of the Earth’s hydrosphere, geosphere, atmosphere, and biosphere [Rubric Section 1f]
   b. Predict how the cycling of matter and energy in Earth’s systems will respond to alteration of different system components and processes [Rubric Section 1f]

2. Evaluate the role that human actions and policies play in changing environmental systems
   a. Assess the impacts of human actions on environmental systems and processes [Rubric Section 1f]
   b. Recommend strategies, including legislation, mitigation, remediation, and protection, that can be used to reduce human impacts [Rubric Section 1f]

3. Design and implement environmental research and monitoring programs in natural and/or built environments.
   a. Formulate and test hypotheses [Rubric Section 1f]
   b. Measure and characterize environmental systems using appropriate field and laboratory instrumentation and techniques [Rubric Section 1f]
   c. Analyze and interpret environmental data in the context of the scientific literature [Rubric Section 1f]
   d. Use computer models to simulate real-world situations and predict responses in environmental systems to human and natural changes [Rubric Section 1f]

4. Assess the technical and social complexities of sustainable development [Rubric Section 1c].
   a. Examine reinforcing and balancing cycles within biophysical, economic, and social systems [Rubric Section 1f]
   b. Integrate knowledge of biophysical, economic, and social systems to discover novel ways of creating sustainable societies [Rubric Section 1f]
   c. Critique the structure and function of current economic and social systems in the context of creating sustainable societies [Rubric Section 1f]

5. Use professional skills of practicing environmental scientists [Rubric Section 1c].
   a. Interpret and synthesize ideas from the scientific literature [Rubric Section 1f]
   b. Prepare technical reports [Rubric Section 1f]
c. Present scientific concepts and the results of scientific research in written and oral form to technical and general audiences [Rubric Section 1f]
d. Correctly attribute the work and ideas of others from the scientific literature and other resources [Rubric Section 1f]
e. Report analytical and research results accurately and ethically [Rubric Section 1f]

Learning Outcomes and External Stakeholders [Rubric Section 1c]: There is no single widely-accepted organization that sets professional expectations and standards for environmental professionals. Students graduating with a degree in Environmental Science from UWRF may, after acquiring a position in the environmental field, choose to pursue certification from organizations such as:

- Academy Board of Certified Environmental Professionals
- American Academy of Environmental Engineers and Scientists
- Soil and Water Conservation Society
- National Association of Environmental Professionals
- National Registry of Environmental Professionals--Certified Environmental Scientists

The learning outcomes adopted by the Environmental Science program reflect the professional expectations established professional environmental science associations like those listed above. Some of the common requirements for certification include: a Bachelor’s degree in Environmental Science (or a related field) from an accredited institution of higher education, mastery of technical principles and knowledge, work experience and/or professional engagement in environmental science activities on a full time basis, and good moral character and high ethical integrity.

Environmental Science students doing research in classes or individually participate in regional and national conferences held by organizations such as:

- American Water Resources Association
- American Geophysical Union
- Society for Freshwater Science
- Minnesota Ground Water Association
- Minnesota Water Resources Conference
- Midwest Invasive Species Network
- Citizen Science Association
- St. Croix River Research Rendezvous
- St. Croix Summit
- UWRF Fall Gala and Spring URSCA Day

The Environmental Science Program regularly sponsors special seminars where guest speakers from academic institutions or professional environmental organizations discuss topics of concern and current research projects with our students. Seminars also provide opportunities for students to interact one-on-one with these professional environmental scientists.

As noted in the Assessment Venues section of this plan, the program also engages with professionals and organizations regarding the knowledge and skills needed to be effective environmental science professionals.
Learning Outcomes and UWRF Strategic Goals: The ability of our students and graduates to demonstrate mastery of the program’s learning outcomes supports the UWRF Strategic Goals. [Rubric Section 1d]

Distinctive Academic Excellence

The Environmental Science Major (3rd oldest amongst UW System Comprehensive institutions, but the only program within a College of Agriculture) is a dynamic, academically rigorous program demonstrating distinctive academic excellence in a number of ways. Coursework includes a firm foundation in basic sciences combined with the practical hands-on application of knowledge required to prepare students for successful careers [LO1, LO3]. Using the Kinnickinnic River and surrounding lands along with modern laboratory equipment, students develop critical, practical skills needed by environmental scientists [LO3, LO5]. Students often work in groups to monitor real-world situations and consider possible solutions [LO2, LO4]. Students are active in undergraduate research projects and presenting research at professional meetings [LO5]. An example of how our courses intertwine real-world environmental and agricultural issues is the new Explore Your Watershed (ESM 389) course, which recruits students from environmental science and crop science majors and engages them in current issues in land-use decision-making and sustainable development in the local community. Faculty members support distinctive academic excellence by obtaining professional certifications (e.g. Certified Ecologist- Ecological Society of America, Professional Geologist-Wisconsin Department of Safety and Professional Services) and being actively engaged in professional research activities that lead to publications in scientific journals and invited presentations at professional meetings [LO3, LO5]. Faculty members bring the results of these activities into the courses they teach, adding interest and relevance to course content. Coming out of this educational program our graduates are finding success in obtaining quality positions with both private and governmental sectors or attending graduate school. The content in the UWRF Environmental Science program reflects the same high caliber standards as programs in other well known four-year comprehensive universities; however, our program is unique in that it has strong ties with the agriculture programs in the College and because of the faculty’s backgrounds also emphasizes hands-on field research, laboratory experience and management, and consulting that are not highlighted in other Environmental Science programs.

Global Education and Engagement

Many environmental science problems are global in nature and solutions require global cooperation and scientific efforts. Coursework and other experiences in the Environmental Science program emphasize not only the local and regional but also the global aspects of environmental science issues and their solutions [LO2, LO4]. Many students are advised to take the course Geological Destinies of Nations, where resource utilization and environmental changes are a focus of that course. In addition, Environmental Science students are strongly encouraged to participate in Education Abroad and/or other international experiences. Faculty members are involved with the UWRF Semester Abroad: Europe (SA:E) program, where students complete independent research projects in a European country of their choice. Faculty members have served as Project Advisors for Environmental projects in Europe, and also as Group Leader for the SA:E program. A number of students have participated in other Education Abroad experiences, such as Wisconsin In Scotland and International Traveling Classroom (in Europe) [LO2]. A new course covering tropical environmental issues is actively being developed in collaboration with staff at the the Forfar
Field Station, Andros Island, Bahamas and is anticipated to be taught summer 2017. Faculty members are involved in regional, national, and international research collaborations.

