Tropical Biome Ecology and Climate Change
SFS 3691

Syllabus
4 credits

The School for Field Studies (SFS)
Center for Rainforest Studies
Yungaburra, Queensland, Australia

This syllabus may develop or change over time based on local conditions, learning opportunities, and faculty expertise. Course content may vary from semester to semester.

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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

In Tropical Biome Ecology & Climate Change, you will obtain a broad appreciation of the diversity and dynamics of tropical terrestrial & marine biomes. You will be introduced to the current and past distributions of tropical rainforests, dry forest, savannas and coastal biomes, their biodiversity, and their relationships with the abiotic environment, human use, present threats, and restoration practices. This course aims to bring together an understanding of the underlying ecological processes that affect different biomes with the role of human society in shaping the present and future rainforests of the Wet Tropics & the coral reefs of the Great Barrier Reef. The course will take the rainforest Australian Wet Tropics & the coral reefs of the Great Barrier Reef (GBR) as case studies to investigate this field, yet many of the skills you learn here can be transferred to other systems. Topics covered will include: biophysical determinants vegetation and coral reef distribution; past, present, and future threats to Wet Tropics rainforests & GBR; and the theory and practice of rainforest and coral restoration.

The course is a mixture of class lectures, field lectures, field laboratory courses, workshops, field trips, and readings to complement the material presented in the lectures. A major emphasis is on field skills, the collection, management and analyses of data, and skills of writing a scientific paper. A wide range of material will be provided and should be used to study the class topics and to acquire the desired skills. Be aware that all material covered in class, lectures, field lectures, and field trips.

Center Research Direction

The Centre for Rainforest Studies' research plan addresses the question: *How can the future of the Wet Tropics in a changing world be ensured?* Staff and students of SFS-CRS investigate this topic by engaging in research under three core components:

1. Understanding ecological and social systems
2. Conflict, vulnerability, and change
3. Effective response to change

Through our research, we aim to assist a range of stakeholders and research partners. These include local landholders; non-government conservation organizations conducting rainforest restoration or having a special interest in flora and fauna; several levels of government, particularly local and state government; regional research organizations, including universities and the Commonwealth Scientific and Industrial Research Organization.

We aim to improve stability, sustainability, environmental awareness, and concern for natural resources in the Wet Tropics, on the Atherton Tablelands. Our goal is to strengthen research, technical and practical collaboration between SFS-CRS and other research organizations, governmental agencies, and non-governmental organizations to carry out this agenda.

Learning Objectives

Following this course, students should understand:

1. the factors that influenced the origin of the Wet Tropics rainforests & GBR coral reefs
2. the ecology of rainforest and associated ecosystems in the Wet Tropics Bioregion
3. an overview of coral reef ecology
4. how climate change is affecting these biomes in Australia
5. restoring terrestrial and marine ecosystems

Assessment

Assessment Item	Value (%)
Field Exercise (FEX) and Data Interpretation	25
Biodiversity Assignment	10
Plant ID Quiz	15
Climate Change Presentations	15
Final Exam	30
Participation	5
TOTAL	**100**

Field Exercise (FEX) and Data Interpretation (25%)

One of the main aims of our study abroad program is to give you a keen appreciation of the diversity of tropical forests and their structure. One of the best ways to get such an appreciation is to construct a profile of a forest using data collected in the field. This includes setting up plots to sample vegetation and measuring and identifying plants. By going through such an exercise, you will learn valuable skills in setting up research plots. You will also learn to analyze and interpret data you collect from your study plots during the course, and also write a short report that presents and interprets the data you collect. Data curation is an important aspect of the FEXes and will represent 5% of the grade.

Biodiversity Assignment (10%)

Following the lectures on rainforest biodiversity, you will use iNaturalist to document rainforest diversity around you. This exercise will give you a deep appreciation of the plant and invertebrate biodiversity of the region.

Plant ID Assignment and Quiz (15%)

This assignment brings you back to the basics. Good science is good observation. Good observations come with good notes. Many prominent scientists in the fields of natural science such as botany and zoology are known for their careful collections of specimens and meticulous notes. This assignment therefore aims to give you a keen appreciation of this fundamental practice of making biological collections and practicing your plant identification skills as part of a team.

