



PATAGONIA ECOSYSTEMS:  
THE CHILE PROJECT  
WINTER 2017  
JANUARY 11 – FEBRUARY 24

## ACADEMIC SYLLABUS

**Lead Instructor:** Daniel J. Hagaman, M.S.

**Contact 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-faculty 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 we are happy to oblige.

**Class Meetings:** This Wildlands Studies Project involves seven days per week of instruction and field research, with no days off during the program (other than days we use to resupply). 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 9am, with breaks for meals. Most evenings include scheduled activities, including guest lectures, discussions, structured study time, and workshops. 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 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 is established for this project and will be provided to students in advance of the project or upon arrival. 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.

## Contents of this syllabus:

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### I. Project Overview

The vast landscape of fjords, glaciers, and ancient forests of southern Chile were one of the last places in the world to be explored and remain one of the most pristine on Earth. In this program, team members will take part in unique firsthand investigations of Patagonia's diverse ecosystems, the species they support, the people who depend on them, and the conservation efforts in a region experiencing the pressures of rapid economic growth. We will immerse ourselves into the fascinating natural history and biogeography of Patagonia, where some species remain little changed since the breakup of Gondwana 200 million years ago. We will gain personal familiarity with the ecological diversity of southern Chile, ranging from vast mountain ice fields to grassy steppes and diverse coastal temperate rainforests. Together we will explore national parks, privately owned protected areas, and unprotected wildlands to study the ecology, conservation, and management of ecosystems and threatened wildlife populations. Through extensive field studies, information exchanges with land managers, conservation practitioners, scientists, and local community members, we will examine on-site the intertwined scientific, cultural, and management dimensions – and the global economic forces – shaping conservation strategies in Chile today.

Team members will have opportunities for hands-on investigations of the ecology and conservation of southern Chile's species and communities. Our first objective is to become fluent in the natural history of this region, its climate and geography, and to become intimately familiar with many of the species that live therein. We will travel across a transect of ecological systems ranging from coastal Valdivian rainforests, home of the ancient alerce trees, to alpine forests, tundra, and snowfields of the Andes, and the grasslands that lie in the rain shadow of the Cordillera. As we become familiar with the inhabitants of these ecosystems, we will conduct ecological research projects, examining interactions, patterns of diversity, and ecological niches of species we encounter.

We will also investigate the effectiveness of key conservation measures such as the establishment of national parks and private reserves which seek to create sustainable livelihoods for local communities while protecting biodiversity through participation in ongoing conservation, restoration, and sustainable agriculture projects. Highlights will include extended field investigations in Parque Pumalín, one of the largest private nature reserves in the world and Parque Nacional Chiloé, on the fabled Isla Grande. These are two remarkable natural laboratories with intact forest and wildlife communities. However, despite their protected status and almost impenetrable landscapes, daunting conservation challenges loom, ranging from unsustainable and unregulated resource use by local communities to ambitious multinational development plans including new roads, dams, and salmon farming.

### II. Learning Objectives

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

1. ***The ecosystems of Chilean Patagonia in terms of flora, fauna, and ecological processes, including threats, conservation, and ongoing change.*** Species identification is essential to managing and understanding the flora and fauna communities in this region and for identifying any change in these communities over time. Through a series of lectures, workshops, and journal assignments students will learn techniques for keying out and confirming identification of plant and animal species using field guides and taxonomic keys. In a series of field excursions, lectures, readings and discussions, students will learn basic ecological concepts, be able to identify community types and the processes that underlie community development and change.

2. **Field observation skills, including methods for documenting and sharing findings in multiple formats.** Field observation skills are an integral part of good science and promote understanding of the world around you. Through directed learning of geology, ecology, and biology in the region, students will gain experience observing the world around them and will become adept at critically examining ecosystem features, comparing those features to other ecosystems, analyzing relationships among different organisms and their environment, etc. Following an introduction to various techniques of recording and presenting information (e.g., natural history sketching, Grinnell style journals and species account techniques), students will gain experience using a variety of techniques to present natural history observations. One of the important components of this objective is learning how to keep good field notes and how to transfer these later into a field journal.
3. **The cultural, political, and management history within Chilean Patagonia and, in particular, within the different management units and parks we visit.** Emphasis includes indigenous perspectives, policies governing conservation, management, and 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 – what has worked and what hasn't.
4. **Introduction to various field research techniques and equipment used in ecological studies worldwide.** 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 surveys, evaluating cover (of vegetation, of epiphytes on trees, etc.), bird point count surveys, mapping features using global positioning systems, estimating tree height, estimating slope, and gathering climatological data, among others.
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. In addition, at the end of the course students will participate in an ongoing long-term ecological research project that was set up by a previous group of Wildlands Studies students at the Senda Darwin Biological Station. Students gain significant experience in conducting research by contributing to this field project.
6. **Critical reading, discussion, and evaluation of primary literature in ecology, geology, and social science.** Throughout this course we rely 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 during our backcountry trips (on non-hiking days), 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 Chilean Patagonia.** Through visits to different types of conservation areas – a large private reserve funded by an entrepreneur, national parks, and pristine but legally unprotected areas – students will gain firsthand experience understanding the challenges and advantages to these different approaches to conservation and preservation. At each location we will meet with land managers whenever possible, providing students the opportunity to hear from the locals the conservation and management objectives at that location, 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. At the end of the course, students will synthesize information gathered at each location and will present a paper in which they critically examine and discuss advantages and disadvantages to each approach to conservation and provide suggestions for improvement at each location. A discussion will ensue following the students' synthesis of the information at the end of the course.

