ENVIRONMENTAL SCIENCE PROGRAM REVIEW

St. Norbert College

March 2011
EXECUTIVE SUMMARY

• The Environmental Science Discipline equips graduates with the broad scientific foundation necessary to understand how the physical, chemical, and biological processes of the Earth interact in the environment, and how humans have the capacity to act as important catalysts of these processes. This goal is accomplished through active learning in an atmosphere of students and faculty working together. The program challenges students to become independent and reflective thinkers about environmental issues, and to use scientific fact that elevates debate and discussion above emotion and reactionary thinking.

• Four faculty are affiliated with the ES program, including two from the Biology Discipline, one from the Chemistry Discipline, and one from the Geology Discipline. The faculty members are active scholars and collegial citizens. They all share common research and teaching interests focused on water—water chemistry, aquatic ecology, and hydrology. The faculty has an excellent record of scholarly work at the peer level and with SNC students.

• The ES program relies on the contributions of many faculty members in the Biology, Chemistry, Geology, and Mathematics Disciplines to teach courses for the majors. Greater than 70% of the required courses in the ES curriculum are taught by faculty other than those formally affiliated with the program.

• The financial investment to operate the ES program is modest. The discipline operating budget is about $1000/yr and the TA budget is about $300/yr. The operating budget is spent every year. The TA budget is not spent entirely each year. The discipline receives consideration for instructional support funds. Each year a 0.25 FTE is allocated to teach the only course offered entirely from the discipline (ENVS300 Environmental Science). This course also serves Area 11 of the current General Education Program.

• The ES major attracts several times more students than graduate at the end of four years at the College. The number of declared majors in the program has steadily decreased from a high of 54 in 1996-1997 to 10 in 2004-2005. The number of graduates in the last 10 years has varied between 1 and 5. The curriculum is academically demanding, has many required courses (17), and appears difficult for some students to complete.
• The students who graduate from the ES program have entered a diverse range of environmentally-related professions to include natural resource management, environmental law, teaching, and research. Similar to other science students at SNC, academic performance plays a major role in determining their opportunities after graduation. The program provides adequate preparation for a number of post-graduate career options.

• The ES Discipline recognizes key issues that have impacted enrollment and retention of students during the past five years. A critical staffing issue has been the loss of the full-time teaching and student-mentoring contributions of the two biology faculty in the program, Dr. Anindo Choudhury and Dr. James Hodgson. Dr. Choudhury was on 0.25 FTE/year the past five years due to his duties as Associate Academic Dean. Dr. Hodgson was on 0.50 FTE/year the past three years due to phased retirement.

• Some of the concerns recognized by the CEPC as part of the last ES review persist today and the recommendations made by the committee, in most cases, have not been implemented for practical administrative, financial, and logistical reasons. These include support for more directed advertising of the program, support for team-taught courses, and ‘cohesion’ (considering the staffing issues above). Nonetheless, critical issues involve staffing will resolve soon, and other issues such as curricular revision should be considered in the next year (please see next point).

• With the return of Dr. Choudhury to full-time teaching following a one-year sabbatical (2011-12 academic year) and the addition of Dr. Carrie Kissman as a full-time tenure-track ecologist to replace Dr. Hodgson, the ES discipline has a plan to consider several changes to the program in an effort to recruit more students to major and minor in Environmental Science. These include establishing a first-year-student ES course, evaluating the entire curriculum including the total number of required courses, developing a new senior capstone course(s), and more effective recruiting of students in General Biology II, Ecology, and Limnology courses. The discipline also should consider the addition of ES minors or concentrations linked directly to the biology, chemistry, and geology programs.
REPORT

I. Program Vision Statement and its relation to SNC's Mission and Core Values

The mission of the Environmental Science Discipline remains consistent with the stated goals in our first program review in 2006. We strive to equip graduates with the broad scientific foundation necessary to understand how the physical, chemical, and biological processes of the Earth interact in the environment, and how humans have the capacity to act as important catalysts of these processes. We seek to accomplish this goal through active learning in an atmosphere that fosters partnerships among students, and between students and faculty. This situation in turn strengthens their sense of community. While the program gives each student the rigorous training and flexibility to succeed in postgraduate education or in positions with government agencies or industry, the program also challenges students to become independent and reflective thinkers about environmental issues while being firmly grounded in the scientific rigor of their discipline. In this age of increasing concern about the fate of our planet, the broad synthetic scope of the program provides a liberally-educated person a context based on scientific fact that elevates debate and discussion above emotion and reactionary thinking.

We encourage students to use their knowledge to develop an informed environmental ethic, share their knowledge and their ethics with their community, and to do so while respecting the dignity of all. In the end, it is this ability to engage one’s fellow man and woman, and make decisions on critical issues as an informed citizen that may be the most lasting outcomes of a Catholic liberal arts education. The mission of the Environmental Science program is consistent with the Mission of St. Norbert College on many levels, but especially so with respect to fostering within students a call to use their education for ‘the greater good’ in solving environmental problems, developing sustainable land and water use practices, and promoting an environmental ethic.

II. Program Description (Objectives, Learning Outcomes and Curriculum)

A. Objectives of the program and its learning outcomes

Environmental Science (ES) is an interdisciplinary major that concentrates its coursework in the areas of biology, geology, and chemistry, and requires its majors to conduct independent laboratory or field research leading to a final report, presentation, and defense (senior thesis). The design of the Environmental Science Program gives the ES major a broad perspective in the major fields of study for solving environmental problems and the ‘tools’ courses that are part of scientific investigation (e.g. mathematics and statistics).

The program concentrates intermediate and upper-level coursework in the biological sciences, specifically organismal biology and ecology, while also including exposure to the basic concepts of geology and chemistry. This model keeps with a philosophical approach of providing advanced skills in one major area of science, while at the same time providing experience in other areas that are integral to the interdisciplinary nature of environmental problems. The senior thesis project trains the student to solve practical problems in an area of environmental sciences, obtain knowledge through and effective use of the scientific method, and follow a project through to completion. We attempt with our coursework to provide Environmental Science majors with as much hands-on, problem-solving experience as possible.
In addition, given the respective education and research backgrounds of the faculty in the ES program, the major has traditionally focused on aquatic systems (i.e. water chemistry, aquatic ecology, hydrology).

We encourage our students to gain professional experience above and beyond their coursework. We often obtain outside research grants or contracts to hire students as research assistants (e.g. National Science Foundation Research Experiences for Undergraduates). Some students have received ‘in-house’ scholarships, such as the Anselm Keefe Scholarship in support of their senior thesis research. Other students have obtained internships at nearby nature centers or summer jobs with the Wisconsin Department of Natural Resources and other agencies.

