

Academic Year	2019-2020	Semester	2
Course Coordinator	Kelly Andersen		
Course Code	ES2003		
Course Title	E2S2 Biosphere		
Pre-requisites	None		
No of AUs	4 AU		
Contact Hours	Lecture: 36 hours Tutorial: 12 hours		
Proposal Date	01/11/2019		

Course Aims

E2S2 Biosphere aims to provide a basic introduction to biological systems and to the origin and evolution of life on our planet, its distribution and the importance of maintaining biodiversity. Throughout the class there will be a focus on the relationships between biological and non-biological components of ecosystems and on the effects of human activity on the biosphere, including, but not limited, to the effects on biodiversity, climate change, and sustainability. By the end of the course, you will gain a fundamental understanding and appreciation of ecological systems, interactions between the biosphere and other earth systems, and how human activities are changing these interactions. The course is a required course for all ASE undergraduate students and is a pre-requisite for ES2303 Introductory to Ecology.

Intended Learning Outcomes (ILO)

By the end of this course, you should be able to:

1. *Summarize interactions between the biosphere, atmosphere, geosphere, and hydrosphere on multiple spatial and temporal scales.*
2. *Articulate the relationships between ecology, evolution, and biogeochemistry and explain their connections to the functioning of ecosystems on multiple spatial and temporal scales.*
3. *Demonstrate critical thinking to evaluate multiple hypotheses for biological processes or concepts (ie., origin of life, maintenance of biodiversity, biosphere resilience to climate changes, etc.)*
4. *Generalize how human activity alters ecological processes, and how ecological changes can interact with human societies at multiple scales.*
5. *Apply knowledge of biological systems and human-mediated environmental change to ecological and conservation challenges and potential sustainable solutions and mitigation strategies, considering implications for at-risk populations.*

Course Content

The course will explore four main topics: (1) Origins of the Biosphere and Life on Earth, (2) Interactions between the Biosphere and other Earth Systems (Atmosphere, Hydrosphere, and Geosphere), (3) Evolution and maintenance of biodiversity and species interactions, (4) Human influence on the Biosphere and feedbacks with other Earth Systems.

Assessment (includes both continuous and summative assessment)

Component	ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/ Individual	Assessment Rubrics
1. Participation during class and online discussions	1, 2, 3, 4,5	1, 2, 3, 4, 5, 6	10%	Individual	Appendix 1
2. Tutorial continuous assessments	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 6	30%	Individual	Appendix 2
3. Mid-term assessment	1, 2, 3, 4, 5	1, 2, 3, 4, 5	30%	Individual	Appendix 3
4. Final assessment	1, 2, 3, 4, 5	1, 2, 3, 4, 5	30%	Individual	Appendix 4
Total			100%		

These are the ASE Learning Outcomes:

At the completion of your course of study in ASE, you will be able to:

- 1) Demonstrate intellectual flexibility and critical thinking in order to apply environmental knowledge in the real world
- 2) Communicate environmental concepts with enthusiasm to varied audiences both orally and in writing
- 3) Formulate scientific questions, and be able to access and analyse quantitative and qualitative information to address them
- 4) Exhibit the motivation, curiosity and skills for lifelong learning
- 5) Demonstrate ethical values and responsibility
- 6) Collaborate and lead by influence

Formative feedback

Feedback is central to this course. You will receive formative feedback through written responses on mid-term assessments and through in class discussions.

There will be occasional short assessments at the beginning of lectures and during tutorials, either to assess prior knowledge on the topic to adjust lecture materials appropriately to the knowledge level of students or on the topic of the previous lecture to let students check their understanding of the key concepts.

Tutorials will include group presentations and debates, with feedback given during your presentation and through peer-review appraisal.

Learning and Teaching approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	There will be three one hour lectures each week to pass on key conceptual and basic theoretical knowledge related to the Biosphere. Lectures will be interactive, involving your participation in the form of answering questions, discussions and contributions.
Tutorial	Tutorial discussions will be directly after the third lecture of the week and are specifically designed as an interactive summary of the key concepts of the week through different activities. Active learning and group activities will reinforce concepts and skills related to studying the Biosphere.

Reading and References

This course incorporates original research articles, online resources, and textbook resources to provide a variety of classical studies and emerging research topics related to the Biosphere and contemporary issues relating the Biosphere to other Earth systems.