Innovation and Partnerships
Our faculty are closely attuned to private firms and governmental agencies involved in the environmental field. Class projects often involve assessing impacts of actual land use changes that allow collaboration with resource management organizations and agencies. Internships are encouraged and widely available [LO5]. Faculty members have devoted considerable time doing research and building relationships within the private consulting industry in the area, as well as with government and nonprofit organizations such as the MN and WI Department of Natural Resources, MN Pollution Control Agency, Science Museum of Minnesota, National Park Service, and US Geological Survey. With the recent acquisition of new analytical equipment, the program has developed a student-driven, fee-for-analysis service for partners in land management, agricultural production, and water resource protection sectors [LO5]. This new analytical service is designed to fund equipment maintenance and provide students with professional laboratory experience and networking opportunities. Partnerships have also resulted in support for the university. Our program received donations (equivalent to approximately $45,000) of glassware, analytical equipment and instrumentation (multiparameter sondes, high performance liquid chromatography analyzer), and materials to install and sample groundwater wells. Field water-temperature monitoring probes, pressure transducers, current meters, and other field instruments have been provided (on loan) by the US Geological Survey, Summit Envirosolutions, and the St. Croix Watershed Research Station for teaching and student research projects. Environmental data sets have been obtained or provided by the City of River Falls, City of Minneapolis, St. Croix County Land & Water Conservation Department, and the Wisconsin Department of Natural Resources so students can use real-world data collected and managed by professionals in the field [LO5]. Students also learn about and perform specialized environmental analyses at nationally recognized environmental laboratories such as the St. Croix Watershed Research Station and the Limnological Research Center at the University of Minnesota.

Learning Profile [Rubric Section 2]

The knowledge, skills, and ability to apply literacy in the field of Environmental Science needed to achieve the program learning goals are developed both in and out of the classroom using both theoretical and real-world examples and experiences.
Course Assessment

Appendix A contains the course map showing the core environmental science courses and where knowledge and skills are introduced, emphasized, reinforced, and/or applied. Since there are no options within the major all students master the learning outcomes through the same core courses. As noted in Appendix A, assessment artifacts are embedded in all courses [Rubric Section 2a and 2b].

The following courses are the synthesis courses used to ensure continuous improvement in student development and reinforcement of the knowledge gained in foundation classes within the major. All outcomes are linked back to these courses and their interdependencies. These courses were identified as synthesis courses because they are either the closure course or require the use of knowledge and skills developed in other courses.

Table 1. Synthesis courses

<table>
<thead>
<tr>
<th>COURSE</th>
<th>STANDING</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESM303: Environmental Policies and Administration</td>
<td>Junior</td>
<td>This course provides in-depth analyses of natural resource and land use planning policies and their formulation at the various levels of government. The historical development and current framework of public policy are investigated and specific foundational legislation critiqued.</td>
</tr>
<tr>
<td>ESM305: Environmental Impact Assessment</td>
<td>Junior</td>
<td>Fundamentals of environmental impact assessments including basic documents, document processing, and agency and public involvement in the assessment process. Preparation of environmental impact statements, environmental assessments, phased site investigations and environmental audits are discussed. Key elements of impact analysis are presented on specific environmental topics including water resources, air quality, environmental health and safety, wildlife and wetlands.</td>
</tr>
<tr>
<td>ESM360: Applied Hydrology and Water Quality</td>
<td>Junior</td>
<td>The course is a study of the hydrologic cycle with emphasis on precipitation measurement and analysis, estimation and prediction of surface runoff, evaporation and evapotranspiration processes, and storage and movement of surface water, soil water and groundwater. Role of lakes and wetlands in the hydrologic cycle is discussed. Impact of point and nonpoint sources on surface water and ground water quality are considered.</td>
</tr>
<tr>
<td>ESM412: Chemical Fate and Transport in the Environment</td>
<td>Senior</td>
<td>The course includes study of the physical and chemical behavior of environmental contaminants, the governing principles of contaminant migration and the impacts of contaminants on major environmental media: surface waters, ground waters, soil and the atmosphere. Topics will also include primary sources of contamination as well as human health and economic impacts.</td>
</tr>
<tr>
<td>ESM413: Environmental Analysis</td>
<td>Senior</td>
<td>The course includes study of environmental pollutants, sources of contamination, health and economic impact, methods of control and remediation; Emphasis will be on water, soil and air quality sampling for organic and inorganic pollutants using established protocols for collection of legally defensible data, applicable regulations in risk evaluation, principles of project management, data analysis and reporting.</td>
</tr>
<tr>
<td>ESM485: Seminar in Resource Management</td>
<td>Senior</td>
<td>This is a writing intensive course. This course provides resource management majors the opportunities to conceive, research, organize, and communicate their</td>
</tr>
</tbody>
</table>
Out-of-Classroom Experiences

The Environmental Science program provides and facilitates a number of learning experiences outside of the classroom. The following are ongoing experiences. The actual focus of the experience may vary in content and context, but the value-added learning is consistent within each category and supports all program learning outcomes (denoted in brackets). These experiences provide students valuable opportunities to apply their knowledge, gain new knowledge, network with professionals and external stakeholders. [Rubric Section 2c]

External stakeholders, such as environmental agencies, environmental consulting firms, and other private sector firms regularly hire Environmental Science graduates from UWRF, demonstrating that they have the necessary and expected skills, foundational understanding, and extracurricular experiences that make them attractive hires. These graduates have demonstrated their abilities to be successful in these organizations by being retained and promoted. A number of our graduates have also been successful in pursuing related graduate degrees.

Competitions: Faculty in Environmental Science are involved with Science Olympiad and include students to serve as mentors and judges for the competition [LO1, LO2, LO4, LO5]. This allows the Environmental Science students to share their knowledge with and assess the work of High School students participating in the competition.

Internships: The program has developed strong professional relationships with local and regional agencies and organizations, and CAFES has a very well organized internship program. Internships in environmental science are widely available and many students majoring in Environmental Science participate in one or more internships. During these internships students gain practical experience in employment situations related to their major [LO5] and encounter the real-world complexity of environmental issues introduced in class case studies [LO2, LO4]. For example, students have recently interned with the Army Corps of Engineers, St. Croix Watershed Research Station, Wisconsin DNR, and local county and state governmental agencies. Some of these opportunities lead to full-time permanent environmental science positions.

