



THE SCHOOL
FOR FIELD STUDIES

Applied Research Techniques and Strategies Towards Sustainability in Costa Rica SFS 4930

Syllabus, Summer Session II

Dr. Achim Häger
M.S. Emily Blau
Dr. Edgardo Arévalo
Dr. Gerardo Avalos

Office hours by appointment

The School for Field Studies (SFS)
Center for Sustainable Development Studies (CSDS)
Atenas, Costa Rica

This syllabus may develop or change over time based on local conditions, learning opportunities, and faculty expertise. Course content may vary from semester to semester.



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 environment and development in Costa Rica. Specifically, we will analyze the management of tourism impacts on conservation, as well as on the sustainability of the human communities and ecosystems it is supposed to support. In addition we will analyze the relationships between conservation, land-use change, biological diversity and climate change mitigation and adaptation. This course prepares students to develop scientific approaches to identify key issues related to tourism management, and use this context to illustrate the conservation and sustainable development problems tackled in Costa Rica as well as in other tropical countries. The research topics are derived from the SFS Center's Five Year Research Plan (5YRP) as defined by the Center staff and our clients. Through this course students will progressively learn to implement the scientific research process while contributing to solve a real case of conservation and resource management involving the management of tourism impacts in the Tropics.

All students will engage in all the steps of the research process on problems identified by our professors and by our clients, who have requested scientific support from CSDS. Research teams will engage together in field data collection, and each student will analyze a subset of the group data and base their paper and oral presentation on their specific topic. Whenever possible, results will be presented to our clients in formats (oral presentations or written reports) that will facilitate the application of our results to their decision-making process. To achieve this, students will put together the knowledge acquired through hands-on field practices with the information provided in the course and will apply it to the problem at hand under the guidance of a faculty member. Issues to be examined include (but are not limited to): visitation management in National Parks, the social and economic impacts of ecotourism on local communities, impacts of visitation on the ecology of flora and fauna species such as providing food to attract the fauna, extraction of non-timber forest products, as well as economic dependence on servicing visitors. In the research projects students will incorporate concepts and methodologies learned in class, field lectures and field exercises. Technical reports produced by faculty based on student work will be delivered directly to our stakeholders. Each student in this summer program will engage in projects centering on one of the following research components:

ESTABLISHMENT OF PERMANENT PLOTS FOR MONITORING CARBON SEQUESTRATION AND TREE DIVERSITY (ACHIM HÄGER)

At a global scale, tropical forests have a disproportionate importance for biological diversity and carbon cycling, although large uncertainties remain about aboveground and belowground carbon fluxes in these ecosystems. Tree diversity and composition are linked to ecosystem functioning, for instance in the case of carbon storage and sequestration in tropical forests. The effects of global change on forest dynamics, species shifts and carbon fluxes can only be understood by repeated measurements of relatively large, permanent plots. During this research component, we are planning to establish a 1-ha plot in a tropical moist forest, where we are going to tag, measure and identify all trees with a diameter of ≥ 10 cm, in order to continuously monitor forest dynamics, as well as carbon sequestration in the future. This new permanent plot will be part of a small network of plots that SFS is maintaining in collaboration with the Universidad Técnica Nacional (UTN) in Atenas. This research collaboration will allow us to generate data that can be used for informing local government actors, as well as to contribute to our understanding to the role that tropical dry and moist forests play within the national strategy for climate change mitigation and for tree species conservation.

SOCIO-ECONOMIC IMPACTS OF POÁS VOLCANO NATIONAL PARK CLOSURE AND COPING STRATEGIES OF NEIGHBORING COMMUNITIES (MA EMILY BLAU)

Poás Volcano National Park is one of most visited parks in Costa Rica, due to its proximity to San José and its magnificent natural attractions. The park closed in April 2017 due to extreme volcanic activity, and has unfortunately remained closed for over a year. The communities that depended on tourism were suddenly experiencing a major decline in visitation. It is said that the park will be re-opened June 2018 but with extremely regulated visits for safety reasons. Because of the park closure, as well as fear of increased volcanic activity, tourism has drastically reduced in the area surrounding the volcano. In February 2018, 10 months after the closure, the National Emergency Commission (CNE) gave the park permission to start the reopening process, as long as safety requirements were met, including shelter and protection, reconstructed trails and the regulated visitation plan. For this study, we will be analyzing the impact of the park closure on local tourism businesses and the overall local community. We will interview and survey residents and evaluate their coping strategies and assess if service diversification is possible. One of the most relevant aspects of this study is to evaluate the direct benefits that national parks provide to local communities.

