Teaching Geographic Field Methods Using Paleoecology

Megan K. Walsh

Abstract

Field-based undergraduate geography courses provide numerous pedagogical benefits including an opportunity for students to acquire employable skills in an applied context. This article presents one unique approach to teaching geographic field methods using paleoecological research. The goals of this course are to teach students key geographic field skills as well as a few more specialized research methods, to give students experience gathering original data, and to train students to write a grant proposal. Specific course activities, including vegetation sampling/mapping, dendrochronology, and lake-sediment coring, are discussed as well as the merits and struggles of designing and teaching a research-based field course.

Key Words: *field-courses, undergraduate geography curriculum, paleoecology, experiential learning, forest management*

Megan K. Walsh is an assistant professor of geography at Central Washington University, Ellensburg, Washington, USA. Her teaching and research interests are in biogeography and paleoecology with a focus on past and current climatic and anthropogenic influences on the fire and vegetation regimes of the Pacific Northwest.

Introduction

Geography as a discipline has a long and global history of incorporating fieldwork into both teaching and research methodologies (see Kent, Gilbertson, and Hunt 1997; Nairn 1999). Debate over the merits of involving students in fieldwork and its effectiveness in terms of providing participants with a deeper learning experience—one that goes beyond traditional classroom learning—has been in the forefront of geographic literature the last several decades (see Fuller *et al.* 2006 for a discussion). Most geographic educators today, however, agree that field-based learning provides numerous pedagogical benefits (Fuller, Rawlinson, and Bevan 2000; Scott, Fuller, and Gaskin 2006; Boyle *et al.* 2007; Hope 2009), including active instead of passive learning, greater one-on-one time with instructors, and improved personal growth in students (Hovorka and Wolf 2009). This is especially true when fieldwork is combined with research-based inquiry that is incorporated in a planned and meaningful way (Kent, Gilbertson, and Hunt 1997; Harris and Tweed 2010).

Unfortunately, the field component of many geography degrees has become more and more of a rarity in recent decades (Salter 2001; Zelinsky 2001). As departments experience ever-increasing student enrollments and dwindling budgets (Haigh and Gold 1993; Higgitt 1996; Hvorka and Wolf 2009), faculty face pressure to do more with less, including teaching larger, more efficient or even Web-based courses (Solem and Foote 2004). However, many geographers still feel the need to maintain a healthy amount of field-based instruction in their curriculum (Paradis and Dexter 2007; Krakowka 2012). Further complicating the situation is the direct competition field method courses face from computer-based technique courses (Hoalst-Pullen and Gattrell 2011). Courses such as GIS (geographic information systems) and remote sensing often seem more attractive to students (and their parents) who see the acquisition of these employable skills as a good investment.

Perhaps lacking is the understanding that field-based courses can provide students with equally essential and employable skills (Kent, Gilbertson, and Hunt 1997). In fact, field courses often offer additional benefits that many computer-based classes do not, including practical experience implementing subject-specific technical skills, practice working as a team or a group in physically demanding situations, and an increase in a student's confidence in their own abilities (Haigh and Gold 1993; Hovorka and Wolf 2009). Additionally, field courses can act as a positive feedback mechanism within a department, improving its image and aiding in student recruitment (Fuller *et al.* 2006). Unfortunately, this push to keep fieldwork as a part of geographical curriculum may come at a price. The trend by administrations to shift more of the financial burden for field trips onto students (Jenkins 1994), coupled with higher tuition rates, may deter students from taking field courses that have a fee attached, or may even inadvertently exclude students who do not have the extra money required to be a part of these courses.

The purpose of this article is to present a carefully evaluated, unique approach to teaching geographic field methods. The primary goal in providing a summary of the materials and approaches used in this course is to make a case for the feasibility and effectiveness of research-based, specialty-technique-driven field methods courses. I also argue that it is possible to design and teach such a course for students representing a wide range of geographical interests (i.e., human geographers, physical geographers, geo-technique geographers) and abilities.