Undergraduate Research: Opportunities for student involvement in undergraduate research are available through ongoing research efforts in water quality of the Kinnickinnic River, as well as other research interests of students and faculty members [LO1, LO2, LO3, LO5]. Environmental Science faculty have recently been awarded more than $500,000 in internal (URSCA USE, Summer Scholars, and Faculty Research
Grants) and external grants and fellowships (UW-System URDG, USDA NIFA, NSF) that provide undergraduate research experiences. Many students work with faculty during the academic year assisting with research and data analysis. Students also have the option to undertake their own research project for credit (ESM 490 Special Problems/Independent Study) or have the option to be supervised by Environmental Science faculty through the URSCA Summer Scholars program, Undergraduate Stipends & Expenses (USE) Grant, external grants, or as a volunteer. Several Environmental Science students have presented oral and poster presentations at professional scientific meetings [LO5].

**Student Assistantships:** Environmental Science students have the opportunity to serve as laboratory and field technicians, helping maintain and set up materials and instrumentation for their peers [LO5]. Some assistantships involve peer teaching and training as part of course projects and external research projects, in which sample analyses for outside partners are completed [LO1]. Students also assist faculty with course-related tasks, including data compilation, grading, and preparation of course materials [LO5].

**Student Organizations:** Environmental Science students participate with the Resource Management Club, the Environmental Corps of Sustainability, and the Student Alliance for Local and Sustainable Agriculture [LO1, LO2, LO4]. The missions of these student organizations are closely aligned with the Environmental Science Major. These active student clubs provide both professional and social opportunities for environmental science students, including advanced training (e.g., wildfire training and certification), workshop, seminar development and implementation (e.g., Climate Summit, Earth Month film and discussion series), and hold special events within the community (e.g., Kinni South Fork Clean-up day and maintain bird nest boxes with the USFWS) [LO5].
International Experience: All of our faculty strongly support global education and encourage students to participate in study abroad experience offered by UWRF. Although there is no formal requirement for students to complete an international experience, many of our students see the value in these experiences and participate in programs such as Wisconsin in Scotland, International Travelling Classroom, and Study Abroad: Europe. Environmental Science Faculty are also involved in international experiences serving as group leaders, independent project advisors, and organizers for travel courses and programs. Depending on the program and/or project students participate in, any or all of the learning outcomes [LO1-LO5] may apply.

ASSESSMENT VENUES [Rubric Section 3]

Both formative and summative assessment venues are used. As part of its formative direct assessment, the program physically and electronically maintains content knowledge exam/application performance data for each of its courses for approximately six years. Aggregate trend data from courses associated with learning outcomes are available to be included in assessment reports. [a]

1. **Assessment Venues**

The assessment artifacts presented in the subsections below are designed to assess one or more of the following learning outcomes:

1. Analyze components, processes, and functions of Earth’s complex environmental systems
2. Evaluate the role that human actions and policies play in changing environmental systems
3. Design and implement environmental research and monitoring programs in natural and/or built environments.
4. Assess the technical and social complexities of sustainable development.
5. Use professional skills of practicing environmental scientists

The learning outcomes addressed by each artifact are listed in brackets at the end of each artifact description.
Venues, as defined by the Assessment Committee, include artifacts, records, documentation; communication with students, alumni, professionals; etc. that demonstrate student learning in relationship to specific outcomes.

**Direct Assessments**

**Artifact 1 - Technical Course Performance:** The faculty members teaching each of the technical environmental science courses (ESM 105, ESM 220, ESM 303, ESM 305, ESM 360, ESM 412 and ESM 413) maintain detailed records of student performance on exams and activities. The overall course performance is tabulated and examined over time to evaluate any trends within a given course. In the year-end assessment meeting the mean and standard deviation for scores on the final examinations of each of the courses listed for the previous six semesters are distributed to environmental faculty members and discussed.

[Learning Outcomes addressed: LO1, LO2, LO3, LO4]

**Artifact 2 – Writing Assignment in Environmental Policies and Administration Course:** A two-part writing assignment in Environmental Policies and Administration (ESM 303) requires students to argue in favor of policies that they do (part 1) and do not (part 2) support. Students are required to construct basic arguments, provide evidence for their position, address potential weaknesses in their position, and predict some implications for the environment and society if their policy were adopted or declined. The assignments are evaluated using the rubric shown in Appendix B.

[Learning Outcomes addressed: LO2, LO4]

**Artifact 3 – Water Quality Monitoring Project:** In ESM 360, Applied Hydrology and Water Quality: Two-person teams, trained by a peer senior student in the correct use of field instrumentation, spend half-a-day monitoring and collecting water quality samples at 12-20 established sites (streams, detention basins, outflow pipes, and reservoirs) around the River Falls area. The data from the multiple water quality sampling events are then assembled into a Master semester data set (using Excel). Using this collaboratively-obtained dataset, students then individually prepare various types of graphs, and apply principles learned throughout the course to evaluate and interpret their graphs. During the final class session, students present their results in a “mini-poster session.” Assessment of this project (rubric in Appendix C) is based on the quality of their graphical data analysis, and written text summarizing their interpretation of results.

[Learning Outcomes addressed: LO1, LO3]

**Artifact 4 – Scientific Presentation in Senior Seminar:** Students enrolled in ESM 485, Seminar in Resource Management, are required to research the published literature on a specific conservation or environmental science topic. They present a 20-minute talk on their findings to faculty and peers in a formal presentation session. Students are evaluated using the form shown in Appendix D.

[Learning Outcomes addressed: LO2, LO5]
Artifact 5 – Standard Operating Procedure Writing Assignment in Environmental Analysis: ESM 413 is a lab-intensive course considered to be a capstone experience for students in the Environmental Science Major. Students are required to document their proficiency in using scientific instrumentation by producing a written standard operating procedure (SOP) with supporting video. Students produce a stepwise document that guides a new user through the start-up, calibration, and operation of an instrument. Students are also asked to include information for troubleshooting common problems that they encounter. Students turn in individual SOPs as well as final group SOPs. The rubric used to evaluate draft and final documents is provided in Appendix E.

[Learning Outcomes addressed: LO3, LO5]

Artifact 6 – Writing Assignment in Environmental Sustainability: Students in ESM 220, Environmental Sustainability, are required to complete a writing assignment and poster for display in which they address both the technical and social aspects of an issue related to sustainability. All students display their posters during the last week of class and are asked to give each other anonymous feedback on poster evaluation forms. The two pieces of the assignment are evaluated by the instructor using the rubrics given in Appendix F.

