

Climate Change and Marine Biology in Southern Patagonia and Antarctica

ENVI-3005 (3 credits)

Argentina: People, Environment and Climate Change in Patagonia and Antarctica

This syllabus is representative of a typical semester. Because courses develop and change over time to take advantage of unique learning opportunities, actual course content varies from semester to semester.

Course Description

This course focuses on the various ways in which Southern Patagonia and Antarctica's biodiversity, more specifically their marine biology, are impacted by climate change. In this course students will examine the natural and dynamic components of the Beagle Channel, the Southern Ocean and Antarctica and studies the coastal and marine biology of the region. The course includes site visits to a range of ecological sites chosen to represent Southern Patagonia and Antarctica's exceptionally unique biodiversity. Through the lens of climate change, students will be exposed to how the region's biodiversity reflect geological, evolutionary, and biogeographical events to achieve greater understanding of the impact of climate change and other environmental dynamics.

This course runs concurrent with the thematic seminar Socio-ecological Dynamics and Conservation in Southern Patagonia and Antarctica and with the Environmental Research Methods and Ethics seminar. Classes with professors and researchers are also imparted during the program excursions/expedition. There are several day excursions which include academic activities to the Tierra del Fuego National Park, Almanza-Estancia Haberton and in the Beagle Channel. There is an excursion from Ushuaia, across the Beagle Channel to Port Williams, Chile, which is located in the Cape of Horns Biosphere Reserve as well as an excursion to Cabo San Pablo and Río Grande. On all of these excursions students will deepen their knowledge about climate change and coastal-marine biology.

The ten-day expedition from Ushuaia to Antarctica is another unique opportunity to learn more about the region's environment and the impacts of climate change. Aboard this 90-passenger ice-strengthened polar vessel "*Ushuaia*" with Antarpply Expeditions, an IAATO member company, students will visit the last pristine region of the world. The

highly experienced expedition team from the ship will guide the students on the shore excursions and help with the identification of the amazing wildlife at research stations and penguin colonies and observe various different species of whales, seals, penguins and seabirds. On board the ship students will participate in lectures and reflection sessions.

Learning Outcomes

By the end of the course, students will be able to:

- *Describe* the impact of climate change on Southern Patagonia and Antarctica's biodiversity;
- *Identify* the most relevant features of the geological, evolutionary and biogeographical events that have occurred in the region;
- *Analyze* the impact of climate change on the maritime communications routes and marine biology in the region;
- *Explain* the influence of Antarctica's ice scape and how it pertains to climate change.

Language of Instruction

This course is taught in Spanish, though some subjects may be introduced in English. Students will be exposed to vocabulary related to course content through in-country expert lectures and field visits to a wide range of venues and regional locales.

Instructional Methods

SIT's teaching and learning philosophy is grounded in the experiential learning theory developed by Kolb (1984; 2015) and informed by various scholars, such as Dewey, Piaget, Lewin, among others. Experiential learning theory recognizes that learning is an active process that is not confined to the formal curriculum; "knowledge is created through the transformation of experience" (Kolb, 2015, p. 49). Learning involves both content and process. Learning is holistic and happens through various life experiences upon which students draw to generate new ways of knowing and being. Learning involves a community and is a lifelong endeavor. Learning is transformational. The suggested four step-cycle of a *concrete experience, reflective observation, abstract conceptualization, and active experimentation* embedded in the experiential learning model is not linear and might not always happen in that specific order, as any learning is highly context dependent. These stages of taking part in a shared experience; reflecting on that experience by describing and interpreting it; challenging their own assumptions and beliefs to generate new knowledge; and ultimately applying new knowledge, awareness, skills, and attitudes in a variety of situations and contexts are important for students to engage in to become empowered lifelong learners.

Assignments and Evaluation

Assignment Descriptions and Grading Criteria

Participation: Every student is expected to come to class prepared to discuss assigned readings, to listen attentively to any lectures, to seek to understand the perspectives of their peers, to share thoughts and opinions about the topics of the course, and to otherwise engage in healthy exploration of the course themes in order to contribute to the collective learning of the group. (10%)

Facilitation: In pairs or small groups, students will be responsible for facilitating discussion on an assigned topic once during the semester. Students are responsible for meeting with the instructor prior to the discussion to review their proposed process for facilitation. (10%)

Field Quiz on Species Identification (10%)

Field Quiz on Landscape Formation (10%)