B. Description of the program’s curriculum, how it reflects current best practices, and its relevance/connection to the program’s objectives and learning outcomes.

The Environmental Science curriculum has not changed significantly since its first program review in 2006 (two exceptions are discussed below). The required courses are grouped into major discipline categories. The current program in the 2010-12 SNC College Catalog is listed below (17 required courses). The program reflects the long-held programmatic belief of the faculty that environmental issues today are addressed primarily by interdisciplinary training. As such, students are exposed to the three core lab sciences that integrate in the natural realm—biology, geology, and chemistry. Second, the faculty members believe that students should gain advanced experience in one core area, which in our program is biology (with emphasis in ecology). Third, the program includes additional courses in mathematics and statistics that represent the common ‘language’ used by scientists to express scientific measurements and the validity of observations, experiments, models, and forecasts.

Required Courses:

1. BIOL 121 General Biology 2 (BIOL 120 Gen Bio 1 is not a pre-requisite for BIOL 121)
2. BIOL 201 Botany
3. BIOL 228 Ecology
4. BIOL 338 Limnology

5. CHEM 105 General Chemistry 1
6. CHEM 107 General Chemistry 2
7. CHEM 216 Organic Chemistry or CHEM 220 Organic Chemistry 1
8. CHEM 302 (cross listed ENVS 310) Environmental Chemistry

9 ENVS 300 Environmental Science

10. GEOL 105 Geology or GEOL 107 Environmental Geology
11. GEOL 225 Hydrogeology

12. MATH 124 Survey of Calculus or MATH 131 Calculus and Analytical Geometry
13. SSCI 224 Basic Statistics or BUAD 284 Statistics for Business and Economics
Electives:

14./15./16. Minimum of one elective from the following courses in Biology:
BIOL 350 Microbiology
BIOL 355 Invertebrate Biology
BIOL 380 Plant Ecology
BIOL 390 Ichthyology
BIOL 489 Special Topics

15./16. Additional elective course(s) approved by the advisor and ES discipline coordinator (if electives aren’t fulfilled from the list above)

17. BIOL 428 Environmental Biology Research or GEOL 428 Environmental Geology Research or ENVS 428 Environmental Science Research

Two significant changes were made to the program since the last review. First, the requirement of a single course in basic computer skills was removed. This requirement was part of the original ES major formulated over 20 years ago—at a time when many students still entered St. Norbert College with minimal computing skills. This requirement is no longer needed given the typical computing abilities of entering first-year students.

The added requirement of BIOL201 Botany was made for two reasons. This course addresses the need for students to take a biology course that incorporates training in systematics and taxonomy. The subject of taxonomy refers to the study of the evolutionary relationships among a significant group of organisms and the formal naming system used to communicate such relationships. The ES faculty recognized that a major in our program could conceivably graduate from SNC without getting detailed practice with the systematics and taxonomy of a major organismal group (keeping in mind that basic principles can be applied to other groups of organisms). Over the last few years, some students clearly showed deficiencies in this area as part of our assessment process. This adjustment addresses this problem. Second, the ES program at SNC has traditionally focused on the animal realm of aquatic environments because of the research and teaching interests of Drs. Hodgson and Choudhury. The faculty believed it was important to include a botany course at the introductory level so that our majors received formal training in this subject area.

The ES Program uses technology extensively in teaching and research. This includes technology in the ‘smart’ lecture rooms, in the laboratories, and in the field. Some of the more significant technology now available includes the following (list updated since last program review):

• Numerous research grade compound and stereo microscopes (light microscopy)
• Scanning Electron Microscope
• Standard and ultra centrifuges
• Cell culture chambers
• Plant growth chambers
• Autoclave sterilizers
• High precision field data loggers
• Water monitoring equipment (for dissolved oxygen, pH, conductivity, temperature etc.)
• Water discharge measurement equipment (Gurley meters)
• Electro-shockers (portable and boat shockers)
• GIS (geographic information system) and digital mapping software (ARC Suite and Global Mapper)
• 3-D digital imaging display equipment (GeoWall)
• GPS (global positioning system) technology

C. Program administration and the process of decision making

During the current review period, the ES program has operated with relatively little formal departmental interaction because of the administrative duties of one member (Dr. Choudhury) serving as Associate Academic Dean and the phased retirement of another (Dr. Hodgson). Dr. Poister and Dr. Ham served as discipline coordinators during this time for three years and two years, respectively. Decisions about the use of our relatively modest departmental budget (approximately $1000/year) and TA resources (approximately $300/year) were made informally by consensus with members of the discipline when necessary. All members were also consulted when instructional support or library requests were made. Administrative work was/is handled almost exclusively by the discipline coordinator.

III. Assessment of Student Learning Outcomes

A. Viable Assessment Plan (Summarize intended learning outcomes for majors and describe how the program regularly assesses student learning)

The CEPC program review of the ES Discipline in 2006 stated that the assessment plan of the program was strong. The discipline has continued to use the same basic plan during the past five years, which is summarized below. However, the issue of low sampling size because of the low number of graduates continues to be problematic in seeing trends. As such, we continue to evaluate our program both with ‘numbers’ and by looking at each graduate individually in terms of academic ability, success in the program, and what we know about their work after leaving the institution.

The principal tool used for the assessment of the program is still based on the evaluation of senior theses projects completed by all ES majors. Upon completion of the project, the student summarizes his or her activity and findings in the form of a written thesis which is distributed to the ES Faculty. The student also presents the project to a panel consisting of the entire ES Faculty (other faculty and students may attend if they wish). After the presentation, the ES Faculty ask questions of the student for clarification and assessment of the student’s understanding of the project, and to gauge the level of competence achieved by the student in the ES major. As noted in the 2006 program review, by the 2003 – 2004 academic year it was clear after consultation with the AVP for Institutional Effectiveness that a more objective and specific definition of learning outcomes was desirable to assess the performance of this capstone experience (and by extension of the program itself). As a result, a scoring rubric (see Appendix A) was developed to evaluate senior theses and has been used ever since (04-05 year). The nature of the rubric is important to understand. It focuses on several key ‘cycles’ and ‘themes’ that a student would be exposed to in several courses during the course of their curriculum. As such, because the ES faculty don’t teach many of courses in the major, these themes are deemed more important than many detailed-oriented questions that might or might not be taught in only
B. Direct Evidence

Eight students graduated in the 2005-06 to 2008-09 period with major degrees in ES. The following data summarize the scores relative to the detailed scoring rubric given in Appendix A. In the first section focusing on curriculum knowledge, a score of ‘2’ on the rubric generally indicates ‘poor’ mastery of the topic, whereas a score of ‘3’ indicates ‘good’ mastery or understanding of the topic. The second area focuses on the quality of the senior-thesis research. The implications of thesis results are discussed in section C below.

