

Master of Science

Biodiversity & Conservation



Course Handbook 2018/19



School of Natural Sciences
University of Dublin, Trinity College

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INTRODUCTION

Biodiversity is the diversity of all life on earth, and is currently being lost at an ever increasing rate. Biodiversity provides us with food, clothing, fuels, construction materials, medicines and a wide range of ecosystem services. We ourselves are part of the biodiversity of this planet: we must understand and conserve biodiversity to secure a sustainable future for humanity.

This programme will provide in-depth training and experience for those looking to further their career in various aspects of biodiversity and its conservation, for students wishing to pursue further post-graduate research in this area, and for professionals already working in conservation biology wishing to obtain relevant qualifications.

The TCD School of Natural Sciences has an internationally recognised research profile in the areas of biodiversity research and conservation, and integrates these research experiences fully within its undergraduate and postgraduate teaching programmes. We also have very close links with various State agencies and institutions with activities in biodiversity and conservation, including National Parks and Wildlife Service, the Environmental Protection Agency, various local authorities and county councils, and NGO groups.

Academic staff have significant expertise in taxonomy and systematics, ecosystem function, population biology, community ecology, policy and other related areas. Several large scale projects involving biodiversity research operate from the School of Natural Sciences. Staff have research and teaching experience in Ireland, South-East Asia, west Africa, Central America and the Caribbean, and Pacific Islands.

As an M.Sc. graduate in *Biodiversity and Conservation* you will be able to take advantage of the worldwide demand generated by the increasing need to document, understand and conserve biodiversity. There are a wide variety of career opportunities available, including State and non-governmental conservation bodies, biodiversity research institutions (zoological and botanic gardens, museum etc.), and numerous consultancies.

Our aim is to produce conservation scientists with an interdisciplinary background, able to tackle the broadest range of issues in biodiversity and its conservation. As new members of the *Biodiversity and Conservation* MSc course we hope that you will play your part in creating a more sustainable future for the varied diversity of life on this planet.

In the event of any conflict or inconsistency between the General Regulations published in the University Calendar and information contained in programme/departmental handbooks, the provisions of the General Regulations will prevail.

ADMINISTRATIVE STAFF

Programme Director

Prof Steve Waldren

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Programme Administrator

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MSc Teaching Assistant

Dr Jean Wilson

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MODULE CO-ORDINATORS

Dr Jean Wilson (jewilson@tcd.ie) is a Postgraduate Teaching Fellow for the MSc in *Biodiversity and Conservation*, the MSc in *Environmental Science* and MSc in *Development Practice*. Jean's research interests centre on environmental applications of remote sensing, GIS and spatial analysis, specifically in the context of water resources monitoring and management. Her work has been funded since 2009 under the EPA STRIVE initiative. She has developed novel methodologies in the application of thermal remote sensing and geochemical tracing techniques for localising and assessing groundwater discharge to lakes and coastal waters nationally.

Jean coordinates the modules BD7051: *Environmental Policy*, BD7053: *Desk Study*, and BD7057: *Project Planning*, and contributes to BD7060: *Practical Conservation Skills*.

Prof Andrew Jackson (a.jackson@tcd.ie) is an Associate Professor in Zoology. His research interests centre on understanding ecological systems and processes from an evolutionary perspective via the use of computational / mathematical models. His primary areas of interest are behavioural ecology and community ecology, but has also published in areas of conservation biology, virology and epidemiology. In addition, he develops Bayesian statistical tools for ecologists, such as stable isotope mixing models.

Andrew co-ordinates the module BD7054: *Data Handling and Analysis*.

Prof Gayle McGlynn (mcglyng@tcd.ie) is an Assistant Professor in Geography. She completed both her BA and PhD in Geography in Trinity College Dublin, and also holds an

MSc in Quaternary Science from the University of London. Her research interests centre on understanding the causes, patterns and impacts of climate and environmental change in tropical Africa. This mainly involves using sediment-based records to reconstruct palaeoenvironmental change using pollen, diatom and geochemical analyses. Her research focuses both on long-term vegetation changes and on recent changes in high-altitude ecosystems – particularly in areas associated with the Albertine Rift biodiversity hotspot.

Gayle coordinates the module BD7059: *Global Environmental Change*.

Prof John Parnell (jparnell@tcd.ie) is Professor of Systematic Botany and Curator of the College Herbarium. His research interests focus on higher plant systematics and his research team is largely concerned with studies of the Irish and S.E. Asian floras, especially that of Thailand. In addition, his interests include biogeography, evolutionary theory, conservation biology and pollination biology. His main teaching areas include plant conservation, biodiversity, evolution and taxonomy.

John co-ordinates the module BD7055: *Systematics, Taxonomy and Identification Skills*.

Prof Jane Stout (stoutj@tcd.ie) is a Professor in Botany. She is an ecologist and her work seeks to understand the links between biodiversity and ecosystem functioning and the delivery of ecosystem services, which ultimately influence human livelihoods and well-being. She examines processes and consequences of changes in land management and non-native species invasion, using plant-pollinator interactions as a model system. Changes in habitat management and agricultural systems, along with other elements of environmental change (including climate change) have resulted in bee decline and pollination ecology becoming an increasingly important subject. Her main teaching includes general ecology, data handling and plant-animal interactions.

Jane co-ordinates the module BD7056: *Human Interactions with Biodiversity*.

Prof Steve Waldren (swaldren@tcd.ie) is an Associate Professor in Botany, and is Curator/Administrator of the College Botanic Garden. He has worked extensively on biodiversity research in Ireland and the tropics, especially Polynesian islands. His research includes monitoring of plant communities and application of their ecology for assessment of conservation status. He has an ongoing interest in the plant communities associated with turloughs (temporary groundwater-fed lakes). His main areas of teaching are biodiversity conservation, systematics and vegetation analysis. *Steve's College office is room 2.07 in the Centre for the Environment, Anatomy Building.*

Steve co-ordinates the modules BD7050: *Introduction to Biodiversity*, BD7052: *Introduction to Conservation Biology*, BD7058 *Overseas Field Course*, and BD7060: *Practical Conservation Biology*.

