THE SCHOOL FOR FIELD STUDIES

The Patagonian Winter

SFS 3282

Syllabus
4 credit

The School for Field Studies (SFS)
Center for Climate Studies (CCS)
Puerto Natales, Chile

www.fieldstudies.org

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COURSE CONTENT SUBJECT TO CHANGE

Please note that this is a copy of a recent syllabus. A final syllabus will be provided to students on the first day of academic programming.

SFS programs are different from other travel or study abroad programs. Each iteration of a program is unique and often cannot be implemented exactly as planned for a variety of reasons. There are factors which, although monitored closely, are beyond our control. For example:

- Changes in access to or expiration or change in terms of permits to the highly regulated and sensitive environments in which we work;
- Changes in social/political conditions or tenuous weather situations/natural disasters may require changes to sites or plans, often with little notice;
- Some aspects of programs depend on the current faculty team as well as the goodwill and generosity of individuals, communities, and institutions which lend support.

Please be advised that these or other variables may require changes before or during the program. Part of the SFS experience is adapting to changing conditions and overcoming the obstacles that they may present. In other words, this is a field program, and the field can change.

Course Overview

The Patagonian winter is a defining aspect of the physical, ecological, and social systems of the region. This course will examine the different ways that winter affects human and non-human systems. We bring you to the world-famous Torres del Paine National Park in the stillness of winter, to observe the camelid guanacos and flightless ñandús as they get ready for the approaching winter. The shortening days drive changes in the ranching practices in the *estancias* in the area as they move their livestock to winter pastures. The approaching Winter Solstice also connects indigenous communities as they make ready for the coming New Year. Finally, the winter brings the season when glaciers would normally be recovering their mass. However, climate change is creating changes in all these interactions.

High-latitude regions, such as Patagonia, are often more prone to the effects of climate change, making changes more apparent and significant. Indeed, climate change in Patagonia is quite clear, and one of the seasons that have seen the most marked change is the winter. There has been less precipitation, and higher temperatures, and the precipitation tends more toward rain. This is leading to changes in ecological and social contexts of the Patagonian winter that we will explore in this course.

This course covers the relevance and changes to winter in high latitude regions. In addition, it evaluates past adaptations to historic winter climates, from plant and animal community distributions and the human settlement patterns driven by climate conditions for the maintenance of communities. We examine what defines the Patagonian winter and how it drives the ecology and social contexts of the region.

Note that – as with many things related with the field – topics and timings may change.

Learning Objectives

A fundamental skill is applying interdisciplinary lenses to examine the impacts and implications in Patagonia of the coming of winter and the longest night of the year.

You will be challenged to examine the natural phenomenon of the Winter Solstice through various lenses – physical, social, and ecological – within the context of Southern Patagonia. This interdisciplinary approach will teach you a variety of skills, including: interdisciplinary system-thinking around conservation, key informant interviewing, aquatic macroinvertebrate sampling in freezing glacial rivers, and landscape observation of Patagonian glaciers, steppes, forests, wetlands, and rivers.

You will visit locations and with people that will help provide context to explore the implications and impacts of the coming of winter and the deepest night of the year. This includes visiting Patagonian ranches (*estancias*) in the hills and forests of Southern Patagonia, hiking through the forests, along the rivers, and up to glaciers in Torres del Paine National Park, and learning from Kawesqar and Mapuche-Williche people living in the region.

Thematic Components and Research Direction

How do human [social] and non-human [ecological] systems respond to the physical phenomenon of winter and the lengthening nights?

In order to address this rather broad question we will examine two specific components:

Subtheme 1
Understand how physical systems in high latitudes like Patagonia are driven by light and heat to generate the phenomenon we know as winter. This gives us different understandings of the ways that water functions as the connector of energy between physical and ecological processes. It drives the glaciers that dominate the mountains of Southern South America. We give a special focus on how drivers of change are affecting the climatic processes of Patagonia's winter.

