



OFFICE OF THE
VICE-PRESIDENT, ACADEMIC

TEL +1 778 782 3925
FAX +1 778 782 5876
sfu.ca/vpacademic

Simon Fraser University
Strand Hall 3100
8888 University Drive
Burnaby BC
Canada V5A 1S6

MEMORANDUM

ATTENTION: Senate

TEL

FROM: Jon Driver, Vice-President, Academic and Provost, and Chair, SCUP

RE: Faculty of Environment: External Review of the Environmental Science Program (SCUP 15-44)

DATE: December 9, 2015

TIME

At its December 9, 2015 meeting, SCUP reviewed and approved the Action Plan for the Environmental Science Program that resulted from its External Review.

The Educational Goals Assessment Plan was reviewed and is attached for the information of Senate.

Motion:

That Senate approve the Action Plan for the Environmental Science Program that resulted from its External Review.

c: J. Venditti
I. Stefanovic

A handwritten signature in blue ink, appearing to be "Jon Driver", is written over the distribution list.

8888 University Drive, Burnaby, BC
Canada V5A 1S6TEL: 778.782.4636
FAX: 778.782.5876avpcio@sfu.ca
www.sfu.ca/vpacademic**MEMORANDUM**

ATTENTION Jon Driver, Chair, SCUP
FROM Gord Myers, Associate Vice President,
Academic
RE: Faculty of Environment: External Review of the Environmental Science Program

DATE November 19, 2015**PAGES** 1/1

Attached are the External Review Report and the Action Plan for the Environmental Science Program. The Educational Goals Assessment Plan is included, for information only, with the Action Plan.

Excerpt from the External Review Report:

"SFU has a real opportunity here, as the profile of FENV has grown and its programs have expanded and attracted student interest. Given the numerous environmental issues currently facing Canada, including the role of government in environmental science, changing energy development priorities, and the magnitude of environmental impacts, this is an opportune time for SFU to be strengthening its programs in this area. The EVSC Program has the opportunity to be the centrepiece of FENV, bringing together the various participating units."

Following the site visit, the Report of the External Review Team* for the Environmental Science Program was submitted in March 2015. The Reviewers made a number of recommendations based on the Terms of Reference that were provided to them. Subsequently, a meeting was held between the Dean, Faculty of Environment and the Director, Environmental Science to consider the recommendations. An Action Plan was prepared taking into consideration the discussion at the meeting and the External Review Report. The Action Plan has been endorsed by the Program and the Dean.

Motion:

That SCUP approve and recommend to Senate the Action Plan for the Environmental Science Program that resulted from its external review.

***External Review Team:**

Kimberly Strong, University of Toronto (Chair of Review Team)
Lincoln Pratson, Duke University
Robert Wissmar, University of Washington
Daniel Leznoff (Internal), Simon Fraser University

Attachments:

1. External Review Report (March 2015)
2. Environmental Science Program Action Plan
3. Environmental Science Program Educational Goals Assessment Plan

cc Ingrid Stefanovic, Dean, Faculty of Environment
Jeremy Vendit, Director, Environmental Science

**External Review Report
Environmental Science Program
Simon Fraser University
March 24, 2015**

External Review Committee

Dr. Kimberly Strong, School of the Environment, University of Toronto (Chair)
Dr. Lincoln Pratson, Nicholas School of the Environment, Duke University
Dr. Robert Wissmar, School of Aquatic & Fishery Sciences, University of Washington
Dr. Daniel Leznoff, Department of Chemistry, Simon Fraser University (Internal)

Preface

We visited Simon Fraser University on March 11 and 12, 2015, to review the Environmental Science Program. This visit was at the invitation of Dr. Glynn Nicholls, Director of Academic Planning and Quality Assurance, Office of the Vice President Academic. The Environmental Science Program (EVSC) is a program within the Faculty of Environment (FENV) of Simon Fraser University (SFU). Prior to the visit, the External Review Committee received the following documents:

1. Self-Study Report for the Environmental Science Program
2. Terms of Reference for the External Review
3. Data on SFU Research Grants and Contracts to Academic Departments
4. Faculty of Environment Five-Year Academic Plan (2013 - 2018)
5. SFU Senate Guidelines
6. Envision SFU
7. SFU Five-Year Academic Plan
8. Strategic Research Plan (2010 - 2015)
9. Institutional Accountability Plan & Report (2014/15 - 2015/16)
10. Senior Administrative Structure Chart
11. Senior Academic Administrative Structure Chart

During the visit, we also received a copy of the May 2006 External Review Report for the Environmental Science Program. The Committee was impressed with the Self-Study Report, which provided a comprehensive and informative overview of EVSC. The quality of the Self-Study Report showed real commitment to the program.

The Review Committee's agenda and meeting participants are attached as an appendix. At all meetings, information was exchanged in a frank and open manner with a view to assessing the state of the EVSC Program and identifying ways to improve it. We also received a number of written submissions following the meeting. We thank all those who met with us and wrote to us for their thoughtful and constructive comments.

The remainder of this report closely follows the template provided to us. We consider the academic and scholarly activities of the EVSC Program and its administration, and provide an appraisal of the quality, structure and effectiveness of EVSC at SFU.

We wish to thank everyone who was involved in setting the agenda for the site visit, arranging the meetings, making travel and accommodation arrangements and providing the documentation. The site visit was very well organized and we appreciate the welcome that we received.

Introduction

The Faculty of Environment was established in 2009 and has a hybrid structure, comprised of departments and programs. It is still a work in progress; this review provides some suggestions to help rationalize the administrative structure for the Environmental Science Program within FENV so that it is well-positioned for future growth.

SFU has a real opportunity here, as the profile of FENV has grown and its programs have expanded and attracted student interest. Given the numerous environmental issues currently facing Canada, including the role of government in environmental science, changing energy development priorities, and the magnitude of environmental impacts, this is an opportune time for SFU to be strengthening its programs in this area. The EVSC Program has the opportunity to be the centrepiece of FENV, bringing together the various participating units. There is a need for the Faculty and EVSC to articulate a vision; together, they should identify key questions in environmental science that can be addressed by the growing EVSC Program. The units should also identify the goals of the program. For example, undergraduate education is currently the dominant function of EVSC. What type of undergraduate experience and training would the EVSC Program ultimately like to provide, and what are types of careers are they training their students for? If research is to be added to the EVSC Program, will subset of fields be emphasized and will they tie into the education goals of the unit?

The EVSC Program is at a crossroads. It has 234 students currently enrolled, with considerable potential for more, but it needs a better administrative framework, more resources including dedicated space and faculty, and a strategy for growth, with metrics for measuring accomplishment in order for the unit to realize its potential. Programs such as this, which serve a particular need but operate outside a departmental framework, face a variety of challenges and resource limitations. For the EVSC Program to thrive, support needs to be in place at the highest levels of university administration. It is up to SFU and FENV to commit to providing the EVSC Program with the means to develop and grow. The recent appointments of a new Dean of FENV and a new Director of EVSC make this an opportune time for elevating environmental sciences at SFU to a higher level.

1. The Quality of the Unit's Programs and Educational Goals

The mission of the Environmental Science Program is to give its students a multidisciplinary education that enables them to apply their knowledge to solving environmental problems. EVSC is a non-departmentalized program within FENV that is dependent on existing courses offered by two partner units in the Faculty of Environment (the Department of Geography and the School of Resource and Environmental Management) and three partner departments in the Faculty of Science (the Departments of Biological Sciences, Earth Sciences, Statistics and Actuarial Sciences). Students also take courses from the Departments of Mathematics, Chemistry, and Physics in the Faculty of Science. EVSC students specialize in one of four concentrations: Applied Biology, Environmental Earth Systems, Environmetrics or Water Science, and can enroll in the Major, Honours, or Cooperative Education. The EVSC Program itself offers four required courses: (1) EVSC 100: Introduction to Environmental Science, (2) EVSC 205: Methods in Environmental Science, (3) EVSC 399: Environmental Science Seminar-I, and (4) EVSC 499: Environmental Science Seminar-II.

The educational goals of the EVSC Program were developed in Fall 2014. They state that with completion, a student with a Environmental Science degree will be able to demonstrate:

1. broad understanding of environmental science underpinned by a foundational knowledge of biological and physical sciences, mathematics and statistics
2. ability to critically evaluate scientific studies, interpret data, and synthesize information from multidisciplinary studies
3. effective oral, visual, and written communication, including scientific writing for scientific, government, industrial or general audiences
4. an understanding of i) the social, economic and political context for environmental issues, ii) the legislative framework for management actions, and iii) the role of stake-holders in decision making
5. discipline specific knowledge (defined for each of the four concentrations)
6. proficiency in specific skills (defined for each of the four concentrations)

A strong environmental science curriculum should include both breadth and depth of knowledge, as well as skills development. Building on the disciplinary content in courses offered by the partner units, the core courses offered by EVSC should enable students to synthesize that material to examine a variety of topics in environmental science. Some thought should also be given to developing the skills that students need for a diverse job market that includes consulting, government, industry, education, planning, resource management, and community outreach. Students need to be able to problem solve and to communicate their knowledge effectively. The educational goals of the EVSC Program are well articulated and relevant, however, efforts should be made to ensure that the core curriculum provides the content and training to ensure that these goals are achieved by the program.

Recommendation: The EVSC curriculum should be reviewed, and if needed, revised to ensure that it provides the content and training needed to achieve the educational goals of the program.

Clearly the EVSC Program relies heavily on contributions from different disciplines to provide multiple perspectives on environmental science. This is achieved by assembling courses from departmental offerings inside and outside FENV, which are combined with the four core courses. The EVSC Program aims to train students for both graduate studies (knowledge focus) and for jobs (skills focus). There was some discussion of whether the program offers sufficient depth to prepare students for graduate school. It appears that students headed in this direction build depth using electives. It is important that students who do wish to pursue graduate studies receive appropriate guidance to ensure that their undergraduate program serves them well for this purpose.

There is considerable student interest in EVSC, but there were questions about whether students are “getting their money’s worth” given the reliance on sessional instruction for the core courses. The number of students in the program seems to justify the investment of more resources to enable it to reach its full potential. The goal is to develop a cohesive program with a home that offers high quality instruction to its students. “High quality” means changing the current model, which involves the hiring of sessional instructors to teach the four core courses on a term-by-term basis.

EVSC is limited by not having its own faculty or laboratory space, making it difficult to mount a graduate program. There did not seem to be much interest in introducing a Masters in Environmental Science at this time, as students can do this within existing programs. The scope for an associated graduate program could be re-evaluated in the future as the EVSC Program matures.

