ECOLOGY AND CONSERVATION
THE PERU PROJECT
FALL 2017

SEPTEMBER 29 - NOVEMBER 11

ACADEMIC SYLLABUS

Instructor:
Geoff Gallice, Ph.D.

Office hours: We will all be in close contact, meeting every day throughout the course. There will be a number of "check-in days" where we will schedule student-instructor meetings. If you would like to have a meeting outside of those times, you can certainly make an appointment, or find an appropriate available time, and I am happy to oblige.

Class meetings: The Wildlands Studies Peru Project involves seven days per week of instruction and field research during the program. Faculty and staff work directly with students 6-10+ hours a day and are available for tutorials and coursework discussion before and after scheduled activities. Typically, scheduled activities each day begin at 7am, with breaks for meals. Most evenings include scheduled activities, including group reading discussions, faculty or guest lectures, structured study time, and workshops. When in the backcountry or at a field site, our activities may start as early as 4am or end as late as 10pm (e.g., for wildlife observation). It is necessary to be flexible and able to accommodate a variety of class times.

Course credit: Wildlands Studies Project students receive credit for three undergraduate courses. These three courses have distinct objectives and descriptions, and we integrate teaching and learning through both formal learning situations (i.e., lectures/seminars) and field surveys. Academic credit is provided by Western Washington University. Extended descriptions follow in the course description section of this syllabus.

1. **ESCI 437A, Environmental Wildlands Studies (5 quarter credits)** – Field study of environmental problems affecting the natural and human-impacted ecosystems of our study region, including the role of human interactions.
2. **ESCI 437B, Environmental Field Survey (5 quarter credits)** – In this field-based course we conduct on-site examinations and analyses of environmental problems affecting wildlands and wildlife in our study region.
3. **ESCI 437C, Wildlands Environment and Culture (5 quarter credits)** – Field studies course involving on-site research in our field location, studying the relationships among cultural groups and the environment. Using region- and culture-specific case studies, students assess historical and current cultural and environmental uses of wildlands and/or wildlife communities. Course examines outcomes of environmental policies and wildlands/wildlife management, including both sociological and natural consequences.

Readings: A Course Reader is established for this project and will be provided to students in electronic form in advance of the project. Students are responsible for printing the entire reader before the course and bringing it with them to Peru. Readings include selections from academic primary literature, technical reports, book chapters, and environmental impact assessments and planning documents. Field guides and textbooks supplement our field activities and are an integral part of our project; we will carry a shared reference library of these on all activities and backcountry trips.

Required texts: Three books are required for the Peru Project:

1. Forsyth, A. and K. Miyata. 1984. *Tropical Nature*. Touchstone, New York.
2. Kricher, J. 2017. *The new neotropical companion*. Princeton University Press, Princeton.
3. Terborgh, J. 2004. *Requiem for nature*. Island Press, Washington, D.C.

These books can be purchased at bookstores or at various online retailers. Amazon.com carries new and used copies of all three books for roughly $10-20, sometimes less for used books; other major retailers that may carry these books include bookdepository.com, barnesandnoble.com, and ebay.com, among others. **Please purchase paperback copies of these books**—Kindle or other electronic editions require the use of gadgets that we may not reliably be able to recharge, or that might fail due to wet and humid tropical conditions at our field sites.

*Please note: Students should read the entirety of *Tropical Nature* (except for Chapter 17) **before** arriving in Peru; there will be a quiz covering this material in the first days of the course.

Contents of this syllabus:

I. Project Overview

Our Peru Project introduces team members to the flora, fauna, diverse ecosystems, and conservation challenges of the southern Peruvian Andes and the Amazon rainforest. In the company of local biologists and other professionals, as well as representatives from local communities, we will encounter extraordinary biodiversity, learn about the threats posed by development and resource extraction, investigate methods in field ecology and conservation, and address questions of sustainable resource use and development. Most of our time will be spent in the Amazon, both the largest and most biodiverse rainforest ecosystem on the planet. Typically, we will travel by road, foot, or by boat to remote research stations and villages from which we will conduct our field studies. We will learn field research methods by participating in ongoing research and by conducting group projects at an active biological station. We will also gain an understanding of the ecological impacts of local and national government policy, Amazonian society, resource management practices, and development activities.

Participants will gain experience, skills, and understanding in three inter-related academic domains. These include: 1) Field research methods through a hands-on introduction to field methods for biological research regarding ecology, natural history, and conservation; 2) Ecology, conservation, natural resource management, and sustainable development in the southern Peruvian Andes and Amazon regions, and; 3) Culture and its environmental impact including an exploration of indigenous history and current issues with particular attention to relationships between society and the natural environment.

Our learning methods will be experiential and academic. We will learn through engagement with people, places, plants, and animals, as well as through academic means such as lectures, readings, and discussions. Our learning will be both traditional and communal, with each team member striving to bring new insights to the group based on discussions with biologists and Amazonian people, and analysis of wide-ranging experiences. Our guest speakers will include indigenous experts with sophisticated traditional knowledge of their local environments and biologists engaged in studies of lowland forest, mountain, and aquatic ecosystems.