<table>
<thead>
<tr>
<th>Item—curric. knowledge</th>
<th>Ave. Score (scores range from 1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. tropic levels</td>
<td>3.25</td>
</tr>
<tr>
<td>b. plate tectonics</td>
<td>3.25</td>
</tr>
<tr>
<td>c. hydrologic cycle</td>
<td>3</td>
</tr>
<tr>
<td>d. natural selection</td>
<td>3.25</td>
</tr>
<tr>
<td>e. taxonomy</td>
<td>2.75</td>
</tr>
<tr>
<td>f. biogeochemical cycles</td>
<td>2.75</td>
</tr>
<tr>
<td>g. biodiversity/extinction</td>
<td>2.7</td>
</tr>
<tr>
<td>h. human population impacts</td>
<td>2.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item—thesis project design and execution</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. hypothesis/variables</td>
</tr>
<tr>
<td>b. experiment design</td>
</tr>
<tr>
<td>c. protocol design</td>
</tr>
<tr>
<td>d. statistical/data analysis</td>
</tr>
<tr>
<td>e. thesis/writing</td>
</tr>
<tr>
<td>f. oral presentation</td>
</tr>
</tbody>
</table>

C. Indirect Evidence

Current student survey data (28 surveys) show that students report they are ‘very satisfied’ or ‘satisfied’ with the ES program in virtually every category of the survey. The subject areas of ‘quality of instruction’, ‘quality of course content’, and ‘quality of curriculum’ consistently are ranked the highest by students. A few minor exceptions were noted in the areas of ‘range of courses offered’, ‘overall major program’, and ‘advisement quality’ in some years. Complete data is available in the OIE. Survey data for students who have graduated from the ES program are probably not meaningful; although they indicate 100% satisfaction with the program, only one student completed a survey.

Tracking of alumni by the College provides information on about one-third of ES graduates during the period from 1997-2008 (12 of 33 graduates). This information is available from the Office of Advancement. However, the diversity of positions held by ES graduates matches the anecdotal information known by the SNC faculty about our former students. The positions held by ES graduates are diverse and include the following: environmental projects manager, forester, graduate student, science teacher, waste-management specialist, Ph.D. candidate. Additional positions held by ES graduates not indicated by the alumni survey include environmental engineer and fisheries biologist.
D. Document program improvement efforts based upon assessment.

Several key issues have resulted from our assessment efforts and the use of a senior thesis as a capstone course to the ES major. In two instances these issues have resulted in changes to the program curriculum (briefly mentioned previously), which we hope will result in better training for our students and career preparation. Specifically,

1. The computer science course that was an original requirement of the major was eliminated, primarily because it became clear over the past decade that ES students (as most SNC students) were coming to SNC with basic computer skills already in hand. These skills included the ability to access and navigate the Internet, basic use of Microsoft Office programs, and use of email. Today, these skills are basic, but 20 years ago many students arrived at SNC with little experience with personal computers.

2. In turn, the elimination of a computer science requirement allowed the ES program to require Botany. One deficiency we observed in graduating students was a clear understanding of taxonomy and systematics. In addition, the fact that the two biology faculty in the program were largely focused on animals instead of plants meant that students didn’t get an introduction to this important area within the framework of the required courses in ecology and limnology. Thus, the addition of Botany addressed both the taxonomy issue and an introduction to plants/plant ecology as it might apply to environmental science.

3. An ongoing dilemma is whether the senior capstone course in research should be eliminated or replaced by a more flexible option in terms of a senior capstone. One of the primary issues concerns student ability. In all other lab science programs at SNC, senior research is generally considered a special opportunity for highly-motivated students who seek out such an experience. In addition, the intellectual ability of a student who likely would gain the most from such an experience is typically well above the ‘average’ SNC student. Increasingly, the ES faculty have found it frustrating to work with some ES majors who were largely unmotivated or intellectually unable to conduct an independent research project. We believe a couple of alternatives might be worth considering.

   a. one model might be that of a junior/senior capstone project, in which a small group of ES majors conducts a group research project selected and supervised by one ES faculty member (or perhaps team taught, which still appears logistically unrealistic). The team project approach would more closely simulate the working experiences that most of our students are likely to encounter in the environmental field. In addition, it would give an opportunity to work toward their strengths while having support from peers when dealing with aspects of a project that are more daunting (because of lack of skills in mathematics or statistics for example). This model is used by the UW-Madison Water Resources Program (M.S.).

   b. a second model might involve allowing students the opportunity to intern or conduct a service-learning project as part of their capstone experience. In some instances, internships have proven exceptionally valuable to ES majors, and they have used a project based on their internship to satisfy their senior thesis option. Again, one issue is the minimum GPA requirement for engaging in an official SNC internship. In recent years, a couple of ES students have been ineligible to do so.
Many of these changes are best considered with our new faculty member in ecology, Dr. Kissman, on board in the Fall of 2011, and the return of Dr. Choudhury to full-time teaching in the Fall of 2012.

IV. Program Demographics & Comparisons

A. FTE program faculty

The regular faculty full-time faculty members of the ES program are listed below along with their respective academic ranks. Please note that Dr. Choudhury and Dr. Hodgson were on reduced teaching loads during the past five (0.25 FTE) and three (0.50 FTE) years, respectively. Dr. Carrie Kissman was hired as a new tenure-track ecologist and will begin in the Fall of 2011.

Continuing Tenured Faculty:
1. Dr. Anindo Choudhury* Ph.D., Associate Professor of Biology & Environmental Science
   (*Assoc. Academic Dean Fall 2006-Spring 2011 with a teaching load of 0.25 FTE; one year sabbatical Fall 2011-Spring 2012)
2. Dr. Nelson Ham Ph.D., Professor of Geology & Environmental Science
3. Dr. David Poister Ph.D., Associate Professor of Chemistry & Environmental Science

Retiring Faculty:
4. Dr. James Hodgson** Ph.D., Professor of Biology & Environmental Science
   (**on phased retirement Fall 2008-Spring 2011 with teaching load of 0.50 FTE; Emeritus Professor beginning Fall 2011)

New Faculty (tenure track):
5. Dr. Carrie Kissman*** Ph.D., Assistant Professor of Biology & Environmental Science
   (**starting Fall 2011)

B. Number of majors and/or minors

The average number of recognized majors and minors during the current program review period (19.8) has remained almost identical to the previous five-year period (20.4). However, there are fewer numbers of recognized majors but more minors. The decline in recognized majors is about 25% (from an average of about 20 to 15 students) and number of minors increased about 2.5 times (from an average of about 2 to 5 students).