Background

The Field Methods in Geography course at Central Washington University is a five-credit (quarter system), upper-level geography course. This course is offered during a six-week summer session, which provides an enormous amount of flexibility when scheduling class and field time and allows the course to run with a lower enrollment than during the regular academic year. The field methods course falls in the techniques category, which also includes GIS, remote sensing, and air photo interpretation courses. Students are currently required to take only one upper-level techniques course to complete their major in geography (but they often take more), so field methods is in direct competition with a number of other classes. Student fees attached to the course pay for van rental, gas, and food for field trips, although a departmental field trip fund set up by an emeritus faculty member covers some costs and helps to keep student fees low.

Given the flexibility of the summer session, the majority of the class time is spent in the field (see Course Structure, below). The setting of the field course is select study sites within the Okanogan-Wenatchee National Forest, which encompasses more than 1.6 million hectares along the eastern flank of the Cascade Mountains of Washington. This area was chosen for several reasons; the first is its proximity to the university, which allows for short travel time to field sites and more time spent actually doing fieldwork. Another is the number of ecologically important management issues facing the forest, including insect and pathogen outbreaks, catastrophic wildfires, concerns over the effects of current and future climate change, as well as the prevalence of direct human impacts on the forest such as fire suppression, logging, and mining.

Course Objectives and Structure

Course Objectives

The goal of the Field Methods in Geography course is to teach some basic geographic field methods, as well as a few more highly specialized research techniques from the field of biogeography, and more specifically, paleoecology. Additionally, the intent is to make the research activities real in the sense that the students are actually doing research that contributes to a larger research agenda. The hope by doing this is that students feel less like they are just taking a class and more like members of a research team, and as a result are more invested in the outcome of their activities.

The two themes decided upon for the course are paleoecology and forest health/management. Paleoecology is a subdiscipline of biogeography and is the study of past organisms and their interaction with other organisms and the environment (Dodd and Stanton 1981). Often the goal of paleoecology is to better understanding past landscape change, including shifts in vegetation, fire regimes, and climate. In this course, paleoecological field methods are used as a framework to address the very relevant and timely issue of forest health and management of the Okanogan-Wenatchee National Forest. Field activities center on vegetation analysis, dendrochronology, and lake-sediment coring. Because of its long-term perspective and applicability to important geographic issues such as loss of biodiversity, human impact on landscapes, and management of invasive species (Willis and Birks 2006), paleoecology is a more than suitable and enjoyable way in which to teach this course.

The specific student learning objectives for this course include: (1) to learn key geographic field skills, such as topographic map reading, use of GPS units, and field observation and note taking, as well as a few more specialized field methods; (2) to gain experience contributing to the design of a research study and carrying out fieldwork (including gathering original data); and (3) to use the skills learned and the data gathered in the field to develop a grant proposal to hypothetically fund future research. Successful completion of these objectives should ensure that any student who takes the course understands what it means to do geographical fieldwork and is prepared to participate in future fieldwork, either their own or that of other researchers.

Course Structure

Table 1 provides a summary and timeline of the course structure, lecture and field topics, homework, and reading assignments. The first three weeks of the course are structured with a two-hour in-class meeting on Monday mornings and a full day of fieldwork the following day. The in-class portion of the course is designed to introduce the field topic for the week and give students the necessary background to be able to complete selected field exercises. Readings are assigned following Monday's class and the students are required to have completed them prior to the field trip. All day Tuesday (approximately eight hours) is spent in the field; topics and activities vary. Homework assignments are posted on Blackboard following the completion of each field day and are due Sunday night. The assignments typically require students to read several research articles focusing on what was seen or discussed in the field, and to answer essay questions regarding those articles. They are expected to incorporate their observations and experiences from the field into their answers.

