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The Best "Lied" Plans: Engaging Undergraduate Participation in Fieldwork

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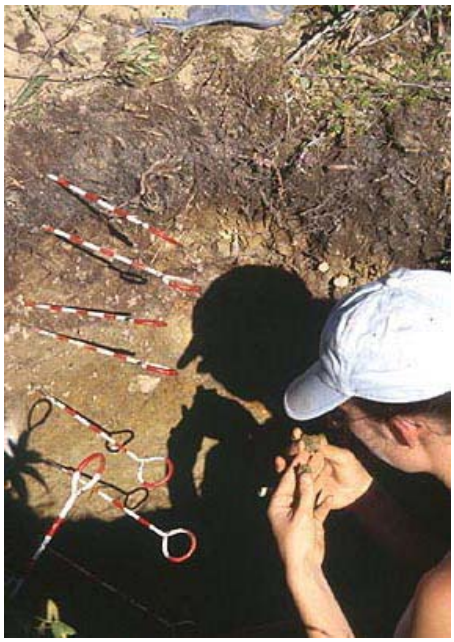
Introduction

It was 6 A.M., and rain pelted my tent on a chilly May morning. I was six hours from home and an hour from civilization. Thirty-seven students slumbered nearby, when they awoke they would probably have the same thoughts as me: The prospect of hiking three kilometers through the rain, digging holes in the ground, recording soil and vegetation data; can I roll over and make this class just go away? As the instructor, the answer, of course, was no. I must get up and motivate the students to hit the trail in order to complete a class project. Luckily, I had anticipated such as scenario. Rain, early mornings without coffee, longs hikes, hard work; all these difficulties of fieldwork were surmounted by detailed planning and enthusiastic promotion.



Fieldwork is a much-heralded component of the geographical tradition. My educational and professional experience firmly lies in this tradition; however, several trends can keep undergraduates out of the field, especially cost (of travel and loss of income) and time conflicts. I feel that to attract students away from weekend activities one must engage the student in fieldwork by justifying to them that the experience will be worthwhile. This is not always an easy task when most students are working or partying their way through school. Once the students are involved in the field experience, it is critical to have the affair well planned. While fieldwork can be marred by the unexpected, you can anticipate the expected and have the students prepared. This will ensure the event runs smoothly and students will come away with a good experience, paving the way for better student involvement in your academic program.

This paper describes a field project from an introductory soils course taught in spring 2001. Looking at soils in the field is a necessity, since the physical details of soils cannot be readily reproduced in a class or lab setting. Convincing students that crawling into a muddy hole will help them learn does not always work. So I conceived a plan to inspire the class about looking at soil in the field. I used geography as a starting point, by selecting an extraordinary environmental setting for the field project. Then I fully developed a research project for the class, including hypotheses to be tested and provided ample background information. I followed the lead of television and peppered advertisements for the project throughout lectures, overemphasizing several aspects with the aim to entice the students into the field. The combination of preparation and marketing resulted in a hugely successful field experience.

Geographic Setting

Your mental map of the Olympic Peninsula's west slope is probably blank or perhaps covered with temperate rainforest or clear-cuts. It is likely blank because the area is relatively remote (even from Seattle) and there really is not much going

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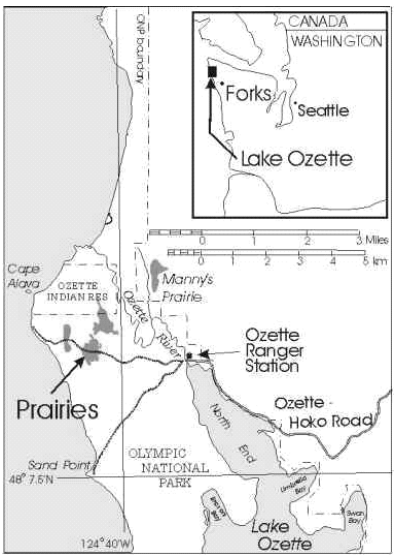
on—a few small towns, a declining logging industry, a few environmental battles, and outdoor recreation with little tourism. The Hoh Rainforest, part of Olympic National Park, is the region's largest draw. The exceptionally luxurious forest growth nestled within the windward facing valleys of the Olympic Mountains is awe-inspiring. Towering conifers and massively sprawling maples covered with ferns and dripping with thick mats of moss and lichen remind one of a primeval world. You expect a dinosaur to crash through the forest at any moment. Most of the west slope of the Olympic Peninsula was covered with similar forests before commercial logging began in the early 1900s. Annual Rainfall averages 100 inches (250 cm) at sea-level and increases up the mountain slopes. While ecologists argue over exactly what constitutes temperate rainforest in the Olympics, for most of us any forest over about 50 years old in the region will appear thicker than any other forest outside of the tropics.