The main textbooks for the course are below and copies are found in the library. Textbooks are intended to supplement lecture materials.

1. Relyea, R., & Ricklefs, R. (2018). Ecology: the economy of nature (Eighth edition.). New York: W.H. Freeman and Company.
2. Skinner, B., & Murck, B. (2011). The Blue Planet. An introduction to earth system science (3rd Edition). John Wiley & Sons, Inc.

Course Policies and Student Responsibilities

(1) General

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

(2) Absenteeism

This course requires you to be present in class and contribute to class activities. The quiz part of the assessment will build on material from the lectures. Absence from class without a valid reason

will affect your overall course grade. Valid reasons include, but are not limited to: falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. Policy on medical leave for student may be found from <http://www.ntu.edu.sg/Students/Undergraduate/AdminServices/Pages/Applyforshortleave.aspx>.

If you miss a lecture or tutorial, it is your responsibility to inform the course instructor via email and obtain relevant course material and notes from classmates and online.

(3) Compulsory Assignments

You are required to submit/present compulsory assignments on due dates, unless a valid reason is provided. Valid reasons include falling sick supported by a medical certificate. If you will miss a deadline for a valid reason you must inform me via email (Kelly.andersen@ntu.edu.sg) prior to the deadline, and as soon as is possible.

(4) Special Accommodations

All courses will have some form of assessment and if you envision that you will have difficulty satisfying an assessment component due to your disability then you are advised to contact the Course Coordinator within the first 2 weeks of the course.

Students requiring assistance in the learning environment should contact and notify the Associate Chair (Academic) in their School within the first 2 weeks of their first semester so that you and School can work together to optimise your learning experience. Examples of services that may be provided or supported in individual courses include an editor service to help those with reading and writing difficulties, and access to a personal mentor within the School. Please access the NTU Office of Academic Services' website <http://www.ntu.edu.sg/sasd/oas/Pages/>

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. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Kelly Andersen	N2-01C-69	6904 7659	Kelly.andersen@ntu.edu.sg
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Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
Week 1	Origin of the Biosphere and life on Earth	1, 2, 3	Debate 1: hypotheses for the origin of life
Week 2	Macro-Evolution: Hierarchy of life on Earth over geologic time Adaptations to life on a changing Earth	1, 2, 3, 4	Group presentations 1: Patterns of diversity over geologic time & space
Week 3	Natural selection micro-evolution	1, 2, 3, 4, 5	Group presentations 2: Wallace's line, Darwin & adaptation
Week 4	Population dynamics Life history strategies Intraspecific interactions	1, 2, 3, 4, 5	Group activity 1: Populations
Week 5	Ecological communities & species interactions Food webs	1, 2, 3, 4, 5	Group activity 2: Species invasions
Week 6	Energy flow Primary productivity & photosynthesis	1, 2, 3, 4, 5	Debate 2: Top-down vs. Bottom-up trophic cascades
Week 7	Biomes and patterns of species diversity	1, 2, 3, 4, 5	Mid-term test
Week 8	Global climate systems Biomes	1, 2, 3, 4, 5	Group activity 3: Biogeography
Week 9	Biogeochemical cycles	1, 2, 3, 4, 5	Debate 3: Nutrient limitation
Week 10	Community succession Soil evolution Chronosequences	1, 2, 3, 4, 5	Field trip to MacRitchie Reserve
Week 11	Human activities & the Biosphere: Drivers of environmental degradation and species loss	1, 2, 3, 4, 5	Group activity 4: IPBES report
Week 12	Global changes and the Biosphere	1, 2, 3, 4, 5	Group activity 5: IPCC reports
Week 13	Review of course material	1, 2, 3, 4, 5	Mid-term 2

Appendix 1: Assessment Criteria for participation during class and online discussions

Criteria	Standard				
	A+ (Exceptional) A (Excellent)	A- (Very good) B+ (Good)	B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	C (Bordering unsatisfactory) C- (Unsatisfactory)	D, F (Deeply unsatisfactory)
Contribution to class discussion	Important; Meaningful	Meaningful	Some	Minimal	Very minimal to none
Capacity to articulate and present points of view	Very clear	Clear	Some	Limited	None
Respectful discussion where all students contribute and no-one dominates the conversation	Achieved	Achieved	Not consistently	Limited	No
Arguments and debates about the topic, based on the literature and student's own insights and knowledge	Well-reasoned	Some evidence of reasoning	Some evidence of having considered the discussion topic	Little serious thought about the discussion topic	Unexplained or unjustified absences from discussions