The purpose of the quiz is to develop your skills in identifying the flora of our rainforest by using spot characters and identification tools. As the rainforest of Atherton Tablelands is home to a diverse flora the familiarization with the most common species will help to better understand the roles these plants play in the ecosystems of this region. Plant ID skills depends on attention to detail and trains your observational powers. These skills are applicable in forest regions beyond the Australian tropics. We will conduct an intensive plant ID workshop early in the course to practice techniques of plant identification.

Climate Change Presentations (15%)

The purpose of this assignment is to help you develop skills in scientific presentation. For this 15-minute talk, a range of topics related to climate change and tropical biomes will be available to choose from.

Final Exam (30%)

During the final exam you will be tested on material presented in lectures, field lectures and excursions, requiring critical and analytical thinking across the various teaching units.

Participation (5%)
During the course, students will be graded by faculty based on their overall participation in fieldwork and during lectures or discussion. Students may also have their peers involved in giving feedback on how each of them participated during group work.

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

Honor Code/Plagiarism – SFS places high expectations on their students and we hold students accountable for their behaviors. SFS students are held to the honor code below. SFS has a zero-tolerance policy towards student cheating, plagiarism, data falsification, and any other form of dishonest academic and/or research practice or behavior. Using the ideas or material of others without giving due credit is cheating and will not be tolerated. Any SFS student found to have engaged in or facilitated academic and/or research dishonesty will receive no credit (0%) for that activity.

> *"SFS does not tolerate cheating or plagiarism in any form. While participating in an SFS program, students are expected to refrain from cheating, plagiarism and any other behavior which would result in a student receiving credit for work which they did not accomplish on their own. Students are expected to report any instance of cheating or plagiarism by others."*

Deadlines – Deadlines for written and oral assignments are instated to promote equity among students and to allow faculty ample time to review and return assignments before others are due. As such, deadlines are firm; extensions will only be considered under extreme circumstances. Late assignments will incur a penalty of 10% of your grade for each day you are late. After two days past the deadline, assignments will no longer be accepted. Assignments will be handed back to students after a one-week grading period. Grade corrections for any assessment item should be requested in writing at least 24 hours after assignments are returned. No corrections will be considered afterwards.

Content Statement – Every student comes to SFS with unique life experiences, which contribute to the way various information is processed. Some of the content in this course may be intellectually or emotionally challenging but has been intentionally selected to achieve certain learning goals and/or showcase the complexity of many modern issues. If you anticipate a challenge engaging with a certain topic or find that you are struggling with certain discussions, we encourage you to talk about it with faculty, friends, family, the HWM, or access available mental health resources.

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.

Course Content

Type- L: Lecture, **FL:** Field Lecture, **FEX:** Field Experience, **REV:** Review, **FLAB:** Field Lab, W: Workshop, **GL:** Guest lecture

Readings in **bold are required*

No	*Topics covered*	*Hours*	*Type*	*Required Readings*
1	**Course Overview** This lecture gets you into the swing of discovering Australia's natural assets and exploring ecological patterns and processes	1.0	L	Attiwill & Wilson (2006).
2	**Biomes 1: The Tropical Rainforest** Understand the main factors that determine the occurrence of a Rainforest in an area. You will learn how to recognize and classify this important biome and learn about its relevance	2.0	L	**Bowman, D.M.J.S. (2000).** Richards, P. W. (1952). Tracey, J. G. (1982). Adam, P. (1992).
3	**Plant ID workshop** This workshop will introduce the fine art of rainforest plant ID using spot characters At the end of the workshop, we will also introduce you to your plant collection assignment	5.0	FL; W; FLAB	Hyland, B.P.M., et al. (2010). Jackes, B.R. (2001).
4	**Plant diversity in the Australian Wet Tropics** An overview of the biodiversity of tropical plant life in the Australian Wet Tropics from a phylogenetic perspective	1.0	L	Jackes, B.R. (2001).
5	**Biomes 2: Wetlands and Mangroves** We will explore what is considered freshwater and a coastal wetland and understand in which environmental conditions each type occurs. You will learn why this is such a unique habitat where the plants need to deal with a waterlogged condition and explore the connection between land and sea.	1.0	L	**Keddy, P.A. (2010).** **Mcleod, E., et al. (2011).**
6	**Biomes 3: Dry forests and Savanna** Let's talk about fire: you will navigate on one of the most widespread biomes in Australia, the Savanna, and understand how fire plays an important role in this Biome. You will also learn the specific features of Dry Forest and why this important biome has its biodiversity been neglected.	1.0	L	**Skarpe, C. (1992).** **Sunderland, T., Apgaua, D., et al. (2015).**
7	**Biomes 4: Tropical Marine Biomes & Coral Reefs** These series of lectures will give you an overview of tropical marine biomes and marine diversity, and help you to understand how terrestrial biomes are interconnected with marine biomes. These sessions will be an introduction for your excursion to an offshore island in the Great Barrier Reef.	1.0	L; GL	**Castro & Huber (2016).** Hayden, B. P., Ray, G. C., & Dolan, R. (1984).

