



THE SCHOOL
FOR FIELD STUDIES

Directed Research

SFS 4910

Syllabus, Fall 2016

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Course Overview

The aim of this course is to provide students with the opportunity to apply the scientific process in a field research project addressing a local issue related to the environment. This course prepares students to distinguish hidden assumptions in scientific approaches and separate fact from interpretation, cause from correlation, and advocacy from objectivity. Through Directed Research students will contribute to a growing body of scientific research that informs local conservation, development and resource management decisions.

This course will give you an intensive practical field experience conducting research in tropical areas on a topic of immediate relevance to specific clients working in the context of tropical ecology, conservation biology, and political ecology of the Andes-Amazon region. Students will go through the steps of the research process: identification of relevant questions within the ecological and political/cultural context of the region; research design and proposal writing; field data collection; methods of qualitative and/or statistical data analyses; and presentation of results to the interested parties and the scientific community. To achieve this, students will integrate the information provided in the core courses of the SFS Program and will apply it to the problem at hand under the guidance of a faculty member. In their research projects, students will integrate concepts and methodologies learned in class, field lectures, and field exercises to deliver technical reports directly to a local audience. Each student in the Spring 2015 program will engage in one of the projects listed below.

Assessments: Grading Rubric

<i>Assignment Requirement</i>	<i>Marks Assigned</i>
Proposal: Literature review Methods Potential results (Tables/Figures) Budget and Timeline Literature cited	10% 5 2 1 1 1
Research Methods: Field Data Collection Submission of Data Reports Group Participation/Support	30% 20 8 2
Research Paper: Literature Review Methods Results Discussion and Conclusions Referencing	30% 5 5 9 9 2
Oral Presentation: Clarity of Presentation Visual Design Timing	25% 18 5 2
Contribution to Public Presentation:	5%

Assessment Descriptions

Research Methods

Your Directed Research Skills will be graded throughout the semester by your supervisor. Your final grade will depend upon your attendance at all DR activities, active involvement and competencies in field data collection, data entry, and group participation/support.

Literature Review / project proposal

The main objective of the *Literature Review* is that students familiarize themselves with previous research and publications in the area of their chosen Directed Research project. The literature review should draw upon a large literature base (where possible) – firstly to review the current status of research in the field, and then to build a background and justification for research that still remains to be done.

Research Paper

The most important deliverable of the Directed Research project will be a research report written in the form of a scientific manuscript. Research paper rubrics will be handed out separately by each professor.

Oral Presentation

An oral presentation with accompanying visuals will be delivered to an audience composed of all Center SFS staff and students. Presentations will be 12 minutes long and must include a stream of slides (e.g. in Microsoft Office PowerPoint) and a script, both to be handed in at the end of the presentation session. Emphasis will be made on setting the context (introduction) and in the results, implications, and conclusions. Font and colors should be selected in a way that enhances meaning and information, and attention should be paid to the visual design and composition of figures and images. The correspondence of visuals with the idea presented, plus the logical flow of ideas and sections within the presentation will be evaluated, as well as the selection of appropriate font sizes and figure colors.

Contribution to Public Presentation

SFS strives to produce information that local authorities and the public can use to manage their natural resources. Presenting research results in the local language to the public is therefore critical to SFS's mission. Every group of students working under a professor is expected to put together a public presentation based on their individual research results. The presentation has to communicate the significance, goals, and main findings of every group in a way that is accessible and inspiring to a general audience. Not all students have to present but all have to participate in the production of the public presentation and their individual contribution to the final result will be evaluated.

Grading Scheme

A	95.00 – 100.00%	B+	86.00 – 89.99%	C+	76.00 – 79.99%	D	60.00 – 69.00%
A-	90.00 – 94.99%	B	83.00 – 85.99%	C	73.00 – 75.99%	F	0.00 – 59.99%
		B-	80.00 – 82.99%	C-	70.00 – 72.99%		

General Reminders

Plagiarism - Using the ideas and material of others without giving due credit is cheating and will not be tolerated. A grade of zero will be assigned if anyone is caught cheating or aiding another person to cheat

actively or passively (e.g., allowing someone to look at your exam). All assignments unless specifically stated should be individual pieces of work.

Deadlines

Deadlines for written and oral assignments are instated for several reasons: They are a part of working life to which students need to become accustomed and promote equity among students, and deadlines allow faculty time to review and return assignments before others are due.

Assignments will be handed back to students after a one-week grading period. Late assignments will incur a 10% penalty for each day that they are late. No assignment will be accepted after three days.

