



THE SCHOOL
FOR FIELD STUDIES

Directed Research SFS 4910

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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 Directed Research is to provide students the opportunity to apply ecological, biological, and/or social-scientific methods to field research projects that address local environmental issues. This course prepares students to experience the research process, and distinguish hidden assumptions in scientific approaches. We will also investigate the ways that various methods and theories differentiate (or do not) fact from interpretation, cause from correlation, and advocacy from objectivity. Through the Directed Research projects, students will contribute to a growing body of scientific research that informs local and national conservation and resource management decisions.

Each student will join a faculty-led team that will carry out field research, data analysis, and communication of results in one or across several of the following disciplines: ecology, natural resource management, and human geography. The Directed Research course is designed to build on the information students have learned in the topical courses, as well as Directed Research lectures and workshops specifically designed to assist students in understanding the scientific process, hypothesis testing, and results presentation in written and spoken formats (see below for these courses).

Center Research Direction

SFS Bhutan is operated in partnership with the Ugyen Wangchuck Institute for Conservation and Environmental Research (UWICER) and the Bhutan Ecological Society (BES). The research efforts of the SFS Bhutan Center aim to contribute to the mission and goals of both UWICER and BES. The research focus of UWICER seeks “...to understand and uncover the ecological, socio-economic and policy dimensions of biophysical systems and their impact on human ecology” focusing on the key areas of sustainable forestry, conservation biology, water resources and socio-economics. BES research is aimed at understanding the interplay between development and environment and pays particular attention to issues such as demographic changes, climate change, energy, food, water, forests and urban landscapes.

Directed Research Topics

Please be aware that the following DR topics are from the previous semester and may change in future terms based on local conditions, research permits, learning opportunities, and faculty expertise.

Directed research topics: For Fall 2018, SFS Bhutan will engage in the following Directed Research projects:

1. **Ridgelines to Riverscapes - Connecting Ecological and Cultural Landscapes in Paro Valley**

Principal Investigator: Jesse Lewis

Ecological Status of Pa Chhu Riparian Ecosystems

The Pa Chhu is a dominant feature of the Paro Valley, providing natural beauty and a critical water source for drinking, rice irrigation and habitat for birds, macroinvertebrates and a diverse riparian plant community. Running through an agriculturally active and growing urban valley, the river receives inputs from upstream, as glacier melt and from adjacent human land uses. As residents of the Paro Valley

increase their consumption of modern packaged goods, the river is increasingly seen as a place to deposit trash, including long-lived plastic bottles and packaging, to wash vehicles and as a source of water and shade for roaming cattle and dogs and associated impacts. The Pa Chhu is also impacted by sand extraction to support a local housing and infrastructure boom.

This dynamic riverscape provides an amazing opportunity to initiate Directed Research that allows students to apply their growing knowledge of field ecology methods to gain baseline data of the Pa Chhu and neighboring tributaries. By sampling sensitive indicator species of the river food web, such as algal presence, macro-invertebrates and birds, as well as mapping inputs, measuring water depths and changes in flow, students will work in small teams to create baseline datasets and a visual map of the Pa Chhu along its sinuous path through the Paro Valley. Students also have the opportunity to examine the community ecology of the river system by surveying macro-invertebrate abundance and diversity across habitats and between sites of greater or lesser development. Furthermore, as bird species are highly mobile, it is also feasible to compare bird use in the riparian areas with the adjacent agricultural and cultural landscapes through paired surveys within 2 km of the river channel and at the river edge. Having collected baseline data for two terms on the Paro Chuu it is hoped that this term we may also expand our directed research focus to other tributaries in the Paro Valley - class I and II feeder streams - to compare water quality and macroinvertebrate communities between stream/river orders. Additionally, it would be possible to sample adjacent river systems such as Haa and Thimphu to compare results of our baseline data on the Paro Chuu.

