



THE SCHOOL
FOR FIELD STUDIES

Land Use, Natural Resources & Conservation

SFS 3050

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The School for Field Studies (SFS), UWICER and Bhutan Ecological Society
Himalayan Environment and Society in Transition
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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.

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Course Overview

Situated between the high plateau of Tibet and the sub-tropical plains of India, the Kingdom of Bhutan consists of some of the most rugged terrain in the world spanning a huge variation in altitudes and life zones. Within a North-South width of approximately 170 km, Bhutan's elevation varies from roughly 200 meters above sea level in the South to over 7,500 meters in the North. The rapid variation in elevation creates a diversity of landscapes and micro-climatic conditions that are ideal for a range of ecosystems and species to flourish. Essentially, about 60% of the Bhutanese still live in rural areas and practice mostly traditional forms of livestock rearing, agriculture and natural resource management. These management practices include both technical and spiritual aspects. Technical aspects include land management strategies such as terracing, plowing, sowing and planting. Spiritual practice relates to complex mixtures of Buddhism and ancient Bon practices. However, these practices are rapidly changing with democratization and modernization.

In this course we will consider natural resources in the context of local livelihoods through the lens of ecology and economics, and across regional, national and global scales. We will examine the implications of different land uses related to various agricultural practices and livestock rearing. Furthermore, we will consider historical and current land use trajectories to understand the impacts of such practices over time on ecosystem resilience. For example, what are the principal stressors to the local economy and the environment at local, regional and national levels? We will consider food security, both at the local and regional levels and link those to natural resource stressors. Furthermore, we will look for synergies between conservation (both biodiversity and agrobiodiversity) in relation to rural livelihoods and development.

This course is closely linked to the other two disciplinary courses in our program: Mountain Ecology and Political & Socioeconomic Dimensions of Environment. Conceptually, we will focus on the notions of resilience and multi-functionality and seek evidence for these in the field. Course lecture material will be complimented by field lectures, guest lectures, student led discussions and field exercises. Students will explore the science behind current local and global issues in conservation biology, land use, water resources, food production, biodiversity and climate change. The purpose of this course is to provide students with opportunities to develop a strong foundation of scientific knowledge on the natural environment and to build a tool kit of field research methodologies and analytical skills to uncover, test and describe the relationships between natural resources, land use practices and conservation.

Learning Objectives

Students will develop a conceptual and practical understanding of Bhutan's biological and agrobiological diversity, and global strategies for natural resource use and management. Specific learning objectives include the following:

1. Understand drivers of land use change and their consequences on biodiversity conservation and resource use.
2. Understand the relationships and tensions between policies related to natural resource management and on the ground realities.
3. Learn about issues related to biodiversity conservation in relation to changing socio-economic conditions and climate change and examine how conservation can be strengthened or threatened by different policies and practices.

- Employ and become familiar with field research methods and analytical tools used in natural resource management and conservation of biodiversity.

Assessment

Our goal is to conduct ongoing assessment of student learning throughout the course, and provide timely and constructive feedback. Some assignments encourage students to work together, to share ideas and knowledge. This allows students to take advantage of the range of backgrounds within the group. Assessment will be conducted on an individual basis, unless otherwise stated. The final course grade will be based on the following:

Assessment Item	Value (%)
Active Participation	10
Student Led Discussion	10
Sustainable Indicators of NRM	10
FEX I: Land Use Planning in GIS	10
FEX II: Forest Inventory Studies	10
Midterm Exam	10
FEX III: Camera Trapping & Conservation	10
FEX IV: Bhutanese Farming & Food Systems	10
Final Exam	20
TOTAL	100

Assessment Descriptions

Active participation (10%): During this program we will travel through many eco-regions and rural communities. We expect that you will be an active observer, constantly observing the landscape, livelihoods, and culture and participating in discussions regarding these observations. Active participation includes constructive engagement with the full range of course activities, respectful awareness of our cultural context, and responsible behavior as a group member who is involved in others' learning. There will be opportunities throughout the semester for constructive feedback.