2. The Quality of the Unit's Faculty and Research

Research is not a focus of the EVSC Program since it does not have any faculty appointments. However, the recruitment of new faculty, e.g., through cross-appointments with departments, will provide the opportunity to develop new research strength. One approach might be to define a broad theme for any new hires. An example is the Earth's Critical Zone, defined by the US National Research Council (2001) as the "heterogeneous, near surface environment in which complex interactions involving rock, soil, water, air, and living organisms regulate the natural habitat and determine the availability of life-sustaining resources". This initiative is a research theme by the US National Science Foundation (see Lin, *Hydrol. Earth Syst. Sci.*, 2010, <http://www.hydrol-earth-syst-sci.net/14/25/2010/hess-14-25-2010.pdf>). A theme such as this could provide a means to unify and integrate research across the disciplines that comprise EVSC.

If research is to be a strong element of EVSC, there is a need to assess SFU's research strengths in environmental science and to collectively engage these faculty in identified promising research areas of shared interest. A useful exercise might be to review all current environmental science activities underway at SFU to identify current strengths and engage in discussion of how to build on these. Relevant faculty should be incentivized to participate in defining the scientific research questions and considering how to link these to teaching in EVSC.

Recommendation: A mechanism should be put in place to foster an environment of interdisciplinary scholarship within EVSC and participating units. This could consist of a one-day conference to bring together SFU faculty and students engaged in environmental science research, or a seminar series involving a mix of SFU and external speakers.

3. Administration and Support of the Unit

The administrative support for EVSC is provided within FENV by staff who also administer the other non-departmental programs within the Faculty. The goal has been to create a cohesive administrative structure within FENV, rather than in the individual programs.

This staffing model seems to be working reasonably well. Having a single person responsible for the same tasks across the non-departmentalized programs (e.g., recruitment, calendar entries, scheduling, co-op placements, student advising, etc.) ensures consistency and reduces duplication and inefficiency. However, as the EVSC Program and the new Bachelor of Environment grow, increased student numbers are anticipated, which may put pressure on some of the staffing positions. As this happens, the staffing support should be re-evaluated to ensure that it is commensurate with the needs of the programs.

The EVSC Steering Committee has clearly defined terms of reference and provides a forum for discussion and decisions regarding the program. One challenge for this committee is that the representatives of the participating departments can find that they are in a conflict of interest between the needs of EVSC and the needs of their home unit. These members are also not at liberty to negotiate or commit to levels of support with EVSC on behalf of their home units. While the committee members are a very important source of guidance and ideas for the EVSC, the EVSC Director will also need to be more pro-active in engaging with the departments that the unit relies on to better coordinate shared needs and opportunities. Beyond this additional effort, there may still not be an easy way to resolve more effective communication and collaboration, but the issue should at least be acknowledged and discussed.

4. The Working Environment and Relationships of the Unit

When the EVSC Program was redesigned, six units were involved, each having its own views on various issues. The new Director has been trying to introduce transparent and consensual decision making through the EVSC Steering Committee. This committee does seem to be working to develop a more cohesive program rather than dwelling on past divisions; this approach is both commendable and essential for success. Many courses in the EVSC Program are offered by units outside FENV, with no formal mechanism for resolving cross-Faculty issues. The Steering Committee appears to be the best forum for flagging these issues when they arise and providing input to the Director on how best to go about resolving the issues with EVSC's partner units.

Most of these partner units feel some ownership of EVSC. All units (i.e., departments and schools) believe that EVSC needs a home, but they differed in their views of what that home should be; each unit had a different proposal for the future evolution of the EVSC Program. We encourage all participating units to put aside historical issues and take a positive and constructive view to engaging with the EVSC Program for the mutual benefit of all.

The Department of Statistics and Actuarial Sciences sees an opportunity to engage more EVSC students in their programs and is keen to do so through teaching but also through research, e.g., supervising EVSC student projects. This converges with the students' desire for more statistics in the EVSC Program. A number of models for introducing more statistics content were proposed, including splitting some courses into a modules and folding them into the four-year program. Given this mutual interest, mechanisms for increased interaction between EVSC and the Department of Statistics and Actuarial Sciences should be discussed.

There were some concerns about the impact of EVSC on the enrollments, courses, and resources in the programs of the partner units. There is a perception that EVSC is gaining students at the expense of some programs, although others said that further investigation suggests that students are making their decisions in high school so that EVSC is not poaching from within the SFU student cohort. It is important for the success of EVSC that partner units see themselves as contributing to and benefitting from EVSC, not just servicing the program with their courses.

The Director (EVSC) and the Dean (FENV) should visit each unit to hear its concerns and discuss ways to better the partnership for both the unit and the EVSC. This could be followed by

a meeting with the Dean of Science to review cross-Faculty issues. This exercise would focus on consulting departments about how they want to be involved, helping to ensure transparency and to enable and encourage joint development of the EVSC Program. It is also advisable that they reach out to other departments, such as Archaeology and Chemistry, as potential new partners with EVSC.

Recommendation: The Director of EVSC and the Dean of FENV should meet with each of the units involved in the EVSC Program (Geography, REM, Biology, Earth Sciences, and Statistics) to have a constructive discussion of each unit's vision, role, concerns, and contributions in regard to EVSC, with the goal of establishing long-term engagement in the program.

Student space for EVSC is located in the West Mall, far from FENV and lecture rooms. This isolates the students from the centre of action; priority should be given to finding new space for the students closer to the FENV offices. If this happens, the office of the EVSC sessional instructor should also be moved from West Mall into FENV space. There is also a need for some dedicated space to support EVSC lab and field courses, including some secure space for storing equipment.

Recommendation: Efforts should be made to improve the space situation for EVSC, particularly to bring the student space in West Mall into FENV space. Some dedicated laboratory space for EVSC should also be found, even if it is shared, so that preparing for EVSC courses is both easier and more effective in terms of what can be accomplished in the courses.

Social events involving students and faculty tend to be at the FENV level rather than within EVSC, although the EVSC students to organize some events themselves. Regular social events can help create a cohesive EVSC cohort. There are many options for this, ranging from regular seminars followed by a happy hour or a biweekly mixer at which faculty and students talk informal about their interests, to a more ambitious outing like a canoe trip. It would be helpful and presumably create a better esprit de corps among the contributing faculty, as well as the students, if these social functions could draw faculty from the EVSC's partner units.

5. Future Plans of the Unit

The EVSC Self-Study Report describes future goals for EVSC, with regard to instructional planning, program development, and the administrative structure. These are discussed briefly here, with some further discussion in Section 6.

Instructional Planning: The need for improved quality of instruction and full-time faculty is clearly explained in the Report and five options for teaching, including the status quo, are provided. The current model of relying on short-term sessional instructors is not sustainable for the credibility of the program or for the longevity and commitment of the EVSC Director. Based on discussions during the site visit, the immediate priority is to hire a permanent lecturer to teach EVSC courses, particularly EVSC 100 across all SFU campuses and EVSC 205. Beyond this, a mechanism should be put in place to enable and encourage team teaching by faculty in the

partner units, ensuring that faculty are given credit for teaching and/or co-teaching EVSC courses. In addition, new full-time, tenure-track faculty should be hired to support the EVSC Program; these could be cross-appointments with partner units so that these faculty could teach courses in both EVSC and their home discipline. The combination of increased team teaching and new hires would enable the development of new EVSC courses to strengthen and expand the program.

Recommendation for immediate consideration: The University should hire a full-time instructor for EVSC as soon as possible, either a contract faculty position or teaching-stream appointment, to replace the course-by-course sessional hiring now in place.

Program Development: The need for curriculum development is also addressed. The Report recognizes the need to differentiate the Applied Biology concentration from the Ecology, Evolution, and Conservation (EEC) stream in the Department of Biological Sciences. This should be a priority. Some reinvention of EVSC 205, combined with the introduction of field courses at the third and fourth year level (EVSC 305 and 405) is proposed and seems like a logical evolution for the program. Similarly, the format and effectiveness of EVSC 399 and 499 should be evaluated with a view to revising these courses to better meet the educational goals of the program. There is student interest in a thesis course, more experiential learning opportunities, and interdisciplinary courses that are carefully designed to include material from different disciplines, ideally involving team teaching by several faculty.

Administrative Structure: The EVSC Program is supported by a partially seconded Director and support staff who are also responsible for other programs within FENV. The non-departmental model has strengths for a program like EVSC, which spans a range of disciplines in the natural and mathematical sciences. Future options for the administrative structure are discussed in Section 6.1 below. The EVSC Program also needs some dedicated space to give it a physical home and a visible presence at SFU.

Recommendation for immediate consideration: The Faculty of Environment and the Department of Geography should review the responsibilities of the current Director of EVSC to ensure adequate recognition of his academic leadership role and an appropriate time allocation for his responsibilities.

6. Issues of Specific Interest to the University and/or the Unit for the Review

6.1. Assess the current institutional structure of the Program regarding its suitability and sustainability for the future of the EVSC program.

It was clear from all of the meetings that EVSC needs a better administrative structure, one that enables the program to have a unique mission and the support of all contributing units. The challenge for the EVSC Program, and for environmental science in general, is that it relies on the disciplines and tends to be issues-driven. EVSC needs a governance model that allows it to make full or cross-appointments of faculty to meet its teaching needs and address important environmental issues.

Several different options were suggested during the site visit:

- Maintain EVSC as a non-departmentalized program within FENV.
- Merge EVSC with an existing unit.
- Disband EVSC and distribute the four streams amongst existing units.
- Eliminate the departmental structure within FENV, so that it becomes a fully non-departmental Faculty.
- Create a new Department of Environmental Science capable of offering its own courses in a way that doesn't duplicate existing courses within other units.
- Create an interdisciplinary School as the home for EVSC within FENV.

While some units proposed the establishment of a new Department of Environmental Science or the merger of EVSC with an existing department or school (e.g., Geography, REM), such a structure could impose disciplinary boundaries that are contrary to the vision of a multi-disciplinary environmental science program. EVSC is nowhere near being a standalone department at this point. It would be better structured as an interdisciplinary organization that, with sufficient development (including of research) and attainment of focus, could evolve into a department sometime in the future.

At present, a preferable model has EVSC housed in a new School that draws on the disciplinary expertise of the various programs but also brings together faculty with common interests in environmental science, ideally including budgetary cross-appointments to create real engagement between the new School and different units within FENV and the Faculty of Science. SFU has implemented, or is implementing, an array of programs involving the word "environment" that in the absence of some umbrella structure are confusing and appear to compete with one another. A new School could thus be the home for all non-departmental programs with FENV, including the Environmental Science Program, the new Bachelor of Environment, the Development and Sustainability Minor and Graduate Certificate, the Sustainable Community Development Certificate and Post-Baccalaureate Diploma, the Environmental Literacy Certificate and the Environment One program.

