Integrating Field-Based Service-Learning into an Introductory Hydrology Course

John G. Van Hoesen, Department of Environmental Studies, Green Mountain College, One College Cirle Drive, Poultney, VT 05765, vanhoesenj@greenmtn.edu

Green Mountain College

Poultney-Mettowee Watershed Partnership

BACKGROUND:

Students in introductory hydrology courses are typically required to engage in a number of field-based laboratory exercises. Often, these exercises merely help students understand the process of data collection, gain proficiency with field equipment, and ask for rudimentary interpretations of the data. The establishment of a service-learning component to any geology course provides students with a greater understanding of the "need" for data collection and contributes to their engagement in the exercise by giving them an answer to question so often asked: "What am I ever going to use this for?"

During the spring 2004 semester, students at Green Mountain College enrolled in an introductory hydrology course collaborated with fellow students in an introductory chemistry class on a service-learning project. The students were responsible for establishing a long-term monitoring project along Poultney River in east-central Vermont working with the Poultney Mettowee Watershed Partnership (PMWP), a local non-profit conservation group. In collaboration with the PMWP, four sites were established for long-term monitoring.

Students in the hydrology course were required to: (1) survey the cross-sectional morphology of the stream channel (2) collect pebble counts above and below the cross-section, (3) collect GPS coordinates for the monitoring sites and backsight monuments used for surveying (4) collect discharge measurements along the cross-section, (5) provide a detailed sketch of the river and surveyed area, and (6) provide graphs of cross-sectional morphology and pebble counts for each site.

Students in the chemistry course were responsible for collecting: (1) conductivity, (2) pH, (3) temperature, (3) hardness, (4) alkalinity, and water samples sent to the DEC State lab for total phosphorus, total nitrogen, E. Coli, chlorophyll a.

In addition to achieving the traditional goals of familiarizing students with field equipment, feedback from the students was positive and genuinely interested in the results because they felt they had actually "contributed to society," rather than just completing the lab for a grade.

LEARNING GOALS:

- **Content or Concepts**
  - Fluvial processes of meandering streams
  - Grain size variability in fluvial environments
  - Interdisciplinary nature of geology/chemistry
- **Geologic Skills**
  - Stream surveying using a total station
  - Stream gauging
  - Grain size analysis
- **Higher Order Thinking Skills**
  - Interpreting stream cross sections
  - Interpreting Microsoft Excel plots
  - Evaluating stream competency using field-data
- **Other Skills**
  - Writing site descriptions and drawing field sketches
  - Learning to use high-resolution GPS unit
  - Learning to use a Total Station
  - Becoming more comfortable with graphing
  - Group collaboration
  - Rewards of community service

CONTEXT:

- **Instructional Level**

  This course is taught at an environmental liberal arts college attended exclusively by undergraduate students. However, courses at any level could utilize a field-based service-learning module.
- **Required Skills**
  - Students must be comfortable with computers
  - Students must be competent with Microsoft Excel
  - Students must have been exposed to stream surveying
  - Students must be familiar with concepts of GPS
  - Students must have been exposed to stream gauging
- **Course Logistics**

  This exercise is used as a field-experience that integrates concepts from class lecture and previous laboratory assignments.

Figure 1: Merged USGS digital raster graphics depicting the location of the sampling area in east-central Vermont along the Poultney River.

