Perspectives:

Teaching Wetland Ecology: What If You Can't Take Students Into the Field?

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While on the faculty of the University of Wisconsin-Milwaukee (UWM), I recently taught a first course in Wetland Ecology to upper-level undergraduates and graduate students in biology. The lecture component was a broad survey of topics, including wetland definitions and classification, wetland indicators (hydrology, hydric soils, vegetation), biological adaptations, community and ecosystem processes, functions and values, and wetlands regulation. 1 structured the course to combine these lectures with hands-on field trips and activities, but a field laboratory is not always a feasible option for some instructors. So how can one make wetland science more "real" to students in a lecture course, and in a more challenging way than a term paper assignment? Here I describe a successful library-based project that directs each student to research a wetland site by using a variety of available data sources. I adapted the idea from a similar exercise developed by a UWM colleague who teaches a limnology course in which students compile data on a "favorite lake" of their choice.

At the start of my course, I provided a list of potential sites from which each student selected a project wetland. Southeastern Wisconsin's glacial geology presents a setting of numerous lakes and wetlands within reasonable distance from campus, so I developed the list by searching local maps and by consulting with knowledgeable local experts. To keep the projects manageable, I particularly looked for wetlands that: (1) were relatively small and structurally uncomplicated (typically, discrete palustrine or lacustrine wetlands), and (2) had feasible public access (though students did not necessarily know this at first). If a student personally knew of a wetland not on the list and wanted to investigate it, we located the site on a quad map, and I approved it if I judged that the wetland was not too large or too complex for a novice to interpret.

As a starting point for investigation, each student received a copy of a county highway map with the wetland's location marked. Students were then directed to particular data sources (maps, manuals, or photos), and they completed worksheets which asked for specific information from each data source and for interpretations based on material presented in lecture (see Table 1). The worksheets were formatted to be self-guiding. I encouraged students to first try to figure out the answers on their own by carefully examining the materials and noticing what kinds of information each contained. If they were still at a loss, they then consulted me for help. Assignments were due in several parts throughout the course (Table 1), and I reviewed the worksheets to provide feedback and identify problem areas.

Thus, as we covered various lecture topics, students examined quad maps for location and topographic data, plat maps for land ownership, water table and flood hazard maps for hydrology, soil surveys for hydric soils identification, and aerial photos and wetland inventory maps to see how their wetlands were delineated. Graduate student enrollees were further required to make a visit to their wetlands and to compare the inventory mapping with what they saw in the field. Undergraduates were not required to make a visit, but most actually did so as they developed a personal interest in their project sites. Students visited the wetlands on their own time, typically during the weekend. I approved visits only if public access was permitted; this issue provided a good forum for discussing private property concerns about wetlands. At the end of the course, students were required to compile all data into a brief, professional-format report with an introduction, neatly-labeled tables and maps, and summary comments on their findings.

Logistics

Implementing this exercise required some up-front effort to find wetlands, to locate the data sources and make them accessible, and to develop the worksheets. However, once these initial logistics are worked out, the self-guiding format of the exercise is easy to manage and to repeat in future classes. A list of suitable project wetlands could be reused and added to from year to year. A key to success was having access to a wide range of information resources, but the assignments could be adapted to whatever is available. Campus libraries should have many of the maps and manuals, and these can be placed on reserve or otherwise made accessible for consultation. Most materials can be obtained free from the issuing agencies (e.g., soil survey manuals) or purchased at minimal cost (e.g., topographic maps). At UWM we were especially fortunate, because the university library houses the American Geographical Society (AGS) Collection,

Perspectives, continued

Table 1. Data sources and tasks assignedfor student projects in the wetland ecology course. Worksheets were submitted in a sequence of three parts during the course, with a summary report due at the end.

