# Environmental Science | 2013-2014 Assessment Report

Please answer the following two questions based on the data you collected as part of your Programmatic Assessment Plan, which is provided below for your reference.

1. Please give a brief overview of the data you collected. This can be in any form you feel is appropriate, such as a table, a short narrative of results, statistical analysis, highlighting findings that were of particular interest, etc. In short, it doesn't matter how you submit your findings.

Assessment of Env Sci Outcome 4 was limited to: Build practical skills for scientific problem-solving and ability to use current computer technology.

Throughout the Spring 2014 offering of Env Sci 407 Modeling of Environmental Systems, students were exposed to increasingly complex mathematical models of environmental systems. Two subsets of practical skills were focused on – the ability to appropriately create mathematical models, as well as the ability to complete basic mathematical analysis of such. Additionally, computer technologies were used to simulate and analyze two broad classes of mathematical models – Excel was implemented for discrete (time) models and STELLA, primarily, for continuous (time) models. Finally, appropriate interpretations of analysis and simulation were sought.

During the first portion of the course the focus was on discrete models. Such models are typically written in the form of difference or recursive equations. Basic analysis of these models is algebra based (skills that are assumed by the course prerequisites), together with some matrix algebra and calculus (skills that are taught in the course). Computer simulations can be accomplished using Excel.

The second portion of the course focused on continuous models. These models are typically written in the form of differential equations. Basic analysis of these models is accomplished through an extension of the mathematical skills used and developed in the first part of the course.

The final portion of the course focused on the simulation of continuous models using the modeling software STELLA. Here students gained the knowledge to build relatively complex computer models. Students were alerted to pitfalls of simulation and how they may be overcome.

A table follows in which I have qualitatively indicated the gain the group of students in the Spring 2014 offering of the Env Sci 407 Modeling of Environmental Systems have made.

**Gain Over Length of Course**

| | | Poor | Fair | Good | Excellent |
|---|---|---|---|---|---|
| Rote Mathematics Algebra | | X | | | |
| Rote Mathematics Matrix Algebra | | | X | | |
| Rote Mathematics Calculus | | | X | | |
| Modeling BuildingDiscrete | | | X | | |

| | | | | | |
|---|---|---|---|---|---|
| Modeling BuildingContinuous | | | X | | |
| Analytical Analysis of ModelsDiscrete | | | X | | |
| Analytical Analysis of ModelsContinuous | | | X | | |
| Computer Simulation Discrete (Excel) | | | X | | |
| Computer SimulationContinuous (STELLA) | | | | X | |

2. How will you use what you've learned from the data that was collected? Some examples are: a change in assessment plan for the following year because you want to drill down deeper to find more or better information, faculty will discuss the data to decide what to do with it, curricular changes, faculty development, etc.

Generally, I was satisfied with what level has been achieved by this group of students. There were times during the course that I had wished that the students had a stronger remembrance of the prerequisite environmental science topics – especially associated with population ecology. Topics from physical systems, such as material transfer, were adequate. Some trepidation of mathematics and importance of the use of mathematics in the environmental science field remains with our students. Comfort with the mechanical aspects of computer simulation is evident; however, trust that the output is correct / valid (just because it was generated by the computer) is too high.

The next evolution of this course is to focus on mechanics and simulations with little theory. I believe that this can be done well and has the opportunity to keep students heavily engaged throughout the course. If I were to have taught the course again, I would have made modifications to course content / exercises that would require students to spend more time determining the validity of models and associated simulations.

**Environmental Science Assessment Plan**

1. Which outcome will you assess?
Env Sci Outcome 4: Build practical skills for scientific problem-solving, including familiarity with laboratory and field instrumentation, ability to use current computer technologies, and experience in statistical modeling techniques.

2. Which technique will you use to assess this outcome?
Env Sci Outcome 4 will be assessed via a combination of locally developed tests and embedded assessment.

3. Which course or group of students will you assess on the outcome chosen above and when?
Work from, the approximately 20, students enrolled in the Spring 2014 offering of the course Env Sci 407 Modeling of Environmental Systems will be assessed. Env Sci 407 is a required course in the Environmental Science major having a significant prerequisite structure and seldom is taken by students outside the major.