

Environmental Studies Program Review



Portland Community College 2015

Prepared by:

Valance Brenneis – SAC Chair

April Ann Fong

Betsy Julian

Kevin Lien

Alexie McNerthney

Taryn Oakley

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1. Program/Discipline Overview

A. *What are the educational goals or objectives of this program/discipline?*

The overarching goal of the Environmental Studies (ESR) program at Portland Community College (PCC) is to prepare environmentally literate students who make informed, evidence-based decisions about the environmental issues affecting their communities. The fields of environmental studies and science are interdisciplinary, integrating the sciences with the study of human society, law and policy in order to address our most pressing environmental issues. The Environmental Studies program prepares students to pursue degrees in both environmental science and environmental studies. Environmental science is a field that integrates biological and physical science and uses scientific practices to investigate environmental systems, problems and solutions. Environmental studies is a field that investigates coupled human-natural systems, requiring an understanding of environmental processes as well as social systems including law, policy, sociology, economics, planning and natural resource management.

The goals of the Environmental Studies program are well aligned with the PCC strategic plan. We offer **outstanding and affordable environmental studies and science education** through small, hands-on courses that **drive student success** and **promote sustainability**, through an emphasis on real-world problem solving and skill-building. Environmental Studies faculty and students are actively engaged in outreach to the community. ESR faculty at the Rock Creek campus have developed and led workshops for Latina girls through the Adelante Chicas STEM summer camp and the Hermanas conference. ESR faculty and students at all campuses partner with local governments, schools and non-profits to complete community-based learning projects. These outreach activities align with PCC's goal of **transforming the community through opportunity** and is part of our effort to **lead in diversity**. Environmental Studies faculty and students are engaged in authentic research, environmental restoration and stewardship through partnerships with local agencies including Clean Water Services (CWS) and SOLVE, and through participation in innovative programs such as the Community College Undergraduate Research Initiative (CCURI). Engaging in the practice of science through a variety of projects and partnerships contributes to the goal of **fostering a culture of innovation** in the environmental sciences at PCC.



Figure 1. ESR 204 students learn about a streambank restoration project along Gales Creek.

In all ESR courses, our goals are to:

- Introduce students to the interdisciplinary nature of environmental studies and science, specifically the integration of science and society.
- Provide opportunities for students to develop hands-on experience through a variety of activities including scientific fieldwork, habitat restoration, and community-based learning partnerships.
- Increase awareness of global, regional and local environmental issues and engage students in problem solving at the personal level and beyond.
- Improve students' ability to express information and ideas clearly and effectively through oral and written communication.

For our majors sequence (ESR 150, ESR 160, ESR 201, ESR 202), our goals are to:

- Prepare lower division collegiate transfer students to successfully pursue environmental science or environmental studies degrees at a 4-year university through our sequence of rigorous, quantitative and writing-intensive field and lab-based courses.
- Develop critical thinking, problem solving, and communication skills by engaging students in scientific practices including observation, hypothesis generation, data collection and analysis, and written, graphical and oral communication of results.
- Develop cultural awareness and self-reflection in regards to global environmental issues using a case-study approach to understand law, policy and the positions of various stakeholders.



Figure 2. ESR students get hands-on experience collecting invertebrates in the field, building hydroponic systems in the greenhouse, and testing for nutrient levels in water.

For our non-majors courses, our goals are to:

- Provide opportunities for all students at PCC to learn about and engage in environmental science, while earning general education lab science credits (ESR 171, ESR 172, ESR 173).
- Provide opportunities for all students at PCC to increase their understanding and engagement in sustainability at multiple scales (ESR 140, ESR 141, ESR 171).

Please see Appendix A for a full list of our courses.

How do these compare with national or professional program/discipline trends or guidelines?

Nationally, the number of academic interdisciplinary environmental and sustainability (IES) programs has increased in the last decade¹. Nationally, between 2008 and 2011, the number of schools offering IES degrees increased by 29% and the total number of IES degree programs increased by 57%. In Oregon, 68% of 4-year institutions now offer some type of interdisciplinary environmental or sustainability degree. The Environmental Studies program at PCC offers the types of lower-division classes offered by these 4-year institutions. At Portland State University, which is the primary transfer institution for our ESR majors, the number of students majoring in environmental studies or science more than doubled in the five-year period between 2007 and 2011.² The number of students minoring in environmental studies at PSU increased from 30 to 140 in that same time period. Clearly, the interest in and demand for environmental studies and science education is growing. Similarly, job opportunities for science, technology, engineering and math (STEM) graduates in the environmental field are growing and graduates in this field are in high demand. The US Bureau of Labor Statistics projects that the number of environmental scientist and specialist positions will increase by 15% between 2012 and 2022, which is faster than average for the professions analyzed.³

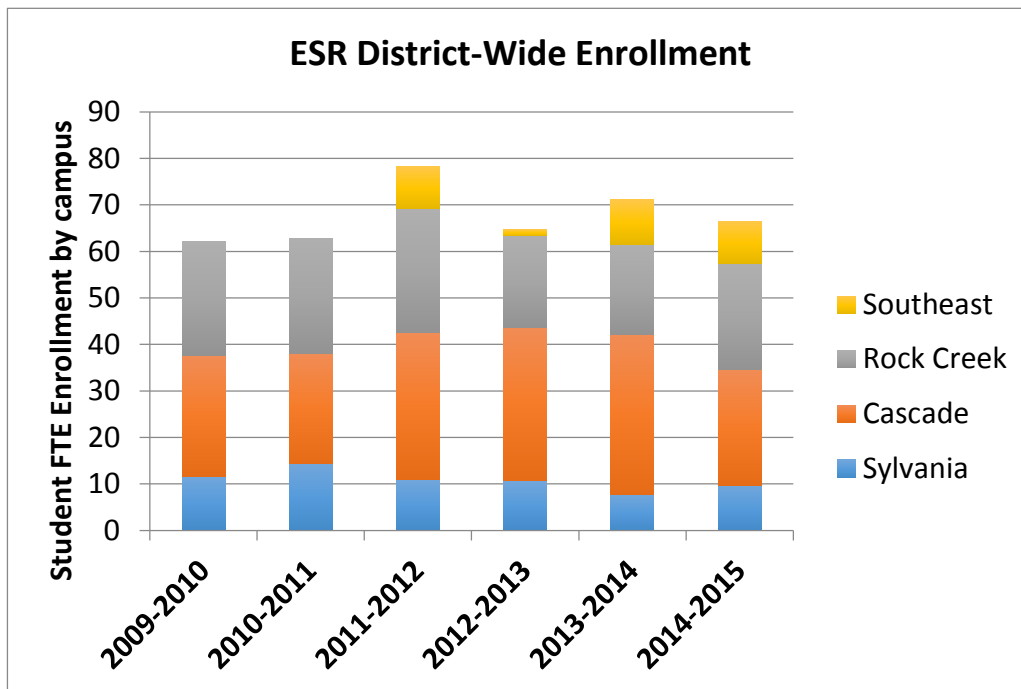


Figure 3. Enrollment in all ESR courses across the district.

¹ Portland State University Department of Environmental Science and Management Comparative and Strategic Analysis. 2013. Report prepared by Dr. Shirley Vincent, National Council for Science and the Environment.

² Portland State University Department of Environmental Science and Management Program Review 2013.

³ United States Bureau of Labor Statistics. Occupational Outlook Handbook. <http://www.bls.gov/ooh>

Here at Portland Community College, we have seen the demand for environmental studies courses increasing across the district. At Cascade, the demand for the fall term section of ESR 171 has increased greatly; generally enough students are on the wait list to warrant a second section of the course. At Sylvania, there is a demand to offer ESR 171 more consistently and frequently. The Rock Creek campus now offers ESR 171 three out of four terms a year. ESR 171 is currently being offered twice a year at the Southeast campus with good enrollment. ESR 171 was offered at the Hillsboro center for the first time during the fall 2015 term. We hope to expand our offering of non-majors courses to the Columbia County center in the future as well. Currently, the majors sequence is offered only at the Rock Creek campus. We see a potential to expand our course offerings and build the ESR program across all campuses.

Have they changed since the last review, or are they expected to change in the next five years?

The goals of the ESR program have expanded since the last program review. We continually revise and update our curriculum to best prepare our students for success in the environmental field. In addition to serving lower division collegiate transfer students, ESR has partnered with the Landscape Technology CTE program to offer courses required for the new Environmental Landscape Maintenance Technology (ELMT) AAS degree.

Required courses for this degree include the majors core sequence, as well as a newly designed course, ESR 204: Introduction to Environmental Restoration, which was created specifically for the ELMT students and serves as an elective for environmental studies and science students. For ELMT students, the goals of these courses are to:

- Prepare students to integrate ecological principles into the design and management of restoration and low-impact development projects.
- Introduce students to a variety of restoration practitioners and projects.
- Engage students in the design, implementation and monitoring of a restoration project.



Figure 4. ESR 204 students plan, install and monitor a native pollinator garden at Rock Creek campus.

B. Briefly describe changes that were made as a result of SAC recommendations and/or administrative responses from the last program review.

One of the major changes that our SAC has seen since the last program review was the 2013 retirement of Dr. Tom Robertson who was essential to the creation of the ESR program at Portland Community College. During his tenure, Dr. Robertson built a strong transfer program based at the Rock Creek campus. During this time, PCC faculty worked with Portland State University (PSU) to develop good alignment with the PSU environmental science and studies majors. In 2013, Dr. Val Brenneis was hired to replace Dr. Robertson as the one full-time instructor with more than half of her teaching load dedicated to ESR (22 credits of ESR and 12 credit of Biology taught per year). In the last two years, Dr. Brenneis has worked with ESR instructors across the district to strengthen communication and involvement in SAC-level decision-making, increase coordination for the ESR 171, 172, and 173 courses, and develop assessment of college-level outcomes in ESR 171 involving part-time and full-time instructors from all campuses. Dr. Brenneis has also worked with faculty and advisors at Portland State University and PCC to clarify transfer guidelines and align curricular goals for the majors sequence and revise the majors courses to improve alignment with PSU courses.

The ESR SAC identified several areas for improvement and made several recommendations in the 2011 program review. These included the need for better long-term student tracking, better coordination of the ESR 171, 172 and 173 courses across the district, improved intercampus communication and coordination with transfer institutions, additional lab tech support and a dedicated lab classroom, the addition of a half-time position to be split with another science department, and additional funds for faculty development and monitoring equipment. The administrative response to these requests stated that funding was not available to add a half-time ESR position, dedicate a teaching lab to ESR at Rock Creek, or provide additional faculty development funds. However, the administrative response suggested that the ESR SAC put together a funding proposal to purchase equipment and in the last two years, ESR has received additional funds to purchase equipment (2013), install a student-designed pollinator garden and informational signage on the Rock Creek Campus (2014), and help maintain the forests of the Rock Creek Environmental Studies Center (2015). While we currently (2014-2015) do not have a laboratory technician with time dedicated specifically to ESR at Rock Creek, in the past we did have a lab technician assigned partially to ESR. This technician maintained our specialized lab equipment in good working order and we have seen a decline in equipment maintenance in the last year with the loss of his expertise.

The administrative response to the previous program review also asked that the ESR SAC “give particular attention to assessment-driven change and upcoming milestones established by the Learning Assessment Council and PCC Academic Services”. The ESR SAC had asked for assistance with the increased assessment demands placed on this small SAC (only one full time instructor with more than half of her load dedicated to ESR courses). The administrative response indicated that some funding was available (10 hours for part-time faculty) who wish to assist with the assessment process. In 2014-2015, we completed a district-wide assessment of college

level outcomes (critical thinking and problem solving) for all sections of ESR 171. This was the first ESR assessment to include faculty and student work from all campuses. We have also instituted SAC level questions for the courses evaluations to gather additional data, from the perspective of students, on college-level outcomes addressed by ESR courses (see Appendix B).

While the SAC has not yet instituted an effective long-term tracking system, we did create an ESR majors listserve to share job, internship, volunteering opportunities with former students. All students who successfully completed ESR 160 between Fall 2013 and Winter 2015 were invited to join this PCC Google group. In the future, all students passing ESR 160 (the introductory core course) will be invited to join this group.

2. [Outcomes and Assessment: Reflect on learning outcomes and assessment, teaching methodologies, and content in order to improve the quality of teaching, learning, and student success.](#)

A. *Course-Level Outcomes: The College has an expectation that course outcomes, as listed in the CCOG, are both assessable and assessed, with the intent that SACs will collaborate to develop a shared vision for course-level learning outcomes.*

- i. What is the SAC process for review of course outcomes in your CCOGs to ensure they are assessable?

Members of the SAC build their courses based upon the CCOGs, which include both content knowledge and skill outcomes as well as a specific list of assessment tools. These tools vary among specific courses, but generally include essay, multiple choice and short answer exams, group projects, research papers, interpretation of graphs and published data, and oral presentations. When teaching a course, each instructor plans a set of assignments and exams that use a subset of these assessment tools (or all of them). The strength of our existing general CCOGs for non-majors courses is that each instructor can base their courses on the CCOG and have flexibility to design their own courses. We feel that the CCOGS for ESR 140, 141, 171, 172, 173, 201 and 204 are clear and assessable. However, as a SAC, we would like to develop more common goals and/or broad course themes over the coming years. An example of the work that has been done to achieve these goals is the adoption of a common textbook and development of a common rubric for assessing problem-solving and critical thinking in ESR 171 courses across the district. Fieldwork is an important component in many of our courses and we are considering the addition of a new CCOG for those courses to indicate that some form of environmental data collection and observation is essential to developing professional competency in environmental science.

We are currently revising the CCOGs for ESR 160 and ESR 202 to better align our courses with the equivalent courses offered at Portland State University. The goal of these revisions is to increase clarity and rigor to improve student success. Our students often transfer to PSU mid-way through the majors sequence and we want to make sure that they are mastering key skills

and concepts in the introductory courses. As we engage in this revision process we will make sure that these course outcomes are assessable and assessed.

ii. Identify and give examples of changes made in instruction to improve students' attainment of course outcomes, or outcomes of requisite course sequences (such as are found in MTH, WR, ESOL, BI, CH, etc.) that were made as a result of assessment of student learning.

ESR 171, 172 and 173 curricula are designed to develop student understanding of biological, chemical and geological environmental topics. Lectures, labs and term projects all support development. However, in 2014 the SAC decided the textbook for ESR 171 and 172 did little to support students in critical analysis of various topics presented. The SAC has adopted a different text, which focuses more on critical thinking skills.