8	**Tropical Marine Biomes and Reef Ecology** Following the class lectures, we will explore the ecology of the reef and adjacent ecosystems in the Great Barrier Reef.	7.0	FEX	**Cheal et al. (2012). Georgiou et al. (2015). Jones et al. (2018).** Wooldridge and Brodie (2017). Turton (2019).
9	**Documenting biodiversity with a citizen science app** You will be given your iNaturalist assignment.	1.0	L	**Callaghan, C.T., et al. (2021)**. **Mesaglio, T., & Callaghan, C.T. (2021).**
10	**Soil Microbiome** In this class, you will gain an understanding of how soil constitutes a living ecosystem driven by its soil food web. Additionally, you will grasp the environmental benefits associated with it.	1.0	L; W	Masters, N. (2019). Altieri, M. A. (2018).
11	**Ecology of invasive species** You will learn about the concept of invasive species (with an emphasis on invasive plants) and how and why species become invasive. Think critically about whether this issue is the cause or the consequence of a bigger problem, and what the international community is doing about invasive species.	1.0	L	**Colautti, R.I., & MacIsaac, H.J. (2004).** **Didham, R. K., et al. (2005).**
12	**Climate change & anthropogenic impacts on biomes** Understanding climate change has become crucial for critical thinking about a more sustainable future. In this class you are going to understand the anthropogenic climate change causes and its consequences on natural environments.	2.0	L	**Rahmstorf, S., et al. (2007).** **Thuiller, W. (2007).** **Swain, D. L., et al. (2020).**
13	**Agroecology – understanding the ecology of regenerative agriculture** learn about how the science of ecology applies to agricultural systems. This lecture ties in with the agroecology lectures in the ESSV course.	3.0	L; FL; GL	**Götsch, E. (1995).** **Andrade, D., et al. (2020).**
14	**Reversing Fragmentation: Theory and Practice** Habitat fragmentation has profound impacts on ecological communities – we will consider some theoretical aspects of these impacts and consider some examples from flora and fauna. You will be introduced to the principles of mitigating fragmentation effects. We will then explore factors which determine how an organism responds to a fragmented landscape and how to mitigate the effects of fragmentation on species.	2.0	L; FL	**Soule, M.E. et al. (2004).** **Jones et al. (2011).** **Goosem et al. (2005).** **Pascual-Hortal and Saura (2006).** **Villard-Metzger (2014).** **Cattarino et al. (2016).** **Zeller et al. (2012).**

15	**Field Exercises** These exercises are designed to give you practical experience in ecological field studies. Most of these exercises will be carried out during the major field excursions and also some at the CRS.	15.0	L; FL; FEX	Ellenberg, D., & Mueller-Dombois, D. (1974). Elzinga et al. (2001). Kent, M. (2011).
16	**Plant ID quiz** Utilize your knowledge acquired during the plant ID course and the provided resources to prepare yourself for the plant ID quiz.	2.0	FEX	Hyland, B.P.M., et al. (2010). Jackes, B.R. (2001).
17	**Climate Change Topics Presentation** Assignment where you present what you have researched about a topic relevant to the course	3.0	L	
22	**Exam Review**	1.0	REV	
	Total	**50**		
	UMN Instructional Hours*	**60**		

**UMN defines* an instructional hour as a 50-minute block. SFS syllabi are written in full 60-minute hours for programming purposes. Therefore 50 full hours = 60 UMN instructional hours (for four credit courses) and 25 full hours = 30 UMN instructional hours (for two credit courses).*

