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.

COURSE CONTENT SUBJECT TO CHANGE

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.

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 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 discussions	15
FEX 1: Forest Resource Assessment	15
FEX 2: GIS Applications in NRM	15
FEX 3: Bhutanese Farming and Agricultural System	15
Final Exam	30
TOTAL	**100**

Participation (10%)

During this program we will travel through many eco-regions and rural communities. We expect that you will be an <u>active observer</u>, constantly observing the landscape, livelihoods, and culture and <u>participating in discussions</u> 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-let Discussion (15%)

SLD 1. Can Forests be a Driver for Economic Growth?

Bhutan has over 70% forest cover and is frequently lauded for being carbon neutral (even negative). The constitution even stipulates maintaining at least 60% forest cover for all times. However, can Bhutanese forests also be driver of economic growth? What is the tradeoff between forestry, conservation, and economic development within the Bhutanese context? Working in 5-6 groups, students will gather information, examine literature, watch the BLISS talk by Dr. Phuntsho Namgyel, and hold an interactive discussion in class on whether Bhutan's forests can be a driver for economic growth.

SLD 2: Conservation Challenges – Human Wildlife Conflicts

Conservation related conflicts are increasing and need to be addressed 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 in the class. Students will work in groups of 5-6.

SLD 3: 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 conservation look like in the Himalayas, and specifically in Bhutan. Based on the review of current literature, working in groups of 5-6, students will hold an interactive session on the emerging natural resource issues

FEX 1: Forest Resource Assessment (15%)

The class will be divided into groups of 5-6. 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 2: GIS Applications in NRM (15%)

GIS plays a crucial role in Natural Resource Management (NRM) due to its ability to analyze, visualize, and integrate spatial data. GIS serves as a decision support system by providing a spatial framework for NRM. It assists in identifying suitable locations for resource extraction, conservation areas, and infrastructure development. GIS-based tools and models aid in evaluating alternative scenarios, optimizing resource allocation, and assessing the trade-offs associated with different management options. We will learn how to use ArcGIS Software and then develop a land use/landcover map for Punakha District. A test will be administered to assess the students at the end of the module.

FEX 3: Bhutanese Farming and Agricultural System (15%)

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 practice 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. This FEX will be a continuous assignment throughout the semester, and students must update field journal regularly.

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

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

Honor Code/Plagiarism – SFS places high expectations on their students and we hold students accountable for their behaviors. SFS students are held to the honor code below. SFS has a zero-tolerance policy towards student cheating, plagiarism, data falsification, and any other form of dishonest academic and/or research practice or behavior. Using the ideas or material of others without giving due credit is

cheating and will not be tolerated. Any SFS student found to have engaged in or facilitated academic and/or research dishonesty will receive no credit (0%) for that activity.

> *"SFS does not tolerate cheating or plagiarism in any form. While participating in an SFS program, students are expected to refrain from cheating, plagiarism and any other behavior which would result in a student receiving credit for work which they did not accomplish on their own. Students are expected to report any instance of cheating or plagiarism by others."*

Deadlines – Deadlines for written and oral assignments are instated to promote equity among students and to allow faculty ample time to review and return assignments before others are due. As such, deadlines are firm; extensions will only be considered under extreme circumstances. Late assignments will incur a penalty of 10% of your grade for each day you are late. After two days past the deadline, assignments will no longer be accepted. Assignments will be handed back to students after a one-week grading period. Grade corrections for any assessment item should be requested in writing at least 24 hours after assignments are returned. No corrections will be considered afterwards.

Content Statement – Every student comes to SFS with unique life experiences, which contribute to the way various information is processed. Some of the content in this course may be intellectually or emotionally challenging but has been intentionally selected to achieve certain learning goals and/or showcase the complexity of many modern issues. If you anticipate a challenge engaging with a certain topic or find that you are struggling with certain discussions, we encourage you to talk about it with faculty, friends, family, the HWM, or access available mental health resources.

