ECSC10036 Conservation Science

Course organisers: Isla Myers-Smith (isla.myers-smith@ed.ac.uk), Aidan Keane (aidan.keane@ed.ac.uk)

Course Secretary: TBA

Course Organiser:	Dr. Isla Myers-Smith	**Other Key Staff:**	Dr. Aidan Keane
Course Secretary:	TBA	**Course location:**	Kings Buildings
Credits available:	20	**SCQF Level:**	11

Room: Room 4 Crew Annexe with break out group rooms in the Crew Annexe and Crew Building
Day: Tuesdays 9:30 to 12:30, weekend field course late October (TBA)
Credits: 20

Conservation Science is an honours course combining biological and social science perspectives on the field of conservation. The course is a 20-credit course demanding significant student investment into the coursework of 200 hours: lectures/discussions/workshops (3 hour sessions each week), preparation and readings (at least 3 hours per week), group learning (3 hours per week), assignment preparation (60 hours), field course (three days) and external reading and engagement (20 hours). The course does not have any pre-requisites, but students are expected to have a background in ecology or biological sciences and to be comfortable reading and interpreting the scientific and social science literature and understanding basic applied statistics and mathematics.

http://conservationscienceblog.wordpress.com/

Learning Objectives

1. Understand the concept of biodiversity change and identify threats to global biodiversity.
2. Understand how and why we conserve ecosystems and populations.
3. Understand people-focused conservation.
4. Use ecological and social science methods to communicate science to academic, public and policy audiences.
5. Give a poster presentation, write an opinion piece and write a POSTnote on selected topics in the field of conservation science.

Week	Date	Lecture/Activity
Week 1	17th Sept.	No lecture this week
Week 2	24th Sept.	Introduction to Conservation Science (Keane + Myers-Smith)
Week 3	1st Oct.	Patterns of biodiversity (Myers-Smith)
Week 4	8th Oct.	Background population ecology for conservation (Myers-Smith)
Week 5	15th Oct.	Why do we conserve biodiversity? (Keane)
Week 6	22nd Oct.	Protected areas (Keane)
Weekend Fieldtrip	Fri 25th – Sun 27th	Weekend fieldtrip to the Cairngorms: Conservation management in practice
Week 7	29th Oct.	Conservation Science Mid-term Conference *** **Presentations** ***
Week 8	5th Nov.	Threats to biodiversity (Myers-Smith) *** **Opinion Piece Due (8th Nov. 12pm noon)** ***
Week 9	12th Nov.	People-focused conservation (Keane)
Week 10	19th Nov.	Earth observation and conservation (Myers-Smith)
Week 11	26th Nov.	Conservation careers, course wrap up (Myers-Smith and Keane) *** **POSTnote Due (29th Nov. 12pm noon)** ***

Week 2: Introduction to conservation science – Isla Myers-Smith and Aidan Keane
What is conservation science?

- Science of biodiversity and people's behaviour
- History of conservation science
- Three case studies of conservation issues
- Outline to the course

Discussion: What is Conservation Science?
We will discuss how the field of conservation science is defined and what controversy exists in the interpretation of this field.

Soulé, Michael E. "What is conservation biology? A new synthetic discipline addresses the dynamics and problems of perturbed species, communities, and ecosystems." *BioScience* 35.11 (1985): 727-734.
http://bioscience.oxfordjournals.org/content/35/11/727.extract

Kareiva, Peter, and Michelle Marvier. "What is conservation science?." *BioScience* 62.11 (2012): 962-969.
http://bioscience.oxfordjournals.org/content/62/11/962.short

Soule, M. The "new conservation." *Conservation Biology* (2013) 27:895-897.
http://onlinelibrary.wiley.com/doi/10.1111/cobi.12147/abstract

Homework: Brainstorm of current hot topics is conservation science. Students will be asked to choose a hot topic, within the first two weeks of the course, on which they will write their opinion piece and present their poster at the class conference. Please bring a hot conservation topic that has featured recently in a scientific paper or the news to the next class.

Week 3: Patterns of biodiversity – Isla Myers-Smith
What is biodiversity?

- Global patterns of biodiversity
- Measuring biodiversity – alpha, beta, gamma, etc.
- Genetic-species-community-ecosystem level diversity
- How many species are there on planet earth?
- Where are the hot spots of diversity?
- How to calculate biodiversity change and extinction rates

Discussion: How do we monitor changes in biodiversity?
We will discuss how we define, monitor and calculate biodiversity change and how this information is summarised for policy makers.

