

**Two Stream Ecology Courses Requiring Interactions With
Campus Facilities Managers
William English, Clemson University**

**Stream restoration project at
Clemson's Simpson Farm**

On the 4th of December the C.U. Landscape Design class, taught by Mary Haque of the Department of Horticulture, planted 100 small oak trees in the riparian zone of a newly completed Stream Restoration Project on Clemson's Simpson Farm.

The roots of the oak trees will stabilize the channel banks and reduce erosion from Little Garvin Creek. The trees and their leaves will provide shade and cool waters in the channel. In the fall, dropped leaves will provide the major food resource of small animals (macroinvertebrates) living in the stream. They in-turn become food for fishes. The acorns of the oak are a preferred food of white-tailed deer. All parts of the tree are essential to restoring ecosystem function at the restoration site.



FINAL REPORT

South Carolina Sustainable Universities Initiative Mini-Grants Program “Stream Ecology Course Development”

By William R. English, Associate Professor, Department of Forestry and Natural Resources,
Clemson University, Clemson SC.

Justification:

In South Carolina, there are 19,487 miles of streams and rivers. Forty-two percent of tested South Carolina rivers are considered impaired. The first step in protecting and restoring stream ecosystems from pollution is an understanding of how streams function. None of the major Universities in South Carolina provides a course that teaches graduate and undergraduate students how streams integrate physically, chemically and biologically.

Grant Activity:

SUI funds assisted in the development of my course titled “ Stream Ecology” This was a four hour course that had three hours of lecture and one three-hour field/laboratory section emphasizing techniques in stream ecology. This course was taught at Clemson University during the spring semester of 2003 and will be offered again in spring of 2005. This course was open to advanced undergraduates and graduate students.

Enrollment for 2004 was 17 students from six different departments (Geology, Aquaculture, Fisheries and Wildlife, Entomology, Environmental Systems Engineering, Biological sciences and Forest Resources).

Brief course description

Topics covered included: geomorphology, physical factors, chemistry, stream dwelling organisms, autotrophy, heterotrophy, trophic relationships, predation, herbivory, food webs, competition, colonization, drift, community structure, disturbance and human impact. The lecture section of the course used Stream Ecology by David Allen as the main text. Many outside readings were used to supplement the text. Student teams were formed to discuss outside readings. The field/laboratory section of the course used Methods in Stream Ecology edited by Rich Hauer and Gary Lamberti. Most field trips were to streams on Clemson University property. Techniques taught in the field focused on those used to assess water quality impairment. Topics included in the Field/Laboratory section of the course were: techniques for analysis of landscape features and land-use practices, channel morphology and discharge, erosion and sediment assessment, biological monitoring (fish and macroinvertebrates), microbial contamination assessment, nutrient enrichment and physical and chemical monitoring. Syllabus is included in the appendix.

Visiting educators for this course included Will Harmon, a hydrologist who specializes in stream restoration, Scott Templeton, a natural resources economist, Jim Lichatowich, the author of Salmon Without Rivers, and Henry Lickers, a native american, natural resources advocate.

Outcomes:

Students given a pre-course exam averaged 51%. The post-course exam average was 97%.

All students (graduate and undergraduate) developed and presented a lecture on a stream ecology related subject. Most were of excellent quality.

The final project for students in this course was 1. to find impaired streams on Clemson University properties, 2. evaluate the extent of impairment using SCDHEC standards and 3. provide viable solutions to the stream pollution problems. See Syllabus for more detail. Additionally, students had to 4. evaluate the stream's economic value in its present condition compared to non-polluted condition (natural capitol), 5. Determine the cost in fines if not corrected, and determine the cost/benefits associated with solving the problem.

Student teams provided oral presentations of the findings as a part of their final project. Presentations were made to Clemson facilities managers including James Arnold manager of the State Botanical Garden, Johnny Jordan, manager of the Clemson Experimental Farms Systems, Clemson campus facility managers and the Clemson, Walker Golf Course manager.

Stream water quality problems on Clemson University properties included: nutrient enrichment, fecal coliform contamination, erosion and sedimentation due to animal agriculture, impervious surfaces, storm water discharge, channel straightening, improper location of roads and row cropping, chemical pollutants from parking-lot runoff, improper application of pesticides and illegal dumping.

The abstracts of the final written reports by the student teams are provided in the appendix.

Transferability:

Having students understand and evaluate stream ecosystems and the impact of their university on that ecosystem may be transferred to any school with streams flowing through or near their campus. Getting facilities managers to listen and work with the students is more difficult but possible. We had managers from four different land-use categories at the final student presentations.

This stream ecology course will serve as the foundation for the development of an internet course on stream ecology that would provide computer based lectures and weekend field session in streams throughout the South Carolina.

Appendices

Appendix 1.

Course Syllabus

SYLLABUS

Stream Ecology

Spring Semester 2003
4 credits

Class sections and meeting times:

FOR - 493 sec 2, MWF 9:05-9:55, Rm. 114 Lehotsky Hall

FOR - 493 Lab 12:30-3:15 Th, Rm. 114 Lehotsky Hall

WFB - 861 Sec 4, Stream Ecology, Rm. 114 Lehotsky Hall

WFB - 863 Stream Ecology Lab Th 12:30-3:15, Rm. 254

Note that 863 is the graduate student lab for 861 and must be taken with 861.