Mammal Communities of the Paro Valley Forests

The vertical gradients of the mountains in Western Bhutan are visually stunning and ecologically compelling. Little research exists on the large mammal communities of the Paro District, particularly large predators. With the recent move from Central to Western Bhutan, new opportunities emerge for SFS Mountain Ecology students to contribute to knowledge of the forest mammal communities and provide insights into how forest mammal communities interact or avoid the human-dominated valley landscapes as compared to the more intact forest landscapes associated with the ridgelines. For this proposal, we will investigate the differences between the mammal communities observed in the lower forests of the valley as compared to the ridgelines with the aid of camera traps and through an understanding of associated habitat relationships. Additionally, we have the opportunity to pair our camera trap study with studies on community successional processes following a large forest fire above the valley comparing camera trap results of mammals in healthy forests compared to the newly burned area. Camera trapping in the ridges above the Paro valley by researchers with the Bhutanese Ecological Society recently revealed the presence of tigers ranging at higher elevations than widely accepted. If our camera trapping reveals the presence of tigers this study could help contribute to an exciting nationwide tiger demographic survey currently being conducted by UWICE colleagues. Students will deploy 24 camera traps (12 along ridgelines paired with 12 placed at lower or mid elevation locations and in burned forest) in late March and retrieve SD cards on a bi-monthly basis. Habitat measurements will be collected at each camera location. This project can be continued across seasons and semesters to build a long-term dataset for mammal occurrence in forested mountains adjacent to the SFS Center and human settlements of the Paro Valley while assessing potential and actual human-wildlife conflicts.

2. Impact of Forest Fire on Forest Successional Pathways in Temperate Conifer Forests of Western Bhutan

Principal Investigator: Purna B. Chhetri

Fires occur all over the world in different forest types either naturally or due to human activities. Fires in Himalayan forests which may be becoming increasingly destructive due to climate change have only received scant attention from researchers thus far.

Forests which cover over 70% of Bhutan's total land area provide a host of goods (both timber and non-timber produce) and are integral to rural livelihoods. Forest fires thus pose significant threats to rural livelihoods and also to Bhutan's constitutional commitment to keep 60% of land area under forests. In Bhutan, there is little recorded history of natural fires and the majority of forest fires in Bhutan are anthropogenic. From 1992 to 2016, as per records maintained by the Department of Forest and Park Services (DoFPS), 62 forest fire incidences have been recorded per year, resulting in a loss of about 7423 ha of forest per year.

During the spring of 2018, a fire burnt an estimated 1100 hectares of forest within Paro Valley close to the SFS Center. These recently burnt forests provide an incredible opportunity to investigate impacts of fires on ecosystems and how forests recover and rejuvenate from such significant disturbances. We will measure common forest metrics to assess damage, growth and recovery. We will draw on concepts and understanding of forest succession and dynamics.

3. The Socio-economic and Policy Aspects of Rice Self-sufficiency in Paro Valley

Principal Investigator: Kuenga Wangmo

The overarching objective of this research project is to study the social, economic, and political drivers and barriers around Paro Dzongkhag's role in the national objective of achieving rice self-sufficiency. Paro, a mid-hill fertile valley with flat agricultural fields, is traditionally an important rice producing valley and the first district to experiment with improved technologies in agriculture including farm mechanization and cultivation of improved rice varieties. Given Paro Dzongkhag's proximity to Thimphu and a recent Government proposal to urbanize one of Paro's iconic rice-growing villages to a *thromde* (township),¹ debates are already ensuing about the impact of such a move on Paro's paddy fields. On the one hand, the Government acknowledges the significance of paddy cultivation and the intimate relationship it has with local culture and traditional way of living; the protection of paddy land is enshrined in the Government's *dzongkhag* development plan for Paro. Yet, this sentiment is offset by practical issues arising from the growth, demography, and the demand for land to build infrastructure to support this growth, of Paro.

This Project will seek to understand the 'development' of Paro and whether this development directly threatens the survival of paddy land in the valley.