[Learning Outcomes addressed: LO1, LO2, LO4]

Artifact 7 – Out-of-Classroom Experience Documentation: Digital versions of posters, presentations, reports, and publications that students produce during out of classroom experiences such as Semester Abroad Europe, Internships, and Undergraduate Research are collected by faculty advising students in those experiences. Records of student awards are also maintained. The content and context of those documents vary according to the experience and therefore may correlate with different program learning outcomes.

Indirect Assessment [Section 3 d, e, and f]
The program obtains feedback on the relevance of our curriculum, the appropriateness of our learning outcomes, and the effectiveness of our learning experiences from both internal and external stakeholders. To obtain the feedback, the program uses the following:

Student Course Satisfaction Survey: Faculty members teaching environmental science courses use the standard university course evaluation form to get feedback from students within a specific technical course. The survey is given every third semester at a minimum (Appendix G).

Graduating Student Exit Survey: Each year the graduating students complete an annual survey to examine how students perceive their learning in the environmental science program and how courses have helped them to meet their needs. Their perceptions of each learning outcome are evaluated on a six point scale (Appendix H).
Alumni Survey: Every six years, the program sends out an electronic survey to students who have graduated in the past 5 years. The survey asks about the relevance and effectiveness of the program’s curriculum in preparing them for their professional career. The survey also provides opportunities for alumni to make suggestions and recommendation regarding program curriculum and structure. A copy of the Alumni Survey is included in Appendix I.

Feedback from Environmental Professionals
Environmental Science faculty use indirect professional stakeholder feedback to inform learning outcomes, improve courses, and design out-of-classroom experiences via talking with colleagues by phone, through email, and at professional meetings, workshops, and seminars. Discussions commonly address trends and issues in the environmental science field, providing faculty with better understanding of how our students can be best prepared for their future careers. A list of professional organizations and employers with whom our faculty communicate regularly will be provided as an appendix to the Assessment Report.

PROCESS FOR ASSESSMENT [Rubric Section 4]

Accreditation: There is currently no environmental science higher education accreditation program in the United States. [Rubric Section 4g]

Program Stakeholders: The primary stakeholders for the Environmental Science program are: students enrolled in the program, Department Faculty, and College of Agriculture, Food, and Environmental Science. [Rubric Section 4b]

Secondary stakeholders for the Environmental Science program include environmental consulting companies, businesses who directly employ our graduates in their environmental regulatory or sustainability departments, environmental and natural resource management agencies at local, county, regional, state, and federal levels, environmental research organizations, such as the St. Croix Watershed Research Station and the U.S. Geological Survey, graduate programs in environmental science and related fields, and more broadly, communities and citizens who require access to clean water, productive soils, forests, clean air, and ecosystems. [Rubric Section 4b]

The Assessment Plan and Assessment Report are available to all UWRF faculty and administrators on the University server (T:\Campus\CAFES\Plant and Earth Science\Assessment Plans and PP&PAR\Program Prioritization and Program Audit and Review). Assessment plans, reports, and summaries of key findings are available to external stakeholders and students upon request. [Rubric Section 4e]
Learning Outcome Assessment and Accountability: Each learning outcome is assessed on an annual basis as shown on Table 2. Data/artifacts are collected by the faculty member responsible for teaching the course. Numeric and rubric data are maintained by each faculty member in physical (as hardcopies) and electronic formats (e.g., in Excel spreadsheets or D2L files) for at least 6 years [Rubric Section 4a and c]. Please see artifact descriptions in Section 3 above for the specific learning outcomes addressed in each course.

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze components, processes, and functions of Earth’s complex environmental systems</td>
<td>Artifact 1, 3, 5</td>
<td>Artifact 1, 3, 6</td>
<td></td>
</tr>
<tr>
<td>Evaluate the role that human actions and policies play in changing environmental systems</td>
<td>Artifact 1, 2, 4, 6</td>
<td>Artifact 1, 4, 6</td>
<td></td>
</tr>
<tr>
<td>Design and implement environmental research and monitoring programs in natural and/or built environments.</td>
<td>Artifact 1, 3</td>
<td>Artifact 1, 3, 5</td>
<td></td>
</tr>
<tr>
<td>Assess the technical and social complexities of sustainable development.</td>
<td>Artifact 1, 2, 6</td>
<td>Artifact 1, 6</td>
<td></td>
</tr>
<tr>
<td>Use professional skills of practicing environmental scientists</td>
<td>Artifact 1, 4</td>
<td>Artifact 1, 4, 5</td>
<td></td>
</tr>
</tbody>
</table>

*Note Artifact 7 occurs on an irregular basis depending on when students participate in assessed, out-of-classroom experiences.

Assessment Cycle and Accountability: The Environmental Science program uses a three-year assessment cycle (year=academic calendar year). For this assessment cycle, an Assessment Plan and Assessment Report are submitted to the UWRF Assessment Committee. All Environmental Science faculty members participate in the assessment process and preparation of the Assessment Report; the program assessment coordinator is responsible for submitting reports, communicating with the Assessment Committee, and updating the environmental science faculty with important assessment information. [Rubric Section 4b] Additionally, every 6 years the Program is Audited by the Program Audit Review Committee. Internal and external stakeholders described above inform the assessment plan/process via feedback in the form of surveys, discussions, etc. as described in Section 3 above.

Assessment Discussion and Review: At the end of each academic year (in May), the environmental science program assessment coordinator organizes and facilitates an assessment meeting [Rubric Section 4b]. The meeting has four major components:

a.) Review and Discussion- review data and artifacts for each of the learning outcomes; discuss issues and concerns supported by the data; share insights, concerns, and course specific happenings; document findings. Each faculty member is responsible for analyzing/aggregating assessment data for artifacts collected in their classes and reporting
those data at the annual meeting. Each faculty member is responsible for making recommendations to improve assessment artifacts and student performance based on their data. The assessment coordinator collects data from each faculty member and maintains electronic copies of the data on the T:\ drive. Review of out-of-classroom experiences occurs on an ongoing/as-needed basis. A summary report will be produced by the Program Assessment Coordinator by the October 1 of the next academic year that aggregates all of the artifact data assembled by individual faculty and includes annual meeting minutes covering data review, opportunities, and action plans as described below. [Rubric Section 4c]