Pereira, Henrique M., and H. David Cooper. "Towards the global monitoring of biodiversity change." *Trends in Ecology & Evolution* 21.3 (2006): 123-129.
http://www.sciencedirect.com/science/article/pii/S016953470500337X

Myers, Norman, et al. "Biodiversity hotspots for conservation priorities." *Nature* 403.6772 (2000): 853-858.
http://www.nature.com/nature/journal/v403/n6772/abs/403853a0.html

Kareiva, Peter, and Michelle Marvier. "Conserving Biodiversity Coldspots Recent calls to direct conservation funding to the world's biodiversity hotspots may be bad investment advice." *American Scientist* 91.4 (2003): 344-351.
http://www.jstor.org/stable/27858246

Week 4: Background population ecology for conservation – Isla Myers-Smith
Basics of population biology, evolution and population genetics for conservation

- Biology of small populations
- Island biogeography
- Meta populations
- Population genetics, bottle necks
- Demographic stochasticity
- The rescue effect

Activities:

- Getting hands on with the theory of island biogeography
- Mark recapture to estimate population sizes
- Intro to programming and mathematical ecology

We will head outside to test out ecological theory using breakfast cereal Tupperware containers and a laser range finder, then we will head back inside to use the computer software R and our own mathematical brains to calculate island biogeography relationships and to estimate populations sizes in our model breakfast cereal populations. Time to get quantitative in Conservation Science!

Check out the blog post on this session from 2015 and 2016:
https://conservationscienceblog.wordpress.com/2015/10/20/getting-quantitative-in-conservation-science/
https://conservationscienceblog.wordpress.com/2016/10/30/go-forth-and-multiply/

Discussion: Population ecology and conservation management in practice
We will discuss how population ecology and ecological theory is used in conservation science and management today.

What were the major findings of these studies?

How have changes in large mammal populations been associated with warfare and wildlife conflict in this study?

What are winners and looser species and why should we also be thinking about the winners and not just the loosers?

What key population ecology metrics are used in these studies? And how are they calculated?

How was population change linked statistically to wildlife conflict in the Daskin and Pringle 2018 paper? How was population change modelled over time in the Dornelas et al. 2019 paper? What type of statistical models were used?

Dornelas, M., Gotelli, N.J., Shimadzu, H., Moyes, F., Magurran, A.E. and McGill, B.J., 2019. A balance of winners and losers in the Anthropocene. Ecology Letters, 22(5), pp.847-854.
https://onlinelibrary.wiley.com/doi/full/10.1111/ele.13242

Daskin, J.H. and Pringle, R.M., 2018. Warfare and wildlife declines in Africa's protected areas. Nature, 553(7688), p.328.
http://www.nature.com/articles/nature25194

Discussion of how to write an opinion piece on a conservation topic.

Week 5: Why do we conserve biodiversity? – Aidan Keane

- Ecosystem services
- Wellbeing

- Valuing diversity
- Moral obligation
- What is the role of scientific evidence?
- Policy and political trade offs

Discussion: Why do we conserve biodiversity?
We will discuss the reasons why we conserve biodiversity and the tension among managing for different conservation priorities.

Van Houtan, Kyle S. "Conservation as Virtue: a Scientific and Social Process for Conservation Ethics". *Conservation Biology* 20.5 (2006): 1367–1372
http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2006.00447.x/abstract

Justus, James et al. "Buying into conservation: intrinsic versus instrumental value". *Trends in Ecology and Evolution* 24.4 (2008): 187-191
http://www.cell.com/trends/ecology-evolution/abstract/S0169-5347(09)00049-4

Activities:
Dragon's Den: Make a pitch to save a species!

Discussion of hot topics in preparation for your choice of subject for your opinion pieces.

Homework: Bring your final choice of hot topic to the next week's class.

Week 6: Protected areas – Aidan Keane

- Design of protected areas – single large or several small
- Coverage of protected areas
- How well are protected areas managed?
- How successful are protected areas?
- Conflicts between protected areas and people

Discussion: Fortress Conservation?
We will discuss the benefits and drawbacks of so called "fortress" approaches to protected areas versus community-based conservation programmes.