These topics will be addressed through classroom lecture and discussion, course readings, field activities, visits with local experts, exposure to ongoing research, 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 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 with broader skills and understanding of ecological, geological, and social sciences that allows 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 (these were introduced on page 1):

**ESCI 497T, Environmental Wildlands Studies (5 quarter credits)** – Field study of the ecology, biology, and geology of environmental problems affecting the natural and human-impacted ecosystems of our study region, including the role of human interactions.

*Experiences/Activities:* A firsthand understanding and appreciation of the flora, fauna, biogeography, human history, and geography of Chilean Patagonia; learning directly through observation and experience, as well as guidebooks, technical keys, scientific and popular literature; learning techniques for animal and plant identification using field guides as well as skills taught through lectures and field activities; identifying what key characteristics to look for in order to properly identify plant and bird species; learning and using proper scientific terminology to describe species, geological formations, environmental characteristics; introduction to characteristics of many Patagonian species, how these characteristics make them well adapted to their environment, how these characteristics enable us to tell species apart and to tell how species are related; learning the Latin and common names of many bird and plant species we encounter. This knowledge will be further utilized in conjunction with ESCI 497U field activities. Additional experiences include learning to take high-quality field notes on their observations. We will cover how to keep good field notes and then how to transfer these field notes into a complete, thorough, accurate field journal or species accounts. Written journals and species accounts will incorporate key ecological concepts such as interactions among species and their environment, predator-prey relationships, food webs, how form fits function, etc. Other activities will include field sketching exercises, field observation practice and review, mapping, etc.

*Outcomes:* Students will develop skills in field observation and documenting and sharing observations in multiple formats. Students will be able to identify species known to them by their Latin and/or common names. Students will also be able to describe key characteristics of species, geological formations, etc., using proper scientific terminology. Students will be able to relate form to function in key organisms. Students will also be able to identify species unknown to them using taxonomic keys, geologic maps, field guides, and other resources. Students should be able to demonstrate understanding of basic ecological and geological concepts. Students will employ varied techniques to present and record their natural history observations including, but not limited to, Grinnell Style Journals and Species Accounts, natural history sketching, narrative writing, and mapping.

Evaluation/Assessment: 50% Field Journal, evaluated by faculty in several reviews during the program. The journal grade is based on all the criteria as presented during the journaling class and as specified in the journal handout. 50% field quizzes and exams. Students will demonstrate knowledge of key organisms and their characteristics through quizzes.

**ESCI 497U, Environmental Field Survey (5 quarter credits)** – In this field-based course we conduct on-site examinations and analyses of various aspects of the ecosystem and environmental problems affecting wildlands and wildlife in our study region as well as learning about how these systems have been and are being studied.

Experiences/Activities: Ecological research techniques and a comprehension of the methods, principles, and applications of conservation biology will be the focus of this course, taught in conjunction with ESCI 497T and 497V. Students will design and participate in ecological research projects which may include surveys of plants and animals, monitoring of rare populations and species of concern, documentation of human disturbance patterns, assessment of management approaches, plans, and goals, and other conservation-related studies; group research projects will be designed, implemented, and results will be summarized and presented using a variety of media. Many different ecological research techniques will be taught through firsthand experience or through review of literature – historical and current techniques – including their advantages and disadvantages. Reading and discussion of peer-reviewed literature as well as popular literature will provide the opportunity to understand what has been and is being studied, how general ecological and conservation biology principles are applied and related to individual research projects, etc. These readings will also provide topics for further analysis, activities and lectures: understanding key ecological concepts such as disturbance, competition, dispersal, regeneration, and how these concepts relate directly to our personal observations of the environment and species in Patagonia.

Outcomes: Students will gain the ability to design, implement, summarize, present, and critically review ecological research projects. Students will also gain the ability to critically read and evaluate primary scientific and policy literature. Students will be able to lead a dynamic, thoughtful discussion of the primary literature. Students will gain a knowledge base in wildlands natural history and policy, with specific emphasis on Chilean Patagonia. Students will discuss and critique the literature in light of other information they have learned in this project from local experts, lectures, their observations, and other relevant readings. Students should be able to demonstrate understanding of basic ecological, geological, and management and policy concepts as related to Chilean Patagonia including endemism, climate and geology, regeneration of forest species, invasion biology, key dispersal mechanisms and species, harvesting of marine species, umbrella/keystone/etc. species, and more. Students will be able to apply their knowledge of geology, ecology, and social science to new scenarios (as presented in the mid-term and final exams) and clearly demonstrate understanding of the material through their narratives.

Evaluation & Assessment: 70% midterm and final exams; 20% research project participation and assignments; 10% leading and participation in discussions.

**ESCI 497V, Wildlands Environment and Culture (5 quarter credits)** – Field studies course involving studying the socioeconomic and political landscape of conservation and 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.

Experiences/Activities: Students will become aware of many of the conservation issues in southern Chile, and their environmental and social components. Students will design and complete an independent research project in order to gain an in-depth understanding of one of these complex issues. The research project will require a proposal, final written report (summarizing data), and oral presentation. It will incorporate review, summary, and synthesis of primary literature, conducting of interviews with community members, land managers, or others, and/or implementation of a field-based independent research project. Students will also participate in activities and assignments designed to further their understanding of conservation strategies utilized in Patagonia – topics covered will be the concept of wilderness, analysis of conservation strategies in the form of private parks versus

federal or state parks, goals and objectives of conservation and/or management and how these are being (or not being) reached, critical analysis of the positive and negative aspects of various conservation strategies, ideas of conservation versus preservation. Students are required to participate in discussions and meetings and to complete writing and other assignments. Students will conduct independent research on a relevant issue of their choosing, and present a preliminary proposal and a final written presentation on their findings. Students will participate in peer-reviews of each other's research projects. Students will write journals on assigned cultural topics and will keep a cultural dictionary throughout the course.