In the state of Washington, treeless areas often have a placename of 'prairie.' While the term prairie perhaps evokes an image of the expansive rolling hills of the Great Plains, most Washington prairies are rather small, less than 100 km^2. The term meadow is much more accurate. It might be the tall grass and sedge vegetation that naturally covered these

surfaces that earned them the name prairies. In many cases, first nation groups utilized and maintained (through burning) prairies for hunting, gathering and camping. Four small prairies occur near the northwest tip of the Olympic Peninsula, in an area that receives about 100 inches of rain annually and boosts dense rainforest. An indigenous group, the Makah Tribe, occupied a village site two kilometers from these prairies. The prehistoric Makah culture is very well understood from a series of excavations of the nearby village site at Cape Alava. The Makah lived along the coast and successfully exploited the marine resources by fishing, sealing and whaling. No physical evidence has been found to link them to the prairies. These prairies, which are within Olympic National Park, contain numerous endemic plant and animal species. They are in an area isolated from intense anthropogenic disturbances because the area is not accessible by road or commercially logged. Over the last thirty years, the prairies have experienced a dramatic vegetation change, including invasion by native trees.

Project Background

In my soils course we focus on the physical properties of soils and field sampling. In addition to required half-day field excursions to introduce students to techniques used to describe soils from open pits, I offer students the option of a field project in place of a library paper. The field project is designed to be a mini-soil survey by describing and sampling a number of soils in a small geographic area to evaluate landscape variations in soil development, the relationship of soil type to geomorphic surface or other environmental factors, and to assess the accuracy of published soil surveys. To collect data at a sufficient number of sites to see variations, these projects have been weekend trips. University rules do not allow me to require weekend trips, thus I attempt to make the projects exciting enough to attract students away from a weekend of working, skiing, partying etc., without cheapening the educational experience.

In January 2001, I began to plan my soils class for the spring term by calling Dave Conca, an archeologist for Olympic National Park. I had previously worked with Dave on some fluvial soils near an archaeological site in the park, and he suggested that we expand the project with my soils class. Instead of fluvial soils, Dave suggested the prairies where tree invasion was occurring. The National Park Service wants to understand why the invasion is occurring and what might be the best mitigation methods. The soils have not been described by the NRCS, but Dave thought that they might tell us something about their history. Park lore states that homesteader burning created the prairies, but no scientific work has ever been carried out in the area.

In order to address why the tree invasion is occurring, we developed several working hypotheses, the most basic of which is that the prairies are either natural or anthropogenic in origin. If the prairies are natural features, then their presence might be due to:

- drainage (i.e. saturated soils), nutrient deficiency or toxicity which does not allow the forest to grow in these areas
- disturbance features such as a natural burn scar
- last remnants of Pleistocene vegetation (refugia).

If the prairies are anthropogenic features, they might have been formed by:

- prehistoric land management (i.e. burning or tree removal)
- European Homesteader land management (burning, tree removal by hand, and/or livestock activities)
- recent actives related to National Park Service management (i.e. recreation)

Having never visited the site, I discussed a sampling strategy with Dave that could address the origin of the prairies. Simply, we would sample soil transects across the prairies and into the adjacent forests. If the soil development was the same in the prairies and in the forests, then the forest had likely been removed recently (i.e. by homesteaders). If the soil development was very different, then the forest had likely never been in the prairies and they are natural features related to long-term vegetation differences. If the soil development was similar, yet somewhat different in the prairies and in the forests, then the forest had likely been removed prehistorically and a new pedogenic regime was altering the forest soils. Luckily, a similar soil study had been conducted on another prairie in Washington, thus we had a methodological model to follow, and literature for the students to read.