Week 4 varies from this structure and includes a three- to four-day field trip. Readings are assigned before leaving and are discussed in the field. Additionally, the students are required to be present for packing and unpacking the vehicles and trailer with food, supplies, and research equipment so that they understand the amount of work that goes into planning and executing a research trip.

Weeks 5 and 6 also vary from the initial course structure. Week 5 is spent in the lab instead of the field. This gives students the opportunity to participate in a preliminary analysis of the samples they gathered in the field. No class is held week 6, but instead individual student meetings are arranged to discuss progress on the final project. The final product for the course is a ten-page grant

Table 1. In-class topics, assigned reading topics, field topics/skills, and homework assignments for Field Methods in Geography.

	In-class topic	Assigned reading topic	Field topics/skills	Homework assignment
Week 1	Introduction to geographic field methods	Field research design (Lounsbury and Aldrich 1986)	• Study site selection/reconnaissance • Field observations • Note taking • Map reading skills • Formulating research questions and hypotheses (assigned reading)	Health of the Okanogan and Wenatchee National Forest (Townsley *et al.* 2004)
Week 2	Vegetation identification and surveying	Introduction to pollen analysis (Pielou 1991)	• Developing testable research questions • Data gathering • Vegetation transects/plots • Plant identification • Biodiversity • Pollen analysis (assigned reading)	Reconstructing forest change using pollen and charcoal analysis (Whitlock and Bartlein, 2004); fire and vegetation history (Walsh, Whitlock, and Bartlein 2008)
Week 3	Dendrochronology and paleoecology	Dendrochronology and dendroclimatology (Fritts 1991), sampling procedures (Lounsbury and Aldrich 1986)	• Developing sampling schemes • Using increment borers • GPS use • Data recoding • Teamwork • Dendrochronology and dendroclimatology (assigned reading)	Field reports; forests of the Eastern Cascade Mountains (Wright and Agee 2004)
Week 4	4-day camping trip to the Sinlahekin Wildlife Area, north central Washington	Fire and landscape change in the Sinlahekin Wildlife Area (Schellhaas Conway, and Spurbeck 2009)	• Combined topics and skills from weeks 1-3 • Lake-sediment coring • Interacting with land managers • Field work and safety • Development of grant proposal topics based on field observation	Students write a 2-page essay on their field experience; turn in grant proposal topic including research questions and objectives
Week 5	No class meeting	Sample grant proposals	**Meet in lab** • Data analysis techniques • Methods in charcoal and pollen analysis • Tree-ring mounting and counting • The importance of preliminary data • Discussion of grant proposals (assigned reading)	Work on grant proposal
Week 6	No class meeting; individual appointments to discuss grant proposal	None	N/A	Grant proposal due

proposal designed around the work done in the field and a preliminary analysis of the samples collected. Each student is required to develop an individual proposal that expands upon the work completed in the course, and is based on their specific area of interest within the larger context of forest health and management of the Okanogan-Wenatchee National Forest (e.g., loss of endangered species, the cost of fire suppression, risks associated with living in the wildland-urban interface, etc.).

In-Class Topics and Field Exercises

Week 1 (In-Class): Introduction to Geographic Field Methods

The in-class meeting during week 1 is a chance to get to know the students and their interests, as well as provide an introduction to geographic field methods. Material for this lecture mostly comes from Doolittle's online Field Techniques course materials developed for use in the Department of Geography at the University of Texas (Doolittle 2007). The lecture I designed is fairly informal and is built around asking questions designed to make the students think about geography in a different way. The questions include: What is geography? How do we traditionally study it in a classroom? What makes it necessary for geographers to go outside and study it (in other words, why are field methods necessary)? What are some of the different field methods available to use? How do we gather data in the field? What are some of the things geographers need to think about before heading out into the field? What are some of the things you should bring into the field with you? This discussion is aimed

at giving students a better idea of what it means to do fieldwork, instead of just participating in field trips. I also discuss different styles of geographic fieldwork, including examples from both physical and human geography, as well as the attitude of needing to "see it for themselves" (Hope 2009). I end the lecture with a discussion of why it is necessary in most instances to have a good topographic map of the intended research area, as well as ways in which field observations and data are recorded (e.g., video, audio, note taking, etc.). Students are required to purchase a *Rite-in-the-Rain* notebook before the first field excursion.

