Part IB Ecology, Evolution and Conservation

2019-20

Cover image: 'Nesting colony' — Red-throated bee-eaters (Merops bulocki), Murchison Falls National Park, Uganda

NST Part IB
Ecology, Evolution and Conservation

Welcome to IB Ecology, Evolution and Conservation

(formerly IB Ecology)

If you are interested in the theory and application of ecology and evolution - from the distribution of global biodiversity and the evolution of predator-prey behaviour, to conservation science and the ecological impacts of climate change - this is the course for you!

It provides a general introduction to the subject and a broad platform for more advanced studies in evolution, ecology and conservation at Part II. Ecology, Evolution and Conservation is also unique among the IB courses in giving students the opportunity to carry out, analyse and present an independent, cutting-edge research project. This is immensely popular with students and provides great training for Part II research.

To take IB Ecology, Evolution and Conservation it is not necessary for students to have attended the first year subject 'Physiology of Organisms', 'Evolution and Behaviour' or any other specified first year subjects. We ensure the course is accessible to students with little or no previous biological background - though students who have not taken biology courses previously are advised to consult their Director of Studies before the deadline to take the course.

Course Structure

For further information please refer to the course website:
https://www.biology.cam.ac.uk/undergrads/nst/courses

Any questions on the course please contact teaching@zoo.cam.ac.uk.
Please note: there may be some minor content changes between now and October – any updates will be posted on the course website, link above.

Lectures

Monday, Wednesday, and Friday, 12 – 1pm, Department of Zoology.

- ***Michaelmas term themes****:* Humans and ecology; Ecological applications; Factors shaping global vegetation; Ecosytem productivity and climate change.
- ***Lent term themes****:* Biodiversity and ecosystems; The role of collections in understanding long-term change; Predators and prey; Evolutionary ecology.
- ***Easter term theme*****:** Paleoecology and human migrations; *Ecology synthesis.*

Projects

In lieu of weekly practicals, you will complete a project which comprises one third of the total mark. Students are also required to give a short presentation on their project work.

It is highly recommended that students attend the 10-day field course at Juniper Hall Field Centre. This introduces a wide array of field techniques and is where most students carry out their research projects. For those unable to attend, alternative projects will be available during Michaelmas term.

Field trips

Students will attend short excursions throughout the year, for example, to the Wildfowl and Wetlands Trust at Welney, and to Hayley Wood, a well-known ancient wood.

Juniper Hall Field Course, Surrey

Monday 24 June – Thursday 4 July 2019

This course focuses on practical work, and will introduce students to many key techniques in field ecology, integrating both plant- and animal-focused approaches.

Students contribute £100 towards the cost of the course, plus travel expenses; the remaining costs (approximately £400) are covered by the Department of Zoology. Please consult your Director of Studies to find out if your college has grants available to help towards your costs.

If you would like to attend, please complete the application form, which is available via the course website (link below) by **Sunday 28 April 2019.**

https://www.biology.cam.ac.uk/undergrads/nst/courses/ecology/fieldcourse

Students unable to attend this field course will undertake a research project at the beginning of Michaelmas Term.

MICHAELMAS TERM

Humans and ecology

Professor Andrew Balmford

Aims and outcomes

To introduce exciting topics in applied ecology and conservation biology, largely by means of accessible case studies.

- Why are people from Europe typically richer than South Americans? Why did mammoths, ground sloths, sabre-tooth cats and elephant birds all become extinct in just a few thousand years?
- What can pirates tell us about the ecology of the Caribbean?
- And what does all this say about what to expect during your lifetimes?

All these questions will be tackled in six lectures that use case studies to explore the history of ecological interactions between people and the biosphere. These lectures will inspire you to think about ecological interactions between humans and the biosphere from a historical perspective.

Ecological applications

Dr David Aldridge

Aims and outcomes

To demonstrate that ecological principles underpin wise and effective stewardship of the environment and natural resources. An introductory lecture will cover key concepts and set a framework for thinking about ecological application. We will then move on to the global challenge of managing eutrophic freshwaters. Next we will look at ecotoxicology and how we can use biological monitoring to understand current and historical pollution events. The following lecture will investigate the management tools available for controlling non-native invasive species before we move onto a group workshop where students will battle for fictional funding to support management of different emerging invaders. The final lecture will look at the ecology of aquaculture, discussing how we can optimise production and minimise wider environmental damage.

The course aims to show that a sound understanding of ecological principles can make a real difference to effective environmental management. It will show students that a background in ecology can open up careers in many applied fields. By attending this lecture block, students will be able to think about the other lectures from a wider and more applied perspective.

Factors shaping global vegetation

Professor David Coomes

Aims and outcomes

To introduce you to the fundamental environmental processes that shape the diverse array of ecosystems found on land.

Why are our British forests dominated by deciduous species while tropical rain forests are evergreen? How has tolerance of frost shaped the evolution and ecology of vegetation? How do we know the sequence of vegetative succession across Europe and America in the period since glaciers last retreat? Why is global warming leading to increased drought stress in regions where rainfall has remained unchanged? Was Darwin right when he argued that diverse plant communities are more resistant to invasion by alien species? Why do we have savanna systems in regions of the world which climate-based models predict should be woodlands? How has fire shaped the evolution of plants? How do plant communities affect where on earth ungulates are abundant and where they are rare? All these tantalising questions and more will be addressed in six lectures introducing you to the key environmental processes shaping plant communities.