Brosius, J. Peter. "Indigenous Peoples and Protected Areas at the World Parks Congress". *Conservation Biology* 18.3 (2004): 609-612
http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2004.01834.x/abstract

Terborough, John. "Reflections of a Scientist on the World Parks Congress". *Conservation Biology* 18.3 (2004): 619-620
http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2004.01837.x/abstract

Brooks et al. "Protected Areas and Species". *Conservation Biology* 18.3 (2004): 616-618
http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2004.01836.x/abstract

Juffe-Bignoli, D. et al. "Protected Planet Report 2014". UNEP-WCMC: Cambridge, UK.
http://www.iucn.org/about/work/programmes/gpap_home/?18786/Protected-Planet-Report-2014

Activities: Role play
Role play a negotiation between park managers and local people over use of forest products around a tropical protected area.

Discussion of communication skills in advance of the Mid-term Conference

Weekend fieldtrip: Conservation management in practice – Isla Myers-Smith, Aidan Keane and student demonstrators

In this weekend field trip, we will visit a part of Scotland where conservation issues such as rewilding, regeneration of natural scots pine woodland, control of red deer, management of habitat for rare species, protection of alpine ecosystems, management of a National Park and development of the local tourist economy are important conservation issues. The students will visit relevant natural areas and speak to land managers to delve into these conservation issues first hand.

Check out the blog posts about the fieldtrip:
https://conservationscienceblog.wordpress.com/2015/10/19/conservation-in-the-cairngorms/
https://conservationscienceblog.wordpress.com/2017/10/10/the-cons-sci-2016-field-trip/
https://conservationscienceblog.wordpress.com/2017/10/31/the-cons-sci-2017-field-trip/

Week 7: Conservation Science Mid-term Conference
Poster presentations and discussion of the conservation hot topics

We will hold a Conservation Science conference to share findings from the opinion piece projects. This is a chance to practice your communication skills and to convince others to share your opinion on your hot-topic conservation issue.

Week 8: Threats to biodiversity – Isla Myers-Smith

- Habitat loss, fragmentation
- Invasive species
- Climate change
- Exploitation
- Pollution
- Biodiversity change in the Anthropocene
- The extinction crisis

Activities: Same data different results? The students will break into discussion groups and be presented with the same biodiversity and land cover datasets from one research site. Each group will be asked to come up with one research question and to test that research question and present their results back to the class. Do scientists come to the same conclusion when working with the same data? How might any differences in research questions, analyses and interpretation influence the take-home messages that scientist draw about controversial topics.

Discussion: Biodiversity change across scales
How do different scientists interpret similar data on biodiversity change?
How do we come to a scientific consensus with differing evidence from different sources?

Dornelas, Maria, et al. "Assemblage time series reveal biodiversity change but not systematic loss." *Science* 344.6181 (2014): 296-299.
http://science.sciencemag.org/content/344/6181/296

McGill, Brian J., et al. "Fifteen forms of biodiversity trend in the Anthropocene." *Trends in ecology & evolution* 30.2 (2015): 104-113.
http://www.sciencedirect.com/science/article/pii/S0169534714002456

Newbold, Tim, et al. "Global effects of land use on local terrestrial biodiversity." *Nature* 520.7545 (2015): 45-50.
http://www.nature.com/nature/journal/v520/n7545/abs/nature14324.html

IPBES

http://www.ipbes.net/index.php/about-ipbes

Week 9: People-focused conservation – Aidan Keane
- How to change people's behaviour
- Community-based conservation
- Payments for ecosystem services
- Social data collection
- Measuring peoples well being

Adams, William M. et al. "Biodiversity Conservation and the Eradication of Poverty". *Science* 306 (2004): 1146-1149
http://www.sciencemag.org/content/306/5699/1146.short

Milner-Gulland, E.J. et al. "Accounting for the Impact of Conservation on Human Well-Being". *Conservation Biology* 28.5 (2014): 1160–1166
http://onlinelibrary.wiley.com/doi/10.1111/cobi.12277/pdf

Activities: Asking sensitive questions
We will explore interactive examples using specialised survey techniques for studying illegal or otherwise sensitive topics in conservation.