We begin the Peru Project in Cuzco, high in the southern Peruvian Andes, where we will orient you to the program and our expectations during the first few days of the project. From Cuzco, we begin our descent down the eastern slope of the Andes along the world-famous 'Manu Road,' stopping first at the Wayqecha Biological Station. At Wayqecha we'll study the ecotone where the windswept Andean altiplano meets lush Andean cloud forest, including an almost overwhelming abundance and variety of epiphytes: orchids, bromeliads, ferns, and mosses, as well as unique cloud

forest animals ranging from birds to insects to amphibians to Andean bears. From Wayqecha we continue our descent, ending in Pillcopata, where we will spend several days exploring primary and secondary rainforest habitats, including a several-day backpacking trip to the privately-managed 'Gallito de las Rocas' conservation concession where we'll have stunning views of cloud forest and mid-elevation rainforest, with the towering Andes as the backdrop.

From Pillcopata we'll travel for almost two entire days by motorized canoe to reach the remote Cocha Cashu Biological Station, located in the heart of Manu National Park, the gem in Peru's protected area network in the Madre de Dios region. Here, students will complete group research projects that will emphasize field research methods in tropical ecology and conservation studies. Reading discussions, seminars, and faculty presentations continue during this period. At Cocha Cashu, due in part to its geology and also to its remoteness, we'll have the opportunity to study pristine lowland tropical rainforest that is essentially free from human impact (although hunter-gatherers do inhabit the area in low densities), and which is bursting with wildlife such as giant river otters, monkeys, harpy eagles, tapirs, and jaguars.

Our next stop is the Los Amigos Biological Station, adjacent to the 370,000-acre Los Amigos Conservation Concession. At Los Amigos we will explore the rainforest canopy, conduct river-based surveys for birds, mammals, and reptiles, and paddle through an 'aguajal'—a swamp dominated by *Mauritia flexuosa* palm trees that is a preferred habitat for anaconda. Los Amigos is a pioneering conservation effort—a concession not for mining, logging, or oil extraction, but for the protection of biodiversity—that aims to preserve a major part of a biological corridor between Manu National Park (where we are coming from) and the Tambopata National Reserve (towards which we are headed next).

Our final field site will be Finca Las Piedras, a small non-profit farm and research site near Puerto Maldonado, the bustling economic hub of Madre de Dios. Here we will examine the impacts of the expanding agricultural frontier along the recently completed Interoceanic Highway that connects Peruvian Pacific ports to ports on Brazil's Atlantic coast. We will also learn about what is being done to make economic activities in the region more friendly to wildlife and biodiversity, and more sustainable in the long term—promoting the harvest of cacao, Brazil nuts, and other non-timber forest products is among the organization's key strategies. From Finca Las Piedras we'll return to Puerto Maldonado, where the project concludes.

II. Learning objectives

Following this course, students should have working knowledge of, and experience in:

1. ***Southern Peruvian Andean and Amazonian ecosystems, including their flora, fauna, and ecological processes.*** Due in part to its location at the juxtaposition of the massive Andes mountains and the vast Amazon basin, our field location is home to a vast variety of plants and animals that occupy a very large number of ecosystems and microhabitats. We will try to make sense of this 'hyper-diversity' by surveying some key plant and animal groups, and by exploring some of the processes underlying community structure and function. Activities will include plant and animal identification workshops, and readings and lectures covering Andean and Amazonian ecology at a variety of scales.

2. ***Field observation skills, including methods for documenting and sharing findings in multiple formats.*** Sharp field observation skills are key to uncovering natural processes and the interactions between plants, animals, and their environment. Through direct learning of geology, ecology, and biology in the study region, students will gain direct experience in observing the world around them and will become adept at critically examining plants, animals, and other ecosystem features, comparing those features to other ecosystems, analyzing relationships between different organisms and their environment, etc. Following an introduction to various techniques of recording data (e.g., through natural history sketching, field journals, and species account techniques), students will gain experience using a variety of techniques to present natural history observations. One of the most important components of this objective is learning how to keep good field notes.

3. ***The cultural, political, and management history within the Southern Peruvian Andes and Amazon regions and, in particular, within different management units and parks we visit.*** Emphasis includes indigenous perspectives, policies governing conservation, management, and resource use, potential problems associated with these policies, and local community involvement. Following introductory lectures and readings on the cultural, political, and management history in the region, students will have the opportunity to meet with local residents and land managers who can relay to the students their experiences with conservation and land use.

4. ***Introduction to various field research techniques and equipment used in ecological studies.*** Students will gain field research experience through a series of assignments and activities designed to introduce them to the wide array of techniques utilized in ecological studies. Students will implement these techniques in various locations throughout the course. Examples of some of these techniques include vegetation plot and transect surveys, bird point count surveys, methods for collecting forest arthropods, and backcountry navigation using compass and global positioning systems.

5. ***Designing a field research project, collecting field data, managing, synthesizing, and presenting interpretations of this data to peers, faculty, and the public both in writing and in presentation.*** Students are mentored through the research process by a faculty advisor, through workshops, and through working with a small group of their peers. The skills learned in this project are transferable to other fields (and to their future careers): working well within a group, taking and using feedback, managing, synthesizing and interpreting information, presenting interpretations in oral presentation and in written form.