Data Source	Tasks and information requested
	Part One: Physiography and Geology
USGS 7.5' topographic map	— identify wetland boundary on copy of map — list map name, year, contour interval, and scale — report wetland latitude, longitude, and elevation AMSL — dentify county, township, range, and section(s) of wetland report wetland size: length, width, and area (using grid overlay) — give topographic interpretation of wetland type and landscape
Surficial geology map (as available)	— describe surface geology of the wetland site
County plat book	— overlay wetland boundary on copy of plat map — ist land ownerships of the wetland comment on feasibility of access
	Part Two: Hydrology and Soils
FEMA flood hazard map	— overlay wetland boundary on copy of map — determine if wetland is located on a floodplain (if so, in what drainage system)
Water table map (as available)	— interpret wetland elevation relative to water table elevation — comment on potential groundwater inputs
USDA county soil survey and ***Hydric Soils of the US*** [1]	— list soil series mapped in the wetland — report soil classification of each series (if more than one) — identify type of each series (organic/mineral; hydric/non-hydric) — list drainage class, depth and duration of seasonal water table, and occurrence of flooding for each series — note the hydric indicators in profile description of each series — interpret potential hydrologic regime of the wetland
	Part 3: Wetland Assessment and Final Report
1:4800 aerial photo	— overlay wetland boundary on copy of photo — give date and season of wetland photo — interpret image for evidence of flooding, appearance of vegetation (one or more types?), and surrounding land uses
Wetland Inventory map (state or national)	— give date of map — list classification(s) of wetland vegetation — overlay classification onto copy of aerial photo and interpret — ndicate expected plant communities, based on classification
	Final report: assemble all data, with introduction and summary comments

1 USDA Soil Conservation Service 1991. ***Hydric Soils** of the United States.* 3rd ed. Misc. Publ. No. 1491.

which was a centralized source of maps and had a helpful staff. At many universities, departments of geography may support similar map collections.

I was also aided greatly by cooperation from wetland scientists at a nearby state planning agency, the Southeastern Wisconsin Regional Planning Commission (SEWRPC), which supplied me with less accessible items such as copies of aerial photos and wetland inventory maps. Increasingly, these items are being converted to digital formats and thus are becoming more widely available. For example, the AGS Collection had 1:4800 digital orthophotography supplied by SEWRPC that could easily be printed out for the students.

Perspectives, *continued*

Educational value

Basically, the project leads the student through the process of compiling the background data that typically would be gathered as part of any wetland identification or delineation. Student feedback was overwhelmingly positive. They developed a personal investment in their wetlands, and while they sometime struggled with deciphering unfamiliar materials, all agreed that the projects enhanced their understanding of wetlands and also gave them good practical training. They gained a better appreciation of the effort needed before one even goes into the field to assess a wetland site.

I found the exercise to have some desirable advantages for teaching. As "problem-based" learning, it challenges the students to synthesize different types of data. Each wetland is unique, so final reports clearly reflect individual student effort. The instructor has more one-on-one interaction with students, and the students can also work together and learn cooperatively. Another benefit was somewhat unexpected. For these biology students in particular, I found that the exercise exposed them to an array of information sources that they were unaware of, partly because these were outside of their discipline. Most students had never worked with quadrangle maps, and few knew of the existence of county soil survey manuals, FEMA maps, aerial photos, etc. Thus the projects provided a broader practical education beyond wetland science.

Finally, developing this exercise within the course created a good opportunity for university-public agency partnership. In addition to supplying data sources, planning commission biologists participated in the course as guest experts (and as enrollees in some cases). Students were not necessarily familiar with the agency's work and so were able to interact with practicing professionals in wetland science. For one student, this led to a cooperative independent study project of ground-truthing some wetland inventory mapping for the agency.

I would be glad to share materials with anyone interested in trying something similar in their classes. Contact me via e-mail request (ddesteven/srs_charleston@fs.fed.us) for copies of the course syllabus and the project worksheets. I want to thank my colleague Art Brooks, whose "Favorite Lake Report" was the inspiration for this exercise. Thanks also to Doug Wilcox and Barb Kleiss for sharing their own wetland course syllabi with me, and to the staff at SEWRPC (especially Don Reed, Chief Biologist) and at the AGS Collection for their help in implementing the projects.

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