**Outcomes:** Students will be able to critically assess conservation and management strategies that we have seen, encountered, and experienced on our program. Students will demonstrate understanding of key ecological and conservation concerns affecting Chilean Patagonia and how these relate to us as citizens of this world and as North Americans. Students will gain the ability to conduct a research project using peer-reviewed literature as well as personal experiences and information-gathering techniques (interviewing, collecting data, etc.) while in a field setting. Students will also gain experience summarizing and synthesizing the information/data they collect, reviewing a written draft of a peer's research, writing a report, and presenting research results orally. Students will gain an appreciation and understanding for how Chilean history, culture, and language differ from that of other Latin American countries.

**Evaluation & Assessment:** 50% independent research project; 25% assignments including a final critical evaluation of conservation strategies experienced during the course; 25% cultural history journal including cultural dictionary.

#### IV. Assessment

The following is an overview of the academic requirements for the program. Some of the assignments are ongoing (journal, readings, independent research project) and some have specific dates (field quizzes; Midterm and Final Exam). Due dates are subject to adjustment in response to environmental and demographic stochasticity. Final grades for each course listed above will be based on the following items:

| Course Number | Assessment Item  |                        | Date due <sup>1</sup>                      | Percent of grade |
|---------------|--|------------------------|--|------------------|
| ESCI 497T     | Field Journal  |                        | January 29<br>February 17                  | 50%              |
|               | Field quizzes and exams                                      |                        | Weekly <sup>2</sup>                        | 50%              |
| ESCI 497U     | Midterm and Final exams                                      |                        | February 1<br>February 22                  | 70%              |
|               | Research project participation and assignments               |                        | Weekly to Bi-weekly <sup>3</sup>           | 20%              |
|               | Participation and leading of discussion                      |                        | Ongoing <sup>4</sup>                       | 10%              |
| ESCI 497V     | Independent Research Project                                 | Proposal               | January 19                                 | 5%               |
|               |  | Final paper            | February 14                                | 30%              |
|               |  | Data collection effort | Ongoing                                    | 10%              |
|               |  | Oral presentation      | February 15                                | 5%               |
|               | Assignments including Conservation Strategies Analysis (CSA) |                        | Ongoing (assignments)<br>February 23 (CSA) | 25%              |

|  |                          |   |     |
|--|--------------------------|---|-----|
|  | Cultural History Journal | Ongoing<br>(journal)<br>February 19<br>(dictionary) | 25% |
|--|--------------------------|---|-----|

- 1: Subject to change due to weather and other constraints.
- 2: Typically given at the end of our stay in each location. There will be a total of 6 quizzes/exams.
- 3: Approximation – some research will be ongoing while some written assignments will be due the day after assigned. Expect an average of 2 assignments per week.
- 4: Discussions of readings will occur almost daily.

### **ESCI 497T – Field Journal**

The field journal is an integral part of the Chile Wildlands Studies course – it serves as a learning tool and a time when students can sit, observe the environment around them, reflect on what they have seen, heard, smelled. The field journal will be an ongoing assignment throughout the course. Several activities will be designed at the beginning of the course which will help outline what characterizes a thorough, well-written, detailed, observation-based field journal. Assignments will focus on various techniques and styles for recording and presenting observations in a field notebook and journal. A total of 25 journal entries will be graded, collected at two different times during the course. The field journal will consist of two different types of entries (10 required of each; 5 can be of either): journal entries and species accounts.

#### **Requirements:**

- 1) Field journal entries: a total of ten journal entries are required for full credit. The focus of journal entries is a detailed record of observations from a specific time period in a specific location written in a coherent, readable, and sometimes creative way. It is an in-depth natural history record. The journal can be written about 30 minutes of silent observation in one spot; it can also be written about a theme observed several times (e.g., Epiphytes); it can describe a landscape and the forces that influence it; it can focus on relationships among species observed (food webs; other interactions); it can focus on human influence on the environment; it can focus on geological history as seen by the observer; it can focus solely on smells or sounds encountered. The most important thing is that the emphasis of the journal is on personal observation: things that the student actually saw, heard, smelled, tasted, etc., themselves, not on what they learned that day or a recording of what they did that day. There are many styles of journaling: a handout on Grinnell style field journals will be included in the reader. This handout will be reviewed at the beginning of the course.
- 2) Species accounts: A total of ten species accounts are required for full credit. Species accounts focus on one species that is observed for approximately thirty minutes or a species that is observed several times. These accounts allow students to delve deeper into the biology and ecology of individual species. Species accounts should be a recording of personal observations of the species' appearance, its behavior, its habit, its interactions with other species. It is also a place where species should then be related to ecosystem processes, ecological principles, etc. (food webs, ecosystem services, pollination and dispersal, etc.).
- 3) Other assignments (as assigned): Other assignments refer to any specific journal activity or assignment given by the faculty throughout the course.
  - Not included as formal journal entries: Class notes, personal entries. When journals are handed in for review, please clip or cover personal entries.
  - All entries must include orienting information including date, time, location, weather, and individuals present.

