WILDLIFE AND ECOSYSTEMS
THE ECUADOR PROJECT
WINTER 2017
JANUARY 18 – MARCH 3

ACADEMIC SYLLABUS
Lead instructor:
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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 Ecuador 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. Scheduled activities each day begin as early as 6 am, with breaks for meals. Most evenings include scheduled activities, as well as reading discussions, guest lectures, structured study time, and night time field activities. When in the backcountry or at a field site, our activities may start as early as 4 am or end as late as 10 pm (e.g., for wildlife observation). It is necessary to be flexible and able to accommodate a variety of class and activity 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 and 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 497T, 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 497U, 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 497V, 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 wildland and/or wildlife communities. Course examines outcomes of environmental policies and wildland/wildlife management, including both sociological and natural consequences.

Readings: A Course Reader that includes various selections from the primary literature will be an integral part of our project in Ecuador. The Reader will be provided to students via the web in advance of the project; students should print it in its entirety, have it bound, and bring it with them to Ecuador. Please note that there are three additional texts that will supplement the Course Reader (listed below); students are required to purchase these and bring them Ecuador. Field guides and other reference materials will also be available at

several of our field sites, as well as in a small, shared reference library that we will carry with us throughout the project.

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

1. Forsyth, A. & K. Miyata. 1984. *Tropical Nature*. Touchstone, New York.
2. Kricher, J. 1997. *A Neotropical Companion*. Princeton University Press, Princeton.
3. Weiner, J. 1995. *The beak of the finch: a story of evolution in our time*. Vintage Books, New York.

These books can be purchased at or through bookstores or at various online retailers, such amazon.com. Please purchase paperback copies of these books; electronic editions require the use of gadgets that we may not reliably be able to charge, or that might fail due to wet and humid tropical conditions at our field sites.

* Students should read the entirety of Forsyth & Miyata (1984) **before** arriving in Ecuador; there will be a quiz covering this material in the first days of the course. Weiner (1995) should be read in its entirety on or before 23 February, when we travel to the Galapagos Islands; students will be quizzed on this material at that time.

Contents of this Syllabus:

I. Project Overview

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 methods for biological research regarding ecology, natural history, and conservation; 2) Ecology, geological and anthropogenic history, flora, and fauna of Ecuador's diverse tropical ecosystems, and; 3) conservation, natural resource management, and sustainable development, with particular attention to the relationship between society and the natural environment.

Our learning methods will be experiential and academic. We will learn through direct 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 people from our various study sites, 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 montane, lowland forest, island, and coastal ecosystems.

We begin the project in Quito, the Ecuadorian capital nestled high in the tropical Andes, where we will cover the program goals and expectations, as well as essential risk management information. From Quito we will travel higher still into the Andes to our first field site, the Guandera Biological Station, where the chilly

grasslands of the paramo are the dominant ecological feature. Here, the bizarre frailejones, a giant member of the daisy family, contribute to the mysterious, almost other-worldly atmosphere of this unique ecosystem. Traveling down the eastern Andean slopes towards the Yanayacu Biological Station, our second field site, the paramo gives way to cloud forest, so named because the trees are enveloped in a near-perpetual covering of fog and mist. Here in the Andes we will hone our field and observational skills, examine endemic plant and animal species, and study conservation initiatives to protect these disappearing ecosystems. From the high Andes we will descend to the Rio Bigal Biological Reserve, at the base of the Sumaco volcano, where we will get our first taste of the Amazon rainforest. Spanning an elevation of 1,400 to 3,600 feet in the Andean foothills, this unique reserve is home to a unique mix of Andean and Amazonian plants and animals: here, Andean spectacled bears and jaguars from the lowland jungle roam the same area. The reserve aims to protect biodiversity in an area of primary and secondary forest that serves as a buffer to the adjacent Sumaco-Galeras National Park. At Bigal, we will focus on plant and animal census techniques, field observational skills and ecological study, and biodiversity inventory and monitoring.

