1. TEMPLATE FOR NEW/CURRENT/REVISED COURSE CONTENT

Academic Year	AY2022/2023	**Semester**	2
Course Coordinator	Eleanor Slade (Asst Prof)		
Course Code	ES2302		
Course Title	Introduction to Field Ecology		
Pre-requisites	ES1006 Introductory Field Experience ES2003 E2S2 Biosphere		
No of AUs	3		
Contact Hours	Total hours – 83 hours Field lab:70 hours; Lectures: 9 hours; Tutorials: 4 hours		
Proposal Date	27 April 2022		

Course Aims

Tropical forests are the most diverse ecosystems on earth, supporting over 50% of all biodiversity. They play a major role in regulating global climates and are key to the livelihood of a substantial proportion of the world's human population. However, they are also among the most threatened of all biomes. Understanding the ecology and evolution of tropical forests, and people's dependence on these habitats is fundamental to their future management and conservation. This course will help you appreciate how conducting experiments and surveys in the field is critical to understanding and using the theory you learn in the classroom. The course presents the natural history and ecology of tropical forests through practical exercises, lectures, site visits, tutorials, small group project work and (most importantly), day to day experience in the field. You will learn survey techniques for monitoring plants, vertebrates and invertebrates and ecosystem functions, visit and discuss large-scale experiments, forest management and restoration sites, and explore the importance of evidence-based science for conservation and management of tropical ecosystems.

Intended Learning Outcomes (ILO)

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

1. Describe the natural and anthropogenic heterogeneity of tropical forest habitats and associated variations in biodiversity and ecosystem functioning.
2. Identify the ecological, evolutionary and biogeographic processes leading to high diversity in tropical forests in general, and Bornean forests in particular.
3. Discuss the importance of natural history and taxonomy for the study of biodiversity in tropical forests.
4. Explain the drivers of change in tropical forests and give examples of solutions.
5. Relate ecological concepts to the design of large-scale experiments in tropical forest.
6. Recognise the challenges and complexities of conservation and sustainable management in tropical forests and oceans and critically assess the evidence for conservation actions.
7. Employ fieldwork skills and experience relevant to practical tropical forest ecology and biodiversity.
8. Demonstrate skills in research project design, execution, and analysis through the completion of small-group research projects.

Course Content

1. Tropical Forest Ecology
Understand the ecological, evolutionary and biogeographic processes leading to high diversity in tropical forests. Discuss importance of natural history and taxonomy in the study of biodiversity of tropical forests.

2. Biodiversity Field Surveys
Undertake biodiversity field surveys for vertebrates (herps surveys, camera trapping), invertebrates (butterflies, dung beetles, dragonflies, stream inverts), plants (50 ha plot), and assessments of ecosystem functioning (seed predation, herbivore predation).

3. Large scale experiments in tropical forests
Give examples of large-scale experiments in tropical forests in Sabah (e.g. 50 ha plots, Biodiversity Experiment, mammal exclosures, SAFE project) and what they can tell us about tropical forest ecology and conservation.

4. Tropical Forest and Ocean Management and Conservation
Understand the threats and drivers of change in tropical forests (e.g. logging, agriculture) and oceans (e.g. pollution, plastics, overfishing, climate change), how they can be managed (e.g. Forest restoration, RIL,), and pragmatic solutions (e.g. connectivity, Protected Areas, muti-use areas, carbon trading, education programmes, community involvement). Critically assess the evidence for conservation actions.

Assessment (includes both continuous and summative assessment)

Component	Course ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Field participation	1,2,3,4,5, 6, 7	1,3,4,5,6	30%	Individual	Appendix 1
2. Tutorial participation	1,2,3,4,5, 6	1,2,3,4	20%	Individual	Appendix 1
3. Project work and presentation	7,8	1,2,3,4,5,6	30%	Group	Appendix 2
4. Reflections	1,2,3,4,5, 6	1,2,3,4,5	20%	Individual	Appendix 3
5. 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 verbal feedback through discussions in the field and during tutorials. You are encouraged the think widely and critically about the topics discussed and make notes in your field logbook and raise questions on subjects which you do not understand.

You will get written feedback on your reflections assignment.

You will work on a project in groups. You will discuss and design the project and do the analysis together. You will give a joint presentation to your peers, and feedback will be given during your presentation by the lecturers and your peers.