BIODIVERSITY ASSESSMENT AND MONITORING IN CHANGING LANDSCAPES SUBJECT TO HUMAN DEVELOPMENT AND CLIMATE CHANGE (DR. EDGARDO AREVALO)

Human development often involves the reduction of habitats, an increase in fragmentation, and the reduction of habitat connectivity; affecting animal movements during their natural dispersal processes. In addition, such human-made alterations may induce changes in species composition and species geographic distributions. Since landscape modifications take place at different spatial and temporal scales, local and regional factors may act synergistically, causing negative effects on biodiversity. In Costa Rica, human development and the concomitant expansion of roads are directly and indirectly affecting 70 protected areas of the 170 extant in the country. Parallel to this infrastructure development, increasing climate anomalies may further exacerbate habitat alterations and biodiversity loss. This project aims to generate baseline information on the abundance, distribution and species diversity found in areas close to active human development to investigate potential long-term effects on biodiversity.

Learning Objectives

The core skills students will learn in this course are field data collection techniques, analytical methods, communication skills and critical thinking, as well as team work and time management. The added benefit is the context of a real-life conservation and management case. The specific objectives of the course are the following:

1. Become familiar with local environmental issues
2. Understand the process of designing a field research project
3. Conduct field data collection
4. Manage, interpret and analyze data sets
5. Communicate research results to diverse audiences

To achieve these objectives, the specific tools used in this course include field trips, classes, workshops and exercises on experimental design, field techniques, basic descriptive statistics and parametric and

non-parametric quantitative analyses. Succinct scientific writing, graphic and tabular presentation of results and effective delivery of oral presentations will be emphasized.

Assessment

We expect active participation in all aspects of the course, from the discussion and analysis of the assigned readings to the review of literature, classes and field work. Approximately half of the course experience is a group effort; the other half represents your individual work. In the first two weeks of the course the students will engage in short field exercises to gain practical skills in data collection, processing and analysis. In the remaining two weeks you will be part of a field research team that will develop the specific research topic mentioned above. While all members of each team work together to collect data in the field, each student will identify and address a distinct question within the overall project and will be responsible for data analysis, interpretation and communication of the obtained results. Each student's topic will address the overall objectives of the research problem at hand, and can make use of the current data, previous research if available, or a combination of the two. The aim is to give you enough room to develop your own creativity within the context of the selected research component. All student topics, although individual, must be related to the general questions and objectives, which are part of proposed research problem and the overall Center's 5YRP and our commitment to collaborate with our clients.

Student performance in the summer course will be evaluated based on the assessment items and their proportional weight to your final grade described below. Each assessment item will be evaluated on an individual student basis.

Assessment Item	Value (%)
Field Exercises	15
Statistics homework	5
Literature Review	5
Research Report	35
Revised Research report	10
Oral Presentation	10
Data Management	5
Participation	5
Written Exam	10
TOTAL	100

Field exercises (15%): Students will conduct three field exercises, each one implemented during a given field trip in the first two weeks of the program or in the vicinity of Atenas. These exercises will introduce students to field techniques and will foster the development of skills required for the research component. The data generated by the field exercises will be used opportunistically to illustrate examples of applied data analyses in the statistics classes. During this session we will conduct the following three field exercises:

FEX 1: Tourists' sustainable engagement and practices, Monteverde (Emily). In this FEX we will examine tourists' awareness, interest and participation in sustainable practices through survey sampling. Monteverde attracts many "ecotourists" interested in nature-based activities. We will gather quantitative data to determine if these travelers actively seek out sustainable tourism options, and if so, whether demographic factors such as age or nationality impact responsible tourism decision making. .

FEX 2: Tree diversity in the oak forest of Cerro de La Muerte (Achim).

Tropical montane forests represent important centers of biological diversity. Although tree diversity decreases at high elevations, the share of endemic species increases. Consequently, tropical montane forests are ecosystems with a unique structure and composition. Due to Costa Rica's function as a land bridge we find taxa from the Northern hemisphere (such as oaks) and from the South (e.g. *Podocarpus*) at high elevations. During this field exercise we will establish a 50 m transect through a high elevation forest, which is situated near the tree line on Cerro de La Muerte. On this transect, we are going to analyze tree species composition and forest structure. This information will help us to understand ecological processes, such as cycling of nutrients and carbon.

