Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	
Semester/Trimester/Others (specify approx. Start/End date)	
Course Author * Faculty proposing/revising the course	Dr Shawn Lum
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Course Title	Introduction to Ecology
Course Code	ES2303
Academic Units	0
Contact Hours	39
Research Experience Components	

Course Requisites (if applicable)

Pre-requisites	BS1001 ES2003
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

You will be taught the main theories and concepts of modern ecology, with the course structure following a hierarchy of biological scales from individuals to ecosystems. The most important aim of this course is to provide the fundamental knowledge that all of the subsequent ecology in the programme will build on. The course further aims to introduce you to practical methods of ecological research, and will help to develop your technical writing skills and ability to analyse ecological data.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Explain key ecological concepts and theories that apply at different levels of ecological organisation; for example, inter-specific competition and trophic cascades
ILO 2	Critically analyse and interpret ecological data
ILO 3	Statistically analyse a dataset, and present and discuss your results in form of a written report
ILO 4	Apply ecological concepts to real-world environmental problems

Course Content

The course will consist of 13 lectures with topical tutorials. The topics will sequentially move through the main levels of ecological organisation, namely (1) Ecology of Individuals; (2) Ecology of Populations; (3) Ecology of Communities; (4) Ecology of Ecosystems. Specific topics that will be covered include: Resource Acquisition and Growth, Evolution and Ecology, Life Histories, Spatial Distribution, Intrinsic and Extrinsic Population Dynamics, Intra- and Inter-Specific Competition, Community Structure, Community Succession and Hysteresis, and Trophic Interactions. Some topics will be spread across multiple lectures. Each week's teaching will consist of a 2-hour period for a lecture and an on-paper problem set, and a 1-hour tutorial. The tutorial will be used to discuss scientific papers that you will be assigned to read, to teach some aspects of experimental design, or to do some computer practical exercises. You will be assigned into groups (of 2-3) at the start of the course and each group will lead a tutorial with a presentation to summarise the paper(s) assigned for that week's reading. These presentations will contribute to the assesment. Tutorials will also be used to teach fundamental aspects of experimental design using a hands-on approach: together with the papers assigned for the weekly reading, you will be asked to design an experiment to answer a specific research question. You will need to first formulate a hypothesis and then devise a specific experimental design to test it. One group will present your design in each week, and the merits and shortcomings of the design will then be discussed in the class. The purpose of this part of the tutorial work is to introduce you to concepts such as the need for independent replicates, how to mitigate possible confounding factors, etc. Two tutorials will be data analysis computer practicals, in which the you will be introduced to using R for statistical analysis of datasets; this will complement your learning in the Biostatistics course by applying statistical methods to ecological data and questions. Finally, you will be set two written assignments as part of the assessment, for which you will collect, analyse, and interpret an ecological dataset. The first assignment will be undertaken individually, the second assignment will be undertaken in groups of 2 or 3.

Reading and References (if applicable)

1. Ricklefs RE, Miller GL, 2014, Ecology: The Economy of Nature, 7th Edition, Macmillan 2. Begon M, Howarth RW, Townsend CR, 2014, Essentials of Ecology, 4th Edition, Wiley

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction: ecological scales, and evolution	1,2,3,4	The course is based on the textbook by Rickleffs, but the book is intended as a complementary resource – no parts of the textbook will be assigned as compulsory reading. Instead, original research and review papers will be set as weekly compulsory reading in advance of tutorials. Papers will vary from year to year as new research is published.	In-person	
2	Resource acquisition and foraging	1,2,3,4		In-person	
3	Life histories	1,2,3,4		In-person	
4	Population growth and intra-specific competition	1,2,3,4			Computer practical for data analysis using R
5	Population dynamics and predation	1,2,3,4		In-person	Predation modelling practical using Populus
6	Distribution of individuals of a population	1,2,3,4		In-person	Plant sampling practical
7	Inter-specific competition	1,2,3,4		In-person	
8	Mutualism	1,2,3,4		In-person	
9	Community structure and diversity	1,2,3,4		In-person	