b.) Opportunities- based on the data aggregation and review faculty members discuss potential opportunities to improve the program and students’ learning through revision of existing and/or development of new courses, revision of learning outcomes, expansion of out-of-classroom opportunities for environmental science majors. Faculty maintain meeting minutes and other documentation (e.g., spreadsheets) on their computers. Documentation of anything (e.g., new courses, revised outcomes, expanded out-of-classroom opportunities) that moves forward into formal development is maintained on the T:\ drive. [Rubric Section 4c]

c.) Action Plan- based on opportunities identified, the program assessment coordinator delegates faculty to further research and/or implement potential changes. Depending on the nature of the item, the program coordinator determines an appropriate timeline and schedule to meet for follow-up discussion and review. An action plan summary table will be prepared (Table 3). The action plan will document the action that needs to be taken (e.g., artifact change, curriculum revision, rubric revision, process/learning outcome change) and designate the person responsible for the action, date to be completed, and what review/follow up will occur and when. [Rubric Section 4c]

d.) Documentation- the program assessment coordinator documents the above items and communicates necessary findings, issues, or action plan items with the Department of Plant and Earth Science Chair. [Rubric Section 4c]

<table>
<thead>
<tr>
<th>Table 3. Action Plan Summary Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action to be taken</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Assessment related material is stored electronically on the T:\ drive. All Environmental Science faculty can access the drive. The structure of T:\ Drive follows: [e]

- T:\CAFES\Plant and Earth Science\ESM\Environmental Science Major
  - Plan
  - Documentation from Annual Assessment Meetings
  - Action Plans and Opportunities documentation
  - 3-year cycle Assessment Reports
Assessment documentation is available to external stakeholders upon request from the program assessment coordinator so that any confidential/sensitive data may be removed. Contact information for the program assessment coordinator and means for obtaining assessment data is on the Environmental Science program webpage, which is accessible to any external stakeholder. [Rubric Section 4e]

**Appendix A - Course Map** [Rubric Section 3a and 3b]

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>ESM 105</th>
<th>ESM 220</th>
<th>ESM 303</th>
<th>ESM 305</th>
<th>ESM 360</th>
<th>ESM 412</th>
<th>ESM 413</th>
<th>ESM 485</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Analyze components, processes, and functions of Earth’s complex environmental systems</td>
<td>I</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>E/A</td>
<td>E/A</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>2. Evaluate the role that human actions and policies play in changing environmental systems.</td>
<td>I/E</td>
<td>E</td>
<td>E/A</td>
<td>A</td>
<td>R</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>3. Design and implement environmental research and monitoring programs in natural and/or built environments.</td>
<td>I</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>E/A</td>
<td>E/A</td>
<td>E/A</td>
<td>R</td>
</tr>
<tr>
<td>4. Assess the technical and social complexities of sustainable development.</td>
<td>I/E</td>
<td>E/A</td>
<td>E</td>
<td>A</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>5. Use professional skills of practicing environmental scientists.</td>
<td>I</td>
<td>R</td>
<td>R</td>
<td>A</td>
<td>E</td>
<td>R</td>
<td>E/A</td>
<td>A</td>
</tr>
</tbody>
</table>

5 Artifacts are physically and/or electronically archived for approximately six years and evaluated by faculty members for formative or summative assessment of the learning outcomes. Artifacts are also used to assess individual student performance when writing letters of support and providing recommendations.
I = introduce, R = reinforce, E = emphasize, A = apply

Definitions:
Introduce: Concepts, terminology, questions, activities, etc. related to that specific learning outcome are first encountered, considered, explored as a part of that specific class.
Reinforce: Concepts, terminology, questions, activities, etc. related to that specific learning outcome are encountered and considered at least occasionally as part of that specific class.
Emphasize: Concepts, terminology, questions, activities, etc. related to that specific learning outcome are regularly discussed, considered, explored, analyzed, etc. as a key component of that specific class.
Apply: Concepts, terminology, questions, activities, projects, etc. related to that specific learning outcome are utilized, developed, critically evaluated, debated, applied to problem solving, analyzed, etc. as a key component of that specific class.

APPENDIX B
Environmental Policies and Administration (ESM 303)

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Level 4</th>
<th>Level 3</th>
<th>Level 2</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic argument</td>
<td>Author provides a clear and thorough explanation of basic argument in the essay and demonstrates why readers should support their policy.</td>
<td>Author generally provides a good explanation of basic argument in the essay and demonstrates why readers should support their policy.</td>
<td>Author's basic argument is decipherable, but may not be clearly stated in the essay. Reader may not be convinced why policy should be supported.</td>
<td>Author's basic argument may not be clear and is not be clearly stated in the essay.</td>
</tr>
<tr>
<td>Propositions and evidence</td>
<td>The author provides clear and ample evidence why policy is needed. Evidence is supported by references and well-reasoned ideas.</td>
<td>The author provides good evidence why policy is needed. Evidence is usually supported by references and well-reasoned ideas. Some details may not be clear or provided.</td>
<td>The author provides some evidence why policy is needed. Evidence is not usually supported by references and/or reasoning may not be entirely clear. Some details may not be clear.</td>
<td>The author does not provide much evidence for why policy is needed. Evidence is not usually supported by references and/or reasoning may not be entirely clear. Some details may not be clear.</td>
</tr>
<tr>
<td><strong>Implications</strong></td>
<td>Author describes how their policy could be implemented and provides thoughtful discussion about what kinds of social and environmental issues may arise with implementation/enforcement.</td>
<td>Author describes how their policy could be implemented and provides good discussion about what kinds of social and environmental issues may arise with implementation/enforcement. Some details may not be clear or discussed.</td>
<td>Author may generally describe how a policy could be implemented, but may not be very specific. Some discussion about what kinds of issues social and environmental may arise with implementation/enforcement, but many details may not be included.</td>
<td>Author may gloss over how their policy could be implemented. Little discussion about what kinds of social and environmental issues may arise with implementation/enforcement, and many details may not be included.</td>
</tr>
<tr>
<td><strong>Spelling and grammar</strong></td>
<td>Spelling and grammar are very good. Author makes one or two errors at most. Sentences are of appropriate length and of varied structure.</td>
<td>Spelling and grammar are good. Author makes a few errors here and there, but meaning is still clear. Sentences are usually of appropriate length and well structured.</td>
<td>Spelling and grammar are decent. Author makes several errors which may hinder meaning. Sentences are not always of appropriate length or may all be structured the same way.</td>
<td>Spelling and grammar need some work. Author makes many errors and thoughts are often not clear as a result. Sentences are not well structured or of appropriate length.</td>
</tr>
</tbody>
</table>
### APPENDIX C