OTHER TEACHING STAFF

Several staff contribute their expertise to the course through teaching contributions to the various modules, and through the supervision of research projects, and the BD7053 *Desk Study* module. In addition, you may contact staff within the School of Natural Sciences regarding projects related to their research interests. See the School research webpages

for details (naturalscience.tcd.ie/research/): from this page you will find links to the various disciplines that make up the School, and to the research pages of the individual staff / disciplines.

THE SCHOOL OF NATURAL SCIENCES

The School, comprising the disciplines of Botany, Geography, Geology and Zoology, and the Centre for the Environment, is the largest school in the Faculty of Engineering, Mathematics and Science and hosts biological, physical and social scientists. The School currently accommodates ca. 44 academic staff, 20 postdoctoral research fellows and 100 graduate research students, has an annual research income in excess of €4 million and produces an average of about 150 publications per year. The School has a wide variety of resources available: specialist laboratories, zoological and geological museums, a herbarium and botanic gardens and several specialist libraries. We encourage you to engage with the wider activities of the School; in particular, the School offers several seminar programmes related to both disciplines and research groupings, and you are encouraged to attend these – details will be posted on the course Blackboard pages. For further details on the School see <https://naturalscience.tcd.ie>.

COURSE AIMS

Our aim is to promote an understanding of biodiversity and its conservation, and help you develop the capability to apply that knowledge to current issues in the area, as part of sound environmental management for a sustainable future.

You will develop the necessary intellectual skills and practical expertise to design and execute high quality independent and group research.

Finally, we aim to produce skilled communicators who are proficient in organizing thoughts and ideas, and disseminating them effectively through written and oral presentations.

Programme Level Learning Outcomes

On successful completion of this course, the student will be able to:

- Demonstrate a critical understanding of the breadth and multi-disciplinary nature of the study of biodiversity and its conservation, including key concepts and foundational theories
- Assemble and critically evaluate information at the forefront of current understanding across a range of fields related to biodiversity and its conservation, and assess its significance for contemporary issues linking science and society
- Identify, formulate and address key research questions through the design and execution of individual projects, including discrimination in the selection and application of appropriate methods, analytical tools and statistical techniques
- Demonstrate adaptability in working practice, with the ability to work autonomously and as part of a team, incorporating the capacity to exercise a leadership role
- Identify and critically evaluate gaps in their own knowledge or expertise, and devise steps to address them through continued learning

- Appraise complex information, formulate judgements, and clearly communicate knowledge and conclusions to both specialist and non-specialist audiences in written and verbal formats.

REQUIREMENTS & EXPECTATIONS

Prompt attendance for **all** taught components, including practicals and fieldwork, is a requirement of this course. Prior permission for absence should be sought *in writing* from the module co-ordinator. Absence due to illness should be reported to the module co-ordinator, the Programme Director and the Programme Administrator; medical absences for three days or longer require a doctor's note to be presented ***Failure to attend classes is regarded as a failure to comply with the fundamental course requirements.***

Some modules, and many projects, will require field work. Please ensure you have read the safety guidelines (circulated during the induction week and available online at <https://naturalscience.tcd.ie/healthsafety/>, for more general college safety, see <https://www.tcd.ie/estatesandfacilities/health-and-safety/>) and are always equipped for bad weather. Suitable footwear and adequate food supplies are vital components of being in the field. In addition to attending a safety briefing, you are required to complete health and safety forms during the induction week.

We aim to develop key transferable skills of both independent work, and working together as part of a group. For group work, it is essential that you participate fully with your assigned group; take the initiative and do not leave it to others. Group work will be subject to peer group assessment.

*****IMPORTANT – THIS IS A FULL-TIME COURSE*****

This is a post-graduate qualification and therefore contains a considerable component of independent study (student centred, self-directed learning). It is **vital** that you effectively manage the time spent outside of classes. The course structure assumes a nominal 40 to 50 hour week, although there will inevitably be some variability of workload throughout the year. This is especially the case as enrolled students usually come from a wide range of backgrounds with diverse skills and knowledge. This diversity (and the breadth of Conservation Science as a subject) may mean that you are unfamiliar with some basic concepts during the course. This may require extra reading for familiarisation of subjects that you may not have studied previously.

Please note that certain components of the course (e.g. seminars or field trips) may occasionally involve evening or weekend work, so please consult your timetables carefully. **IMPORTANT: non-attendance due to paid employment is not an acceptable excuse or mitigating circumstance!**

DESCRIPTION OF THE EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

The European Credit Transfer and Accumulation System (ECTS) is an academic credit system based on the estimated student workload required to achieve the objectives of a module or programme of study. It is designed to enable academic recognition for periods

of study, to facilitate student mobility and credit accumulation and transfer. The ECTS is the recommended credit system for higher education in Ireland and across the European Higher Education Area.

The ECTS weighting for a module is a measure of the student input or workload required for that module, based on factors such as the number of contact hours, the number and length of written or verbally presented assessment exercises, class preparation and private study time, laboratory classes, examinations, clinical attendance, professional training placements, and so on as appropriate. There is no intrinsic relationship between the credit volume of a module and its level of difficulty.

The European norm for full-time study over one academic year is 60 credits for undergraduate courses, usually 90 credits for 1-year taught Masters. The Trinity academic year is 40 weeks from the start of Michaelmas Term to the end of the annual examination period 1 ECTS credit represents 20-25 hours estimated student input, so a 5-credit module will be designed to require 100-125 hours of student input including class contact time and assessments.

ECTS credits are awarded to a student only upon successful completion of the course year. Progression from one year to the next is determined by the course regulations. Students who fail a year of their course will not obtain credit for that year even if they have passed certain component courses. Exceptions to this rule are one-year and part-year visiting students, who are awarded credit for individual modules successfully completed.

COURSE STRUCTURE

This is a one year, full-time postgraduate qualification that will lead to a Master of Science in Biodiversity and Conservation. As part of the Bologna Process, Trinity College ascribes credit to taught courses using the European Credit Transfer System (ECTS). This course is worth **90 ECTS credits**.

One ECTS is equivalent to ~25 hours of student input, and therefore includes formal contact time (e.g. lectures), independent study, research, assessment exercises, revision etc. In this way, 2 ECTS is nominally about one week of work.

