

ECOLOGY AND ECOSYSTEMS (YID2203)

2nd Semester, AY 2017-2018

Time and location: Monday & Thursday 9:00-10:30 am, classroom ...

Note: Classes end 10 minutes prior to the timetabled end time

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1. Course Description

1.1 What we will study

Ecology investigates the complex interactions of living organisms with one another and their environment at different levels of organization, from populations up to ecosystems. The scope of ecology is as wide as the diversity of life on earth. However, this module we will not try to cover as much as possible, but rather is organized around - and focuses on four questions:

1. *Species differences*: Why do we expect trade-offs in ecology?
2. *Population dynamics*: What regulates the distribution and growth of natural populations?
3. *Biodiversity*: What mechanisms drive the coexistence of species in natural communities?
4. *Ecosystem dynamics*: How do complex interactions and feedback mechanisms influence ecosystem functioning and services?

Each of these focal questions will provide for the framework to introduce and explore new questions and concepts, while explicitly building on what we learned previously. We will focus on basic ecological questions and research, but we will learn that humans influence natural systems in many profound ways. Occasionally, we will dive deeper into how ecological research and models inform the sustainable management of our natural resources in fields such as biodiversity conservation, agriculture, fisheries, ecosystem restoration, wildlife management, public health and other fields.

1.2 Learning Objectives

Upon successful completion of this module, you should be able to:

1. Summarize and explain key questions, principles and concepts in ecology.
2. Clarify and illustrate the broad significance of ecological research in natural resource management and biodiversity conservation.
3. Differentiate and instantiate how ecologists try to find answers to their questions.
4. Interpret, contrast and link basic mathematical, verbal and graphical models of ecological processes and mechanisms.
5. Interpret, summarize and draw conclusions from published empirical research, including graphs and tables.
6. Carry out basic analysis of ecological data, and interpret the findings in the context of the ecological concepts discussed in this module.
7. Apply your understanding of the principles of sampling and experimental design in the development of a proposal for a simple ecological study
8. Demonstrate ecological literacy and engage in informed discussions on applied issues in ecology and natural resource management.

1.3 Course outline

Each week is organized around a specific topic (e.g., predator-prey interactions) that links to one of the four focal questions of this module. Generally, the Monday class will be seminar-style with a mix of a short interactive lecture with questions & answers, a free-flow or structured discussion of the readings and small exercises aimed at either (i) reinforcing newly introduced concepts; (ii) taking a deep dive into how ecologists came to specific conclusions; or (iii) practice specific analytical and numerical skills (e.g., drawing conclusions from an experiment or observation, interpreting graphs, or simple data analysis). In the Thursday class we will generally work on a larger in-class activity, with a strong emphasis on the questions ecologists ask, on why they ask these questions and on the different ways in which they try to answer these questions. Purpose of these in-class activities is to get familiar with different research approaches in ecology and

practice analytical skills that are important in the ecological and environmental research. The course schedule in section 6 gives examples of such activities.

2. Course Assessment and description of assignments

2.1 Preparation and participation (35%)

- a) Weekly online submission on a Canvas discussion board of at least five comments, questions or observations directly related to the assigned reading from the module's textbook. This can also include responses to each other's comments and questions. Purpose is to make you think about and actively engage with the text.
 - Deadline: 8:30am, day of class.
 - *Submission graded as unsatisfactory, satisfactory or good; 5%.*
- b) Weekly online submission of your answers to 3 questions from a list of questions related to the assigned reading from the textbook. One question is about reviewing and retaining what you learned. A second question is about applying what you learned. For example, you might be asked to articulate predictions generated by a hypothesis, link new concepts to concepts learned in previous chapters or apply a new concept in a different context. A third question will present you with data or graphs which you will have to analyze and interpret in the context of a concept introduced in the chapter.
 - Deadline: 8.30am, day of next class (usually Thursday).
 - Submission graded as unsatisfactory, satisfactory or good; 10%.
- c) Submission of results / notes of pre-class assignments and in-class activities and exercises before next class on Canvas.
 - Deadline: 8.30am, day of next class.
 - Submission graded as unsatisfactory, satisfactory or good; 10%.
- d) Instructor evaluation of the degree to which you participated constructively and consistently, which means (i) contributing to class discussions and learning (ask questions, respond to questions of instructor and other students, share ideas and give space to other students) and (ii) working actively and with purpose on in-class activities and assignments. In addition, you will be asked once or twice (depending on class size) to shortly describe one of the question assigned to you to the whole class, explain your answer, and discuss follow-up questions or remarks, using the white board when helpful. (10%)

2.2 Quizzes (30%)

The quizzes will assess learning objectives 1-5 (section 1.2).