Field Quiz on Climate Change/Climate Regulation (10%)

Excursion Log: Students will be asked to keep an excursion log during the excursion to Antarctica. The Excursion Log contains ecological, biological, conservation, and sustainability observations gained on your own in the during the excursion, and includes information from a wide variety of field sources, such as guided sessions during excursions, field activities and direct observations. (20%)

Final Project: Each student will choose a final project for this course that examines a topic related to climate change and biodiversity to be presented during the final synthesis module. The final project must be approved by the instructor and may take the form of a short research paper, a polished presentation based on research, a photo/video project, or a significant art project. Collaborative group work with other students is possible and all final projects will include presentations. (30%)

Attendance and Participation

Due to the nature of SIT Study Abroad programs, and the importance of student and instructor contributions in each and every class session, attendance at all classes and for all program excursions is required. Criteria for evaluation of student performance include attendance and participation in program activities. Students must fully participate in all program components and courses. Students may not voluntarily opt out of required program activities. Valid reasons for absence – such as illness – must be discussed with the academic director or other designated staff person. Absences impact academic performance, may impact grades, and could result in dismissal from the program.

Late Assignments

SIT Study Abroad programs integrate traditional classroom lectures and discussion with field-based experiences, site visits and debriefs. The curriculum is designed to build on itself and progress to the culmination (projects, ISP, case studies, internship, etc.). It is critical that students complete assignments in a timely manner to continue to benefit from the sequences in assignments, reflections and experiences throughout the program.

Example: Students may request a justified extension for one paper/assignment during the semester. Requests must be made in writing and at least 12 hours before the posted due date and time. If reason for request is accepted, an extension of up to one week may be granted at that time. Any further requests for extensions will not be granted. Students who fail to submit the assignment within the extension period will receive an 'F' for the assignment.

Assessment:

Participation	10%
Facilitation	10%
Field Quizzes	30%
Excursion Log	20%
Final Project	30%

Grading Scale

94-100%	A
90-93%	A-
87-89%	B+
84-86%	B
80-83%	B-
77-79%	C+
74-76%	C
70-73%	C-
67-69%	D+
64-66%	D
below 64	F

Expectations and Policies

- Show up prepared. Be on time, have your readings completed and points in mind for discussion or clarification. Complying with these elements raises the level of class discussion for everyone.

- Have assignments completed on schedule, printed, and done accordingly to the specified requirements. This will help ensure that your assignments are returned in a timely manner.
- Ask questions in class. Engage the lecturer. These are often very busy professionals who are doing us an honor by coming to speak.
- Comply with academic integrity policies (no plagiarism or cheating).
- Respect differences of opinion (classmates', lecturers, local constituents engaged with on the visits). You are not expected to agree with everything you hear, but you are expected to listen across difference and consider other perspectives with respect.

Please refer to the [SIT Study Abroad Handbook](#) and the [Policies](#) section of the SIT website for all academic and student affairs policies. Students are accountable for complying with all published policies. Of particular relevance to this course are the policies regarding: academic integrity, Family Educational Rights and Privacy Act (FERPA), research and ethics in field study and internships, late assignments, academic status, academic appeals, diversity and disability, sexual harassment and misconduct, and the student code of conduct.

Please refer to the SIT Study Abroad Handbook and SIT website for information on important resources and services provided through our central administration in Vermont, such as [Library resources and research support](#), [Disability Services](#), [Counseling Services](#), [Title IX information](#), and [Equity, Diversity, and Inclusion](#) resources.

Course Schedule

**Please be aware that topics and excursions may vary to take advantage of any emerging events, to accommodate changes in our lecturers' availability, and to respect any changes that would affect student safety. Students will be notified if this occurs.*

Module I: Marine Biodiversity

The first module is on marine biodiversity, where students will learn about the physical conditions and dynamics of the marine environment in the Beagle Channel, including currents, fjords, and glaciers. Students will also learn of marine biology in the ocean with classes which emphasize understanding climate drivers, and community ecology marine fronts, climatic conditions and climate effect on environmental systems, trophic webs, and exotic species and resources in coastal communities. This module complements the content covered by the Socio-Ecological Dynamics and Conservation course and builds on that conceptual background to deepen the discussion on climate change and its effects on biodiversity in Southern Patagonia and Antarctica.