In order to conduct research in a National Park, one must go through a permitting process that includes identifying sample sites so the Park Service can assess potential impacts. Pre-site assessments are also invaluable for field trips so that the instructor knows: 1) what you are getting into, 2) where you are going, 3) field time is not wasted in site selection, and 4) you can anticipate student questions. In the field we selected two transects of soil sampling sites, which addressed the above hypotheses. I carefully identified each sampling site on a map, with GPS coordinates, and with flags in the field so the Park Service and students could locate the sites. A description of each sampling site was recorded, and a justification of the location significance (in terms of the hypotheses) was determined. This ensured that we knew what we were doing once we arrived at the field site.

After the Park Service completed their environmental evaluation of our sampling sites, they informed us that several of our sites were occupied by endangered plants, which served as hosts to endangered butterflies isolated to these prairies. They would let us complete the soil sampling, but we would need to be exceptionally careful in our field protocol. Spoils would need to be contained on tarps and vegetation trampling would need to be minimized. Nothing more than what one would do in a soil study under most circumstances.

By the time Spring term started, I had invested a considerable amount of time into the planning of this project, largely because I saw the longer term research potential. I wanted to ensure that I had a critical mass of students involved in order to collect enough data to make some sort of evaluation of our initial hypotheses. From the first day of class, I began to introduce the project and elaborate on the details. Typically, I find discussing a final project early in the semester to be a waste of my time, as most students do not begin to think about them until a week or day before the project is due.

I began describing the wonderful natural setting on the Olympic coast; this caught the attention of many students. A potential drawback, which I also emphasized from the beginning, was the distance: A minimum six hour drive each way. This required leaving on a Friday afternoon and returning late Sunday. Second, I stressed the real world nature of the project. That we would do original work—describing soils in an area never investigated. The project had answerable questions based on the hypotheses. The project was couched in natural resource management (our program's emphasis, thus an area of genuine student interest) and that the results could be used by the Park Service to make management decisions. This resulted in many students straightening up in their chairs to listen. I talked about the geographical relationship to the Makah village and that we might find the first archeological evidence of their presence on the prairies in the form of artifacts or charcoal. Students actually began to take notes on the first day of class! Noticing the class interest, I went on mentioning the endangered butterfly— some students began to drool with excitement. The show of hands for interest was the usual first day interest about 80-90% of the 38 students. My past field trip experience was that this high interest rate usually wanes by the time the trip rolls around and only a handful attend.

Determined to keep student interest and involvement high, I weaved the project into my lectures. Many of the students were intrigued by the presence of the endangered butterfly. I did a little research. The Makah Copper (Lycana mariposa) had only been discovered the year before and nothing of its life history was known, other than it had no potential habitat outside of the prairies. A butterfly biologist suggested that no manipulation of the prairie habitat be undertaken until their life history was understood.

I overemphasized and made light of the divergent views of prairie management within the two divisions of the Park Service. The Cultural Resources Division wanted to demonstrate that prehistoric burning had been used to maintain the prairies (thus could justify prescribed burns in the future). The Biological Division which appeared to not want to find burning and instead preserve the butterfly population. I gently manipulated their positions (well, yes, maybe I even lied a little) to set up an internal conflict. Such conflicts often do exist within agencies like the National Park Service, which are responsible for managing diverse natural, cultural, and land-use landscapes.

A couple of weeks before the scheduled field trip, I asked the class to commit to the project. An astonishing 37 of 38 students were ready to drive for 12 hours, likely into rainy conditions and hike 6 kilometers into the forest to dig 1-meter deep holes in the ground. I felt as if I had done too good of a job selling the project. How was I to manage this many students on the road, in the field, and in the campground? Careful planning of every detail of the entire trip seemed the only option to ensure success.

I provided the students with a tree's worth of handouts, including several relevant articles on soils research using similar methods, and a 7-page research proposal summarizing the project (which had been developed for the National Park Service permit), the problem statement, the hypotheses to be tested in the field, the soil forming environment, the methods to be used, what was expected to be found, and descriptions of the sampling sites, with a justification for each site (i.e. why sample here?). This quantity of background information served to ensure the students would be sufficiently prepared for the field experience by demonstrating the types of things we might see. Other handouts included a 5-page assignment detailing what they should bring and expect; the project objectives and hypotheses (again); a step-by-step field procedure to ensure all data were collected and the sites experienced little impact; a write-up procedure, including how

(Continued on next page)

to present data, what components were needed for the paper, when and how to share data with the rest of the class; and group assignments in the field. To ensure the camp ran smoothly, I assigned everyone a camp job (e.g. who cooks, cleans, etc.).