Learning and Teaching approach

Approach	**How does this approach support students in achieving the learning outcomes?**
Lectures	There will be lectures throughout the course to pass on the theoretical knowledge required to understand the ecology of tropical forests and their management and conservation. These will be done in an interactive way, involving your participation in the form of discussions and contributions and you are encouraged to ask questions and discuss topics, and you are expected to actively engage in this and think how the lectures can be applied to what you are learning in the field. The project and reflections assignment will allow you to apply the content covered during lectures (LO 1,2,3,4,5,6).
Tutorials	During tutorials we will discuss pre-assigned papers and datasets. The tutorials will allow you a space to discuss in-depth what you have learned in the lectures and readings, and think about how this knowledge relates

	to what you have been seeing in the field (LO 1, 2,3,4,5,6). You will be encouraged to share your thoughts and observations with your classmates informally through discussion and presentations in pairs.
Project & presentation	You will work in groups to come up with a question you would like to test and design to test this. You will work together to execute the project and present your project and simple analyses to your classmates and the lecturers. This will allow you to put everything you have learnt into practice, and enable both independent learning and critical thinking, as well as learning from each other. This will develop both your research, team-work and presentation skills (LO7,8).

Reading and References

We do not have a course text as such. At this level, we think that it is best to direct you towards the primary literature and authoritative review articles; these will be highlighted in individual lectures and tutorials. Having said that, the following books provide good background information on tropical forests and will often be referred to in the lectures. You do not need to bring copies of these books on the field course.

- Ghazoul, J. & Sheil, D. (2010). *Tropical Rain Forest Ecology, Diversity and Conservation*. Oxford University Press.
- Chazdon, R. (2014). *Second Growth: The Promise of Tropical Forest Regeneration in an Age of Deforestation*. University Chicago Press.
- Corlett, R.T. (2019). *The Ecology of Tropical East Asia*. Oxford University Press.
- Hazebroek, H.P. et al. (2012). *Danum Valley - The Rain Forest*. Natural History Publications, Borneo.
- Sodhi, N.S. & Ehrlich, P.R. (eds.) (2011) *Conservation Biology for All*. OUP.
- Kareiva, P., Marvier, M & Silliman (B. (eds.) (2018) *Effective Conservation Science: Data not Dogma*. OUP.

<u>Background Reading Specific to Borneo</u>
Some of you may want to do some background reading more specific to Borneo in preparation for your trip. As a context-setter you may want to look at the Borneo chapters (Chapters 4 & 5) of The Malay Archipelago by Wallace, which provides a historical introduction to Borneo and its biodiversity (Wallace, A.R. (reprinted 2000) *The Malay Archipelago*. Periplus Editions).

Bringing things slightly more up to date we recommend looking at a Special Edition of *Philosophical Transactions of the Royal Society* published in 2011 on "The future of Southeast Asian rainforests in a changing landscape and climate."
See http://rstb.royalsocietypublishing.org/content/366/1582.toc
The papers by Reynolds et al., Bagchi *et al*., Hill *et al*., Hector *et al*. and Foster *et al.* are particularly relevant to the field course content.

<u>Please read these papers before our day trip on Day 8 to the Sabah Biodiversity Experiment</u>

- Hector et al. The Sabah Biodiversity Experiment: a long-term test of the role of tree diversity in restoring tropical forest structure and functioning https://royalsocietypublishing.org/doi/10.1098/rstb.2011.0094

- Tuck, S.L., et al. (2016) The value of biodiversity for the functioning of tropical forests: insurance effects during the first decade of the Sabah biodiversity experiment. Proceedings of the Royal Society B: Biological Sciences, 283, 20161451. https://royalsocietypublishing.org/doi/full/10.1098/rspb.2016.1451

- Check out Tansley MJ, Veryard R, Simonsen DF, Morford J, Chung AYC, Parrett JM, Slade EM (2021). Rivers are not complete barriers to the movement of tropical forest dung beetles. Sepilok Bulletin 30: 1-18. This paper was published by some Oxford undergraduates based on their field course project in Danum! Using MRR to investigate if dung beetles can cross large river barriers. So it is possible to do neat studies in a short project time frame :)

Field guides

- Rogier De Kok and Tim Utteridge (2010) Field Guide to the Plants of East Sabah, Malaysia. Royal Botanic Gardens, Kew.
- Quentin Phillipps and Karen Phillipps (2014) Phillipps' Field Guide to the Birds of Borneo. John Beaufoy Publishing Ltd.
- Susan Myers (2016) Birds of Borneo: Brunei, Sabah, Sarawak, and Kalimantan (Princeton Field Guides) New Holland Publishers Ltd.
- Quentin Phillipps and Karen Phillipps (2018). A Field Guide to the Mammals of Borneo. John Beaufoy Publishing Ltd.
- Indraneil Das (2020) Snakes and other reptiles of Borneo. Bloomsbury Pocket Guides.
- Indraneil Das (2004) Pocket Guide to Lizards of Borneo. Natural History Publications.
- Inger et al (2016) A Field Guide to the Frogs of Borneo. Natural History Publications.
- Stuebig et al (2000) A Field Guide to the Snakes of Borneo. Natural History Publications.

