Immersed in Hydrology, Buried in Soils

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This paper describes an interdisciplinary field course at the University of Georgia with the formal title: The Soils, Hydrology, and Geology of Georgia. The purpose of the course is to provide an in-depth, hands-on study of the physical environment of Georgia by examining the diverse geology, soils, and surface and subsurface hydrologic processes within the state. We visit mines, farms, forests, wetlands, rivers, lakes, barrier islands, and estuaries to explore the natural development of these resources as well as the influence of human activities on the environment. The course is offered during a three-week long session between spring and summer semesters that we refer to as the Maymester. Instructors from engineering, forest resources, soil science, and geology jointly teach the course along with guest instructors from other disciplines. The students come from diverse backgrounds (generally science-oriented) with a mix of graduate and undergraduate students as well. The emphasis of the course is on hands-on, experiential observation and learning in the field. General learning objectives for this course include:

1. Develop and understanding of the relationships between geology, soils, and water quantity and quality,
2. Appreciate the diverse nature of surface and ground water resources in Georgia,
3. Recognize the importance of Georgia's natural resources to economic development across the state, and
4. Become familiar with regional water resources issues.

The idea for the course grew out of informal discussions between faculty on limitations we all face with regard to inflexible curricula, prerequisite requirements in other disciplines, and laboratory facilities. Engineering curricula, in general tend to be highly prescribed with limited elective options due to accreditation requirements. Therefore engineering students often face the dilemma of adding courses that do not count toward their degree in order to pick up courses in what many might consider to be fundamental areas (for environmental engineers) such as geology, soils, and "pure" hydrology. Geology, soils, forestry and other science majors that might benefit from engineering courses such as fluid mechanics are often prohibited from registering due to lack of prerequisites such as differential equations and statics. No matter how conscientiously laboratory exercises are planned, limitations on physical facilities, travel time, and conflicts with other classes prevent many natural resource-related majors from getting to observe and quantify such things as water quantity and quality over a wide range of conditions "in the field." Such limitations served as the basis for designing a new, multidisciplinary course that would emphasize outdoor, hands-on instruction covering natural resources issues across the large and diverse State of Georgia.

There are no mandatory prerequisites for this course beyond "permission of instructor." This was done in order to allow flexibility in accommodating undergraduate and graduate students from a range of disciplines and experiences. It is generally expected, however, that the students who are sincerely interested in the course would be from science-related disciplines and would have some familiarity with basic math, physics, and chemistry. Equations that are presented and utilized during the course are usually relatively simple algebraic relationships, *i.e.* flow = mean velocity times the cross-sectional area, or $Q=V \cdot A$.

In order to accommodate the diverse backgrounds of the students and to make sure that everyone has the same scientific "vocabulary" with regard to the topics to be studied, the course begins with two days of classroom lectures covering fundamentals of geology, soils, hydrology, and water quality. On the third day we are off on a whirlwind tour of the State of Georgia during which the students and instructors camp or lodge at various State or University owned properties (in order to minimize costs). At every location there are one or more participatory exercises such as stream gauging, water quality measurement, and soil profile observation and description. These exercises are preceded by an introduction to what the students will be doing that day and followed up by an informal, relaxed, evening discussion of what might have influenced the observations of the day. We travel to all of the physiographic regions of the state, including the Upper and Lower Atlantic Coastal Plain, the Dougherty Plain of Southwest Georgia, the Upper and Lower Piedmont, the Blue Ridge Mountains, and the Ridge and Valley Provinces of North Georgia.

The schedule for the 2002 Maymester course is presented in Table 1 as an example of the topics and location covered during the course.

Table 1. Maymester 2002 Schedule.

Date	Location	Topics(s)	Lodging
13 May	Athens, GA	Introductory Material	Home
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15 May	Savannah River Site, South Carolina	Ground water monitoring, environmental monitoring, Carolina bays	Magnolia Springs State Park (SP), Millen, GA
16 May	Magnolia Springs, Ogeechee River	Stream gauging, water quality, karst, geology & hydrology	Magnolia Springs SP, Millen, GA
17 May	Skidaway Island	Estuaries: hydrology, chemistry, ecology	Sapelo Island
18 May	Sapelo Island	Barrier island geology, ecology; salt water intrusion; water chemistry, soil development	Sapelo Island
19 May	Sapelo Island	Barrier island geology, ecology; salt water intrusion; water chemistry, soil development	Okeefenokee National Wildlife Refuge

Table 1. Continued.