Ecosystem productivity and climate change

Professor Howard Griffiths

Aims and outcomes

To demonstrate the impact of increasing atmospheric carbon dioxide on vegetation, and associated responses by ecosystems, and how this represents one of the greatest challenges facing the current generation of students. Forests and oceans are really absorbing, both literally and metaphorically! We set out to explore the basis of carbon sequestration for contrasting forest biomes, and the equivalent role of marine ecosystems in responding to CO_2 enrichment. We will also explore the potential means, including bioenergy and geoengineering, which could mitigate future climate impacts as we seek to stabilise CO_2 emissions.

The responses of plants and associated ecosystems to CO_2 fertilisation will demonstrate that acclimation is both species-specific and co-limited by other factors, which reduce carbon sequestration potential. The challenge for the next generation will be to provide scientific evidence to underpin the need for Negative Emissions Technologies and sustainable energy generation technologies, so as to justify associated economic costs and generate the political will for implementation.

LENT TERM

Biodiversity and ecosystems

Dr Edgar Turner

Aims and outcomes

To explore the local and global distribution of biodiversity, what drives differences in biodiversity between regions, and how species interact to determine the functioning of ecosystems. We will also be discussing patterns and drivers in the distribution of species, the role of biodiversity in ecosystem functioning, the impacts of anthropogenic change and investigating management solutions for conserving healthy-functioning ecosystems.

Over the course of these lectures you will gain a better understanding of why species are found where they are and how they interact in functioning ecosystems. You will also be encouraged to think critically about conservation goals and management solutions for conserving functioning ecosystems into the future.

The role of collections in understanding long-term change

Dr Edgar Turner, Dr Robert Asher, Dr Mike Brooke,
Dr Richard Preece, Dr Jason Head

Aims and outcomes

Zoological collections house an extraordinary wealth of information that can be used to research past and future biological change. Focusing on the Museum of Zoology, this lecture series will explore the diverse roles that collections can play in understanding biological diversity, taxonomic relationships between different animal groups, evolutionary change, and past and future ecological change and extinction events. The course will also include a chance to visit parts of the collection and to find out more about the important role that biological collections have in education and engagement.

Students will gain a sound understanding of the diversity and role of biological collections, how these collections can underpin research into contemporary questions of evolution and environmental change, and their importance in education and public engagement.

Predators and prey

Lecturer tbc

Aims and outcomes

- To show how natural selection has designed predators as efficient foragers, and prey as efficient at evading predation. This results in an evolutionary arms race, with co-evolved adaptations and counter-adaptations by the two parties.
- To show how competition within and between species has interesting consequences for foraging niches and community structure.

A newly-hatched ringed plover chick has a white neck collar, which makes it look like two pebbles on the beach - an example of camouflage by disruptive markings.

By the end of this course you should have learnt the following main points, and be able to discuss the theories critically with examples to test their assumptions or predictions:

- How optimality models can be used to investigate trade-offs in foraging and prey defences.
- How co-evolution can influence predator and prey design.
- How foraging behaviour and niches can be influenced by both intra- and inter-specific competition.

Evolutionary ecology

Dr Andrew Tanentzap

Aims and outcomes

To discover how evolutionary forces in the past, such as competition and herbivory, have left their mark on present day species and discuss how evolution generates biodiversity. We will consider the importance of ecological opportunity and evolutionary innovation in unlocking access to new environments, and how these different processes favour speciation. The dependency of diversification on the rate at which new species versus new habitats arise will be debated, as well as the importance of extinction, and we will consider why historical contingencies matter when resources are finite.

EASTER TERM

Paleoecology and human migrations

Professor Eske Willerslev

Aims and outcomes

To explore benefits and drawbacks in applying different types of DNA approaches in order to understand paleoecology and human migrations; to become familiar with the different models attempting to explain the underlying cause(s) of Ice Age megafaunal extinctions, the data supporting or contradicting the models, and their implications for future conservation efforts. We will discuss the archaeological/paleontological and genetic models explaining the human history of Europe and Central Asia from Neanderthals and Heidelbergensis to the Iron Age including disease outbreaks, also considering the complex and controversial human population histories of Southeast Asia, Papua Guinea, and Australia: *Homo erectus*, the "Hobbits", Denisovans, and anatomically modern humans. Finally we will uncover the many competing models on how north-eastern Siberia and the Americas were first populated by humans and the data supporting or contradicting them, as well as their political implications.

Ecology synthesis

Dr Andrew Tanentzap

Aims and outcomes

The aim of these two lectures is to summarise major themes from the lecture course. Our goal is to help you revise for exams by drawing connections among lecture blocks and highlighting how different content and examples can be used in new contexts.

Book List

Recommended books that you might consider buying:

- **Begon. M. Harper & J. L. Townsend C. R. (2005)**
  Ecology: From Individuals to Ecosystems (4th Edn.) Blackwell Science, Oxford.
- **Davies, NB, Krebs, JR and West, SA (2012)**
  An Introduction to Behavioural Ecology (4th Edn.) Wiley-Blackwell.

Recommended Popular Books

- **Balmford, A (2013)** *Wild Hope* Chicago
- **Diamond, J (1997)** *Guns, Germs & Steel* Vintage
- **Wilson EO (1992)** *The Diversity of Life* Penguin

Back image: 'Mother with calf' — Southern white rhinoceros (Ceratotherium simum simum), Ziwa Rhino Sanctuary, Bugembe, Uganda

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