6. ***Critical reading, discussion, and evaluation of primary literature in ecology and conservation science and policy.*** Throughout this course we rely mostly on primary literature in lieu of a textbook, therefore, students gain a significant amount of experience reading and critically discussing primary literature. Following an introductory lecture and workshop on "how to read a scientific paper," students read at least one piece of primary literature each day, learning over time and with practice where to focus their attention to be able to critically evaluate the work. Each reading is debriefed with a group discussion, ensuring that students have understood the work and are able to critically evaluate it. The first discussions will be led by faculty members, demonstrating to the students how to facilitate a discussion, generating critical thinking and positive contributions. Students will then each lead at least one discussion on the primary literature during the course.

7. ***Basic theoretical concepts of wildness vs. wilderness, management vs. preservation, sustainable development and environmental sustainability, and the practical applications of these concepts in conservation and human experience.*** Students will gain knowledge and appreciation for the differences among these concepts and their usage in the popular and the primary literature. These concepts are frequently encountered throughout this course in readings, discussions, and visits with local experts. Issues surrounding their influence on conservation and management are discussed frequently throughout the course.

8. ***Critical examination of various approaches to conservation used in the southern Peruvian Andes and Amazon regions***. Through visits to different types of conservation areas – a large privately owned conservation allotment, a national park, the world's first conservation concession, a family-run Brazil nut plot, and pristine but legally unprotected areas – students will gain firsthand experience understanding the challenges and advantages of these different approaches to conservation. At each location we will meet with land managers whenever possible, providing students the opportunity to hear from local actors what the conservation and management objectives at that location are, how they are being implemented, and what they believe is working (or not working). We will look at what makes each location unique – in terms of its ecology, resources, history of use, current use, accessibility to the public, threats, etc.

These topics will be addressed through informal field and classroom lectures and discussions, course readings, field visits, extended backcountry excursions, and independent and group field research projects. The course generally

progresses from faculty-led instruction in the beginning (i.e., more lectures and readings) to student-led critical evaluation, analysis, and synthesis in the end of the course. Our overarching goal is to have students leave the course not only with extensive knowledge about this particular region, but also broader skills and understanding of ecological and social issues that allow students to critically evaluate information in other settings in their future lives and careers.

III. Course descriptions

We teach these three courses in an integrated format in the field; however, students will receive transcript credit for the following three courses:

ESCI 437A, Environmental Wildlands Studies (5 quarter credits) – In this field-based course we introduce practical, theoretical, and analytical skills and apply them to the hands-on biological study of the diverse flora and fauna, as well as ecological processes, of our study region. We will explore the process of field research in the tropics from the formulation of questions and the generation of hypotheses to the collection, analysis, and interpretation of data.

Experiences/Activities: Extended field study of flora, fauna, biotic communities, and ecological relationships within the study region. Students participate in field research that may cover topics spanning wildlife, plant, and community ecology, conservation biology, natural history, surveys of key plant and animal species, monitoring of populations of rare species, assessment of management approaches, and tropical biology. Various ecological and other biological research techniques will be taught through firsthand experience or through review of literature—historical and current techniques—including their advantages and disadvantages. After studying various methods for conducting field-based research in the tropics, as well as examining an array of possible research topics, students will be assigned to groups of two to three, and each group will propose and carry out a research project. The proposed project should be feasible given the time allotment and materials available. Student projects from past Wildlands Studies courses in Peru have included an examination of the effect of topography and vegetation structure on bird foraging, primate behavior, edge effects on plant and insect communities, and nocturnal surveys of amphibians and aquatic reptiles such as black caiman; other possible topics include, but are not limited to studies of the community of decomposers, stratification of the rainforest, limnological studies, and adaptations of flowers to tropical pollination syndromes. Taught in conjunction with ESCI 437B and ESCI 437C.

Outcomes: Students will gain the ability to undertake a substantial, complex field project and will be able to gather, organize, analyze, interpret, and present data in a way that is appropriate to the audience and subject matter.

Evaluation/Assessment: Final project, including preparation, fieldwork, analysis, written final report and oral presentation. The oral presentation and written report are 50% and the project proposal, field effort, and project participation are 50% of the grade.

ESCI 437B, Environmental Field Survey (5 quarter credits) – Field study of the natural and human landscape, and the problems affecting undisturbed and human-impacted ecosystems in our study region. We will explore the ecological and anthropogenic mechanisms driving tropical plant and animal community assembly, function, and change.