Week 10: Applied techniques in conservation
New technology is transforming conservation science. In this workshop, students will learn how to process satellite remotely-sensed data to explore forest loss in protected areas around the world.
- Short introductory lecture on satellite imaging and GIS
- Practical exercise – Students will work in teams to access forest cover change data for protected areas and interpret change observed using the Google Earth Engine

Google Earth Engine
https://earthengine.google.com/

Global Forest Cover Dataset
https://earthenginepartners.appspot.com/science-2013-global-forest

Hansen, Matthew C., et al. "High-resolution global maps of 21st-century forest cover change." *Science* 342.6160 (2013): 850-853.
http://www.sciencemag.org/content/342/6160/850.short

Week 11: Conservation in practice – Isla Myers-Smith and Aidan Keane
Future career opportunities in conservation science from local to international

In this final session of the course, we will discuss what ongoing research is being conducted at the University of Edinburgh on conservation issues, what sort of careers exist in the field of conservation science, how are new technologies influencing conservation practice (mobile phones, drones, etc.), and how can students continue to build relevant skill sets and stay involved in conservation after the end of the course.

Conservation Drones
https://conservationdrones.org/

iSpot
http://www.ispotnature.org/communities/global

iNaturalist

https://www.inaturalist.org/

Assessments:
As part of week 1 activities, there will be a brain-storming session at which students will be encouraged to identify current conservation issues and to choose a topic for their opinion piece and presentation.

Poster Presentation 15% - Due Week 7 (29th Oct. in class)
Skills being assessed: Communication skills, poster design, public speaking, interpretation of the scientific literature, development of an informed scientific opinion

Students will be asked to give a 2-minute poster presentation introducing their chosen hot issue in conservation science to the class in our mid-term conservation conference. They will be asked to introduce the issue in question, explain the science behind the topic and the conservation approach required or being undertaken. The presentation should be modelled on a scientific "speed talk" for a conference such as the British Ecological Society Conference. Each student will be asked at least one question after their talk by one of their fellow students or the teaching team. The conference will consist of two hours of poster presentations and a half our catered coffee break in the middle.

Opinion piece 60% - Due Week 8 (8th Nov. 12pm noon)
Skills being assessed: Scientific communication and writing, interpretation of the scientific literature, development of an informed scientific opinion

The students will be asked to write a 2000-word fully-referenced opinion piece in the format appropriate for a scientific journal giving a detailed yet concisely written description of their chosen hot issue in conservation science (the same topic on which they are presenting at the conference). The students can choose to format this piece in the style appropriate for a scientific conservation journal of their choice using the author guidelines indicated on the journal's website (Conservation Biology, Biological Conservation, Journal of Applied Ecology, etc.).

POSTnote 25% - Due Week 11 (29th Nov. 12pm noon)
Skills being assessed: Public/policy communication, distillation of the scientific literature, summary of scientific information, engagement with policy/public audiences, development of a data visualization using quantitative skills

As a final assignment, students will be asked to produce a four-page up to 2000-word POSTnote summary with references for the Scottish or UK governments on an assigned current conservation issue. This will assess the student's abilities to conduct scientific research, interpret the literature and summarise an issue using language appropriate for a broad policy audience. Students will be asked to replicate the format of a UK government POSTnote. Additionally, students will be asked to make a data visualization and analysis with interpretation using their quantitative skills in a box featured in the POSTnote from data provided. The topics will be chosen from issues discussed as a part of the course lectures and will be given to the students at the end of the week 10 lecture and the assignment will be due at the end of week 11.

e.g., Ecosystem service valuation, May 2011 - POSTnote
http://www.parliament.uk/business/publications/research/briefing-papers/POST-PN-378/ecosystem-service-valuation-may-2011

Marking Schemes:

Opinion Pieces:

Opinion/topic - 40%

- Does the student clearly present a reasoned argument expressing their own opinion and that of the opposing side of the argument using convincing writing and appropriate references to the literature?
- Does the student have a deep understanding of the issue being presented and show evidence of critical thinking?
- Is the topic appropriate for an opinion piece?
- Is the argument convincing?

Evidence/research - 30%

- Is the opinion piece well researched providing a broad basis for the argument and topic with references to the scientific literature?
- Does the student provide well-researched evidence for both sides of the argument?
- Does the student provide evidence including background theory, case studies or examples, and the opinions of experts?
- Are there appropriate references both in the specific topic area and the more general conservation literature?