Each student was assigned to a work group and given specific tasks (e.g. collect data X). I believe that the group assignments were critical in the project's success. Each group consisted of three students. I cautiously made the group assignments using the following criteria: at least one exceptional student, no more than one unexceptional student, and background diversity. Background diversity includes gender, ethnicity, major, and friends (mostly evaluated by who sits next to who in classes); this was my attempt to compel students to work with someone they would not normally. By selecting the groups, this avoided a common pitfall of group projects where the exceptional (and unexceptional) students often congregate.

Most of these instructions were well beyond the level of anal-retentive, but it paid off after going over the procedure in class and in the field the morning of the fieldwork. This was the smoothest running field trip with which I have ever been associated. Everyone knew exactly what to do; we efficiently collected all our data and finished 1/2 day early. The students took a huge amount of pride in their projects; every report was fabulous. Several comments on the course evaluation indicated that this had been the highlight of their academic careers.

Project Findings (based on student reports)
Two soil transects of 6 sample sites each were sampled. Soil pits were excavated at each site using a pick and shovel to the depth of about 1.5 m. In the wetlands, a Livingston piston corer was used to recover samples at 3 sites. Soil and sediment properties were described and photo-logged on the pit wall or recovered core sample, and they were sampled using the standard nomenclature. The soils were classified following USDA specifications.

Glacial or glacio-fluvial sediments of mixed lithology underlie the entire study area. All thirteen sites have abundant charcoal particles within their profiles suggesting that fires were commonplace. The radiocarbon age of a charcoal sample within the soil profile suggests that a single fire occurred on the Prairie at 860±60 years BP (additional samples have been submitted to better define the fire history). Two significantly different soils were identified in the study area, a spodosol (forest soil) and a histosol (wetland soil). Each soil type has distinctive soil properties, particularly the horizonation, which allows interpretations to be made into the environmental history of the area. Histosols are accumulations of organic materials. Radiocarbon analysis of a piece of wood recovered from near the base of one histosol provides evidence for the timing of the formation of a wetland in the prairie at 2280±40 year BP.

Spodosols develop under forest cover with a distinctive O-E-Bhs-Bs-horizonation (see *Pacifica* insert). The O-horizon is the accumulation of leaf-litter. The bleached white E-horizon is formed by intense leeching from inputs of acidic conifer needles and high precipitation totals. Organic matter and iron are translocated and accumulate in the underlying Bhs-Bs-horizons that appear as bright red-to-orange colors. These B-horizons are often cemented, creating an impervious surface to root growth. The resulting shallow rooting habit of the trees influences forest structure when mature trees topple during wind storms before they become very old.

The spodosols found on the prairies undergoing tree invasion are slightly different than those in the forest, suggesting that the soils are undergoing a changeover to a new soil type in a process known as depodzolization. The O-horizons of the praries are thinner than the forested sites, indicative of organic matter removal by fire. The E-horizons of the praries appear to be melanizing (darkening due to organic matter accumulation) compared with forest E-horizons. This melanizaiton suggests that organic matter that was previously eluviated through the E-horizon when there had been a forest cover is now illuviated and deposited in the E-horizon, causing it to darken in color. The lack of acidic conifer needles from the forest cover is slowing the decomposition rate of organic matter, thus allowing its accumulation and a conversion from an E-horizon to an A-horizon. The subsurface Bhs- and Bs-horizons of the invaded-prairie soils are slightly less red in hue than the forested soils, indicating the removal of iron oxides from these horizons by leaching. Collectively these soil properties support the hypothesis of prehistoric burning of the forest to expand the prairie area.

Summary and Future Work
This project has continued. In addition to the soils work, ethnobotanical, historical, geological, and ecological methods have been employed to gain an understanding of the origin and history of these landscape features. The ethnobotany of the region is being evaluated by reassessing the archeological materials recovered from earlier excavations at the nearby village site. The majority of the materials recovered were marine in origin, thus the majority of the initial analysis was on fishing and marine hunting artifacts. Interviews with tribal elders and field assessments of plants, which might have been