This School will serve as an interdisciplinary hub, differing in concept from a discipline-based department. The name of this new School should be chosen to accurately reflect its programs; a few suggestions are the School of Applied Environmental Science and Policy, or the School of Applied Environmental Education. A clear mission should be defined for the new School, for example: "educating the next generation of applied environmental practitioners".

Recommendation: The University should establish a School within the Faculty of Environment to house all non-departmental programs, including the Environmental Science Program, the new Bachelor of Environment, the Development and Sustainability Minor and Graduate Certificate, the Sustainable Community Development Certificate and Post-Baccalaureate Diploma, the Environmental Literacy Certificate and the Environment One program. The name of this new School should be carefully chosen to accurately reflect its programs.

While the challenges of cross-appointments are recognized (two home units, potential for too

many demands, the possibility of disenfranchisement, resource and space issues), they still offer a viable model if carefully implemented and managed. A strategy should be developed to determine areas for new cross-appointments and how they can best be administered to the benefit of EVSC and partner units (e.g., as discussed in Section 2.1 above).

There is a need to fully engage different units in curriculum development and ownership of EVSC. Three mechanisms can be used to enable long-term ongoing engagement: (1) cross-appointments, (2) curriculum development, and (3) continuous consultation and discussion by the Steering Committee.

Recommendation: The mission of the EVSC Program should be clearly defined, setting out what it is trying to accomplish and defining milestones against which to measure the program's success in achieving these accomplishments. The EVSC curriculum should then be assessed to determine whether it is providing the content and skills needed to achieve this mission, and redesigned if needed. Such a mission statement could also help with student recruitment.

6.2. Assess the teaching resources that support the multidisciplinary EVSC program and provide for improvement.

The EVSC Program needs improved teaching resources, including faculty affiliated with it. A permanent full-time lecturer dedicated to EVSC could provide support for lower-division core courses, while cross-appointed faculty could teach in the more specialized upper-division courses. Cross-appointments will create institutional capacity and help bridge the divide between EVSC and departments, and perhaps between departments themselves. The lecturer could also take on some administrative duties as needed to support curriculum goals, recruitment/outreach, and events coordination. This person could liaise across units to ensure appropriate resource and space sharing on an ongoing basis.

Recommendation: The new School should be put on a firm footing with a series of tenure-stream faculty cross-appointments with each unit involved in teaching in the EVSC Program (e.g., Geography, REM, Biology, Earth Sciences, and Statistics). Additional cross-appointments with other units at SFU should also be assessed, particularly with Chemistry, Economics, and Public Policy. These cross-appointments would have the departments as their primary unit for tenure and promotion (51%) and the new School as the secondary unit (49%), with the Director a voting member of their tenure and promotion committees.

Recommendation: A full-time tenure-stream lecturer should also be hired in the School to provide dedicated support to EVSC teaching needs.

Recommendation: The Director of the new School should be given a formal cross-appointment between the School and the home unit for the duration of his/her term to properly recognize the commitment involved in taking on this role. The need for an Associate Director should be assessed, e.g., this position could have responsibility for laboratory and field courses.

A mechanism is needed at the Faculty level to encourage faculty to teach in EVSC. This should include engaging those faculty members in developing the EVSC curriculum and recognizing and encouraging mutual support between EVSC and the departments. If an additional incentive can be conceived for faculty to develop or at least tailor courses as much for EVSC as for their home units, the partner faculty will feel greater ownership of the courses. Currently, even if faculty are interested in teaching EVSC courses, there does not appear to be any motivation for departments to effectively contribute their own teaching resources to allow this to happen. We were told that there is no mechanism at SFU for shared credit for co-taught courses. If true, this is very surprising and would seem to be a severe deficiency that should be addressed. Other universities have workable models for compensating team teaching across Departments and Faculties, so this is entirely feasible.

Recommendation: As a multi-disciplinary program, some EVSC courses could benefit from being co-taught by instructors from different units. A mechanism for giving instructors shared credit for co-taught courses should be implemented.

There appears to be competition for students, whether perceived or real, between EVSC and some participating units. There is potential for conflict when resources are reallocated between programs and when units do not feel that they are receiving the resources needed to support their participation in the EVSC Program. In some cases, we heard that departments feel that EVSC is draining resources, e.g., additional TA support is needed to run multiple laboratory sessions, while we also heard that EVSC courses, particularly EVSC100, are actually subsidizing other units within FENV. Since units do get credit for students taught in their courses, part of the resource issue seems to be due to the time lag associated with providing new (TA) support as enrollment increases.

The new Bachelor of Environment (B.Env.) rolled out in fall 2014 and is expected to grow quickly. There should be a clear description and branding of the EVSC and B.Env. programs so that students are able to differentiate between them.

REM has a highly successful graduate program with an excellent reputation and a widely recognized “brand”. However, it is an expensive program for SFU, as the current funding model is based on undergraduate student enrollment. There appears to be considerable scope to engage REM faculty in undergraduate teaching in both the EVSC and B.Env. programs.

6.3. Evaluate the suitability of current suite of courses offered by the EVSC program (EVSC 100, 205, 399, 499) and the Faculty of Environment (ENV 319, 320, 321) in fulfilling the common programs-level educational goals. Your view on the social science content would be appreciated.

The EVSC Program has only four core courses. There is scope for new course offerings to expand the Program’s content and to build a more cohesive student cohort. Student demand justifies raising the cap on EVSC 100 (~60 in the winter and summer terms, and up to 150 in the fall term) but this seems to be imposed by lecture hall availability. Lack of a sufficiently large room seems to be limiting the growth of a popular course. Furthermore, EVSC 100 is currently

serving both as a core course for EVSC students and as a breadth course for non-science students. Serving these two different cohorts can be challenging. There appears to be a case for partitioning the course to create two complementary offerings: a core science-focussed EVSC course and a first year environmental issues course for non-science majors that could serve as an alternate recruitment path and also bring in revenue. Such a course might also function as the core first-year course for the Bachelor of Environment.

EVSC 205 provides students with a valuable introduction to a small variety of field methods, and requires a group field project. However, is a difficult course to teach, particularly with a different sessional instructor each year. It has no dedicated space or lab equipment; all such equipment must be found and then borrowed on a largely ad hoc basis from partner units, notably Geography and Biology, brought to the classroom or field, and later returned. The hiring of a permanent full-time lecturer could alleviate some of the challenges associated with this course, as this person could be given responsibility for lab and field courses. At a minimum, EVSC should acquire some dedicated and secure space to store its own lab equipment. Faculty cross-appointments could help with accessing departmental resources for lab and field courses.

There is some perception by different units of overlap and competition between courses, e.g., EVSC 100 and other first year courses such as REM's Global Change. Some central curriculum development is needed to identify and eliminate duplication, and to ensure adequate resources for all components of the program. Curriculum design is also critical to define what students need to have learned by the time they graduate.

The students in the EVSC Program would like to have:

- More quantitative analysis (e.g., computer programming, modelling).
- More statistics before writing the project report in EVSC205.
- More social science courses – the current options are somewhat limited because many courses have prerequisites. There are courses of interest to students that are not on the list of EVSC electives.
- More courses with application to real-world environmental examples.
- More chemistry electives in all four streams.

Students also suggested a mandatory internship or co-op term. They would like to see more flexibility in the Honours program, with faculty supervisors from a variety of departments. A capstone course for EVSC could be introduced to allow the students to apply what they have learned in their program and perhaps do a formal project. Students thought that the joint offering of EVSC399 and EVSC499 was not as effective as it could be. They like the course but don't see the need to do it twice. Some students would rather not be in a mixed cohort, and the large size is now discouraging discussion, particularly amongst third-year students. There appears to be pedagogical value in separating this joint course into separate offering for third-year and fourth-year students. This could allow EVSC499 to incorporate a capstone project or be converted into a capstone course.

Another suggestion was a seminar course, possibly in third year, giving students insight into the breadth of environmental science research. This could be accomplished by having guest lecturers speak about their own research trajectories, and collaborations, or by having a dedicated lecturer

walk students through such collaborative research projects from conception to completion. This would expose students to breadth of research, and develop critical thinking skills.

EVSC students expressed some interest in having their programs accredited. We understand that there are plans to seek accreditation by EcoCanada as recommended by the 2006 review of the EVSC Program, as well as plans to have the Applied Biology concentration accredited by the British Columbia College of Applied Biology Program Accreditation Pilot program. While there is interest in having the Water Science and Environmental Earth Systems concentrations accredited by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC), there are some challenges associated with revising the curriculum to meet the requirements of APEGBC. We encourage further investigation of the feasibility of offering an accredited EVSC stream to students.

Some departments are trying to meet teaching needs by changing their course pre-requisites to allow access by EVSC students. However, this can be an issue for accredited programs, which have formal requirements. Some thought should be given as to whether separate EVSC courses could be offered to avoid the prerequisite issue; such courses would need to take a different approach to existing courses to ensure no duplication. The Steering Committee noted that there are existing courses within departments that could improve EVSC offerings, e.g., in the EEC stream, but are not currently part of the program. The usefulness and feasibility of cross-listing of courses between EVSC and departments should be investigated. Overall, there is scope for greater discussion around departmental courses accessed by EVSC.

It was suggested that EVSC joint majors with departments be introduced. These could provide both breadth across environmental science and depth in the partner discipline. The feasibility and appropriateness of this option could be assessed.

There does seem to be considerable duplication between EVSC's Applied Biology concentration and the Ecology, Evolution, and Conservation stream in the Department of Biological Sciences. The relationship between Applied Biology and EEC should be examined and revisions made to ensure that the streams are clearly differentiated. For example, EEC could focus more on conceptual courses, while Applied Biology includes more applied and skills-based courses, as well as more social science. It was also suggested that Applied Biology be replaced by an Applied Ecology concentration. Course prerequisites can be used to make the two paths clear to students.

There is also some overlap between EVSC's Environmental Earth Systems concentration and the Biogeosciences concentration in Physical Geography. They differ in the social science component (with more such content in Biogeosciences) and some changes are being made to the Biogeosciences courses to increase flexibility in this concentration that may clarify for students the difference between the two programs.

EVSC students do at least two of three social science electives (law, economics, ethics). These should be retained. A course on environmental policy could be added to the program. As it grows, the program could consider new EVSC concentrations, for example, there was student interest in the possibility of a concentration linked to Chemistry.

Recommendation: The Steering Committee should review the EVSC curriculum in the context of other course and program offerings to eliminate overlap and ensure the availability of adequate resources. This review could also evaluate: (i) the introduction of an Environmental Science Minor, (ii) the introduction of a fourth year capstone course, and (iii) the content and number of credits needed for the EVSC Honours.