FEX 3: Hypothesis testing (Edgardo) Science is based on intuition, logic and reason. The scientific method begins with an observation; we seek for patterns and then formulate hypotheses that could explain those patterns. We can also use experiments to test hypotheses. Finally, we conclude on the results thus contributing to a broader theory. Our objective is to develop observation skills in the field and to learn and apply the process of the scientific method. Students will be provided with theory and guided in the process of observation, hypothesis formulation, data collection, data analysis and writing. The core of this FEX is scientific inquiry.

Statistics homework (5%): professors will provide an introduction to the most common methods of statistical analysis within the context of the FEX and/or the independent research. A statistical exercise will follow based on these classes.

Literature review (5%): this assignment requires that each student will explore peer-reviewed journal articles relevant to the topic under investigation (each article chosen has to be different from those of other group members). Each student will present a brief report that includes the following elements for each article reviewed: a) Citation in the same format as it should be cited in the reference section of the research report; b) Five key words; c) A brief explanation of why the article was selected; d) A brief summary of the paper other than the abstract (approximately 200 words). In addition, each student will submit the original article as a PDF document.

Research report (35%): This is one of the main products of this course. The report is written individually and following specific guidelines for scientific writing. All details are specified in the document entitled: "Directions for writing scientific reports".

Revised research report (10%): reports are returned to students after they have been graded by faculty. Each student is to look at all the comments provided and make the changes requested in order to obtain all the points. Editing and revising submitted papers is a relevant part of the scientific process, which is fundamental to validate scientific research.

Oral presentation (10%): an important component of the scientific process involves the communication and dissemination of information. Although writing documents is the norm in many disciplines, scientific meetings of all kinds are widely used to disseminate information to colleagues and other stakeholders. Therefore, each student will make a slide show and present the research project individually.

Data management (5%): Each individual student is responsible for handling and organizing the collected data. Data should be saved in excel files with their corresponding appropriate labels along with all the analysis and graphs produced.

Participation (5%): With regards to participation, everybody should be prepared for each session. This implies reading the materials for each session with enough detail to be able to ask relevant questions; and to contribute to in-depth discussions about the key issues. This aspect will consider your contribution to the analyses, not simply the amount of time you talk. However, without being an active participant in discussions, it is difficult to make contributions to the discussion. Thus, quality and quantity of comments are important elements of participation.

Written exam (10%): at the end of the course, a written examination will evaluate all the material presented and discussed during this course.

Grade corrections for any of the above items should be requested in writing at least 24 hours after assignments are returned. No corrections will be considered afterwards.

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 either actively or passively (e.g., allowing someone to look at your exam). Cheating and plagiarism in any form or manifestation will not be tolerated and will carry severe consequences that range from a grade of 0 in the material to a request by the professor to the CD of expulsion from the program.

Readings. The readings will be provided to students during the course, depending on your interests and the particular needs of the project. Each lecture and exercise is listed in this syllabus, and readings may be assigned prior to the lecture. Most of the readings are in PDF format in the student drive on the server to help save printing paper and reduce waste.

Deadlines for assignments are established to promote equity among students, to allow faculty enough time to review and return comments and grades before other assignments are due and to avoid clashes with other activities and courses. Therefore, deadlines are firm and extensions will only be considered under extreme circumstances. When appropriate, the files should be placed in the assigned folder within the students drive on the server. Late assignments will incur a 10% penalty for each day that they are late. Papers submitted after 3 days of the deadline will not be accepted. Please plan ahead to avoid such situations.

It is the responsibility of the faculty to articulate how grades are determined. It is the responsibility of students to consider these explanations and, if there is a lack of clarity, to request clarification immediately. Students who feel that any grading basis or grades are unfair should explain their concerns directly to the relevant faculty in writing using the “Grade Change Petition Form”. Their written explanation on the “Grade Change Petition Form” must include both their reasons for believing the unfairness exists and their requests for specific changes. Faculty members have the obligation to respond fully, clearly, and promptly.