Experiences/Activities: Students will learn the concepts and principles of environmental studies, wildlife and natural resource management, and field-based ecological and biological research. A number of individual and group assignments will test students' ability to work individually and as a team to explore topics ranging from plant-insect interactions and pollinator syndromes to the use of camera trapping to monitor wildlife populations to the carbon-storage potential of various Andean and Amazonian forest habitats in the study region. Other skills to be taught include backcountry navigation and proper use of map, compass, and GPS, wildlife observational skills and species identification of key groups of plants and animals, critical assessment of key ecosystem features, and indicators of environmental quality. Students will learn the importance of proper experimental design, data collection techniques, analysis of field data, and report writing. The importance of good note taking will be stressed through daily field journal entries in which students will document their expectations and experiences and synthesize what they have learned through hands-on individual and group activities and assignments. The field journal will also be used to document natural history observations and site-specific species lists. Students will learn to observe, identify, and

catalogue biodiversity in a format useful in future studies and by other field workers. Taught in conjunction with ESCI 437A and ESCI 437C.

Outcomes: Students will develop skills in field observation and documenting and sharing observations in multiple formats, including critically discerning appropriate formats for each subject or audience.

Evaluation & Assessment: 25% is the Field Journal, evaluated by faculty in several reviews during the program. Expectations for the Field Journal will be covered in detail at the start of the program. Included in the field journal component of the final grade are four extended entries based on group activities conducted at several field sites. Another 25% of the grade is divided across four group research activities. The remaining 50% is the final exam, completed during the final days of the course.

ESCI 437C, Wildlands Environment and Culture (5 quarter credits) – Field-based course that stresses the relationships between society and the environment. Using region-specific case studies, students assess historical and current impacts of human activity on wildlands and wildlife populations, and explore the socioeconomic and environmental outcomes of policy, management activities, and local resource use.

Experiences/Activities: Students will gain a better understanding of the relationship between society and the environment through an in-depth exploration of the primary literature. Students will learn to read and critically evaluate information from a variety of sources, including scientific journal articles, reports generated by government agencies or non-governmental organizations (NGOs). Students will learn to synthesize the information gathered from primary literature with their observations in the field to assess the outcomes of historical and contemporary policy decisions, wildlife and natural resource management actions, the economic activities of local communities, and the conservation actions of non-profit organizations on the natural and cultural landscape. Taught in conjunction with ESCI 437A and ESCI 437B.

Outcomes: Students will gain the ability to critically read and evaluate primary scientific and policy literature. Students will also gain a knowledge base in wildlands natural history and policy, with specific emphasis on southern Peru.

Evaluation & Assessment: Participation in discussions is 25% of the final grade, the four quizzes are 25%, and final exam is 50%.

IV. Assessment

The following is an overview of the academic requirements for the program. Some of the assignments are ongoing (field journal and reading discussions) and some have specific dates (e.g., quizzes, group activities, final exams). Due dates are subject to adjustment in response to weather, transportation delays, etc. Final grades for each course listed above will be based on the following items:

Course number	Assessment item		Date due[1]	Percent of grade
ESCI 437A	Research project	Proposal	15 Oct.	25%
		Fieldwork/participation	Ongoing	25%
		Oral presentation	31 Oct.	25%
		Final report	31 Oct.	25%
ESCI 437B	Field journal		13 Oct./9 Nov.	25%
	Group activities		See Part VII	25%
	Final exam		10 Nov.	50%
ESCI 437C	Reading discussions/questions		Ongoing	25%
	Quizzes		See Part VII	25%
	Final exam		10 Nov.	50%

1. Dates subject to change due to weather or other logistical constraints.

ESCI 437A. Research project

The research project is a group project; after introductory lectures and investigations through the rainforest, students, in groups of 2-3, will propose projects that can be completed within the allowed time at the research station (Cocha Cashu), or about 10 days. Projects may also be assigned that are within the expertise of the instructors, including ecology, entomology, botany, natural history, and wildlife studies. Your final grade includes preparation, participation, field work, written report, and oral presentation. Students will be evaluated on participation during the collaborative field work as well as on specific contributions to the final written and oral products, both by instructors and by peers.

Components of the research project

1) *Research proposal*
   The proposal should include an Introduction that lays the foundation for the proposed questions/research topic. Introductions generally start broad and narrow towards the specific question to be addressed. The final sentence of the introduction should be a statement of the question to be addressed. Other components of the proposal include a Hypothesis, if relevant; a detailed Methods section, in which you will outline the study site(s), focal group(s), materials to be used, and observational/experimental techniques to be used; Expected Results, in which you outline your anticipated findings; and a Discussion, in which you will discuss the implications of your expected findings, as well as the implications of your arriving at different results. Pay close attention to the formulation of your proposal—this is a crucial component of your research project and the design of your observations/experiments at this stage will determine the success of all your subsequent work. Make sure to think carefully about all possible shortcomings and contingencies of your research plan, including the inability to find your model organisms, what to do if inclement weather disrupts data collection, what to do if you collect insufficient data, etc. Make sure to propose a project that is feasible in the short time permitted and using the limited resources at our disposal.
2) *Field work and participation*
   All group members are expected to contribute equally in experimental design, collection and analysis of data, and presentation of results. Participation will be monitored throughout the various stages of the research project.
3) *Oral presentation*
   The oral presentation is your chance to share your research with your peers. In a 10 minute presentation, each group should cover all the major components of the research project, including a brief introduction to the research topic and questions, brief overview of the methods used, results, and a discussion of the importance and implications of findings. After each presentation, 5 minutes will be allowed for questions from the audience.
4) *Written report*
   The written report, included at the back of the field journal, will be a detailed account of every component of the research project, including a detailed introduction to the study topic and questions addressed, detailed methods, results, and a thoughtful discussion of the importance and implications of all findings. Results should be conveyed using appropriate charts, graphs, and tables in a way that clearly presents major results.