Taught Component

The taught component of this course comprises formal lectures, seminars, laboratory and desk-based practicals, fieldwork and independent study.

The course commences with a compulsory *Induction Week* (Monday 3rd to Friday 7th September – see *Induction Week Programme* for details).

There are **NINE TAUGHT MODULES** which are each worth **5 ECTS credits** (see *Taught Modules* for details).

In addition, there is an individual *Desk Study* module worth **10 ECTS credits** (see *Desk Study* for details) and a *Project Planning* module worth **5 ECTS credits** (see *Project Planning* for details).

The combined taught component of this course therefore comprises **60 ECTS credits** (equivalent to a postgraduate diploma).

Module Delivery

Most taught modules in this course are three week blocks (see outline timetable at the back of this booklet). This provides a concentrated period of uninterrupted study, during which time students can immerse themselves in the subject matter and ensure they have addressed any gaps in their knowledge. Assessment for each module will usually take place during these blocks unless otherwise stated in the module outline. The exceptions to this are the BD7053: *Desk Study* and BD7057: *Project Planning* modules, which will run consecutively with other modules and also outside of teaching semesters. BD7054: *Data Handling* also runs over three weeks, but these are separated into three distinct week-long sessions throughout the year.

Timetabling

A general timetable for the course is included at the back of this handbook. Detailed timetables for each module will be circulated by module co-ordinators prior to the start of each module. Timetables are subject to change, so please check carefully all email correspondence from module co-ordinators. Please follow the timetables given to you by the module co-ordinators (and available on Blackboard), and **not** any automatically generated timetable: the latter will be inaccurate, for example they will not include any field-based teaching. In general, contact hours of teaching will be much less than the allocated module time, though this will vary and will be flexible; non-contact hours should be fully utilised for reading primary literature on the study area, and for completing assignments.

Research Project

To complete the MSc degree programme a candidate must design and execute an individual research project. This project is worth **30 ECTS credits**.

Further details concerning choice and design of the project along with requirements for the final dissertation will be given to you in the '*Project Planning*' module.

RECOMMENDED TEXTS

Recommended reading will be provided separately for each module, however some general texts that cover much (but by no means all) of the course include the following:

Essentials of Conservation Biology (6th edition) by Richard B Primack. 2014, Sinauer Associates

We also recommend:

Problem-Solving in Conservation Biology and Wildlife Management by James P Gibbs, Malcolm L Hunter and Eleanor J Sterling. 2nd Edition, 2008, Blackwells

and

Successful Scientific Writing by Janice R Matthews and Robert W Matthews, 2007, Cambridge

The journals *Animal Conservation*, *Biodiversity and Conservation*, *Biological Conservation* and *Conservation Biology* are among many that will contain important articles relevant

for the course. The College has on-line access to these and many other journals, and we recommend that you consult these regularly to keep abreast of up to date research.

COURSE MODULES

Induction Week

Co-ordinators: Prof Sean McClenaghan (Programme Director, MSc in Environmental Science) & Prof Steve Waldren

Description: A week of seminars, activities and fieldtrips designed to introduce the course, the staff, the University and current biodiversity and conservation issues. See *Induction Week Programme* for details. This week will also form a part of the *Introduction to Biodiversity* module (BD7050).

Learning Outcomes

On successful completion of this part of the module, students will:

- Understand course structure, delivery, requirements and expectations.
- Be familiar with College facilities including the library.
- Be aware of health, safety and risk assessment requirements.
- Be able to outline current biodiversity and conservation issues, and related research interests within College.
- Demonstrate basic scientific skills in the field.

Assessment: Attendance, participation and satisfactory completion of all requirements (100%). An assignment linked to the field trip will form a part of the assessment for BD 7050: *Introduction to Biodiversity*.

BD 7050 Introduction to Biodiversity

Module Coordinator: Prof Steve Waldren

ECTS Allocation: 5 credits

Description: This module will act as an introduction to the whole MSc programme, and provide grounding in some of the key concepts. Topics covered will include the definition and measurement of biodiversity, the biodiversity hierarchy - communities, species, genetic diversity - biomes and ecoregions of the world, global biodiversity hotspots, and introduce the dynamics of biodiversity. Students will also be introduced to the critical evaluation of relevant scientific literature, developing key skills that will be required for all other modules. The module will include a residential field course based in the Burren region of Co. Clare over the first weekend of the module – further details will be provided separately.

Learning Outcomes:

On successful completion of this module students will be able to:

- Show an awareness of the range of biodiversity expertise and facilities available in the School of Natural Sciences, and TCD in general
- Understand fundamental concepts in biodiversity, including patterns of global distribution
- Understand, evaluate and apply different methods of measuring biodiversity

- Understand the hierarchical nature of biodiversity, from genes through species to communities and landscapes, and be aware problems of scale in both time and space
- Be capable of critically reviewing scientific literature in the area of biodiversity and its conservation.

Assessment:

Writing a critical abstract of selected research papers	50%
Essay based around the Induction Week field trip	50%

BD 7051: Environmental Policy

Module Co-ordinator: Dr Jean Wilson

ECTS Allocation: 5 credits

Description: The aim of this module is to introduce students to environmental policy and legislation relating particularly to environmental protection including impact assessment legislation at national and European level. Student learning will take place through lectures, individual and group led research activities.

Learning outcomes:

On successful completion of this module, including attendance at lectures, completion of reading and research activities students will be able to:

- Demonstrate knowledge of environmental policy and legislation at national and EU levels
- Understand the requirements, legislative background to, and practice of, environmental impact assessment and its implementation in Ireland
- Discuss the environmental regulatory framework within which our society operates

Assessment: 100% coursework.

Essay (40%)

Wiki assignment (40%)

Group work presentation and report (20%).

BD 7052 Introduction to Conservation Biology

Module Coordinator: Prof Steve Waldren

ECTS Allocation: 5 credits

Description: This module will introduce the broad topic of conservation biology. The main aims are to provide further basic theory to support the modules which will follow, in particular focusing on the main principles underlying community and population ecology, conservation genetics and population dynamics and determine how they relate to the persistence of biodiversity. Threats to biodiversity and how these are assessed will be covered in general terms, though these will be further developed in later modules. The module will consider conservation options, including *in situ* and *ex situ* approaches.