Week 1 (Field): Reconnaissance, Observations, and Formulating Research Questions

The goal of the field component of week 1 is to expose students to select basic geographic field methods. The specific exercises for this week include: (1) comparing what students believe a study site should look like based on their interpretation of a topographic map versus what it looks like in reality; (2) observing, describing, and sketching a field site (i.e., a lake surrounded by second-growth forest) in their field notebooks; and (3) developing a problem statement, research question, and hypothesis relating to the field site based upon their earlier observations. This last exercise of developing research questions and hypotheses builds on a discussion of the chapter "Field Research Design" from Lounsbury and Aldrich (1986), which the students are required to read prior to the field trip. As a group we help tweak the questions and hypotheses posed until they are framed in a way that they can be easily answered with empirical field data (which is the point of the exercise). We also discuss the next step in designing a research study, including the kind of information that should be gathered before moving forward (e.g., Forest Service records of logging or fire activity, air photos of the site, other research that has been done nearby or has addressed similar research questions).

The week 1 homework is designed to familiarize students with the specific study area now that they have seen it in the field (Table 1). The introductory reading provides background information on the current ecological situation of the forest by introducing such topics as fire regimes and fire suppression, natural range of variability, and forest structure and composition. This reading is especially important given the wide array of experience of the students and is extremely helpful for those who have taken few (or no) upper-level physical geography courses. See Table 2 for examples of the homework questions.

Week 2 (In-Class): Vegetation Identification and Surveying

The week 2 class meeting is spent helping students who typically have never taken a botany course become familiar with plant identification and vegetation surveying techniques. Lecture materials include information on basic plant taxonomy and classification, flower parts and terminology, a simple guide to leaf style, and instructions on how to distinguish the conifer trees of the inland Pacific Northwest, as well as a discussion of why it is important to survey vegetation at a study site. I also discuss what kind of things should be recorded when doing a vegetation survey

Table 2. Sample essay questions from the weekly homework assignments.

Week	Sample homework questions
1	1. What is natural range of variability and why is it important to understand, especially in terms of forest restoration?
	2. What kind of disturbances were historically common in the Okanogan/Wenatchee NF? How are those disturbances likely to change in the future?
	3. What are some of the insects/diseases that affect trees in the Okanogan/Wenatchee NF? How are they controlled either naturally or by human actions?
	4. How have the fire regimes of the Okanogan/Wenatchee NF been altered by human action over the last 100 years?
2	1. How are dendrochronological methods used to reconstruct fire history? What are the benefits of tree-ring based fire history reconstructions versus ones based on particulate charcoal that accumulates in lakes and wetlands?
	2. Describe in general how charcoal data are used in conjunction with pollen data to understand fire history.
	3. What is the difference between fire weather and fire climate?
	4. In general, what controls fire activity on century and longer time scales? What paleoecological evidence do we have to support this?
	5. Why do you think it is important to understand the current vegetation composition/structure at a field site when carrying out a fire history study?
3	1. What was the goal of the study? What type of sampling scheme was used? Do you think it was appropriate for the study?
	2. What was determined in terms of the total number of fires, the change in fire frequency, and the seasonality of historical fires within the Teanaway drainage?
	3. What are some of the major points the authors address, especially in regard to fire size and its effects on the ecosystem?
	4. What do the authors determine about the relationship between past fire and vegetation in the Teanaway drainage?
	5. What management actions do the authors suggest as a result of the study? Do you agree or disagree with the recommendations? Why or why not?