6.4. Would an increased amount of experiential (field/lab based) learning opportunities in the EVSC program enrich the program?

The EVSC Program could certainly be enriched by additional experiential learning. Currently, there is only one core course (EVSC 205) that involves lab and field methods. This course can access limited equipment for soil, water and biotic sampling, but students should receive instruction in methods that include air, water, soil, rock, biota, and more sophisticated chemistry, as well as techniques that teach core principles and research design. EVSC 205, with its combination of field methods and a group field project appears to be very ambitious for a second-year course. There are challenges associated with the course coming before other second year courses that provide necessary background, the ability of second year students to develop a research hypothesis, and some duplication of material with field courses offered by partner units.

Pedagogically, there is a strong case for increasing experiential learning opportunities. Additional EVSC courses could be added to provide expanded training as well as instruction in both theory and practice, e.g., following the progression EVSC 205 – 305 – 405, as envisioned in the Self-Study Report. The second and third year courses could be split such that one covers field methods and the other is an independent field project course. A group project course would offer a stepping stone to a senior project, without the challenges of devoting supervisory resources to individual students. Students who do not pursue a senior thesis would still have this opportunity to conduct a small research project, and could use this as a basis for deciding whether to pursue a research path.

EVSC students also take lab and field courses offered by other departments. In some cases, the large number of EVSC students (as high as 75% in one field course) can cause challenges. Where possible, if the experiential learning of EVSC students can be met by making use of existing field courses rather than introducing new ones, this approach would make better use of resources.

Additional lab and field courses would provide students with more applied experience and skills training and enhance their value for future employment. Students would also benefit from a skills course that deals with environmental consulting, environmental planning, and resource management. However, it may be possible to offer such training through existing courses.

One model suggested for the EVSC lab/field course progression:

First year: EVSC 100 (core) / EVSC service course / REM 100

Second year: EVSC 205 field methods course without a project (or a community-based experiential learning course)

Third year: EVSC 305 field project

Fourth year: EVSC 405 and/or 499 thesis course

Recommendation: Options for improving the experiential learning component of the EVSC Program should be examined to create an expanded and coordinated set of course offerings in this area. The BC environment appears to be a fantastic area for developing and carrying out such experiential learning activities.

6.5. Evaluate the effectiveness of the EVSC program in providing students with the discipline-specific knowledge and skills required for employment.

The success of the EVSC Program in preparing students for employment is most obvious in the co-op program. This is very successful, with 54% of eligible students enrolled and more placements available than students to fill them. The success of the program indicates that students are filling a market need. A significant number of students appear to return to work with one of their co-op employers after graduation. The program appears to provide excellent preparation for employment. Co-op placements are somewhat self-selecting as only good students tend to be hired. Employers focus on skills rather than the degree. They prefer to hire good people and then train them. They want students who can think.

Co-op scheduling is flexible but there are challenges associated with courses not being available in all terms. Time to completion is longer for co-op students given the longer time taken to do the four placements and fulfill all the course requirements. There is a poor rate of completion of four co-op work terms, as senior students find it relatively easy to find positions on their own, without having to pay the co-op tuition fee. This would appear to be a wider issue for co-op across SFU that deserves some attention.

The FENV Co-op Coordinator is responsible for managing nine programs, up from five a few years ago. The Coordinator looked after ~300 students and placed ~100 in co-op positions last year. There was a notable drop in EVSC placements after 2010, apparently associated with having to manage the increased demands on the co-op program across FENV. There is potential for placing even more students in co-op positions, if additional support were available to identify more employers and to recruit and place more students. Additional support could also be used to provide more mentoring and support to students, e.g., helping with resumes, preparing for interviews, career advice, etc..

Co-op resources are managed centrally at SFU. The current allocation of resources to FENV seems to be historical. Given the recent growth the number and size of FENV programs, the resources allocated to run co-op in the Faculty should be reassessed and adjusted for consistency with other co-op programs at SFU.

Recommendation: Given the recent growth in the number and size of FENV programs, the resources allocated to run co-op in the Faculty should be reassessed and adjusted for consistency with other co-op programs at SFU.

External Review Report

Summary of Recommendations for the Environmental Science Program

1. For immediate consideration: The University should hire a full-time instructor for EVSC as soon as possible, either a contract faculty position or teaching-stream appointment, to replace the course-by-course sessional hiring now in place.
2. For immediate consideration: The Faculty of Environment and the Department of Geography should review the responsibilities of the current Director of EVSC to ensure adequate recognition of his academic leadership role and an appropriate time allocation for his responsibilities.
3. The University should establish a School within the Faculty of Environment to house all non-departmental programs, including the Environmental Science Program, the new Bachelor of Environment, the Development and Sustainability Minor and Graduate Certificate, the Sustainable Community Development Certificate and Post-Baccalaureate Diploma, the Environmental Literacy Certificate and the Environment One program. The name of this new School should be carefully chosen to accurately reflect its programs.
4. The new School should be put on a firm footing with a series of tenure-stream faculty cross-appointments with each unit involved in teaching in the EVSC Program (e.g., Geography, REM, Biology, Earth Sciences, and Statistics). Additional cross-appointments with other units at SFU should also be assessed, particularly with Chemistry, Economics, and Public Policy. These cross-appointments would have the departments as their primary unit for tenure and promotion (51%) and the new School as the secondary unit (49%), with the Director a voting member of their tenure and promotion committees.
5. A full-time tenure-stream lecturer should also be hired in the School to provide dedicated support to EVSC teaching needs.
6. The Director of the new School should be given a formal cross-appointment between the School and the home unit for the duration of his/her term to properly recognize the commitment involved in taking on this role. The need for an Associate Director should be assessed, e.g., this position could have responsibility for laboratory and field courses.
7. Recommendation: The EVSC curriculum should be reviewed, and if needed, revised to ensure that it provides the content and training needed to achieve the educational goals of the program.
8. The mission of the EVSC Program should be clearly defined, setting out what it is trying to accomplish and defining milestones against which to measure the program's success in achieving these accomplishments. The EVSC curriculum should then be assessed to determine whether it is providing the content and skills needed to achieve this mission, and redesigned if needed. Such a mission statement could also help with student recruitment.

9. The Director of EVSC and the Dean of FENV should meet with each of the units involved in the EVSC Program (Geography, REM, Biology, Earth Sciences, and Statistics) to have a constructive discussion of each unit's vision, role, concerns, and contributions in regard to EVSC, with the goal of establishing long-term engagement in the program.
10. The Steering Committee should review the EVSC curriculum in the context of other course and program offerings to eliminate overlap and ensure the availability of adequate resources. This review could also evaluate: (i) the introduction of an Environmental Science Minor, (ii) the introduction of a fourth year capstone course, and (iii) the content and number of credits needed for the EVSC Honours.
11. Options for improving the experiential learning component of the EVSC Program should be examined to create an expanded and coordinated set of course offerings in this area. The BC environment appears to be a fantastic area for developing and carrying out such experiential learning activities.
12. As a multi-disciplinary program, some EVSC courses could benefit from being co-taught by instructors from different units. A mechanism for giving instructors shared credit for co-taught courses should be implemented.
13. A mechanism should be put in place to foster an environment of interdisciplinary scholarship within EVSC and participating units. This could consist of a one-day conference to bring together SFU faculty and students engaged in environmental science research, or a seminar series involving a mix of SFU and external speakers.
14. Efforts should be made to improve the space situation for EVSC, particularly to bring the student space in West Mall into FENV space. Some dedicated laboratory space for EVSC should also be found, even if it is shared, so that preparing for EVSC courses is both easier and more effective in terms of what can be accomplished in the courses.
15. Given the recent growth in the number and size of FENV programs, the resources allocated to run co-op in the Faculty should be reassessed and adjusted for consistency with other co-op programs at SFU.

In addressing the above recommendations, the goal should be to have an academic plan in place by September 2015, with implementation to follow in September 2016.

**Simon Fraser University
Environmental Science Program
Itinerary for External Review Site Visit
March 11 – 12, 2015**

Reviewers: Dr. Kimberly Strong, University of Toronto
Dr. Lincoln Pratson, Duke University
Dr. Robert Wissmar, University of Washington
Dr. Daniel Leznoff, Simon Fraser University

Wednesday, March 11, 2015

7:15	8:00	Car Service from Delta Vancouver Suites to SFU Burnaby Campus	
8:00	9:00	<u>Opening meeting with Senior Administrators:</u> Dr. Gordon Myers, Associate VP Academic (Chair) Dr. Glynn Nicholls, Director, Academic Planning Dr. Ingrid Stefanovic, Dean, Faculty of Environment	Strand Hall, PCR Room 3187 Continental breakfast served
9:00	9:15	Walk to Faculty – Jeremy Venditti or designate	
9:15	10:15	Jeremy Venditti, Director, Environmental Science	TASC2 8570
10:15	10:30	Break	TASC2 8570, Coffee served
10:30	11:30	Michele Black/Stevie Benisch (Administration)	TASC2 8570
11:30	12:00	Sandy Goettler/Leigh McGregor (Advising and Recruitment)	TASC2 8570
12:00	1:15	Lunch at DAC with Jeremy Venditti and Ingrid Stefanovic	Diamond Alumni Centre
1:15	2:15	EVSC steering committee	TASC2 8570
2:15	3:00	EVSC Student Union	TASC2 8570
3:00	3:30	Paul Degrace (Co-op program coordinator)	TASC2 8570
3:30	4:30	Ingrid Stefanovic, Dean, Faculty of Environment	TASC2 8570, Coffee served
4:30	5:00	External Review Committee – Discussion Time	TASC2 8570
		Return to Hotel by Car Service	

**Simon Fraser University
Environmental Science Program
Itinerary for External Review Site Visit
March 11 – 12, 2015**

Thursday, March 12, 2015

8:15	9:00	Car Service from Delta Vancouver Suites to SFU Burnaby Campus	
9:00	9:30	REM Representatives	TASC2 8570
9:30	10:00	EASC Representatives	TASC2 8570
10:00	10:30	STATS Representatives	TASC2 8570
10:30	10:45	Coffee Break	Coffee served
10:45	11:15	BISC Representatives	TASC2 8570
11:15	11:45	GEOG Representatives	TASC2 8570
11:45	12:15	Marnie Branfireun, Current Sessional Instructor for all EVSC courses	TASC2 8570
12:15	1:30	Lunch	TASC2 8570, Lunch served
1:30	2:30	Jeremy Venditti, Director, Environmental Science Ingrid Stefanovic, Dean, Faculty of Environment	TASC2 8570
2:30	2:45	Coffee Break	Coffee served
2:45	3:00	Walk to Strand Hall – Jeremy Venditti or designate	
3:00	4:00	External Review Committee – Discussion Time	Strand Hall, PCR Room 3187
4:00	5:00	Closing meeting with Senior Administrators: Dr. Gordon Myers, Associate VP Academic (Chair) Dr. Jon Driver, VP Academic Dr. Glynn Nicholls, Director, Academic Planning Dr. Ingrid Stefanovic, Dean, Faculty of Environment	Strand Hall, PCR Room 3187
		Return to Hotel by Car Service	

**Response to the External Review Report
of the Environmental Science Program
at Simon Fraser University**

Jeremy Venditti
Director of the Environmental Science Program
Correspondence: evsc_director@sfu.ca

November 6, 2015

Executive summary

As a program, Environmental Science (EVSC) does not have any permanent, dedicated faculty, base budget or stable space allotment. The program is administered through the Faculty of Environment Dean's office with a modest budget. All teaching is currently undertaken by sessional instructors who are difficult to retain on a continuing basis. There is little within the purview of the program that can be done to develop action items without a significant investment in permanent instructors (lecturers and tenure track faculty), resources and space by the Faculty of Environment Dean.