- Quiz 1 – week 6, on population dynamics, Tradeoffs and life history strategies. (15%)
- Quiz 2 – week 11, on ecological interactions. (15%)

2.3 Final take-home assignment (35%)

The final take-home assignment will cover most of the topics of the module (e.g., species traits and tradeoffs, population dynamics, species interactions, feedback mechanisms and ecosystem dynamics) and assess learning objectives 1-7 (section 1.2). The following is to give you a broad idea of how this assignment may look like. Through questions and writing prompts, you may be asked to:

1st part (10%)

- Interpret, summarize and draw conclusions from the results of ecological studies.
- Analyze and graph simple data and interpret and discuss the results in the context of specific ecological concepts.
- Explore and discuss the dynamics of simple systems using toy simulation models.

2nd part (10%)

- Outline how field experiments, simulation models and analytical models complement each other.
- Relate empirical data from a field study to the parameters and decision rules of a simulation model and/or coefficients of a basic theoretical model.

3rd part (15%)

- Predict how forest succession (dynamics, trajectories, main drivers) differs among contrasting landscapes, based on provided data with regard to landscape context and environmental conditions, and additional assumptions when needed.
- Design a simple (and short) field experiment to test one of the hypotheses.
- Design and carry out a simple experiment in a simulation model, analyze and discuss the results, and relate to your initial hypotheses.

Please note that:

- The description of this final assignment is provisional!
- The final assignment will be available in week 11, with the deadline for submission at the beginning of the exam week
- All elements and required skills have been discussed in class and/or practiced in assignments and exercises during the semester

3. Module policies

3.1 Late Assignment Policy

- You are expected to plan and manage your workload, and to ensure you do not lose work through IT malfunction.
- You are expected to submit work on or before the deadlines specified in the syllabi or as advised in class or on Canvas.
- Your assignment will be considered late if it misses the deadline without a Vice Rector note or Medical Certificate.
- For every late assignment, your grade will fall by 5% per 12 hours after the deadline.

3.2 Attendance

- During class time, we will spend most time on discussing readings and on assignments and exercises that link content and skills. As such, classes are an integral part of the learning objectives of this module and your attendance and participation is a substantial part of the course assessment (section 2.1). *You are therefore expected to attend all classes.*
- A maximum of one absence is allowed without a Medical Certificate or Vice Rector note for the purposes of required fieldwork for another course, but you must still request and agree this absence with me in advance.
- Permission to be absent from class for reason of extra-curricular activities is not automatic and is at the discretion of the instructor.
- Absence *without an agreed exemption* will affect your instructor evaluation (From 1 to 5 absences, grade penalties will be -2%, - 5%, -8%, -11%, -14%; while you will fail the course with more than 5 absences without permission).
- When you miss a class, you are still expected to prepare for class (as outlined in section 2.1a and b), do the in-class assignments and exercises (or replacement assignments) and submit the results online (as outlined in section 2.1c).
- Consistently coming late to class will negatively affect the instructor evaluation.

3.3 Canvas Page Usage Policy

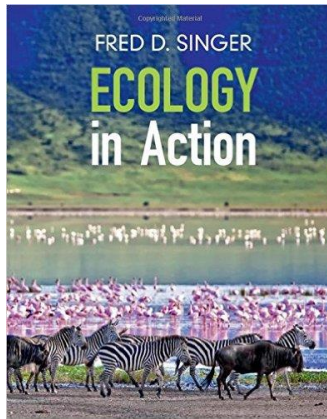
Announcements, changes to the syllabus, assignments and learning materials are all posted on Canvas. Similarly, Canvas is the location for submission of assignments, grading and online instructor-student feedback. Therefore, students are expected to check the course page daily.

3.4 Electronic devices and social media

- Use of social Media is not allowed in class
- Laptops and any other electronic device stored (i.e., not on the table) except when needed for a class activity.

4. Course Materials

- The main textbook is Singer, F.D. (2016). *Ecology in action*. Cambridge University Press. ISBN-13: 978-1107115378. Available as ebook (Amazon and Cambridge U.P.).



- Optional readings from N.J. Gotelli (2008) *A Primer of Ecology*, 4th Edition. Sinauer Associates. ISBN-13: 978-0878933181. Provides very clear explanations of some of the theoretical models we will deal with during the course. Available in the Yale-NUS library.
- We will also use texts from other books, reports, scientific articles and websites, as well as well as videos and other resources. All materials or links to these materials will be posted on our Canvas site.
- We will use software for data analysis (R and Rstudio) and for simulation modelling (Netlogo, Stella and a simulation model developed by Yale-NUS students (!).

5. Integrity, conduct & Wellness

5.1. Academic Integrity Policy

Yale-NUS College expects its students to abide by the highest standards of academic integrity as a matter of personal honesty and communal responsibility. Acting with academic integrity requires that (a) students do their own work, (b) students not interfere with the work of others, (c) students accurately and honestly represent the content of their work, and (d) students properly attribute others' work. Violations of the College's academic integrity standards undermine both the community and the individual growth of students. Accordingly, they will be addressed with the utmost seriousness and sanctions ranging from grade penalties to expulsion. Examples of violations of academic integrity include plagiarism, copying or sharing homework answers, submitting work completed for one course as 'new' work for another course, or fabricating or falsifying research data. For more information please visit the Student Services website, Policies and Procedures section: <https://studentlife.yale-nus.edu.sg/policies/academic-integrity/>. The Yale-NUS Library provides resources on citations and plagiarism here: <http://library.yale-nus.edu.sg/plagiarism/>

5.2 Nondiscriminatory Language and Conduct:

This course encourages non-discriminatory language and conduct. Students should not use racist, sexist or other discriminatory language in class discussions or written work.