<table>
<thead>
<tr>
<th>Majors &amp; Minors</th>
<th>Total as of Fall Semester each Academic Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>05-06</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>6</td>
</tr>
<tr>
<td>Env. Science-Non-Declared</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
</tr>
<tr>
<td>Minors</td>
<td>05-06</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
</tr>
<tr>
<td>Total Majors &amp; Minors</td>
<td>15</td>
</tr>
</tbody>
</table>
C. Number of graduates

The average number of students completing ES degrees during the current review period has stayed about the same as the previous review period (note that the data from the 09-10 year was not available in the OIE ES data file). The ES program during the past decade has graduated an average of three students per year, typically two majors and one minor.

<table>
<thead>
<tr>
<th>Total Program Graduates</th>
<th>IPEDS Reporting Year of July - June</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>05-06</td>
</tr>
<tr>
<td>SNC Total Graduates</td>
<td>432</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>3</td>
</tr>
<tr>
<td>Total Majors</td>
<td>3</td>
</tr>
<tr>
<td>% of All Grads</td>
<td>1%</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>1</td>
</tr>
<tr>
<td>Total Minors</td>
<td>1</td>
</tr>
<tr>
<td>Total Majors &amp; Minors</td>
<td>4</td>
</tr>
<tr>
<td>% of All Grads</td>
<td>1%</td>
</tr>
</tbody>
</table>

D. Ratio of graduates to majors

The ratio of graduates to majors and minors has fluctuated significantly during the history of the ES program and shows not consistent trends over the 20 years that data have been kept.

<table>
<thead>
<tr>
<th>Ratio of Graduates to Majors/Minors</th>
<th>IPEDS Graduates to Fall Declared Majors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>05-06</td>
</tr>
<tr>
<td>Ratio Grads to Majors</td>
<td>0.27</td>
</tr>
<tr>
<td>Ratio Grads to Minors</td>
<td>0.25</td>
</tr>
</tbody>
</table>

E. Ratio of majors to FTE full-time faculty

The following table summarizes data for determining the ratio of environmental science majors to FTE full-time faculty who contribute to the program. The variable FTE numbers for the faculty members reflect years in which some members had a reduced teaching load because of sabbatical leave, phased retirement, parental leave, or re-allocated duties to administration (i.e. associate academic dean). As such, the ratio of majors to FTE full-time faculty for the last four years is 5.4:1.

However, in each of the last five years, only one ENVS-designated course (ENVS300 Environmental Science) per year in the Environmental Science program has been taught by the faculty group as a whole as a regular allocation of teaching duties. This constitutes a 0.25 FTE per year. As such, the faculty teaching contribution necessary to maintain the program is quite small. Using this FTE value, the ratio of majors to FTE (ES courses) averaged over the past four years is about 62:1. Please note that ENVS300 serves as an Area 11 course and has more general education students than environmental science students enrolled in it. We should note
that CHEM302 Environmental Chemistry is a chemistry elective and ENVS requirement, however it has been taught infrequently. Finally, BIOL428, CHEM428, and GEOL428, all of which serve as the ‘senior thesis’ courses taken by ES majors are not included in this calculation because none of the faculty have ever received teaching credit for supervising student projects.

<table>
<thead>
<tr>
<th>Ratio of Majors to Full-Time FTE Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Majors</strong></td>
</tr>
<tr>
<td>Environmental Science</td>
</tr>
<tr>
<td>Env. Science-Non-Declared</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

**ES Faculty Annual FTE:**

<table>
<thead>
<tr>
<th>Faculty</th>
<th>05-06</th>
<th>06-07</th>
<th>07-08</th>
<th>08-09</th>
<th>09-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Choudhury</td>
<td>1</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>N. Ham</td>
<td>1</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>J. Hodgson</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>D. Poister</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Combined ES Faculty FTE:**

<table>
<thead>
<tr>
<th>05-06</th>
<th>06-07</th>
<th>07-08</th>
<th>08-09</th>
<th>09-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2.75</td>
<td>3.25</td>
<td>2.75</td>
<td>2.75</td>
</tr>
</tbody>
</table>

**RATIO ES MAJORS/ES FTE:**

<table>
<thead>
<tr>
<th>05-06</th>
<th>06-07</th>
<th>07-08</th>
<th>08-09</th>
<th>09-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.75</td>
<td>6.54</td>
<td>5.23</td>
<td>5.45</td>
<td>4.36</td>
</tr>
</tbody>
</table>

**RATIO of ES MAJORS/ES FTE ave. last four years = 5.4**

**Ave. # ENVS courses taught per year by all ES faculty = 1 (0.25 FTE)**

**RATIO of ES MAJORS/0.25 FTE ave. last four years = 62**

**F. Course enrollments and grade distributions**

Enrollments for ES courses in the past five years are listed in the table below. The majority of the enrolled students took ENVS300 Environmental Science (Area 11), which was offered once every academic year.

<table>
<thead>
<tr>
<th>Environmental Science Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Class Enrollments by Academic Year (Fall, Spring, Summer Semester)</strong></td>
</tr>
<tr>
<td><strong>Other Enrollment = Arranged, Independent Study, Internships</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Regular Enrollment</td>
</tr>
<tr>
<td>GS Enrollment</td>
</tr>
<tr>
<td>Other Enrollment</td>
</tr>
<tr>
<td><strong>Total Enrollment</strong></td>
</tr>
</tbody>
</table>
The percentage grade distribution for the Environmental Science discipline is somewhat lower than the average for all SNC disciplines (see tables below).