This statement from the External Reviewers' report summarizes the current state of affairs for the Environmental Science Program:

The EVSC Program is at a crossroads. It has 234 students currently enrolled⁽¹⁾, with considerable potential for more, but it needs a better administrative framework, more resources including dedicated space and faculty, and a strategy for growth, with metrics for measuring accomplishment in order for the unit to realize its potential. Programs such as this, which serve a particular need but operate outside a departmental framework, face a variety of challenges and resource limitations. For the EVSC Program to thrive, support needs to be in place at the highest levels of university administration. It is up to SFU and FENV to commit to providing the EVSC Program with the means to develop and grow. The recent appointments of a new Dean of FENV and a new Director of EVSC make this an opportune time for elevating environmental sciences at SFU to a higher level.

The reviewers have recommended an administrative structure for EVSC that includes formation of an undergraduate 'school', the immediate appointment of an instructor to teach the current EVSC courses and the appointment of cross-appointed faculty between the new school and the partner departments that offer the majority of courses in the EVSC program. The reviewers' recommendations are unambiguous and constitute a reasonable plan that will need to be adapted to SFU's structure and institutional arrangement. Important elements of that plan would help to set the EVSC program on a solid foundation for future growth in enrollments.

There is some danger in maintaining the status quo. The number of undergraduate majors in EVSC has grown very rapidly, but the students are not pleased with both the current institutional arrangement (they feel that they have no home), as well as the absence of truly interdisciplinary courses offered by EVSC and the quality of instruction that has been provided by a menagerie of sessional lecturers over the past 5 years. Enrollment growth has been due to the rise of the 'environment' brand on campus and in the public consciousness. If we cannot provide quality instruction by permanent lecturers and faculty, dedicated space, and a range of interdisciplinary courses, there is the real possibility that the reputation of the program and university could be damaged, and that students will pursue environmental science education elsewhere.

The reviewers' recommendations are listed below with responses to each. These recommendations have been translated into an action plan. However, without the formation of an administrative structure, appointment of a lecturer and cross-appointed faculty, many of the important recommendations cannot be substantially addressed. Formation of a new administrative structure and appointments ultimately lie within the purview of the Dean of Environment and Academic Vice President. They are urged to consider the recommendations of the external reviewers and develop an implementation plan in consultation with the EVSC steering committee and the partner departments, so that EVSC may have a bright future at SFU.

¹ Note the number of majors has risen to 285 since the report was received.

Recommendations

The Quality of the Unit's Programs and Educational Goals

Recommendation 1: The EVSC curriculum should be reviewed, and if needed, revised to ensure that it provides the content and training needed to achieve the educational goals of the program.

Action Item 1.1: With the support of the FENV educational consultant, the Director will review the EVSC curriculum in Spring 2016 as part of the educational goals and assessment process. If necessary, and in consultation with the EVSC Steering Committee, the curriculum will be revised to ensure that it provides the content and training needed to achieve the education goals of the program.

Action Item 1.2: Members of Biological Sciences and the EVSC steering committee will begin working together in Spring 2016 to make modifications to the Applied Biology concentration in the existing EVSC program, so that it better matches the educational goals, is distinguished from similar programming in Biological Sciences and so the concentration meets the needs of students interested in biological and ecological aspects of environmental science.

The Quality of the Unit's Faculty and Research

Recommendation 2: A mechanism should be put in place to foster an environment of interdisciplinary scholarship within EVSC and participating units. This could consist of a one-day conference to bring together SFU faculty and students engaged in environmental science research, or a seminar series involving a mix of SFU and external speakers.

There already exist some opportunities for environmental scientists to interact on campus (i.e. the Center for Coastal Science and the recently formed Pacific Water Research Centre), but these are directed towards research. There are few opportunities for undergraduates to interact with faculty from the diverse partner departments.

Action Item 2.1: The Director, steering committee and EVSC student union will meet in Spring 2016 to explore ways to promote more interaction between the EVSC undergraduates and environmental scientists on campus (e.g. one-day conference, seminar series, social events, etc.).

The Working Environment and Relationships of the Unit

Recommendation 3: The Director of EVSC and the Dean of FENV should meet with each of the units involved in the EVSC Program (Geography, REM, Biology, Earth Sciences, and Statistics) to have a constructive discussion of each unit's vision, role, concerns, and contributions in regard to EVSC, with the goal of establishing long-term engagement in the program.

Action 3.1: The Director of EVSC will request meetings with each of the partner units, as well as the Departments of Archeology and Chemistry, during the Spring and Fall 2016 semesters. The intention of these meetings will be to discuss each unit's vision, role, concerns, and contributions in regard to EVSC, with the goal of establishing long-term engagement in the program. Either the Dean or Associate Dean (Undergraduate) will aim to accompany the Director in these discussions, where the Director deems this to be necessary.

Recommendation 4: Efforts should be made to improve the space situation for EVSC, particularly to bring the student space in West Mall into FENV space. Some dedicated laboratory space for EVSC should also be found, even if it is shared, so that preparing for EVSC courses is both easier and more effective in terms of what can be accomplished in the courses.

This is absolutely critical to the maintenance of the existing enrollments and building cohesion between the students, the administrative staff who run the program out of the Dean's office in TASC II, sessional lecturers and the director. Space needs to be made available in the TASC II building for a director's office, an office for a lecturer, a shared office for sessional lecturers and TAs and a student room.

The reviewers also recommended some allocated laboratory teaching space and storage space for resources, which is sorely needed. We have been offering our tutorials and methods courses in spaces not well suited to instruction in the natural sciences. The EVSC methods course, for example, is being taught in a classroom without sinks, lab benches or simple equipment such as analytical balances. This reflects very poorly on the program, the faculty and the university.

Action 4.1: The Director will request from the FENV Dean additional appropriate space in the TASC II building for a director's office, an office for a lecturer, a shared office for sessional lecturers and TAs, a student room, storage space and a teaching laboratory.

Future Plans of the Unit

Recommendation 5 (for immediate consideration): The University should hire a full-time instructor for EVSC as soon as possible, either a contract faculty position or teaching-stream appointment, to replace the course-by-course sessional hiring now in place.

Having an undergraduate program with 285 undergraduate majors and offering courses with enrollments of ~450 (2014/2015) without at least a dedicated lecturer or faculty is unprecedented at SFU. The whole program is currently supported by sessional lecturers, which is not sustainable. In the absence of a permanent lecturer to support EVSC, we will have no choice but to limit offerings of EVSC courses and reduce the number of undergraduate majors to maintain quality instruction.

There is significant room for growth in enrollments in the first year EVSC course. In Summer 2015, we offered EVSC 100 on the Burnaby campus for the first time and it filled to capacity immediately. We have the opportunity to expand enrollments considerably by teaching EVSC 100 on all campuses, 3 semesters a year. Furthermore, the students are requesting more interdisciplinary courses offered by the program and we have a standing audience of majors to take them. Therefore, there is considerable room for growth, which will generate additional funds to support hires. It makes good pedagogic and financial sense to make hires to support teaching in EVSC.

Appointment of a permanent full-time lecturer to cover lower division offerings in EVSC would substantially improve the current situation. Appointment of research faculty with teaching responsibilities in EVSC would also substantially strengthen the program. (See response to Recommendation 9 for further discussion).

Action 5.1: The Director will request that the Dean of Environment make funding available to hire a permanent lecturer to teach lower division EVSC courses. An appropriate home unit for the position (perhaps temporary, until a new governance model for Environmental Science is developed) will be decided in consultation with the Dean's Office.

Administrative Structure:

Recommendation 6 (for immediate consideration): The Faculty of Environment and the Department of Geography should review the responsibilities of the current Director of EVSC to ensure adequate recognition of his academic leadership role and an appropriate time allocation for his responsibilities.

The Director's current time allocation to EVSC (a one-course teaching reduction) is adequate to maintain the program in its current state. However, in order to implement the action items the Director will need a further reduction in teaching load.

Action 6.1: To help to facilitate program growth in a sustainable manner, the Dean's office has already agreed that the Director will have a two-course teaching reduction for the duration of his time as director.

Issues of Specific Interest to the University and/or the Unit for the Review

1) Assess the current institutional structure of the Program regarding its suitability and sustainability for the future of the EVSC program.

Recommendation 7: The University should establish a School within the Faculty of Environment to house all non-departmental programs, including the Environmental Science Program, the new Bachelor of Environment, the Development and Sustainability Minor and Graduate Certificate, the Sustainable Community Development Certificate and Post-Baccalaureate Diploma, the Environmental Literacy Certificate and the Environment One program. The name of this new School should be carefully chosen to accurately reflect its programs.

This is the most controversial suggestion in the review, but only because 'school' is viewed by some at SFU as interchangeable with 'department' and in the case of the Beedie School of Business, interchangeable with 'faculty'. What the reviewers are suggesting is a need of a more coherent core structure, as well as one that is more flexible and collaborative than a traditional department.

Another issue of concern is the suggestion that a new 'school' incorporate the Bachelor of Environment (BEnv) credential and the sustainability certificates and diploma. During the site review, the reviewers had some difficulty understanding the hybrid administrative structure within FENV that supports both departmentalized and non-departmentalized programming. The reviewers suggested an administrative structure that they felt would provide greater coherence. The perceived need to house all the non-departmentalized programs in a single unit is not necessary. The BEnv is a credential that is currently being marketed as a single program. However, any unit or program in the FENV could offer and administratively house a BEnv degree.

Nevertheless, the recommendation to form an administrative unit in the spirit of what the reviewers suggest makes sense. There is a clear need for appointment of a lecturer to support lower division teaching and faculty to teach at the upper division. And they must be appointed somewhere.