Learning outcomes:

On successful completion of this module, students will be able to:

- Understand the classic and recent research literature relevant to conservation biology
- Demonstrate their knowledge of the major features of community and population ecology, and the relative importance of these in terms of the maintenance of biodiversity
- Evaluate the major current threats to biodiversity, and be capable of placing the current extinction crisis in the context of past major extinctions
- Understand how threat categories are assigned, and apply threat categories to given species
- Critically evaluate the relevance of population models to species persistence
- Critically synthesise relevant information to provide practical conservation prescriptions for a threatened species
- Effectively present concepts and research areas in conservation biology to their peers.

Assessment:

Oral presentations of an assigned population biology topic	20%
Oral presentation of an assigned island biology research paper	20%
Write up of a conservation management plan based on population modelling	60%

BD 7053: Desk Study

Module Co-ordinators: Dr Jean Wilson

ECTS Allocation: 10 credits

Description: An independent, desk-based review of literature relating to a current topic of relevance to biodiversity and its conservation. A list of proposed topics will be circulated early in the first term. There is also an opportunity for students to select a study of their choice in negotiation with the module co-ordinator and a member of staff. Desk study topics should not significantly overlap with proposed research project topics.

Learning Outcomes

On successful completion of this module students will be able to:

- Search, identify and collate academic and related literature using library and on-line resources
- Critically analyse research, and identify key themes, areas of consensus / debate, and gaps in existing knowledge
- Synthesise this information in a concise, logically structured review that is clearly presented and correctly referenced
- Summarise a research topic in a brief oral presentation to a non-specialist audience.

Assessment:

Oral presentation of topic scope and key findings	25%
Written report of c. 6,000 words	75%

BD 7054: Data Handling and Analysis

Module Co-ordinator: Prof Andrew Jackson

ECTS Allocation: 5 credits

Description: This module outlines the principles of data collection, coding and analysis within the context of research design, and provides a firm quantitative base with particular relevance to the research project. It includes an introduction to types of data, how data can be described statistically, and a series of methods used for extracting information from complex datasets. It also includes practical examples and illustrations of statistical applications to real-world research projects. The software R will be used throughout owing to its ubiquitous application in ecology and environmental science, and as a transferable skill in data analysis more generally.

Learning Outcomes

On successful completion of this module students will be able to:

- Explain the central importance of data collection and analysis in effective research design
- Use data visualisation techniques to describe patterns in data and inform subsequent analyses
- Employ hypothesis-testing in research design
- Perform routine data manipulation and analysis using the statistical software package R
- Analyse datasets using the framework of Generalised Linear Models
- Identify appropriate statistical methods to employ for a range of research projects.

Assessment: Continuous assessment, including multiple choice tests and an open book exam (100%)

BD 7055: Systematics and Taxonomy

Module Co-ordinator: Prof John Parnell

ECTS Allocation: 5 credits

Description: This module will provide an introduction to the principles of systematics, the classification of biological diversity. Various species concepts and their application will be described, and the application of classical morphological approaches and modern molecular approaches will be compared. Part of the course will involve an individual project on the systematics of a particular group of organisms.

Learning Outcomes:

On successful completion of this module students will be able to:

- Understand the rationale behind various approaches to the classification of biological diversity
- Demonstrate familiarity with historical and current approaches to systematic classification, including use of molecular phylogenies
- Interpret and use phylogenetic classifications
- Demonstrate a sound grasp of morphological features used in the identification of chosen groups
- Understand the application and merits of various species concepts

- Apply their identification skills and systematic knowledge to a wider range of taxa
- Use the study topic as a link to combine practical skills with appropriate theoretical knowledge.

Assessment:

Study topic essay 100%

BD 7056: Human-Biodiversity Interactions

Module Co-ordinator: Prof Jane Stout

ECTS Allocation: 5 credits

Description: This module will address how the concepts of ecosystem services and natural capital can be used in the conservation of biodiversity. Students will explore how and why businesses might integrate biodiversity into their practices, and discuss conflicts between biodiversity conservation and human well-being.

Learning Outcomes:

On successful completion of this module students will be able to:

- Demonstrate knowledge of the links between biodiversity and ecosystem functioning and the flow of ecosystem services which benefit human well-being.
- Articulate the pros and cons of the “Natural Capital Approach” to nature conservation.
- Develop business cases for biodiversity initiatives for corporate enterprises
- Appreciate human-wildlife conflict in urban temperate and tropical biodiverse areas and debate in situ nature conservation vs human livelihoods.
- Carry out independent and group research, synthesise information and present in a variety of formats

Assessment:

Business and biodiversity presentation (group mark)	20%
Conflicts summary	20%
Written article	60%

BD 7057: Project Planning

Module Co-ordinators: Dr Jean Wilson

ECTS Allocation: 5 credits

Description: During this module you will select a research project title. Workshops will be held to guide the development of key project management skills, and to initiate the process of literature review and development of methods in relation to the project. This will all be placed in the context of a grant application submission, related to the project title. The module will involve discussions with members of staff supervising project work.

Learning Outcomes:

On successful completion of this module students will be able to:

- Provide the context of a research project, through critical evaluation of published literature, and use this to refine research questions
- Develop relevant hypotheses to be tested, an outline of the methods used to test these hypotheses, and a realistic time plan for the completion of a project
- Evaluate the resources required for successful project completion
- Plan an effective timeframe for project completion
- Present the project context, research questions, methods and a delivery plan for peer review
- Develop skills in the preparation of grant applications.

Assessment:

Grant application based on project plan (3-4,000 words) 100%

BD 7058: Overseas Field Course

Module Co-ordinator: Prof Steve Waldren

ECTS Allocation: 5 credits

Description: This will be a 13/14-day residential field course based in game reserves in Limpopo Province, South Africa. The module will provide hands-on experience of wildlife ecology and conservation management, with an opportunity for close observation of large grazing and predatory animals, and the varied conservation issues that arise. For further details, see the separate Overseas Field Course handbook.