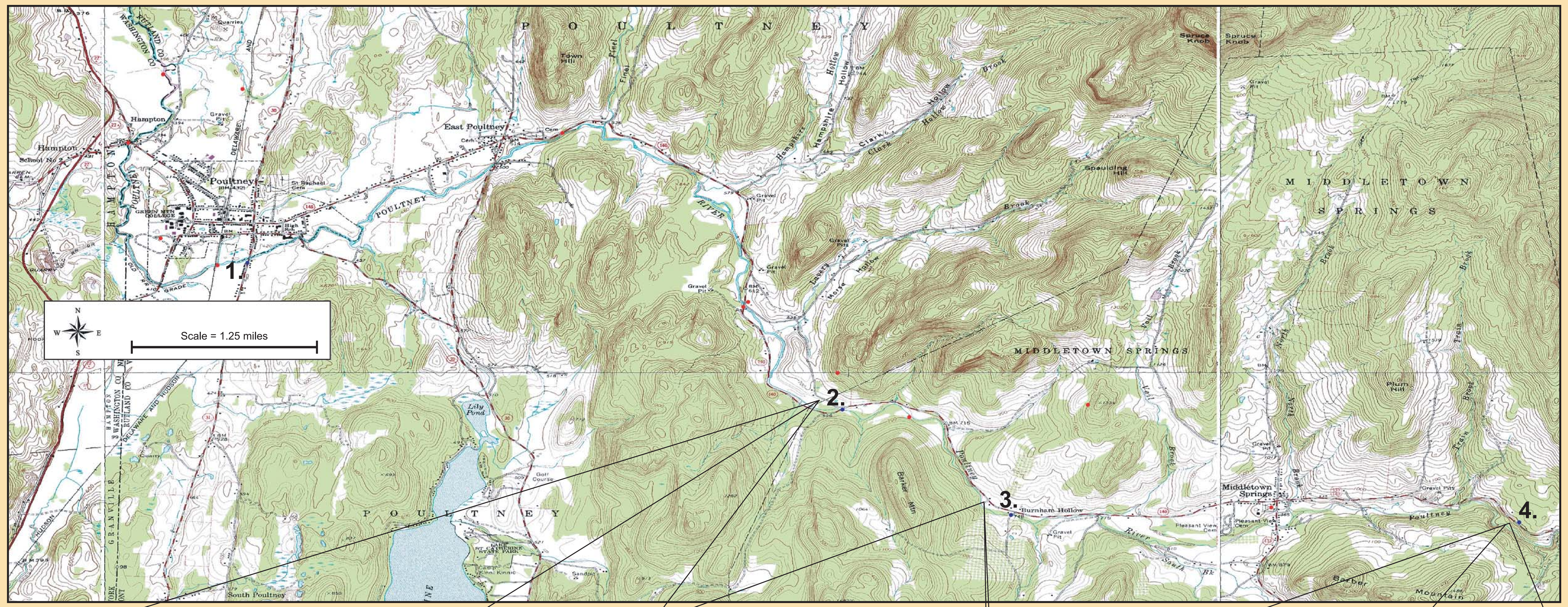


Figure 2: Setting up a cross-sectional transect at Site 2. This site is "midway" between the two end member sampling sites we've chosen for the long term monitoring project.

Figure 3: Chemistry students sampling the Poultney River at Site 3, which was selcted because it is a disturbed site.

Figure 4: Hydrology and chemistry students collecting survey data for cross sectional profile at Site 4 (closest to headwaters).

Figure 5: Hydrology students taking down total station after stream surveying at Site 3.

Figure 6: Hydrology and chemistry students collecting survey data for cross sectional profile at Site 3.

Figure 7: Dr. Sutheimer discussing water sampling techniques with Hydrology students.

MATERIALS, DATA, TOOLS, AND LOGISTICS:

- **Special Tools/Equipment**
  - This exercise requires a total station (a Topcon GTS-212 was used for this lab). A transit would suffice, but fewer cross-sectional profiles will be obtained.
  - This exercise requires a high-resolution GPS (a Trimble GEO XT with beacon-on-a-belt and Pathfinder Office was used for this lab).
  - This exercise requires a means of measuring stream/river discharge (an Ohio Digital Stream Flowmeter was used for this lab).
  - This exercise also requires the standard equipment for measuring streamflow and cross-sectional profiles (e.g. - compass, tape measure, waders, rangefinder, calipers, etc).
- **Logistical Challenges**

There are a number of challenges when trying to establish a long term monitoring project within an undergraduate hydrology course:

- Steep learning curve for students in another course not familiar with surveying or GPS.
- Identifying a suitable community partner.
- Organizing schedules between two courses (hydrology and chemistry)
- Quality control between each successive class (e.g. - variations in students)

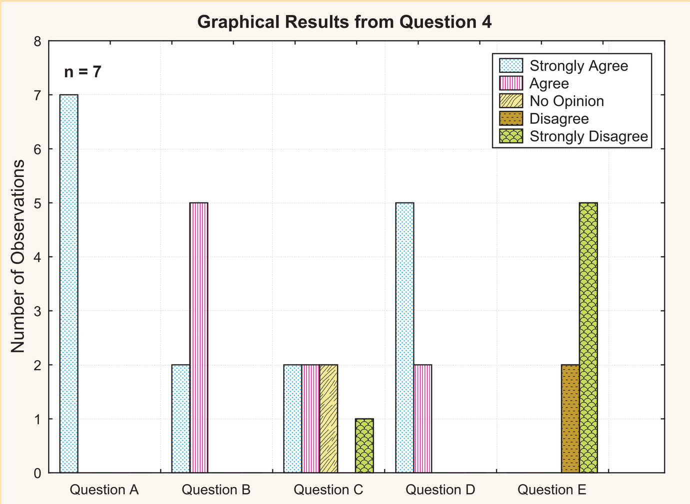
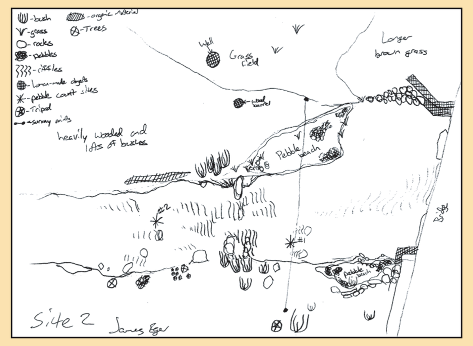
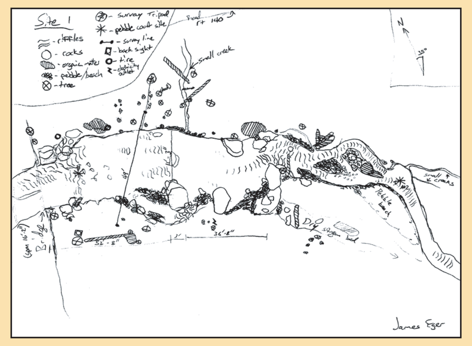