ESCI 437B. Field journal

The field journal is an integral part of the Wildlands Studies Peru Project experience. All scientists who work in the field keep a field journal in which they record everything they find, observe, and collect. Observations at all levels of organization from the individual organism to the ecosystem, including behavior, natural history and life history traits, distribution, abundance, habitat, landscape, human dimensions, and how all of these might be interrelated go in the field journal. The journal is a permanent record of observations and, no matter what the purpose of the field trip, the journal contains all the evidence on which all subsequent work will be based. It is also a place where your observational skills are repeatedly and continuously tested and sharpened. The field journal will contain scientific evidence that might one day be used as a reference to others and in order to fulfill its purpose, it should be useful and comprehensible to others, perhaps long after the author is dead (hint: especially to Wildlands faculty, who will read and grade the journal). We will introduce journal-writing style and our expectations during the first few days of the project. Important: Do not lose your field journal! Make sure to put your name, address, phone number, and email address in a conspicuous spot. The data contained within your journal cannot be reconstructed, and losing it will be disastrous!

There will be a number of group assignments that will be recorded in the field journal. These entries should be easily located (i.e., in a separate section of the journal and easy for the course instructor to find).

Requirements:

1) *Daily entries (40 total; 5 pts each):*
   The daily entry contains the who, what, where, why, and when of the day's activities. You should begin with the basics: site name/location, date, temperature and weather conditions (cloudy, sunny, windy, raining, cold, hot, etc.), soil conditions (e.g., moist or dry), who you were with, etc. Then record your observations—keep in mind that you can never record too many observations, and no matter how trivial some observations might seem at the time, every single observation in the field journal will become valuable information later as you attempt to synthesize your experiences. Things to note might be dominant plants in flower at your field site, any pollination or feeding activities observed, groups of conspicuous animals, dominant vegetation at the field site, patterns of human land use, condition of the local habitat (e.g., pristine, degraded/disturbed, etc.). Anything you think might be important goes in the journal, and remember, nothing is too trivial to be recorded. When in doubt, *write it down*.
2) *Species descriptions (40 total; 5 pts each)*:
   As part of your daily entry each day, you will be noting many new species you observe. However, each day you will also note at least one species of plant, mammal, bird, arthropod, or fungus that captured your attention. Describe the species in detail: its size, appearance, behavior, microhabitat, interactions with other species, and anything else you found interesting about it. Remember to describe the organism, its habitat, and its behavior in detail—nothing is too trivial. An important part of a species description is a drawing of the organism, including important details about its habitat if relevant; the drawing will add information that cannot be easily expressed in words and will complement the written description. You won't be graded on the aesthetic quality of your drawing, but you will be expected to put effort into it such that it is a useful contribution to the species description. With the exception of insects, fungi, and some birds and small mammals, unidentified species will not count towards your points for the day's species description. However, don't shy away from writing about organisms you can't immediately identify—use the resources at your disposal, including the project reference library, resources at the various field sites, faculty, and your peers. A major part of the job of a field naturalist is species identification, and although sometimes difficult, this is an important and rewarding aspect of field biology.

Journal Grading Criteria:

1) Orienting Information: All entries need orienting information, even if written on the same day.
2) Consistency of entries: This refers to regular and consistent use of the journal. Points will be deducted for missing entries as noted above.
3) Organization: You should be able to use your journal as a reference. Information should be accessible and related to specific dates and locations.
4) Neatness/Readability: Someone else should be able to use your journal as a reference (or grade it). Entries that are illegible will receive a grade of zero.
5) Diversity of Expression: We encourage you to use a diversity of journaling techniques. Avoid using only one form of expression.
6) Detailed Observation: Attention to detail will improve your observation skills.
7) Effort: Did you use your field journal and improve your skills throughout the course?

ESCI 437B. Final exam

This is a written exam during the final days of the course; it will take about 1-3 hours. We see this exam as a teaching/learning tool to solidify what you have learned up to this point in the program. The exam is set up as a series of essay questions. Questions draw on our field experiences, course lectures, and reading material, and will require understanding of the material, not straightforward memorization. For example, we may ask you to synthesize what you have learned about field ecology research methods, as well as the flora, fauna, and habitats of the study region, by designing a study to investigate the biology of a focal group of organisms, or we may ask you a series of questions

probing your understanding of the interactions between the natural and human landscapes encountered throughout the course.