Subtheme 2
Understand how social systems in Patagonia respond to the coming of the Winter solstice, specifically evaluating the impacts to indigenous peoples, economic activities like tourism operations, and protected areas. By examining how winter structures and defines the ways people interact with the landscape, it is possible to examine the economic dynamics and impacts on sustainable development. We give special emphasis to local ecological knowledge and how it can be integrated with scientific disciplines.

Subtheme 3
Understand how non-human ecological systems in Patagonia respond to the lengthening nights. We will specifically examine plant and animal behavioral responses on land and in freshwater. Tying this to glacial and hydrological dynamics, it is possible to examine how the growing nighttime shifts the ways that natural ecosystems behave during this time of year. We look more deeply at the ways that changes in winter is leading to landscape-scale shifts in Patagonian ecosystems.

Assessment

The evaluation breakdown for the course is as follows:

Assessment Item	Value (%)
FEX a: Physical processes of Winter	15
FEX b: Ecological preparations for winter	15
FEX c: Socioecological comparisons	15
Participation	15
Student-led discussion	20
Final Exam	20
TOTAL	**100**

Assignment Delivery – All assignments must be handed in by their deadline. All written assignments must be submitted using MS Word or – if handwritten – must be sufficiently clearly written so as to be easily legible. Submissions sent after the hand-in deadline will be considered late, with 10% being deducted for every day.

Final Exam (20%)

A written examination will be given, based on the lectures, discussions, field activities, and readings.

Student-Led Discussion (20%)

Students will work in small groups to draw together themes surrounding climate change on the winters in Patagonia, specifically related to the human, ecological, and physical systems covered in the class. Each group will be select one topic at the start of the course and will use online academic resources to deepen the content developed in the course lectures. (These can include resources used in the FEX reports.) Each student group will present the content of their findings, creating a conceptual map of the ways in which climate change affects winter systems. Then, the class will work together to find cross-

linkages between the different themes, further exploring the ways that the implications of changing winters have multiple, sometime concatenated, impacts across systems.

Field Exercise Reports (total 45%)

Our field expeditions offer a great opportunity to explore the region's diverse landscapes, engage in activities, experience the landscape, and delve into the physical, ecological, and social processes found here. What's more, the context of the coming winter provides a rare perspective into how these processes play out when few tourists visit the area. During the course of this semester, you will develop three field reports, using field observations and augmented with online materials.

FEX a: Physical processes of winter (15%)

We will visit different locations where we will see good examples of winter processes. These include Glacier Grey, Perito Moreno Glacier, and the ski areas. We will also see examples of climatic change affecting these processes. You will work in small groups to develop a short report that uses field observations, course topics, and your own research into your topic to explain, compare, and contrast two physical processes associated with winter that we have seen during the session.

FEX b: Ecological preparations for winter (15%)

Winter is a challenging time for biotic systems, and there are many ways that living systems have adapted to survive the winter conditions of a location. This is true when considering biotic systems from organismal or landscape perspectives. During our session, we will visit various locations where we will observe the ways that organisms and landscapes respond to winter. For this assignment, you will work in small groups to explore how an organism or a landscape responds to winter, using examples drawn from field observations and from online research.

FEX c: Socioecological comparison among field expeditions (15%)

The physical phenomenon of winter has a unique expression in the social system in Patagonia. During this session, students will visit different locations for different purposes like developing tourism, conservation, or cultural regeneration. Students will work in small groups defining a socioecological activity (tourism, conservation, cultural knowledge) and will compare between the field expeditions during this session. Each group will develop a short report and they will gain a holistic perspective on Patagonia's unique attributes during winter.

Participation and topic discussions (15%)

Everybody should be prepared for each academic session. This implies reading materials for each session with enough detail to be able to ask relevant questions; participating in analytical discussions about the key issues. Throughout the semester, students will also be asked to lead assignments on assigned topics. Active participation during classes, discussions, and assignments is expected, both in the classroom and in the field.

Grade revisions in any of the above items should be requested in writing at least 24 hours after assignments are returned. No revisions will be considered afterwards.