20 May	Okeefenokee National Wildlife Refuge	Okeefenokee geology, ecology; Flatwoods soils development, "black water" chemistry	Okeefenokee National Wildlife Refuge
21 May	Valdosta and Tifton, GA	Surface water - ground water interaction, agr. water use, agr. impacts on water quality	Lake Blackshear, UGA property
22 May	Joseph W. Jones Ecological Research Center	Surface water - ground water interaction, agr. water use, agr. impacts on water quality; stream ecology, ecotones	Lake Blackshear, UGA property
23 May	Providence Canyon	Coastal Plain geology, soil erosion	Home
24-27	Holiday	Recuperation	Home
28 May	Graves Mountain, Tignal	Geological resources, mining, acid mine drainage, constructed wetlands	Home
29 May	Sandersville, Oconee River	Kaolin mining, Robust Redhorse (endangered fish species), sedimentation in stream, stream bank stabilization	Home
30 May	Lake Lanier	Limnology, water supply and demand, drought in the Southeast	Home
31 May	Dahlonega, Amicolola Falls	Gold mining, stream chemistry, stream gauging	Cloudland Canyon SP
1 June	Redbud, Conasauga River, Cartersville fault	Soils development; stream ecology; water use, hydroelectric power generation	Cloudland Canyon SP
2 June	NW Georgia	Ridge and Valley province, karst topography, geology, and hydrology	Cloudland Canyon SP
3 June	Copper Hill, USDA-FS Coweeta Hydrologic Laboratory	Copper mining, refining – environmental impacts; hillslope hydrology	Balsam Grove, NC (private property)
4 June	French Broad River, Cradle of Forestry	Aquatic ecology, stream surveying: flow and slope; origin of professional forestry in the U.S.	Balsam Grove, NC (private property)
5 June	Chattooga River; Tallulah Gorge	Multiple (competing) uses; development impacts; stream bed erosion, Blue Ridge geology	Home
6 June	Athens	Final Exam	

Student evaluations have consistently rated the course as one of the most enjoyable learning experiences of their college careers. They report benefits to their learning experience that come from the diversity of the students and instructors, the hands-on nature of the course, and the rare opportunity to watch and participate as instructors from different disciplines disagree (generally with good humor) about the causes, interpretations, and significance of various observations. A typical comment from student evaluations is

> "The practical applications of course materials to real world examples are invaluable. The combination of instructors was very helpful in understanding the various principles covered well. Besides being a great educational experience it is also fun!"

Another measure of the success or value of the course has come from Dr. Bill Tollner, a professor in the Biological and Agricultural Engineering Department of UGA. In the summer of 2000, he taught a Natural Resources Engineering course in a special topics format to two engineering students who had just returned from the Maymester course. After completing the course with the students, he suggested that every engineering student at UGA with an emphasis in environmental or natural resources engineering should be required to take the Maymester course. He came to this suggestion based on the ease and depth with which these two students grasped the concepts he taught. Unfortunately, the format of the course requires limited participation (we might be able to handle 20 students). Such limitations, combined with the desire to assure multidisciplinary interactions between students means that only a handful of engineering students can take the course in any given year.

In order to maximize student interactions and keep domestic chores from becoming too much of a burden, we try to arrange for a different student, or combination of students, to take responsibility for preparation of supper each evening. This predictably leads to some friendly competition and incredibly diverse and tasty meals. We have found that the instructors in the course also inevitably learn from each other and the students during the course. We have also strived to vary the locations and some of the topics to be covered so that the instructors do not burn out on the same locations and materials each year.

We believe that this course, in which we keep a multidisciplinary group of students "immersed in hydrology and buried in soils" has tremendous educational benefits for the students and faculty alike. We wish that there were opportunities to expand the offering of the course to accommodate additional students, but limited time and faculty resources will predictably keep this course offering limited.

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