(e.g., frequency, dominance, percent cover, height, species, health). The rest of the class time is spent introducing vegetation surveying techniques, including *relevé* (vegetation plots) and line-intersect transects.

Week 2 (Field): Vegetation Identification and Surveying

The goal of the week 2 field time is to apply the basic botany and vegetation surveying concepts introduced the day before to the field site. The specific exercises include: (1) developing testable research questions and hypotheses that can be answered with the collected data; (2) completing vegetation transects and collecting vegetation data; and (3) vegetation mapping. For completing the vegetation transects, the students are split into teams of two and given a 30-meter long tape measure, a meter stick, a GPS unit, and plant identification manuals, and each are assigned an area in which to work. The students complete a 30-meter-long transect during which they record the position (distance along the transect and elevation), diameter at breast height (dbh), species, and general health of every tree greater than 10 cm dbh within the 10-meter-wide transect. The teams are also responsible for identifying the dominant plants (e.g., shrubs and herbs) in the understory of their transects. Following this we discuss the results, specifically looking at the size and number of tree species each team encounters and differences in the composition of the understory vegetation. We hypothesize as to why the data vary between groups and then return to our original research questions to see if even without a statistical analysis of the data, whether we can come to a conclusion.

In terms of the vegetation mapping, the students sketch site maps showing the different vegetation communities (e.g., closed forest, open forest, wet meadow) and their relative position with regard to the lake. They also determine the dominant plants within each community and record the information in their field notebooks. Additionally, we hypothesize as to why the vegetation communities vary around the lake (e.g., different soil types, changes in the water table, disturbance patterns, etc.) and discuss ways in which we could design a study to answer those questions.

The week 2 homework assignment consists of two articles relating to paleoecological methods (Table 1). The readings were chosen because they provide examples of how empirically gathered paleoecological data is used to address current environmental issues. These reading also help the students start formulating their own research proposals by showing that all the information we gather in the field has a purpose and place within a research publication (or grant proposal, in their case) (Table 2).

Week 3 (In-Class): Dendrochronology and Paleoecology

The in-class portion of week 3 is spent discussing field, lab, and analysis methods associated with dendroecology and paleoecology. The aim of this is to prepare students for upcoming field-sampling activities, not to make them experts in the analysis of tree rings or lake-sediment cores. In terms of dendrochronology, tree-ring anatomy, methods for tree-ring sampling, tree-ring sensitivity, dendroclimatology (i.e., the use of tree-ring sampling to understand past climatic variability), and dendroecology (i.e., the use of tree-ring sampling to determine stand age and presence of fire scars) are introduced. As for paleoecology, topics such as extracting lake-sediment cores, site selection, dating techniques (e.g., radiocarbon dating, tephra [volcanic ash] identification), and lab methods (including pollen and charcoal sampling and analysis) are discussed.

Week 3 (Field): Tree-Ring Sampling and Sampling Schemes

The time in the field during week 3 is mostly spent extracting tree-ring cores (Fig. 1). I require the students to develop novel research questions and hypotheses to guide the day's field activities, as well as devising a sampling scheme. This is facilitated by the weekly reading assignment, "Dendrochronology and Dendroclimatology" (chapter 1) from Fritts (1991) and "Sampling Procedures Appropriate for Geographic Field Study" (chapter 5) from Lounsbury and Aldrich (1986). In order to complete the tree-ring sampling, I typically split the group into teams of two and give each an increment borer, a can of WD-40 for lubrication, a GPS unit, and a meter stick. They are instructed to create a table in their field notebook and record the sample number (e.g., East-1, North-4), tree location (latitude, longitude, and elevation), tree diameter, species of tree, and any notes about the tree or the sample (e.g., tree rotten in the middle, cat face on uphill side of tree, etc.). Successfully extracted cores are placed inside drinking straws (taped together when necessary), labeled with the sample number, and returned to the Paleoecology Lab for analysis.