Grading Scheme

A	95.00 - 100.00%	B+	86.00 - 89.99%	C+	76.00 - 79.99%	D	60.00 - 69.99%
A-	90.00 - 94.99%	B	83.00 - 85.99%	C	73.00 - 75.99%	F	0.00 - 59.99%
		B-	80.00 - 82.99%	C-	70.00 - 72.99%		

General Reminders

Plagiarism – using the ideas or material of others without giving due credit – is cheating and will not be tolerated. A grade of zero will be assigned for anyone caught cheating or aiding another person to cheat either actively or passively.

Deadlines – Apart from the FEX reports, all graded materials (i.e., field activities and final exam) will be submitted on the same day as assigned. In contrast, each FEX report must be submitted by email no later than 6pm on the day following the final observation made for that report. For example, a group's final observation for FEX b is on June 14, then the due date for their report is June 15 at 6pm. All FEX reports must be submitted by email. Exceptions to this rule will be evaluated individually. Late assignments will incur a penalty of 10% of your grade for each day you are late. After two days past the deadline, material will no longer be accepted. Assignments will be handed back to students no more than three days following submission.

Participation – Since we offer a program that is likely more intensive than you might be used to at your home institution, missing even one lecture can have a proportionally greater effect on your final grade simply because there is little room to make up for lost time. Participation in all components of the course is mandatory, it is important that you are prompt for all activities, bring the necessary equipment for field exercises and class activities, and simply get involved.

A Note about Class Readings

Many of the class readings are research articles. These cover a variety of research areas and may use specific data collection and analysis methods that you may be unfamiliar with. We are most interested in understanding the contexts in which the research was conducted and the implications of the research findings. We will spend time in class, focusing on learning how to read scientific papers and extract relevant information for your own purposes.

Lectures, Exercises, and Exams

D: Discussion; **FEX:** Field Exercise; **FL:** Field Lecture; **GL:** Guest Lecture; **L**: Lectures; **O**: Orientation

Code	*Title and outline*	*Readings*	*Type*	*Hrs*
Winter01	**Introduction to course:** Orientation to the course topics and syllabus.		O	1.5
	Semester assignments: Outline the FEXs and student-led discussions. Learning how to read scientific papers.		L	1.5
Winter02	**a. The Phenomenon of Winter:** Exploring winter as a multi-disciplinary phenomenon at the high latitudes of Patagonia.		L	2.0
	b. Introduction to Patagonia: learn how to evaluate Patagonia through physical, ecological, and cultural lenses with a special focus on how winter has shaped this territory.		FL	1.0
	Multi-day Expedition to Parque Nacional Torres del Paine			
Winter03	**a. Energy and water balance in Winter:** How winter creates the interaction between snow and glaciers.	(Cuffey & Paterson, 2010)	FL	2.0

	b. The role of glaciers on forest structure: Exploring up close how glaciers shape the forests that grow near them.		FL	1.0
Winter04	**a. Winter management of the Torres del Paine National Park*:*** Comparing trends and activities in Protected Areas.	(Ruiz et al., 2019)	FL	1.0
	b. Climate Change and Patagonian Winter: How the climate change is affecting the different components and cycles	(Allan et al., 2020)	FL	1.0
	c. Winter adaptations: How do plants and animals survive the challenges of frost, desiccation, and lack of light?	(Iriarte et al., 1991)	FL	1.0
Winter05	**<u>ACTIVITY:</u> Physical systems:** How physical systems define winter and drive social and ecological systems.		D	1.5
Winter06	**a. Eco-social connections:** Winter can highlight the ways that ecosystems, ecology, and society are intertwined.	(Rozzi, 2013)	L	1.0
	b. Glaciers in Patagonia: A mapping exploration of the Last maximum Glaciation on Patagonia.	(Davies et al., 2020)	L	1.0
	c. Context setting: Setting the expectations for the similarities and differences between El Calafate and Ultima Esperanza areas. Connecting these through ecological patterns.		L	1.0
	Multi-day Expedition to El Calafate			
Winter 07	**a. The first "Patagonians":** The settling of the landscape during the retreat of the glaciers.	(Nakatsuka et al., 2020)	FL	1.0
	b. Winter and wetland Understanding wetland biogeochemical dynamics.	(Christensen et al., 1996)	FL	1.0
	c. Winter birdwatching: Many birds take advantage of the coastal wetlands along Lago Argentino. In Humedal Nimez, we look for iconic birds and understand what they do with the onset of winter.		FL	1.0
Winter08	**a. Glaciers:** Comparing the processes of Grey Glacier and Perito Moreno Glacier.		FL	1.0
	b. Connectivity and disconnection with the environment: Comparisons of the ecological experience and impacts of the boardwalk in Perito Moreno vs. the trails in Torres del Paine		FL	2.0
Winter07	**a. Winter tourism:** Winter is a slow time for tourism in Patagonia. In the town of Rio Turbio, we will explore some implications for winter tourism.		FL	2.0
	b. Land management effects on ecology		FL	1.0
Winter10	**<u>ACTIVITY:</u> Ecological adaptations:** How biotic systems have adapted and evolved to live in Patagonian winter conditions.		D	1.5