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
10	Trophic interactions, cascades, and keystone species	1,2,3,4		In-person	
11	Community succession	1,2,3,4		In-person	
12	Community stability / resilience, alternate stable states	1,2,3,4		In-person	
13	Biogeochemistry: from ecosystems to atoms and back again	1,2,3,4		In-person	Computer practical for data analysis using R

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Lectures will efficiently communicate the framework of what knowledge you are expected to have, and will effectively convey the critical concepts and theories of the course (LO1).
Written problem sets after lectures / as homework	Completing these problem sets will deepen your knowledge and will train you to apply that knowledge to unfamiliar situations. The problem set questions will be similar in style to the final exam, giving you practice in applying your ecological knowledge under these circumstances (LO1, LO2, LO4).
Tutorial paper discussions and ecological methods teaching	Reading and discussing a broad range of ecological research papers, both older "classic" papers and very recent contributions, will consolidate your knowledge and help you to critically evaluate scientific papers. Through in-class discussions, you will train your ability to formulate ecological arguments, propose research questions, and make connections between the various lecture topics. Moreover, several tutorials will focus on teaching experimental design by making you prepare and present possible experiments to test a specific hypothesis. A group discussion about the proposed experimental design will be undertaken to develop an improved design (if necessary) or discuss why the proposed design is suitable (LO1, LO2, LO4).
Computer data analysis practicals	There will be two tutorial sessions to undertake statistical data analysis using R. The first tutorial will teach you how to analyse population growth data to estimate growth rates and carrying capacities using a logistic model, which you will then need to apply independently to different data as part of your first written assignment. In the second session, you will work through a problem set that essentially makes you repeat the data analysis from a published journal paper. For both practicals, you will be provided with the analysis code but will need to answer and discuss questions about the data, the statistical output, and the experimental design to ensure that you understand the script properly.
Written assignments	The written assignments will train you in technical writing, presenting data graphically, formulating a research question, analysing data, and drawing conclusions from the data (LO1, LO2, LO3).

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Summative Assessment (EXAM): Others([final examination])	1,2,4	Knowledge, Intellectual flexibility and critical thinking	40	Individual		
2	Continuous Assessment (CA): Others([assignments (e.g. term paper, essay)])	1,2	Knowledge, Formulating questions, Passion and communication	15	Individual		
3	Continuous Assessment (CA): Others([assignments (e.g. term paper, essay)])	1,2,3	Knowledge, Formulating questions, Passion and communication, Problem solving, Research, Collaboration and leadershi	35	Team		
4	Continuous Assessment (CA): Others([presentations] Group paper presentations)	1,4	Knowledge, Intellectual flexibility and critical thinking, Passion and communication	10	Team		

Description of Assessment Components (if applicable)

Formative Feedback

You will receive oral and written feedback for your first written assignment before the submission deadline of the second assignment. You will receive more general oral feedback during tutorial discussions and following paper presentations to allow you to gauge your overall progress and deepening understanding. Specimen answers to after-lecture/homework problem sets will be given to you after each week so that you can gauge your ability to apply your knowledge to the kind of questions you will encounter in the final exam. You will also receive written feedback for the second assignment at the end of the course.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level

Course Policy

Policy (Academic Integrity)

Policy (General)

(1) General

You are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions you have missed. You are expected to participate in all seminar discussions and activities.

Policy (Absenteeism)

(2) Absenteeism

Absences from tutorials and lectures will likely affect your overall course grade. If you miss a lecture or tutorial, you must inform me in advance by e-mail (pmartin@ntu.edu.sg). There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

(3) Compulsory Assignments

You are required to submit the two written assignments on due dates via the Turnitin system. Extensions will not be granted unless you have a valid reason, e.g. illness as supported by a medical certificate. If you do need an extension for a valid reason, you must inform me as soon as possible by e-mail (pmartin@ntu.edu.sg).

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