Ushuaia and the Beagle Channel in Southern Patagonia are important within the Southern Ocean in terms of its marine biodiversity. Students will learn from lectures, readings and site visits the diversity of marine species as well as the impact of currents,

fjords and glaciers as well as oceans and trophic webs and how changes in climate impact these and other marine resources and regional fauna. Students will study trends and systems established for their monitoring and management applying scientific research tools such as remote systems (GIS, images, remote sensing), mobile platforms (boats) as well as probes sampling and monitoring of the marine environment.

Session 1: Physical conditions of the marine environment (Beagle Channel)

- Currents
- Fjords
- Marine dynamics
- Glaciers

Session 2: Oceans – marine biology

- Marine fronts
- Trophic webs

Session 3: Resources

- Fish
- King crab
- Regional fauna

Required Readings:

Cassasa, Gina, editor. *The Patagonian Icefields A Unique Natural Laboratory for Environmental and Climate Change Studies*. Springer Verlag, 2012. [Selected Chapters.]

Peña, M. "Biología Reproductiva de la Tacuarita Azul *Poliophtila Dumicola* en la Reserva de la Escuela Granja (UNL), Esperanza, Santa Fe, Argentina." *FAVE Sección Ciencias Veterinarias*, vol. 4, no. 1/2, Oct. 2005, doi:10.14409/favecv.v4i1/2.1416.

Rabassa, J. "El cambio climático global en la Patagonia desde el viaje de Charles Darwin hasta nuestros días." http://www.scielo.org.ar/scielo.php?script=sci_serial&pid=0004-4822&lng=es&nrm=iso Rev. Asoc. Geol. Argent. vol.67 no.1 Buenos Aires ago. 2010

Module II: Regional Biodiversity

This module, on regional biodiversity, includes lectures on seabirds, marine mammals, and landscapes: fjords, channels, peninsulas. Much of the teaching of this module will happen on the program excursions and in preparation for the expedition to Antarctica. Class meetings prior to the excursions will prepare the students for the intensity of research and opportunities in the field and will include classes on seabirds, marine mammals like whales, dolphins and seals. Students will also learn in situ about the

landscape – the fjords, channels and peninsulas. Students will continue to investigate regional biodiversity on board the vessel to Antarctica. Students will learn about the deep bays and fjords of the Antarctic Peninsula with its massive glaciers. Students will witness penguin rookeries, basking seals and reminders of early explorers. Students will be exposed to the biodiversity including petrels, albatrosses, penguins, gulls and cormorants that populate the archipelago. This module will be an opportunity for students to learn about life as a scientist in Southern Patagonia and Antarctica.

Session 1: Seabirds

- King and Magellanic Penguins
- Albatrosses
- Petrels

Session 2: Marine mammals

- Whales
- Dolphins/porpoise
- Seals

Session 3: Landscapes

- Fjords
- Channels
- Peninsulas

Required Readings:

Rogers, S. F. *Antarctica: life on the ice*. Solas House, 2007.

Cassasa, Gina, editor. *The Patagonian Icefields A Unique Natural Laboratory for Environmental and Climate Change Studies*. Springer Verlag, 2012. [Selected Chapters.]

Module III: Climate Change

In the concluding module of the course, students will now more thoughtfully approach the larger topic of climate change in Southern Patagonia and Antarctica. Students will visit research stations and learn about ice shelf dynamics. Students will investigate how climate changes has impacted marine species through acidification and temperature variations. Students will examine climate change through geology examining peat moss and glaciers. Finally, students will have discussions with scientists, conservationists, guides and other stakeholders through lectures and activities with the Observatory for Climate Change. During and after the expedition to Antarctica students will have the opportunity to interpret the influence of sea ice and glaciers in the Antarctic biota. Students will study how the ozone layer and ultraviolet radiation relates to Antarctica and its role in climate regulation.

Session 1: Climate Change & the Antarctica

- Reserach stations
- Ice shelf dynamics
- Ozone layer

Session 2: Climate Change and Marine Species

- Acidification/temperture variations

Session 3: Global Environmental Watch – Ushuaia

- Obervation of Climate Change Ushuaia

Session 4: Climate Change seen through geology

- Peat moss –precursor to carbon
- Alternation of generations
- Glaciers

Required Reading:

Bull, Benedicte, and Mariel Cristina. Aguilar-Støen. *Environmental politics in Latin America: elite dynamics, the left tide and sustainable development*. Routledge, 2015. [Selected Chapters.]

Climatic change and variability: A southern perspective. (2010). Cambridge: Cambridge University Press. [Selected Chapters.]