Course Policies and Student Responsibilities

(1) General

You are expected to complete all assigned pre-class readings and activities, attend all lectures punctually and hand in scheduled assignments by due dates. You are expected to participate in all tutorial discussions and activities.

(2) Absenteeism

Absence from activities without a valid reason will affect your overall course grade.
If you miss a lecture/activity, you must inform the course instructor prior to the start. A student who is absent from assessment without valid reason
will be given zero mark for the missed assessment. Lecturers may, however, use his/her own discretion for extenuating circumstances.

(3) Compulsory Assignments

You are required to submit 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 (eleanor.slade@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.
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 behavior. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honor 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.

Diversity and Inclusivity Statement

The classroom is a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

In line with thinking about JEDI issues in teaching and conducting field-based ecology I would ask you all to read this article, and consider the principles outlined both when thinking about how we conduct ourselves and approach our learning on this field course, but also going forward as research scientists conducting our own research both at home and overseas.
A set of principles and practical suggestions for equitable fieldwork in biology https://ecoevorxiv.org/uszd7

Please pay particular attention to Box 1. A set of principles to promote fieldwork: Be Collaborative, Be Legal, Be Safe, and Be Respectful.

Course Instructors

Instructor	Office Location	Phone	Email
Eleanor Slade	N2-01C-66	65911611	Eleanor.slade@ntu.edu.sg

Planned Weekly Schedule

Day	Topic	Course ILO	Readings/ Activities
1	Fly SG to Sabah		Travel To Sabah
2	Travel to field site KK - Danum		Acclimatize. Night walk/drives. **Precourse Briefing/Lecture (before leaving SG):** Intro to the field course and site
3	Tropical forest ecology and biodiversity surveys	1,2,3,4,5,6,7	**Group fieldwork & tutorial** – rotating groups on different survey methods (plants, inverts, herps, mammals) **Lecture:** Introduction to tropical forests
4	Tropical forest ecology and biodiversity surveys	1,2,3,4,5,6,7	**Group fieldwork & tutorial** – rotating groups on different survey methods (plants, inverts, herps, mammals) **Lecture:** Tropical forest biodiversity and species interactions
5	Tropical forest ecology and biodiversity surveys	1,2,3,4,5,6,7	**Group fieldwork & tutorial** – rotating groups on different survey methods (plants, inverts, herps, mammals) **Lecture:** Importance of taxonomy and natural history
6	Tropical forest ecology and biodiversity surveys	1,2,3,4,5,6,7	**Group fieldwork & tutorial** – rotating groups on different survey methods (plants, inverts, herps, mammals) **Lecture:** Conservation Evidence
7	Project planning	8	Project planning. Own time. Waterfall walk.
8	Tropical forest management	1,2,3,4,5,6,7	Day trip to visit logged forest sites, restoration areas and seedling

			nurseries, the Sabah Biodiversity Experiment, canopy walkway **Lecture:** Tropical Forest Management in Sabah
9	Project	7,8	Plan, design, execute group project **Lecture:** Tropical forest threats
10	Project	7,8	Plan, design, execute group project **Lecture:** Tropical forest solutions
11	Project	7,8	Execute and simply analyse group project **Presentation of group project**
12	Return to KK		Travel out of Danum
13	Marine biodiversity and conservation	6	Day trip snorkelling, beach clean, Marine Research Foundation visit. **Lecture:** Turtle and marine conservation
14	Back to SG		

Appendix 1: Assessment Criteria for contributions during fieldwork and tutorials

Standards	**Criteria**
A+ (Exceptional) A (Excellent)	Important contributions to discussions, activities and tutorials; ask questions and responds to questions of other students; capacity to articulate and present points of view very clearly; participates in a meaningful and constructive manner including enabling other students to contribute and not dominating; evidence of having read and assimilated course material beyond the assigned reading; strong signs of evidence-based formation of points of view on the topics.
A- (Very good) B+ (Good)	Meaningful contributions to discussion, activities and tutorials; asks questions and responds to questions of other students; capacity to articulate and present points of view clearly; participates in a meaningful and constructive manner; evidence of having read and assimilated the course material; some signs of evidence-based formation of points of view on the topics.
B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	Some contributions to discussion, activities and tutorials; ask questions; some evidence of constructive engagement during discussion; some familiarity with the assigned reading; some evidence of having thought about controversial topics.
C (Bordering unsatisfactory)	Minimal contributions to discussion or activities and tutorials; limited capacity to articulate and present points of view; limited evidence of constructive engagement during discussion; little or no familiarity with the assigned reading.

D+ (Unsatisfactory)	
D, F (Deeply unsatisfactory)	Very minimal or no contributions to discussion, activities and tutorials; no questions; no evidence of an individual viewpoint; failure to read the assigned reading; unexplained or unjustified absences during activities.