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>A</th>
<th>AB</th>
<th>B</th>
<th>BC</th>
<th>C</th>
<th>CD</th>
<th>D</th>
<th>F</th>
<th>W</th>
<th>Su m</th>
<th>Total GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Fall</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3.000</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>3.091</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Distribution</td>
<td>8%</td>
<td>33%</td>
<td>33%</td>
<td>17%</td>
<td>8%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>Fall</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>22</td>
<td></td>
<td>3.000</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Distribution</td>
<td>18%</td>
<td>27%</td>
<td>23%</td>
<td>9%</td>
<td>9%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Fall</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>27</td>
<td></td>
<td>2.778</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Distribution</td>
<td>15%</td>
<td>7%</td>
<td>44%</td>
<td>15%</td>
<td>11%</td>
<td>0%</td>
<td>0%</td>
<td>7%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>Fall</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3.250</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>11</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>24</td>
<td></td>
<td>3.375</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>12</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Distribution</td>
<td>46%</td>
<td>15%</td>
<td>23%</td>
<td>12%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>4%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Fall</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>#DIV/0!</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>18</td>
<td>2.133</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% Distribution</td>
<td>6%</td>
<td>17%</td>
<td>11%</td>
<td>11%</td>
<td>0%</td>
<td>17%</td>
<td>11%</td>
<td>11%</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percentage Grade Distribution for Most Recent Academic Year – All Disciplines

<table>
<thead>
<tr>
<th>A</th>
<th>AB</th>
<th>B</th>
<th>BC</th>
<th>C</th>
<th>CD</th>
<th>D</th>
<th>F</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>31%</td>
<td>17%</td>
<td>20%</td>
<td>9%</td>
<td>8%</td>
<td>3%</td>
<td>2%</td>
<td>1%</td>
<td>4%</td>
</tr>
</tbody>
</table>

G. Advising load per full-time faculty

The average advising load per SNC faculty member is currently 18 students. The current advising load for each ES faculty member is listed below; however, please note the unusual circumstances for Drs. Choudhury and Hodgson. Under normal circumstances, the advising load has been consistent with the College average.
Dr. Anindo Choudhury  55 students (includes students in the Nursing Program)
Dr. Nelson Ham  20 students
Dr. J. Hodgson  1 student (no longer advising due to retirement)
Dr. David Poister  21 students

H. Percent of course sections taught by part-time faculty.

None of the courses within the program is taught by part-time faculty on a regular basis.

I. Peer and Aspirant Comparisons

The IPEDS data provided by the OIE does not show the same number of environmental science graduates from SNC as the table in section IV. Part C. In either case, the number of graduates from the Environmental Science program at SNC is nearly the same (3 year average) as our peer institutions, but significantly lower than our aspirant institutions.

### IPEDS DATA ON TOTAL GRADUATES AND ENVIRONMENTAL SCIENCE MAJORS

<table>
<thead>
<tr>
<th>CIP CODE 03.0104</th>
<th>Total</th>
<th>Environ. Science</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grads</td>
<td>Grads</td>
</tr>
<tr>
<td><strong>PEER INSTITUTIONS</strong></td>
<td>3YR AVG</td>
<td>2007</td>
</tr>
<tr>
<td>Median of Peers</td>
<td>509</td>
<td>0</td>
</tr>
<tr>
<td>Median of Peers w/Environ. Science</td>
<td>452</td>
<td>2</td>
</tr>
<tr>
<td>Average of Peers w/Environ. Science</td>
<td>452</td>
<td>2</td>
</tr>
<tr>
<td><strong>ASPIRANT INSTITUTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median of Aspirants</td>
<td>575</td>
<td>0</td>
</tr>
<tr>
<td>Median of Aspirants w/Environ. Science</td>
<td>509</td>
<td>9</td>
</tr>
<tr>
<td>Average of Aspirants w/Environ. Science</td>
<td>537</td>
<td>9</td>
</tr>
<tr>
<td><strong>St. Norbert College</strong></td>
<td>479</td>
<td>0</td>
</tr>
</tbody>
</table>

Some institutions, including SNC, utilize more general major categories when reporting IPEDS data. Therefore, it can't be determined if every student majoring in a particular area can be accounted for by these CIP codes.

V. Teaching and Learning

A. Indicators of Teaching and Advising Quality

The core course taught entirely within the ES program is ENVS300 Environmental Science. This class is offered typically once every academic year (usually during the spring semesters) and in recent years has rotated among three of the faculty members, although not necessarily on a regular schedule. Teaching evaluations for the period of the current program
review are limited to three sections (see table below). The average ratings for the three sections for ‘course’ and ‘instructor’ are close to the college average for all instructors.

Most of the courses taken by ES majors are taught by several instructors within the Biology, Chemistry, Geology, and Mathematics Disciplines. As such, teaching evaluations provided by those disciplines in their respective program reviews provide evidence of teaching quality that contributes significantly to the ES program. Two ES faculty have been awarded the L. Ledvina Teaching Award (see CV).

<table>
<thead>
<tr>
<th>Teaching Evaluation Subscores for Environmental Science (ENVS300)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVS300</td>
</tr>
<tr>
<td><strong>SPR 05-06</strong></td>
</tr>
<tr>
<td><strong>Course Rating</strong></td>
</tr>
<tr>
<td>(college ave)</td>
</tr>
<tr>
<td><strong>Instructor Rating</strong></td>
</tr>
<tr>
<td>(college ave)</td>
</tr>
</tbody>
</table>

**B. Scholarly/Creative Efforts**

The scholarly agendas of the ES faculty are strongly linked to the ES program. Specifically, their research directly informs their specialty courses in their respective disciplines that also serve the ES program and it provides the ideas, and often funding, for student capstone research projects. All of the faculty members have been actively engaged in peer-level research and faculty-student collaborative research during their tenures at SNC. Although much of this work has been at SNC, in many cases it has extended well beyond the boundaries of the College to include international work. In general, all of the faculty members have a general interest in stream and lake ecosystems—from geological, chemical, and biological viewpoints. A general list of research interests of the faculty are as follows:

Dr. Anindo Choudhury: Evolutionary trends of fish parasites
Dr. Nelson Ham: Past and present climate as indicated by glacial deposits in the Midwest and glacier changes in Alaska
Dr. James Hodgson: Food web dynamics in lake ecosystems in north temperate forests
Dr. David Poister: Complex growth dynamics of diatoms in lake ecosystems
Dr. Carrie Kissman: Climate change impacts on aquatic ecosystems

Specific accomplishments of the faculty in their respective traditional disciplines are included in the Biology, Chemistry, and Geology Discipline Program Reviews and not repeated here. Three ES faculty have been awarded the D. King Scholarship Award. In the past five years (05-06 to 09-10), the scholarly activity of the ES faculty members is represented by the following (see CV for details):

<table>
<thead>
<tr>
<th>Publications (peer-reviewed)</th>
<th>Conference Presentations</th>
<th>Student Presentations (mostly senior thesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>38</td>
<td>24</td>
</tr>
</tbody>
</table>
C. Collegial and Community Service

Although not applicable as a direct part of the ES curriculum or program, the ES faculty have long been regularly involved in a variety of collegial and community service. Individual accomplishments have been discussed in the Biology, Chemistry, and Geology Program Reviews and are not repeated here. Individual faculty members include lists of their service on their respective CV. One ES faculty member has been awarded the R. Weakland Community Service Award.