Making 100% appointments to existing disciplinary units with teaching responsibilities in EVSC is potentially problematic if it forms an allegiance to a specific disciplinary unit that betrays the collaborative nature of the program between departments across two faculties. However, there are equally good reasons not to form a separate department, in a traditional disciplinary sense of the

word. The reviewers note that 'EVSC is nowhere near being a standalone department at this point.' What is unique about EVSC at SFU is the solid basis in the natural and mathematical sciences in lower division requirements *and* the breadth of the program at the upper division. Isolating a multidisciplinary program like EVSC in a department may lead to a reduction in the breadth of the program and a more insular, disciplinary pedagogic environment.

However, some form of governance reorganization does make sense. One option, as reviewers suggested, is the creation of an interdisciplinary, core unit such as a 'school' with a lecturer to handle lower division courses and cross-appointed faculty from different disciplinary units to teach interdisciplinary courses at the upper division. This option, amongst others, will be discussed further with the steering committee.

The issue of what to include in such a governance reorganization is open for discussion. The EVSC program needs a home. It may make sense that the recently established Masters in Ecological Restoration, which is also administered from the Dean's office, is included in a reorganized unit that is focused on Environmental Science. Again, this option will be discussed with the steering committee and the Dean's Office.

Action 7.1: The Director will meet in Spring 2016 with the FENV Dean and the steering committee to explore various governance (organizational) models for the Environmental Science program. Such a consultation process will ensure that the formation of any new governance structure maximizes the overall benefit to the Environmental Science program, as well as EVSC partner units and others within the FENV.

Recommendation 8: The mission of the EVSC Program should be clearly defined, setting out what it is trying to accomplish and defining milestones against which to measure the program's success in achieving these accomplishments. The EVSC curriculum should then be assessed to determine whether it is providing the content and skills needed to achieve this mission, and redesigned if needed. Such a mission statement could also help with student recruitment.

Action 8.1: The steering committee and director will work on a mission statement in 2016, following the educational goals and assessment process.

2) Assess the teaching resources that support the multidisciplinary EVSC program and provide for improvement.

Recommendation 9: The new School should be put on a firm footing with a series of tenure-stream faculty cross-appointments with each unit involved in teaching in the EVSC Program (e.g., Geography, REM, Biology, Earth Sciences, and Statistics). Additional cross-appointments with other units at SFU should also be assessed, particularly with Chemistry, Economics, and Public Policy. These cross-appointments would have the departments as their primary unit for tenure and promotion (51%) and the new School as the secondary unit (49%), with the Director a voting member of their tenure and promotion committees.

There is a need for tenure-track research faculty to teach upper division, inter-disciplinary courses in EVSC. Tight constraints prevent members of the disciplinary units from developing and co-teaching interdisciplinary courses outside the purview of their units. The EVSC students are increasingly vocal about wanting such courses, including upper division methods courses (field-based, statistics, programming) and a capstone course. All of these are reasonable requests, but further program

development cannot be undertaken without appointment of faculty to the program. A cohort of faculty needs to be appointed in EVSC.

Some disciplinary units have expressed enthusiastic support for hires in EVSC. Others are concerned about how this will affect future hires within their academic hiring plans. Still others have rejected the idea because they do not have the resources to support another faculty member at this time. If cross-appointments are to be made to EVSC, some consideration will have to be given to: i) how to handle tenure and promotion requirements, ii) work load allocation, which varies considerably across the units in FENV and between the Faculties of Science and Environment, iii) impacts of cross-appointments on a unit's hiring plans and iv) provision of space and research facilities. These issues will have to be resolved by the Deans of Environment and Science before any appointments are made.

New appointments need to build on the partner units' disciplinary expertise and not replace it. Appointment of faculty to teach in EVSC, based on disciplinary units' existing academic hiring plans, and taking some portion of their teaching for EVSC, limits disciplinary teaching capacity. It is not possible to have interdisciplinarity without well-supported disciplinary expertise.

The appointed faculty will need to have cohesion between them, and the best way to accomplish that is to have a common research focus. The reviewers recommend appointments of tenure-track faculty around a central theme such as the *critical zone*, a rapidly emerging collaborative research focus on the interactions between the physical and biological components of landscapes and the lower atmosphere. There is considerable expertise in this area at SFU already and insertion of some faculty in key areas would make SFU a leader in the study of the critical zone in Canada, possibly seeding a National Center for Excellence in the area.

Water is an alternative focus for an EVSC faculty cohort. SFU has considerable expertise in water science with physical scientists (groundwater hydrology, geomorphology, limnology) in Geography and Earth Sciences and biological scientists (aquatic biology, fisheries, oceanography) in REM, Geography and Biological Sciences. There is also a group of social scientists working on water resource issues, governance and policy in REM and the Faculty recently established the Pacific Water Research Center to foster interaction and collaboration between natural and social scientists working on water issues. There is scope for additional faculty focused on surface water hydrology, ecohydrology, ecogeomorphology, coastal dynamics, water resources, water governance, social hydrology, social-economic hydrologic modelling, and integrated water management. The key to developing a successful interdisciplinary group is to hire people at the interface between existing disciplinary boundaries and filling gaps in existing disciplinary expertise.

Action 9.1: The Director will meet in 2016 with the FENV Dean to explore the feasibility of a cohort of tenure-stream faculty, that may include cross-appointments with partner units.

Action 9.2: Given the emerging interest in collaboration expressed by members of the Department of Chemistry, the Director will meet with representatives in Chemistry to assess the feasibility of adding a Chemistry-themed EVSC concentration.

Recommendation 10: A full-time tenure-stream lecturer should also be hired in the School to provide dedicated support to EVSC teaching needs.

This is the same as Recommendation #5, except here they recommend a permanent position rather than immediate appointment of a limited-term lecturer.

Action 10.1: Refer to Action 5.1.

Recommendation 11: The Director of the new School should be given a formal cross-appointment between the School and the home unit for the duration of his/her term to properly recognize the commitment involved in taking on this role. The need for an Associate Director should be assessed, e.g., this position could have responsibility for laboratory and field courses.

Previous directors have commented on the pressure that the duality of their role as a departmental member and leadership of an external program exerts. A formal cross-appointment to the program could help to ameliorate that, but the prospect of cross-appointment to a program with no space, resources, research capacity or graduate program is not very appealing. Formation of a new governance model that would support cross-appointments, and a commitment to build a cohort of faculty around a central theme makes the proposal for cross-appointments more reasonable. In the absence of any commitment to grow the program, there is no need for an associate director. However, a permanent lecturer could act as a de facto associate director and take care of laboratories and field courses while the director focuses on planning and institutional arrangements, if a commitment is made to change the status quo.

Action 11.1: Refer to Action 7.1.

Recommendation 12: As a multi-disciplinary program, some EVSC courses could benefit from being co-taught by instructors from different units. A mechanism for giving instructors shared credit for co-taught courses should be implemented.

There is interest in doing this, but it is up to the Deans of Environment and Science as well as the chairs of partner units to work out a suitable arrangement for team teaching.

Action 12.1: The Director will initiate preliminary discussions with interested parties to address the need and mechanism for team teaching in Fall 2016, after the EVSC Director has met with each of the partner units, as well the Departments of Archeology and Chemistry during the Spring and Fall 2016 semesters.

3) Evaluate the suitability of current suite of courses offered by the EVSC program (EVSC 100, 205, 399, 499) and the Faculty of Environment (ENV 319, 320, 321) in fulfilling the common programs-level educational goals. Your view on the social science content would be appreciated.

Recommendation 13: The Steering Committee should review the EVSC curriculum in the context of other course and program offerings to eliminate overlap and ensure the availability of adequate resources. This review could also evaluate: (i) the introduction of an Environmental Science Minor, (ii) the introduction of a fourth year capstone course, and (iii) the content and number of credits needed for the EVSC Honours.

The reviewers note that 'there is scope for new course offerings to expand the Program's content and to build a more cohesive student cohort'. The reviewers have rightly flagged the current series of EVSC courses as inadequately supporting the program. The reviewers note that 'Introduction to Environmental Science' (100) is an effective breadth science course on campus, but that servicing EVSC majors and non-science students is challenging. A team taught second year course limited to EVSC majors would be an effective way to separate EVSC majors as a cohort.

Action 13.1: Given the recommendation by reviewers to offer distinct courses to service EVSC majors and non-science students, a new course progression will be discussed by the steering

committee in Spring 2016 that could include a team taught second year course, limited to EVSC majors.

'Methods in Environmental Science' (205) has proven increasingly difficult to teach without allocated space and pedagogically, it occurs too soon in the program. The course should be moved to the third year with a replacement at the second year that focuses on field experiences (field trips and demonstrations) rather than teaching field and laboratory methodologies. It should be replaced with a series of experiential learning courses as suggested by the reviewers (see below).

Action 13.2: In response to the reviewers recommendation for revision of the experiential learning opportunities in the program, the option of moving 'Methods in Environmental Science' (EVSC 205) to the third year and replacing it with a second year course that focusses on field trips and demonstrations will be discussed with the steering committee in Spring 2016.

Introduction of the Environmental Science seminar courses (399/499) have proven ineffective. They should be replaced by a single third year seminar course that serves as a forum for discussion of the science behind high profile environmental problems with discussants invited from academia, NGOs, community groups and industry. A fourth year, project based capstone course needs to be introduced that will bring together the entire cohort of EVSC students from all the concentrations to work together.

Action 13.3: To better accommodate the need for a discussion forum of the science behind high profile environmental problems, the option of replacing the one credit seminar courses (EVSC 399 and 499) with a three-credit, third year seminar course will be discussed with the steering committee in Spring 2016. The course could serve as a forum for discussion of the science behind high profile environmental problems with discussants invited from academia, NGOs, community groups and industry.

Action 13.4: A new capstone project-based course that will bring together the entire cohort of EVSC students from all the concentrations to work together will be discussed with the steering committee in Spring 2016.

The students in EVSC expressed interest in a number of specific areas including: i) quantitative analysis (e.g., computer programming, modelling), ii) statistics, iii) social science courses without prerequisites, iv) courses with application to real-world environmental examples, v) chemistry. Most of these can be accommodated by working with the partner units.

Action 13.5: Options for the addition of environmental-focused courses on computer programming, modelling, statistics, social science and chemistry will be discussed by the steering committee and during meetings with partner units, Chemistry and Archeology in and Spring 2016.

The students have expressed an interest in a mandatory co-op term. However, discussions with Co-op Coordinator, Paul De Grace, indicate that there would be major challenges with such a proposal. While desirable, this is simply impractical with 285 undergraduate majors. However, the director can explore establishing relationships with industry and government that allow students more work experience during their program.