From the foothills of Rio Bigal we will travel deep into the lowland Amazon rainforest to Yasuni National Park, part of a larger UNESCO Biosphere Reserve that is home to the highest levels of biodiversity known on earth. On the trails in Yasuni we'll be able to find as many as 600 species of birds and 10 species of primate; other wildlife here include herds of white-lipped peccary up to 300 strong, enormous black caiman, anacondas, big cats including jaguar and puma, and giant anteater (among many, many others). While the majority of Yasuni's rainforest is intact and wildlife populations are generally healthy, oil development within the park has emerged as a growing threat in recent decades, bringing the danger of environmental contamination, road construction, and colonization, as well as dramatic changes to local indigenous communities. In Yasuni we will further enhance our field skills by conducting group research projects on topics ranging from plant phenology to insect biodiversity to primate or bird behavioral studies. We will also examine the various conservation challenges facing this ecological treasure.

After our time in the Amazon we will travel back across the Andes and far off the Ecuadorian coast to the Galapagos archipelago, perhaps the world's most famous natural evolutionary laboratory. In the Galapagos we will study how extreme isolation has helped produce a flora and fauna that is almost entirely endemic. Having evolved in the complete absence of predators, the islands' wildlife is without fear of humans. Charles Darwin famously described an episode in which he repeatedly threw a marine iguana as far as he could into the sea, only to have it return time after time to him. Darwin noted that 'this reptile has no enemy whatsoever on shore, whereas at sea it must often fall prey to the numerous sharks'. Of course, we will study marine iguanas and other Galapagos wildlife – including sea lions, blue-footed boobies, frigatebirds, albatross, and giant tortoises – from a greater distance than did Darwin, but his account is nonetheless revealing of the island's evolutionary isolation. In the Galapagos we will also study the human activities that now threaten local plant communities and wildlife, and what is being done to protect and restore the archipelago's fragile and irreplaceable ecosystems.

This project in Ecuador provides an exciting opportunity to learn about the functioning of diverse ecosystems from the Andes to the Amazon and on to the remote Galapagos, as well as the interaction between the natural environment and local communities in one of the most visually stunning and biodiverse spots on the planet. By the end of the project, team members will have a deep understanding of the Ecuadorian natural and human landscape, the human activities that threaten both, and the efforts underway to conserve and restore the natural environment for the benefit of people and myriad tropical plant and animal species.

II. Learning Objectives

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

1. ***Andean and Amazonian ecosystems of Ecuador, 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, as well as the isolation of the Galapagos archipelago, our field location is home to a stunning 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 key plant and animal groups, and by exploring the processes underlying community structure and function. Activities will include plant and animal identification workshops, and readings and lectures covering Andean, Amazonian, and island 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 and presenting information (e.g., natural history sketching, Grinnell-style 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 of the Ecuadorian Andes, Amazon, and Galapagos 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, mammal surveys using camera traps, 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 orally and in writing.*** 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 future careers): working well within a group, receiving 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 students how to facilitate a discussion, as well as how to think critically about the reading topic and methodology. Later, students will organize themselves into smaller reading groups and work through a set of questions designed to test synthesis of the material.

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 Ecuadorian Andes, Amazon, and Galapagos regions***. Through visits to different types of conservation areas – two small privately-managed reserves adjacent to larger state-protected areas, the country's largest national park in the lowland Amazon, the mosaic of protected areas and degraded lands in the Galapagos, 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 lecture and discussion, course readings, field visits, extended backcountry excursions, and 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 towards the end. Our overarching goal is to have students able to leave the course not only with extensive knowledge about this particular region, but also with broader skills and understanding of ecological and social issues that will allow them 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 497T, 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 design and implement research projects 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, documentation of human disturbance patterns, assessment of management approaches, and tropical biology. Various ecological and other biological research techniques will be taught through demonstration or by examining the literature; both historical and current techniques will be evaluated and compared, and their advantages and disadvantages considered. 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 into 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 and resources (i.e., materials) available. Student projects from past Wildlands Studies courses in Ecuador and other Neotropical countries have included an examination of the effect of topography on bird communities, primate daily activity patterns, edge effects on plant and insect communities, daily vertical migration of oxbow lake zooplankton, nocturnal surveys of aquatic reptiles such as black caiman, and quantification of the biomass harvested by leaf-cutter ants. Taught in conjunction with ESCI 497U and ESCI 497V.

