



THE SCHOOL  
FOR FIELD STUDIES

# Land Use, Natural Resources, and Conservation

## SFS 3050

**Syllabus**  
**4 credits**

The School for Field Studies (SFS)  
Center for Climate and Sustainable Futures (CCSF)  
Paro, Bhutan

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 CONTENT SUBJECT TO CHANGE**

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***Please note that this is a copy of a recent syllabus. A final syllabus will be provided to students on the first day of academic programming.***

SFS programs are different from other travel or study abroad programs. Each iteration of a program is unique and often cannot be implemented exactly as planned for a variety of reasons. There are factors which, although monitored closely, are beyond our control. For example:

- Changes in access to or expiration or change in terms of permits to the highly regulated and sensitive environments in which we work;
- Changes in social/political conditions or tenuous weather situations/natural disasters may require changes to sites or plans, often with little notice;
- Some aspects of programs depend on the current faculty team as well as the goodwill and generosity of individuals, communities, and institutions which lend support.

Please be advised that these or other variables may require changes before or during the program. Part of the SFS experience is adapting to changing conditions and overcoming the obstacles that they may present. In other words, this is a field program, and the field can change.

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## Course Overview

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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

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Students will develop a conceptual and practical understanding of Bhutan's biological and agro-biological 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.
4. 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 (%)
Participation	10
Student led discussion: Can forests be a driver for economic growth?	10
FEX 1: Camera Trapping and Conservation	15
FEX 2: Forest Inventory	15
FEX 3: Bhutanese Farming and Agricultural System	20
Final Exam	30
<b>TOTAL</b>	<b>100</b>

### 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%)

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 tradeoff between forestry, conservation, and economic development within the Bhutanese context? Working in groups, students will gather information, examine literature, watch the BLISS talk by Dr. Phuntsho Namgyel, and prepare a 15-minute presentation on whether Bhutan's forests can be a driver for economic growth.

### FEX 1: Camera Trapping and Conservation (15%)

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. Students will synthesize their findings in a short report.

### FEX 2: Forest Inventory (15%)

The class will be divided into groups of 3 to 4. Each group will work in a forest inventory plot and collect DBH, height and other attributes within the plot. The group will use the data to estimate total growing stock and other forest parameters. A detailed handout will be provided to conduct the forest inventory.

### FEX 3: Bhutanese Farming and Agricultural System (20%)

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. Students will summarize their observations in a reflection paper including an interpretive map of the Bhutanese land use and agriculture system, before the final exam. This FEX will be ongoing, and up to the student to update in their field journal.

### Final Exam (30%)

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

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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

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**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.

**Participation** – Since we offer a program that is likely more intensive than you might be used to at your home institution, missing even one lecture 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 course is mandatory, it is important that you are prompt for all activities, bring the necessary equipment for field exercises and class activities, and simply get involved.

## Course Content

**Type- L:** Lecture, **FL:** Field Lecture, **GL:** Field Lecture, **FEX:** Field Exercise, **D:** Discussion, **O:** Observation, **P:** Practical

**\*Required readings are in bold**

No	Title and outline	Type	Time (hrs)	Readings
1	<b>Introduction to Land Use, Natural Resources, and Conservation</b> We will discuss some of the expectations, goals, and purpose of the course, detailing overall content, field exercise (FEXs), grading system, and assignments.	L	1:15	
2	<b>Global Land Use and Land Cover Change</b> 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	<b>Foley et al, 2005</b> Krausmann, 2013 Defries, 2010 Newbold, 2015 Borrelli, 2013
3	<b>Land Use in the Bhutan Himalayas</b> 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	<b>Bruggeman, 2018</b> Agrawal, 2017 Gilani, 2015 NBSAP, 2014 Reddy et al, 2018
4	<b>GIS &amp; Landuse – An Introduction</b> Students will be introduced to GIS, data structures and how to perform basic analysis in a GIS.	GL	1:15	
5	<b>GIS Continued</b> Students will learn how to create basic land use maps and perform basic analysis	P	3:00	
6	<b>Traditional Land Use Practices in the Himalayas</b> We will discuss traditional practices of land uses in the Himalayas, such as tseri, shokshing and tsamdrol. We will discuss pros and cons of such practices and how they have evolved over time. We will also review social restriction in traditional forest management systems, and its implications for biodiversity conservation in Bhutan.	L	1:15	<b>Penjore &amp; Raptan 2004</b> <b>Wangdi et al. 2014</b> Dorji et al. 2006
7	<b>Natural Resources Management System &amp; Challenges in Bhutan</b> Here we will discuss how natural resources in Bhutan under the Department of Forests and Park Services are Managed	L	1:15	
8	<b>Forest Management Unit</b> 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.	GL	1:15	<b>Agrawal, 2008</b> Khan et al, 2008