Reading List

***Readings in bold are required**

1. Adam, P. (1992). Australian rainforests. Oxford University Press.
2. **Andrade, D., et al. (2020).** Syntropy and innovation in agriculture. Current Opinion in Environmental Sustainability, 45, 20-24.
3. Attiwill & Wilson (2006). Ecology. An Australian Perspective. (2nd ed). Oxford University Press.
4. **Bowman, D.M.J.S. (2000).** Australian rainforests: islands of green in a land of fire. Cambridge University Press. (Selected chapters)
5. **Callaghan, C. T., et al. (2021).** Three frontiers for the future of biodiversity research using citizen science data. BioScience, 71, 55-63.
6. **Castro & Huber (2016).** Marine Biology. (10th ed.). McGraw-Hill Education. (Selected chapters)
7. **Cattarino et al. (2016).**
8. **Cheal et al. (2012).**
9. **Colautti, R. I., & MacIsaac, H. J. (2004).** A neutral terminology to define 'invasive' species. Diversity and Distributions, 10, 135-141.
10. **Dawson, S. K., et al.. (2021).** The traits of"trait ecologists": An analysis of the use of trait and functional trait terminology. Ecology and evolution 11, 16434-16445.
11. **Didham, R. K., et al. (2005).** Are invasive species the drivers of ecological change?. Trends in ecology & evolution, 20, 470-474.
12. Ellenberg, D., & Mueller-Dombois, D. (1974). Aims and methods of vegetation ecology. New York: Wiley.
13. Elzinga et al. (2001). Monitoring plant and animal populations. Blackwell Science, Inc.
14. **Georgiou et al. (2015).**
15. **Goosem et al. (2005).**

16. **Götsch, E. (1995).** Break-through in agriculture (p. 22p). Rio de Janeiro: AS-PTA.
17. Hayden, B. P., Ray, G. C., & Dolan, R. (1984). Classification of coastal and marine environments. Environmental Conservation, 11, 199-207.
18. Hyland, B.P.M., et al. (2010). Australian tropical rainforest plants. Trees, shrubs and vines. Version, 6.
19. Hyland, B.P.M., et al. (2010). Australian tropical rainforest plants. Trees, shrubs and vines. Version, 6.
20. Jackes, B.R. (2001). Plants of the tropics : rainforest to heath ; an identification guide. Townsville, Qld: James Cook University, School of Tropical Biology.
21. Jackes, B.R. (2001). Plants of the tropics : rainforest to heath ; an identification guide. Townsville, Qld: James Cook University, School of Tropical Biology.
22. Jackes, B.R. (2001). Plants of the tropics : rainforest to heath ; an identification guide. Townsville, Qld: James Cook University, School of Tropical Biology.
23. **Jones et al. (2011).**
24. **Jones et al. (2018).**
25. **Keddy, P.A. (2010).** Wetland ecology: principles and conservation (2nd ed.). New York: Cambridge University Press.
26. Kent, M. (2011). Vegetation description and data analysis: a practical approach. John Wiley & Sons.
27. **Mcleod, E., et al. (2011).** A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2. Frontiers in Ecology and the Environment, 9, 552-560.
28. **Mesaglio, T., & Callaghan, C. T. (2021).** An overview of the history, current contributions and future outlook of iNaturalist in Australia. Wildlife Research.
29. **Pascual-Hortal and Saura (2006).**
30. **Rahmstorf, S., et al. (2007).** Recent climate observations compared to projections. Science, 316(5825), 709-709.
31. Richards, P. W. (1952). The tropical rain forest. The tropical rain forest: an ecological study. Cambridge University Press.
32. **Skarpe, C. (1992).** Dynamics of savanna ecosystems. Journal of Vegetation Science, 3, 293-300.
33. **Soule, M.E. et al. (2004).** The role of connectivity in Australian conservation.- Pacific Conservation Biology 10: 266-279. CRS Library JPCB104
34. **Sunderland, T., Apgaua, D., et al. (2015).** Global dry forests: a prologue. International Forestry Review, 17, 1-9.
35. **Swain, D. L., et al. (2020).** Attributing extreme events to climate change: A new frontier in a warming world. One Earth, 2(6), 522-527.
36. **Thuiller, W. (2007).** Climate change and the ecologist. Nature 448, 550–552
37. Tracey, J. G. (1982). Vegetation of the humid tropical region of north Queensland. CSIRO, Melbourne.
38. Turton (2019)
39. **Villard-Metzger (2014).**
40. **Violle, C., Navas, M. L., Vile, D., Kazakou, E., Fortunel, C., Hummel, I., & Garnier, E. (2007).** Let the concept of trait be functional!. Oikos, 116, 882-892.
41. Wooldridge and Brodie (2017)
42. **Zeller et al. (2012).**