Student Led Discussion (10%): Many topics we cover in this course lend themselves well to critical thinking, discussion and debate. Some sections will end in a class discussion, led by a small group of students. You will be asked to provide at least two short readings for the class based on that thematic topic, make a short presentation on a related topic, and moderate the discussion. Prior to discussion students should meet to discuss their topic/s with the professor, and then send out relevant readings and materials to the group. Students will be assessed for their ability to clearly articulate concepts and thoughts in writing and speech, to recognize discrepancies between claims and realities and to stimulate critical and meaningful discussion.

Discussion section topics: (1) Forestry & Development (2) Sustainable Farming (3) Biodiversity Conservation (4) Valuation of Ecosystem Services (5) Securing Bhutanese Landscapes

Sustainable Indicators of NRM (10%): We will organize at least five field trips in different parts of the country focused specifically on natural resource uses and sustainable enterprise. The various trips will likely include (1) a handmade paper factory and sawmill in Paro, (2) traditional medicine garden and institute in Thimphu, (3) an herbal tea garden in Bumthang, (4) a bee keeping cooperative in Bumthang, and an (5) Agricultural Resource & Development Center in Wangdue. Collectively, these organizations are connected to natural resources utilization, management and development for various clients and purposes. Students are expected to see and learn how these organizations are operating and managing natural resources and how they are connected to securing local livelihoods and rural development. Each student will write a reflection paper on any one of the organizations, illustrating its linkage to natural resource management and considering their ability to sustain into the future. A detailed handout will be given prior to each field visit.

Field Exercise (FEXI): Land Use Planning in GIS (10%): Students will be introduced to Geographic Information Systems (GIS) and will undertake a field exercise to collect GPS data. Using ArcGIS, students will learn how to produce basic maps using field data. The class will be divided into groups and each group will work on a certain land use problem using GIS and produce a written report.

Field Exercise (FEXII): Forest Inventory Studies (10%): The class will be divided into groups of four. Each group will work in a forest inventory plot and collect DBH, height and other attributes within the plot. The group will then use the data to estimate total biomass and other plot forestry parameters. A detailed handout will be provided to conduct the forest inventory.

Midterm Exam (10%): A midterm exam will be conducted half way into the semester. Students will be examined on what they have been exposed to in the class (lectures, discussions) and in the field, and what they have been asked to read. The exams allow students to draw on multiple concepts and experiences, and to synthesize the information.

Field Exercise (FEXIII): Bhutanese Farming & Food Systems (10%): The various ecological, cultural and market forces that guide what crops people grow and how they grow them vary from region to region in Bhutan. Throughout the semester we formally, and informally learn about the way people do agriculture in the Himalayas to understand how the food system works in Bhutan. An assessment sheet with questions and prompts will be handed out at the beginning of the semester to guide journal notes about agriculture, farming techniques and observations related to the food system at each site. At semesters' end students will summarize their observations into an interpretive map of the Bhutanese food system. This FEX will be ongoing, and up to the student to update in their field journal.

Field Exercise (FEXIV): Camera Trapping & Conservation (10%): Camera traps are the most efficient method of surveying shy, low density animals such as large mammals and some large ground-walking birds. Data collected from camera traps is an increasingly useful tool for assessing and monitoring wildlife for conservation and management purposes. We will learn how to operate camera traps and then retrieve a set of traps set up prior to the course at a site in the Paro Valley. Retrieval will be combined with a hill top monastery hike and day out in the field. Image data collected from the camera traps will then be sorted and synthesized into a report.

Final Examination (20%): One comprehensive exam will be administered at the end of the course. Students will be examined on what they have been exposed to in class (lectures, discussions, etc.) and in

the field, and what they have been asked to read. The exam allows students to draw on multiple concepts and experiences, and to synthesize information.

Grading Scheme

A	95.00 - 100.00%	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	0.00 - 59.99%
		B-	80.00 - 82.99%	C-	70.00 - 72.99%		

General Reminders

Readings: You are expected to have read all the assigned research articles prior to each class. All readings are available as PDFs on the Student Drive. Readings might be updated or changed during the course of the semester. Readings from textbook chapters are for reference/supplemental learning. Not all material will be explicitly taught during lectures, material from textbook chapters not covered in lecture will NOT be on exams. Additional readings could be assigned.