Appendix 2: Assessment Criteria for group project and presentation
Please note that teamwork is an important graduate outcome that we wish to inculcate in all students. Therefore, we expect everyone to meaningfully contribute to the project and presentation. If there is any evidence that you are not contributing to your team's work, your individual score may be adjusted.

Standards	**Criteria**
A+ (Exceptional) A (Excellent)	- Clearly formulated research question/study. - Appropriate and well justified design. - Excellent execution of fieldwork. - Simple, well conducted analysis. - Shows excellent understanding of the limitations of the study design. - Excellent explanation of how the study could be improved. - Shows excellent interpretation of the results and the implications of the findings. - Exceptionally prepared presentation, well structured, and keeps to time. - Excellent teamwork evident. - Delivery is clear, articulate and concise. - Any questions are answered knowledgably. - Students asks thoughtful questions to the other presenters, showing understanding and engagement with the rest of the class.
A- (Very good) B+ (Good)	- Clearly formulated hypotheses and predictions. - Appropriate and mostly well justified experimental design. - Mostly well executed fieldwork. - Mostly well conducted analysis. But either missing some points, or overly complicated. - Good understanding of the limitations of the study design. - Good explanation of how the study could be improved. - Good interpretation of the results and the implications of the findings. - Well prepared for the presentation, adequate structure and timing. - Good teamwork evident. - Delivery is clear, articulate and concise. - Any questions are answered correctly. - Students asks questions to the other presenters, showing understanding and engagement with the rest of the class.

B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	- Adequately formulated hypotheses and predictions. - Adequately justified experimental design. - Adequately executed fieldwork. - Adequate analysis of data. - Adequate understanding of the limitations of the study design. - Adequate explanation of how the study could be improved. - Adequate interpretation of the results and the implications of the findings. - Shows some preparation for the presentation, adequate structure, and timing. - Adequate teamwork evident. - Delivery is adequately clear, articulate and concise. - Any questions are answered correctly. - Students ask 1 or 2 questions to the other presenters, showing engagement with some of the class.
C (Bordering unsatisfactory) D+ (Unsatisfactory)	- Unclear hypotheses and predictions. - Limited justification of experimental design. - Execution of fieldwork minimal. - Minimal analysis or analysis not correct. - Limited understanding of the limitations of the study design. - Poor explanation of how the study could be improved. - Poor interpretation of the results and the implications of the findings. - Shows marginal preparation for the presentation, marginal structure, and timing. - Evidence of teamwork minimal. - Delivery is marginally clear, articulate and concise. - Any questions are answered mostly correctly. - Students ask no questions to the other presenters.
D, F (Deeply unsatisfactory)	- Failure to formulate clear hypotheses and predictions. - No justification of experimental design. - No evidence of fieldwork. - Limited or no analysis. - No understanding of the limitations of the study design. - No explanation of how the study could be improved. - No interpretation of the results and the implications of the findings. - Shows no preparation for the presentation, no structure and does not keep to time. - No teamwork evident. - Delivery is not clear, articulate and concise. - Any questions are answered incorrectly. - Students ask no questions to the other presenters and show obvious lack of engagement. OR failure to conduct project or give presentation.

Appendix 3: Assessment Criteria for Reflections assignment

Standards	**Criteria**

A+ (Exceptional) A (Excellent)	Exceptional understanding and critical thought of the topics discussed during the course. Evidence of having read and assimilated course material beyond the assigned reading; strong signs of evidence-based formation of points of view on the topics. Identifies their target audience and exceptional communication of their thoughts and opinions creatively. Key messages are very clear and concise.
A- (Very good) B+ (Good)	Good understanding and some critical thought of the topics discussed during the course. Evidence of having read and assimilated course material. Some signs of evidence-based formation of points of view on the topics. Identifies their target audience and communicates their thoughts and opinions creatively. Key messages are clear and mostly.
B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	Some understanding and some critical thought of the topics discussed during the course. Some familiarity with the assigned reading. Some evidence of having thought about controversial topics. Not entirely clear who is the target audience. Communicates their thoughts and opinions somewhat creatively. Key messages are mostly clear but overlong and not very concise.
C (Bordering unsatisfactory) D+ (Unsatisfactory)	Limited understanding and critical thought of the topics discussed during the course. Little familiarity with the assigned reading. Little evidence of having thought about controversial topics. Target audience not clear. Thoughts and opinions not communicated very creatively. Key messages somewhat unclear and lengthy.
D, F (Deeply unsatisfactory)	No understanding and critical thought of the topics discussed during the course. No evidence of an individual viewpoint. Failure to read the assigned reading. Target audience not clear. Thoughts and opinions not communicated creatively. Key messages are unclear and/or no attempt to make them concise.

GRADES

A+	A	A-	B+	B	B-	C+	C	D+	D	F
100-85	84-80	79-75	74-70	69-65	64-60	59-55	54-50	49-45	44-40	39-0