Writing/structure/presentation - 30%

- Is the opinion piece well-presented following either the format and structure of an opinion piece in a scientific journal?
- Is the opinion piece well written and engaging using a very clear structure with an introductory/summary paragraph, body paragraphs with evidence for the different arguments and a conclusion paragraph that ties all the information together and presents the final take-home message for the piece?
- Does the opinion piece use modern scientific or journalistic style writing with short sentence and paragraphs and a very clear structure and order to the information presented?
- Are the ideas presented integrated into a cohesive overall argument?
- Is the writing grammatically correct without spelling mistakes, formatting issues, etc?
- Are topic and transition sentences used to structure the writing and is the writing easy to read?
- Are the references formatted correctly?
- Does the student demonstrate creativity in the presentation of their arguments?

POSTnotes:

Communication of science to policy/public audience (40%)

- Does the POSTnote distil the scientific message in appropriate language to a policy/public audience?
- Does the POSTnote cover important information relevant for understanding the topic?
- Does the POSTnote provide images, illustrations, figures or conceptual diagrams to illustrate the scientific messages?
- Does this POSTnote approach the scientific writing of a POSTnote produced by the UK government?

Evidence provided, research and references (30%)

- Is the POSTnote well researched with appropriate references?
- Does the POSTnote provide a policy take-home message for the topic?
- Does this POSTnote approach the quality of research and referencing of a POSTnote produced by the UK government?

Writing quality, structure and presentation (30%)

- Is the POSTnote well written using clear to the point writing appropriate for a public audience?
- Is the POSTnote well-structured by highlighting the key information and providing more explanation where necessary?
- Does this POSTnote approach the quality and presentation of a POSTnote produced by the UK government?

Poster Presentations:

Planning and Preparation (1/5)

- Was there evidence of plenty of research and careful preparation of material?

Subject Matter (1/5)

- Was the content relevant, accurate, and based on sound evidence?

Poster (1/5)

- Did the student make good use of visual aids and design?
- Was the poster engaging?

Presentation of poster (1/5)

- Did the student have a good strong voice and relaxed posture?
- Did they speak directly and clearly to the audience?

Narrative and Structure (1/5)

- Did the student explain the material in a structured way with a clear story?
- Were they able to answer questions and engage with the subject matter?

Planning and Preparation						
Evidence of plenty of research and careful preparation of material	A	B	C	D	E	Little evidence of preparation or research
Subject Matter						
Content is relevant, accurate, based on sound evidence	A	B	C	D	E	Anecdotal and fails to address the title of the talk
Poster						
Good use of visual aids and design, appropriate amount of text	A	B	C	D	E	Poor visual aids and design, too much text or text not informative enough
Presentation of poster						
Good strong voice, relaxed presentation style	A	B	C	D	E	Couldn't hear voice, poor communication skills
Narrative and Structure						
Explained material in a structured way with a clear story	A	B	C	D	E	Structure disorganised and confused

Cons. Sci.
University of Edinburgh
POSTNOTE
December 2019

Title Here *(5 words or fewer)*

Image or figure here

Overview

- 3 to 6 bullet points summarising the issue

Include an overall summary paragraph of 3 sentences or fewer here.

Background
Include two paragraphs of background information here.

Heading 1
Add your body text here using headings throughout. This text should consist of about 15 to 20 short paragraphs in total and one or two boxes of text. The full POSTnote should not be longer than 1500 words total.

Please provide one figure or table in one of the boxes that summarises relevant data for the topic. This figure must be understandable for a public or policy audience. The accompanying text in the box must explain the figure and its relevance.

Heading 2

For further details on the formatting and content of a POSTnote, see the UK government POSTnote website:

http://www.parliament.uk/mps-lords-and-offices/offices/bicameral/post/publications/postnotes/

Please submit your POSTnote as a PDF file using the formatting in this template through Turnitin.

The POSTnote assessment is designed to test your abilities to conduct scientific research, interpret the literature and summarise an issue using language appropriate for a broad policy audience.

Box 1
Box text describing the topic of the box.

Add figure or table here if appropriate

Fig. 1 Include legend here

Heading 3
More of your body text here.
…

Box 2
Box text describing the topic of the box.

Heading 4
More of your body text here.
…

Endnotes
1 Add your references here
2 You are permitted 15 - 20 references, no fewer than 15 and no more than 20
3 Use the nature format for references, a numbered list with superscript numbers in the text
4 See any POSTnote on the website above for referencing formatting
5 Zotero is a great and entirely free referencing programme if you don't use one already (https://www.zotero.org/)
6
…
20 Thanks for participating in Cons. Sci. Have fun putting together your POSTnotes!