MSc in Ecological Applications

Programme Guidebook
2018 – 2019
Contents

1 Course Overview
   1.1 Course Administration
   1.2 Course Aims
   1.3 Learning Outcomes
   1.4 Transferable Skills
   1.5 Course Activities and Assessment
   1.6 External Examiner Names and Contacts
   1.7 Background Reading

2 Course details, timetables, and week descriptions
   2.1 Teaching Staff
   2.2 Outline timetable and important dates
   2.3 Taught theme descriptions
Along with this handbook, you will receive a copy of the Student Guidebook for the Silwood Park Campus, containing the following important information for all living and working at Silwood.

**Introduction to the department and facilities**
For information about key contracts, weekly seminars, key dates, the FrEEC Symposium and information on the library, IT, and health and safety.

**Academic regulations**
The regulations for the EA course are provided in this handbook, but the Student Guidebook provides information about the general regulations. This includes academic integrity, plagiarism, employment during your studies and complaint and appeals procedures.

**Thesis writing and submission guidelines**
All information about project organization, thesis writing and submission, final presentations, and vivas are in the Silwood Guidebook.

**Welfare and Advice**
Imperial has a wide support network for students. The Student Guidebook provides details of the available support and key contacts and links.

**Student Feedback and Representation**
We are very grateful for feedback on the course and will ask you for it at regular intervals! However, there are a range of options for providing feedback and getting support on your academic studies and the Student Guidebook provides details.

Electronic copies of both of these guidebooks are available on the course Blackboard website.
1 Course Overview

Welcome to Silwood Park and the Masters programme in Ecological Applications.

The MSc course in Ecological Applications was a new addition to our Masters suite in 2013, drawing on ecological expertise from researchers across the college and our partner organisations.

The impetus behind the course is to produce independent researchers with the skills and knowledge most relevant to the application of ecological theory to real world problems. The course has been designed in collaboration with a variety of NGO, charity, and industry partner organisations who are major employers of ecology graduates to ensure that you have the cutting edge skills most desired for PhDs and job opportunities.

The course puts a strong emphasis on developing the practical, analytical and management skills required by public and private sector ecologists in a core framework of ecological theory. The taught course has a strong practical or project work content that is delivered in concert with external organisations to give direct experience of a variety of applied ecology careers paths. This is then followed by a long research project with one an internal Imperial academic, or an external partner supported by an internal supervisor with complementary expertise.

1.1 Course administration

<table>
<thead>
<tr>
<th>Masters Course Director</th>
<th>Professor Tim Barraclough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postgraduate Administrator</td>
<td>Mrs. Amanda Ellis</td>
</tr>
<tr>
<td>Postgraduate tutor</td>
<td>Dr. Julia Schroeder</td>
</tr>
</tbody>
</table>

Blackboard e-learning website https://bb.imperial.ac.uk

The course runs for one year from the 1st October 2018 through to 20th September 2019. The taught components of the course (lectures and practicals/workshops) typically start at 1000 and finish by 1700 but this varies from week to week – details for each week are provided in your electronic timetables. Please check Blackboard and your College e-mail regularly for the most up-to-date information. Wednesday morning is either used for taught material or reserved for private study and Wednesday afternoon is normally reserved for sports, leisure activities or private study.

In addition to the formal taught and research components of the programme, there is a research seminar series run at Silwood Park. Department seminars (which run between 1-2pm on Thursdays) are presented by a mix of internal and external researchers. These seminars are excellent way to hear about cutting edge research, meet leading scientists from all over the world, and to engage actively with the scientific process. We expect all Masters students to attend these seminars. You can find more information about seminars and journal clubs at Silwood in the Silwood Student Guidebook.

Teaching materials and other course materials are provided using the online Blackboard virtual learning environment (see link above). Paper copies of lecture notes and handouts are not normally provided but you will receive printing credit for use during the course on your security card.

It is anticipated that reading and coursework will require additional study in your own time. During research projects, you are expected to work full time on the project, including Wednesday afternoons. Some projects may require out-of-hours work, for example maintaining greenhouse experiments.

The full programme specifications for the MSc are available on Blackboard and from the course websites below, but the following sections provide a summary of the programme and assessment structure.

MSc website
http://www3.imperial.ac.uk/lifesciences/postgraduate/courselist/ecologicalapplications
The course *objectives* are that, on completion of the course, graduates will have:

- An understanding of basic and applied aspects of theoretical ecology as it applies to ecosystem health and function, conservation planning and monitoring, ecological policy and legislation, management of manmade and natural ecosystems.