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 FEX assignments will be at midnight two days after the actual FEX unless otherwise stated in assignment. Late assignments will incur a 10% penalty for each day that they are late. Assignments will be handed back to students after a one-week grading period at the latest.

Course Content, Lectures

Key: **L** lecture and discussion, **GL** guest lecture, **FL** field lecture, **SLD** student led discussion, **FEX** field exercise, **D** discussion, **NRM** sustainable indicators of natural resource management, **DR** directed research.

*Readings in **Bold** are required. Not bolded readings are meant for preparing lectures and students are also encouraged to read them

No.	Lecture Title and Description	Type	Time (Hrs)	Readings
Land Use Principles, Management Theories & Tools				
1	<p>Introduction to Land Use, Natural Resources, and Conservation</p> <p>We will discuss some of the expectations, goals, and purpose of the course, detailing overall content, field exercise (FEXs), grading system, and deadlines for assignments.</p>	L	1:15	<p>Syllabus</p> <p>The Himalayas: History of this Beautiful Mountain Range (2:56) Video</p>

2	Global Land Use and Land Cover Change We will examine global, regional, and national statistics on natural resources, human population, primary productivity and current issues related to conservation, and natural resources. We will also learn about land uses in the Himalayas and land use statistics in Bhutan.	L	1:15	Foley et al, 2005 Krausmann, 2013 Defries, 2010 Newbold, 2015 Borrelli, 2013
3	Land Use in the Bhutan Himalayas Following the global land use discussion prior we will transition to learn about natural resource management in Bhutan. We will explore different land use practices, natural resources, and strategies for biodiversity conservation globally, in the Himalayas, and in Bhutan.	L	1:15	Bruggeman, 2018 Agrawal, 2017 Gilani, 2014 NBSAP, 2014 Reddy et al, 2018
4	Land Use in GIS Here, we learn about the basics for mapping land uses and drivers of land use change. We will learn to collect data using different field methods and use those data to do mapping. We will also practice making notes of our field observations of landscapes, identify land uses and landscape attributes for analysis.	FEX	5	Handout Angelstam, 2013
Mountain Forests & Water Resources				
5	Forest Management & Challenges in Bhutan We will be introduced to different forest types of Bhutan, their main resources, and their significance to livelihoods. We will study both traditional and contemporary management systems in the Himalayas and some of the challenges they face, specifically in Bhutan.	L	1:15	Agrawal, 2008 Khan et al, 2008
6	Community Forestry in Bhutan We discuss the traditional history and current practices of community forestry in Bhutan and compare these with practices in other countries. We look at sustainability of forest resources and study the technical, economic, and environmental aspects of Community Forests.	GL	1:15	Wangdi, 2006
7	Forest & Livelihoods: Handmade Paper and Sawmill Trip A trip to a local hand-made paper factory and a sawmill in Paro will be organized. We will learn about the resource base of these enterprises. We will also hear how these enterprises are engaged with local producers at different stages of production and marketing.	NRM	3	NRM Handout

8	Watershed & Wetland Management Here, we will closely examine watershed and wetland management processes. We will also study the monitoring and evaluation process. Using Phobjikha Valley as a case study, we try to understand why Phobjikha is considered one of the most successful conservation and development models in Bhutan. We will discuss how this can be translated to other locations.	GL	1:15	ICIMOD & RSPN, 2014 Peimer, 2016 Kerr, 2007 Russi, 2013
9	Conflicts in Natural Resource Management We will examine conflicts arising from common pool resources and their consequences on land use, natural resource management and conservation. Drawing inferences from a case study in the Phobjikha Valley we will engage in a class debate and explore resolutions for such conflicts.	L/D	1:15	Adams, 2003 Namgay, 2016 Pandit, 1991
10	Forestry & Development Bhutan has over 80% forest cover and is frequently lauded for being carbon neutral (even negative). A rule in the constitution even stipulates maintaining at least 60% forest cover. However, can Bhutanese forests also be drivers of economic growth? What is the trade off between forestry, conservation and economic development within the Bhutanese context?	SLD	1:15	Kuensel Online, Forestry can be a Bigger Driver than Hydropower Kuensel Online, Saving Bhutan's Forest & Saving Bhutan's Forests
11	Forest Resource Inventory We will conduct a forest resources inventory by taking measurements of DBH, height and other parameters. We will also learn to obtain tree ring cores, forest soils, leaf litters and plant samples for further analyses. This exercise will teach students to identify and select mother trees for seed collections, which is crucial for regenerating logged forests and plantation forestry.	FEX	5	Handout Forest Resource Inventory, 2014
Mountain Agriculture & Food Systems				
12	Agrobiodiversity & Development We will visit an Agricultural Resources and Development Center in Wangdue to speak with experts on a range of topics that may include: agrobiodiversity, agricultural development, seed saving, sustainable enterprise, development of new or improved crops, and the interplay of agricultural science, with livelihoods and policy.	NRM	3	NRM Handout