No	Title and outline	Type	Time (hrs)	Readings
9	<p><b>Natural Resources Management: Community Forestry in Bhutan</b></p> <p>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.</p>	L	1:15	<p>Wangdi, 2006</p> <p>Buffum 2012</p>
10	<p><b>Natural Resources Management: Protected Area Systems in Bhutan</b></p>	L	1:15	<p>Dorji et al. 2019</p> <p>Lham et al. 2018</p> <p>Coad et al. 2015</p>
11	<p><b>Valuing ecosystem services, PES Namey Nichu Watershed</b></p> <p>We will visit the Namey Nichu watershed and talk with a representative of the local community forestry group &amp; Namey Nichu Watershed Management Group about the different conservation schemes they oversee that ensure clean water for the four hotels that contribute to the PES.</p>	FL	3	
12	<p><b>Forest Management Unit</b></p> <p>A trip to the Zonglela Forest Management Unit, Paro will be organized. Forest Management Unit (FMU) are established throughout the country to manage the forests scientifically. These are strictly prepared as per the prescription under the “Forest Management Code of Bhutan, 2004”.</p>	FL	3	
13	<p><b>Watershed &amp; Wetland Management</b></p> <p>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.</p>	GL	1:15	<p>ICIMOD &amp; RSPN, 2014</p> <p>Peimer, 2016</p> <p>Kerr, 2007</p> <p>Russi, 2013</p>
14	<p><b>Conflicts in Natural Resource Management</b></p> <p>We will examine conflicts arising from common pool resources and their consequences on land use, natural resource management and conservation.</p>	L; D	1:15	<p>Adams, 2003</p> <p>Namgay, 2016</p> <p>Pandit, 1991</p>
15	<p><b>Can Forests be a Driver for Economic Growth?</b></p> <p>Working in groups, students will gather information, examine literature, watch the BLISS talk by Dr. Phuntsho Namgyel, and prepare a 15-minute presentation to be delivered in class on whether Bhutan’s forests can be a driver for economic growth.</p>	D	1:15	
16	<p><b>FEX: Forest Resource Inventory</b></p> <p>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</p>	FEX	4:00	

No	Title and outline	Type	Time (hrs)	Readings
	students to identify and select mother trees for seed collections, which is crucial for regenerating logged forests and plantation forestry.			
17	<b>Agrobiodiversity &amp; Development</b> We will visit an Agricultural Resources and Development Center in Bajo 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.	FL	4:00	
18	<b>Agrarian Landscapes of Bhutan</b> 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.	GL	1:15	<b>MoAF, 2010</b> <b>Wangchuk, 2015</b> Roder 2017
19	<b>Agroecology &amp; Land Management</b> 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.	L; FL	1:15	<b>Partap, 1999</b> <b>Silici, 2014</b> Ted Talks, Pablo Tittotel.
20	<b>FEX: Bhutanese Farming &amp; Food Systems</b> Over 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 (homestays, personal observation) learn about agricultural practices. We will gain a better understanding of the physical, cultural, and economic drivers that underpin the Bhutanese farming and food system. This will be continuous FEX that students will submit in the form of field journal/field notes.	FEX	4:00	<b>Rasul, 2010</b> Sharma et al, 2018
21	<b>Agrarian Livelihoods: Small Scale Enterprises in Natural Resources</b> 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	FL	4:00	<b>Saxena, 2001</b>



