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

Course Overview

Expected Implementation in Academic Year (New format)	AY2026-2027
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Asst Prof Zeng Yiwen
Course Author Email	yiwen.zeng@ntu.edu.sg
Course Title	Global Change Ecology
Course Code	ES3306
Academic Units	3
Contact Hours	39
Research Experience Components	Research Defined Course (at least 50% of deliverables involve practical research activities: problem identification, hypothesis forming, data collection/analysis/interpretation, result communication)

Course Requisites (if applicable)

Pre-requisites	ES2303 Introduction to Ecology
Co-requisites	NIL
Pre-requisite to	NIL
Mutually exclusive to	NIL
Replacement course to	NIL
Remarks (if any)	

Course Aims

Global change drivers, such as pollution, land-use change, biological invasions, and climate change, are reshaping ecological systems across the world. Understanding how these drivers affect ecosystems, communities, populations and organisms is central to modern ecology. This course examines the ecological consequences of global change and the ways in which researchers study these processes across multiple spatial and temporal scales. The course explores key drivers of global change and their individual and combined effects on ecological systems, using examples from a wide range of terrestrial and freshwater ecosystems. Through lectures, data-driven tutorials, and case studies, you will gain experience working with real-world ecological data and develop an understanding of how ecological theory, macroecological patterns, and empirical analyses are used to interpret global change impacts. This course is particularly relevant for environmental science majors and students interested in research, conservation, or environment-related careers in the public, private, or non-governmental sectors.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	Describe how different global change drivers—individually and in combination—affect ecological processes across populations, communities, and ecosystems
ILO 2	Apply core ecological concepts and theory to analyse real-world ecosystems under multiple drivers of global change
ILO 3	Synthesise, interpret, and contextualise primary scientific literature and macroecological evidence, and communicate ecological insights effectively
ILO 4	Develop evidence-based arguments about complex environmental issues by integrating ecological data, theory, and multiple scientific perspectives.
ILO 5	Identify knowledge gaps in global change ecology and propose appropriate analytical, data-driven, or conceptual approaches for future research.

Course Content

This course will cover major drivers of global change and their ecological consequences across populations, communities, and ecosystems. It will include deeper exploration of how multiple global change drivers—such as pollution, land-use change, biological invasions, and climate change—shape ecological processes, often in interacting ways. The course introduces macroecology as a framework for understanding broad-scale ecological patterns and trends, and examines how ecological theory and data-driven approaches are used to study global change. Key topics include pollution and eutrophication, land-use change and habitat modification, biological invasions, climate-driven ecological responses, and the ecological implications of environmental solutions.

Reading and References (if applicable)

General reading

1) Global Change Biology by Erica Bree Rosenblum. Published in 2020

2) Half-Earth: Our Planet’s Fight for Life by EO Wilson. Published in 2016

3) No Way Home: The Decline of the World's Great Animal Migrations by David Wilcove. Published in 2010

Planned Schedule

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
1	Introduction to Global Change Ecology	1	In-person	In-class discussion	Global Change Biology by Erica Bree Rosenblum. Published in 2020 Half-Earth: Our Planet's Fight for Life by EO Wilson. Published in 2016
2	Macroecology & global change	1, 2	In-person	Class exercise: basic ecological analyses in R	Banks-Leite, C., Betts, M. G., Ewers, R. M., Orme, C. D. L., & Pigot, A. L. (2022). The macroecology of landscape ecology. Trends in Ecology & Evolution, 37(6), 480-487.
3	Pollution	1, 2, 3	In-person	Class exercise: multivariate stats in R	Smith, V. H., & Schindler, D. W. (2009). Eutrophication science: where do we go from here?. Trends in ecology & evolution, 24(4), 201-207.
4	Eutrophication	1, 2 , 3	In-person	Class exercise: ordination techniques in R	Smith, V. H., & Schindler, D. W. (2009). Eutrophication science: where do we go from here?. Trends in ecology & evolution, 24(4), 201-207.
5	Ecological impacts of land use change	1, 2	In-person	Class exercise: geospatial modelling in R (Part 1)	Landscape Ecology in Theory and Practice: Pattern and Process (2nd edition) by Turner, Gardner. 2015
6	Ecological impact of habitat protection strategies	1, 2	In-person	Class exercise: geospatial modelling in R (Part 1)	Landscape Ecology in Theory and Practice: Pattern and Process (2nd edition) by Turner, Gardner. 2015
7	Student presentations (elevator pitch)	2, 3, 4 ,5	In-person	Student presentations (elevator pitch)	nil