We ask, "Are *chuzhing* (wetland) or paddy land being converted to *kamzhing* (dry land) and at what rate?" We also ask, "What are the implications of provisions in the Land Act of Bhutan that allows

¹ "Urbanising Paro," Kuenselonline.com July 16 2015

Bhutanese without *khimsa* or land for house construction to convert wetland to dry land in Paro?” The Project will try to study what the impacts to Paro’s image as a ‘traditional rice-growing valley’ will be if large parts of the valley are committed to real estate development. Also, logging a baseline of the traditional knowledge and practice still intact, we ask, “Have modernization and technological development eroded traditional knowledge and practice of paddy cultivation, including loss of traditional rice varieties, in Paro Valley?” and “Is the investment in paddy cultivation in keeping with Bhutan’s national objective of becoming rice self-sufficient?”

We will draw from thinking in the disciplines of development and policy studies, anthropology, and environmental studies amongst others. Using Paro Dzongkhag as our study area, we will employ a mixed method approach that includes field surveys, semi-structured interviews, in-depth interviews with key influencers/informants, policy studies, and participant observation.

Areas of investigation include gender roles, livelihood choices, land use change, self-sufficiency levels, historical narratives and knowledge of paddy cultivation, agro-biodiversity, climate change, irrigation and technology, urbanization, GNH, and the environment.

4. Opportunities & Challenges for Building Nature Based Enterprises in and around Paro

Principal Investigator: Nawang Norbu

As of 2017, 30% of Bhutanese population were between the ages of 20 to 35 years. Creating jobs for this economically productive group is a serious challenge for Bhutan. Through sample surveys in the Paro valley and also examining published Government statistics, we will first try and quantify the extent and diversity of employment within this age group.

Bhutan’s forests provide a suite of both ecological and economic goods. A rich forest cover and unique tourists attractions offers the potential to develop a portfolio of nature based enterprises which creates jobs as well as help promote the stewardship of nature. We will document existing nature based enterprises in the Paro valley. We will also conduct preliminary economic analyses of a select few nature based enterprises to understand the pre-requisite for success. Through interviews and assessment of extant enterprises, opportunities for developing novel and sustainable eco-friendly business enterprises will be explored and potential business projects proposed.

Learning Objectives

The core skills students will learn in this course are field techniques, analytical methods, communication skills and critical thinking, as well as team work and time management. The specific objectives of the course are the following:

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

Assessment

You will present your DR projects in the standard scientific formats of a peer-review style report and a conference style presentation. You will also be graded on your data management and your positive contribution to the class. Comprehensive details of all assignments will be provided separately, see below for the general descriptions and expectations.

Assessment Item	Value (%)
Select research mentor	
Draft project proposal	10
Final project proposal	15
Final project report	30
Data management	10
Project presentation	20
Directed research skills	15
TOTAL	100

Project Proposal (25%): The project proposal has two elements: a *Literature Review* and a *Project Summary*.

1. Literature Review

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

- A full literature review: A critical evaluation of knowledge in subject area
- An exploration of the DR project status within the literature: Highlight knowledge gaps and how the proposed project fits within the current literature

2. Project Summary

The main objective of the *Project Summary* is for students to develop a detailed outline (framework) for their Directed Research. The DR *Project Summary* must include the following items:

- Aims/Hypothesis(es): A list of questions that the student would like to answer as a result of the research project they will design.
- Materials & Methods: A detailed description of the methods to be used in their study and why these methods will be used over other potential methods. This should include sampling design, as well as the physical data collection methods to be employed.
- Predicted Findings & Importance: A list of 'predicted findings' and implications for each

Final Report (30%): The final report is written in the style of a peer-review submission to a journal in the appropriate field. The report will have a word limit of 3500-4000 (excluding references). You will have ample opportunity for guidance from your DR supervisors throughout the DR period and especially during DR data analysis week. The analytical tools for research workshops in the DR course (and complementary

classes in other courses) are designed to prepare you for producing the results section and improve the quality of your work.