**Water Quality Monitoring Rubric**

**Assessment Rubric:** To analyze, evaluate, and interpret results.

**Student Name:**

**Course Name/Number:** Hydrology & Water Quality - ESM 360

**Date:**

**Topic/Title:**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Mastery</th>
<th>Proficiency</th>
<th>Competence</th>
<th>Novice</th>
<th>Inexperienced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly construct several types of graphs that are appropriate for the data. Student graphs are prepared for the three correct categories. The data axes and choice of variables are appropriate.</td>
<td>Each type of graph is constructed correctly, with intentional, useful, and logical choices of variables. Graphs include all key elements and features, e.g., legend, trend lines. Axes use correct values, units and intervals, and best type of axis, e.g., arithmetic or logarithmic. Dependent and independent variables are plotted on correct axes.</td>
<td>Graph types are correct and variable choices make sense. Graphs include nearly all key elements. Axes use correct values and choice of axes scale is reasonable. Dependent and independent variables are correct.</td>
<td>Graph types are generally correct. One graph may have an unusual choice of variables plotted, or graphs may have minor flaws. Graphs have most key elements, but may not include some optional features. One or two axes have minor errors.</td>
<td>One type of graph is not correct for a given category. One or two graphs have obvious flaws. Graphs are missing one or two key elements. One or two axes are problematic, with serious errors in intervals, data ranges, scales. One graph has an incorrect use of dependent variables/axes.</td>
<td>Each type of graph has some obvious flaw(s), incorrect graph types are presented in one or more graph categories. Graphs are missing several items: e.g., legends or key elements/features. Axes are problematic, with incorrect intervals, data ranges, and scales (i.e., arithmetic vs. logarithmic). Choice of variables (dependent vs. independent) is confused in more than one graph.</td>
</tr>
</tbody>
</table>

| Graphics are aesthetically pleasing, informative, and professional | Graphs are very well laid out, with appropriate sizes of text, bold is used appropriately. Lines, text, and colors all enhance the meaning of the graph. Graphs are pleasing and easy to read at a glance. A clear, succinct design is the goal. The graph title is correct, clear, and concise. Accompanying interpretative text uses bullet points or other text styles/colors that clearly enhance meaning. | Graphs are well laid out, with clear elements. Graph title is clear and accurate, but could be improved via rewording. Accompanying text is well designed. | Graphs are designed fairly well, and nearly all elements are easy to read and distinguish from one another. Graphs look OK. Graph title is acceptable, but could be improved. Accompanying text is readable, clear, and layout is acceptable. | Graph design is barely acceptable. Graph title is unappealing. Accompanying text is difficult to follow, with confusing aspects of its layout. | Graphs are poorly designed, with out-of-proportion text, elements rather hard to read, or difficult to distinguish. Graphs are aesthetically poor. Graph title doesn't match what is plotted. Accompanying text is confusing, it may have no bullets; overall organization or content is unclear. |

| Analysis of plotted data, and its interpretation is sound, and is well stated. Analysis of trends, characteristics, relationships observed in data is well described. Interpretation is consistent with graphed data. Interpretation is clear and concise. | Analysis of trends or characteristics of the plotted data is precise, concise, and very clear. Interpretation follows logically from data, and graphs. It is consistent with the plotted data. Interpretation is very clear, concise, and well stated. Interpretation considers other cited references, comparison with other results. Interpretation places the results in broad context of results from other key studies. | Analysis of the plotted data is clear and accurate. Interpretaitions are generally sound, although one or two points are not fully developed or are not as well tied to the data. Interpretation is clear, and fairly well stated. Interpretation makes connection to results from other studies, and mentions at least one other reference. | Analysis of the data is fairly well done, includes most key aspects. Most interpretations are reasonable, although some points are partly developed, and some may be questionable. Interpretation is mostly clear. It includes at least one solid comparison with results from other studies. | Analysis of the data is present but incomplete. Interpretations are fair, at least one or two correlate to a degree with the plotted data. Some interpretations are clear, but others are confusing. Minimal consideration of other ideas or studies. | Analysis of the data is missing, extremely brief, or very weak inaccurate. Interpretations are poor, unsupported by the data. Interpretations are unclear, confusing. Do not consider at all other ideas or studies. |

### APPENDIX D

**Faculty Evaluation of Senior Seminar Presentations**

ESM 485 – SEMINAR IN RESOURCE MANAGEMENT - STUDENT PRESENTATIONS
Student _________________________________   Reviewer _________________________________

---

**Topic Statement:**

A. **Information Content and Adequacy of Research** (Focus on Topic Statement, Adequacy of Topic Coverage, Source Credibility and Timeliness, Data Relevance, Data Interpretation and Assessment, Use of Citations)

Rating (1-10, with 10 = Excellence or Mastery): ______  ______

Strengths: ___________________________________________________________

Weaknesses: __________________________________________________________

Comments: __________________________________________________________

---

B. **Multidisciplinary Approach/Critical Thinking** (Breadth of Coverage, Diversity of Disciplines, Linkage to “Big Picture”)

Rating (1-10, with 10 = Excellence or Mastery): ______  ______

Strengths: ___________________________________________________________

Weaknesses: __________________________________________________________

Comments: __________________________________________________________

---

C. **Professionalism** (Control of Setting, Confidence, Grammar, Timing, Appearance)

Rating (1-10, with 10 = Excellence or Mastery): ______  ______

Strengths: ___________________________________________________________

Weaknesses: __________________________________________________________

Comments: __________________________________________________________
D. Overall Presentation Effectiveness (General Impact)