Participation

Since we offer a program that is likely more intensive than you might be used to at your home institution, missing even one activity can have a proportionally greater effect on your final grade simply because there is little room to make up for lost time. Participation in all components of the program is mandatory because your actions can significantly affect the experience you and your classmates have while at SFS. Therefore, it is important that you are prompt for all land and water based activities, bring the necessary equipment for field exercises and directed research, and simply get involved.

Course contents: classroom component

The coursework component of the DR is designed to prepare the students to conduct scientific research. The lectures are delivered throughout the semester, in conjunction with the topical courses, so that students are well prepared to work with their faculty mentor on meaningful research.

<i>Code (Type)</i>	<i>Hrs</i>	<i>Lecture Title and Description</i>		<i>Readings</i>
DR1	1	Introduction to DR Course objectives, design, pace, selection of topics, evaluation, professors' interests.	AT, WH, KM	
DR2	1	Science Truth, reality, knowledge, pattern, process, evidence, observation, and experimentation. The goals, methods, and power of science.	AT, WH, KM	Optional: Sagan, 1995. Demon Hunted World
DR3	2	Qualitative methods: In this class we will introduce the use and practice of qualitative methods in social research	KM	
DR4	1	Research ethics: In the first third of this class, we will explore the parallel issues of voice, representation, and power in the practice of qualitative research. Next, we will discuss what constitutes plagiarism and data integrity, and finally we will survey opinions on the humane treatment of fellow species.	KM, WH, AT	Garcia-Yi and Grote, 2012. plagiarism.org http://iacuc.yale.edu/
DR5	2	Reality or delusion: statistics as the quantitative tool to find truth	AT, WH	

<i>Code (Type)</i>	<i>Hrs</i>	<i>Lecture Title and Description</i>		<i>Readings</i>
DR6	1	Storytelling How to make (almost) anyone interested in what you have to say.	AT, KM, WH	Optional: Olson, R. 2009
DR7	1	Directed research topics for Fall 2015	AT, KM, WH	
DR8	1	Publish or perish Writing and publishing scientific papers	AT, KM, WH	
DR9	2	DR team meetings	AT, KM, WH	
	12	TOTAL CONTACT HOURS		

DR Research Component:

The rest of the DR course is made up of research time, which includes: data collection; synthesis; and dissemination.

<i>Research Component Activity</i>	<i>Days Allocated</i>
Data Collection Students work within their DR group to go into the field to collect data	10 – 15 days
Data Synthesis Students work closely with their faculty mentors to analyze their collected data and write up their findings in a structured scientific paper	3 – 5 days
Research Dissemination Students prepare, practice, and then deliver presentations for both internal SFS and community audiences.	2 – 4 days

Course Readings:

Garcia-Yi, J. and U. Grote. (2012). Data Collection: Experiences and Lessons Learned By Asking Sensitive Questions in a Remote Coca Growing Region in Peru. *Survey Methodology*, 38(2): 131-141.
 Olson, R. (2009). Don't be such a scientist. Island Press.
 Sagan, C. (1994). Demon hunted World: Science as a candle in the dark. Random House.

Schedule

<i>Activity</i>	<i>Dates</i>
DR proposal due	Monday October 24 th
Data collection	Monday, October 31 st ; Tuesday, November 8 th – Tuesday November 29 th
Data analysis and writing	Wednesday, November 23 rd – Tuesday,

Activity	Dates
	November 29 th
Presentation preparation	Tuesday, November 29 th
In-house presentations	Wednesday, November 30 th
Paper Due	Wednesday, November 30 th
Town presentation	Friday, December 2 nd
Presentation in Cusco	Tuesday, December 6 th

Course contents: research component

Conservation Science Directed Research (Will Helenbrook, Ph.D.)