Learning Outcomes:

On successful completion of this module, students will be able to:

- Demonstrate holistic knowledge of the South African bushveld ecosystem, including the varied habitats of this ecosystem and the extent & the nature of human interactions in these habitats
- Understand the principles which underpin the ecology of tropical savannas, including the diversity of plant and animal life
- Explain and assess the impact of large mammals on the ecological functioning of bushveld
- Be able to synthesise and reconcile the conflicting arguments for ecosystems' future
- Be capable of integrating these arguments into sustainable management plans
- Be able to make written synthesis of animal abundance in relation to habitat type and management.

Assessment:

Individual write up of game transect data 50%

Written essay (to be determined in the field, typically a selected habitat) 50%

BD 7059: Global Environmental Change

Module Co-ordinator: Prof Gayle McGlynn

ECTS Allocation: 5 credits

Description: This module covers the scientific basis necessary to understand environmental (including climate) change from first principles, including a particular focus on humans as agents of environmental change. Topics include the biogeochemistry of carbon and nitrogen, ocean circulation, heat and mass transfer fundamentals, as well as the tools to read and comprehend the scientific literature providing evidence of changes occurring through time. Lectures on specific topics and their wider significance will be developed through whole class discussions on their practical significance.

Learning Outcomes

On successful completion of this module students will be able to:

- Outline atmospheric and oceanic circulation change and comment on their potential significance for abrupt climate transitions
- Explain in what way living systems control and/or are influenced by the geology and chemistry of the Earth
- Describe how records of past environmental change are constructed and illustrate their applications and limitations with reference to named examples
- Use the concepts of earth system science to assess current issues related to climate change and project their likely significance on topics of relevance for selected applications.

Assessment: Group work and individual presentation including peer review (100%)

BD 7060: Practical Conservation Skills

Module Co-ordinator: Prof Steve Waldren

ECTS Allocation: 5 credits

Description: This module will present practical approaches to the study of biodiversity and its conservation. The first part of the module will cover various practical aspects of biodiversity conservation, including practical habitat mapping using GPS, monitoring and various practical interventions, and will involve numerous site visits. The second part will involve training in GIS techniques, including utilisation of some of the data generated during the first part of the module.

Learning Outcomes:

On successful completion of this module students will be able to:

- Evaluate various options for effective practical conservation
- Apply GIS techniques to biodiversity conservation
- Turn the theory learnt elsewhere in the course into practical conservation actions
- Understand how to turn policy and planning into effective conservation action
- Know how to set up and implement appropriate monitoring programmes
- Be familiar with career options in the general area of biodiversity and conservation.

Assessment:

Conservation management exercise	50%
GIS-based exercises	50%

BD 7061: Research Project

Module Co-ordinator: Prof Steve Waldren, with supervision from various staff

ECTS Allocation: 30 credits

Description: The research project provides students with an opportunity to pursue a topic in their chosen area of biodiversity and conservation biology in depth, to employ relevant skills (including research planning, literature review, experimental design, and statistical analysis) and to apply and develop their knowledge of research methods. The nature of the project work may vary, with varying amounts of experimental work included. There will be opportunities to carry out project work with collaborative institutions, including local authorities, the National Botanic Garden, National Parks & Wildlife Service, etc.; in these cases an academic supervisor from TCD who will oversee the project will be mandatory. Students will be expected to demonstrate a level of academic performance appropriate to a masters' degree.

Learning Outcomes

On successful completion of this module students will be able to:

- Prepare a clear rationale for the selection of a problem or issue to be studied
- Carry out an appropriate review of the relevant literature and consider its implications for the proposed study
- Develop a set of hypotheses or ideas to be tested
- Select and employ suitable methods and procedures for the collection, analysis and presentation of relevant data
- Discuss the results in terms of their implications for the hypotheses
- Present the study in a coherent and acceptable fashion, in the form of a scientific paper or other report as appropriate
- Produce well-reasoned conclusions and discuss their significance and implications.

Project Selection:

Teaching staff in the school will be invited to submit research topic titles together with a brief explanation of the project in late winter. These will be presented to the students at the first workshop of the Project Planning module (see above). In addition, students are encouraged to devise their own research project ideas, for which they will need to liaise with an academic supervisor in College. Research for projects can be undertaken overseas, and in collaboration with agencies outside of College.

Supervision:

Following discussion with the Programme Director and course teaching staff, each student will be assigned a supervisor and project. The normal expectation is that twelve supervision hours will be required for students to complete the dissertation. The precise timing of meetings will be subject to agreement between students and supervisors.

Role of the Supervisor

The supervisor will;

- Assist in selecting and developing a topic for research
- Advise on a literature search
- Advise on ethical and practical issues
- Monitor data collection and general progress
- Advise on data analysis
- Advise on the format and content of the dissertation
- Review **one** draft of the dissertation to a schedule agreed with the student

Assessment

Assessment will be by means of a dissertation in the form of *either* a scientific paper, or another form of reporting as appropriate to the study, based on the investigation of a selected topic in biodiversity and conservation. Further details will be announced in the *Project Planning* module.

ASSESSMENT AND EXAMINATION PROCEDURES

Submission & Deadlines

Assessments must be submitted by the time and date stipulated by the module co-ordinator in the timetable; any hard copy submission will normally be to the Programme Administrator in the School Office. All work will also be submitted by the SafeAssign feature on Blackboard. Each assessment must include a title page giving the name and number of the student, the module title and the date, and the College Plagiarism Declaration.

It is your responsibility to ensure work is signed for on receipt as a record of submission.

You should keep hard copies of all work that you submit.

Assessments submitted after the deadline will receive a 10% deduction in the final mark for each working day late. Assessments will not be marked if more than two working days late unless by prior, written agreement with the module co-ordinator.

Marking and Feedback

Unless otherwise stated, indicative grades (see Table 1 for details) will be circulated within one month of submission. A date and time will also be circulated at which you can collect assessed work.

All marks are provisional until passed by the final Court of Examiners meeting with the External Examiner in attendance.

All assessed work **MUST BE RETURNED** prior to the first Court of Examiners meeting. The deadline for return of work will be circulated during the second semester.

Table 1: Indicative grades and associated provisional mark range for formative feedback. Marks are finalised at the Court of Examiners meeting.