- An ability to choose an appropriate ecological model to answer a particular question for ecological management or conservation.

- An ability to design, implement and evaluate field protocols.

- An ability to communicate effectively with a wide range of stakeholders, and appreciate their value and needs.

- An appreciation of the value of taxonomic skills, and a working knowledge of their application.

- An ability to generate, analyse and interpret typical ecological and conservation databases.

- A broad appreciation of the scientific opportunities within the Division of Biology, Imperial as a whole, collaborating research, industry and conservation institutions and globally in the area of applied ecology.

- A range of transferable skills including: communication skills (oral and written); project management, team project coordination; computing, statistics and mathematical modelling; specific research skills.
1.2 Course aims

The aims of the EA Masters programme are:

- To develop understanding of the fundamental principles underlying research in theoretical and applied ecology.
- To provide broad training in practical and analytical research skills relating to applied ecology.
- To show how these principles and skills can be applied to solve real problems facing the biosphere.
- To prepare students for a career in conservation or applied ecology.
- To prepare for PhD studies and make an informed choice of research topic.

1.3 Learning Outcomes

1. Knowledge and Understanding

- Ecological principles of population and environmental management and control;
- Social and economic dimensions of policy and management and their evaluation;
- Research techniques, including information retrieval, experimental design and statistics, modelling, sampling, taxonomic keys, bioassays, environmental microbiology, molecular biology, laboratory and field safety;
- Detailed knowledge and understanding of the essential facts, concepts, principles and theories relevant to the student’s chosen area of specialisation;
- Management and communication skills, including problem definition, project design, decision processes, teamwork, written and oral reports, scientific publications.

2. Skills and other Attributes

Intellectual Skills

- Analyse and solve ecological-based problems using an integrated multidisciplinary approach, applying professional judgements to balance costs, benefits, safety and social and environmental impact;
- Integrate and evaluate information;
- Formulate and test hypotheses using appropriate experimental design and statistical analysis of data;
- Plan, conduct and write-up a programme of original research.

Practical Skills

- Plan and execute safely a series of experiments;
- Use laboratory and field-based methods to generate data;
- Analyse experimental results and determine their strength and validity;
- Prepare technical reports;
- Give technical presentations;
- Use the scientific literature effectively;
- Use computational tools and packages.
1.4 Transferable Skills

Students will be able to:

- Communicate effectively through oral presentations, computer processing and presentations, written reports and scientific publications;
- Apply statistical and modelling skills;
- Management skills: decision processes, objective criteria, problem definition, project design and evaluation, risk management, teamwork and coordination;
- Integrate and evaluate information from a variety of sources;
- Transfer techniques and solutions from one discipline to another;
- Use Information and Communications Technology;
- Manage resources and time;
- Learn independently with open-mindedness and critical enquiry;
- Learn effectively for the purpose of continuing professional development.

All students must attend the taught weeks (detailed below) in both the Autumn and Spring Term. Students must also attend Thursday afternoon seminars appropriate to the course. Students are of course welcome and encouraged to attend any additional seminars as they wish. MSc students must also complete a 5-month research project running during the summer from April until end of August.

1.5 Course activities and assessment

Assessment of this work will be based on two written examinations (30% of marks), the four pieces of assessed coursework (20%) and the research project report, presentation and viva (50%). Students should not skip lectures or practicals to complete coursework. Example exam papers and assessment schemes for exams, coursework and research project will be provided on Blackboard.

An online list of research project titles is provided at: https://mhasoba.pythonanywhere.com/marking_reports/default/project_proposals

The projects list will provide broad details of research projects but the precise topics of projects will be finalised in discussion between the student and potential supervisors. Project descriptions will appear throughout the year but you are also encouraged to discuss your own research ideas with staff to develop your own proposal. Project titles and supervisors should be confirmed to the course directors by 26/01/19.

The assessed components and their percentage contribution to your overall mark are described below, along with the key dates and deadlines for this year.

Examinations (30% of overall mark)

The examinations are timetabled to follow immediately after the Christmas vacation and two reading weeks dedicated to revision in Term 2.

**January essay exam (15%) Tuesday 8th January 2019 10am-1pm**

This assessment will examine work done during the Autumn term and seminars from the Autumn term. You will have to choose two essay questions out of a choice of six. This is a closed book exam.