Night monkeys (*Aotus* spp.) - also known as owl monkeys - are the only true nocturnal monkey species. They are of scientific interest for several reasons. Firstly, though they are listed as Least Concern by the IUCN Red List of Threatened Species, they are likely still impacted by anthropogenic disturbance throughout their range. Since they are nocturnal though, researchers traditionally have avoided studying them due to the logistical difficulty of working at night. Thus, information on *Aotus* behavior, ranging patterns, habitat, ecology, and conservation status is generally limited. For example, *Aotus nigriceps* is found throughout Peru, Brazil, and Bolivia and yet has only been studied in the wild as part of overall *Aotus taxonomy* studies. A second reason that night monkeys are of scientific interest is because of their susceptibility to human malaria, *Plasmodium falciparum*. For this reason in particular, they are often used as laboratory models for experimentation purposes. This also explains why much of what is known about this genus is largely limited to studies in captivity. Thirdly, night monkey species are unique in several different ways, most notably because they are the only nocturnal monkey. This behavioral attribute allows researchers to test different hypotheses related to the evolutionary function of an active night life. Lastly, because there are 10 different species occupying varying types of habitat, with different size groups, and even behaviors (i.e., *Aotus azarae azarae* is cathemeral), there is the ability to test hypotheses related to topics such as behavior, ecology, and density across species. Specific to Villa Carmen and the Kosnipata region, *Aotus nigriceps* also makes a compelling model organism for the reasons previously stated, but also because of accessibility and benefits to tourism through further understanding of this unstudied species.

Students involved with Conservation Science Directed Research will be each be involved with one of the following research objectives:

1. Examine gastrointestinal parasites and composition in relation to geographic distribution of hosts
2. Diet analysis and impact of digestion on seed germination success
3. Assessment of vocal diversity and response to predator calls

Tropical Ecology Directed Research (Adrian Tejedor, Ph.D.)

Mitigating Global and Local Threats to Ethnobotanical Resources in the Andes-Amazon: Tree Ferns as Model Organisms

Phase 2: Investigating use and climate change threats

Semester 5: Effects of elevation on sporophyte recruitment and abundance and efficacy of medicinal treatment

Introduction

Among the thousands of valuable plants of the Peruvian Andes and Amazon, tree ferns stand out as some of the most heavily used but, ironically, least understood species. Tree fern resin is a common topic and sometimes oral treatment offered or recommended to treat cuts and contusions in rural areas of the Amazon-Andes region of Peru. In spite of its prevalence, no scholarly studies to date have investigated in depth any aspect of this practice, including the medical, economical, and ecological. Focusing the efforts of SFS-Peru students on elucidating the ecology of tree ferns along the altitudinal gradient of Manu, will provide critical information about the capacity of these plants to withstand current use and the basis for better informed harvest practices and potential commercialization.

When damaged, tree ferns profusely secrete a mucilage that covers exposed conductive tissue of fronds and trunks. This secretion presumably functions as a physical and perhaps chemical barrier to viral, fungal and/or bacterial infections, while the plant permanently seals its wounds through tissue regrowth or constriction. Mucilage plugs are produced immediately and, in spite of their gelatinous texture, resist being washed away by the abundant downpours of the Andean cloud forest and adjacent Amazonian lowlands. Given these properties, which hold even when applied to human wounds, and the ubiquity of tree ferns in areas of permanent high humidity along the east slope of the Andes, tree fern mucilage is a widespread first line treatment in this region. For almost every human cut and contusion, common minor injuries during regular field labor, and individual tree fern is cut down to provide this natural sealant.

The simplicity of tree fern mucilage use disregards two inherent dangers to the sustainability of this practice: 1) most tree ferns cannot regrow and die after their trunks are cut, so almost every single treatment eliminates one individual tree fern; and 2) under continued climate change, the resiliency of tree fern populations will be challenged by both the destructive harvest and the displacement of their climatic optima.

Tree ferns constitute an ancient plant group that has retained the arborescent habit for over 200 million years, and thus represent an evolutionary and ecological relic of the earliest angiosperm forests. In spite of their antiquity, tree ferns have mostly conserved their ancient narrow ecological niche, being restricted to areas of high rainfall, warm to cool temperatures, and little annual variation in both temperature and rainfall. For this reason, they only occur in moist to wet tropical forest, and attain their highest diversity at mid elevations on wet tropical mountains. Manu National Park harbors at least 40 species, of which 18 are present in Villa Carmen, and 15 at Wayqecha. About half the species at Villa Carmen and Wayqecha have elevation ranges spanning less than 500 m, which makes them very vulnerable to the stress of range shifts and contraction associated with climate change.

The overarching goal of this project is to understand tree fern ecology and responses to climate change, harvest, and cultivation, so that this knowledge can be applied in the management of their populations, the conservation of tree ferns, and, potentially, in the sustainable commercialization of their medicinal products. The first phase of the project will be focused on determining the ecological factors that limit tree fern growth and distribution in nature, both across climatic and edaphic gradients. Successive phases will aim to propose best tree fern use practices, including identifying the most productive and resilient species, the best methods of resin extraction, and the best conditions for successful cultivation, harvest and commercialization. Ultimately, this project will contribute to the livelihood of the people of the Andes-Amazon and to the conservation of biological diversity of the Andean biodiversity hotspot.