More students enroll in ESR 171 than any other non-majors course. While ESR 171 is not a pre-requisite for ESR 172 or ESR 173, most students may view this as a sequence and therefore take ESR 171 first. Of the 74 students who enrolled in ESR 171 across the district in the Fall of 2013, only 9 of them had gone on to take ESR 172 by the end of Winter 2015; only 4 took ESR 173 as well (all at Cascade). Similar patterns were noted for the ESR 171 cohort for Fall 2014. In other words, very few students are likely to take ESR 171 at one campus and then enroll in either ESR 172 or 173 at another campus. These enrollment patterns indicate that while it is important to have shared curricular goals and outcomes for the ESR 171, ESR 172 and ESR 173 courses across the district, flexibility in content based on instructor expertise and campus-specific lab and field opportunities does not pose a problem for students.

At the Southeast campus, two labs were developed (replacing two generic labs) to make use of the nearby Mt. Tabor Park ecosystem, an urban, multi-use forested park. Students now conduct vegetation and invertebrate surveys in the park, and test hypotheses about native vegetation and biodiversity. Students also meet with the Portland Parks Stewardship coordinator and participate in an ongoing habitat restoration project in the park. They learn first-hand about the challenges associated with urban forest/park management and the value of citizen monitoring and volunteer work, in supporting the goals of Portland Parks and Recreation. One student who completed the course in 2014 is now a volunteer crew leader with Friends of Mt. Tabor Park, continuing the restoration efforts.



Figure 5. ESR 171 students from Southeast engaged in restoration work at Mt. Tabor Park.

In regards to the majors courses at the Rock Creek campus, we continuously revise the content and assignments based on student assessment, as well as conversations with university and community partners about required skills and knowledge. For example, in ESR 160 we revised the major writing assignment for the course to provide more structure and skill-building opportunities. In lieu of an open-ended term paper, we developed a three-part assignment. The first assignment requires students to summarize and correctly cite a provided scientific review paper on the topic of climate change. This is followed with a library workshop on searching for peer-reviewed papers, the selection of a scientific paper that addresses some impact of climate change, and the writing of an accurate summary of this paper. Finally, students must find and read three peer-reviewed scientific papers and write a synthesis paper describing current research on a particular aspect of climate change. We have found that this scaffolding approach has increased student ability to locate and cite scientific papers, while reducing plagiarism and improving the quality of the final papers. In the future, we plan to introduce additional in-class activities to develop graph reading and data interpretation skills needed for understanding the scientific literature.

At the Cascade Campus, multiple sections of ESR 171 are offered by multiple instructors. Miguel Estrada's ESR 171 is composed of a lecture sequence oriented towards developing critical thinking, understanding the role of individual choices in creating and solving environmental problems, and mastering the basic biological and ecological concepts underlying ecosystem processes. These lectures are supported by a hybrid Laboratory that includes introduction to basic instrumentation use and care and basic water chemistry methods. These labs are coupled with field trips, where material learned at the labs is applied. The streams visited include Johnson and Eagle Creeks allowing students to interpret and compare water quality data, species diversity measures of riparian vegetation and aquatic organisms in relation to land uses. Team effort and inter-group collaboration is emphasized in the lab. In previous years, ESR 171 at Cascade has collaborated with the City of Portland's Portland Parks & Recreation department to remove invasive species from Columbia Children's Arboretum to complement lecture material related to human impacts on biodiversity. Taryn Oakley's ESR courses (171 – 173) are a combination of lectures and labs, with the labs primarily being field trips. The lectures discuss a

broad range of environmental topics discussed not only on a global scale, but also at the local and individual levels. Field trips to nearby sites allow students to examine various aspects of environmental sustainability, often for the first time. Every term Taryn has students who have lived their entire lives in Portland but have never been to Forest Park. By visiting the natural areas that surround them, the students gain a greater appreciation for the environment that supports them.

B. Addressing College Core Outcomes

- i. *Update the Core Outcomes Mapping Matrix.* <http://www.pcc.edu/resources/academic/core-outcomes/mapping-index.html>. *For each course, choose the appropriate Mapping Level Indicator (0-4) to match faculty expectations for the Core Outcomes for students who have successfully completed the course.*

Please see Appendix A for updated core outcomes mapping matrix.

C. For Lower Division Collegiate (Transfer) and Developmental Education Disciplines: Assessment of College Core Outcomes

- i. Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects, highlighting efforts made to improve students' attainment of the Core Outcomes.

In the last two years the ESR SAC has worked to increase the involvement of more faculty in the assessment of college core outcomes. While all the majors courses (ESR 150, 160, 201, 202 and 204) are taught by a single instructor (Val Brenneis) and require her participation in assessment, we have worked to involve our part-time faculty as well as other full-time faculty across the district in the assessment process as well. Specifically, we involved all four of the instructors teaching ESR 171 across the district between Fall 2014 and Spring 2015 in the assessment of critical thinking and problem solving. We developed a common rubric to be used for projects assigned in each class. While the specifics of the projects varied between sections, each of the assignments had a written component that could be used to assess critical thinking and problem solving.

During the spring 2015 SAC meeting, we normed the rubric as a group and randomly selected a subset of these student papers to assess. We scored work from 38 students using three separate criteria on our assessment rubric (identify, provide an example and a solution for an environmental problem). Of those 38 students, 24 (63%) met the benchmark level in their ability to clearly identify an environmental problem. Twenty-five students (66%) also met the benchmark level in providing specific examples of this environmental problem. Only 17 students (45%) met the benchmark for our third criteria, providing a solution to an environmental problem. As a result of this assessment process, we revised the rubric to provide clearer and more specific categories for re-assessment. We also plan to spend more time discussing and clarifying the goals of the assignment for the students in our respective classes.

This was a valuable process, in part, because it gave ESR 171 instructors an opportunity to discuss and refine their own assignments in order to improve critical thinking.

We recognize that if we want students to be better problem-solvers, we should make that evident to them. One way to communicate our expectations is to share with them a grading rubric specific to these objectives. We used a good rubric for this assessment, but it could be improved. Most instructors shared the rubric with students this year, and we will recommend that all instructors share it next year. The rubric may need to be modified to better fit each assignment at the beginning of the term (incorporating the rubric into the handout of directions for the term project assignment). Our analysis of student work showed that students who achieved the benchmark for critical thinking and problem solving were those who possessed skills in information literacy and effective use of citations. We plan to incorporate information literacy into our courses, via a library orientation or a specific handout. Most instructors do something around this topic, but we could explore this more formally, and make it specific to this assignment.

ii. Do you have evidence that the changes made were effective (by having reassessed the same outcome)? If so, please describe briefly.

In 2014, we assessed cultural awareness in ESR 201: Environmental law and policy. The instructor used a case study approach that asked students to read about, discuss and work in small groups to propose solutions to particular law and policy issues. Students were assigned to represent the position of an assigned stakeholder, often representing a view different from their own. After engaging in the case study in class, each student was asked to write an individual case study analysis. These questions specifically addressed cultural awareness by asking students to state the environmental problem and preferred solution from the position of a variety of stakeholders. Students were asked to consider what factors influence the lens through which a stakeholder views the issue. These case study analyses were assessed twice, once at the beginning of the term and once at the end of the term. In 2014, we saw a slight increase in the number of students demonstrating the benchmark level of cultural awareness at the end of the term. In 2015, the instructor used a similar approach to re-assess cultural awareness. The instructor revised the grading rubric and chose new case studies and saw an increase in the cultural awareness scores of the students. The careful selection of appropriate case studies and an increase in the amount of time spent discussing the importance of valuing diverse stakeholder perspectives may have contributed to these higher cultural awareness scores. The instructor will continue to address cultural awareness in this course by incorporating the discussion and analysis of local environmental justice issues.

iii. Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?

Overall, we have learned how to streamline the assessment process for several outcomes, and now are able to assess two different outcomes using one body of student work. For example, in 2013-14 we were able to assess both self-reflection and cultural awareness by using different rubrics but the same assignment. In 2015-2016, we will re-assess critical thinking and assess communication using a common assignment and a revised rubric. We did learn that it is better to keep it simple and make it useful for us - and integrated the assessment into the courses. We have learned how to involve multiple instructors and class sections using a common rubric and norming session. The joint assessment process has led to helpful discussions about assignments and tools for assessing important outcomes such as critical thinking and problem solving while maintaining flexibility in our courses. In addition to a handful of full-time instructors who teach ESR courses, we have several dedicated part-time ESR instructors who are essential to multi-campus, multi-section assessment. The time required for high-quality, college-wide assessment remains a serious challenge for the ESR SAC.

iv. Are there any Core Outcomes that are particularly challenging for your SAC to assess? If yes, please identify and explain.

As evidenced by our recent assessment, it is difficult to demonstrate critical thinking with a 'simple' assessment but we have revised our rubric to better capture steps of this process (identify problem, use evidence, and propose solutions). As is the case with any higher-level skill, it is hard to demonstrate that students have improved their critical thinking over the course of the term as a result of the class. We have not yet addressed professional competence in our courses and we are engaged in discussion of what 'professional competence' means in a lower-division environmental science or studies course.

3. Other Curricular Issues

A. *Which of your courses are offered in a Distance Learning modality (online, hybrid, interactive television, etc.), and what is the proportion of on-campus and online?*

By their nature, many ESR courses are grounded in real-world experiences that allow students to master concepts and skills essential to the environmental field. As ESR instructors, our experience shows us that most of our students prefer a tactile, hands-on approach to learning the material, however we recognize that providing distance learning options would allow a greater number of students to take environmental studies courses. We do not currently offer any ESR courses as hybrid or online courses. As a SAC, we are interested in discussing which of our courses would be amenable to an online or hybrid format and the SAC would support instructors who are interested in developing online or hybrid versions of these courses. Non-lab courses, such as the ESR 140 or 141 sustainability courses, are potential candidates for online

instruction. For hybrid courses, students might complete the lecture and written assignments via a DL platform and then come to campus or assigned locations for the hands-on lab and field-based portion of the unit. We feel that it would be important to have same instructor for both the lab and lecture sections to ensure continuity. All classes for transfer majors with the exception of ESR 150 and ESR 201 have lab-based components. ESR 150: Environmental Studies Orientation includes several visits from guest speakers representing a variety of environmental careers. Because of this, we feel that the course is not a good fit for distance learning. ESR 201 involves student discussions of law and policy case studies in small groups as well as student presentations. While this could be done through distance learning, we have found the small group, in-person interactions to have great value. The other two majors courses are ESR 160 and ESR 202. Both of these classes have critical lab and field based components. An option for ESR 160 would be a hybrid course with one lecture 'meeting' online per week and then the second lecture of the week held in person on the same day of the lab. One in-person meeting per week, as opposed to three (the current format) would reduce student commute/attendance time and still allow for in class activities and exams. We do find some of the tools associated with distance learning very useful in campus-based courses, for example most ESR instructors utilize the MyPCC portal or Desire 2 Learn to share course content online and serve as a communication tool.

B. *Has the SAC made any curricular changes as a result of exploring/adopting educational initiatives (e.g., Community-Based Learning, Internationalization of the Curriculum, Inquiry-Based Learning, Honors, etc.)? If so, please describe.*

Many of these educational initiatives have long been a central part of our curriculum.

Inquiry-based learning – This approach has always been a part of ESR 160 and 202. In ESR 202, students performed research focused on the Rock Creek watershed. Students collect physical, chemical and biological data from the watershed and learn a variety of statistical tools to perform quantitative analyses. Students then write several drafts of a scientific report based on the data, much in the manner of an environmental consultant or agency staff. Studies have consistently reported gains in deep learning when hands-on inquiry learning is included in the curriculum. Potential employers also find this experience valuable.

“The field experience and papers directly contributed to me being offered a competitive paid internship with Clean Water Service. During the interview process, I shared my experience of touring the Rock Creek Watershed and doing field research into stream ecology. I also provided them with copies of the semester paper entitled "Rock Creek Watershed Analysis" which I completed in ESR 202.”

–Nathan Herzog, Fall 2014 ESR 202 student

Instructors in ESR have modified their pedagogy to incorporate some aspects of inquiry-based learning. Inquiry-based learning has as one of the major components the concept of open

learning. “Open learning is when there is no prescribed target or result which students have to achieve. In many conventional traditional science experiments, students are told what the outcome of an experiment will be, or is expected to be, and the student is simply expected to 'confirm' this. In open teaching, on the other hand, the student is either left to discover for themselves what the result of the experiment is, or the teacher guides them to the desired learning goal but without making it explicit what the goal is. Open teaching is an important but difficult skill for teachers to acquire.”⁴

We are working to integrate more open-ended inquiry-based labs into our ESR courses. For example, ESR instructors at PCC Rock Creek have been involved with the Community College Undergraduate Research Initiative (CCURI). CCURI involves the design, implementation and evaluation of a model for integrating undergraduate research into a community college science curriculum. We have had students working in the Rock Creek Environmental Studies Center (RCESC) on fungi, mosses, bark beetles and other projects – some of which have the added collaboration with Biotechnology (BIT) in DNA barcoding of select species. During the summer of 2015, two ESR faculty members (Kevin Lien and Val Brenneis) participated in a CCURI field methods course and learned how to use wildlife cameras and tracking techniques to monitor wildlife in the RCESC. We have purchased four wildlife cameras to install in wetland, forest and meadow habitats on campus. The cameras will be used to gather data on the diversity of wildlife using this protected wildlife habitat and living laboratory. Students will be able to generate and test hypotheses about how wildlife use this valuable habitat using camera trap studies. This work complements our previous studies of the physical and botanical aspects of the RCESC.



Figure 6. The Rock Creek Environmental Studies Center is a 110-acre wildlife sanctuary. It is used as a living laboratory for our ESR and Biology classes, to provide environmental education opportunities for local schools and as important habitat for local wildlife such as birds, frogs, coyote, deer and elk.

Community Based Learning – Several courses incorporate some form of community-based learning or volunteer work. For example in ESR 150, students may choose to complete a service-learning component for the class (in lieu of a library-based paper on an environmental

⁴ U.S. National Science Educational Standards, 2014

career). Several students have volunteered with the City of Portland, the Portland Audubon Society, the Wetland Conservancy, the Sandy River Watershed Council, the Columbia Slough Watershed Council, the Oregon Zoo, the Nature Conservancy, Metro and the Tualatin Hills Parks and Recreation District. Faculty members and students at Rock Creek have organized annual Earth Week events focusing on the removal of invasive vegetation and maintenance of structural components of the RCESC. Students also volunteer at various times during the year to help with data collection and outreach to the local community. Students and instructors at Sylvania (through ESR 171 and the Habitat Team), Cascade (through ESR 171) and Southeast (through ESR 171) Campuses all engaged in community-based learning by performing stewardship work in local parks and natural areas through the year.