13	<p>Agrarian Landscapes of Bhutan</p> <p>Bhutan is an Agrarian society with more than 50% of Bhutanese classified as subsistence farmers. However, land use statistics show only about 3% of the country's total land area as agricultural land. We will learn about different agricultural resources (field crops, vegetables and horticultural crops), as well as livestock husbandry. We will try to understand constraints in farming and herding, and opportunities for food production and food self-sufficiency.</p>	L	1:15	<p>MoAF, 2010 Wangchuk, 2015 Roder 2017</p>
14	<p>Agroecology & Land Management</p> <p>We will explore the history and practice of agroecology, through a historical lens and case studies before narrowing our focus to Bhutan. Being a mountainous country the retention of plant nutrients and water for growth and development of food crops are prerequisite for sustainable agriculture in Bhutan. We will examine different land management techniques (agroforestry, check dams, and other indigenous practices, such as land terracing) used for various agroecological farming systems in Bhutan.</p>	L/FL	1:15	<p>Partap, 1999 Silici, 201 Ted Talks, Pablo Tittotel. Feeding the World with Agroecology, (12:42) Video</p>
15	<p>Bhutanese Farming & Food Systems</p> <p>Over the course of the semester we will visit many regions of Bhutan ranging from sub-tropical border towns to high altitude farming villages. During our field visits we will formally (short hikes, guest lectures) and informally (home-stays, personal observation) learn about agricultural practices across the country. Through note taking, prompts and handouts we will gain a better understanding of the physical, cultural and economic drivers that underpin the Bhutanese farming and food system.</p>	FEX	4	<p>Rasul, 2010 Sharma et al, 2018</p>
16	<p>Sustainable Farming</p> <p>Can organic farming feed the world? How can principles of agroecology, better land management and sustainable farming contribute to a healthy food system and environment? Furthermore, can Bhutan achieve its lofty goals to become a 100% organic nation? Other discussion themes may include: agroecology and conservation, case studies and more.</p>	SLD	1:15	<p>Feuerbacherm, 2018. IAASTD, 2009 World Watch Magazine Online, 2006. Can Organic Farming Feed Us All?</p>

17	<p>Agrarian Livelihoods: Small Scale Enterprises in Natural Resources</p> <p>In Bumthang we will visit the Bee Keeping Association and Herbal Tea Farm at Dhur valley, two natural resource based economic enterprises in Bumthang. We will learn about production, marketing, and their contribution to food security and local livelihoods. Agriculture, forest, and livestock resources are central to rural livelihoods in Bhutan.</p>	NRM	4	Saxena, 2001
Biodiversity Conservation & Management				
18	<p>Conservation in the Bhutan Himalayas: Landscapes and Institutions</p> <p>Here, we examine the significance of Bhutan as the last biodiversity refugia for conservation in the Himalayas. We will learn about various factors that place Bhutan at the center of conservation in the Eastern Himalayan region.</p>	GL	1:15	Banerjee, 2016 Myers et al, 2000 WWF Living Himalayas Initiative (2:37) Video
19	<p>Conservation Challenges – Human Wildlife Conflicts</p> <p>Conservation related conflicts are increasing and need to be addressed in order to minimize their negative impacts on biodiversity, human livelihoods, and human wellbeing. Here, we will examine various approaches to mitigate human wildlife conflicts through shared case studies and group discussion.</p>	L	1:15	Sangay, 2008 Kuensel, 2018 Presence of Tigers Reduces Crop and Livestock Depredation, Finds Study Katel, 2014 Tshering and Thinley, 2017
20	<p>Camera Trapping & Conservation</p> <p>Camera traps are the most efficient method of surveying shy, low density animals such as large ground-walking birds. Data collected from camera traps is an increasingly useful tool for conservation and management purposes. We will learn how to operate camera traps, retrieve previously set up traps at a site in the Paro Valley and analyze the data.</p>	FEX	5	Sangay et al, 2014. Wang et al, 2009.
21	<p>Conservation Management Systems</p> <p>Here we will learn about conservation management systems at different scales - local, regional and global. We will study concepts related to keystone species, biological corridors, protected area design, community-based conservation and other compensatory schemes practiced in Bhutan, and worldwide.</p>	L	1:15	Wilson, 2009 Watson, 2014 Rinzin et al, 2009