For the week 3 homework the students are required to fill out a field report documenting their activities (Appendix), primarily so that they understand the importance of recording their fieldwork, and secondly, so they have the opportunity to reflect on the exercise. I also assign a reading that provides a local, real-world example of a study that uses dendrochronology to examine past fire activity (Table 1). The purpose in assigning this reading is to illustrate the importance of developing an appropriate sampling scheme so that field data adequately address a research question (Table 2).

Week 4 (Field): Research Trip and Lake-Sediment Coring

The extended field trip typically occurs during week 4. The primary goal of the research trip is to extract lake-sediment cores, but it is also a chance for the students to apply what they have learned during previous field excursions to a new study area in the Okanogan-Wenatchee National Forest. By traveling to a new study site the students are forced to make new observations and develop novel research questions and hypotheses that are appropriate for the area. They are also required to nail down a grant

Figure 1. Collecting a tree-ring sample using an increment borer (left) and examining a tree core (right). (Color figure available online.)

proposal topic by the end of the trip. The research area we visit is one of my own study sites, therefore I am able to guide the students in terms of the major land management concerns within the forest and how paleoecology can be used to address some of those issues.

Most of the field time is spent extracting lake-sediment cores recovered from a floating platform anchored to the middle of each lake (Fig. 2). The students help unload the research gear, build the floating platform, row and anchor the platform, extract the sediment cores, wrap and label the cores for transport, and repack the research trailer. The students are required to keep track of the coring notes, which include our coring locations (latitude, longitude, elevation, and water depth), the core lengths, and the general core descriptions. They also spend time identifying the vegetation at the study sites and record the information in their field notebooks. The goal of this is to make the students responsible (as much as possible) for the success of the coring expedition.

A portion of our field trip is spent talking to local land managers, which in itself is an important geographic field method. Managers provide the students with information on the history and development of the area, as well as discuss current management concerns (e.g., invasive species, forest health, human impacts on wildlife, etc.). The students are required to listen and take notes, and are encouraged to ask as many questions as possible, especially regarding issues that relate to their grant proposal topics. Other field trip activities are less formal and include practicing plant and tree identification, visually comparing and discussing treated (i.e., thinned and prescribed-burned) and untreated forest stands, taking additional tree-ring samples, and photographing the study sites.

The assigned homework following the research trip is divided into two parts. First, the students write a two-page reflective essay about their experience on the trip. They are required to include specific observations they made in the field, especially those that pertain to the development of their grant proposal topic, and they must be as detailed as possible in their writing (where they saw something, when, why it struck them as important). I also encourage them to discuss their feelings about the experience as a whole (Did they like the experience? What did they learn? What could be done differently next time?). For the second part of the homework they are required to turn in their grant proposal topics, along with a rough draft of their problem statement, research questions, and hypotheses.

Week 5 (Lab): Laboratory and Data Analysis Techniques

Class time during week 5 is spent in the CWU Paleoecology Lab working with the collected tree-ring samples and lake-sediment cores. Given the short amount of time available to spend in the lab, the goal of these activities is not to train the students in all available techniques, it is merely

Figure 2. Assembling the research platform (left) and describing a lake-sediment core (right). (Color figure available online.)

to familiarize them with the lab methods associated with this kind of research. However, students are trained on how to prepare tree-ring samples for analysis (i.e., mounting and sanding) (Fritts 1991); they then use stereomicroscopes to determine an approximate age of each sample. From these counts the students create a table of the results in their field notebooks. The students are also trained on how to describe sediment cores based on their lithology (i.e., changes in sediment type, color, presence of volcanic ash layers) using the Munsell soil color chart, and they do this for the recovered cores. This information also gets recorded in their field notebooks. Additionally, the students learn to take and process macroscopic charcoal samples from the sediment cores, and, time-permitting, use the stereomicroscopes to practice counting charcoal samples. The tree-ring ages and core descriptions, as well as the lab techniques they learn, are subsequently included in the student's grant proposals as preliminary data and methods. Again, the point of the lab time is not to make the students experts in laboratory analysis of tree-ring and lake-sediment samples (that is beyond the scope of the course), but to give them the opportunity to understand how the collected field samples are prepared and analyzed. Students are encouraged to remain involved in future research efforts involving the cores they obtained by volunteering in the Paleoecology Lab during the academic year.