#### **Timeline:**

Field journals will be collected twice during the course. Twelve journal entries will be graded the first time; thirteen will be graded the second time. Entries can be any combination of species accounts and field journals as long as there are a minimum of 10 of each and a total of 25 when the journal is submitted for the final time. Professors will be available for review of students' first journals to make sure they are on the right track.

**Journal Grading criteria:**

- 1) Detailed, personal observation: this should be the bulk and focus of the entries.
  - Journal entries should describe, in depth, the subject matter (the surroundings, events, behaviors, etc.).
  - Species accounts need a full description of the species as well as its behavior.
- 2) Personal observation within the context of ecological principles: observations made should be related to the larger ecosystem picture.
  - Entries should ask “why” questions and hypothesize answers (e.g., Why is the hummingbird’s beak so long and thin? Why are there so many evergreen broadleaf trees in Chilean Patagonia?).
  - Entries should demonstrate that thought was put into interpreting the observations made.
- 3) Orienting Information: All entries need orienting information (location, date, etc.).
  - Consistency of entries: This refers to regular and consistent use of the journal.
  - Organized: You should be able to use your journal as a reference. Information should be accessible and related to specific dates and locations. Include a table of contents in the beginning so we can find specific assignments.
- 4) Neatness/Readability: Someone else should be able to use your journal as a reference (or grade it).
  - Diversity of Expression: We encourage you to use a diversity of journaling techniques. Avoid using only one form of expression. We will discuss in detail a variety of journaling techniques.
- 5) Effort: We expect to see your field journal improve throughout the course, and will assess this accordingly.

**ESCI 497T – Field Quizzes and Exams**

These quizzes and exams are given in the field, will take up to an hour each, and are given approximately six times throughout the course, generally at the end of our stay in a particular location. These quizzes are designed to evaluate the students’ ability to recognize and identify species as well as key characteristics of species, using proper terminology and scientific and/or common names. Generally, we will require students to know scientific and common names of plant species and common names of bird species. Recognizing common family names and characteristics of both birds and plants will also be required. Students will be quizzed on material and species covered in field exercises, workshops, and natural history walks. Later quizzes will be cumulative.

**ESCI 497U – Midterm and Final Exams**

These exams are written exams taken in the field; exams will take approximately 2 hours each. We see these exams as a teaching/learning tool to solidify what students have learned up to this point in the program. The exams will utilize a combination of evaluation tools including multiple choice and true/false-type questions, short answer questions, and longer essays. Questions on the exam reflect material learned through lectures, guest presentations, and assigned readings. Shorter answer questions evaluate students’ knowledge of key concepts, activities, dates, etc., and how they relate to Chilean Patagonia. Longer answer questions evaluate students’ ability to apply what they have learned to a new scenario. For example, we may probe understanding of the material by asking students to apply what they have learned about fire ecology to the management of an area of mixed native forest remnants and pine plantations. The points allocated to each individual question are given on the printed exam and each exam grade is worth 35% of your ESCI 497U final grade (for a total of 70%).

**ESCI 497U – Research project participation and assignments**

Research projects will be an ongoing part of the course. Students will help design, implement, and summarize a variety of ecological research projects from assessing epiphyte abundance on trees to comparing bird species richness in various locations to assessing forest stand dynamics. Field projects will be set up by the students with instructor supervision; students will collect data and will do simple summary analyses. Students must participate in all research projects. With many of the projects, students will be asked to write up the methods, results, and discussion and submit for grading. These assignments will be graded based upon content, organization, and readability/neatness. Students will also participate in a long-term research project set up by a previous Wildlands Studies class at Senda Darwin Biological Station. Other written assignments will ask students to analyze different topics (such as wilderness) within the context of where we are. These will be short (1-2 page) written assignments, to be handed in one day after assigned. Research project participation and various assignments are worth 20% of the grade for this course.

### **ESCI 497U – Participation and leading of discussions**

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 we are reading articles that are directly relevant to our location.

We will cover the basics of reading primary literature on one of the first evenings of the first backcountry trip, and then will expect students to read, on average, one primary literature piece each day while in the field. Instructors will lead the first few discussions to demonstrate to students how to lead an interactive, thought-provoking discussion. Students will then sign up to co-lead two discussions each. We will discuss these readings as a group either in the morning before travel for the day, or after supper at the end of the day. We strongly suggest that students leave themselves ample time to read the papers before discussions as some may take longer than others to digest. Grades will be based on whether a student participates in the discussions, whether it is obvious that the reading was read and understood, and on participation in other activities we do with readings (e.g., student-led discussions, etc.). The grade for each individual discussion is weighted equally for a final percentage. Students will also be graded on their leading of discussions. Discussions should include a summary of the article, several thought-provoking questions which further elucidate or analyze portions of the paper, and they should be organized and well-managed. Leading and participation in discussions is worth 10% of the grade for this course.

### **ESCI 497V – Independent Research Project**

The independent research project effectively starts during our first backcountry trip and continues until the end of the course. With the help and advice of instructors, students will choose, design, implement, summarize, and present (written and oral) independent research projects. Instructors will meet individually with each student during the first week of the course to find out what students' interests are and to help them choose an appropriate project. All projects will be field-based, and students will be required to collect data throughout the next 3 weeks of the course. Data collection will depend on the research type – some students will be conducting interviews; others will be collecting data of ecological parameters. The amount of data required will be jointly determined by students and faculty. Free time will be given during which students can collect data. Final (written) reports should include an Introduction, Methods, Results, and Discussion. Examples of papers written in this format will be read and discussed throughout the course. Brief oral presentations of research results will be given after a written project is turned in. The project is worth 50% of the grade for this course.