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	**Introduction to Land Use, Natural Resources, and Conservation** We will discuss some of the expectations, goals, and purpose of the course, detailing overall content, field exercise (FEXs), grading system, and assignments.	L	1.0	
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/D	1.0	**Foley et al, 2005** Krausmann, 2013 Defries, 2010 Newbold, 2015 Borrelli, 2013

No	Title and outline	Type	Time (hrs)	Readings
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/D	1.0	**Bruggeman, 2018** Agrawal, 2017 Gilani, 2015 NBSAP, 2014 Reddy et al, 2018
4	**Application of GIS in NRM – An Introduction** Students will be introduced to GIS, data structures and how to perform basic analysis in a GIS.	L	1.0	
5	**FEX: GIS** Students will learn how to create basic land use maps and perform basic analysis	FEX	5.0	
	Mountain Forests and Water Resources			
6	**Traditional Land Use Practices in the Himalayas** We will discuss traditional practices of land uses in the Himalayas, such as tseri, shokshing and tsamdro. 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/D	1.0	**Penjore & Rapten 2004** **Wangdi et al. 2014** Dorji et al. 2006
7	**Natural Resources Management System & Challenges in Bhutan** Here we will discuss how natural resources in Bhutan under the Department of Forests and Park Services are Managed	L/D	1.0	**Forest and Nature Conservation code of best Practices 2020**
8	**Sustainable Forest Management 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/D	1.0	**Forest and Nature Conservation code of best Practices 2020**
9	**Sustainable Forest Management & Forest Management Units** A field 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 and Nature Conservation Code of Best Management Practices 2020"	L/FL	4.0	
10	**NRM: 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	L/D	1.0	**Wangdi, 2006**

No	Title and outline	Type	Time (hrs)	Readings
11	**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.	L/D	1.0	**ICIMOD & RSPN, 2014**
12	**Valuing ecosystem services, PES Namey Nichu Watershed** We will visit the Namey Nichu watershed and talk with a representative of the local community forestry group & 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.	FL	4.0	**MoAF (2012)**
13	**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.	L/D	1.0	**Adams, 2003**
14	**Can Forests be a Driver for Economic Growth?** 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.	SLD-1	2.0	**Kuensel Online**, Forestry can be a Bigger Driver than Hydropower **Kuensel Online**, Saving Bhutan's Forest & Saving Bhutan's Forests www.bliss.bt
15	**FEX: Forest Resource Inventory** We will conduct a forest resources inventory by taking measurements of DBH, height and other parameters of trees. This exercise will teach students to estimate volume of tree and biomass. The exercise will also teach how to survey understory vegetation and regeneration.	FEX	4.0	Forest Resource Inventory, 2014
16	**Agrobiodiversity & Development** 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	4.0	
17	**Agrarian Landscapes of Bhutan** 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	GL	1.0	**Wangchuk, 2015**

No	Title and outline	Type	Time (hrs)	Readings
	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.			
18	**Agroecology & Land Management** 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	4.0	**Partap, 1999** Ted Talks, Pablo Tittotel.
19	**FEX: Bhutanese Farming & Food Systems** 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 (homestays, 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. This will be continuous FEX that students will submit in the form of field journal/field note and an interactive map.	FEX	6.0	**Rasul, 2010**
20	**Natural Resources Based Small Scale Enterprises** We will visit some natural resource based economic enterprises in Paro/Thimphu. 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.	FL	4.0	**Saxena, 2001**
	Biodiversity Conservation and Management			
21	**Role of Institutions in Environmental Governance** 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	1.0	**Banerjee, 2016**
22	**Conservation Management Systems** 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	1.0	**Wilson, 2009**

No	Title and outline	Type	Time (hrs)	Readings
23	**Conservation Challenges – Human Wildlife Conflicts** Conservation related conflicts are increasing and need to be addressed 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.	SDL-2	1.0	**Sangay, 2008**
24	**In-situ and Ex-situ Conservation Approaches in Bhutan** We will visit the Nature Conservation Division Office in Thimphu will learn about in-situ conservation approaches, management of protected areas, other effective conservation measures, issues and challenges. We will also visit the National Biodiversity Center in Thimphu to learn about the ex-situ conservation initiatives in Bhutan.	FL	4.0	
Natural Resource Management in a Changing World			
25	**What do Conserved Landscapes Provide?** We will identify ecosystem services and define different valuation methods for attaching economic values to ecosystems, biodiversity, and landscapes.	L	1.0	**De Groot, 2002**
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 on future of land use, natural resources and conversation look like in Himalayas/Bhutan.	SLD-3	1.0	**Devereux, 2004**
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, and other relevant financial institutions.	GL	1.0	**McCarthy, 2012**
28	**Securing Bhutanese Landscapes | Capstone** 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?	L/D	1.0	**Bolch, 2012**
29	**Exam Review**	L/D	1.0	
		Total	60	
		UMN Instructional Hours*	72	

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.