The Environmental Studies program is an important educational resource for the greater PCC community. For the last several years we have offered summer sections of ESR 171 at the Rock Creek campus for students in CTE fields (ThinkBIG). This program is a partnership between Portland Community College and partnering Caterpillar dealerships in the Northwest. ThinkBIG is an industry specific two-year associate's degree program with required on-the-job training/internships. In 2014, we partnered with neighboring Springville Elementary School to provide hands-on environmental education to 125 third graders. ESR students led the children in water quality and benthic invertebrate collection in the pond and wetlands on campus. During the 2015-2016 school year, students from Rachel Carson Environmental Middle School will be partnering with SOLVE and PCC to perform outdoor education and stewardship work in the Rock Creek Environmental Studies Center. ESR instructors at Rock Creek have led workshops on water quality and botany for other outreach events for young women including Adelante Chicas and the Hermanas conference. These activities focus specifically on increasing the participation of young, Latina students in the Science, Technology, Engineering and Math (STEM) fields. Environmental Science provides a highly accessible, relevant and fun introduction to an important STEM field. The ESR program actively supports increasing the diversity in the STEM pipeline by recruiting and supporting diverse students in the environmental fields.

Internationalization – Classes in ESR incorporate international environmental issues as a major part of the curriculum. All ESR courses discuss the global issue climate change, including the causes, impacts and policy approaches that can be addressed at the local, regional and global levels. In several courses, such as ESR 160, taught by Val Brenneis, and in ESR 171 taught by Kevin Lien, Alexie McNerthney and several adjunct faculty members, students discuss the social and ecological consequences of increasing human population size, habitat loss, urbanization and resource distribution and use on a global scale.

Kevin Lien (Rock Creek), visited Kenya, Tanzania, Zanzibar and Ethiopia in 2012 through the CIEE initiative and Cuba in 2014 as part of an Institute for Food and Development Policy delegation as part of a sabbatical. Kevin also attended the Conference on Organic and Sustainable Agriculture held in Varadero, Cuba. The information gleaned from this trip has been incorporated into several ESR courses. The lecture/discussion on agriculture for the next century in ESR 171

(Biological perspectives) uses Cuba as an example. The African information has been incorporated into the population, urban studies, biodiversity and land use sections of ESR 171. April Ann Fong (Sylvania) has included examples from China; students watched a video on e-waste in Nigeria and China and then volunteered to assist with electronics recycling at Free Geek, a non-profit in Portland. Betsy Julian has used international examples from Iceland, Kenya, Guatemala and New Zealand in ESR 173 (Geological perspectives).

Sustainability – Sustainability is a key component of every ESR course. ESR 140 and 141 were specifically developed to address sustainability issues at the individual and societal levels. Classes at Rock Creek (ESR 140, 160 and 171) tour and discuss the PCC Rock Creek sustainability loop system. This tour includes a discussion of the Learning Garden, cafeteria, and composting system as an energy-efficient loop system. In 2015, ESR 160 students had the opportunity to help build a hydroponic system in the Landscape Technology greenhouse. The vegetables grown in this system are transplanted to the Learning Garden where they will be harvested to provide produce for the local community through the cafeteria and farm stand. At Rock Creek campus, ESR 160, 171 and 204 students use the on-site stormwater treatment facilities to learn about wetland characteristics and low impact development approaches. These vegetated swales treat stormwater run-off from parking lots, building roofs, and adjacent athletic fields. Students sample vegetation, soils, water quality and hydrology in the swales to gain field experience and understand how these green infrastructure projects can improve the sustainability of the built environment. In ESR 173, students participate in a self-guided walking tour of stormwater management features in downtown Portland (“Storming Downtown Portland”). Sylvania ESR 171 instructor Heather Carpenter takes her students on field trips to the Metro transfer station in North Portland, the Durham wastewater treatment plant, local farms, and examples of green buildings. Guest speakers are brought in to discuss issues such as stormwater management and green fashion.

Sustainability is discussed at many levels, from a student’s day-to-day responsibility for recycling, transportation (many are backers of mass transit and take advantage of PCC inter campus shuttle), to the City of Portland’s Program in sustainability, to our nation’s responsibilities to global sustainability issues. PCC’s sustainability efforts are college wide and are driven by students, faculty and PCC’s sustainability coordinators with the full support of administration. The environmental studies SAC is committed to helping PCC achieve its goal of excellence in sustainability.

C. *Are there any courses in the program offered as Dual Credit at area High Schools? If so, describe how the SAC develops and maintains relationships with the HS faculty in support of quality instruction.*

Courses taught district-wide (at all four main campuses) include the non-science majors laboratory based sequence 171 (Environmental Science – Biological Perspectives), 172 (Environmental Science – Chemical Perspectives) and 173 (Environmental Science – Geological

Perspectives). These three courses may be used to fulfill the science laboratory course requirement for the AAOT degree requirements and are a good fit for the Dual Credit program.

ESR 171 and ESR 172 are currently taught at select high schools as part of the dual credit program. The dual credit office facilitates dual credit connections meetings and symposia, which are required for ESR dual-credit high school instructors and ESR dual credit liaisons. These meetings allow us to share information and teaching practices. Additionally, we have created an ESR 171 Google group that allows all ESR 171 instructors to share syllabi and teaching materials. Instructors teaching dual credit sections are part of a continuing collegial interaction, through professional development, seminars, site visits, and ongoing communication with the post-secondary institutions' faculty and dual credit administration. This interaction addresses issues such as course content, course delivery, assessment, evaluation, and professional development in the field of study. In May 2015, the ESR SAC liaison, Dr. Betsy Julian, hosted a dinner and science lecture for all interested on-campus and dual credit ESR instructors. Three dual credit instructors, two deans and two PCC ESR instructors attended this informal event. Relationship building activities such as this event have helped to strengthen our dual credit program.

Table 1. 2013-2014 dual credit agreements.

PCC Course	High School	Instructor
ESR 171	Alliance HS – Meek Campus	Misty Scevola
ESR 171	Aloha HS	Sara Trakselis
ESR 171	Life Christian School	Holly Neill
ESR 171	McMinnville HS	Laura Syring
ESR 171	Forest Grove HS	Neil Borzcik
ESR 172	Life Christian School	Holly Neill
ESR 172	Forest Grove HS	Neil Borzcik

As with all dual credit courses, high school course syllabi are evaluated by a member of the ESR faculty to ensure that course content matches the CCOGs. All dual credit high school classes are visited by an ESR SAC member to evaluate the course content and confirm that the high school course is equivalent to the on-campus ESR course. If any discrepancies occur, the ESR SAC member works with the high school instructor to make sure that the content is changed to align with the CCOGs and is equivalent in content to the PCC course. ESR has been approached by other high school instructors who are interested in developing dual credit courses; the next course would likely be ESR 173. The main barrier to developing further dual credit agreements is that faculty at PCC as well as faculty at the high schools are simply stretched too thin to devote the time to pursuing more agreements.

D. *Please describe the use of Course Evaluations by the SAC. Have you developed SAC-specific questions? Has the information you have received been of use at the course/program/discipline level?*

The ESR SAC continues to use course evaluations for course and instructor feedback as well as scheduled teaching evaluations for full and part-time faculty. We recently developed a set of SAC specific questions to address college-level outcomes. This was implemented during Winter and Spring 2015. From the initial data, students report that our courses offer opportunities to address community and environmental responsibility, critical thinking and problem solving and self-reflection.

Please see Appendix B for questions and results.

E. *Identify and explain any other significant curricular changes that have been made since the last review.*

Since our last review, the SAC has been involved in helping the LAT Department to create a new degree, Environmental Landscape Management Technology (ELMT). The ELMT Degree is a partnership with Biology and ESR and students take classes from Biology, ESR and LAT. ESR 204 – Environmental Restoration was specifically developed to help LAT produce the Environmental Landscape Management Technology (ELMT) Degree.

We also have the new ESR 140 and 141 courses focusing on Sustainability – ESR 140 focuses on sustainability in the broad, global sense and ESR 141 focuses on choices an individual can make to increase sustainability.

The Cascade campus consistently offers the most sections of the non-majors courses (see Table 2). Southeast has varied between offering one and two sections of ESR 171 and ESR 173. Southeast is planning to increase its offering of ESR courses in the coming years. Rock Creek offers two to three sections of ESR 171 per year, and offers one section of ESR 172 and ESR 173 some years. For the first time, ESR 171 will be offered at the Hillsboro center during Fall 2015. One section of ESR 140 has been offered in most years at Sylvania, Rock Creek and Cascade. ESR 141 is offered at Cascade and Rock Creek campuses (one section per year).

Table 2. ESR course offerings by campus for the 2014-2015 academic year

Campus	140	141	171	172	173	150	160	201	202	204	Total
Cascade	1	2	4	1	1	0	0	0	0	0	9
Rock Creek	1	0	2	0	1	2	2	1	1	1	11
Southeast	0	0	1	0	1	0	0	0	0	0	2
Sylvania	1	0	1	1	1	0	0	0	0	0	4

In regards to the majors sequence (ESR 150, 160, 201 and 202), we are in the midst of curriculum revisions for ESR 160 and 202 to strengthen student education and better align our courses with the equivalent courses at Portland State University. We have proposed adding pre-requisites (WR 115, RE 115 and MT 65) and re-numbering ESR 160 as ESR 200 in an effort to

make the courses numbering reflect the higher-level expectations in the majors versus non-majors sequence. We believe that it would be more intuitive for the majors sequence to have higher numbers (ESR 200, 201 and 202) than the non-majors courses (ESR 171, 172, 173). This re-numbering, in addition to content revision, would also be more in line with the equivalent courses at Portland State University (ESM 220, 221 and 222). This re-numbering will also aid students and advisors in making choices about which classes are most appropriate for students intending to major in environmental studies or environmental science. We have also proposed to add ESR 200 to the general education science list because it is a lab science course that is well aligned with the current general education goals and the PCC strategic plan.

4. Needs of Students and the Community

A. *Have there been any notable changes in instruction due to changes in the student populations served?*

The ESR SAC would like to encourage and support the full range of students we teach and this includes students with disabilities, veterans, and students from backgrounds that are historically underrepresented in the sciences. Environmental studies and science are high-interest subjects that have the capacity to engage and be relevant to students of all backgrounds. We have not made any sweeping, college-wide changes in instruction due to changes in the student population served. ESR instructors at each of the campuses have responded to the needs of their student populations as they arise. We have all noted an increase in the number of veterans enrolled in ESR courses. We work with student support services such as the Veterans Resource Center and Disability Services to help our students meet the demands of our courses and succeed in their studies. Our classes have an equal number of male and female students of a wide-range of ages (see Figure 7).

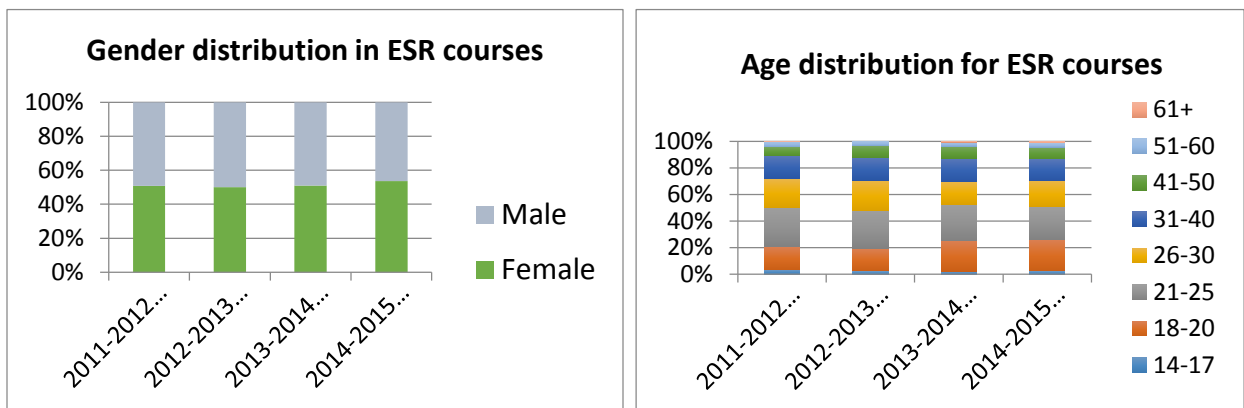


Figure 7. Gender and age distribution in ESR courses across the college.

Taryn Oakley, a long time ESR 171, 172 and 173 instructor at Cascade, notes that her students come from diverse backgrounds and she has consciously incorporated more specific content to address race and cultural issues involved with environmental science, including environmental justice issues. The average percentage of African American students in ESR courses at the Cascade campus (9.5%) was nearly twice the district wide average (5.1%) for the academic years 2011-2014. Taryn teaches non-majors courses, where many students tell her that they are electing to take her courses because they are parents and are concerned about the future of the world for their children and community.

“Environmental justice...goes something like this. No community should be saddled with more environmental burdens and less environmental benefits than any other. Unfortunately, race and class are extremely reliable indicators of where we might find the good stuff...and where we might find the bad stuff.”

- Majora Carter⁵

Kevin Lien, a long time ESR 171 instructor at Rock Creek, has noted an increase in diversity at the Rock Creek campus and in ESR 171 as well. At Rock Creek, the number of Hispanic students in ESR courses has increased in recent years, from 5% in 2011 to 16% in 2013. We hope to encourage and support this trend.

"Thank you for being a great professor. I'm sure I wasn't the best student, but I sure did learn a lot. I hate science, but you sure made me enjoy it for the first time ever. Definitely my favorite class I have taken at PCC. Thank you!"

- Manny Romero, ESR 171 student at Rock Creek

Val Brenneis, the ESR majors sequence instructor at Rock Creek notes that the diversity of students at PCC and at Rock Creek is not represented proportionately in ESR majors courses. Val has also incorporated environmental justice into her ESR 160 and ESR 201 courses and is involved in community outreach events aimed at underserved populations such as the Hermanas conference and Adelante Chicas for Latina girls.

At Sylvania, April Ann Fong notes that advisors have started sending more students with special needs (ADD, ADHD) to ESR 171 because it ESR courses are more active and hands-on and engaging for students.