**Spring exam (15%) Tuesday 26th March 2019 10am-1pm**

This exam will be a single compulsory structured question which will ask you to apply the knowledge and skills gained throughout the whole of the taught course to a problem based on one of the spring term weeks. The question will consist of three main elements: 1) ecological theory relevant to the question, 2) data interpretation, 3) application to a “real world” problem. NB, this is an open book exam, i.e., you may bring in your course notes for use during the exam.
Coursework (20% of overall mark)

Ecological Impact Assessment (5%) Due 3rd December 2018 10am
Within this fortnight, run by Ecological consultancy Thompson Ecology, the students will put together an ecological impact assessment of a model site. Individuals will be primarily assessed on their individual contribution to the assessment, although this assessment will also take into account group work and team skills. Time will be allocated in week 2 for writing the report.

Applied Ecology presentations (5%). Due 31st January 2019 2pm
You will give an oral presentation that applies your recently gained theoretical knowledge to an ecological problem of your choice.

Microbiology/Biocontrol POSTnote (5%) Due 13th March 2019 10am
This piece of written course work will follow the format of government POSTnote on an applied ecology, conservation ecology, or microbiology. [http://www.parliament.uk/mps-lords-and-offices/offices/bicameral/post/publications/postnotes/]

Taxonomy Diary (5%) Due 9th May 2019 10am
Throughout the whole course you should develop a taxonomic ‘diary’. This can be based on recording and identifying specimens that you have personally seen along with notes on identification and ecological significance or be based on desktop research on a group you are interested in. You can choose to specialize in a taxonomic group or to be taxonomically broad. The method of presentation of the data collected is at your discretion, but should be electronic, visually appealing and easily navigated (eg, Prezi, website, or linked electronic notebook). Note that this piece of work is equally weighted to the other pieces of coursework and so the time you input should be similar.

Written pieces of coursework will be submitted electronically via Blackboard

Research project (50% of overall mark)
The research project must be completed and written up in the style and formatting of a scientific research paper. Full details of academic regulations and project assessment are given in section 3.7 (Programme Regulations). In brief, project assessment and will be based on your supervisor’s assessment of the project (10% of the project mark), a mark on the written project agreed by two independent markers (60% of the project mark), a mark for your final research presentation (10%) as well as your performance in a viva voce examination (20%). A second viva with an external examiner may also be held for each student, which will be mandatory but not assessed.

The criteria for obtaining Pass, Merit and Distinction overall are outlined in the Master’s regulations.

1.6 External vivas and examiners

All students will undertake a final 30 minute viva with an External Examiner, to be held between the internal summer project viva and the final meeting of the Board of Examiners. The dates are shown in the Silwood Guidebook and these vivas form a part of both the exam moderation process and oversight of the course by the External Examiner, currently Dr Lindsay Turnbull (Univ Oxford).

It is common for Master’s level students to have some form of academic or social interaction with their external examiners at some point during or after their studies as well as during the assessment process itself.

It is inappropriate for you to submit complaints or representations direct to external examiners or to seek to influence your external examiners. Inappropriate communication towards an examiner would make you liable for disciplinary action.

External examiners reports can be found here:
www.imperial.ac.uk/staff/tools-and-reference/quality-assurance-enhancement/external-examining/information-for-staff
2 Course details and timetables

2.1 Teaching Staff

You will be taught by Imperial staff members and external partners from a very diverse set of research backgrounds. Here are the details of the staff who will be convening each week with lectures coming from others.