ESCI 437C. Reading discussions
This is ongoing throughout the program and includes group discussions of many of the readings presented in the Course Reader, incorporating readings from biology and ecology, general natural history, biodiversity conservation, social sciences, and wilderness and management theory (see the Reading List below in VIII). We will tailor the discussions and reading choice to our backcountry location and current topic focus, so that knowledge is developed in a logical progression. We will cover the basics of reading primary literature on one of the first days of the program, and then will expect you to read on average one primary literature piece each day while in the field. We will often discuss these readings as a group, typically at the end of the day, before having dinner, to maximize our time in the field. However, due to logistical considerations some discussions will be at other times; it is the responsibility of the student to make sure he or she is prepared for all group discussions. We suggest you leave yourself ample time to read the papers before we meet as some may take longer than others to digest. Your grade will be based on whether you participate in the discussions, whether it is obvious that you read and understood the reading, and your participation on other activities we do with readings (e.g., pre-discussion questions, student-led discussions, etc.).

ESCI 437C. Quizzes
Quizzes will be administered to periodically evaluate your synthesis of the reading material. Questions will be drawn from the previous week's readings, and will cover experimental design, results, conclusions and interpretations of findings, as well as how those findings relate to our experiences and other topics discussed during the course. Please note that a quiz covering Forsyth & Miyata (1984; required reading before the course start date) will be given in the first few days of the project.

ESCI 437C. Final exam
This exam will be administered along with the final exam for ESCI 437B, and will take about 1-3 hours to complete. This exam will be set up as a series of essay questions designed to test your understanding of the course material. For example, we may probe your understanding of the material by asking you to apply what you have learned about conservation strategies through the various course readings and activities by comparing them to a new scenario or location or by asking you to critically examine the conclusions of one of the readings compared to another which disagrees.

V. Grading scheme

Individual and group assignments will be assessed according to the following point schedule:

Course number	Assessment item		Points possible	Course total points possible
ESCI 437A	Research project	Proposal	400	1600
		Participation	400	
		Oral presentation	400	
		Final report	400	
ESCI 437B	Field journal		400	1600
	Group activities	Group activity #1	100	
		Group activity #2	100	
		Group activity #3	100	
		Group activity #4	100	
	Final exam		800	

ESCI 437C	Reading discussion participation/questions		400	1600
	Quizzes	Quiz #1	100	
		Quiz #2	100	
		Quiz #3	100	
		Quiz #4	100	
	Final exam		800	

To convert final grade percentages to letter grades for each course that will appear on your transcript, we will use the following grading scheme:

Letter grade	Percentage	Letter grade	Percentage
A	92.5 ≤ % < 100	C+	77.5 ≤ % < 80.0
A-	90.0 ≤ % < 92.5	C	72.5 ≤ % < 77.5
B+	87.5 ≤ % < 90.0	C-	70.0 ≤ % < 72.5
B	82.5 ≤ % < 87.5	D+	67.5 ≤ % < 70.0
B-	80.0 ≤ % < 82.5	D	62.5 ≤ % < 67.5
		D-	60.0 ≤ % < 62.5
		F	% < 60.0

VI. General reminders

Academic Integrity is as relevant in this field course as it is at your home institution. Plagiarism, using the ideas or materials of others without giving due credit, cheating, or putting forth another student's work as your own will not be tolerated. Any plagiarism, cheating, or aiding another to cheat (either actively or passively) will result in a zero for the assignment. Cases of academic dishonesty may be reported to your home institution.

Assignment deadlines are established to promote equity among students and to allow for ample assessment time from faculty before other assignments are due or other activities are to occur. Therefore, deadlines are firm and late work will receive at a minimum a 10% loss of grade points for each day they are late. If you believe that extenuating circumstances have prevented you from completing your work on time, make sure to discuss this with the relevant instructor as soon as possible and certainly before the work is due.

Participation and attendance are crucial throughout this project. Because of the demanding schedule and limited time, all components of the program are mandatory (unless indicated) and missing even one lecture can have a proportionally greater effect on your final grade. Hence, it is important to be prompt and prepared (i.e., with required equipment) for all activities.

Students with special needs should meet with the lead faculty member as soon as possible to discuss any special accommodations that may be necessary.

VII. Academic schedule & course content

Outlined in the following table, but subject to change; we will frequently change plans because of weather or because of opportunities that arise. The schedule is organized by location, and is intended to produce realistic student expectations regarding the timing of course activities and schedule. Each day will be full, and all activities, readings, assignments, etc. listed will be completed at the locations they are listed under. However, the timing of these activities will be determined on arrival. Exact schedule will be reviewed with students 1-3 days ahead of time.