One-day expedition to Rio Ventisquero				
Winter 11	**a. Socioecological systems and freshwater ecosystem services:** What are some social services provided by water?	(Zagarola et al., 2014)	FL	1.0
	b. Winter and life in freshwater: How does winter affect Patagonian freshwater ecosystems?		FL	1.0
	c. Frozen soils: Observing the implications of freezing and soils.		FL	1.0
Winter 12	**a. Winter and rural areas in Patagonia:** describe the dynamics of rural activities during winter, impacts and imaginaries.		L	1.5
	b. Reforestation efforts: Visiting the CONAF tree nursery to see how reforestation efforts start.		FL	1.5
One-day Expedition to Rupestre Patagonia				
Winter 13	**a. Winter planning:** planning and effects of winter and climate change.		GL	1.0
	b. Cultural conservation: The challenges of climate, dispossession, and conservation.		FL	1.0
	c. Climate change effects on winter: Exploring the ways that climate change is directly altering winters in Patagonia.	(Aguirre et al., 2018)	FL	1.0
Winter 14	**a. Indigenous knowledge: Kawésqar:** The pre-Hispanic indigenous peoples of the Patagonian canals and fjords.		GL	1.0
	b. Winter Solstices: Connecting the physical and cultural on the day with the longest night.		D	1.0
	c. Celebration of *We-Tripantu*		GL	1.0
Winter 15	**<u>ACTIVITY:</u> Synthesis of social perspectives:** Combining what we have learned about human associations with nature and winter in Patagonia.		D	1.5
One-day Expedition to MN Cueva del Milodón				
Winter 16	**Chile's conservation model:** Examine the history and management principles of Chile's models for landscape, coastal, and marine conservation.	(Petit et al., 2018)	FL	1.5
	Biodiversity Conservation vs Biocultural conservation: Explore how landscape conservation can be placed at odds with indigenous cultural practice and maintenance	(Laterra et al., 2021)	FL	1.5
Winter 17	**Student-Led Discussions:** Students will present the findings from the previous three weeks. Common themes will be highlighted between projects.		D	3.0
Multi-day Expedition to Punta Arenas				
Winter 18	**a. Wetlands & water supply:** Changes regarding wetlands and the implications for water supply.		FL	1.0
	b. Ecological landscape change: Examine the expected impacts of climate change on local ecology	(Lazo-Cancino et al., 2020)	FL	1.0

Winter 19	**a. Winter tourism and climate change:** Evaluate the role of natural areas, climate change, and the ski industry. **b. Snow pit and snow properties:** Understand field techniques and measure snowpack properties		FL FL	1.0 2.0
Winter 20	**Final Exam**		Exam	3.0
Winter 21	**a. Snow-vegetation interactions** **b. Kelp and blue carbon** **c. The Magellanic rainforest:** Exploring the broadleaf evergreen forests of the southernmost rainforests in the world.	(Wipf et al., 2009)	FL FL FL	1.0 1.0 1.0
		Total hours	58.5	

Course Readings

Aguirre, F., J. Carrasco, T. Sauter, C. Schneider, K. Gaete, E. Garín, & G. Casassa, 2018. Snow cover change as a climate indicator in Brunswick Peninsula, Patagonia. Frontiers in Earth Science 6: 130.