VI. Other Indicators of Program Achievement and Contribution

A. Quality of Entering Students Attracted to Major

The entering and graduating profile data of environmental science students, along with the ratio-of-graduates-to-majors data, provided by the OIE illustrates issues that the faculty have observed for a number of years. Namely, two trends occur with respect to prospective graduates of the ES program—many do not finish the program, and the average graduate GPA tends to decline relative to their high school performance. In both instances the major control seems to be program requirements. No other lab-science major at SNC requires that students pass the same number of courses (17), and the ES major requires students to master courses across most of the major science/math disciplines—biology, chemistry, geology, and mathematics. Students who drop the major early in their time at SNC usually struggle initially with basic biology and chemistry. Those who continue with the major often struggle with intermediate courses in chemistry, hydrogeology, and mathematics.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>05-06</td>
<td>3</td>
<td>26.00</td>
<td>25.33</td>
<td>25.67</td>
<td>27.67</td>
<td>25.33</td>
<td></td>
</tr>
<tr>
<td>06-07</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-08</td>
<td>3</td>
<td>27.67</td>
<td>29.00</td>
<td>26.00</td>
<td>28.00</td>
<td>27.00</td>
<td>3.400</td>
</tr>
<tr>
<td>08-09</td>
<td>3</td>
<td>23.33</td>
<td>24.33</td>
<td>23.67</td>
<td>21.00</td>
<td>24.33</td>
<td>3.517</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Entering Profile of Program Graduates**

<table>
<thead>
<tr>
<th>Graduation Year</th>
<th>Count</th>
<th>Double Majors</th>
<th>Have Minors</th>
<th>Ave. GPA</th>
<th>G.P.A. 3.5 -4.00</th>
<th>G.P.A. 3.0-3.49</th>
<th>G.P.A. 2.5-2.99</th>
<th>G.P.A. 2.0-2.49</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-06</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3.239</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>06-07</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-08</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3.163</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>08-09</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2.827</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>3</td>
<td>4</td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Exiting Profile of Program Graduates**

<table>
<thead>
<tr>
<th>Graduation Year</th>
<th>Count</th>
<th>Double Majors</th>
<th>Have Minors</th>
<th>Ave. GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-06</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3.239</td>
</tr>
<tr>
<td>06-07</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-08</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3.163</td>
</tr>
<tr>
<td>08-09</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2.827</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Avg**

<table>
<thead>
<tr>
<th>ENVIRONMENTAL SCIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entering Profile of Program Graduates</strong></td>
</tr>
<tr>
<td><strong>Count</strong></td>
</tr>
<tr>
<td>05-06</td>
</tr>
<tr>
<td>06-07</td>
</tr>
<tr>
<td>07-08</td>
</tr>
<tr>
<td>08-09</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| **Exiting Profile of Program Graduates** |
| **Count** | **Double Majors** | **Have Minors** | **Ave. GPA** |
| 05-06 | 3 | 2 | 0 | 3.239 |
| 06-07 | 0 |   |   |     |
| 07-08 | 3 | 1 | 1 | 3.163 |
| 08-09 | 3 | 0 | 3 | 2.827 |
| Total | 9 | 3 | 4 |     |

**Avg**

<table>
<thead>
<tr>
<th>ENVIRONMENTAL SCIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exiting Profile of Program Graduates</strong></td>
</tr>
<tr>
<td><strong>Count</strong></td>
</tr>
<tr>
<td>05-06</td>
</tr>
<tr>
<td>06-07</td>
</tr>
<tr>
<td>07-08</td>
</tr>
<tr>
<td>08-09</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Avg**
B. Contributions to General Education and Other College Programs

The Environmental Science Program serves as a primary attraction for incoming students with interests in environmental impact assessment, environmental monitoring, natural resource management, and related areas of environmental science. Graduates of the program usually seek jobs with government agencies, industry, or consulting firms. A few majors have pursued law degrees focusing on environmental law. Often, students switch from other areas in the sciences when they discover their real interests in obtaining a more interdisciplinary experience in the natural sciences. Some of the ES majors are double majors in biology, geology, or chemistry—with biology the most common.

The ES Program serves the General Studies Program of the College with one course (designated ENVS) that is taught on a regular basis: Environmental Science (Area 11; once per year usually in the spring semester).

C. Uniqueness/Distinctiveness of Program

The interdisciplinary nature of the program remains its distinctive characteristic. Students come to appreciate how the various areas of the natural sciences are necessarily integrated in understanding the interaction of the Earth’s physical and biological components. This holistic intellectual environment provides a broad basis for active learning within the scientific process, unlike any other discipline in the sciences.

In the last 5 years, the program has produced a variety of unique achievements especially with respect to student-faculty collaborative research and faculty peer-level research. The faculty CV indicate publications and presentations that include undergraduate students. In some instances, this work has resulted in publication in peer-level journals.

D. Contributions to Diversity Goals

Many, if not most, environmental issues are inexorably linked to poverty and discrimination. In fact the Pope and Vatican have taken formal positions on the importance of combating climate change and becoming better stewards of the Earth. In 2007, the Vatican held an interdisciplinary conference on climate change with the goal of fostering better communication among the Catholic Church, scientists, and policy makers. The Vatican has become more vocal on the issues of sustainable development and combating climate change in its recognition that the world’s poorest people are suffering the most from changing climate and its multi-faceted impacts on weather, agriculture, water resources, etc.

The ES faculty take a broader view, beyond the campus of SNC, that students must gain an appreciation for the crisis that a multitude of environmental problems present to the Earth System and people, but especially to certain groups because of poverty, racial, or religious discrimination, or other factors.

E. Accreditation:

This section is not applicable.
F. Evidence of Integrating Strategic Planning Into Practice

None that are not covered elsewhere in this program review.

G. Efforts to Attract Grant Funding

All of the faculty members of the ES program have been successful in securing internal and external funding for research and equipment/lab improvement during their tenure at the College (please see CV). In most instances these research projects have supported students to engage in collaborative research. From 2006 to 2010 the faculty have been awarded $7000 in SNC Faculty Development Grants in support of collaborative research between faculty and students (seven awards). A total of nearly $130,000 has been awarded from the National Science Foundation to Dr. Hodgson. The faculty members have written a number of grants that have been unsuccessful.