### ***Requirements and Grading Criteria***

**Proposal:** proposal should be 1-2 pages long and clearly state what the student plans to research (a question) and how and where they plan to do it (proposed methods). It should also include why this topic/research is important (justification). Grading will be based upon content and organization.

**Data Collection Effort:** A portion of the grade for this project will be earned by implementing the project (collecting the data). Students should be self-motivated and should display consistency, dedication, quality, and integrity in their data collection effort. Instructors will periodically check in with students to ensure that data is being collected and recorded. This is similar to a "participation" grade.

**Written Report:** The final written report should be written in the style of scientific papers and will include four sections: Introduction, Methods, Results, and Discussion. For the written report, students are expected to use at least two primary literature sources in their reports. The use of visual representations of results is encouraged. Grades for the paper will be based upon: content, organization, grammar/readability/neatness, and works cited.

**Oral Presentation:** Oral presentations should be 15 minutes long and will include a brief summary of methods and results and a discussion of the relevance of this research with respect to existing knowledge of the topic. Students' oral reports will be evaluated by both peers and instructors, and final grade for the presentation will be a combination of these evaluations. Grading will be based upon content, organization, and creativity.

### **Grading Scheme**

|                         |           |
|-------------------------|-----------|
| Project proposal:       | 5 points  |
| Data collection effort: | 10 points |
| Written report:         | 30 points |
| Oral presentation:      | 5 points  |
| TOTAL:                  | 50 points |

### **ESCI 497V – Assignments including Conservation Strategies Analysis**

Several short written assignments will be given and graded throughout the course. Topics will incorporate conservation-based themes, and assignments will be graded based upon timely completion and content (thoroughly discussing topic or answering question).

The final Conservation Strategies Analysis assignment is considered a culmination of the course. During the course we visit and meet with land managers from several types of reserves representing several different conservation strategies: a large, private reserve funded by a foreign entrepreneur; a national park; and an unprotected yet pristine valley. Throughout the course students will be asked to take notes at each location about what they think is working in terms of conservation and management and what they think could use improvement. A discussion at each location will ensue regarding each location's objectives and goals with respect to conservation and management, and notes of positives and negatives of each place will be kept with these goals/objectives in mind. A final (group) oral presentation and discussion will be based upon those notes and will include:

- a list of the goals and objectives of each location
- a list of what is working at each location (positive aspects)
- a list of what could use more work at each location (negative aspects)
- suggestions for improvement at each location
- an analysis of which strategy the student believes is the most successful

In addition, we will have visited several different cities/towns during the course (Puerto Varas, Hornopirén, Castro). In each of these locations, students will be asked to make observations and take notes on two topics: sustainability and tourism/ecotourism. A final (group) oral presentation and discussion will be based upon these notes and will include:

- a list of observations of actions within the town that promote ecological/environmental sustainability
- a list of observations of actions within the town that need to be improved to promote ecological/environmental sustainability
- suggestions for improvement within the town to promote ecological/environmental sustainability
- a discussion of what options are available for tourists, keeping in mind the differences between tourism and ecotourism
- suggestions for improvement within the town to promote both economic and ecological/environmental sustainability in terms of tourism and ecotourism

Grading will be based upon content, organization, creativity/presentation style, and individual participation in the presentation and discussion. These assignments are worth 25% of the grade for this course.

### **ESCI 497V – Cultural History Journal**

The cultural history journal will be a compilation of 5-10 entries. Specific relevant, cultural topics will be assigned to students to write about, and entries will be due two days after assigned. Topics might include indigenous people's role in conservation; local harvesting of natural materials; medicinal plants; etc. Entries should be observation-based and should include personal thoughts/opinions on the topic based upon these observations. Entries should be approximately 2-3 pages long and will be graded based upon content and on-time submittal. One of the cultural history journal entries will be an ongoing assignment – a cultural dictionary. In the cultural dictionary students should record words specific to Chilean Spanish ("modismos") with a short description of its use and meaning. A minimum of 20 words is required for full credit. The cultural history journal is worth 25% of the grade for this course.

## V. Grading Scheme

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 |
|--------------|------------|
| A            | 92.5- 100+ |
| A-           | 90.0- 92.4 |
| B+           | 87.5- 89.9 |
| B            | 82.5- 87.5 |
| B-           | 80.0- 82.4 |