Instructor: ***Dr. William “Rockie” English***
243 Lehotsky Hall
Phone: 864-656-4861, (Cell) 864-710-3598
Email: rengsh@clemson.edu

Office hours: Monday and Wednesday 1:30-4:30. Feel free to stop by at anytime. I travel often so please call before you stop by.

Teaching assistants: Jeremy Pike, Kirsten Young
102 Lehotsky
Phone 864-656-6306
Email: jpike@clemson.edu, kyoung@clemson.edu

Lou Jolley
114 Lehotsky Hall
Phone: 864-656-1847
Email: ljolley@clemson.edu

Office hours: Monday and Wednesday 1:30-4:30. Feel free to stop by at anytime. We travel often so please call before you stop by.

Course objectives: To provide students an understanding of the biologic, hydrologic, geomorphic, and trophic process that characterize stream ecosystems. To guide students in using their understanding of stream ecosystems to evaluate stream ecosystem impairment and help them discover viable solutions to stream water quality problems.

Textbook: Stream Ecology: structure and function of running waters by David Allen. (Required) Outside readings are also required in this course.

Text for the lab: Methods in Stream Ecology by Hauer and Lamberti (Not required but highly recommended).

Grading (Lecture and Laboratory):

Lecture:

Lecture Exam 1	10 %
Lecture Exam 2	10 %
Lecture Final Exam	15 %
Student Lecture	10 %
Class Discussion	5 %

Each graduate student will present a subject lecture. Lecture topics will be determined in association with Dr. English. A lesson plan will be developed and material from outside the textbook should be used in this lecture. The lecture should use a Powerpoint type graphics package.

Undergraduate students are not required to present a lecture but may do so for extra credit. Undergraduates will not be required to answer a selected question on each lecture exam but may do so for extra credit.

All students are expected to join in class and laboratory discussions and will be graded on participation.

Laboratory Exercises:

Hydrology, geomorphology, physical characterization exercise	10 %
Trophic relationship & biomonitoring exercise	10 %
Behavior and community dynamics exercise	10 %
<i>Final/Practicum</i> -Impact of man on stream ecosystems	
Journal format - research paper	10 %
Professional meeting format - oral presentation	10%

The laboratory exercises will consist of stream assessments conducted on CU properties.

The first three exercises will consist of summary reports of research you conducted during labs. Keep good notes! The exercises should be written and provide an introduction, methods, results, discussion and references.

The *final/practicum* laboratory project will be to develop research teams, find stream water quality problems on Clemson facilities, collect data, develop solutions and present your solutions to facilities managers. Teams will consist of 3-4 persons with different backgrounds.

The lab final/practicum will consist of a **paper in professional journal format** and an **oral presentation using a format similar to that provided at a professional meeting**. This 15-20 minute presentation will be on the findings of each research team. Presentations should use Powerpoint type graphics. Clemson University Facilities Managers have agreed to attend your presentations. Through this presentation, you will have an opportunity to make changes on your “sustainable university” campus.

For both the paper and oral presentation, the teams should clearly define the problem, methods used to research the problem, the results of their research, and conclusions they have drawn from their research. Each team project will include literature supporting the type of research used and the data they have collected and analyzed. Students should attempt to find solutions to the problems they have found and estimate the costs for solving the problems.

Choose a topic of interest to you, within the broad area of stream ecology. Your paper should be 3 to 8 typed pages, double spaced, regular margins, 12 point font. Photocopy and attach the journal articles used in your paper. Grammar, spelling, punctuation and general “Professionalism” will be considered in the grading. The paper is 10% of the course grade and is due at the beginning of the April

Most laboratories will be in the field and involve working in and around streams. Clothing should be suitable for field-work. No open-toed shoes or sandals. Waterproof boots are recommended. There are many potential dangers around streams please be careful. We will discuss safety issues on the first lab meeting.

Grades:

A = 89.6% or above

B = 79.6 to 89.5%

C = 69.6 to 79.5%

D = 59.6 to 69.5%

F = less than 59.6%

Attendance & Timeliness Policy: You are expected to attend and participate actively in class. Role will be taken and regular attendance may be used to help “round-up” borderline grades. You will be a member of a team and should not let fellow team members down.

Attendance for exams is mandatory. All lecture material and assigned readings, even if not discussed in class, may be included on the exams. If you have a good reason/problem for needing to reschedule an exam, ***you must notify me ahead of time***, otherwise no make-up will be

allowed and the final will count double, assuming you had a valid excuse. The final exam is mandatory.

Students often have justifiable reasons for missing class, labs or exams. We can handle most any foreseeable problem if you will contact me before the fact. If you are unable to locate me (after a reasonably good effort) you may contact my teaching assistants.

If I am late for class and someone else is not scheduled to provide a lecture you are free to dismiss yourselves after 15 minutes.

ACADEMIC INTEGRITY: "As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form."

Class Photo

Field Trip to the Chattooga River