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: The project proposal is 25% of the final grade; field effort and project participation are 25%; and the oral presentation and written report are each 25%.

ESCI 497U, 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 the evolution of insect mimicry complexes to the vertical stratification of rainforest butterfly species, and from 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 using GPS, as well as the proper use of map and compass, wildlife observation 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 497T and ESCI 497V.

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 during several reviews throughout the program (expectations for the Field Journal will be covered in detail at the start of the program). 25% of the grade will be several graded group activities that will be evaluated separately. The remaining 50% is the final exam, administered during the final days of the course.

ESCI 497V, 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 classic and contemporary primary literature. Students will learn to read and critically evaluate information from a variety of primary sources, including primarily scientific journal articles and 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 497T and ESCI 497U.

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 Ecuador.

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

IV. Assessment

The following is an overview of the academic requirements for the program. Some of the assignments are ongoing (journal entries and readings) and some have specific dates (e.g., group activities, quizzes, final exams). Due dates are subject to adjustment in response to environmental and logistical unpredictability. 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 497T	Research project	Proposal	10 Feb.	25%
		Fieldwork & participation	ongoing	25%
		Oral presentation	20 Feb.	25%
		Final report	20 Feb.	25%
ESCI 497U	Field journal		Ongoing	25%
	Group activities		See below	25%
	Final exam		2 March	50%
ESCI 497V	Reading discussions/questions		Ongoing	25%
	Quizzes		See below	25%
	Final exam		2 March	50%

[1] Dates subject to change due to weather-related and other logistical constraints.

ESCI 497T. Research project

The Research Project is a group project; after introductory lectures, discussions, and walks in the rainforest, students, in groups of 2-3, will propose projects that can be completed within the allowed time at the research station (Yasuní), or about 10 days. Projects may also be assigned that are within the expertise of the instructors, including conservation biology, 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. Students will also be required to participate for one day on another of their peers' projects to help provide a fresh perspective, and to broaden their field research experience.

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 and written 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. The oral presentation should be engaging, but avoid excessive jokes. After each presentation, 5 minutes will be allowed for questions from the audience. The written report, included in the field journal, will be a detailed account of every component of the research project, including a detailed introduction to the study topic and the 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 497U. Field journal

The field journal is an integral part of the Wildlands Studies Ecuador 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 (hint: especially to Wildlands staff, 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 disappointing!

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. Such information includes date, time of entry, location (both politically and in terms of local geography/ecology), weather, etc.
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) Detailed observation: Attention to detail will improve your observation skills.
6) Effort: Did you use your field journal and improve your skills throughout the course?

ESCI 497U. 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 497V. Reading discussions and questions

This is ongoing throughout the program and includes group discussions of most of the readings presented in the Course Reader, incorporating readings from ecology, general natural history, geology, 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 evenings of the program, and then will expect you to read on average one primary literature piece each day while in the field. We will discuss these readings as a group typically at the end of the day, before dinner. 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 understand. 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 in other activities we do with readings (e.g., student-led discussions, etc.).

ESCI 497V. Quizzes

Quizzes will be administered to periodically evaluate students' synthesis of the reading, lecture, and discussion material. Questions will be drawn from the previous week's reading topics, 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 course.