Action 13.6: To help to facilitate co-op and career opportunities for EVSC students, the Director will establish an advisory committee in 2017 made up of industrial partners, leaders of NGOs and select government agencies who hire EVSC students.

The reviewers support our continued efforts to have our program and select concentrations accredited. We have applied for accreditation by ECO Canada. We are currently participating in a

College of Applied Biology pilot program to accredit programs. The only impediment appears to be the absence of a cell biology course in the curriculum. The addition would require restructuring the concentration to add several chemistry and biochemistry courses. Accreditation of the Environmental Earth Systems and Water Science concentrations by the Association of Professional Engineers and Geoscientists is not possible due largely to the tight prerequisite constraints on some earth sciences courses.

Action 13.7: Accreditation of all concentrations by ECO Canada is being pursued with a planned site visit in Fall 2016.

Action 13.8: An accreditation application for the Applied Biology concentration by the College of Applied Biology (CAB) was submitted in Summer 2015 and is under review.

Action 13.9: In Spring 2016, the Director will meet with the Chair of Earth Sciences to explore options for a certificate or post-baccalaureate diploma that will allow students to apply for accreditation by the Association of Professional Engineers and Geoscientists.

The reviewers suggest that joint majors with departments be introduced. This is difficult because EVSC does not currently have enough courses to justify a collaboration of this type. Such degrees are unusual at SFU and there is no perceived demand, so no action will be taken on this idea. The reviewers also suggest we explore an EVSC minor. EVSC does not currently have enough courses to justify a minor, however as the program grows via faculty appointments and new courses, this would be a good complement to our existing program and will likely be very popular.

4) *Would an increased amount of experiential (field/lab based) learning opportunities in the EVSC program enrich the program?*

Recommendation 14: Options for improving the experiential learning component of the EVSC Program should be examined to create an expanded and coordinated set of course offerings in this area. The BC environment appears to be a fantastic area for developing and carrying out such experiential learning activities.

The reviewers comment that ‘Pedagogically, there is a strong case for increasing experiential learning opportunities.’ They advocate a 205-305-405 model, providing experiential learning at both lower and upper division levels. The most logical progression would be to: i) modify EVSC 205 so that it is focused on field experiences (field trips and demonstrations), ii) create EVSC 305, which will teach field methods and could be offered from the Burnaby campus or as a residential field school and iii) create a 4th year project based capstone course to be taken by all EVSC majors, bringing together the wide range of disciplinary knowledge acquired in the different concentrations.

Action 14.1: Refer to Actions 13.2, 13.3 and 13.4

5) *Evaluate the effectiveness of the EVSC program in providing students with the discipline-specific knowledge and skills required for employment.*

Recommendation 15: Given the recent growth in the number and size of FENV programs, the resources allocated to run co-op in the Faculty should be reassessed and adjusted for consistency with other co-op programs at SFU.

It is clear that the environment co-op coordinator is overwhelmed with the increased number of programs under his purview since the reorganization of faculties at SFU in 2009 and the growth of EVSC. This situation is likely to get worse as enrollment in the BEnv program increases. There is a need to better support the environment co-op coordinator because these are critical experiences for many EVSC students.

Action 15.1: The director will bring the issue to the attention of the Dean of FENV.

EXTERNAL REVIEW – ACTION PLAN

<u>Section 1 – To be completed by the Responsible Unit Person e.g. Chair or Director</u>			
Unit under review	Date of Review Site visit	Responsible Unit person	Faculty Dean
Environmental Science Program	March 11-12, 2015	Jeremy Venditti, Director	Ingrid Leman Stefanovic
<u>Notes</u> 1. It is <u>not</u> expected that every recommendation made by the Review Team be covered by this Action Plan. The major thrusts of the Report should be identified and some consolidation of the recommendations may be possible while other recommendations of lesser importance may be excluded. 2. Attach the required plan to assess the success of the Educational Goals as an addendum (Senate 2013). 3. Should any additional response be warranted, it should be attached as a separate document.			
<u>1. PROGRAMMING</u>			
<u>1.1 Action/s (description what is going to be done):</u>			
<u>1.1.1 Undergraduate:</u> • Action 1: With the support of the FENV educational consultant, the Director will review the EVSC curriculum in Spring 2016 as part of the educational goals and assessment process. If necessary, and in consultation with the EVSC Steering Committee, the curriculum will be revised to ensure that it provides the content and training needed to achieve the education goals of the program. • Action 2: Members of Biological Sciences and the EVSC steering committee will begin working together in Spring 2016 to make modifications to the Applied Biology concentration in the existing EVSC program, so that it better matches the educational goals, is distinguished from similar programming in Biological Sciences and so the concentration meets the needs of students interested in biological and ecological aspects of environmental science. • Action 3: The steering committee and director will work on a mission statement in 2016, following the educational goals and assessment process. • Action 4: Given the recommendation by reviewers to offer distinct courses to service EVSC majors and non-science students, a new course progression will be discussed by the steering committee in Spring 2016 that could include a team taught second year course, limited to EVSC majors. • Action 5: In response to the reviewers recommendation for revision of the experiential learning opportunities in the program, the option of moving 'Methods in Environmental Science' (EVSC 205) to the third year and replacing it with a second year course that focusses on field trips and demonstrations will be discussed with the steering committee in Spring 2016.			

- Action 6: To better accommodate the need for a discussion forum of the science behind high profile environmental problems, the option of replacing the one credit seminar courses (EVSC 399 and 499) with a three-credit, third year seminar course will be discussed with the steering committee in Spring 2016. The course could serve as a forum for discussion of the science behind high profile environmental problems with discussants invited from academia, NGOs, community groups and industry.
- Action 7: A new capstone project-based course that will bring together the entire cohort of EVSC students from all the concentrations to work together will be discussed with the steering committee in Spring 2016.
- Action 8: Options for the addition of environmental-focused courses on computer programming, modelling, statistics, social science and chemistry will be discussed by the steering committee and during meetings with partner units, Chemistry and Archeology in and Spring 2016.
- Action 9: To help to facilitate coop and career opportunities for EVSC students, the Director will establish an advisory committee in 2017 made up of industrial partners, leaders of NGOs and select government agencies who hire EVSC students.
- Action 10: Accreditation of all concentrations by ECO Canada is being pursued with a planned site visit in Fall 2016.
- Action 11: An accreditation application for the Applied Biology concentration by the College of Applied Biology (CAB) was submitted in Summer 2015 and is under review.
- Action 12: In Spring 2016, the Director will meet with the Chair of Earth Sciences to explore options for a certificate or post-baccalaureate diploma that will allow students to apply for accreditation by the Association of Professional Engineers and Geoscientists.

1.1.2 Graduate:

There is no Graduate programming in EVSC

1.2 Resource implications (if any):

A permanent full-time lecturer to teach lower division offerings in EVSC is required.

Tenure-track faculty are required to teach upper division EVSC courses.

Offering lower and upper division experiential learning courses requires funds to get students into the field and resources to support field observations, which can be offset by mandatory supplementary course fees.

1.3 Expected completion date/s:

See individual action items. Action items 6-8 will be discussed by the EVSC steering committee in Spring 2016 and a plan for implementation for 2017 will be established.

2. RESEARCH

2.1 Action/s (what is going to be done):

EVSC has no Faculty and therefore no research capacity, but the reviewers recommended more interaction between researchers and undergraduates.

- Action 13: The Director, steering committee and EVSC student union will meet in Spring 2016 to explore ways to promote more interaction between the EVSC undergraduates and environmental scientists on campus (e.g. one-day conference, seminar series, social events, etc.).

2.2 Resource implications (if any):

None

2.3 Expected completion date/s:

See action item.

3. ADMINISTRATION

3.1 Action/s (what is going to be done):

Changes to the administration to the program are addressed in more detail below under 'Future Plans for the Unit'. The recommendation of the reviewers 'to review the responsibilities of the current Director of EVSC to ensure adequate recognition of his academic leadership role and an appropriate time allocation for his responsibilities' has been addressed by:

- Action 14: To help to facilitate program growth in a sustainable manner, the Dean's office has already agreed that the Director will have a two-course teaching reduction for the duration of his time as director.

3.2 Resource implications (if any):

There are no resource implications for the EVSC program, however there are resource implications for the director's home unit.

3.3 Expected completion date/s:

See action item.

4. WORKING ENVIRONMENT AND RELATIONSHIPS OF THE UNIT

4.1 Action/s (what is going to be done):

- Action 15: The Director of EVSC will request meetings with each of the partner units, as well as the Departments of Archeology and Chemistry, during the Spring and Fall 2016 semesters. The intention of these meetings will be to discuss each unit's vision, role, concerns, and contributions in regard to EVSC, with the goal of establishing long-term engagement in the program. Either the Dean or Associate Dean (Undergraduate) will aim to accompany the Director in these discussions, where the Director deems this to be necessary.
- Action 16: The Director will request from the FENV Dean additional appropriate space in the TASC II building for a director's office, an office for a lecturer, a shared office for sessional lecturers and TAs, a student room, storage space and a teaching laboratory.

4.2 Resource implications (if any):

EVSC is administered out of the FENV Dean's office and requires the Dean to allocate the necessary space.

4.3 Expected completion date/s:

See individual action items.

5. FUTURE PLANS OF THE UNIT

5.1 Action/s:

- Action 17: The Director will meet in Spring 2016 with the FENV Dean and the steering committee to explore various governance (organizational) models for the Environmental Science program. Such a consultation process will ensure that the formation of any new governance structure maximizes the overall benefit to the Environmental Science program, as well as EVSC partner units and others within the FENV.
- Action 18: The Director will request that the Dean of Environment make funding available to hire a permanent lecturer to teach lower division EVSC courses. An appropriate home unit for the position (perhaps temporary, until a new governance model for Environmental Science is developed) will be decided in consultation with the Dean's Office.
- Action 19: The Director will meet in 2016 with the FENV Dean to explore the feasibility of a cohort of tenure-stream faculty, that may include cross-appointments with partner units.
- Action 20: Given the emerging interest in collaboration expressed by members of the Department of Chemistry, the Director will meet with representatives in Chemistry to assess the feasibility of adding a Chemistry-themed EVSC concentration.

5.2 Resource implications (if any):

EVSC is administered out of the FENV Dean's office and there is no reason that an alternative governance (organizational) model would necessarily change that. The resource implications will vary depending on whether a new governance (organizational) model is adopted and what that model is.

Appointment of a permanent lecturer will require office space and salary costs.