| Letter grade | Percentage |
|--------------|------------|
| C+           | 77.5- 79.9 |
| C            | 72.5- 77.4 |
| C-           | 70.0- 72.4 |
| D+           | 67.5- 69.9 |
| D            | 62.5- 67.4 |
| D-           | 60.0- 62.4 |
| 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 faculty 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 following schedule is organized by location. This is done for this course in order to produce realistic student expectations regarding schedule. Each day will be full, and all activities, readings, assignments, etc., listed will be done at the locations where are listed. 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   | Readings Required  | Assignments Due   |
|-----------|--|---|--|---|
| 11 Jan    | Travel / Puerto Varas                        | Evening: Introductions; Essential Safety and Orientation Briefing<br>Historical figures research time   | Reader Introduction, Maps  |   |
| 11-13 Jan | Puerto Varas                                 | AM: Supply time – food, fuel, equipment<br>PM: Equipment and Health Review; Academic Requirements<br>• Summary and review of Grinnell style field journals  | Wind and air circulation; Patagonia's ice caps and rainforest  |   |
| 14 Jan    | AM: Puerto Varas<br>PM: Travel to Chaitén    | Travel to Chaitén<br>PM: discussion on geology, historical terms geology/geography, etc.  | Volcano excerpts<br>Pallister et al  | Journal assignment (field sketching, observation)   |
| 15 Jan    | AM: Chaitén<br>PM: Travel to Amarillo Valley | Day hike on Chaitén volcano<br>PM: discussion on volcanoes, ecology, and the history of the Chaitén volcano<br>• Volcanoes: introduction to types and terminology; effects (socioeconomic, political, ecological)<br>• Volcanoes: plant succession  | Volcano articles in reader   | Cultural history journal #1   |
| 15-19 Jan | Parque Pumalín: Amarillo Valley              | Activities/lectures:<br>• Introduction to climate and geography<br>• Glaciers–introduction and terminology; history in Patagonia; associated land forms; successional processes following recession<br>• Introduction and field lecture on rainforest types (Valdivian and Northern Patagonian)<br>• Biological classification and naming (review)<br>• Introduction to botany and plant ID; introduction to ornithology and bird ID; introduction to common plants and birds of the forests<br>• Island biogeography and endemism<br>• Field sketching and field notebook<br>• Natural history and nature observation<br>• Backpacking up Amarillo Valley<br><br>Assignments:<br>• cultural history assignment #2<br>• readings and ongoing natural history field journals<br>• bird point count<br>• independent research project<br>• plant succession study design<br><br>Discussions:<br>• N. Myers et al. (hotspots)<br>• Armesto et al. (ecology and importance of Pat. rainforests)<br>• Christie and Armesto discussion (forest regeneration)<br>• Diaz et al discussion (avian diversity and forest composition)<br>• Silva-Rodriguez et al. (pudu and conservation)<br>• Muñoz et al. (vascular epiphytes) | Silva-Rodriguez et al.<br><br>Munoz et al.<br><br>Andes mountains and geology excerpts<br><br>Gondwanaland excerpts<br><br>Christie and Armesto<br><br>N. Myers et al.<br><br>Armesto et al. | Field quiz #1<br><br>Independent research project proposal<br><br>Scales assignments<br><br>Cultural history journal #2<br><br>Bird point count |

| Date        | Location                               | Lecture Topics & Activities   | Readings Required                         | Assignments Due  |
|-------------|--|---|---|--|
| 20 Jan      | Travel from Amarillo to Caleta Gonzalo | AM: Resupply in Chaitén<br>PM: short hike to alerce trees; relax and explore Parque Pumalín or day hike to waterfall<br>Cultural history journal #3   | Armesto et al. (Holocene to Anthropocene) |  |
| 20-23 Jan   | Camp in Caleta Gonzalo                 | AM: waterfall hike<br>PM: lecture and discussion on Armesto et al. (historical land cover change); meeting with Pumalín managers<br>Nature observation and journaling<br><br>Activities/lectures:<br><ul style="list-style-type: none"> <li>• Introduction to Parque Pumalín (history, management, goals, etc.)</li> <li>• Pollination and dispersal</li> <li>• Flowers: parts and dissections</li> <li>• Bird and Plant ID (cont.)</li> </ul> Field work in Cahuelmo (exotic plant management)<br><br>Evening discussions and lectures:<br><ul style="list-style-type: none"> <li>• agriculture in S. Patagonia</li> <li>• Newbold (Mapuche history and economics)</li> <li>• Sarkar (wilderness and biodiversity)</li> </ul> Assignments<br><ul style="list-style-type: none"> <li>• readings and ongoing natural history journals</li> <li>• exotic species</li> <li>• cultural history journal #4</li> <li>• independent research projects</li> </ul> | Newbold<br><br>Sarkar                     | Exotic species<br><br>Cultural history journal #3<br><br>Field quiz #2<br><br>Flower dissection<br><br>Field methods write up<br><br>Plant succession study design |
| 24 Jan      | Travel to Cahuelmo and Hornopirén      | AM: travel, reading time on the ferry<br>PM: activity on marine and fjord ecosystems<br>assignment: cultural history journal #5   | Salmon articles                           |  |
| 24 -25 Jan  | Hornopirén                             | Day hike<br>Field methods: bird point-count<br>PM: discussion on salmon article   |   | Cultural history journal #4  |
| 26 Jan      | Travel to Puerto Varas                 | AM: travel to Puerto Varas<br>Resupply (food, fuel, email)  |   |  |
| 26 – 28 Jan | Puerto Varas                           | Resupply for long backpacking field segment   |   |  |
| 29 Jan      | Travel to Tagua Tagua                  | Bus to begin backpacking field segment to Valle Manso and Cochamó Valley  |   |  |