⁵ Majora Carter: Greening the Ghetto. February 2006. Ted Talk.
https://www.ted.com/talks/majora_carter_s_tale_of_urban_renewal#t-188732

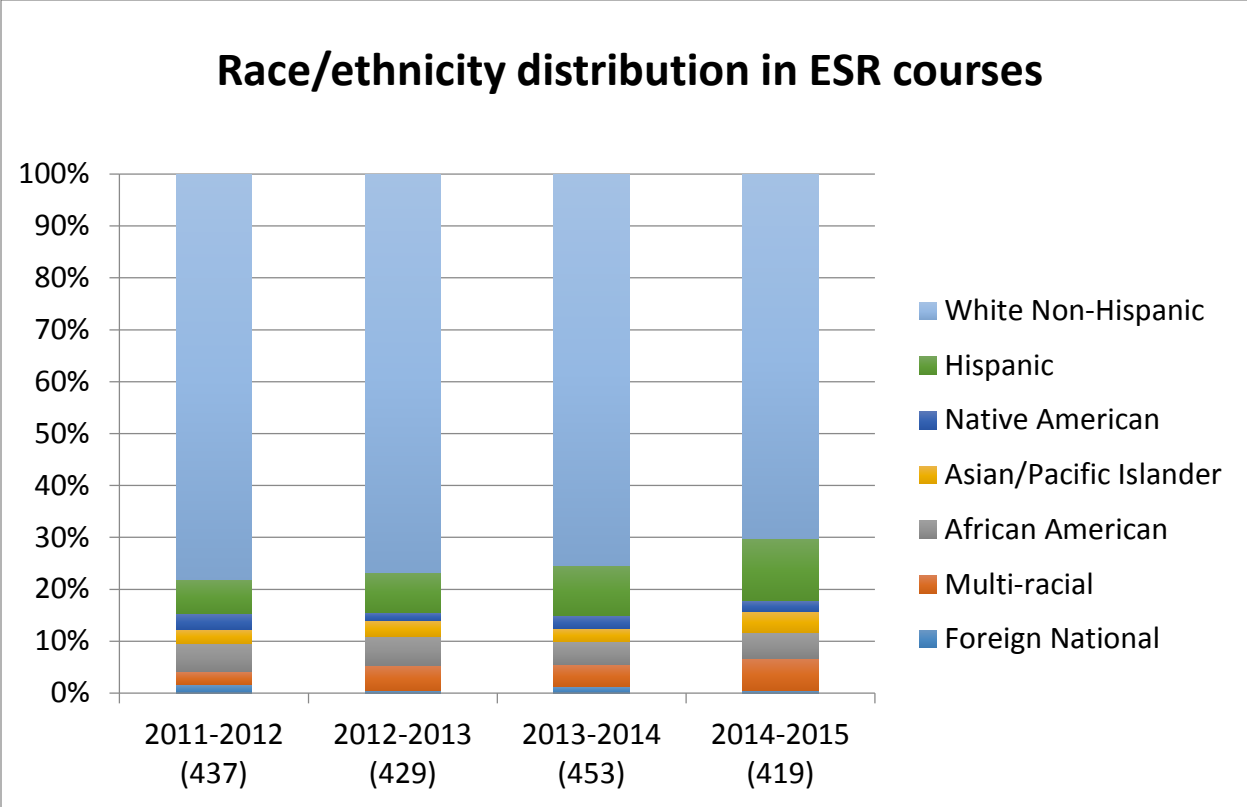


Figure 8. Race/ethnicity distribution for ESR courses across the college.

B. *What strategies are used within the program/discipline to facilitate success for students with disabilities? What does the SAC see as particularly challenging in serving these students?*

Every term, we have multiple students with disabilities. We incorporate multiple modalities for teaching, including field trips, group activities, videos, lecture, labs, and guest speakers. We have accommodated students through the use of sign language interpreters, note-takers, extended and reduced-distraction testing in the testing center, live-scribe pens, captioning services, and providing course materials on Desire2Learn. One challenge that we encounter for many ESR courses is accommodating students with physical disabilities on field trips. Instructors have contacted disability services in regards to students with limited mobility on field trips and they have helped to provide assistants, modify activities and develop alternatives. Field work is an essential element of professional competency for environmental science and studies majors but the specific roles played in the field (e.g., recording data versus wading in a stream) can be adjusted based on the needs of students.

C. *Has feedback from students, community groups, transfer institutions, business, industry or government been used to make curriculum or instructional changes? If so, please describe (if this has not been addressed elsewhere in this document).*

Feedback from students, transfer institutions (primarily Portland State University), and local environmental service organizations (such as Clean Water Services and local Soil and Water Conservation Districts) is highly valued and helps inform our curriculum. At the course level, individual instructors incorporate student and community comments into their planning. For example, feedback from students on field trips as well as from field trip hosts has informed future field trips for ESR courses at Cascade where Taryn Oakley assigns a field journal to document the experience and asks students to provide feedback and opinions. At Southeast, in response to student feedback, we are increasing our course offerings to include ESR 172, in addition to ESR 171 and ESR 173.

Comments from students and conversations with faculty at Portland State University have also led the ESR SAC to propose changes in the majors courses. After two years in the position of ESR instructor and advisor for the majors sequence, Val Brenneis has suggestions for structural changes in the program that will benefit our ESR transfer students. We plan to re-number the introductory course for majors, from ESR 160 to ESR 200, to reduce confusion about why this majors course has a lower number than the non-majors courses (ESR 171, 172, 173). Many students take the non-majors courses mistakenly and believe that they are on track to majoring in environmental studies or science. We also plan to institute pre-requisites and revise the CCOGs. ESR 160 is the first course in the sequence of classes required for students planning to pursue an environmental studies or science degree. It is the prerequisite for all other majors-track courses.

Currently, ESR 160 is only offered on the Rock Creek campus, which is the case for all of the majors courses. The class has absolutely zero pre-requisites and currently does not count as a lab science class for general education requirements. We would like to institute pre-requisites ([WR 115](#), [RD 115](#) and [MTH 65](#) or equivalent placement test scores) and add this science lab course to the general education list. This change would make the course more in line with all other science lab classes offered in environmental studies (ESR 171, 172, 173), biology (all lab classes) and other science departments. We would also like to offer this course at multiple campuses so that a broader, more diverse group of students has access to the entry-level introductory course in the environmental studies majors.

In addition to changing the course number and description for ESR 160, we plan to revise the course description for ESR 202 in order to improve alignment of skills and content with the equivalent course at PSU (ESM 221).

Please see Appendix E for student reflections on the ESR program.

Please see Appendix F for partner comments (PCC LAT program and PSU ESM department)

5. Faculty: Reflect on the composition, qualifications and development of the faculty

A. *How the faculty composition reflects the diversity and cultural competency goals of the institution.*

The ESR faculty composition does not reflect the diversity goals of the institution. The ESR faculty are led by one full-time instructor who teaches the majors ESR courses, but also teaches several classes in the biology program. Three other full-time faculty members, who primarily teach in the biology program, occasionally teach a non-majors ESR class. Only one of those faculty identifies as part of a minority group in Oregon. Several part-time faculty members also teach in the non-majors ESR program. Only one of these part-time faculty members identifies as being part of an under-represented group in Oregon. ESR is a small program, so diverse representation is difficult. Faculty members are dedicated to improving their cultural competency. Examples of this include participation in diversity training workshops offered through the Teaching and Learning Centers.

ESR is an interdisciplinary field, which addresses social justice issues entangled in many environmental issues. Environmental issues must recognize the different stakeholders with their cultures and perspectives, when bringing science-based studies and solutions to governmental groups, non-governmental organizations, corporations, communities, etc. This social justice component has students grapple with diversity issues thereby addressing the cultural competency goals of the institution.

B. *Changes the SAC has made to instructor qualifications since the last review and the reason for the changes.*

The ESR SAC decided to update the instructor qualifications to specify demonstrated competency for non-majors courses (ESR 140, 141, 171, 172, and 173), in part to make these courses more accessible for dual credit instruction at local high schools. Demonstrated competency is now described as equivalent to a Bachelor's Degree in the course subject area and 3 years of experience or a Bachelor's Degree in a course related field and 5 years of experience qualify as instructors. Previously, the instructor qualifications addressed only individuals with Master's Degrees. ESR is a vast interdisciplinary field, where individuals may not have a Masters or terminal degree, but have various experiences that could qualify as appropriate background, so we proposed these changes to provide clearer guidance for demonstrated competence.

Please see Appendix C for updated Instructor Qualifications.

C. *How the professional development activities of the faculty contributed to the strength of the program/discipline? If such activities have resulted in instructional or curricular changes, please describe.*

Two of the full-time faculty members teaching ESR courses have recently had professional leave that allowed them to engage in environmental projects. One of the faculty members focused on participating in and gathering information on citizen-science projects centered around climate change. These activities included study of the climate change effects on European marmots in the French Alps and how American pika populations are affected by climate change in the Sierra Nevada mountain range. Faculty have explored local organizations, such as the Nature Conservancy of Oregon, The Intertwine, Adventurers and Scientists for Conservation, The Hoyt Arboretum, and Environmental Professionals of Color, to give new perspectives on local environmental projects. Citizen-science projects are ways to engage ESR students to apply classroom learning to hands-on field projects. Two of us have joined the Smithsonian's SHOUT Tree-Banding Project, where students set up dendrometers on trees in one quarter, and following classes measure tree growth and enter the data into the Smithsonian's international database. This project allows us explore the correlation between growth of different species with climate changes around the world.

Instructors attend a variety of professional development workshops and classes to expand content knowledge and instruction. Examples include workshops on fungi, lichens and mosses at Opal Creek Ancient Forest Center, wetland plant identification classes through the Portland State University Environmental Professional's Program and soil school workshops presented by local soil and water conservation districts. Instructors regularly attend local science meetings that pertain to ESR, such as the annual Urban Ecosystem Research Consortium at Portland State University, where many aspects of urban environments and management issues are presented. ESR instructors most recently attended the Association for Advancing Sustainability in Higher Education (AASHE) annual meeting. ESR faculty have also participated in the Greater Portland Sustainability Education Network, which is our newly formed United Nations Regional Center of Expertise on Sustainability Education). Faculty also actively participate in the NSF funded CCURI project to involve students in research. This leads directly to student engagement in research.

6. Facilities and Academic Support

A. *Describe how classroom space, classroom technology, laboratory space, and equipment impact student success.*

At the Rock Creek campus, the Rock Creek Environmental Studies Center (RCESC) provides a critical and essential resource for our students. The 110-acre RCESC provides an incredible opportunity for students to engage in meaningful environmental science research on campus in our forests and wetlands. This protected land is actively used by students to conduct research and put their knowledge into practice. We use the wetlands and ponds for water quality testing and plant identification. We use the forests for learning botany and sampling techniques for a variety of parameters (soil, air, flora and fauna). This living laboratory is used not only by ESR

students but also by Biology (BI 141, BI 213, BI 101 – 103), Landscape Technology and Art classes, as well as local elementary and middle school students and by wetland science students from Portland State University. We work with local organizations such as Clean Water Services and SOLVE to restore the function of these ecosystems by removing invasive species, planting native plants and restoring natural hydrology of the wetlands. The value of this resource for students, the ESR program, and their entire PCC system cannot be overstated.

“One of the best components of the ESR program is its commitment to getting students in the field and taking advantage of the RCESC. That hands-on experience strengthens the program's ability to put students, who may or may not pursue higher education levels, in jobs with relevant experience and skills. Also, by incorporating data analysis via Excel and data extraction via reputable websites, students develop empathy for fieldwork and office work and understand the necessity of both.”

- Kellyn Baez, ESR and ELMT student 2013- 2015

In ESR 140 and 160 at Rock Creek campus, students tour the sustainability loop; visiting the Learning Garden and composting sites on the Rock Creek campus. This provides the students with tangible, hands-on examples of best practices to sustainable food and waste management. It allows students to connect theory with practice, which really drives these concepts home.

As the hub of the ESR program, the Rock Creek ESR courses have access to a range of equipment for environmental testing. Continuous upgrades, maintenance, re-stocking and repair of this equipment are essential to the continued success of our program. A lab technician with time dedicated specifically to ESR was very valuable in this effort. In the absence of trained personnel, individual ESR instructors spend significant time maintaining the equipment. Two of the ESR instructors at Rock Creek are full-time. There is a budget for ESR at Rock Creek.

At the Cascade campus, one of the biggest problems identified by instructors is the lack of reliable internet services. This interferes with the ability to watch video clips and share online course materials. While some of the ESR 171, 172, 173 instructors utilize lab facilities and equipment; others have field trip based lab sections. There is a small, dedicated budget for ESR at Cascade. None of the ESR instructors at Cascade are full-time.

At the Sylvania campus, classrooms are often booked to capacity. Classroom technology includes simulation programs, access to science databases, and standard field equipment, such as spectrophotometers, data loggers, etc. Unfortunately, lab space and equipment are only available when other science classes are not using the room or equipment. In fact, there is no equipment dedicated to ESR courses at Sylvania, and there is no budget code for the ESR program. Instead, ESR courses are supported through biology, chemistry and geology programs and part-time instructors have used their own funds to support field trips. Hiring for ESR is split between the chairs for biology and physical sciences. In the last three years, no full-time faculty members have taught ESR courses at Sylvania. Lack of Wi-Fi access has limited the use of laptops in the classrooms for learning activities. These limitations inhibit growth of the program at

Sylvania and also prevent us from being able to offer training that reflects the professional standards used in the field. Despite these limitations due to lab space and equipment, students work in adjacent parks including Lesser and Sylvania Natural Areas where they test water quality and vegetation.

At Southeast, the brand-new laboratory and classroom facilities of the Student Commons Building provide space and materials to support a full series of environmental science courses. Currently at Southeast we offer ESR 171-173, and bond funds were used to purchase sets of environmental monitoring equipment such as Vernier sensors. The laboratory space, along with the budget, is shared with General Science and Geology courses, but scheduling is not currently compromised since we only offer one section of environmental science each term. Our lab technicians at Southeast are very capable of supporting faculty in the preparation and inventory of equipment. We rely on Vernier equipment, and it would be very helpful to have one laboratory technicians (or a faculty member) attend a seminar in how to use and troubleshoot Vernier probes. In the last two years, no full-time faculty have taught ESR courses at Southeast.

Please see Appendix D for a list of lab equipment available at the Rock Creek, Cascade and Southeast campuses. Please note that there is no dedicated ESR equipment at the Sylvania campus; all equipment and materials are borrowed from other programs.

B. Describe how students are using the library or other outside-the-classroom information resources.

The library and other outside the classroom resources are essential to the success of our students.