In the Fall Semester of 2016, students in the School for Field Studies-Peru program will have the opportunity to engage in three areas of the second phase of this project:

1. Assessing conservation risks to tree ferns on the basis of population size
2. Testing for evidence of global warming-induced altitudinal displacement of tree fern species
3. Testing antimicrobial effects of traditional tree fern-based medicinal treatment in the Peruvian Andes

Each student will focus on one of these three areas, following general and specific objectives.

Learning Objectives

In this Directed Research students will learn to perform field and laboratories studies of tropical vegetation that are used to understand plant physiology, sustainable use of plant resources and predict responses to ecosystem changes. Specific learning objectives are the following

1. Establish transects along an altitudinal gradient to study plant population dynamics
2. Use surveying equipment to measure vegetation parameters
3. Design and perform experiments of antimicrobial activity of plant extracts
4. Employ analytical tools—both graphic and statistic—that are used in the study of physiology and ecology

Political Ecology of Developing Landscapes Directed Research (Katie MacDonald, Ph.D.)

“Nos Estamos Contaminando”: Exploring the Impacts of Water Contamination through Fish Consumption in Pilcopata, Peru.

Introduction

The first phase of *Political Ecology Directed Research* (September 2015 – May 2016) was designed to provide interested students with the opportunity to apply the principles of Indigenist Methodologies and Participatory Action Research (PAR) in the co-creation and co-development of a research project by collaborating with local and/or Indigenous communities. Through the application of these principles in a research environment, students were expected to work with community members of Pilcopata to determine the most pressing social, economic, political, and/or environmental concerns facing their communities.

Seven projects were completed in collaboration with seven sub-communities of Pilcopata, including Agriculturalists, Maternal and Child Health Care Workers, Adult Students, *Asociación para la Conservación de la Cuenca Amazónica* (ACCA) Employees, Teachers, Huacaria Community Members, and Queros Community Members. Results indicated that while particular daily life challenges varied between the different sub-communities (see Figure 1), in contrast, the seven sub-communities collectively identified substance abuse as the most significant social concern facing Pilcopata, and water

contamination and waste management as the most significant environmental concerns facing Pilcopata (see Figures 2 and 3).

Sub-Community of Pilcopata	Daily Life Challenges
Agriculturalists	Crop disease
Adult Students	Low income living
Maternal and Child Health Care Workers	Inadequate clinic staff Lack of required clinic materials
ACCA Employees	Transportation/roads
Teachers	Lack of parental support
Huacaria Community Members	Poor work conditions
Queros Community Members	Work-family balance

Figure 1: A summary of the challenges faced in the daily lives of the seven sub-communities of Pilcopata.

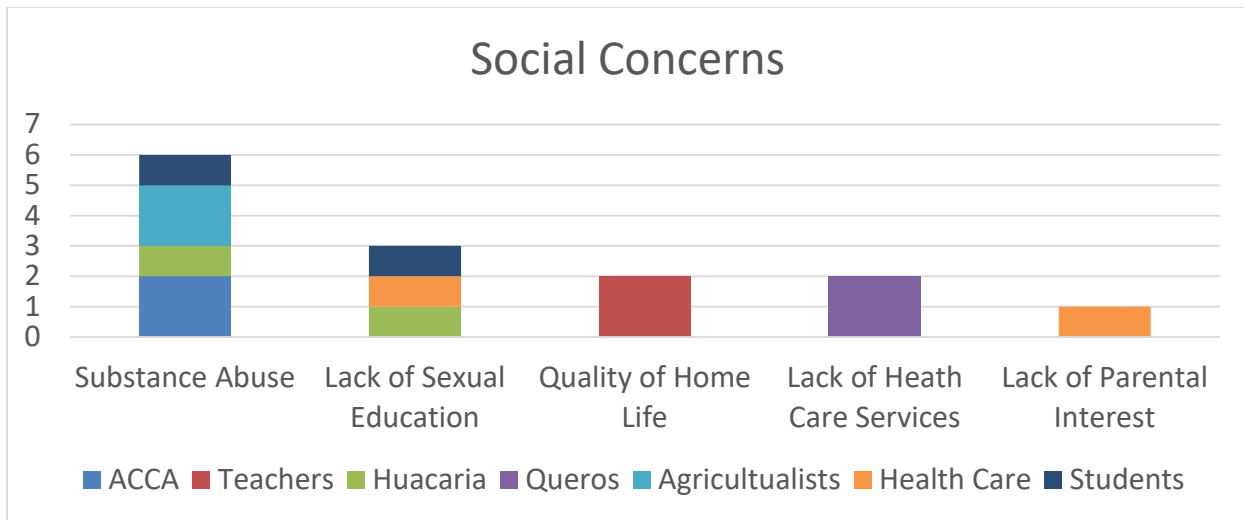


Figure 2: A summary of the most important environmental concerns facing Pilcopata.