Date	Location	Lecture topics & activities	Reading discussion	Assignments due
29 Sept.	Cusco	Students arrive; introductions; essential safety and orientation briefings; high-altitude acclimatization		
30 Sept.	Cusco	Supply time—food & equipment, incl. rubber boots Equipment and health review; academic requirements; course overview	Kricher 2017	Quiz #1 (Forsyth & Miyata 1984)
1 Oct.	Cusco-Wayqecha	Travel to Wayqecha Biological Station	Wade 2015	
2-6 Oct.	Wayqecha	Activities: Introductory cloud forest hikes Estimation of AGB part I Camera trapping Lecture topics: Andean/South American geology & biogeography Andean ecosystems & conservation issues Elevational/altitudinal gradients in biodiversity Insect diversity	Purugganan & Hewitt Erwin 1982 Peyton 1980 Rios-Uzeda et al. 2007 Goldstein et al. 2006 Espinosa & Jacobson 2012 Feeley & Silman 2010 Anderson 2016	3 Oct.: Group activity #2 part I questions due
7 Oct.	Wayqecha-Pillcopata	Travel to Pillcopata		
8 Oct.	Pillcopata	Andean cock-of-the-rock (*Rupicola peruvianus*) lek	McCain & Grytnes 2010	
9-12 Oct.	Pillcopata	Activities: Back country field study: 'Gallito de las Rocas' concession	Wolman 2004 Rice 2002	12 Oct.: Quiz #2 Biodiversity gradients
13-14 Oct.	Pillcopata-Cocha Cashu	13 Oct.: Travel from Pillcopata to Limonal guard post (Manu NP) 14 Oct.: Travel from Limonal to Cocha Cashu Biological Station	Kricher 2017 Salo et al. 1986 OTS 2015	13 Oct.: Field journals due for first revision

Date	Location	Lecture topics & activities	Reading discussion	Assignments due
15-26 Oct.	Cocha Cashu	Activities: Group research projects Estimation of AGB part II Camera trapping cont'd Insect diversity	Tobler et al. 2008 Groenendijk et al. 2014 Utreras et al. 2005 Laurance et al. 2002 Laurance 2005 Gallice et al. 2017 Wallace 2013 Terborgh et al. 2008 Terborgh 2004 Shepard et al. 2010 Yu et al. 2012	15 Oct.: Group research project proposals due 25 Oct.: Group activity #1 report due 25 Oct.: Group activity #2 report due 25 Oct.: Group activity #3 report due 25 Oct.: Quiz #3
27-28 Oct.	Cocha Cashu-Los Amigos	12 Feb. Travel from Cocha Cashu to Boca Manu 13 Feb. Travel from Boca Manu to the Los Amigos Biological Station		
29 Oct.-1 Nov.	Los Amigos	Activities: Palm swamp survey for anaconda Rainforest canopy observation Lecture topics: Los Amigos Conservation Concession	Swenson et al. 2011 Webster 2012 Ulmer 2014 Alvarez & Naughton-Treves 2003	31 Oct.: Group research project oral presentation & final report due
2 Nov.	Los Amigos-Finca Las Piedras	Travel from the Los Amigos Biological Station to Finca Las Piedras		

Date	Location	Lecture topics & activities	Reading discussion	Assignments due
3-10 Nov.	Finca Las Piedras	Activities: Aguaje (*Mauritia* palm fruit) harvest Agricultural visits Rain forest scavenger hunt	Taylor 1999 Peres et al. 2003 Asner et al. 2009 Oliveira et al. 2007 Lalasz et al. 2012 Soule 2013	5 Nov.: Quiz #4 8 Nov.: Group activity #4 report due 9 Nov.: Field journals due for grading
10 Nov.	Puerto Maldonado	Final exams		Final exams
11 Nov.	Puerto Maldonado	Course concludes		

VIII. Reading List

Material will be discussed according to the following schedule (dates listed are discussion dates; students should be prepared to discuss material on the date assigned). Discussion of readings will occur in the morning or evening, depending on the day's activities.

Sept. 30: Selections from: Kricher, J. 2017. The new neotropical companion. Princeton University Press, Princeton.

Oct. 1: Wade, L. 2015. How the Amazon became the crucible of life.

Oct. 2: Purugganan, M. & J. Hewitt. 2004. How to read a scientific article. Rice University.

Erwin, T.L. 1982. Tropical Forests: their richness in Coleoptera and other arthropod species. The Coleopterists Bulletin 36: 74-75.

Oct. 3: Peyton, B. 1980. Ecology, distribution, and food habits of spectacled bears, Tremarctos ornatus, in Peru. Journal of Mammology 61: 639-652.

Ríos-Uzeda, B., Gómez, H., & R.B. Wallace. 2007. A preliminary density estimate for Andean bear using camera-trapping methods. Ursus 18: 124-128.

Oct. 4: Goldstein, I., Paisley, S., Wallace, R., Jorgenson, J.P., Cuesta, F., & A. Castellanos. 2006. Andean bear-livestock conflicts: a review. Ursus 17: 8-15.

Espinosa, S. & S.K. Jacobson. 2012. Human-wildlife conflict and environmental education: evaluating a community program to protect the Andean bear in Ecuador. The Journal of Environmental Education 43: 55-65.

Oct. 5: Feeley, K.J. & M.R. Silman. 2010. Land-use and climate change effects on population size and extinction risk of Andean plants. Global Change Biology 16: 3215-3222.

Oct. 6: Anderson, J.L. 2016. An isolated tribe emerges from the rain forest. The New Yorker.

Oct. 8: McCain, C.M. & J.A. Grytnes. 2010. Elevational gradients in species richness. In: Encyclopedia of Life Sciences (ELS). John Wiley and Sons, Ltd., Chichester, U.K.

Oct. 10: Wolman, A. 2004. Review of conservation payment initiatives in Latin America: conservation concessions, conservation incentive agreements and permit retirement schemes. William and Mary Environmental Law and Policy Review 28: 859-884.