Week 6: Individual Meetings and Grant Proposals

No formal class is held during week 6, but instead I meet individually with the students to discuss progress on their grant proposals which are due at the end of the week.

Student Assessment and Evaluations

Student grades in the course are based on attendance and participation, weekly homework assignments, and a final grant proposal. Although I do not currently include an evaluation of their field notebooks in the final grades, I will likely do this in the future. Based on my personal observation, students who took more field notes that were of greater detail wrote better grant proposals. I decided on a grant proposal as the final product for several reasons. First, I wanted to assign something other than the typical end-of-the-quarter research paper, especially because we actually do real research. The grant proposals give the students an opportunity to incorporate the data they gather in the field into their final project. Second, I have students write a grant proposal because it is an important career skill, as noted in other disciplines (Griffith, Hart, and Goodling 2006). Whether the students continue on in academia or work for a nonprofit or government agency, many of them will have to solicit funds by writing grant proposals. For that reason I evaluate their final proposals based on their ability to articulate clear research objectives and incorporate our

preliminary data to support conducting future research, not their mastery of in-depth paleoecological techniques. In general I have been impressed with the quality of the students' proposals and found that they are a good way to judge the degree to which each student understood and internalized the work we did.

Course evaluations indicate that students have enjoyed the course, especially the amount of time spent in the field. When asked what they liked about the course, representative comments included:

> The course was very enjoyable. The best part was actually being able to go into the field and have hands on work which makes for better learning than sitting in a classroom trying to imagine what is going on.

> One aspect of the course I really liked was going out into the field and being able to use the many tools we had to collect data, i.e. GPS units, tree corers, vegetation ID books. Practicing field techniques and data collection in this class definitely helped me improve my ability and confidence in fieldwork.

When asked what they did not like about the course, there were few responses but they included complaints about the heat and mosquitoes. When asked to describe the specific skills they learned, students responded:

> [I learned] sampling, recording data, organization, working with people. Yes I do think they are important to know as a geographer because they're basic skills that will help you in the future to go farther.

> The course gave a brief idea on how to collect tree and lake cores, to collect data like the diameter of trees, and identification of plant species. The plant species identification will help further in the other classes as well.

The reviews were mixed when asked their opinion of the grant proposal assignment, but indicated overall that they learned a lot by doing it:

> I liked doing the grant proposal because it combined aspects of an individual study, while being something different. Having never done a grant proposal, it was good practice to write one and it gives you an idea of the kind of work and effort needed to write a successful grant proposal.

> I think the grant proposal was helpful for future academic use but I did not like it very much. I would suggest having a presentation and a paper on a topic related to class.

> The grant proposal at times was frustrating and very time consuming. Although it was frustrating at times I did learn a lot from it in the end. I think it really is a good ending to the class to sum up what you have learned.

Perhaps most important (in my opinion) is how the students feel about being involved in real geographic field research. Their responses were overwhelmingly positive as suggested by the following:

> Being involved in real geographic research is great. It gives me a sense of freedom in the field and increases my motivation to do well. I would definitely say it makes the class more rewarding.

> I think it was awesome being involved in real geographic field research. It did make it so much more rewarding knowing that your effort was actually going to something.

In total, the student responses clearly indicate an enthusiasm for the course and an appreciation of the unique opportunity it provides to enhance their geography degree.