H. Success Indicators for Career Preparation

Consistent with the mission statement of the Environmental Science problem, the program goals are to prepare students, in the broadest sense, to develop an environmental ethic, develop sound scientific lab and field skills, and become critical thinkers able to apply the scientific method toward solving environmental problems. Given the diversity of environmental issues today—policy, pollution, planning, sustainability, technology—the major has not attempted to train students for a specific career track. Instead we have focused on preparation that puts students in a position to pursue a number of diverse and interesting paths. Examples would be graduate school in environmental science or related fields (ecology, limnology, etc.), law school, teaching, environmental consulting, and natural resources management.

I. Other Indicators of Program Quality

No additional indicators are included.

VII. SUMMARY—CHALLENGES AND PLANNING
(including reflections on recommendations from 2006 program review)

Reflecting upon the 2006 ES program review report and the CEPC recommendations to the review, many strengths of the programs still remain, but so do areas of concern. In addition, significant changes in staffing have negatively impacted the program in the area of recruiting of new students and teaching (esp. course offerings and mentoring). The program uncertainty of the past five years needs to be addressed in order to find the best ‘fit’ for the program within the Natural Sciences Division.

The key strengths of the program are many. The program clearly interests a number of entering students each year who view it as a viable alternative to traditional majors in biology, chemistry, or geology. The faculty members are all active and successful teachers, scholars, and collegial citizens. The faculty members all have a record of engaging students in collaborative research in a variety of ways (field and lab). The faculty members have a good working relationship when dealing within aspects of program management. And all are passionate about the value of St. Norbert College offering an interdisciplinary perspective to students interested in
environmental work. From a financial standpoint, the program uses relatively modest resources of the College in order to operate, especially given that virtually all of the curriculum courses serve one or more other majors as well as the General Education Program.

The challenges identified by the CEPC in the last program review remain and during the past five years become more pronounced. Notably, the ES faculty had little interaction on a regular basis, either in program management and teaching, because of the fact that two faculty had significantly reduced teaching loads within the Division of Natural Sciences. The recommendation that ES work with Admissions in order to advertise the program in a better way (‘showcase student/graduate accomplishments’) was not successful, nor was it for the Division of Natural Sciences as a whole during the past several years. The Admissions program at SNC has, in the past, been resistant to represent any one program or division more than any other in recruiting efforts. To be fair, retention within the program appears to be a greater issue than recruiting.

In turn, we believe that with the return of Dr. Choudhury to full-time teaching and the hiring of Dr. Kissman as a full-time tenure-track faculty member to replace Dr. Hodgson in the specialty of ecology, this is an important time to re-evaluate the structure of the program as a whole and evaluate its ability to effectively recruit, retain, and graduate students. A number of specific issues to be addressed include:

a. development of a true first-year-student environmental science course
b. evaluation of the 17-course major
c. evaluation of integrating environmental minors/concentrations within other major programs
d. modifying or eliminating the senior thesis requirement
e. developing new junior-senior courses that are truly interdisciplinary and possibly team-taught (although this is logistically unlikely given the current status of teaching demands)

Respectfully submitted,

Nelson Ham
Discipline Coordinator, Environmental Science
March 28, 2011
APPENDICES

A. Copy of Assessment tool used for senior thesis

ENVIRONMENTAL SCIENCE SCORING RUBRIC

Student __________ Evaluator __________ Date __________

1. KNOWLEDGE:

SCORE

a. The student displays a knowledge of trophic structure and understands the interaction between trophic levels.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student uses key terms such as trophic structure, trophic level, thermodynamics, primary, secondary consumers, autotrophy and heterotrophy, limitations to the number of trophic levels correctly and with confidence. The student can explain the processes by which organisms utilize energy and cycle materials.</td>
<td>The student is mostly but not completely familiar with key terms and can explain some but not all the relevant processes relative to the processes by which organisms are organized in the food web and the energy processes involved. The student requires some help in remembering core concepts.</td>
<td>The student is not familiar with most key terms used to describe trophic structure and associated interactions and processes of uses such terms incorrectly. The student is unfamiliar with most of the relevant trophic structure concepts but can describe some aspects of such processes.</td>
<td>The student is completely unfamiliar with the terms used to describe trophic interactions and displays no knowledge of the relevant processes.</td>
</tr>
</tbody>
</table>

b. The student displays a knowledge of plate tectonics.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student is able to correctly explain the Unifying Theory of Plate Tectonics. Core concepts include the general structure of the Earth, the general characteristics of continental versus oceanic crust, the number of tectonic plates, the average rate of plate motion, the major types of plate boundaries, the mechanism of plate motion, and the major types of geologic activity concentrated at plate boundaries. In addition, the student uses correct terminology when discussing these topics.</td>
<td>The student is mostly familiar with the basic concepts of the Unifying Theory of Plate Tectonics, but incorrectly explains or doesn't remember many core concepts. The student also does not use correct terminology when explaining many core concepts.</td>
<td>The student is somewhat familiar with the basic idea of Plate Tectonics, but incorrectly explains or doesn't remember many core concepts. The student also does not use correct terminology when attempting to explain many or all concepts.</td>
<td>The student is unfamiliar with the basic idea of Plate Tectonics, and incorrectly explains or doesn't remember many core concepts. The student also does not use correct terminology when attempting to explain many or all concepts.</td>
</tr>
</tbody>
</table>
c. The student displays a knowledge of the hydrologic cycle.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student is able to describe the hydrologic cycle in terms of the major reservoirs of water on Earth (e.g., oceans, streams, lakes, aquifers, atmosphere, glaciers) and the processes that move water from one place to another (e.g., precipitation, evaporation, transpiration, infiltration, groundwater flow). The student uses key terms correctly and with confidence. The student is able to define all terms appropriate to the hydrologic cycle.</td>
<td>The student is mostly but not completely able to describe the hydrologic cycle. In most instances the student correctly uses and defines key terms.</td>
<td>The student is generally familiar with the hydrologic cycle but is unable to correctly describe most aspects of the cycle, and use and define key terms.</td>
<td>The student is not familiar with the hydrologic cycle. The student may be able to describe some aspects of the cycle, such as individual processes, but cannot articulate the general concept. The student frequently uses terms incorrectly or doesn’t remember key terms.</td>
</tr>
</tbody>
</table>