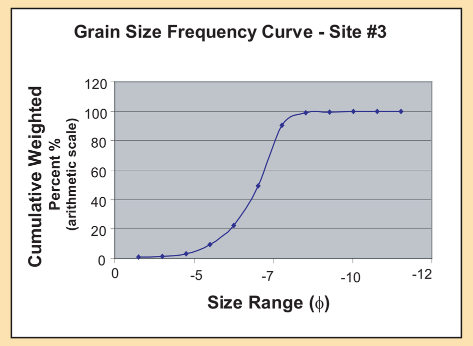
Figure 8: Summary of responses for question 4 from the end of the semester reflection/evaluation filled out by the hdyrology students.

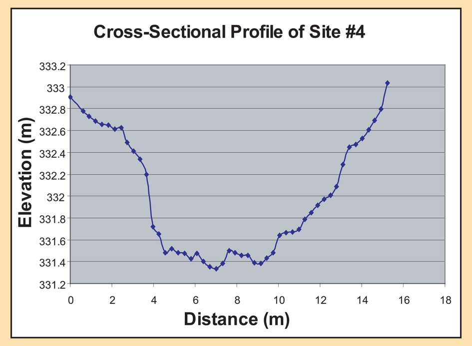
STUDENT RESULTS:

The students were responsible for describing and sketching sampling localities (in addition to taking digital photographs). In addition, they produced cross-sectional profiles and grain-size frequency plots using Microsoft Excel.









STUDENT ASSESSMENT:

Students were asked to complete a reflection/evaluation form regarding their experience with a lab that includes a service-learning component. This form asked the following questions:

1. What was your general impression of this lab, and how could it have been made better?
2. Do you feel you made a contribution to the community in any way?
3. Compare and contrast this lab with other labs from this class or other classes that didn't have a service-learning component.
4. Please rate the following statements using the following rubric (1 = strongly agree, 2 = agree, 3 = somewhat, 4 = disagree, and 5 = strongly disagree).
   a. It was outdoors.
   b. It was integrated with another course.
   c. I feel like I helped someone
   d. It provided hands on experience
   e. I didn't enjoy this lab

STUDENT FEEDBACK:

Students were asked to complete a reflection/evaluation form regarding their experience with a lab that includes a service learning component. This form asked the following questions:

Question 1:

- It gave me a view of what is actually done to measure streams and how they change over time.
- This lab is great because the data collected is actually going to be used and it's the first data collected in a 10(?) year study. Split us up into smaller groups so that everyone gets a chance to do everything.
- I enjoyed how integrated the lab was between the two classes. It gave an indication of what it's like working in a group or with another professional specialist.
- This lab is great because the data collected is actually going to be used and it's the first data collected in a 10(?) year study. The only thing I would have liked to see is a final model of the data (at the end of the study).
- I enjoyed how integrated the lab was between the two classes. It gave an indication of what it's like working in a group or with another professional specialist.

Question 2:

-Data I helped collect is going to help other people, so I'm glad I helped and had a chance to do what I did.

- Yeah, it's neat thinking that the data we collected is actually going to be applied here and now.
- By working with another class, we expanded who we normally interact with and were able to talk with others about work on lab after hours.

Question 3:

- Well, personally I enjoy labs that are outside, but it did provide us with a way to understand how the things we learn in class can be applied to the real world (e.g. - job).
- The service learning component makes you feel like you're working for more than just a grade, which is nice.
- This lab, like others, was good in that we learned and carried out field measurements. This lab was better in that the measurements are actually being used, instead of just being graded and added to the huge collection of other labs that I've done in previous years.
- The other labs have kinda been made up; it still helps by learning how to do it. But knowing that what you are doing is really going to help someone with info your collecting is just really great and makes the lab more important.

Question 4:

- The results from question four (Questions A-E) are shown in the bar graph to the left (Figure 8).

Question 5:

- The combined class thing was definitely neat in the way it added a responsibility dimension. We were responsible for understanding the material and relaying it to others. However, it would have been nice to do more pre-lab work.
- Integrating the classes before lab would be cool. Example, take a class-time (before lab) to meet and talk about what measurements are being made and why, rather than doing it all in the field.
- Maybe work more closely with the chemistry class before lab time.