ESCI 497V. Final exam

This exam will be administered along with the final exam for ESCI 497U, and will also take about 1-3 hours to complete. This exam will be setup 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 497T	Research project	Proposal	400	1600
		Participation	400	
		Oral presentation	400	
		Final report	400	
ESCI 497U	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 497V	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 may frequently change plans because of weather or because of unexpected 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 precise 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	Readings	Assignments due
18 Jan.	Quito	Students arrive Introductions Essential safety & orientation briefing Health & safe travelling review Academic requirements & course overview		
19 Jan.	Quito	Quito city tour (Old Town) Equipment review Supply time – food & equipment	Kricher 1997	Quiz #1 Forsyth & Miyata 1984
20 Jan.	Quito-Guandera	Travel to Guandera Reserve and Biological Station	Hoorn et al. 2010	
21-25 Jan.	Guandera	Activities: Introductory cloud forest/paramo hike Group Activity #1: AGB part 1 (upper montane forest) Lectures: Andean/South American geology & biogeography	Spracklen & Righelato 2013 Keating 2007 Purcell & Brelsford 2004 Kessler 2002 Cuesta et al. 2003 Peyton et al. 1998 Goldstein et al. 2006 Espinosa & Jacobson 2012	23 Jan.: Group Activity #1 part 1 questions due
26-27 Jan.	Guandera -Yanayacu	26 Jan.: travel from Guandera Papallacta (hot springs) 27 Jan.: travel from Papallacta to Yanayacu	McCain & Grytnes 2010	26 Jan.: Field journals due for 1st revision
28 Jan. - 1 Feb.	Yanayacu	Activities: Introductory cloud forest hike Group Activity #1: AGB part 2 (cloud forest) Group Activity #2: Insect diversity Lectures: Elevational/latitudinal gradients in biodiversity Insect diversity, form, & function	Spector 2002 Feeley & Silman 2010 Chen et al. 2008 Greene 2005	31 Jan.: Group Activity #2 report due 1 Feb.: Quiz #2 Biodiversity gradients

Date	Location	Lecture topics & activities	Readings	Assignments due
2 Feb.	Yanayacu-Rio Bigal	Travel to Rio Bigal Biological Reserve	Kricher 1997	
3-8 Feb.	Río Bigal	Activities: Introductory Amazon rainforest hike Group Activity #3: Camera trapping Group Activity #4: Butterfly mimicry Lectures: The Amazon rainforest	Tobler et al. 2008 Vanderhoff et al. 2011 Langham 2004 Laurance et al. 2009 Laurance et al. 2014 Dodson et al. 1969 Finer et al. 2009	5 Feb.: Quiz #3 8 Feb.: Group Activity #3 report due 8 Feb.: Group Activity #4 report due
9 Feb.	Río Bigal-Yasuni	Travel to Yasuni National Park	Bass et al. 2010	
10 Feb. -21 Feb.	Yasuni	Activities: Group Research Projects Group Activity #1: AGB part 3 (lowland rainforest) Tiputini River wildlife safari	Salo et al. 1986 Nadkarni 1994 Ellwood & Foster 2004 Reyna-Hurtado et al. 2016 Groenendijk et al. 2014 Utreras et al. 2005 Espinosa et al. 2014 Terborgh et al. 2008 Blake et al. 2013 Finer et al. 2010 Keyman 2015 Sachs & Warner 2001 Asner et al. 2009	10 Feb.: Research Project proposals due 16 Feb.: Group Activity #1 report due 20 Feb.: Research Project oral & written reports due
22 Feb.	Yasuni-Quito	Travel from Yasuni to Quito	Weiner 1995	

Date	Location	Lecture topics & activities	Readings	Assignments due
23 Feb.	Quito-Galapagos	Travel by air from Quito to San Cristobal Island in the Galapagos archipelago Lectures: Galapagos Islands: geology, biogeography, natural history, and human dimensions	Parent et al. 2008	
24 Feb. -1 Mar.	Galapagos	Activities: Introductory hike: San Cristobal Island highlands Wildlife surveys by boat and foot Galapagos invasive species identification and eradication Lectures: Invasive species in the Galapagos	Tye et al. 2002 Gardener et al. 2010 Platt 2013 AP 2012 Alvear & Lewis 2015 Toral-Granda & Martinez 2005 Cruz et al. 2010 Carrion et al. 2011	25 Feb.: Quiz #4 Beak of the Finch 1 Mar.: Field journals due for grading
2 Mar.	Galapagos	Final exams		Final exams
3 Mar.	Galapagos	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.