Rice, R. 2002. Conservation concessions: concept description. Center for Applied Biodiversity Science at Conservation International.

Oct. 13: Selections from: Kricher, J. 2017. The new neotropical companion. Princeton University Press, Princeton.

Salo, J., Kalliola, R., Hakkinen, I., Makinen, Y., Niemela, P., Puhakka, M., and P.D. Coley. 1986. River dynamics and the diversity of Amazon lowland forest. Nature 322: 254-258.

Oct. 14: OTS. 2015. Tropical biology: An ecological approach (course book).

Oct. 16: Tobler, M.W., Carrillo-Percastegui, S.E., Leite Pitman, R., and G. Powell. 2008. An evaluation of camera traps for inventorying large- and medium-sized terrestrial rainforest mammals. Animal Conservation 11: 169- 178.

Oct. 17: Groenendijk, J., Hajek, F., Johnson, P.J., Macdonald, D.W., Calvimontes, J., Staib, E., & C. Schenck. 2014. Demography of the giant otter (Pteroneura brasiliensis) in Manu National Park, south-eastern Peru: implications for conservation. PLoS ONE 9: e106202. doi: 10.1371/journal.pone.0106202.

Utreras, V., Suárez R., E., Zapata-Ríos, G., Lasso, G., & L. Pinos. 2005. Dry and rainy season estimations of giant otter, *Pteronura brasiliensis*, home range in the Yasuní National Park, Ecuador. Latin American Journal of Aquatic Mammals 4: 191-194.

Oct. 18: Laurance, W.F et al. 2002. Ecosystem decay of Amazonian forest fragments: A 22-year investigation. Conservation Biology 16: 605-618.

Oct. 19: Laurance, W.F. 2005. When bigger is better: The need for Amazonian mega-reserves. Trends in Ecology and Evolution 20: 645-648.

Oct. 20: Gallice, G., Larrea-Gallegos, G., & I. Vásquez-Rowe. 2017. The threat of road expansion in the Peruvian Amazon. Oryx.

Oct. 21: Wallace, S. 2013. Mahogany's last stand in *National Geographic* April 2013, pp. 112-127.

Oct. 22: Terborgh, J., Nuñez-Iturri, G., Pitman, N.C.A., Cornejo Valverde, F.H., Alvarez, P., Swamy, V., Pringle, E.G., and C.E.T. Paine. 2008. Tree recruitment in an empty forest. Ecology 89: 1757-1768.

Oct. 23: Terborgh, J. 2004. Requiem for nature. Island Press, Washington, D.C.

Oct. 24: Shepard, G.H., Rummenhoeller, K., Ohl-Schacherer, and D.W. Yu. 2010. Trouble in Paradise: indigenous populations, anthropogenical policies, and biodiversity conservation in Manu National Park, Peru. Journal of Sustainable Forestry 29: 252-301.

Oct. 25: Yu, D.W., Shepard, G.H., Ohl-Schacherer, J., & T. Levi. 2013. Resolving the people-park conflict in Manu with the Occupy Amazon strategy. In: Reporte Manu 2013: Pasión por la Investigación en la Amazonía Peruana. San Diego Zoo Global Peru.

Oct. 29: Swenson, J.J., Carter, C.E., Domec, J-C., and Delgado, C.I. 2011. Gold mining in the Peruvian Amazon: global prices, deforestation, and mercury imports. PLoS ONE 6(4): e18875. doi:10.1371/journal.pone.0018875.

Webster, D. 2012. The devastating costs of the Amazon gold rush. Smithsonian Magazine, February 2012.

Oct. 30: Ulmer, G.L. 2014. Gold mining and unequal exchange in western Amazonia: a theoretical photo essay. disClosure: A Journal of Social Theory 24: article 2.

Oct. 31: Alvarez, N.L. and L. Naughton-Treves. 2003. Linking national agrarian policy to deforestation in the Peruvian Amazon: a case study of Tambopata, 1986-1997. Ambio 32: 269-274.

Nov. 3: Taylor, D. 1999. Tasty Brazil nuts stun harvesters. Smithsonian Magazine, April 1999.

Nov. 4: Peres, C.A. et al. 2003. Demographic threats to the sustainability of Brazil nut exploitation. Science 302: 2112-2114.

Nov. 5: Asner, G.P., Rudel, T.K., Aide, T.M., Defries, R., and R. Emerson. 2009. A contemporary assessment of change in humid tropical forests. Conservation Biology 23: 1386–1395.

Nov. 6: Oliveira, P.J.C., Asner, G.P., Knapp, D.E., Almeyda, A., Galvan-Gildemeister, R., Keene, S., Raybin, R.F., & R.C. Smith. 2007. Land-use allocation protects the Peruvian Amazon. Science 317: 1233-1236.

Nov. 7: Lalasz, R., Kareiva, P., & M. Marvier. 2011. Conservation in the anthropocene: Beyond solitude and fragility. Breakthrough Journal 2.

Nov. 8: Soulé, M. 2013. The "new conservation." Conservation Biology 27: 895-897.