2. **Banerjee, A., & Bandopadhyay, R. (2016).** Biodiversity hotspot of Bhutan and its sustainability.Current Science,110(4), 521-527. doi:10.18520/cs/v110/i4/521-527.

3. **Bolch, T., Kulkarni, A., Kääb, A., Huggel, C., Paul, F., Cogley, J. G., . . . Stoffel, M. (2012**). The state and fate of Himalayan glaciers. Science, 336(6079), 310-314. doi:10.1126/science.1215828.

4. **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.

5. 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.

6. **Devereux, S.,and Edward, J.(2004).** Climate change and food security. Climate Change and Food Security. IDS Bulletin 35.3: 22-30.

7. Foley, J. A., Ramankutty, N., Brauman, K. A., Cassidy, E. S., Gerber, J. S., Johnston, M., . . . Zaks, D. P. M. (2011). Solutions for a cultivated planet.Nature,478(7369), 337-342. doi:10.1038/nature10452.

8. **Foley, J.A., DeFries, R., Asner, G.P., et al. (2005).** Global consequences of land use. Science, (309) 5734, pp. 570-574, DOI: 10.1126/science.1111772.

9. **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.

10. **McCarthy, D. P., Donald, P. F., Scharlemann, J. P. W., Buchanan, et al. (2012).** Financial costs of meeting global biodiversity conservation targets: Current spending and unmet needs. Science, 338(6109), 946-949. doi:10.1126/science.1229803.

11. **MoAF, (2010).** The food security and food self-sufficiency in Bhutan. MoAF Thimphu Bhutan

12. MoAF,(2012), Benefit-sharing for Ecosystem Services with emphasis on Poverty Reduction. MoAF, Thimphu Bhutan.

13. **Penjore, D., and Rapten, P. (2004).** Trends of forestry policy concerning local participation in Bhutan. In: HARADA, K. and KANAGAWA, M. N. (eds.) Policy Trend Report 2004. Institute for Global Environmental Strategies

14. Pratap, T. (1999). Sustainable land management in marginal mountain areas of the Himalayan region. Mountain Research and Development, 19(3), 251-260.

15. **Rasul, G. (2010).** The role of the Himalayan mountain systems in food security and agriculture development in South Asia. International Journal of Rural Management, 6(1), : 95–116.

16. **Sangay, T., and Vernes, K. (2008).** Human-wildlife conflict in the Kingdom of Bhutan: Patterns of livestock predation by large mammalian carnivores. Biological Conservation, 141(5), 1272-1282. doi:10.1016/j.biocon.2008.02.027.

17. **Saxena, K. G., K. S. Rao, K. K. Sen, R. K. Maikhuri, and R. L. Semwal. 2001.** Integrated natural resource management: approaches and lessons from the Himalaya. Conservation Ecology 5(2): 14. [online] URL:http://www.consecol.org/vol5/iss2/art14/.

18. **Wangchuk, K., & Wangdi, J. (2015).** Mountain pastoralism in transition: Consequences of legalizing Cordyceps collection on yak farming practices in Bhutan. Pastoralism, 5(1) doi:10.1186/s13570-015-0025-x

19. **Wangdi, S., Norbu, N., Wangchuk, S.& Thinley, K. (2014).** Social restriction in traditional forest management systems, and its implications for biodiversity conservation in Bhutan. Bhutan Ecological Society.

20. **Wangdi, R., and Tshering, N. (2006)** Is community forestry making a difference to rural communities. A comparative study of three community forests in Mongar Dzongkhag, A Series of case studies on Community-Based Forest and Natural Resources Management in Bhutan. Ministry of Agriculture.

21. **Wilson, K.A.,Carwardine,J., and Possingham H.P. (2009).** Setting Conservation Priorities. The Year in Ecology and Conservation Biology, 2009: Ann. N.Y. Acad. Sci. 1162: 237–264 (2009). doi: 10.1111/j.1749-6632.2009.04149.x.