Jan. 19:	Chapters 1 & 9 in Kricher, J. 1997. A Neotropical Companion. Princeton University Press, Princeton.
Jan. 20:	Hoorn, C., Wesselingh, F.P., ter Steege, H., Bermudez, M.A., Mora, A., Sevink, J., Sanmartín, I., Sanchez-Meseguer, A., Anderson, C.L., Figueiredo, J.P., Jaramillo, C., Riff, D., Negri, F.R., Hooghiemstra, H., Lundberg, J., Stadler, T., Särkinen, & A. Antonelli. 2010. Amazonia through time: Andean uplift, climate change, landscape evolution, and biodiversity. Science 330: 927-931.
Jan. 21:	Spracklen, D.V. and R. Righelato. 2013. Tropical montane forests are a larger than expected global carbon store. Biogeosciences Discussions 10: 18893-18924. Erwin, T.L. 1982. Tropical Forests: their richness in Coleoptera and other arthropod species. The Coleopterists Bulletin 36: 74-75.
Jan. 22:	Keating, P.L. 2007. Fire ecology and conservation in the high tropical Andes: observations from northern Ecuador. Journal of Latin American Geography 6: 43-62.
Jan. 23:	Purcell, J. and A. Brelsford. 2004. Reassessing the causes of decline of *Polylepis*, a tropical subalpine forest. Ecotropica 10: 155-158. Kessler, M. 2002. The "*Polylepis* problem": where do we stand? Ecotropica 8: 97-110.
Jan. 24:	Cuesta, F., Peralvo, M.F., & F.T. van Manen. 2003. Andean bear habitat use in the Oyacachi River Basin, Ecuador. Ursus 14: 198-209. Peyton, B. 1980. Ecology, distribution, and food habits of spectacled bears, *Tremarctos ornatus*, in Peru. Journal of Mammology 61: 639-652.
Jan. 25:	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.
Jan. 27:	McCain, C.M. & J.A. Grytnes. 2010. Elevagtional gradients in species richness. In: Encyclopedia of Life Sciences (ELS). John Wiley and Sons, Ltd., Chichester, U.K.
Jan. 28:	Spector, S. 2002. Biogeographic crossroads as priority areas for biodiversity conservation. Conservation Biology 16: 1480-1487.
Jan. 29:	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.
Jan. 30:	Chen, I.C., Shiu, H.J., Benedick, S., Holloway, J.D., Chey, V.K., Barlow, H.S., Hill, J.K., & C.D. Thomas. 2008. Elevation increases in moth assemblages over 42 years on a tropical mountain. Proceedings of the National Academy of Sciences 106: 1479-1483.
Jan. 31:	Greene, H.W. 2005. Organisms in nature as a central focus for biology. Trends in Ecology and Evolution 20: 23-27.

Feb. 2:	Kricher, John. 1997. Chapters 2 and 3 in *A Neotropical Companion*. Princeton University Press, Princeton.
Feb. 3:	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. Vanderhoff, E.N., Hodge, A.M., Arbogast, B.S., Nilsson, J., & T.W. Knowles. 2011. Abundance and activity patterns of the margay (*Leopardus wiedii*) at a mid-elevation site in the eastern Andes of Ecuador. Mastozoología Neotropical 18: 271-279.
Feb. 4:	Langham, G.M. 2004. Specialized avian predators repeatedly attack novel color morphs of *Heliconius* butterflies. Evolution 58: 2783-2787.
Feb. 5:	Laurance, W.F., Goosem, M., & S.G.W. Laurance. 2009. Impacts of roads and linear clearings on tropical forests. Trends in Ecology and Evolution 24: 659-669.
Feb. 6:	Laurance, W.F., Clements, G.R., Sloan, S., O'Connell, C.S., Mueller, N.D., Goosem, M., Venter, O., Edwards, D.P., Phalan, B., Balmford, A., Van Der Ree, R., & I.B. Arrea. 2014. A global strategy for road building. Nature 513: 229-232.
Feb. 7:	Dodson, C.H., Dressler, R.L., Hills, H.G., Adams, R.M., and N.H. Williams. 1969. Biologically active compounds in orchid fragrances. Science 164: 1243-1249.
Feb. 8:	Finer, M., Vijay, V., Ponce, F., Jenkins, C.N., & T.R. Kahn. 2009. Ecuador's Yasuní Biosphere Reserve: a brief modern history and conservation challenges. Environmental Research Letters: 034005. doi: 10.1088/1748-9326/4/3/034005.
Feb. 9:	Bass, M.S., Finer, M., Jenkins, C.N., Kreft, H., Cisneros-Heredia, D.F., McCracken, S.F., Pitman, N.C.A., English, P.H., Swing, K., Villa, G., Di Fiore, A., Voigt, C.C., & T.H. Kunz. 2010. Global conservation significance of Ecuador's Yasuni National Park. PLoS ONE 5: e8767. doi:10.1371/journal.pone.0008767.
Feb. 10:	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.
Feb. 11:	Nadkarni, N.M. 1994. Diversity of species and interactions in the upper tree canopy of forest ecosystems. American Zoologist 34: 70-78. Ellwood, M.D.F. & W.A. Foster. 2004. Doubling the estimate of invertebrate biomass in a rainforest canopy. Nature 429: 549-551.
Feb. 12:	Reyna-Hurtado, R., Beck, H., Altrichter, M., Chapman, C.A., Bonnell, T.R., Keuroghlian, A., Desbiez, A.L., Moreira-Ramírez, J.F., O'Farrill, G., Fragoso, J., & E.J. Naranjo. 2016. What ecological and anthropogenic factors affect group size in white-lipped peccaries (*Tayassu pecari*)? Biotropica 48: 246-254.
Feb. 13:	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. 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.