At Rock Creek, ESR 140 students are required to use at least two scholarly sources for their final paper. In class students discuss what constitutes a scholarly source and the instructors shows students how to use the PCC library website's research tools. Research librarians have developed a resource guide for ESR 150 students who visit the library to learn how to access career databases. ESR 150 students learn how to search national and state databases to learn about the requirements and prospects for a variety of environmental careers. In ESR 160, students spend a lecture period with the research librarian learning how to use a variety of databases to search for peer-reviewed scientific literature on a topic of their choice (such as impacts of climate change). As part of ESR 160, students learn how to correctly cite and summarize a scientific article without plagiarizing. In a subsequent writing assignment, students learn how to synthesize several scientific papers in a short review of a selected topic. In ESR 201 students use the library to search for information on an environmental policy issue in the Pacific Northwest. In ESR 202, students perform background research on the Rock Creek watershed and water quality issues and use online databases such as the United States Geological Survey's National Water Information System and Data Grapher program. Accessing and manipulating data from reliable online sources is an essential skill for ESR students.

At Southeast, ESR 171 students must investigate an environmental problem and use credible sources of information to write a term paper. Students rely heavily on the databases to which

our PCC libraries subscribe. At Cascade campus, ESR 171 students spend one lab period in the library with a research librarian learning over how to choose a topic, how to find articles, what a peer-reviewed article is, and how to cite sources. ESR 171 students make use of this skill in their research paper assignment.

Guest speakers play a key role in ESR courses as well. Instructors invite experts to discuss a wide range of issues, such as stormwater management in urban environments, environmental restoration, toxicology and pollinator conservation. Instructors also take students on field trips to see how different organization work on addressing environmental issues. For example, ESR students have studied wastewater management facilities, waste transfer stations, ecoroofs, urban farms, and restoration sites.

C. Does the SAC have any insights on students' use of Advising, Counseling, Disability Services, Veterans Services, and other important supports for students? Please describe as appropriate.

Advising remains a challenge for the ESR program. One area that we clearly need to improve is the presence and clarity of ESR information available through the PCC website and general Advising. We continue to have students mistakenly take non-majors courses instead of the majors courses that count towards the Environmental Studies and Science degrees at Portland State University. These mistakes represent a loss of time and money for our students. We have taken steps to improve the information about ESR in the catalog and in our transfer guides. Currently, Val Brenneis serves as an unofficial advisor to majors via email, phone and in-person meetings with students. As part of the ESR 150 orientation course we provide a guide to the major with course requirements for the environmental science and studies tracks however, the mechanism for updating our transfer guides and advising for the major is unclear. As the Department of Environmental Science and Management at PSU revises its curriculum and course requirements, it is critical that we update the advising information we provide for our students at PCC. For students who are interested in transferring to natural resource programs at Oregon State University, the advising guidelines are less clear, and the required courses differ from those required by PSU. We would like help updating our articulation and transfer guides with other universities. As a small program, we need assistance from Advising to make sure that general PCC advisors are steering students towards the best ESR course for them.

Please see Appendix G for revised transfer guides.

We have found that certain groups of students are advised to enroll in ESR courses (such as students with ADD or ADHD who do better in active learning environments). The Veteran's Center at Sylvania has embraced tending a plot in the Learning Garden as an outdoor activity with potential to be therapeutic, calming, and yet tied to many educational outcomes. This new tie to the Learning Garden generates student interest in courses that also use the Learning Garden, such as ESR courses.

ESR instructors have found Disability Services very helpful in assisting with accommodations such as captioning services. Students in ESR courses have benefitted from the resources provided by Veterans Services as well as the Women's and Queer Resource Centers.

8. Recommendations

A. *What is the SAC planning to do to improve teaching and learning, student success, and degree or certificate completion?*

The Environmental Studies SAC is proud of the accomplishments of our students and instructors. As a small and dedicated SAC, we do great things with our students and in the community at large. We hope to continue our tradition of engaging students in the challenging and rewarding fields of environmental science and environmental studies. We will continue our involvement in the community through outreach events to increase the diversity of the STEM pipeline, and by engaging in community-based learning and habitat restoration.

As a SAC, our long-term goal is to have a full-time instructor teaching ESR courses at each of our campuses. Currently, across the district, only one full-time instructor (Kevin Lien) teaches the non-majors courses (ESR 171). Val Brenneis teaches all of the majors courses. Only at the Rock Creek campus are ESR courses taught by full-time instructors (Val Brenneis and Kevin Lien); all remaining sections of ESR courses, at all other campuses, are taught by part-time instructors. This does not lead to a sustainable program and will not allow for development and growth of the SAC and ESR course offerings. We recommend that we have a designated full-time instructor at each campus who teaches at least one ESR course and can serve as a resource for our part-time instructors and as an advocate for offering and supporting ESR courses.

As Oregon adopts a policy of free community college through the Oregon Promise program, we hope to see an increase in the number of students pursuing environmental studies and science degrees. As mentioned in previous sections, we plan to revise the majors sequence (ESR 160 and 202) and improve information provided for students and advisors. Additionally, we support the idea of offering ESR 150 and ESR 160, the introductory courses for the majors, at the Southeast campus. We want to be well positioned to expand our offerings while maintaining high quality education that is well aligned with university coursework and PCC's strategic goals. The ESR 171, 172, 173 offers high quality, relevant, lab science general education credits and we would like to be able to offer the full complement of these courses at each campus.

In addition to these ESR specific concerns, we would like to engage in a college wide discussion about the alignment of degree requirements for Environmental Studies and Environmental Science majors with Associate of Science Transfer degree (AS) and Associate of Arts Oregon Transfer (AAOT) degree completion. We are concerned that it is difficult for our environmental science majors to complete enough science credits, as well as general education credits for the AAOT to transfer to a university and then go on to complete their degrees in another two years. Because transfer institutions do not require an Associate's degree, but rather the completion of

pre-requisite courses, we believe that is in our students' best interest to make sure that they focus on courses required for a particular major. From the students' perspective, it would be best if these courses were compatible with the completion of an Associate's degree in a reasonable amount of time. This would not only benefit our students but also improve completion outcomes for PCC. Currently, the AS degree may be a better option than the AAOT for students planning to major in environmental science because the AS allows them to focus on completing science pre-requisites due to reduced general education requirements. We are also interested in participating in the development of Environmental Science and Studies majors at the community college level. A challenge facing us in regards to the development of Environmental Studies and Science majors at PCC is the disparity in the requirements for majors at the 4-year universities. For example, the biology courses that counts for students interested in transferring to Oregon State University for the Natural Resources major (BI 101, 102, 103) does not count for a student planning to transfer to Portland State University for the Environmental Studies major (BI 141, 142, 143). As a SAC, we need to work with advisors here at PCC and at transfer institutions as we develop majors at the community college level.

B. What support do you need from the administration in order to carry out your planned improvements? For recommendations asking for financial resources, please present them in priority order. Understand that resources are limited and asking is not an assurance of immediate forthcoming support, but making the administration aware of your needs may help them look for outside resources or alternative strategies for support.

The Environmental Studies subject area committee has several recommendations that are well aligned with the 2015-2020 strategic plan.

To increase our ability to **offer outstanding environmental studies and science education** and **improve student success**, we recommend expanding the points of entry into the ESR majors sequence to more than one campus. We currently recommend taking advantage of the increased capacity of the new Southeast Campus to offer ESR 150 and ESR 160 in the spring term to provide an entry point to the major for a greater number of students. For students living on the eastside of Portland, the commute to the Rock Creek campus may likely discourage them from 'trying out' environmental studies and environmental science as potential majors. We believe that by offering the gateway classes at a second, eastside location, we will increase the number and diversity of students entering the ESR program. Growth in Environmental Studies and Environmental Science majors at Portland State University, our primary transfer institution, has shown that there is a strong interest and history of growth in these majors. While many dedicated student do commute from east Portland to Rock Creek, offering ESR 150 and ESR 160 at both the Rock Creek and the Southeast campuses will not only increase accessibility for students, it will **promote sustainability** as student commute time decreases and it may increase the diversity of students pursuing ESR majors. The environmental studies program is a natural fit

for promoting the college's sustainability goals in our work with students and community partners.

To **increase student success** and build a stronger ESR program, in the long term we recommend having a full-time faculty member who teaches ESR at each of our four campuses. In the near term, we recommend hiring a full-time instructor at the Southeast campus. Currently, the ESR program has only one full-time instructor with a majority of her load dedicated to ESR courses (Val Brenneis) located at the Rock Creek campus. Her appointment is an ESR/Biology split position. A similar position with an ESR/Biology or General Science split would greatly expand and strengthen the existing ESR program. In addition to teaching ESR courses, both of these full time instructors would provide much needed advising for ESR students as well as share SAC-level responsibilities. Three of our four campuses are currently without a full-time instructor who teaches ESR courses on a regular basis. While we do have extremely dedicated part-time instructors, advising ESR majors is beyond the scope of their current job. We believe that additional full-time faculty members with a dedicated ESR course load at would greatly improve advising and therefore student success.

In summary, the ESR SAC makes the following recommendations.

To provide outstanding, affordable education, we recommend:

- Hiring a second full time instructor with a dedicated ESR course load, ideally at the Southeast Campus where the program is growing. We have one sole full-time faculty member dedicated primarily to ESR across the district; a second full time person would help to distribute the administrative workload over time and across the district and improve advising, as well as the sustainability of the ESR program.
- At Cascade and Sylvania, hiring or assigning a full-time faculty member responsible for teaching ESR courses and supporting part-time faculty.
- Funding student transportation for fieldwork opportunities by providing bus passes, renting or purchasing 12 passenger vans or buses for field trips.

To drive student success, we recommend:

- Providing money and time for faculty to formally work with advising staff to improve advising for ESR students across the district and clarify which courses and degrees are better suited to our students' transfer needs.
- Improving internet access and reliability in classrooms at all campuses.

To ignite a culture of innovation, we recommend:

- Purchasing equipment for ESR courses at all campuses.
- Providing part-time lab technicians dedicated to maintaining ESR lab equipment.
- Providing support for professional development including conferences, workshops and technical training for lab and field equipment.

- Providing dedicated space and resources to support student research, both through the Community College Undergraduate Research Initiative and through ESR course-based opportunities.
- Collaborating with Clean Water Services to enhance the Rock Creek Environmental Studies Center wetlands and provide hands-on restoration opportunities for students.
- Continuing collaboration with our many partners in local government, industry, non-profit and educations to provide opportunities for our students to learn from experts and engage in stewardship activities.

To transform the community through opportunity and lead in diversity, equity and inclusion, we recommend:

- Expanding the number of locations where the introductory ESR majors' courses are offered. We recommend offering ESR 150 and ESR 160 at the Southeast Campus in addition to the Rock Creek campus in order to make this program accessible to a broader group of potential students. In the future, we hope to expand further.
- Expanding the number of sections of ESR 171, 172 and 173 offered at all campuses as well as centers to increase access to these highly relevant lab science courses.

To achieve sustainable excellence all operations, we recommend:

- Supporting the continued preservation, restoration and use of the Rock Creek Environmental Studies Center as a unique living laboratory.
- Developing a long-term partnership with Clean Water Services for the restoration and continued stewardship of the Rock Creek Environmental Studies Center wetlands.
- Supporting the development of a learning garden at the Southeast Campus and the existing gardens at other campuses.
- Offering the introductory majors courses (ESR 150 and ESR 160) at an eastside location to reduce commute time and increase student access.
- Hiring a second full-time ESR instructor at the Southeast Campus to increase the scope and long-term sustainability of the ESR program.
- At Cascade and Sylvania Campuses, hiring or assigning a full-time faculty member responsible for teaching ESR courses and supporting part-time faculty.
- Developing closer ties with the sustainability program district-wide.
- Strengthening the college's commitment to sustainability by promoting the ESR program.

Prioritized list of suggestions requiring financial resources:

1. At Southeast Campus, hire a second full-time faculty member.
2. At Cascade and Sylvania, hire or assign a full-time faculty member responsible for teaching ESR courses and supporting part-time ESR faculty.
3. Purchase equipment specifically dedicated to ESR for each campus.
4. Fund the maintenance of ESR equipment by trained technicians.
5. Provide funding for faculty professional development.
6. Fund student transportation for field experiences.
7. Continue supporting the Learning Gardens at each campus and the Environmental Studies Center at Rock Creek.
8. Support improvements in internet service for classrooms at all campuses.

Appendix A. Core outcomes mapping matrix



ESR 160 student meeting core outcomes in the field

Core outcomes mapping matrix

Mapping Level Indicators:							
0	Not Applicable.						
1	Limited demonstration or application of knowledge and skills.						
2	Basic demonstration and application of knowledge and skills.						
3	Demonstrated comprehension and is able to apply essential knowledge and skills.						
4	Demonstrates thorough, effective and/or sophisticated application of knowledge and skills.						
Core Outcomes:							
1. Communication.							
2. Community and Environmental Responsibility.							
3. Critical Thinking and Problem Solving.							
4. Cultural Awareness.							
5. Professional Competence.							
6. Self-Reflection.							
Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
ESR 140	Introduction to Environmental Sustainability	3	4	3	3	2	3
ESR 141	Individual Sustainability	3	4	3	3	2	3
ESR 150	Environmental Studies Orientation	2	3	2	2	3	4
ESR 160	Introduction to Environmental Systems	3	3	3	3	3	3
ESR 171	Environmental Science: Biological Perspectives	3	3	3	3	2	3
ESR 172	Environmental Science: Chemical Perspectives	3	3	3	3	2	3
ESR 173	Environmental Science: Geological Perspectives	3	3	3	3	2	3
ESR 201	Applied Environmental Studies: Science and Policy	4	4	4	3	3	4
ESR 202	Applied Environmental Studies: Preparation for Problem Solving	4	4	4	2	3	2
ESR 203	Applied Environmental Studies: Project	4	4	4	2	3	3
ESR 204	Introduction to Environmental Restoration	4	4	4	2	3	3
ESR 298	Special Topics: Environmental Studies	4	4	4	2	2	3