Challenges and Lessons Learned

Many geographers agree that designing a course such as geographic field methods takes a lot of preplanning and is very time-consuming (Tueth and Wikle 2000). Innumerable details must be worked out before the course starts (e.g., finding appropriate field sites, getting permission to conduct research, arranging field trip logistics). Additionally, planning for the risks associated with including undergraduate students in fieldwork is necessary, as well as being mindful of students' physical limitations (e.g., hiking ability, amount of weight they can carry, eating and drinking habits) (Higgitt and Bullard 1999; Nairn 1999). Especially important for field courses that involve overnight trips is understanding that not every student has camped before, or even knows what it means to camp for multiple days in an area with limited facilities. For many this can be a scary undertaking. Giving students a very specific list of what they should bring and the explaining the possible conditions they can expect (e.g., no sinks or showers, hoards of mosquitoes, heat waves and/or rain storms, no cell phone service) goes a long way in easing their anxiety (Kent, Gilbertson, and Hunt 1997). Perhaps most important is assessing student health in the field, which can be done in the evening through informal campfire conversations. Others have noted the importance of these informal conversations (Fuller *et al.* 2006), as well as the role that multiple-day field trips play in the ability of a group to bond, something that does not typically happen on single-day field trips.

Conclusions

From reading the evaluations and talking with students, I feel that this course successfully completes the objectives I

originally laid out. Beyond learning basic geographic field methods, I believe the students take away from the course a greater understanding of what it means to do geographic fieldwork. To me this is proven by their enthusiasm in the field and the quality of their grant proposals. Given many of the evaluation comments, I am certain that many students will be more inclined to do their own field research in the future, or become involved in that of others. The course structure and activities will likely continue to evolve based on my own experiences and current research focus, as well as the students' comments and suggestions. Potential improvements include incorporating more quantitative analysis of the field data, as suggested by a student.

Although developing field method courses may involve more time and energy than regular classroom-based courses, my personal experiences, as well as student evaluations of the course, indicate it is well worth the extra effort. By incorporating a field methods course into an instructor's research agenda the class activities achieve a greater level of authenticity, while simultaneously making the student's efforts feel more valuable (Rodbell and Gremillion 2005). It also better prepares undergraduate students for entering the work force or graduate institutions where knowledge of how to carry out geographic field research is a necessity. As stated earlier, the actual framework through which the course is taught matters very little and I am not the first to design a course such as this. However, by using paleoecology and forest management as the themes of the course I am able to give CWU students with a wide variety of academic levels and interests the opportunity to participate in a novel and significant learning experience (Fink 2003).

Acknowledgments

I would like to acknowledge the effort of the students in the Field Methods in Geography course during summers 2011 and 2012. Without their hard work and positive attitudes this class would not have been a success. I would also like to thank C. Koski for his technical support building and maintaining much of my research equipment and numerous members of the geography department and the administrators of the College of the Sciences at Central Washington University who helped make this course possible. I also thank S. Hardwick, K. Archer, C. Revels, and three anonymous reviewers for helpful feedback on this manuscript.

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Appendix. Field Report for the Week 3 Field Activity

Field Report	Investigator:
Site:	Date:

A. Site Description (*Describe the field site where you worked, including the layout of the site, the vegetation, signs of human disturbance, and anything else you think is important. Be as geographically descriptive as possible*).

B. Daily Activities (*Describe your daily activities. It is a good idea to go chronologically. This is an account of your time to your "boss" so they know how your day was spent. Leave the exact details about the number of cores collected for the next section. Make sure to include the hike in and out of the site. Including approximate times of your activities would be good).*

C. Data Collection (*Describe the data you collected in the field, including how the samples were collected, the sampling scheme used by the whole team, the number of cores your team obtained, how the samples were stored and transported, the information gathered about each, etc. Each group should only talk about the samples you and your partner gathered*.)

D. Results (*Create a table with the results of your data. Again, only include the samples you and your partner gathered. If there are missing data, please note it and explain why in the next section*.)

E. Comments (*Describe any difficulties you encountered in the field, anything you would do differently next time, or anything you want your "boss" to know or you want to remember for next time*.)