| Date            | Location                                     | Lecture Topics & Activities  | Readings Required  | Assignments Due   |
|-----------------|--|--|--|---|
| 29 Jan to 4 Feb | Travel by foot to La Junta in Cochamó Valley | <p>Activities/lectures:</p> <ul style="list-style-type: none"> <li>• Climate change in Chilean Patagonia (predictions, consequences, and how to study them)</li> <li>• Disturbance ecology</li> <li>• Alerce: history, conservation, importance</li> <li>• Field methods: epiphytes</li> <li>• Threats to biodiversity and conservation in Patagonian Chile (an assessment and review: deforestation, dams, exotic species, plantation forestry, etc.)</li> <li>• Much of daytime will be spent backpacking and/or day hikes</li> <li>• Independent research time (final draft due)</li> </ul> <p>Assignments:</p> <ul style="list-style-type: none"> <li>• readings and ongoing natural history field journals</li> <li>• cultural history journal # 5 and #6</li> <li>• independent research projects</li> </ul> <p>Discussions:</p> <ul style="list-style-type: none"> <li>• Veblen et al. (disturbance ecology and climate change)</li> <li>• Dams in Patagonia?</li> <li>• Rozzi et al. (long term research)</li> </ul> | <p>Veblen et al.</p> <p>Dams readings</p> <p>Rozzi et al.</p> <p>Rignot et al.</p> <p>Lara and Villaba</p> | <p>Midterm exam</p> <p>Field Journals 1-12 due</p> <p>Cultural history journal #5 and #6</p> <p>Field quiz</p>          |
| 4 Feb – 6 Feb   | Stay at La Junta Camping                     | <p>Activities/lectures:</p> <ul style="list-style-type: none"> <li>• Assessment of tourism and ecotourism</li> <li>• Meeting with Daniel/Silvina – history and conservation of the Cochamó valley</li> </ul> <p>Assignments:</p> <ul style="list-style-type: none"> <li>• readings and ongoing natural history field journals</li> <li>• independent research projects</li> <li>• Tourism</li> <li>• Wilderness</li> <li>• Field methods: plots; tree height</li> <li>• Field methods: transect and plot studies; lichen study</li> </ul>  |  | <p>Bird point-count study write up</p> <p>Tree height assignment</p> <p>Field quiz</p> <p>Wilderness Assignment Due</p> |
| 7 Feb           | Travel to Puerto Varas                       | <p>AM: Hike down Cochamó Valley from La Junta</p> <p>PM: travel to Puerto Varas</p> <p>Resupply (food, fuel, email)</p>  |  |   |
| 7 – 9 Feb       | Stay in Puerto Varas                         | Resupply (food, fuel, email)   |  |   |
| 10 Feb          | Travel to Chepu and coastal Chiloé           | Bus to Ancud and then to Chepu   |  |   |

| Date      | Location                         | Lecture Topics & Activities   | Readings Required  | Assignments Due  |
|-----------|----------------------------------|---|--|--|
| 11-19 Feb | Ahuenco and Chiloé National Park | <p>Hike to Ahuenco and National Park Chiloé</p> <p>Activities/lectures:</p> <ul style="list-style-type: none"> <li>• Continued discussion of Valdivian rainforest</li> <li>• Forest regeneration</li> <li>• Bird and Plant ID (cont.)</li> <li>• Backpacking and day hikes: National Park, Ahuenco, Cole Cole, Rio Anay</li> <li>• History of land cover change from the Holocene</li> <li>• Mapuche peoples: history of Chile</li> <li>• Meetings with National Park officials and local indigenous people, and private park staff</li> <li>• Harvesting and use of marine and intertidal species</li> <li>• Volunteer work for 2 days helping maintain facility.</li> </ul> <p>Assignments:</p> <ul style="list-style-type: none"> <li>• readings and ongoing natural history field journals</li> <li>• forest regeneration field study</li> <li>• marine invertebrates</li> <li>• study of description at different scales</li> <li>• independent research project</li> <li>• cultural history journal #7</li> </ul> <p>Discussions:</p> <ul style="list-style-type: none"> <li>• Darwin and Armesto-Wilson (changes on Chiloé)</li> <li>• Amico et al. (monito del monte and dispersal)</li> <li>• Moreno (harvesting on Chilean shores)</li> <li>• Armesto et al. (conservation targets in Patagonia)</li> </ul> | <p>Darwin</p> <p>Wilson and Armesto</p> <p>Amico et al.</p> <p>Armesto et al. (conservation targets)</p> <p>Moreno</p> | <p><b>Independent project paper</b></p> <p>Independent project oral report</p> <p>Field quiz</p> <p>Natural history field journals #13-25</p> <p>Cultural history journal #7</p> <p>Marine invertebrates assignments</p>   |
| 19 Feb    | Travel to Senda                  | <p>Bus to Senda Darwin</p> <p>Skewgar et al. discussion (penguin conservation)</p>  | Skewgar et al.   |  |
| 19-23 Feb | Senda Darwin                     | <p>Activities:</p> <p>Intro to ongoing research</p> <p>20 Feb:</p> <p>AM: field work (data collection on long-term research project)</p> <p>PM: study time</p> <p>21 Feb:</p> <p>AM: final examination</p> <p>PM: field work (data collection on long-term research project)</p> <p>22 Feb:</p> <p>AM: final field quiz; Conservation strategies analysis oral presentations and discussions</p> <p>PM: finish field work (if necessary)</p> <p>Evening: Curanto!</p>   |  | <p>Plant succession study design</p> <p>Field methods write-up</p> <p>Field study write-up (regeneration and disturbance)</p> <p>Cultural history journal #7</p> <p><b>Cultural dictionary</b></p> <p>Final field quiz</p> |

| Date   | Location               | Lecture Topics & Activities  | Readings Required | Assignments Due                  |
|--------|------------------------|--|-------------------|----------------------------------|
| 23 Feb | Travel to Puerto Varas | early AM: conservation strategies presentations and clean up at Senda Darwin<br>PM: Back to Puerto Varas |                   | Conservation strategies analysis |
| 24 Feb | Travel to Airport      | Class Ends.  |                   |                                  |

### VIII. Complete Reading List and Reader Contents (may be updated prior to program)

#### Ecosystems, climate, and geology

- Patagonia's rainforests and ice caps (summary by instructors).
- The Andes Mountains (summary by instructors).
- Excerpts on geology (from *Devil in the Mountain: A Search for the Origin of the Andes*) by S. Lamb, 2006.
- Gondwanaland: short articles on species evolution and dispersal (from *Science Daily*).
- Volcanoes (summary by instructors).
- Chilean Volcanoes, excerpts (from *The Geology of Chile*) by C.R. Stern et al., 2007.
- Interdisciplinary studies of eruption at Chaitén Volcano, Chile (from EOS) by J.S. Pallister et al., 2010.