5.3 Health and Wellness Contacts

If you are experiencing undue stress or feel you might benefit from private counseling, please contact the Yale-NUS Health and Wellness Centre. The wellness centre also offers a wide range of enriching workshops and events. You may also wish to reach out to Vice Rector within your residential College. For this and other kinds of support.

<https://studentlife.yale-nus.edu.sg/wellness/>

6. Course Schedule

Weekly reading assignments include the indicated chapters of the textbook (EiA) (generally) for the Monday class and additional readings for the Thursday class to prepare for in-class activities. The latter learning materials will be announced on Canvas. *Changes to this schedule will be announced on Canvas.*

Week 1: Terrestrial and Aquatic Biomes

- *Monday:*
 - Reading: AiE, chapter 1 (*no submission of comments!*).
 - Optional reading: Sagarin & Pauchard (2009). *Observation and Ecology. Broadening the scope of science to understand a complex world.* Island Press. Chapter 3. Using All the Senses in Ecology.
 - Activity: species diversity and distribution in our garden.
- *Thursday:*
 - Reading: AiE, chapter 2 (*no submission of comments!*).
 - Activity: Plotting and interpretation of changes in community structure along gradients

Week 2: Physiological Ecology: Resources and Conditions

- *Monday*
 - Reading: AiE, chapter 4.
- *Thursday:*
 - Activity (provisional): Measuring Photosynthesis in our Garden.
 - Reading: TBA.

Week 3: Tradeoffs and Life History Strategies

- *Monday*
 - Reading: AiE, chapter 8.
- *Thursday:*
 - Activity: Fast-slow' continuum of the leaf economic spectrum: finding tradeoffs in plant functional traits (PFTs).
 - Reading: TBA.

Week 4: Distribution of Species

- *Monday reading: AiE, chapter 9.*
- *Thursday:*
 - *Sampling and experimental design, with peer feedback.*
 - *Reading: Ruxton & Colegrave (2006). Experimental design for the life sciences. Third edition. Oxford University Press. Chapter 3, pp. 35-74.*

Week 5: Population Growth and Regulation

- *Monday*
 - Reading: AiE, chapter 10
- *Thursday:*
 - Using model systems to study the basic principles of population dynamics.

- Reading: TBA.

Week 6: Landscape Ecology and Biodiversity Conservation

- *Monday*
 - Reading: AiE, parts of chapters 11 and 22.
- *Thursday:*
 - **Quiz 1**
 - Activity: Using spatially explicit simulation models to inform conservation strategies.

Week 7: Interspecific Competition

- *Monday*
 - Reading: AiE, chapter 13
- *Thursday:*
 - Activity: Reading and interpreting graphs.
 - Reading: TBA.
 - [Results Quiz 1 back](#)

Recess Week – No Classes

- [Instructor evaluation first half of semester](#)

Week 8: Predation and Other Exploitative Interactions

- *Monday*
 - Reading: AiE, chapter 14.
- *Thursday:*
 - *Grass, sheep & wolves and other toy models to explore species interactions.*
 - Reading: TBA.

Week 9: Interactions and Coexistence

- *Monday:*
 - reading TBA
- *Thursday:*
 - How does it all relate? A white board exercise to link models and concepts, processes and research approaches.
 - Reading: TBA.

Week 10: Disturbance, Succession and Ecosystem Stability.

- *Monday*
 - Reading: AiE, chapter 21.
- *Thursday:*
 - Your notes from week 1: any new thoughts and ideas?
 - Mini proposals (questions/hypotheses, design, expected results), with peer feedback
 - Reading: TBA.

Week 11: Complex Interactions and Food Webs

- *Monday*
 - Reading: AiE, chapter 16.
- *Thursday:*
 - **Quiz 2**
 - Reintroducing wolves in Yellowstone; nature documentary versus scientific papers.
 - Reading: TBA.

- Final written assignment (take-home exam) available

Week 12: Biological Diversity and Community Stability

- *Monday*
 - Reading: AiE, chapter 17
- *Thursday:*
 - Scientific debate: Presenting and discussing contrasting evidence from experiments and observational field studies.
 - Reading: TBA.
 - [Results quiz 2 back](#)

Week 13: An Ecosystem Close to Your Heart: Gut Microbes

- *Monday:*
 - How life style affects your gut ecosystem (guest lecture by Prof. Steve Pointing)
 - Reading TBA
- *Thursday:*
 - Complementary approaches to study succession: field research versus simulation models
 - Reading TBA

Exam week:

Final Assignment due: 1 April, at 23:59hr