Indicative Grade	Provisional Mark (%)
A++	> 85
A+	75-85
A	70-74
B+	65-69
B	60-64
C+	55-59
C	50-54
F	<50

Module Failure & Re-submission

Students must undertake **ALL 60 ECTS** of the taught component of this course and achieve a **pass** prior to embarking on the **Research Project**. A minimum pass grade must be obtained for both the **Project Planning** and **Desk Study** modules in order to progress to the **Research Project** (these are non-compensatable modules).

Failure of taught course components equivalent to **10 ECTS or more** may result in **FAILURE OF THE COURSE**.

Assessment and Progression Regulations

The following regulations have been simplified from the general regulations for taught post graduate degrees that may be found in Part III of the College Calendar (Graduate Studies: see www.tcd.ie/calendar/) that apply in all courses of study leading to the award of a Masters degree or Postgraduate Diploma. Where there is any discrepancy in the information provided below and that in the College Calendar, the provisions of the Calendar shall prevail.

1. Graduate students must obtain credit by satisfactory attendance at lectures and tutorials, by carrying out the required course work, and by successful completion of designated assignments. Students may be required to attend a viva voce examination (which can be arranged by Skype) with the External Examiner. The vivas generally take place in early November. The final mark is based on a credit-weighted average of the mark awarded in each module.

2. To qualify for the award of the Masters degree, students must, as a minimum and in addition to 1 above:

- (i) achieve an **overall** pass mark (50%) for the credit-weighted average mark for all taught modules, and:

- (ii) achieve a pass mark in all modules designated non-compensatable (i.e. **Desk Study, Project Planning**), and
- (iii) achieve a pass mark in the **Research Project**, and
- (iv) either (a) pass taught modules amounting to 60 credits, or (b) pass modules amounting to at least 50 credits and achieve a minimum mark of 40% in any failed module(s).

Students failing to pass taught modules according to 2(iv) above may present for supplemental examination or re-submit required work within the duration of the taught component of the course, **if and as provided for in the course regulations**; if satisfactory, resubmitted work will be graded at 50%.

Students who, following the supplemental examination or re-assessment, have failed to pass taught modules according to 2(iv) above will be deemed to have failed overall, and may apply to repeat the programme.

Students who have passed taught modules according to 2(iv) above, but who do not achieve a pass mark in the **Research Project**, will be deemed to have failed overall. Such students may apply to repeat the year or may be awarded the associated Postgraduate Diploma.

3. In order to qualify for the award of Masters with Distinction, students must as a minimum, either:

- (i) achieve a mark of at least 70% for the credit-weighted average mark for all taught modules and a mark of at least 70% in the **Research Project**, or
- (ii) achieve a mark of at least 70% in the **Research Project**, and achieve an unrounded mark of at least 68% in the overall average mark for the taught modules, where modules amounting to at least half of the credits for the taught modules (normally 30 credits) each have a mark of at least 70%. A Distinction cannot be awarded if a candidate has failed any credit during the period of study.

4. Students who have passed taught modules according to 2(iv) above, but who do not choose to complete the dissertation or research element, may be awarded the associated Postgraduate Diploma.

Appeals

The appeals procedure is outlined in Section 1.10 of the *General Academic Regulations for Graduate Studies and Higher Degrees* in Part III of the College Calendar (see <https://www.tcd.ie/calendar/graduate-studies-higher-degrees/fems.pdf>).

Note: Appeals can only be made after the final marks are issued following the last Court of Examiners's meeting.

Plagiarism

Plagiarism is interpreted by the University as the act of presenting the work of others as one's own, without acknowledgement. Plagiarism is considered as academically fraudulent, and an offence against University discipline. The University considers

plagiarism to be a major offence, and subject to the disciplinary procedures of the University.

Plagiarism can arise from deliberate actions, and also through careless thinking and/or methodology. The offence lies not in the attitude or intention of the perpetrator, but in the action and in its consequences.

It is your responsibility to familiarise yourself with the regulations regarding plagiarism. These are clearly outlined in Section 1.32 of the *General Academic Regulations for Graduate Studies and Higher Degrees* in Part III of the College Calendar (see <https://www.tcd.ie/calendar/graduate-studies-higher-degrees/fems.pdf>).

New TCD webpages have been designed to help you to understand what plagiarism is and to employ the principles of academic integrity so as to avoid plagiarising (<http://tcd-ie.libguides.com/plagiarism>). They also set out the regulations in Trinity relating to plagiarism offences and how they are dealt with. The College Calendar defines plagiarism, gives examples of the kinds of actions that are deemed to constitute plagiarism, and elaborates on the procedures for dealing with plagiarism cases. It is essential that you read the Calendar entry that is relevant to you as a postgraduate student. You should also look at the matrix that explains the different levels of plagiarism and how they are dealt with.

The webpages also contain materials and advice on citation styles which are used to reference properly. You should familiarise yourself with the content of these pages. Your course handbook may also contain specific examples of referencing conventions in your discipline.

All students **must** complete the College's **Ready Steady Write** plagiarism tutorial and sign a declaration when submitting course work, whether in hard or soft copy or via Blackboard, confirming that you understand what plagiarism is and have completed the tutorial. If you read the information on plagiarism, complete the tutorial and still have difficulty understanding what plagiarism is and how to avoid it, please seek advice from your the Programme Director, your supervisor, or from Student Learning Development.

In general, ensure that you fully reference all previously published work, and check with the module co-ordinator if you are not clear of the requirements relating to group assessment exercises. Do not copy information from the internet or any other sources – you should interpret and explain the information provided in these sources in a format that is relevant to the piece of work you are writing; in any case you should also very carefully appraise the accuracy and validity of any information you use, particularly that from internet sources. Any work that you submit will be assessed through recognised plagiarism detection software currently in use in College.

For all submitted work (online or hard-copy) a coversheet must be included and should contain the following signed declaration:

I have read the section on plagiarism in the college calendar (<http://www.tcd.ie/calendar/>) (Part II, page 82-91).

I have completed the online tutorial on plagiarism at <http://tcd-ie.libguides.com/plagiarism>

HEALTH, SAFETY AND SECURITY

Health & Safety

Procedures for Health & Safety reporting in College are currently undergoing modification. The following is a description of current practices, but please be aware that it is likely these will be modified during the course of the year. You will be notified of any such change in writing.