d. The student displays a knowledge of natural selection.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student is able to: correctly state the theory of natural selection, identify its author, identify what theory it supplants, describe the role of selection in population evolution by making the connection to changes in allele frequencies and hence genotypic frequencies, state many of the mediators of selection, and identify the entity upon which natural selection acts, i.e. the individual.</td>
<td>The student is able to: correctly state the theory of natural selection, identify its author, describe the role of selection in population evolution, state at least some of the various mediators of selection. The student does not remember the theory it supplants, cannot correctly state the entity upon which natural selection acts (confuses the action of natural selection as being directly on the alleles rather than on individuals).</td>
<td>The student is able to state that natural selection causes changes in the genetic structure of populations but does not remember how, cannot make the connection to changes in allele frequency. The student may or may not be able to identify the mediators of natural selection.</td>
<td>The student remembers that natural selection has something to do with evolution but does not know why (how). The student cannot state any of the mediators of natural selection.</td>
</tr>
</tbody>
</table>
e. The student displays a knowledge of taxonomy.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student is able to define what taxonomy is, knows what the basic binomial nomenclature system is, and understands what information taxonomy conveys to the researcher. The student is able to explain what changes in taxonomy mean. The student is able to relate taxonomy to phylogenetic classification.</td>
<td>The student is able to define what taxonomy is, knows what the basic binomial nomenclature system is, and understands what information taxonomy conveys to the researcher. The student needs help in remembering what changes in taxonomy mean or how taxonomy is related to phylogenetic classification.</td>
<td>The student has some idea of what taxonomy means, knows that it is reflected in the scientific name (Latin binomen) of the organism(s) being studied, knows that it is a method of standardizing names, but not much more beyond that.</td>
<td>The student understands that taxonomy is used to name organisms formally but cannot explain the connection between that practice on one hand and the classification of those organisms, or the relationships between organisms with partly similar or completely different names.</td>
</tr>
</tbody>
</table>

f. The student displays a knowledge of biogeochemical cycles and understands the interaction between biotic and abiotic components of environmental systems.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student uses key terms such as limiting nutrient and bioavailable nutrient correctly and with confidence. The student can explain the processes by which elements are transformed and moved through various biotic and abiotic components of an ecosystem as well as the causes and consequences of such transformations.</td>
<td>The student is mostly but not completely familiar with key terms and can explain some but not all the relevant processes affecting nutrient transformation and movement between biotic and abiotic components of an ecosystem.</td>
<td>The student is not familiar with most of the relevant processes that transform elements in biogeochemical cycles but can describe some aspects of such processes.</td>
<td>The student is completely unfamiliar with the terms used to describe biogeochemical cycles and displays no knowledge of the relevant processes that transform elements in biogeochemical cycles.</td>
</tr>
</tbody>
</table>
g. The student displays a knowledge of the planet’s biodiversity and the factors driving extinction.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student uses key terms and concepts such as species richness, proportional abundance of species in an ecosystem, evenness, the importance of biodiversity to ecosystem stability correctly and with confidence. Extinction processes, metapopulations, stochasticity, inbreeding depression. The student can explain the processes by which biodiversity develops and its importance to global ecology and planetary ecological stability.</td>
<td>The student is mostly but not completely familiar with key terms and can explain some but not all the relevant processes relative to the processes by which ecosystems develop biodiversity and the relevancy of biodiversity to ecosystem dynamics. The student requires some help in remembering these core concepts.</td>
<td>The student is not familiar with most key terms used to describe biodiversity or uses such terms incorrectly. The student is unfamiliar with most of the relevant natural selection concepts but can describe some aspects of such processes.</td>
<td>The student is completely unfamiliar with the terms used to describe biodiversity and displays no knowledge of the relevant processes.</td>
</tr>
</tbody>
</table>

h. The student displays a knowledge of the impact of the human population on the planet’s ecological processes.

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student uses key terms and concepts such as logistic and geometric human population growth curves, crude birth and death rates, innate capacity for increase, population density, factors driving population growth in the developed and developing world, carrying capacity correctly and with confidence. The student can explain the processes which influence human population growth and its importance to global ecology and planetary stability.</td>
<td>The student is mostly but not completely familiar with key terms and can explain some but not all the relevant processes relative to the processes which drive the rate of human population growth and its impact on the ecology of the planet. The student requires some help in remembering these core concepts.</td>
<td>The student is not familiar with most key terms used to describe human population growth or uses such terms incorrectly. The student is unfamiliar with most of the relevant natural selection concepts but can describe some aspects of such processes.</td>
<td>The student is completely unfamiliar with the terms used to describe human population dynamics and displays no knowledge of the relevant processes.</td>
</tr>
</tbody>
</table>
2. **SKILLS:**

<table>
<thead>
<tr>
<th>4. VERY GOOD</th>
<th>3. GOOD</th>
<th>2. POOR</th>
<th>1. VERY POOR</th>
</tr>
</thead>
</table>

**SCORE**

a. The student can interpret scientific research by articulating a hypothesis and identifying the related independent and dependant variables.

b. The student can properly design an experiment or data collection protocol and interpret results based on the body of knowledge established by previously published research and accepted scientific principles.

c. The student can properly design an experiment or data collection protocol that follows sound scientific design through replication, experimental control, and the identification of confounding variables.

d. The student can interpret scientific results by applying appropriate statistical tools of data analysis.

e. The student can clearly communicate scientific information through writing using the format of a scientific paper.

f. The student can clearly communicate scientific information through an oral presentation using appropriate visual aids including diagrams, tables, and graphs.

3. **COMMENTS:**
B. CURRICULA VITAE (abbreviated to past 10 years)

Although the instructions for SNC program reviews indicate that CV do not need to be included with reviews for interdisciplinary programs if they were part of reviews for other programs, abbreviated versions for the ES faculty members are attached for the benefit of the CEPC. We have abbreviated the CV to the past 10 years. In addition, the CV of Dr. Carrie Kissman, who will be joining the Biology and Environmental Science Disciplines in the Fall of 2011 is included.
OIE Review of Discipline Efforts to Assess Student Learning for CEPC
Program Review

ENVIRONMENTAL SCIENCE

Overview

- Does the discipline/program have a viable assessment plan? 
  Yes.
- Does the plan include intended student learning outcomes? 
  Yes.
- Does the plan include direct as well as indirect measures of student learning?
  The actual plan does not mention indirect evidence, but indirect evidence is reported in the program review narrative.
- Are the sources of evidence for student learning appropriate? 
  Yes.
- Is data collection and analysis ongoing? 
  Yes.
- Are all program faculty/staff appropriately engaged in assessment? 
  Yes.
- Has the program made or proposed changes/improvements (intended to enhance student learning) based on learning outcomes data? 
  Yes.