Allan, R. P., M. Barlow, M. P. Byrne, A. Cherchi, H. Douville, H. J. Fowler, T. Y. Gan, A. G. Pendergrass, D. Rosenfeld, A. L. S. Swann, L. J. Wilcox, & O. Zolina, 2020. Advances in understanding large-scale responses of the water cycle to climate change. Annals of the New York Academy of Sciences 1472: 49–75.

Christensen, T. R., I. C. Prentice, J. Kaplan, A. Haxeltine, & S. Sitch, 1996. Methane flux from northern wetlands and tundra: an ecosystem source modelling approach. Tellus B 48: 652–661.

Cuffey, K. M., & W. S. B. Paterson, 2010. Glacial Hydrology The physics of glaciers. : 175–223.

Davies, B. J., C. M. Darvill, H. Lovell, J. M. Bendle, J. A. Dowdeswell, D. Fabel, J. L. García, A. Geiger, N. F. Glasser, D. M. Gheorghiu, S. Harrison, A. S. Hein, M. R. Kaplan, J. R. V. Martin, M. Mendelova, A. Palmer, M. Pelto, Á. Rodés, E. A. Sagredo, & V. R. Thorndycraft, 2020. The evolution of the Patagonian Ice Sheet from 35 ka to the present day (PATICE. Earth-Science Reviews 204: 103152.

Iriarte, J., W. Johnson, & W. Franklin, 1991. Feeding ecology of the Patagonia puma in southernmost Chile. Revista Chilena de Historia Natural 64: 145–156.

Laterra, P., L. Nahuelhual, M. Gluch, P. L. Peri, & G. Martínez-Pastur, 2021. Imaginaries, Transformations, and Resistances in Patagonian Territories from a Socio-Ecological Perspective: 397–427.

Lazo-Cancino, D., R. Rivera, K. Paulsen-Cortez, N. González-Berríos, R. Rodríguez-Gutiérrez, & E. Rodríguez-Serrano, 2020. The impacts of climate change on the habitat distribution of the vulnerable Patagonian-Fueguian species Ctenomys magellanicus (Rodentia, Ctenomyidae). Journal of Arid Environments 173: 104016.

Nakatsuka, N., P. Luisi, J. M. B. Motti, M. Salemme, F. Santiago, M. D. D'Angelo del Campo, R. J. Vecchi, Y. Espinosa-Parrilla, A. Prieto, N. Adamski, A. M. Lawson, T. K. Harper, B. J. Culleton, D. J. Kennett, C. Lalueza-Fox, S. Mallick, N. Rohland, R. A. Guichón, G. S. Cabana, R. Nores, & D. Reich, 2020. Ancient genomes in South Patagonia reveal population movements associated with technological shifts and geography. Nature Communications 11: 3868.

Petit, I. J., A. N. Campoy, M. J. Hevia, C. F. Gaymer, & F. A. Squeo, 2018. Protected areas in Chile: Are we managing them?. Revista Chilena de Historia Natural Revista Chilena de Historia Natural 91: 1–8.

Rozzi, R., 2013. Biocultural Ethics: From Biocultural Homogenization Toward Biocultural Conservation In Rozzi, R., S. T. A. Pickett, C. Palmer, J. J. Armesto, & J. B. Callicott (eds), Linking Ecology and Ethics for a Changing World. Springer Netherlands, Dordrecht: 9–32.

Ruiz, J. B., M. Lamers, S. Bush, & G. B. Wells, 2019. Governing nature-based tourism mobility in National Park Torres del Paine, Chilean Southern Patagonia. Mobilities Routledge 00: 1–17.

Wipf, S., V. Stoeckli, & P. Bebi, 2009. Winter climate change in alpine tundra: plant responses to changes in snow depth and snowmelt timing. Climatic change 94: 105–121.

Zagarola, J. P. A., C. B. Anderson, & J. R. Veteto, 2014. Perceiving patagonia: An assessment of social values and perspectives regarding watershed ecosystem services and management in Southern South America. Environmental Management 53: 769–782.