All incoming students receive access to the Faculty of Engineering, Mathematics and Science Health and Safety Manual at: <https://ems.tcd.ie/faculty-health-safety.php>

A lab and field Health Declaration Form and other relevant documents are available in the Quick Links section of <https://naturalscience.tcd.ie/healthsafety/>.

This form will be forwarded to all incoming, registered students via email for completion. It must be completed, signed and returned prior to the start of coursework or research. Please read the instructions carefully to ensure you submit the correct portion of the form. Should you have any medical issues, please follow directions given to you by a medical practitioner such as epilepsy, diabetes, fainting fits, haemophilia, immunodeficiency, asthma, severe allergies, balance disorders or other problems that may require special attention from staff. Students will be notified in the event of any changes to this reporting procedure. Likewise if you experience any changes in your health or fitness you must re-submit the Health Declaration Form.

If you have any health or other issues that may impact on your ability to safely participate in field work, please inform either the Programme Director or the Programme Administrator in confidence so that we can ensure that field work for the whole class is safe, secure and enjoyable.

In case of illness, students may attend the Student Health Centre (House 47).

A Student Counselling Service is located just off the main college campus, on the 3rd floor of an office building in South Leinster Street. See http://www.tcd.ie/Student_Counselling/ for more details.

Accidents

Minor accidents should be treated on site using first aid kits, which are available in all labs, food preparation areas and vehicles. **Wall mounted first aid kits will list the first aiders in the department.** People should be escorted to the Student Health Centre for treatment if necessary. An ambulance should be called in the event of a serious accident through the security office (01 896 1999). People should not be taken to hospital in a private car or taxi.

All accidents must be reported to the School Safety Officer (and the Programme Administrator) as soon as possible after they occur.

Fire Safety

Fire extinguishers and copies of the College General Fire Notice are displayed at various locations within College. These are normally located in hallways, laboratories or lecture rooms.

Please note, to use a fire extinguisher you must attend the course. Details are given during the Induction Week safety briefing.

Help to prevent fires from starting or spreading by the following:

- Do not store flammable materials in corridors and other open-access areas.
- Exercise caution when using flammable materials and electrical equipment.
- Do not place smouldering items in bins
- Keep filing cabinets and presses closed when not in use
- Turn off and switch off at the socket (or unplug) electrical equipment that is not in use.

All teaching areas in College are equipped with fire alarms. On hearing the alarm, leave the building quickly and in an orderly manner, and proceed to your assembly point; follow instructions from your teacher or instructor and any safety personnel. If possible before leaving, turn off all equipment, close windows and doors in the immediate work area but do NOT compromise your own safety by doing so.

In the event of fire, inform Front Gate Security Office (1317 or 1999) who will call the fire brigade. All emergency calls must be placed through the Security Office. When the fire brigade arrives, warn firemen of possible missing persons and of potential hazards (dangerous chemicals, gas cylinders and so on).

Bomb Alerts

Watch out for suspicious packages at all times and, if one is observed, alert a staff member immediately. If there is a bomb alert, follow the same procedures as for a fire alert.

Risk Assessment

A risk assessment must be carried out for research activities such as lab work and field work and submitted as part of your Project Planning report. Risk assessment forms are available from the Safety Officer in your discipline; completed risk assessment forms will be provided for all field visits.

Ethics Assessment

An ethics assessment needs to be completed before undertaking any research and also needs to be submitted as part of your Project Planning report. Ethical considerations include sensitivity to subjects and confidentiality of data, and any threats or disturbance that might be imposed by, for example, field work. Remember that field work may well disturb sensitive habitats, species or natural features even though these may not be the direct target of the research. Ethics assessment forms are available from <http://naturalscience.tcd.ie/research/ethics/forms.php>.

Fieldwork

Detailed safety guidelines on fieldwork are available from the School Safety Officer and at <http://www.naturalscience.tcd.ie/healthsafety/> and should be consulted before fieldwork is undertaken. A risk assessment should be completed BEFORE conducting fieldwork. A few of the more important points are listed below and in the Faculty of Science Health and Safety Manual.

Wear suitable clothing and footwear while carrying out fieldwork.

Always leave an account of your movements with a reliable person before going out on fieldwork.

Inform yourself as far as possible on the likely conditions you will encounter while on field work (weather, state of the tide and so on).

A safety helmet must be worn in situations such as on buildings and building sites, factories, quarries etc. In addition, wear safety glasses if there is a risk of injury to the eyes. A safety harness should be worn in exposed situations where there is a risk of falling (e.g. tops of buildings, cliffs, rafts on water).

Boats

- Lone working is not allowed in boats
- Do not attempt to operate a boat unless you are suitably experienced
- A buoyancy aid must be worn when working in small boats
- Inform yourself of dangers associated with the waters you intend to work on by consulting bathymetric maps and local knowledge.

Diving

Diving may only be undertaken by suitably qualified persons. Rules and regulations governing diving are available from the Dublin University Sub Aqua Club (DUSAC).

Laboratory Work

Safe and sensible practices must be followed at all times in the laboratory. Please read the Safety Statement relating to the discipline where you will be undertaking laboratory work. Any instructions given by a lab staff member must be followed. When working in the a laboratory you must:

- Wear a lab coat and safety glasses (Lab coats are available in the Students Union Shops, No. 6 Front Square and Hamilton Building, East End of College)
- Wear appropriate protective gloves when handling dangerous materials (e.g. acids, sodium hydroxide etc)
- Ensure that the fume cupboard is on when necessary but not otherwise (never turn off the fume cupboard whilst fumes are still being generated, e.g. from hot digestions)
- Ensure all samples are properly labelled, to include: owner; date; and any other important information such as toxicity, hazard warning etc. **WARNING:** Samples not properly labelled will be thrown out!
- Leave benches clean and tidy, and return used items (chemicals, spatulas, pipettes etc.) to their proper place
- Dispose of materials safely. Broken glass should be placed in the special bin provided. If in doubt, consult with laboratory staff
- Report breakages or damage to a member of staff.