Feature Article

gathered from the prairies by the prehistoric Makah, will allow a search of artifacts archived from the village excavation to be reexamined for materials which came from the prairies. Air and ground photographs and maps have been used to reconstruct historical vegetation changes. Significant changes have been documented, including a 46% decrease in prairie area between 1964 and 1998 due to the invasion of trees. There has been an unquantified change in prairie cover from grasses and sedges to woody shrubs. In order to quantify the rates of tree invasion and to develop a fire history, about 200 trees have been sampled for dendrochronolgic analysis. To develop a longer-term history of vegetation, three wetlands have been cored. Between 2-3 m of peat has been recovered over the top of late-Pleistocene glacial till. Stratigraphic analysis of sediments, pollen, and charcoal occurrence will reveal the late-Quaternary vegetation, climatic, geomorphic, human and fire history of the prairies.

1970

1998

Apathetic undergraduates can be engaged in fieldwork by using marketing tools, including repetitive advertising and exaggeration in courses. Once committed to participation in fieldwork, the experience can become influential in the student's academic career. To make a field experience momentous, one must put considerable effort into its organization. In the case of my soils course, the marketing resulted in a large turnout, and I was forced to become highly organized. The success has reverberated beyond the student's involvement in the course. This project spawned two undergraduate Senior Theses, student presentations at several meetings, and three Master's students are expanding the study. The general buzz of the project's excitement around the department the following year (largely promoted by the above students) was expressed in a very active Geography Club (sponsoring more field experiences) and a related rise in majors.

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Editor's Note: Andrew provided an extensive bibliography and additional photographs with this article. Since space is limited, these additional resources are available on-line at http://www.csustan.edu/geography/Pacifica.html. Please take a look. Also at this site, you may enjoy reading past issues of the *Pacifica* in PDF format (often with color images).

News and Notes

President's Message *(Continued from page 2)*

For a geographer, one of the intriguing things is the geography of its ephemeral occurrence. Our annual get-togethers are spun along an ever-evolving necklace of places. Future meeting sites are much debated and speculated upon. I attribute my own attachment to APCG in large measure to the importance the group accords to a sense of place. As a "regional" organization, ours cannot expect to out-compete national congresses for professional stature or symposiums convened on specialized topics of critical concern for the advancement of scientific progress. But as a truly regional organization of geographers, APCG does, better than any other meeting I've been privileged to attend, stir our locationally grounded souls. The meeting's highlight is quite frequently a very special fieldtrip--one led by a fellow geographer willing to share an intimate knowledge and acquaintance of the places being toured. A fieldtrip with a bunch of geographers is a wholly different way of experiencing a part of the world, quite distinct from a solitary explore or tourism undertaken with a partner or an organized group of tourists. There's a special augmented seeing that is made possible by sharing our mutual geographer's perspective (whatever the hell that may be these days!).

The sense of place engendered at an APCG conference also stems from our informal organizational structure--not to mention our intrinsic cheapness! Unlike a national conference held in a vast concrete and glass highrise hotel/conference center, our meeting is largely the sole baby of the local organizers. Our colleagues welcome us onto their campus and show us a good time while showing off their home town. It's kind of the ultimate houseparty… Man-oh-man, I bet our Portland friends were happy to see this year's guests finally go home!

Of course a special aspect of APCG is the Pacific region itself. Spectacular in natural wonders and great in length, there are a multitude of places worth exploring on a long-weekend trip. And, as once explained to me by my Arizona colleague and former APCG President, Lay Gibson, in the early years APCG developed strongly and independently of the AAG because the latter's 'national' meeting sites were usually several days of train-riding to the east. These days, though, hub airports clear across the continent are far closer to one another in time space than are many of our Pacific Coast college towns. The reduced friction of distance would seem to work against the ongoing vitality of regional organizations.

And business and professional fraternal organizations more generally have seen their memberships plummeting ever since our grandparents' day. Television watching, chat rooming, and the chauffering of kids around their overly-scheduled suburban activity spaces has largely replaced the time business people used to spend at the Rotary or the Elks Club. Why then do academics still seem to want to get together, regularly, and in the flesh? If you add in the obsessive amounts of time your average egghead spends e-mailing other eggheads, as a group we academics must devote more of our energies to networking than most any other profession.

I'm not sure I know I can articulate fully the appeal of our association. But I expect to see a lot of you when APCG comes together again next September. We will be in mid-coastal California, enjoying the hospitality of our friends at San Luis Obispo, renewing acquaintances, getting out and about, looking for gossamer.