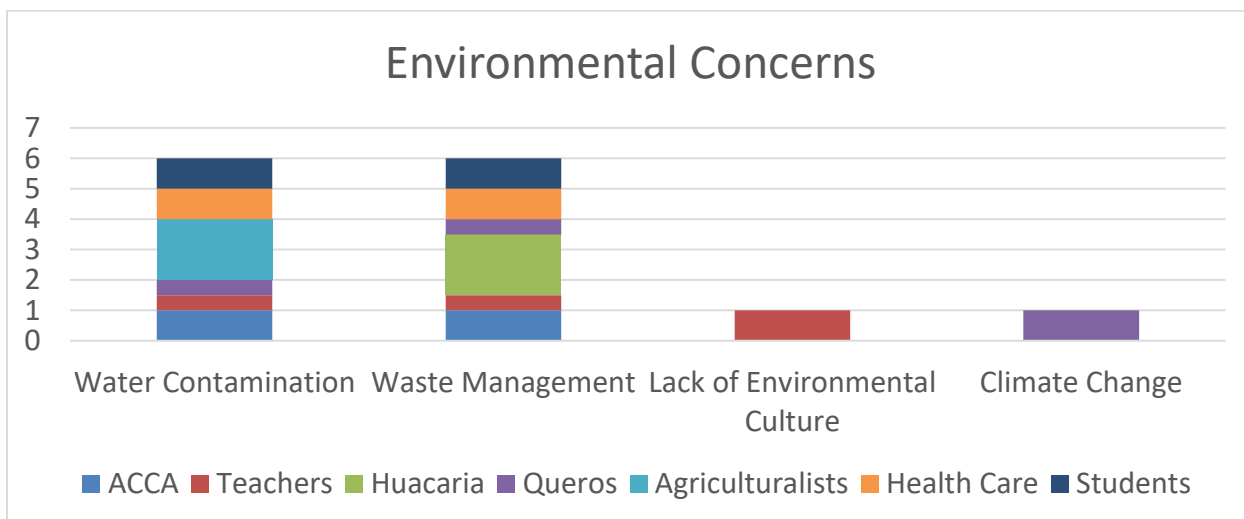


Figure 3: A summary of the most important environmental concerns facing Pilcopata.

Potential future education projects that would be of use to the community in their social, economic, or political development, including the potential roles of the School for Field Studies (SFS) and/or *Asociación para la Conservación de la Cuenca Amazónica* (ACCA) in assisting with these development projects, emerged from this research. Suggestions included the potential for evening activities, such as reading groups, film screenings, cultural dances, theatre of the oppressed, training sessions, or environmental incentive programs, and the development of a library, which in addition to providing educational opportunities for the youth of Pilcopata would also have the beneficial side-effect of engaging community members in organized recreational activities in an alcohol and drug free environment.

Equally importantly, this initial research phase identified key areas for future political ecology research, including exploring the community-identified environmental concerns of water contamination and waste management. Fall 2016 semester political ecology directed research students will begin by investigating the priority concern of water contamination.

Projects for Fall 2016

As noted above, water contamination was highlighted through previous political ecology directed research as of particular concern to Pilcopata residents (Figure 3). Community members suggested potential water quality issues may include:

- chemical pesticide runoff;
- sewage contamination;
- farm runoff (including concerns with animal waste);
- landfill runoff (including potential leakage from improperly disposed batteries);
- road runoff (ie: contamination from poorly maintained vehicles); and
- potential contamination from fish farming activities.

In order to determine the potential impact of water contamination on human populations from a political ecology perspective, this phase of student-generated directed research will target potential harm due to water quality issues as measured through fish consumption.

This semester, students will have the opportunity to engage in three areas to explore fish consumption as a possible avenue of potential harm from water quality issues:

1. Household Survey of Fish Consumption
2. Survey of Fishing Activities
3. Aquaculturalist Survey