When working in a laboratory you must not:

- Use any equipment (e.g. centrifuge etc.) you are unfamiliar with. Check operating instructions with laboratory staff

NOTE: operation may differ from similar pieces of equipment you have used in the past. Always check before use!

- Carry out potentially hazardous operations (e.g. AA work, digestions, handling concentrated acids or alkalis) while alone in the lab
- Leave any heating equipment on overnight e.g. ovens, furnace
- Store samples in the lab, consult a staff member about storage
- Consume food or drink
- Work out of hours unless:
 - (a) A member of lab staff has signed a Risk Assessment and granted permission for a specified procedure. Permission will only be granted for procedures that carry a very low risk.

AND

- (b) A second person is present

AND

- (c) You sign in and out of the late working book that is provided.

Security & Access

Valuables should be kept in a secure place. Lockers are provided but the College accepts no responsibility for loss or damage to personal items.

Bicycles are not permitted inside the buildings at any time.

Intruders

Please be vigilant as College premises have been the subject of targeted theft from individuals posing as staff, students, couriers, trades people etc.

Do not tackle any intruders. If you are concerned about a person's presence, inform staff or the security office at Front Gate (1317 or 1999) and if you are alone, leave the building. Take particular care, and keep the main entrance to all buildings locked, outside normal working hours.

Post Graduate Advisory Service



The Postgraduate Advisory Service is a unique and confidential service available to all registered postgraduate students in Trinity College. It offers a comprehensive range of academic, pastoral and professional supports dedicated to enhancing your student experience.

Who?

The Postgraduate Advisory Service is led by the Postgraduate Support Officer who provides frontline support for all Postgraduate students in Trinity. The Postgrad Support Officer will act as your first point of contact and a source of support and guidance regardless of what stage of your Postgrad you are at. In addition each Faculty has three members of Academic staff appointed as Postgraduate Advisors who you can be referred to by the Postgrad Support Officer for extra assistance if needed.

Contact details of the Postgrad Support Officer and the Advisory Panel are available on our website: <http://www.tcd.ie/seniortutor/students/postgraduate/>.

Where?

The PAS is located on the second floor of House 27. We're open from 8.30 – 4.30, Monday to Friday. Appointments are available from 9am to 4pm.

Phone: 8961417

Email: pgsupp@tcd.ie

What?

The PAS exists to ensure that all Postgrad students have a contact point who they can turn to for support and information in college services and academic issues arising. Representation assistance to Postgrad students is offered in the area of discipline and/ or academic appeals arising out of examinations or thesis submissions, supervisory issues, general information on Postgrad student life and many others. If in doubt, get in touch! All queries will be treated with confidentiality. For more information on what we offer see our website.

If you have any queries regarding your experiences as a Postgraduate Student in Trinity don't hesitate to get in touch with us.

CONTACT DETAILS

Please ensure that you keep Frances in the School Office (Museum Building) informed of your contact details (address and phone) during and after the course.

Queries relating to a specific module should be addressed in the first instance to the module co-ordinator.

General queries relating to the programme in general should be addressed to the Programme Director.

Computing issues should be directed to the IS Services helpdesk (helpdesk@tcd.ie).

USEFUL NUMBERS

Programme Director (Prof Steve Waldren)	4972070 or Extn. 2075
MSc Administrator (Ms Frances Leogue)	Extn. 2990
Emergency Number	Extn. 1999
Front Gate Security	Extn. 1713
Graduate Studies	Extn. 1166
IS Services Helpdesk	Extn. 2000
School Office	Extn. 2920
Student Health Centre (House 47)	Extn. 1556

Provisional Schedule of Modules

College week	From	To	Biodiversity & Conservation
1	27-Aug-18	31-Aug-18	
2	03-Sep-18	07-Sep-18	BD7050 Induction week - SW
3	10-Sep-18	14-Sep-18	BD7050 Introduction to Biodiversity - SW
4	17-Sep-18	21-Sep-18	
5	24-Sep-18	28-Sep-18	BD7054 Data Analysis 1 - AJ
6	01-Oct-18	05-Oct-18	BD7055 Systematics & Taxonomy - JP
7	08-Oct-18	12-Oct-18	
8	15-Oct-18	19-Oct-18	
9	22-Oct-18	26-Oct-18	BD7052 Introduction to Conservation Biology - SW
10	29-Oct-18	02-Nov-18	
11	05-Nov-18	09-Nov-18	
12	12-Nov-18	16-Nov-18	BD7059 Global Environmental Change - GMcG
13	19-Nov-18	23-Nov-18	
14	26-Nov-18	30-Nov-18	
15	03-Dec-18	07-Dec-18	BD7053 Desk Study - JW
16	10-Dec-18	14-Dec-18	
17	17-Dec-18	21-Dec-18	Christmas Period
18	24-Dec-18	28-Dec-18	BD7053 Desk Study - JW
19	31-Dec-18	04-Jan-19	
20	07-Jan-19	11-Jan-19	
21	14-Jan-19	18-Jan-19	
22	21-Jan-19	25-Jan-19	BD7054 Data Analysis 2 - AJ
23	28-Jan-19	01-Feb-19	BD7056 Human/Biodiversity Interactions - JS
24	04-Feb-19	08-Feb-19	
25	11-Feb-19	15-Feb-19	
26	18-Feb-19	22-Feb-19	BD7051 Environmental Policy - JW
27	25-Feb-19	01-Mar-19	
28	04-Mar-19	08-Mar-19	
29	11-Mar-19	15-Mar-19	BD7060 Practical Conservation Skills - SW/JW
30	18-Mar-19	22-Mar-19	
31	25-Mar-19	29-Mar-19	
32	01-Apr-19	05-Apr-19	BD7058 Overseas Field Course - SW
33	08-Apr-19	12-Apr-19	
34	15-Apr-19	19-Apr-19	
35	22-Apr-19	26-Apr-19	BD7057 Project Planning - JW
36	29-Apr-19	03-May-19	BD7054 Data Analysis 3 - AJ
37	06-May-19	10-May-19	BD7057 Project Planning - JW
38	13-May-19	17-May-19	

Highlighted modules are joint with the MSc in Environmental Science

Please note that this schedule is provisional and may be subject to change