Course Content

Activities: L = lecture, FL = field lecture, Lab = classroom lab, D = discussion

Faculty: EA = Edgardo Arévalo, EB = Emily Blau, AH = Achim Häger, SAM = Student Affairs Manager, CD = Center Director

No.	Lecture Title	Type	Faculty	Time (Hours)
WEEK 1				
01	Certification Rainforest Alliance. We will explain the process of the certification by RFA and present latest updates.	L	AH	1
02	Introduction to sustainability contract. The SAM will explain the protocol to understand the sustainability contract.	D	SAM	0.5
03	Ecological diversity of CR. The origin of Costa Rican diversity, distribution and conservation challenges will be analyzed in this lecture.	L	EA	1
04	Risk Management. The most common sources of risks while doing field research within the context of Costa Rica will be discussed and analyzed during this lecture.	L	SAM	0.5
05	General Orientation and introduction to the program. The Five Year Research Plan (5YRP), as well as the impact of research of CSDS at the local and national level, is presented. It is explained how research combines with the rest of the academic and social outreach activities of CSDS in Costa Rica.	L	CD	0.5
06	Introduction to Scientific Methods. Students will learn different methods to carry out scientific research by identifying relevant questions and designing testable hypotheses. Alternative methods of scientific inquiry are discussed (i.e., deductive, inductive, hypothetical-deductive, etc.).	L	EA	1
07	The Costa Rican Conservation System. This class will cover socio-economic drivers of deforestation in CR and the history of the national system of protected areas.	L	AH	1
08	Socio-economic overview of CR. This lecture will discuss the current status and challenges of the Costa Rican	L	EB	1

	economy			
09	Briefing Field Trip Monteverde	L	EB	0.5
10	Field Orientation sustainable tourism LIFE Monteverde		ALL	2
11	Field Orientation Monteverde Cloud Forest		ALL	2
12	FEX #1: Tourists' sustainable engagement and practices		EB	2.5
13	Stats 1 Data management/analysis workshop. Students will learn how to organize and manage large data sets; get acquainted with measures of location and dispersion and with presenting information in graphs with EXCEL examples.	L/Lab	AH	3
14	How to write scientific reports. Students will learn the basic format of the research paper used at CSDS. In addition, the structure of the presentation of scientific information is discussed and explained.	L	EB	1
15	FEX #1: Data analysis	Lab	EB	4
WEEK 2				
16	Research Agenda presentation and group division. Faculty and students will review the research agenda overall goals, as well as the projects proposed by the faculty for the current program and explain the logistics of field conditions.		All	1
17	Meeting with advisors. Instructions for research assignments, schedules, deadlines, and literature review.	L	ALL	0.5
18	Ethical Research Practices. Faculty and students will discuss problems associated to ethical issues in research, such as data manipulation, pattern recognition, plagiarism, animal rights, and related questions.	D	ALL	1
19	Demands of Sustainable Tourism vs. Tourist's Demands: The challenges of selling tourism while remaining "Essential" Costa Rica. Analysis of the role of tourism in Costa Rica's development. Although tourism has played a key role in conservation, continued tourism expansion is having an overall detrimental impact on natural resources.	L	EB	1
20	Stats 2 Data management and analysis workshop. Basic concepts, such as different categories of data, statistical distributions and parametric vs. non-parametric tests are going to be introduced. More specific examples for statistical methods are covered using practical examples from the research proposed by your professors.	L/Lab	ALL	3.5
21	Briefing Field Cerro de La Muerte	L	AH	0.5
22	The role of land use and ecosystem services in climate change adaptation and mitigation in the tropics Identification of specific regional strategies through land management and agroforestry	L / D	AH	1
23	FEX#2 Briefing	L	AH	0.5

24	FEX #2: FEX 2: Tree diversity in the oak forest of Cerro de La Muerte	Lab	AH	3
25	FEX #2: Analysis and writing	Lab	AH	3.5
26	Briefing FEX #3	L	EA	0.5
27	FEX #3: Hypothesis testing.	Lab	EA	2.5
28	FEX #3: Analysis and writing	Lab	EA	2
WEEK 3				
29	Data collection. Students will spend up to 5 days of continuous data collection in the field.		ALL	9
WEEK 4				
30	Effective communication skills. Techniques to deliver oral presentations will be discussed in this class	L	EB	1
31	Data analysis, Writing, Presentation Preparation (Individual). Faculty and students will meet frequently during this period to analyze and discuss the results of the research project, and the individual topics of each student.	Lab	ALL	4
32	Reviews for the Written Exam	L	ALL	2
33	In-house Presentations (Individual). Students will present the results of their individual research topics to the whole class in a symposium-like format.	P	ALL	4
34	Final paper corrections. Students and faculty will finish the last corrections to the research papers and reports to the clients.		ALL	1
35	Exam			1
Total Research Contact Hours				63.5