22	Biodiversity Conservation Bhutan has managed to set aside half of its land area in some form of conservation, and in doing so safeguarded its environment and the services a healthy environment provides for its citizens. Is this approach realistic elsewhere? Can a “Half-Earth” approach succeed in other places? Discussion topics may include: People and protected areas. Big conservation. Integrated Conservation and Development Programs (ICADP) and more.	SLD	1:15	Wangchuk, 2017 E.O. Wilson, Half Earth Webpage
23	Traditional Medicine Systems & Field Excursion to ARDC Yusipang We will visit the traditional hospital at Kawajangsa in Thimphu to learn about the role of traditional medicines in the Bhutanese healthcare system. We will also visit the Agricultural Research and Development Center (ARDC) in Yusipang, where some plant species used in traditional medicines are grown.	NRM	3	NRM Handout Ted Talk, Dr. Cheo Torres. Connecting Modern Medicine to Traditional Healing (11:42) Video
Natural Resource Management in a Changing World				
24	What do Conserved Landscapes Provide? An Introduction to Ecological Services We will identify ecosystem services and define different valuation methods for attaching economic values to ecosystems, biodiversity and landscapes.	L	1:15	ICIMOD, 2003 De Groot, 2002 Swart, 2018
25	Valuation of Ecosystem Services How do we value the environment? In a world of capital, commerce and commodification is valuation of ecosystem services a new way forward for better conservation management? How does the idea align, or misalign with science and policy in Bhutan and elsewhere? Discussion topics include: carbon sequestration, water, pollination schemes. REDD+. Ethical debates with valuation. Case studies.	SLD	1:15	Figge, 2004 Royal Government of Bhutan REDD + Secretariat, Online
26	Emerging Natural Resource Issues The impacts of climate change pose fundamental challenges for current approaches to biodiversity conservation. We will review studies pertinent to climate change and identify common stressors to ecosystems due to changing climate. We will also examine major conservation issues, such as invasive species, disease outbreaks, and human disturbances. Based upon projections what will the future of land use, natural resources and conversation look like in the Himalayas, and specifically in Bhutan.	L	1:15	Devereux, 2004 Ramsfield et al, 2016 Hoy, 2015 Bajracharya, 2014 Singh, 2011

27	GDP, Institutions & Conservation Financing We will examine the role of forest in climate mitigation and how GDP could be playing out with climate mitigation programs such as PES, REDD +, CDM, forest certification and other schemes. We will examine cost and financing mechanisms such as Bhutan Trust Fund, Bhutan for Life and Green Climate Fund, as well as other relevant financial institutions as examples.	L	1:15	McCarthy, 2012 Juffe-Bignoli et al, 2016
28	Securing Bhutanese Landscapes What will the future of land use, natural resources and conservation look like in the Himalayas, and specifically Bhutan? Topics include: Can Bhutan achieve food self sufficiency? How can Bhutan secure conservation funds? Shifting values around land use and conservation and more.	SLD	1:15	Bolch, 2012 Xu et al, 2009
29	Midterm exam	TBA	1	
30	Final Exam	TBA	2	
	TOTAL		60	

Readings

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