Feb. 14: Espinosa, S., Branch, L.C., & R. Cueva. 2014. Road development and the geography of hunting by an Amazonian indigenous group: consequences for wildlife conservation. PLoS ONE 9: e114916. doi: 10.1371/journal.pone.1224916.

Feb. 15: 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.

Feb. 16: Blake, J.G., Mosquera, D., & J. Salvador. 2013. Use of mineral licks by mammals and birds in hunted and non-hunted areas of Yasuní National Park, Ecuador. Animal Conservation 16: 430-437.

Feb. 17: Finer, M., Moncel, R., and C.N. Jenkins. 2010. Leaving the oil under the Amazon: Ecuador's Yasuni-ITT initiative. Biotropica 42: 63-66.

Feb. 18: Keyman, A. 2015. Evaluating Ecuador's decision to abandon the Yasuni-ITT Initiative. Available at http://www.e-ir.info/2015/02/22/evaluating-ecuadors-decision-to-abandon-the-yasuni-itt-initiative/.

Feb. 19: Sachs, J.D. & A.M. Warner. 2001. The curse of natural resources. European Economic Review 45: 827-838.

Feb. 21: 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.

Feb. 22: Weiner, J. 1995. The beak of the finch: a story of evolution in our time. Vintage Books, New York.

Feb. 23: Parent, C.E., Caccone, A., & K. Petren. 2008. Colonization and diversification of Galapagos terrestrial fauna: a phylogenetic and biogeographical synthesis. Philosophical Transactions of the Royal Society B: Biological Sciences 363: 3347-3361.

Feb. 24: Tye, A., Soria, M.C., & M.R. Gardener. 2002. A strategy for Galapagos weeds. In: Veitch, C.R. & M.N. Clout (eds). Turning the tide: the eradication of invasive species. IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland & Cambridge, UK.

Gardener, M.R., Atkinson, R., & J.L. Rentería. 2010. Eradications and people: lessons from the plant eradication program in Galapagos. Restoration Ecology 18: 20-29.

Feb. 25: Platt, J.R. 2013. Once extinct in the wild, Galapagos giant tortoises return to Pinzon Island. Scientific American blog.

Associated Press. 2012. Galapagos Islands steps up extermination of 180 million rats.

Feb. 26: Alvear, C. & G. Lewis. 2016. New 'cucumber conflict' in Galapagos. The Huffington Post blog. Available at: http://www.huffingtonpost.com/cecilia-alvear/new-cucumber-conflict-in_b_7900052.html.

Toral-Granda, M.V. & P.C. Martínez. 2005. Population density and fishery impacts on the sea cucumber (*Isostichopus fuscus*) in the Galápagos Marine Reserve. FAO Fisheries Technical Paper: 91-100.

Feb. 27: Cruz, F., Carrion, V., Campbell, K.J., Lavoie, C., & C.J. Donlan. 2010. Bio-economics of large-scale eradication of feral goats from Santiago Island, Galápagos.

Carrion, V., Donlan, C.J., Campbell, K.J., Lavoie, C., & F. Cruz. 2011. Archipelago-wide island restoration in the Galápagos Islands: reducing costs of invasive mammal eradication programs and reinvasion risk. PLoS One 6(5): e18835.