No	Title and outline	Type	Time (hrs)	Readings
	production, marketing, and their contribution to food security and local livelihoods.			
22	<b>Role of Institutions in Environmental Governance</b> 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.	GL	1:15	<b>Banerjee, 2016</b> <b>Myers et al, 2000</b>
23	<b>Conservation Challenges – Human Wildlife Conflicts</b> 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.	L	1:15	<b>Sangay, 2008</b> <b>Kuensel, 2018</b> Katel, 2014 Tshering and Thinley, 2017
24	<b>FEX: Camera Trapping &amp; Conservation</b> 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.	FEX	5:00	<b>Sangay et al, 2014.</b> Wang et al, 2009.
25	<b>Conservation Management Systems</b> 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.	L	1:15	<b>Wilson, 2009</b> <b>Watson, 2014</b> Rinzin et al, 2009
26	<b>Protected Area Visit</b> We will visit the biological corridor that connects Jigme Singye Wangchuk National Park and Jigme Dorji National Park. Visit JSWNP/WCNP Park HQ. We will learn about the importance of biological corridors, PAs.	FL	4:00	
27	<b>Biodiversity Conservation</b> 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.	D	1:15	<b>Wangchuk, 2017</b> E.O. Wilson, Half Earth Webpage
28	<b>What do Conserved Landscapes Provide? An Introduction to Ecological Services</b>	L	1:15	<b>ICIMOD, 2003</b> De Groot, 2002 Swart, 2018

No	Title and outline	Type	Time (hrs)	Readings
	We will identify ecosystem services and define different valuation methods for attaching economic values to ecosystems, biodiversity, and landscapes.			
29	<b>Emerging Natural Resource Issues</b> 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	<b>Devereux, 2004</b> <b>Ramsfield et al, 2016</b> Hoy, 2015 Bajracharya, 2014 Singh, 2011
30	<b>GDP, Institutions &amp; Conservation Financing</b> 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.	GL	1:15	<b>McCarthy, 2012</b> <b>Juffe-Bignoli et al, 2016</b>
31	<b>Securing Bhutanese Landscapes   Capstone</b> 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.	L; D	1:15	<b>Bolch, 2012</b> <b>Xu et al, 2009</b>
32	<b>Final Exam</b>		2:00	
	<b>Total contact hours</b>		<b>63.5</b>	

## Reading List

### \*Required readings are in bold

1. **Adams, W. M., Brockington, D., Dyson, J., & Vira, B. (2003).** Managing tragedies: Understanding conflict over common pool resources. *Science*, 302(5652), 1915-1916. doi:10.1126/science.1087771.
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3. **Agrawal, A., Chhatre, A., & Hardin, R. (2008).** Changing Governance of the World's Forests. *Science*, 1460 (2008);320, DOI:10.1126/science.1155369.
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11. **Bruggeman, D., Meyfroidt, P., & Lambin, E. F. (2018).** Impact of land-use zoning for forest protection and production on forest cover changes in Bhutan. *Applied Geography*, 96, 153–165. doi:10.1016/j.apgeog.2018.04.011.
12. Buffum, Bill. (2012) "Why is There No Tragedy in These Commons? An Analysis of Forest User Groups and Forest Policy in Bhutan." *Sustainability* 4, no. 7: 1448-1465.
13. Colding, J., & Folke, C. (2001). Social taboos: "invisible" systems of local resource management and biological conservation. *Ecological Applications*, 11(2), 584-600. doi:10.1890/1051-0761(2001)011[0584:STISOL]2.0.CO;2.
14. De Groot, R. S., Wilson, M. A., and Boumans, R. M. J. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics*, 41(3), 393-408. doi:10.1016/S0921-8009(02)00089-7.
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28. IAASTD, 2019. International Assessment of Agricultural Knowledge, Science and Technology for Development. Executive Summary of Synthesis Report.
29. **ICIMOD and RSPN (2014).** An integrated assessment of the effects of natural and human disturbances on a wetland ecosystem: A retrospective from Phobjikha Conservation Area, Bhutan. Kathmandu: ICIMOD.
30. **Juffe-Bignoli, D., Brooks, T. M., Butchart, S. H. M., et al. (2016).** Assessing the cost of global biodiversity and conservation knowledge. *PLoS ONE*, 11(8) doi:10.1371/journal.pone.0160640.
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