Appendix B. Course evaluation: SAC level questions



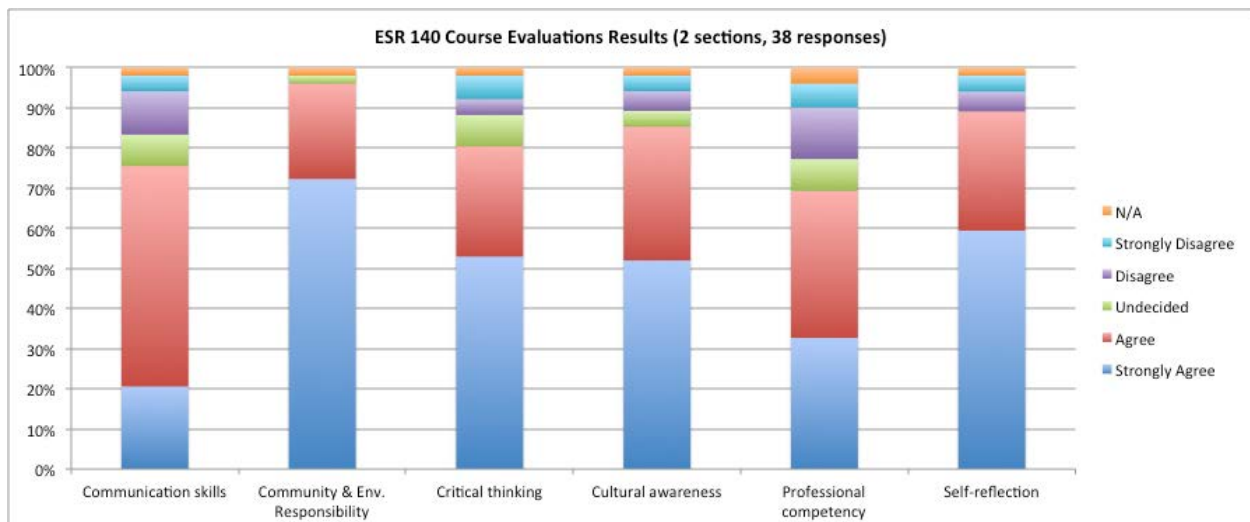
ESR 160 students exploring hands-on solutions to environmental problems

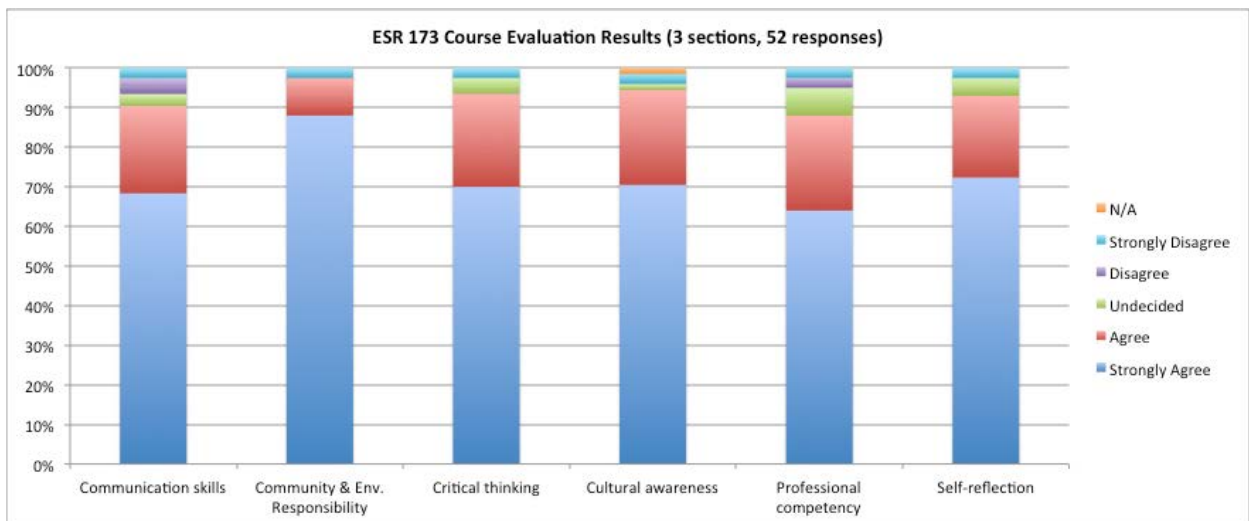
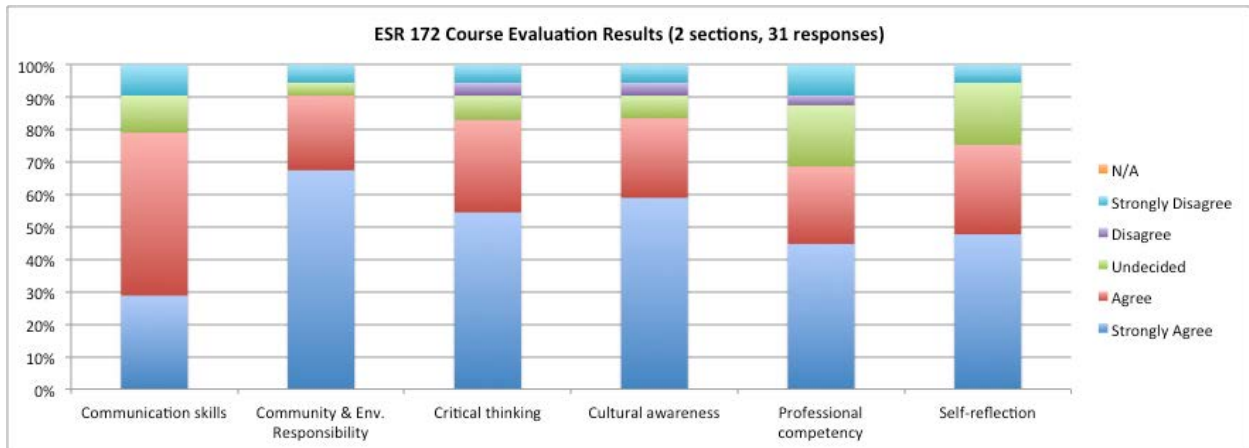
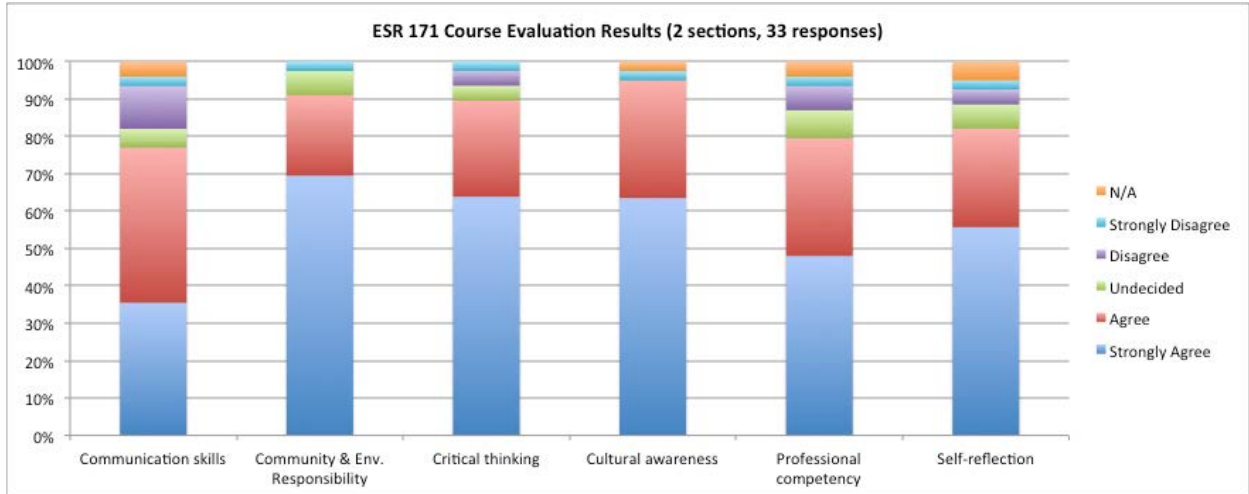
Course evaluation: SAC level questions

Questions 1 – 12. Likert scale questions. Possible answers include: Strongly disagree, Disagree, Undecided, Agree, Strongly agree or N/A

1. Assignments and projects helped me understand course material.
2. Students were asked to make connections between course material and life.
3. The textbook was useful in helping me understand the subject.
4. This course provided the opportunity to improve my communication skills.
5. This course provided content on community and environmental responsibility.
6. This course provided the opportunity to use critical thinking and problem solving.
7. This course provided the opportunity to increase my cultural awareness.
8. This course provided the opportunity to increase my professional competency.
9. This course provided the opportunity for self-reflection.
10. If this was a laboratory course: Proper lab safety protocols were explained and enforced.
11. If this was a laboratory course: Proper use and care of lab equipment was explained and enforced.
12. If this was a laboratory course: There were enough resources available in lab so that I could participate in lab activities.
13. What was your reason or goal for taking this course? Please chose your primary reason from the following list:
 - General interest in the topic
 - Earning lab science credits for my associate degree
 - Planning to transfer to a 4-year university and major in Environmental Studies or Science
 - Pursuing the Environmental Landscape Management Technology AS degree – course required

Select results of evaluations for courses with more than one section offered in Winter and Spring 2015





Appendix C. Instructor qualifications



ESR faculty at the Community College Undergraduate Research Initiative field methods workshop in Wyoming.

ESR Instructor Requirements

ESR 140 and ESR 141

Master's degree or above in subject area:

- aquatic science/limnology
- biochemistry
- biology
- botany
- chemistry
- earth science
- ecology
- entomology
- environmental economics
- environmental engineering
- environmental geology
- environmental science
- environmental studies
- evolution/evolutionary biology
- fisheries and wildlife
- forest science
- geochemistry
- geography
- geology
- landscape architecture
- marine science
- natural resources management
- soil science
- sustainability
- urban studies
- zoology

OR Master's degree in related subject area with 30 quarter hours of graduate credit in any of the above subject areas.

Related subject area:

- education
- science education

For ESR 150, 160, 171, 203 and 298

Master's degree or above in

- aquatic science/limnology
- biology

- botany
- ecology
- entomology
- environmental science
- environmental studies
- evolution/evolutionary biology
- fisheries and wildlife
- forest science
- marine science
- natural resources management
- zoology

OR Master's degree in related subject area with 30 quarter hours of graduate credit in any of the above subject areas.

Related subject area:

- chemistry
- education
- geography
- geology
- science education

ESR 172 – Environmental Science: Chemical Perspectives

Master's degree or above in

- biochemistry
- chemistry
- environmental chemistry
- geochemistry

OR Master's degree in related subject area with 30 quarter hours of graduate credit in any of the above subject areas.

Related subject area:

- biology
- education
- environmental science/studies
- geography
- geology
- science education

ESR 173 –Environmental Science: Geological Perspectives

Master's degree or above in

- earth science

- environmental geology
- geochemistry
- geology
- geophysics
- soil science

OR Master's degree in related subject area with 30 quarter hours of graduate credit in any of the above subject areas.

Related subject area:

- biology
- chemistry
- education
- environmental science/studies
- geography
- science education

ESR 201 –Applied Environmental Studies: Science/Policy Perspectives

Master's degree or above in

- environmental law
- environmental management
- environmental science
- environmental studies/policy

AND

One year full time equivalent non-teaching work experience in the field and at least one graduate level course (of at least three credits) in environmental policy or law

ESR 202 –Applied Environmental Studies: Prep for Problem Solving

Master's degree or above in

- aquatic science/limnology
- biology
- botany
- ecology
- entomology
- environmental science
- environmental studies
- fisheries and wildlife
- forest science
- natural resources management
- zoology

OR Master's degree in related subject area with 30 quarter hours of graduate credit in any of the above subject areas.

Related subject area:

- chemistry
- geography
- geology

AND

Two years full time equivalent experience in environmental field research (research carried out in the completion of an advanced degree can count as/towards this experience)

ESR 204 –Introduction to Environmental Restoration

Master's degree or above in

- biology
- ecology
- environmental science
- geology
- restoration ecology

AND

Two years full time equivalent experience in field research and/or the practice of ecological restoration (research carried out in the completion of an advanced degree can count as/towards this experience)

These subject area lists may not be inclusive as there are other degree titles that may be appropriate for the subject and related areas. The Division Dean, in consultation with the Faculty Department Chair, will make a recommendation to the Dean of Instruction about the applicability of a particular degree that is outside the scope of these lists.

Provisional Approval

For ESR 171, 172, and 173 an instructor without a Master's degree or above may be approved if they have 30 quarter hours of graduate credit in the subject area and are actively pursuing the degree and are anticipated to be awarded the degree within one year of hire, as determined by the instructor's graduate advisor (a letter from the advisor will be required and kept on file.)

Demonstrated Competency Qualifications ESR 140, 141, 171, 172 and 173:

Bachelor's degree in the course subject area, (as identified above) plus a minimum of three years of documented full time equivalent experience consisting of any combination of work and/or research and/or teaching experience, carried out in private industry and/or government agency and/or academic institution and/or volunteer organization settings

OR

Bachelor's degree in a related subject area (as identified above) plus a minimum of five years of documented full time equivalent experience consisting of any combination of work and/or research and/or teaching experience, carried out in private industry and/or government agency and/or academic institution and/or volunteer organization settings.