Rating (1-10, with 10 = Excellence or Mastery): ______  ______

Strengths:  __________________________________________

Weaknesses:  __________________________________________

Comments:  __________________________________________
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Level 4</th>
<th>Level 3</th>
<th>Level 2</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructions</td>
<td>Very detailed instructions. New user is guided step-by-step through each portion of instrument start-up and use. No major gaps in instructions. Format is clear and well organized.</td>
<td>Detailed instructions. New user is generally guided step-by-step through each portion of instrument start-up and use. May be one or two gaps in instructions. Format is generally clear and well organized.</td>
<td>Instructions generally detailed, but may be missing a few steps here and there. New user is usually guided step-by-step through each portion of instrument start-up and use, but a few gaps exist in the instructions. Format is sometimes clear and well organized, sometimes a little unclear.</td>
<td>Instructions generally not detailed enough to guide a new user through each portion of instrument start-up and use. Some gaps exist in the instructions. Format is sometimes unclear and not always well organized</td>
</tr>
<tr>
<td>Instrument start up</td>
<td>Clear description of start up procedures. Tips and important settings described for new users.</td>
<td>Generally clear description of start up procedures. Tips and important settings described for new users. Could maybe use one or two extra details to make start up procedures clearer.</td>
<td>Description of start up procedures provided, could be more thorough. Some tips and important settings described for new users, but more information could be provided.</td>
<td>Description of start up procedures provided, needs to be more thorough. Few tips or important settings described for new users, more information should be provided.</td>
</tr>
<tr>
<td>Calibration standards</td>
<td>Instructions for creating standards clearly described. Information about chemical used to create standards, any stock solutions, and working standards included.</td>
<td>Instructions for creating standards described. Information about chemical used to create standards, any stock solutions, and working standards included, but may be missing a detail or two.</td>
<td>Instructions for creating some standards described. Somewhat limited information about chemical used to create standards, any stock solutions, and working standards included, but may be missing a detail or two.</td>
<td>Instructions for creating standards described, but may be missing info about chemical to use, stock solutions, and/or some of the working standard instructions.</td>
</tr>
<tr>
<td>Calibration procedure</td>
<td>Thorough description of calibration procedure for instrument. Clear and logical order to instructions.</td>
<td>Good description of calibration procedure for instrument. Clear and logical order to instructions. Could include a few more details for further clarity.</td>
<td>Decent description of calibration procedure for instrument. Mostly clear and logical order to instructions. Could include a more details for further clarity.</td>
<td>Description of instrument calibration needs more detail to guide new users through procedure. Could include a more details for further clarity.</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Troubleshooting Information</td>
<td>Very useful troubleshooting tips included to help new users navigate most common instrument issues. Author demonstrates a thorough understanding of the instrument.</td>
<td>Some useful troubleshooting tips included to help new users navigate most common instrument issues. Author demonstrates a good understanding of the instrument, but may have missed a detail or two.</td>
<td>A few useful troubleshooting tips included to help new users navigate most common instrument issues. Author demonstrates a some understanding of the instrument, but may have missed some details.</td>
<td>Few troubleshooting tips included to help new users navigate most common instrument issues. Author may not demonstrate a good understanding of the instrument, and may have missed some details.</td>
</tr>
<tr>
<td>Extra tips</td>
<td>A lot of valuable extra information included in SOP--safety, PPE, crucial solutions, handy tips, etc...</td>
<td>Some valuable extra information included in SOP--safety, PPE, crucial solutions, handy tips, etc...</td>
<td>A few pieces of valuable extra information included in SOP--safety, PPE, crucial solutions, handy tips, etc...</td>
<td>Little extra information included in SOP--safety, PPE, crucial solutions, handy tips, etc...</td>
</tr>
<tr>
<td>Spelling and Grammar</td>
<td>Excellent spelling and grammar. Language is clear and concise. One or two mistakes at most.</td>
<td>Spelling and grammar is very good. A couple issues here and there with spelling and/or sentence structure, but meaning is almost always clear.</td>
<td>Spelling and grammar is good, but some general issues with misspelling words and/or sentence structure throughout. Meaning is usually clear, but not always.</td>
<td>Spelling and grammar are okay. General issues with misspelling words and/or sentence structure throughout. Meaning is not always clear to reader.</td>
</tr>
</tbody>
</table>
# Poster Rubric

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Level 4</th>
<th>Level 3</th>
<th>Level 2</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sustainability Issue Stated</strong></td>
<td>Proposal clearly identifies the larger sustainability issue that the project addresses and discusses some impacts on campus.</td>
<td>Proposal identifies the larger sustainability issue that the project addresses.</td>
<td>Reader has to determine the sustainability issue that the project addresses because the issue is not clearly stated.</td>
<td>The larger sustainability issue is not clearly stated.</td>
</tr>
<tr>
<td><strong>Project Purpose</strong></td>
<td>Clear statement or illustration of how this specific project will impact some part of a larger sustainability issue. Identifies a specific point in the larger system that is impacted.</td>
<td>Good statement or illustration of how this specific project will impact some part of a larger sustainability issue.</td>
<td>Reader has to figure out how this project will impact a larger sustainability issue because there is no clear statement or illustration provided.</td>
<td>The project does not address a sustainability issue.</td>
</tr>
<tr>
<td><strong>Project Details</strong></td>
<td>Proposal provides enough detail so that reader understands how the project will be carried out, by whom, and what other resources might be necessary. Well thought out plan.</td>
<td>Proposal provides some detail so that reader generally understands how the project will be carried out, by whom, and what other resources might be necessary.</td>
<td>Proposal provides some detail but the reader may not understand how the project will be carried out, or by whom, or what other resources might be necessary. Some details missing.</td>
<td>Reader has difficulty understanding how the project will be carried out, or by whom, or what other resources might be necessary. Many details missing.</td>
</tr>
<tr>
<td><strong>Idea Promotion</strong></td>
<td>Proposal does an excellent job of selling the project. Convincing argument made with supporting evidence. Any weaknesses/</td>
<td>Proposal does a good job of selling the project. Fairly convincing argument made with some supporting evidence. May not have addressed</td>
<td>Proposal does a fair job of selling the project. Convincing argument made, but may not have adequate supporting evidence. May not</td>
<td>Proposal does does not really sell the project. Convincing argument not really made, and may not have any evidence. May not have addressed potential</td>
</tr>
<tr>
<td>Criteria</td>
<td>Level 4</td>
<td>Level 3</td>
<td>Level 2</td>
<td>Level 1</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Sustainability Issue Stated</strong></td>
<td>Proposal clearly identifies the larger sustainability issue that the project addresses and discusses some impacts on campus.</td>
<td>Proposal identifies the larger sustainability issue that the project addresses.</td>
<td>Reader has to determine the sustainability issue that the project addresses because the issue is not clearly stated.</td>
<td>The larger sustainability issue is not clearly stated.</td>
</tr>
<tr>
<td><strong>Project Purpose and Need</strong></td>
<td>Clear statement or illustration of how this specific project will impact some part of a larger sustainability issue. Identifies a specific point in the larger system that is impacted.</td>
<td>Good statement or illustration of how this specific project will impact some part of a larger sustainability issue.</td>
<td>Reader has to figure out how this project will impact a larger sustainability issue because there is no clear statement or illustration provided.</td>
<td>The project does not address a sustainability issue.</td>
</tr>
<tr>
<td><strong>Project Overview/Details</strong></td>
<td>Proposal provides enough detail so that reader understands how the project will be carried out, by whom, and what other resources might be necessary. Well thought out plan.</td>
<td>Proposal provides some detail so that reader generally understands how the project will be carried out, by whom, and what other</td>
<td>Proposal provides some detail but the reader may not understand how the project will be carried out, or by whom, or what other</td>
<td>It is not clear how the project will be carried out, or by whom, or what other resources might be necessary. Many details missing.</td>
</tr>
<tr>
<td></td>
<td>Resources might be necessary.</td>
<td>Resources might be necessary. Some details missing.</td>
<td>Proposal does not really sell the project. Convincing argument not really made, and may not have any evidence. May not have addressed potential weaknesses/alternatives.</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>---------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Project Self-Assessment</td>
<td>Proposal does an excellent job of selling the project. Convincing argument made with supporting evidence. Any weaknesses/alternatives are addressed.</td>
<td>Proposal does a good job of selling the project. Fairly convincing argument made with some supporting evidence. May not have addressed potential weaknesses/alternatives.</td>
<td>Proposal does a fair job of selling the project. Convincing argument made, but may not have adequate supporting evidence. May not have addressed potential weaknesses/alternatives.</td>
<td></td>
</tr>
<tr>
<td>Spelling and Grammar</td>
<td>Up to three spelling or grammar errors.</td>
<td>More than 3 spelling or grammar errors, but meaning is still clear.</td>
<td>Meaning is occasionally impacted by spelling and grammar mistakes.</td>
<td></td>
</tr>
<tr>
<td>Timeline and Budget</td>
<td>Timeline and budget provided and are realistic given the scope of the project described.</td>
<td>Timeline and budget provided. Generally realistic given the scope of the project described, but may be a little vague.</td>
<td>Timeline or budget provided, but not both.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Timeline and budget not provided.</td>
<td></td>
</tr>
</tbody>
</table>
1. The instructor displayed thorough knowledge about the material being taught.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