#### Chilean Patagonia – a conservation target

- Biodiversity hotspots for conservation priorities (from *Nature*) by N. Myers et al., 2000.
- Conservation International hotspot: Chilean winter rainfall - Valdivian forests by Conservation International.
- Conservation targets in South American temperate forests (from *Science*) by J.J. Armesto et al., 1998.
- Old-growth temperate rainforests of South America: conservation, plant-animal interactions and baseline biogeochemical processes (from *Old-Growth Forests – Function, Fate, and Value*) by J.J. Armesto et al., 2009.
- Integrating ecology and environmental ethics: Earth stewardship in the southern end of the Americas (from BioScience) by Rozzi et al., 2012.

#### History – Chile, indigenous peoples, land use and conservation

- Chiloé and the Chonos Islands (from *Voyage of the Beagle*) by C. Darwin, 1839.
- The natural history of Chiloé: on Darwin's trail (from *Revista Chilena de Historia Natural*) by M.F. Wilson and J.J. Armesto, 1996.
- Balancing economic considerations and the rights of indigenous people. The Mapuche people of Chile (from *Sustainable Development*) by J. Newbold, 2004.
- From the Holocene to the Anthropocene: A historic framework for land cover change in southwestern South America in the past 15,000 years (from *Land Use Policy*) by J.J. Armesto et al., 2010.

#### Plant ecology and forest conservation

- Regeneration microsites and tree species coexistence in temperate rain forests of Chiloé Island, Chile (from *Journal of Ecology*) by D.A. Christie and J.J. Armesto, 2003.
- Diversity and host tree preferences of vascular epiphytes and vines in a temperate rainforest in southern Chile (from *Australian Journal of Botany*) by Muñoz et al., 2003.

#### Animals and birds – ecology and conservation

- Linking forest structure and composition: avian diversity in successional forest of Chiloé Island, Chile (from *Biological Conservation*) by Díaz et al., 2005.
- The potential key seed-dispersing role of the arboreal marsupial *Dromiciops gliroides* (from *Acta Oecologica*) by Amico et al., 2009.
- Evaluating mortality sources for the Vulnerable pudu *Pudu pudu* in Chile: implications for the conservation of a threatened deer (from *Fauna and Flora International*) by E.A. Silva-Rodríguez et al., 2009.

### **Marine ecology and conservation**

- Community patterns generated by human harvesting on Chilean shores: a review (from *Aquatic Conservation: Marine and Freshwater Ecosystems*) by C.A. Moreno, 2001.
- Marine reserve in Chile would benefit penguins and ecotourism (from *Ocean and Coastal Management*) by S. Skewgar et al., 2009.

### **Salmon – invasion, ecology and effects**

- Global fishiness (from *The Wal-Mart Effect*) by C. Fishman, 2006.
- Salmon aquaculture and coastal ecosystem health in Chile: analysis of regulations, environmental impacts and bioremediation systems (from *Ocean and Coastal Management*) by A.H. Buschmann et al., 2009.
- Impacts of Chilean salmon farms on coastal ecosystem discovered accidentally (from *Science Daily*), 2010.

### **Current climate change**

- Contribution of the Patagonia icefields of South America to sea level rise (from *Science*) by E. Rignot et al., 2003.
- A 3620-year temperature record from *Fitzroya cupressoides* tree rings in southern South America (from *Science*) by A. Lara and R. Villaba, 1993.
- Adapting to global environmental change in Patagonia: what role for disturbance ecology? (from *Austral Ecology*) by T. Veblen et al., 2011.

### **Dams in Patagonia?**

- Dams for Patagonia (from *Science*) by G. Vince, 2010.
- Massive Chilean dams approved (from *Nature*) by E. Gardner, 2011.
- U.S. Greens vs. Chile's Poor. Environmental groups in America lobby to block Chilean energy development (from *Wall Street Journal*) by M.A. O'Grady, 2011.
- Setting the record straight: correcting misconceptions about HidroAysén (from [www.patagoniasinrepresas.cl](http://www.patagoniasinrepresas.cl)) by A. Maxwell, 2011.

### **Wilderness and biodiversity**

- Wilderness preservation and biodiversity conservation – keeping divergent goals distinct (from *Bioscience*) by S. Sarkar, 1999.

### **Maps and resources**

- Map of vegetative zones and climatic factors (from *A Wildlife guide to Chile*) by S. Chester, 2010.
- Forest types map (from *Chile's Frontier Forests: Conserving a Global Treasure*) by E. Neira et al., 2002.
- Geographical maps of Araucanía, Los Lagos, and Chiloé (Chile).
- Wind and oceanic circulation patterns.
- Geological time scale.
- Gondwanaland breakup map.
- Arte de los pájaros (poems by Pablo Neruda).
- How to make and use a clinometer.
- Identifying birds and plants (some things to assist with vocab and ID; compiled by instructors).
- Chilean Patagonia bird and plant list.
- Blank map of southern Chile.