Revised: April 2015

Appendix D. Equipment at Rock Creek, Cascade and Southeast Campuses



Basic field gear on display in the Rock Creek Environmental Studies Center

ESR Inventory

Rock Creek ESR Supply Inventory			
Name	Quantity	Manufacturer	Model Number
1 Gallon Plastic containers	6		
11X17 graph paper	10 sheets		
Bat house	1		
Binoculars	6 pairs		
Bird Houses, large	5		
Bird Houses, small	5		
Bottom Sampling Dredge	2		
Burlese funnels	14		
Cal. Chemicals for H2O Qual. Probes			
Calipers (vernier)	6		
Calipers, plastic	2		
Canon Digital Camera		Canon	Power Shot S1
Clinometers (small)	3		
Clipboards	9		
Collapsible sampling squares	2	Forestry Suppliers	53150
Combination OHP Water Quality Kit	1	LaMotte	5572
Combination Sampling and Measurement Outfit	1	LaMotte	1069
Compasses (geography)	4		
Compasses (geometry)	1		
Conductivity Meter	1	LaMotte	
Cordless Drill (in black case)	1	DeWalt	
Crayfish traps	4		
DBH tapes	3	Forestry Suppliers	59571
Digital Densimeter	1	PAAR	
Digital Stream Flow Meter (old)	1		
Dissolved Oxygen Kits (old)	5	Vacuettes	
Dissolved Oxygen Kits (old, grey boxes)	2	Hach	
Drill driver set	1		
Electric Drill	1		
Ethyl Acetate	0		
Extra Microclimate gear			
Extra Pencils	>75		
Five gallon buckets	5		
Flashlights	6		
Flood light			
flying insect nets	4		
Folding shovels	6		
Forel-Ule Color Scale Outfit	1	LaMotte	5907
Freshwater Analysis Kit	1	Hach	

Funnels, large	6		
Funnels, small	2		
Galvanized deck screws			
Galvanized Nails (various sizes)			
Garden Shears (large, 12" long)	1		
Gardening Gloves	8 pairs		
Green rubbermaid (hydroponics?)			
grey box pH kits (old)	2		
Half meter quadrats (five PVC, one hula hoop!)	6		
Hammers	2		
Hand pruners	4		
Hand Saw	1		
Hand trowels	8		
Herbarium Cards (old)			
Hip-Waders	3		
Hydrolab (old, in rubbermaid)	1		
Ice cube trays	30		
Insect killing jars, large with screw-top lids	6		
Insect Killing Jars, with foam stoppers	23		
Kick Nets	2		
Lab Bench Paper (used)			
Lab Tape			
LaCross 18" Grange Rubber Boots	5	Cabela's	IK-820633
LaMotte Limnology Chemical Storage			
Large Pruners	6		
Limnology Test Kits (in current use)	6		5902
Live Mammal traps (various sizes)	6		
Magnifying viewers	6		
Measuring tapes - 100 Meter	2	Forestry Suppliers	39986
Measuring Tapes, 100 ft	1		
Measuring Tapes, 165 ft	3		
Measuring Tapes, 50 ft	1		
Men's Chest waders (stocking foot)	5	LL Bean	TA275191
Metal Head Mallet	1		
Metal Seives	6		
Microclimate Kits	6		
Miscellaneous			
Miscellaneous storage containers and lids			
Nitrate kits (old, not used in years)	3	Vacuettes	
Oceanographic test kit (wood box)	1		
Oceanography test Kits (blue cases)	2	LaMotte	5903
Old, styrofoam ice chests	2		

Paper Towel Rolls	2		
pH kits (old, not used in years)	4	Vacuettes	
pH meter (L.A.T. dept) (old, works?)	1	LaMotte	
Phosphate Kits (old, not used in years)	4	Vacuettes	
Plankton Samplers	6		
Plant Press (15" square)	4		
Plaster of Paris mix	1 box		
Plastic bags, 1 gallon			
Plastic Pans	7		
Plastic sampling bottles(100mL)	43		
Plastic sandwich bags			
Plastic Sheets, various sizes	?		
Plastic Zip-locs, 1 quart			
Plastic Zip-locs, 1 gallon			
Pooters	3		
Pvc pipe sections (6" diameter)	6		
Rite in the rain paper	3	Forestry Suppliers	49246
Roper (various lengths	4		
Rubber Boots	3		
Rubber Head Mallets	4		
Saltwater Tester (blue case, like Limnology)	1	LaMotte	
Secchi Disks	4		
Shovels, Large	5		
Sieve, Brass 12", No. 18	1	Cole-Parmer	EW-59990-05
Sieve, Brass 12", No. 35	1	Cole-Parmer	EW-59990-09
Sieve, Brass 12", No. 60	1	Cole-Parmer	EW-59990-13
Sieves, plastic	2		
Slurper	1		
Small forceps	24		
Soil "Parent Material"			
Soil core samplers	10		
Soil Kit Chemical storage			
Soil Sieves	2 sets		
Soil Test Kits (commonly used	8	LaMotte	5679
Squirt bottles	2		
Stream D-Nets	8		
String trimmer	1		
Styrofoam egg cartons	7		
Surber Samplers	2	Wildco Instruments	
Survey Tape			
Test Kit Manual Storage			
Titration cells, Alkalinity (blue cardboard box)	4	Titrets	
Titration cells, Carbon dioxide (blue	4	Titrets	

cardboard box)			
Titration cells, Hardness (blue cardboard box)	4	Titrets	
Tree Coring supplies (corers in brown cabinet)			
tripods	2		
Turkey basters	6		
Water Sampling bottle with lead weight	1	LaMotte	1060
Women's Chest waders (stocking foot)	5	LL Bean	TA275194
Wood stakes (3ft)	15		
Yogurt Tubs	29		
YSI D.O. Meter	1		
ESR Cabinet (Remains Locked)			
Altimeter	1		
Arc View Software Package	1		
Compass	3	Suunto	
Compass	2	Silva	
data loggers with rainshield mounts	2	HOBO	
Electronic Field pH meters (clear cases)	8		
eTrex GPS units	6	Garmin	
Extra wind meters	9		
Horizontal Alpha Bottle (brown case)	1	Wards	
InSight™ Rangefinders with Internal LED Display	1	Forestry Suppliers	91097
miscellaneous supplies			
Planimeter	6		
Pocket Bruntons	3		
Pocket Penetrometer	2		
Portable Turbidimeter	1	Orbeco Helige	
Refractometer	6		
Soil pH/Moisture meters	5		
Stream velocity Meter (mesh bag)	1		
Surface waters test kit (baby blue case)	1	Hach	
Tree corers	2	Forestry suppliers	
Trimble data reciever (yellow bag)	1		
Trimble software book	1		
Vertical Densimeter	2		
YSI-556 multiprobe	1	YSI	

Cascade campus ESR Supply Inventory

Item Description	model #/serial #/notes	Qty
Vernier LabQuest data loggers	Model # = LABQ serial #s PS1: 11006749 PS2: 11007176 PS3: 11005783 PS4: 11005904 PS5: 11005765 PS6: 11005756 PS7: 11005898 PS8: --	8
Vernier LabQuest charging stands	LQ-CRG	2
Vernier temperature probes	TMP-BTA	8
Vernier soil moisture sensors	SMS-BTA	8
Vernier relative humidity sensors	RH-BTA	8
Vernier UVB probes	UVB-BTA	8
Vernier CO2 gas sensors	CO2-BTA	8
Vernier voltage probes	VP-BTA	8
Vernier current probes	DCP-BTA	8
Vernier pH probes	PH-BTA	8
Vernier DO probes	DO-BTA	6
Vernier turbidity meters	TRB-BTA	7
Vernier conductivity probes	CON-BTA	6
Vernier light sensors	LS-BTA	8
di H2O squeeze bottles 250 mL		9
DO electrode filling solution		1
pH 7 buffer		1
meter sticks		12
rulers (1 ft ~ 30 cm)		20
protractors		18
measuring tapes 7.5 m		6
beakers 1000 mL	plastic	18
beakers 250 mL	plastic	16
beakers 150 mL	plastic	2

grad cylinders 1000 mL	plastic	24
grad cylinders 100 mL	plastic	37
grad cylinders 25 mL	plastic	24
levels		6
compasses		5
hand lenses		6
stopwatches		8
bottles w/lids 500 mL	plastic	24
dissecting microscopes	3 fixed (10x?), 1 10x/20x	4
Ecology boxes, each containing: <ul style="list-style-type: none"> • soil thermometer • air/water thermometer • 2x 125 mL plastic bottles filled with DI H₂O • whirling hygrometer • pH paper • Sharpie • tree height guage (green triangle) • measuring tape • trowel • string attached to clips • funnel • 1x empty 125mL plastic bottle • DBH (diameter) tape • compass 		
meter sticks		7
reel tapes 100 m		1
reel tapes 50 m		2
reel tapes 30 m		3
reel tapes 20 m		3
DBH tapes (5 m)		3
light meters		3
Berlese funnels	homemade, from 2L bottles	~16
compasses (extra)		3
clinometers		2
hula hoops		3
binoculars		3

soil test kits (N-P-K)	LaMotte 3-5880	6
soil set kit	LaMotte EL	1
soil thermometers (extra)		2
soil seive sets		3
soil texture kit	(missing one of the yellow caps...)	1
soil corers		2
pocket weather stations	Kestrel 3000	1
beakers 1000 mL	glass	8
beakers 600 mL	glass	12
beakers 400 mL	glass	12
beakers 250 mL	glass	12
beakers 150 mL	glass	12
beakers 100 mL	glass	6
beakers 50 mL	glass	24
graduated cylinders 50 mL	glass	10
graduated cylinders 25 mL	glass	9
graduated cylinders 10 mL	glass	8
rulers 150 mm		~24
plant press		1
tree ID keys		12
soil test kit	Lamotte AM-31	1
soil test kit	Lamotte STH-5	1
soil pH test kit	Lamotte ED-12	1
water test kit	Lamotte 5892	1
water test kit	Lamotte 5891	1
light fixtures, clamp-on, w/metal hoods		7
B.O.D. bottles		~40
plankton nets		2
air pollution detection kit	Lamotte	1
rope (climbing? length ~100ft?)		1
increment borers		2

rubber mallets		2
flagging tape rolls		2
marking stakes		lots
collapseable live traps for small mammals		21
Havahart live traps for small mammals		6
analog max-min thermometers	don't work very well, some may have been tossed...	3
digital max-min thermometers	(°F only, reset daily, but otherwise work great!)	3

Southeast ESR Supply Inventory		
Name	Quantity	Manufacturer
Day packs with field sampling equipment including field guides, Binoculars, calipers, DBH tape, insect sticky traps, etc.	12	N/A
Laptops	12	Shared with other science disciplines.
Vernier labquests (with following probes)	12	Vernier
DO probes	12	Vernier
Turbidity meters	3	Vernier
pH probes	12	Vernier
Spectrophotometers	6	Vernier
Temperature probes	12	Vernier

*Note: There is no dedicated ESR equipment at Sylvania.

Appendix E. Student feedback



ESR 204 students in the plant chiller at Scholls Valley Native Plant Nursery

Program Review questions: Sent to ESR student listserve (for student who have complete ESR 160)

We'd really like to get student feedback on their experience taking ESR courses at PCC. Please answer those questions that are relevant to your situation.

1. Why did you take ESR courses at PCC?
2. What are you currently doing in terms of education or career?
3. What are your goals for the near future?
4. If you have transferred to a 4-year university in order to pursue a degree in environmental studies or environmental science, do you feel that your ESR courses prepared you well to transfer?
5. What were the highlights of your experience at PCC?
6. How can we improve the ESR program to better serve the needs of our students?

Responses

1. Why did you take ESR courses at PCC

I took ESR classes because they were required for the ELMT degree I was seeking. Though I ended up looking for ways to take more and count them as electives.

2. What are you currently doing in terms of education or career?

I am presently nearing completion of that degree while working as an Ecological Restoration Specialist with Sound Native Plants. I am working toward being more involved in the planning and design of restoration projects (though there are some muddy--yet valuable--experiences along the way)

3. What are your goals for the near future?

My goals for the near future include continuing to work in the restoration field for the opportunities of networking and relative experience. Though, taking a PCC GIS class as well as working with people from the various SWCDs surrounding Portland have encouraged me to at least look into further education.

4. If you have transferred to a 4-year university in order to pursue a degree in environmental studies or environmental science, do you feel that your ESR courses prepared you well to transfer?

Not yet relevant.

5. What were the highlights of your experience at PCC?

Highlights of my experience with ESR at PCC could go two ways. Either I focus on the skill-building in the classes and labs, like the Excel experiences that were so maddening at the time but have shown themselves to be relevant in other settings. Or I talk about the good times as if it's a highlight reel, like the ESR204 pollinator project which now blooms quite brightly, or the great exposure to the local community of professionals working in the field (like my present employer, whom I met on an ESR field trip) and forever the standout (though a BI class, not ESR) was the trip to the HJ Andrews ancient forest.

6. How can we improve the ESR program to better serve the needs of our students?

The only improvement I can suggest, which will hopefully reach a decision-maker, would be to either offer ESR and BI in the evenings, or at least start them as late as 3 or 3:30 pm so that working students

could take the classes which are often required. Many students, especially those returning to school, have to work during the day. This prevents attending the morning or mid-day ESR and BI classes, thus preventing them from completing degrees.

-Gratefully,
GW Griffin

1. Why did you take ESR courses at PCC?

I was pursuing a new profession and had decided on landscape design, but was enticed by the classes offered as part of the new ELMT degree in the LAT Department. After taking one quarter of ESR classes, where I received hands on skills and heard from a variety of speakers in the natural resources industry, I knew I was on the right track and switched to ELMT.

2. What are you currently doing in terms of education or career?

I am finishing my Environmental Landscape Management Technology degree by doing an internship with a water resources management utility organization (CWS) that protects the Tualatin River watershed, while also volunteering with Portland's regional government (Metro) doing outdoor education and a local nonprofit (Backyard Habitat Certification Program) encouraging native landscaping through community outreach. My internship and volunteer work has exposed me to outreach and education work, which I have come to enjoy and may pursue professionally.

3. What are your goals for the near future?

I am applying to seasonal summer environmental jobs in youth restoration and outreach, and will also be applying to AmeriCorps positions at various environmental agencies in the Portland Metro area that begin in September.

4. If you have transferred to a 4-year university in order to pursue a degree in environmental studies or environmental science, do you feel that your ESR courses prepared you well to transfer?

N/A, but if I was, I would say yes.

5. What were the highlights of your experience at PCC?

The field trip to HJ Andrews Experimental Forest was the experience of a lifetime. I cannot recommend that trip highly enough. Also, the field trips in our ESR 204 class really motivated me as a professional and changed my course as a student. Visiting sites where we could work, meeting potential employers, and translating the concepts we learned in our classes to the outdoors made a difference in my education.

I appreciated learning skills that were important for employment in the environmental industry. I assumed that using a densiometer and conducting stream and vegetative surveys was only relevant in a classroom lab, but upon entering my internship, I realized how vital it was that I knew those skills and understood the processes.

I also thought my ESR 201 class would be non applicable information for the jobs I would be qualified for with an associates, but I have found that knowledge to be incredibly useful when discussing the environment or industry with the public.

Learning the relationship of water quality parameters to fish and macroinvertebrate species was very

informative, practical, and really exciting! It has directly translated into my community outreach efforts and fishing skills.

6. How can we improve the ESR program to better serve the needs of our students?

I wouldn't change anything about the ESR classes or program. One of the best components of the ESR program is its commitment to getting students in the field and taking advantage of the RCESC. That hands on experience strengthens the program's ability to put students, who may or may not pursue higher education levels, in jobs with relevant experience and skills. Also, by incorporating data analysis via Excel and data extraction via reputable websites, students develop empathy for fieldwork and office work and understand the necessity of both.

My experience as an ELMT student is that my ESR classes have been the most appropriate and applicable for entering the industry, while the LAT classes, while valuable, could have more focused material for how landscaping and the environment work together, such as maintaining a swale or designing a rain garden.