Presentation (20%): You will present a subset of your DR work in a conference style presentation of 10 min length with additional time for questions. Unless the scope of your DR project is very small, you should not attempt to squeeze in everything from your final report into this presentation. Making sure that you are within the time limit is a very important skill and so thorough rehearsal is important.

Data Management (10%): It is important to record and store research data in a manner that is useful. You will need to provide (as applicable) Excel sheets with your research data in a format that is intelligible to someone else. You may need to provide both raw and manipulated data you used to create figures, tables and to run statistical tests. You need to annotate your spreadsheets (use text boxes if appropriate) so that an outsider can understand what the data are. You may be required to provide field notes on your findings for review.

Directed Research Skills (15%): Your Directed Research Skills will be graded throughout the DR course by your supervisor. Your final grade will depend upon your attendance to all DR activities, active involvement and competencies in field data collection, data interpretation and group participation/support.

Grading Scheme

A	95.00 - 100%	B+	86.00 - 89.99%	C+	76.00 - 79.99%	D	60.00 - 69.99%
A-	90.00 - 94.99%	B	83.00 - 85.99%	C	73.00 - 75.99%	F	<60.00%
		B-	80.00 - 82.99%	C-	70.00 - 72.99%		

DR 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. In the case of DR project write-ups, careful referencing is of essence.

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. Deadlines allow faculty ample time to review and return assignments before others are due. **All DR related assignments must be delivered by deadline.**

Participation: Participation in all components of DR is mandatory because your actions can significantly affect the experience you and your classmates have as well as the outcome of the project. Therefore, it is important that you are prompt and prepared for all aspects of DR, bring the necessary equipment, and simply get involved and make the most of the experience.

Course Content

DR Coursework Component:

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

Key: **L**: Lecture, **FL**: Field Lecture, **FEX**: Field Exercise, **T**: Test, **D**: Discussion or Breakout Session.

JL: Jesse Lewis, **PC**: Purna Chhetri, **KW**: Kuenga Wangmo, **NN**: Nawang Norbu

	<i>Lecture Title and Description</i>	<i>Type</i>	<i>Lecturer</i>
DR01	DR Course Introduction Students will be introduced to the DR topics, process, including deliverables and dates.	L	JL, PC, KW, NN
DR02	Project Development & Proposal Faculty will lay out expectations of student proposals and students and faculty will form discussion groups to further DR proposals	D	JL, PC, KW, NN
DR03	Introduction to Science & the Scientific Method This discussion with familiarize students with the process of science, both in theory and in practice	L/D	JL
DR04	Introduction to Scientific Writing & Reading Explore the difference between primary and secondary sources; expectations and standards of practice; describe expectations for paper	L	JL
DR05	Qualitative & Quantitative research Introduction of data collection methods and when each is appropriate, as well as a discussion of student's current experiences in scientific data collection.	L/D	PC
DR06	Statistics A brief introduction to basic statistical theory and use of statistical software	L	PC & KW
DR07	Effective Scientific Communication Skills Students will understand the importance of practicing scientific communication skills and start to think about how to address different audiences.	L	PC & JL
DR08	Research Ethics Introduce students to the ethical considerations involved in research (e.g. human subject's protection, data integrity and management).	L	KW
DR09	Risk & Time Management in DR	L	SAM
	Total Hours	12	

DR Research Component:

The rest of the DR course is made up of research time, which includes: data collection; synthesis; and dissemination. Given the intense and mentored nature of the Directed Research project, the students receive over 140 contact hours during this time period.

<i>Research Component Activity</i>	<i>Days Allocated</i>
Preliminary Data Collection	2
Data Collection Students work within their DR group to go into the field to collect data	11
Data Synthesis Students work closely with their faculty mentors to analyze their collected data and write up their findings in a structured scientific paper	4
Research Dissemination Students prepare, practice, and then deliver presentations for both internal SFS and community audiences.	3
Total Days	20