1. The instructor treated me fairly and with respect.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

1. The objectives/learning outcomes for the course were clear.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

1. I felt comfortable asking questions and/or expressing opinions.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

1. The instructor was available for meeting and consultations.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

1. The required tests, quizzes, projects, papers, reports, and other activities allowed me to demonstrate my learning.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

1. The instructor provided effective and timely feedback regarding exams, quizzes, and other assignments.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Disagree Strongly</th>
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1. Course concepts were presented in ways that helped my learning.
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<tr>
<th>Strongly Agree</th>
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APPENDIX H

Graduating Environmental Science Student Exit Survey:

Learning Outcome #1
1. Analyze components, processes, and functions of Earth’s complex environmental systems.

   How do you rate your education here with respect to this learning outcome?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
<th>Slightly Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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   Comments and Suggestions for Improvement

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Learning Outcome #2

2. Evaluate the role that human actions and policies play in changing environmental systems.

   How do you rate your education here with respect to this learning outcome?

<table>
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<th>Strongly Agree</th>
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<th>Slightly Agree</th>
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   Comments and Suggestions for Improvement

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Learning Outcome #3

3. Design and implement environmental research and monitoring programs in natural and/or built environments.

How do you rate your education here with respect to this learning outcome?

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<th>Slightly Disagree</th>
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Comments and Suggestions for Improvement

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Learning Outcome #4

4. Assess the technical and social complexities of sustainable development.

How do you rate your education here with respect to this learning outcome?

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Comments and Suggestions for Improvement

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Learning Outcome #5

5. Use professional skills of practicing environmental scientists.

How do you rate your education here with respect to this learning outcome?

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<th>Strongly Agree</th>
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Comments and Suggestions for Improvement
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Semester and Year __________________

Thank you for your participation in completing this survey. This information will be used to evaluate the program and to make appropriate changes, where necessary.
Environmental Science is the study of the natural environment, integrating the sciences with knowledge of our impacts on the planet and a desire to solve environmental problems. This interdisciplinary major is designed to prepare students to face increasingly complex challenges in the context of environmental quality management and sustainable development. Increased demands on the natural resources of the planet, as well as increased need for environmental protection and restoration, have created opportunities for well-trained individuals in the field.

The major integrates math, chemistry, physics, geology, hydrology, atmospheric science, soil science, biology, and geospatial data analysis, and includes courses from a variety of departments, such as Plant and Earth Science, Agricultural Engineering Technology, Biology, Chemistry, and Geography and GIS.

Environmental Science majors are prepared to monitor, model, and manage environmental systems in the areas of environmental quality and risk evaluation, sampling and analysis, remediation, research and regulatory compliance.

Why major in Environmental Science?

- Flexible program requirements allow you to specialize in a particular area of interest.
- Our program focuses on practical field and lab-oriented experiences at our on-campus trout stream, research well fields, campus farms and nearby natural environmental systems—The Rockefeller and St. Croix watersheds.
- Our internship program exposes you to your professional field while still in college with internships in both Wisconsin and Minnesota.
- Support faculty help you engage in active learning experiences, individual and group research projects, and extracurricular activities.

Contact Us

Plant and Earth Science
exactfacts@uwrf.edu
715-425-3346

UWRF Campus Map

APPENDIX J
Environmental Science Career Opportunities Web Resource
Environmental Science

Career Opportunities

Environmental Science graduates from UW-River Falls often pursue careers in environmental consulting, regulatory agencies or corporations. Or, they may choose field-oriented positions in pollution monitoring and remediation including air, water and soil quality assessment and remediation.

Environmental scientists also control and minimize the impacts of technology and waste on the environment. Graduates may choose specialized positions in environmental policy, environmental risk assessment, ecological assessment or computer modeling.

Corporations and government agencies require environmental science graduates to ensure compliance with applicable law and regulations intended to preserve the environment. Students with environmental research interests are also prepared to pursue advanced degrees.

You can use the links on the right to find areas of work related to environmental science and to locate job vacancies.

Contact Us
Plant and Earth Science
pae@uwrf.edu
715-425-2246
174 Agricultural Science
615 2nd St.