The only aspect of my education I wish I could change would be to turn in better work and focus more on the material because it has translated so well in my professional pursuits. My previous education did not apply well into my professional life, so I had developed a bad system of doing the work but not investing in the material. I did not expect education of any kind to be so relevant and exciting (perhaps it was having labs or science classes in general being so tangible to the natural world), but I am very happy with the outcome.

Thank you so much!
Kellyn Baez

1. Why did you take ESR courses at PCC?

In pursuit of a Bachelors of Science Degree in Environmental Studies, I discovered that PCC offered many classes that would transfer to a four-year degree program at Portland State University. The ESR courses at PCC allowed me to save money on tuition while attending but still provided me with a high level of education and information about environmental science and studies.

2. What are you currently doing in terms of education or career?

I am currently enrolled fulltime at Portland State University pursuing the environmental studies degree. I also currently work for Community Environmental Services as The City of Portland's Event Recycling Project Lead and Multnomah County Surplus Project Lead. Both positions are in the materials management sector which requires a broad knowledge of current waste and recycling policies within the City of Portland.

3. What are your goals for the near future?

My goals are to continue learning about waste reduction and environmental studies, graduate from my program with strong grades and continue working in waste and materials management.

4. If you have transferred to a 4-year university in order to pursue a degree in environmental studies or environmental science, do you feel that your ESR courses prepared you well to transfer?

The ESR courses at PCC offer a strong foundation for transfer to a university. Many of the ESR courses offered were fairly rigorous in content and expectations which is valuable in preparation for many university courses. The Rock Creek Environmental Studies Center offers a wide variety of observational and field study monitoring habitats that are essential to the ESR program and to overall learning outcomes.

5. What were the highlights of your experience at PCC?

The classes offered by Dr. Val Brenneis were thorough, well-structured and demanding which helped me become a successful and knowledgeable student. The biology series and many of the ESR courses are highly recommended to those seeking quality hands-on field experiences and a high level learning experience. I found most of the staff at PCC to be accessible with many resources available to all students in any given degree-seeking path.

6. How can we improve the ESR program to better serve the needs of our students?

- Provide clarity in course guidance for transfer from advisors.
- Offer chemistry classes with an environmental focus.
- In general, offer more ESR classes for transfer.

Jennifer Stefanick

1. Why did you take ESR courses at PCC?

The program seems to be well-connected with PSU's program, which is where I was planning to transfer. I had heard from people who had taken the classes at both PCC and PSU that there are a lot of benefits to PCC's program in terms of instructor quality and class size, as well as price.

2. What are you currently doing in terms of education or career?

Preparing for my transfer to PSU as a junior. Volunteering in free time with parks organizations around Portland.

3. What are your goals for the near future?

More volunteering and internships if I have the free time available.

4. If you have transferred to a 4-year university in order to pursue a degree in environmental studies or environmental science, do you feel that your ESR courses prepared you well to transfer?

N/A because I haven't transferred yet.

5. What were the highlights of your experience at PCC?

Working on projects that I am proud of and working with instructors who are very knowledgeable about different aspects of the field. I also met a lot of cool people who I still connect with on a regular basis.

6. How can we improve the ESR program to better serve the needs of our students?

Don't let ESR students work with PCC advisors. They seem to steer you in a generic path that will get the job done, but involves spending time and money on classes that you don't need.

I think it would be really cool to have a field trip to the PSU campus and tour the ESM program there and talk to some people. In ESR150 it was nice to have people come talk to us, but I think getting a feel for PSU would be beneficial also. And even though not everyone in the class is transferring to PSU, it would still give them an idea of what a university level department is like.

DJ Eickhoff

1. *Why did you take ESR courses at PCC?*

I want to get my major in Environmental Science so it made sense to get my as many prerequisites done as I possibly could at PCC.

2. *What are you currently doing in terms of education or career?*

I will be starting at PSU in the fall with Environmental Science as my major.

3. *What are your goals for the near future?*

Once I graduate with my degree I hope to get a job in a related field. Possibly doing restoration work, or doing field work to assess environmental conditions in different ecosystems. I would like to eventually go back and get my masters.

5. *What were the highlights of your experience at PCC?*

Anytime we did field work. I loved being outside and learning hands on. Also, doing our watershed assessment was time-consuming, but so interesting and I think extremely valuable to my education.

6. *How can we improve the ESR program to better serve the needs of our students?*

At the moment, I can't think of anything.

Meagan Burns

1. Why did you take ESR courses at PCC?

The reason I took course an ESR at PCC is due to my drive to save our planet and to gain the necessary skills to the work required. PCC has small class sizes and Valance Brenneis had interactive courses.

2. What are you currently doing in terms of education or career?

I am in my third year at PCC, I will be transferring to PSU the Fall of 2016. I am currently working on my Math and Chemistry requirement for an AS transfer degree.

3. What are your goals for the near future?

My goals for the near future is to complete all of the remaining courses with high marks, find a part time job or internship in forestry or botany to learn more about identifying plants species and differences between families.

4. If you have transferred to a 4-year university in order to pursue a degree in environmental studies or environmental science, do you feel that your ESR courses prepared you well to transfer?

I have not yet transferred to a four year college. However, I feel every confidence that the ESR series broadened my expectations of what to expect with Environmental Science courses I will be transferring to PSU to take.

5. What were the highlights of your experience at PCC?

I would have to say that the ESR series was the highlight of the experience at PCC. This was interactive with a wide scope of what is expected in the science field. Additionally, Instructor Valance showed exploration and inventiveness in her field trip planning. I have not had a teacher that was more passionate.

6. How can we improve the ESR program to better serve the needs of our students?

The ESR program could be improved by having more teachers available to teach the course. The only class that was extremely difficult for my was the ESR 202. I felt it needed more breaks to process the valuable information. This classes is extremely important for people going into the Environmental field. I would have preferred taking two classes for Law and Policy, instead of the one classes I was assigned.

Millissa Ravenblade

1. Why did you take ESR courses at PCC?

Convenient location of PCC campuses, affordable tuition, small class sizes, and great instructors.

2. What are you currently doing in terms of education or career?

I am pursuing a B.S. in Environmental Studies at PSU, and taking classes at both PCC and PSU to meet the requirements.

3. What are your goals for the near future?

I have been offered a 6 month internship with Clean Water Services working on GIS projects in the Watershed Management department.

4. If you have transferred to a 4-year university in order to pursue a degree in environmental studies or environmental science, do you feel that your ESR courses prepared you well to transfer?

Yes, I feel that the course content, curriculum, tests, papers, research, and field activities all contributed to my ability to be successful in Environmental Studies classes at PSU. The field experience and papers also directly contributed to me being offered a competitive paid internship with Clean Water Service. During the interview process, I shared my experience of touring the Rock Creek Watershed and doing field research into stream ecology. I also provided them with copies of the semester paper entitled "Rock Creek Watershed Analysis" which I completed in ESR 202.

5. What were the highlights of your experience at PCC?

I liked having the same instructor for all 3 courses in the ESR track. She was knowledgeable, excited about the material, and genuinely interested in her students success. I liked the combination of field and lab research combined with the academic knowledge and working in groups.

6. How can we improve the ESR program to better serve the needs of our students?

Nothing in particular stands out for me that needs to be improved. Perhaps having the PSU Environmental Studies/Sciences advising person come in to one of the classes to answer questions regarding transfer/etc.

Nathan Herzog

Appendix F. Comments from partners

From the PCC LAT program

The Environmental Studies (ESR) program partners with Landscape Technology (LAT) in several ways. Perhaps the most important way, is by working together on the relatively new Environmental Landscape Management Technology Degree. This new degree was developed as a collaboration between LAT, ESR and Clean Water Services (CWS) and was offered for the first time in the fall of 2013. As a Career Technical (CTE) degree, the degree is housed and managed in LAT (e.g. advising, scheduling, Co-op Ed) but the biology and environmental courses, a significant portion of the degree, is provided by ESR.

To make this new degree a reality, ESR and LAT (and many, many folks) worked together on its development and continue to work together on the day-to-day management of making it successful.

Some examples of how ESR and LAT work together include:

- being a knowledge resource for each other
- providing guest lectures/sessions for one another
- sharing critical scheduling details to avoid schedule conflicts
- sharing tools and expertise for projects and tasks (e.g. forest/trail management, pollinator garden)

In addition, it was identified that we needed to add one ESR course to complete the ELMT curriculum. Val Brenneis, in her first year here at PCC, stepped in and developed that course, ESR 204 – Introduction to Environmental Restoration, and made it possible to offer the full ELMT curriculum.

A cross-discipline degree such as the ELMT degree would simply not be possible without the expertise and hard work provided by the ESR program. Working with ESR and Biology to meet the needs of our collective students is a joy. Many of our traditional LAT students have pursued or are pursuing the ELMT degree, and I continue to hear wonderful things about Val and ESR.

Submitted on behalf of David Sandrock, Elizabeth Brewster and all of LAT

From the Portland State University Department of Environmental Science & Management

The Environmental Science and Management Department has forged a strong alliance with the environmental program at PCC Rock Creek. Although this seems like an obvious alliance, we don't have a similar relationship with any of the other PCC or MHCC programs. The success of this partnership has really been because both programs realize how valuable it is.

We have an articulation agreement that is clear and sets the students who transfer to PSU up for success. The students that join our program from Rock Creek are well prepared and usually have all the pre-requisites and lower division requirements completed. This preparation allows those students to join in with either of our degrees (Environmental Science or Environmental Studies) at the junior level.

We continue to collaborate to develop courses that serve our students. Several years ago PCC Rock Creek developed a new series of courses to meet the biology requirement based on how organisms deal with their environment. They consulted PSU on these revisions. Now, our department has proposed several courses that are based on those PCC courses. Val Brenneis was extremely helpful to us.

Submitted by John Reuter, Chair of the ESM Department at PSU

Appendix G. Transfer guides for Portland State University



Preparing our students to transfer to the bigger pools of university and the workforce.

Portland State University Environmental Science 2014-2015

Degree Bachelor of Science

Required Courses

University Requirement	PCC Equivalent	Credits
Bi 251, 252, 253 Principles of Biology	BI 211, 212, 213 Principles of Biology	15
Ch 221, 222 with labs Ch 227 & 228 General Chemistry	CH 221& 222 labs included General Chemistry	10
Ec 201 Microeconomics or EC 332	EC 201 Microeconomics	4
Choose 1 from: G 201/204, 202/205 or Ph 201/214, 211/214 (includes labs) or Geog 210	Choose 1 from: G 201, 202 or PHY 201, 211 or GEO 210	4
Mth 251 and 252 Calculus I & II	MTH 251 and 252 Calculus I & II	10
Stat 243 & 244 or Stat 243 & ESM 340	MTH 243 and 244 Statistics	9
ESR 220 Introduction to Environmental Systems	ESR 160 Introduction to Environmental System (ESR 150 may be taken as a prerequisite or concurrently)	4 1
ESR 221 Applied Environmental Studies: Problem Solving	ESR 202 Applied Environmental Studies: Preparation for Problem Solving	4
ESR 222 Applied Environmental Studies: Policy Considerations	ESR 201 Science and Policy Considerations	4

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The **Environmental Science** Program allows students to develop the skills and interdisciplinary understanding needed to deal with environmental systems and human impacts on those systems. Students should consult with a program adviser to assure proper course planning.

The B.A./B.S. degrees in environmental science rest on an interdisciplinary curriculum that develops understanding and expertise in environmental science by building on a foundation in mathematics, natural sciences, and economics complemented by related courses in environmental policy and management. Students complete field experiences working on projects in the University, metropolitan community, and region.

The Environmental Science Program cooperates with several departments and centers, including the departments of Anthropology, Biology, Chemistry, Civil Engineering, Economics, Geography, Geology, History, Mathematics, Physics, Political Science, Sociology; the Center for Science Education; the School of Business Administration; and the College of Urban and Public Affairs.

PCC endeavors to create accurate transfer guides for students; however, requirements may change without notice. Students are responsible for working with PCC advisors and their transfer institution to ensure that their academic plan will meet requirements and timelines.

Last updated: August 2014

Environmental Studies 2014-2015

Degree Bachelor of Science

Required Courses

University Requirement	PCC Equivalent	Credits
<p>Ecology: Select two in a sequence for a min. 8 crs. Bi 252 & 253 Principles of Biology II & III (with labs) Sci 341 & 342 Bio. Concepts & App.</p>	<p>Select two courses in one of the following sequences : BI 212, 213 Principles of Biology <i>(BI 211 is a prerequisite for BI 212)</i> or BI 141, 142, 143 Habitats If students want Sci or ESR 300-level courses, they need to be taken at PSU</p>	8-10
<p>Chemistry: Ch 104 & 105 Intro. Chemistry I & II or ESM 230 & 231 Fund. of Chemistry I & II</p>	<p>CH 104 & 105 Allied Health Chemistry I & II or ESM 230 & 231 at PSU</p>	10
<p>Physical Geography: Geog 210 Physical Geography</p>	<p>GEO 210 The Natural Environment</p>	4
<p>Environmental Science: ESR 220 Introduction to Environ. Systems</p>	<p>ESR 160 Introduction to Environ. Systems. <i>(ESR 150 Environmental Studies Orientation may be taken as a prerequisite or concurrently)</i></p>	4 1
<p>ESR 221 Applied Environmental Studies: Problem Solving</p>	<p>ESR 202 Applied Environmental Studies: Preparation for Problem Solving</p>	4
<p>ESR 222 Applied Env. Studies: Policy Consider.</p>	<p>ESR 201 Applied Environmental Studies- Science/Policy Consideration</p>	4
<p>Choose 4 credits from: STATS 243, SCI 314, GEOG 496, GEOG 497, or ESM 340</p>	<p>MTH 243 only equivalent available at PCC.</p>	5
<p>Geog 380 Maps & Geographic Information</p>	<p>GEO 264 Maps & Geospatial Concepts</p>	4
<p>WR 327 Technical Writing</p>	<p>WR 227 Technical Writing <i>(The Environmental Science department will allow this course to substitute for WR 327 but students will not get upper-division credit)</i></p>	4

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The Environmental Science Program allows students to develop the skills and interdisciplinary understanding needed to deal with environmental systems and human impacts on those systems and social implications of decisions concerning the environment. Students should consult with a program adviser to assure proper course planning.

The B.A./B.S. degrees in environmental science rest on an interdisciplinary curriculum that develops understanding and expertise in environmental science by building on a foundation in natural sciences, social sciences and geography complemented by related courses in environmental policy and resource management. Students complete field experiences working on projects in the University, metropolitan community, and region. This degree is more focused on resource management than the Environmental Science degree.

Last updated: August 2014