Appendix 2: Assessment Criteria for Tutorial class continuous assessments

Standards	Criteria
A+ (Exceptional) A (Excellent)	<ul style="list-style-type: none"> - Exceptionally good knowledge of the assigned reading material, related material and context. - Makes important contributions at appropriate times, covering all the required elements. - Articulates clear, concise and relevant arguments. - Knowledgeable, insightful and thoughtful answers to any questions. - Brings up new viewpoint to the discussion, evidence of thinking outside the box and creative solutions/suggestions. - Showing engagement by asking thoughtful questions to the presenters. - - Forms exceptionally strong conclusions based on evidence and taking multiple perspectives into account.

A- (Very good) B+ (Good)	<ul style="list-style-type: none"> - Well prepared, has good knowledge of the assigned reading material and sometimes additional material. - Makes good contributions at appropriate times, covering all the required elements. - Articulates reasonable clear, concise and relevant arguments. - Knowledgeable and/or insightful answers to questions. - Sometimes brings up new viewpoint or other evidence of thinking outside the box. - Shows engagement by asking questions to the other presenters. - - Forms strong conclusions based on evidence and taking multiple perspectives into account.
B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	<ul style="list-style-type: none"> - Reasonably well prepared, has some knowledge of the assigned reading material. - Contributes to the discussion, covering some of the required elements. - Articulates somewhat reasonable clear, concise and relevant arguments. - Somewhat knowledgeable and/or insightful answers to questions. - Shows engagement by asking questions to the other presenters. - - Forms conclusions based on evidence and sometimes taking different perspectives into account.
C (Bordering unsatisfactory) C- (Unsatisfactory)	<ul style="list-style-type: none"> - Somewhat prepared, has knowledge of some of the assigned reading material. - Contributes little to the discussion, covering all the required elements. - Articulates arguments that are not clear, or relevant. - Has trouble answering questions. - Asks few or no questions to the other presenters. - - Forms conclusions that fail to either be based on evidence or take different perspectives into account.
D, F (Deeply unsatisfactory)	<ul style="list-style-type: none"> - Not familiar with the assigned reading material. - Minimal or no contribution to discussion. - Unable to answer questions. - Asks no questions to the other presenters. - Unable to form conclusions on any relevant basis. - Unexplained or unjustified absence.

Appendix 3: Assessment Criteria for Mid-term assessment 1

Standards	Criteria
A+ (Exceptional) A (Excellent)	Exhaustive answer with compelling and original argumentation that is entirely to the point, without irrelevant tangents.
A- (Very good) B+ (Good)	All relevant points are identified, but some deficiencies in argumentation; or compelling argumentation but fails to mention some aspects
B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	Some relevant points not identified, and argumentation not entirely compelling. Answer is broadly correct, but the student clearly struggles to explain it in detail. Any errors are relatively minor ones.

C (Bordering unsatisfactory) C- (Unsatisfactory)	Only some points of the answer are identified, leaving important omissions. Argumentation is somewhat confused and/or poorly developed, and there are significant errors.
D, F (Deeply unsatisfactory)	Major points are omitted, there are significant inaccuracies, and any argumentation is rudimentary and confused.

Appendix 4: Assessment Criteria for Mid-term assessment 2

Standards	Criteria
A+ (Exceptional) A (Excellent)	Exhaustive answer with compelling and original argumentation that is entirely to the point, without irrelevant tangents.
A- (Very good) B+ (Good)	All relevant points are identified, but some deficiencies in argumentation; or compelling argumentation but fails to mention some aspects
B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	Some relevant points not identified, and argumentation not entirely compelling. Answer is broadly correct, but the student clearly struggles to explain it in detail. Any errors are relatively minor ones.
C (Bordering unsatisfactory) C- (Unsatisfactory)	Only some points of the answer are identified, leaving important omissions. Argumentation is somewhat confused and/or poorly developed, and there are significant errors.
D, F (Deeply unsatisfactory)	Major points are omitted, there are significant inaccuracies, and any argumentation is rudimentary and confused.