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
8	Biological Invasions	1, 2	In-person	Class exercise: species distribution modelling	Invasion Ecology (2nd Edition) by Lockwood, Hoopes, Marchetti. 2013
9	Ecological impacts of climate change	1, 2, 3	In-person	Class exercise: species distribution modelling with climate change	Global Change Biology by Erica Bree Rosenblum. Published in 2020
10	Ecological impacts of climate solutions	1, 2	In-person	In-class discussion	Global Change Biology by Erica Bree Rosenblum. Published in 2020
11	Global trade and telecoupled environmental impacts	1, 2, 3, 4, 5	In-person	Final group presentations	Wiebe, R. A., & Wilcove, D. S. (2025). Global biodiversity loss from outsourced deforestation. Nature, 639(8054), 389-394.
12	Planetary boundaries and interacting drivers of global change	1, 2, 3, 4, 5	In-person	Final group presentations	Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., ... & Rockström, J. (2023). Earth beyond six of nine planetary boundaries. Science advances, 9(37), eadh2458.
13	Dealing with global change	1, 2	In-person	Class trivia session	Half-Earth: Our Planet's Fight for Life by EO Wilson. Published in 2016

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Introduction to key concepts and knowledge necessary in understanding global change ecology
Tutorials	More active engagement with the topics; and exposure to practical skills associated with studying global change
Guided research project	Allows you to integrate ecological theory, empirical data, and analytical approaches to investigate a global change question of your choice, mirroring the research process in global change ecology.
Student presentations	Provide opportunities to apply ecological concepts and data-driven insights to specific global change topics, while developing skills in scientific communication and evidence-based argumentation.
Written assignments (quizzes and report)	Support the development of scientific reasoning and written communication by requiring you to interpret ecological data, evaluate evidence, and draw well-supported conclusions about ecological responses to global change

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Class Participation(Class participation)	1, 2, 4, 5	1,2,3,4,5,6	10		Individual	Holistic	Extended Abstract
2	Continuous Assessment (CA): Test/Quiz(Quiz 1 (short answer): nutrient pollution)	1,2,3	1,3	5		Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Test/Quiz(Quiz 2 (short answer): climate change)	1,2,3	1,3	10		Individual	Analytic	Multistructural
4	Continuous Assessment (CA): Report/Case study(Draft report: introduction section)	1,2,3,4,5	1,2,3,4,5,6	10		Individual	Holistic	Relational
5	Continuous Assessment (CA): Report/Case study(Final Report)	1,2,3,4,5	1,2,3,4,5,6	25		Individual	Holistic	Relational
6	Continuous Assessment (CA): Others(Elevator pitch for proposed group project)	1,2,3,4,5	1,2,3,4,5,6	15		Team	Holistic	Relational

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
7	Continuous Assessment (CA): Presentation(Final group presentation)	1,2,3,4,5	1,2,3,4,5,6	25		Team	Holistic	Relational

Description of Assessment Components (if applicable)

Guided research project
The following are a list of assessments that are based on an overall project that is meant to introduce you to global change ecology through active, inquiry-driven research. The goal of this overall project is twofold—1) to demonstrate how real-world data, current scientific tools, and cutting-edge questions can be used to study global change ecology; and 2) to equip you with the skills and confidence to conduct such research in the future.

You will be given a curated series of large-scale ecological datasets to work on. You will select a single dataset from this list as a focus, but are welcomed to supplement this with other datasets. In a group, you will craft a research project that explores the impact of global change on populations, communities or ecosystems (including ecosystem functioning). You will have the freedom to explore which aspect of global change (e.g. climate change, biological invasions, land-use change, pollution) you would like to investigate, and in what context. You will be evaluated on the presentation as a team (elevator pitch and final group presentation), but write about the project individually (draft report and final written report).

Elevator pitch
As a team, you will present the intended research project, including key information such as motivation, context, dataset and methods to seek comments and suggestions from peers and the teaching team. Each team will do so within a 5 minute timeframe.

Final group presentation
As a team, you will present the findings of the research project, explaining the major findings of the study and interpreting the results and how it furthers the understanding of the ecological impacts of specific global change drivers.

Draft report
Individually, you will write a short introduction to the research project that has been proposed. This should include a brief literature review and highlight the current research gaps. This introduction primarily serves a way to gather feedback and improve scientific writing.

Final written report
Individually, you will write a final report about the research project in the style of a brief communication. This report should be prepared in a way that minimizes jargon but still serves to maintain scientific rigor and accuracy.

Formative Feedback

1. You will receive written feedback on the draft and final reports
2. You will receive verbal feedback for quizzes, general class participation and group presentations and assignments.

NTU Graduate Attributes/Competency Mapping

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

Attributes/Competency	Level
Care for Environment	Advanced
Collaboration	Advanced
Curiosity	Advanced
Global Perspective	Advanced
Transdisciplinarity	Advanced

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

Policy (Absenteeism)

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.
It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.
To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer, Ms Christina Tee, or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.
As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.
All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

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Last Updated By: Sze Chun Chau (Dr)