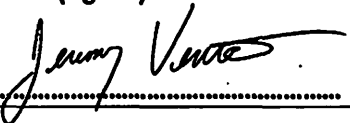
Appointment of tenure track faculty will require office and research space, startup funds and salary costs, which may be usefully shared with existing units if the individuals are cross-appointed.

There are no resource implications for EVSC associated with launching a chemistry-themed EVSC concentration.

5.3 Expected completion date/s:

See individual action items.

The above action plan has been considered by the Unit under review and has been discussed and agreed to by the Dean.

Unit Leader (signed)		Date
	Director of Environmental Science Program	November 9, 2015
Name	Title.....	

Section 2 - Dean's comments and endorsement of the Action Plan:

The external review team was impressed with many aspects of the Environmental Science (EVSC) program, including its growing enrolments and the clear commitment of the current Director to strengthen the program even further. While some minor improvements were suggested, the key recommendation relates to strengthening the core of the program with a more visible, spatial identity, continuing faculty appointments and curriculum expansion to satisfy increasing student interest in interdisciplinary offerings.

Following upon the external review team's recommendations, we have already undertaken some spatial reorganization, locating the Director's office, a Lecturer's office, a shared office for sessional lecturers and TAs and some storage space to Faculty of Environment space in TASC II. We are investigating the very real possibility of converting, in early 2016, a conference room on a lower level of TASC II specifically to serve as a student lounge. Identification of appropriate laboratory space will be addressed over the next year as part of the Faculty of Environment's space planning exercise, due to commence in January 2016.

We have also undertaken to hire a full-time Lecturer, beginning January 2016. Temporarily, the new hire will likely be located within the School of Resource and Environmental Management, as full time teaching and research faculty cannot be appointed within the structure of a program.

The Dean and Associate Dean have met with the Steering Committee to discuss the content of this report and we have received unanimous support for the document in its current form. There is high interest by the Steering Committee in pursuing a number of action items, including working with the Department of Biological Sciences to distinguish the Applied Biology stream within EVSC from the programs within the Faculty of Science; reviewing curriculum changes to strengthen the core interdisciplinary offerings within EVSC; and continuing to carefully assess the social science content within the program.

Perhaps most significantly, the reviewers recommended creation of a "School." The Dean's office agrees with the recommendations of the Director to continue to consult widely about the possibility of founding a "School of Environmental Science and Restoration." Other governance models have been suggested (including the reorganization of an existing department, such as Geography, to accommodate the EVSC program) and these will be discussed within the Steering Committee, at DAC and also in individual meetings with collaborating units. In the Dean's office, we see many advantages to creating a "School of Environmental Science and Restoration," given that EVSC program enrolments (now nearing 300 in number) already exceed those of other units within the Faculty and also given that the new, science-based interdisciplinary Masters of Ecological Restoration needs a home. Once adjustments to the governance model are finalized in a way that allows for continuing appointments, the Dean's office will work with the Director and EVSC Steering Committee to identify opportunities for additional hires of appropriate cross-appointed tenure track faculty to support teaching at the upper division.

We will continue to work closely with the Director of the Environmental Science program to identify an appropriate solution to legibly house and support an interdisciplinary environmental science program, while strengthening discipline-based collaborations across departments through the development of a strong, hub-and-spoke governance model.

Faculty Dean

L. Separeau

Date

Nov. 4, 2015

Environmental Science Program (EVSC)

Educational Goals Assessment Plan

The current environmental science program goals (established in Fall 2014) cannot be adequately assessed in EVSC courses offered by the program. However, program changes based on the recommendations of the external review will bring the program into better alignment with the program goals. Changes recommended include:

1. Redesign the Applied Biology specialization to more strongly differentiate this program from the Ecology, Evolution and Conservation program in Biological Sciences
2. Streamline social science course options and include social science courses designed to support BEnv and EVSC programs (ENV 319, 320 and 321).
3. Modify the course structure and add courses as follows:
 - a. Create a 200 level course specifically for Environmental Science students
 - b. Replace Methods in Environmental Science (EVSC 205) with a course that focuses on field trips and demonstrations.
 - c. Move the current content of EVSC 205 to a newly designed third year field and laboratory methods course.
 - d. Combine EVSC 399 and EVSC 499 to become a mandatory third year seminar course.
 - e. Introduce a mandatory 400-level capstone course for all program streams.
 - f. Introduce an optional 400 level thesis course.

Due to these program changes and the potential inclusion of new courses, the assessment plan will be phased in over several years. For some goals, assessment cannot take place until program changes are made because there are no EVSC courses structured to allow for goals assessment. For other goals, a temporary assessment method will be put into place this year, but the assessment plan will be modified once the program changes have been made.

Assessment Plan based on Course Completions

The Program goals are listed below (bold-italic) and assessment methods are provided for each goal.

When students complete their Environmental Science degrees they will be able to demonstrate the following:

1. broad understanding of environmental science underpinned by a foundational knowledge of biological and physical sciences, mathematics and statistics

- Understanding that environmental problems rely on knowledge from a broad range of disciplines and require an ability to integrate knowledge from the

biological and physical sciences, mathematics and statistics will be demonstrated through successful completion of EVSC 100. The program is targeting a success rate in which 75% of environmental science majors enrolled in EVSC 100 achieve a grade of B- or better.

- Students' foundational knowledge in biological and physical sciences, mathematics and statistics are developed through a common grouping of lower division courses from the Faculties of Science and Environment. Successful completion of the appropriate courses will serve as demonstration that foundational knowledge has been acquired. We therefore already currently assessing this by examination of progress through the program because these courses are required to progress to the upper division.
- A list of concepts that represent foundational knowledge in each of these disciplines will be created by the Program Steering Committee in 2016. A curriculum mapping exercise will be undertaken in 2016 to match these concepts to the existing course list, identify gaps and redundancies, and determine whether the recommended course list needs to be amended.

2. ability to critically evaluate scientific studies, interpret data, and synthesize information from multidisciplinary studies

- This goal cannot be assessed through the existing program structure. A new EVSC course structure is targeted to be in place in 2017-2018. The first students to move through the new structure will, therefore, graduate in 2021.
- Specific assessment techniques will be determined and assessment of this goal will begin in spring 2021 in the 300-level seminar and/or 400-level capstone courses.

3. effective oral, visual, and written communication, including scientific writing for scientific, government, industrial or general audiences

- This goal cannot be assessed through the existing program structure. The new EVSC course structure is targeted to be in place in 2017-2018. The first students to move through the new structure will, therefore, graduate in 2021.
- Specific assessment techniques will be determined and assessment of this goal will begin in spring 2021 in the 300-level seminar and 400-level capstone courses.

4. an understanding of i) the social, economic and political context for environmental issues, ii) the legislative framework for management actions, and iii) the role of stake-holders in decision making

- Currently, achievement of this goal will be demonstrated by the successful completion of REM 100, ENV 319, ENV 320 and ENV 321. Tracking of course completion will begin in Spring 2016.
- Once new EVSC courses are in place, this goal will be demonstrated through successful completion of the 300-level seminar and 400-level capstone courses. Both will include projects and assignments that allow demonstration of an

understanding of the criteria listed in goal 4.

5. discipline specific knowledge that focuses on

- a. Applied Biology: ways abiotic and biotic processes (both natural and anthropogenic) influence the dynamics of populations, the structure of communities and the function of ecosystems.**
- b. Environmental Earth Systems: the atmosphere, biosphere, hydrosphere and geosphere, and how these interacting earth systems affect natural and human-modified environments.**
- c. Environmetrics: statistical and quantitative knowledge as applied to environmental problems, design of monitoring programs for environmental data collection, and the theoretical justifications and implications of statistical decisions, with attention to law, ethics, and economy.**
- d. Water Science: the fundamental processes affecting the cycling of water through Earth's systems, water use and consequences of use, water quality, and the role of water in the functioning and dynamics of aquatic ecosystems.**

- A curriculum mapping exercise will be undertaken in 2016 to match these concepts to the existing course list, identify gaps and redundancies, and determine whether the recommended course list needs to be amended.
- Once the mapping exercise is complete, successful demonstration of this goal will be linked to successful completion of the identified courses.
- Once the program restructure is completed, assessment of this goal will be linked to completion of the capstone course.

6. proficiency in

- a. Applied Biology: sampling and experimental design, quantitative methods of data analysis and interpretation (species classification, estimation of abundance, diversity of one or more taxa, geospatial analysis, population modeling, and multivariate statistical methods).**
- b. Environmental Earth Systems: quantitative analysis of spatial and temporal dynamics in one or more of Earth's systems, or interactions among them, utilizing mathematical or statistical modeling, Geographic Information Systems, remote sensing and field/lab analyses.**
- c. Environmetrics: statistical methods and model selection techniques within statistical software for the analysis of environmental data**
- d. Water Science: quantitative methods of data analysis and interpretation in one or more (or interactions among) aspects of the Earth's water system, estimating uncertainty, measurement of water fluxes and use, and assessment of aquatic ecosystem health.**

- A curriculum mapping exercise will be undertaken in 2016 to match these concepts to the existing course list, identify gaps and redundancies, and determine whether the recommended course list needs to be amended.
- Once the mapping exercise is complete, successful demonstration of this goal will

be linked to successful completion of the identified courses.

- Once the program restructure is completed, assessment of this goal will be linked to completion of the capstone course.

Program-wide Assessment

In addition to assessment-linked to successful course completion and in the future, successful capstone project completion, the program will use two survey tools to assess the program goals including:

- A survey of employers and graduate advisors to determine whether students are entering their careers or graduate studies with the expected knowledge and skills.
- An alumni survey, developed and administered one and five years after graduation. A database will be created and maintained by FENV staff to track student career paths. The survey will be sent to co-op employers, employers of newly graduated students and graduate advisors each spring starting in 2016.

Assessment Plan Implementation

2015-2016

- Track Environmental Science student success in EVSC 100. (Goal 1)
- Steering committee to define a list of characteristics for foundational knowledge in the disciplines that inform environmental science understanding. (Goal 1)
- Collect syllabi for all courses other than the EVSC courses. (Goal 1, 5 and 6)
- Create new EVSC courses to replace existing courses.
- Track completion of REM 100, ENV 319, ENV 320 and ENV 321. (Goal 4).

2016-2017

- Map non-EVSC courses to goals 1, 5 and 6.
- Amend list of course options to remove external courses that aren't providing students with required knowledge.
- Initiate program structure modification and addition of new courses into program.
- Begin tracking student completion of non-EVSC courses. (Goals 1, 5 and 6)

2017-2018

- First students enter program with new EVSC offerings.

2018-2019, 2019-2020

- None

2020-2021

- First students graduate under new course structure.
- Begin assessment for Goals 2 and 3.
- Link assessment to the capstone course for Goals 4, 5 and 6.