<table>
<thead>
<tr>
<th>IMPERIAL COLLEGE STAFF</th>
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<tbody>
<tr>
<td><strong>Tim Barraclough</strong></td>
<td>Evolution of species diversity, speciation, evolution in multi-species systems,</td>
<td><a href="mailto:t.barraclough@imperial.ac.uk">t.barraclough@imperial.ac.uk</a></td>
</tr>
<tr>
<td><strong>Catalina Estrada</strong></td>
<td>Field experiments, field ecology, chemical ecology, insect ecology</td>
<td><a href="mailto:c.estrada@imperial.ac.uk">c.estrada@imperial.ac.uk</a></td>
</tr>
<tr>
<td><strong>Samraat Pawar</strong></td>
<td>Systems biology and theoretical ecology</td>
<td><a href="mailto:s.pawar@imperial.ac.uk">s.pawar@imperial.ac.uk</a></td>
</tr>
<tr>
<td><strong>Julia Schroeder</strong></td>
<td>Social behaviour and genetic variation</td>
<td><a href="mailto:julia.schroeder@imperial.ac.uk">julia.schroeder@imperial.ac.uk</a></td>
</tr>
<tr>
<td><strong>Robert Ewers</strong></td>
<td>Tropical forest ecology</td>
<td><a href="mailto:r.ewers@imperial.ac.uk">r.ewers@imperial.ac.uk</a></td>
</tr>
<tr>
<td><strong>Guy Woodward</strong></td>
<td>The impacts of stressors on the structure and function of aquatic ecosystems</td>
<td><a href="mailto:guy.woodward@imperial.ac.uk">guy.woodward@imperial.ac.uk</a></td>
</tr>
<tr>
<td><strong>Tom Bell</strong></td>
<td>Community ecology and microbial ecology</td>
<td><a href="mailto:thomas.bell@imperial.ac.uk">thomas.bell@imperial.ac.uk</a></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>EXTERNAL PARTNERS</th>
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<tbody>
<tr>
<td><strong>Richard Arnold</strong></td>
<td>Technical Director at Thomson Ecology <a href="http://www.thomsonecology.com">www.thomsonecology.com</a></td>
<td></td>
</tr>
<tr>
<td><strong>Emily Bartlett</strong></td>
<td>Assistant Ecologist at Thomson Ecology <a href="http://www.thomsonecology.com">www.thomsonecology.com</a></td>
<td></td>
</tr>
<tr>
<td><strong>Stephen Fry</strong></td>
<td>Stephen is a freelance Countryside and Heathland Consultant and formerly Senior Warden at Surrey Wildlife Trust</td>
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</tr>
<tr>
<td><strong>Dr Sean T Murphy</strong></td>
<td>Sean is the Regional Director of CABI at Egham and has over 20 years of experience in developing and implementing projects in biocontrol and integrated pest management.</td>
<td></td>
</tr>
<tr>
<td><strong>Bryony Taylor</strong></td>
<td>Bryony is one of our MSc graduates, and now works for CABI <a href="http://www.cabi.org">www.cabi.org</a> using Integrated Pest Management for natural control of pest species on a variety of international projects.</td>
<td></td>
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<tr>
<td><strong>Dr Richard Shaw</strong></td>
<td>Richard completed his PhD at Silwood on plant ecology and now works for CABI on the biological control of weeds and invasive plants.</td>
<td></td>
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</table>
## 2.2 Outline Timetable and Important Dates

We strive to adhere to the schedule printed below, but sometime due to unforeseen circumstances we may have to make small changes to the timetable within a week. It is safe to assume that coursework will occur between the hours of 0900 and 1700 with the exception on Wednesday afternoons which are free. Please be sure to confirm all dates/locations/times with iCalendar (AKA iCal)

[http://www.imperial.ac.uk/timetabling/view/icalendar](http://www.imperial.ac.uk/timetabling/view/icalendar)

<table>
<thead>
<tr>
<th>#</th>
<th>Week Starting</th>
<th>EA Week Title</th>
<th>Convenor</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1 Oct</td>
<td>Induction</td>
<td>Amanda Ellis</td>
</tr>
<tr>
<td>2</td>
<td>8 Oct</td>
<td>Field Ecology Skills</td>
<td>Catalina Estrada</td>
</tr>
<tr>
<td>3</td>
<td>15 Oct</td>
<td>Biological Computing in R</td>
<td>Josh Hodge</td>
</tr>
<tr>
<td>4</td>
<td>22 Oct</td>
<td>Statistics in R</td>
<td>Julia Schroeder</td>
</tr>
<tr>
<td>5</td>
<td>29 Oct</td>
<td>GIS</td>
<td>Rob Ewers</td>
</tr>
<tr>
<td>6</td>
<td>5 Nov</td>
<td>Social context and policy</td>
<td>Colin Prentice</td>
</tr>
<tr>
<td>7</td>
<td>12 Nov</td>
<td>Conservation Decision-making</td>
<td>Morena Mills</td>
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<tr>
<td>8</td>
<td>19 Nov</td>
<td>Ecological Impact Assessment</td>
<td>Thomson Ecology</td>
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<tr>
<td>9</td>
<td>26 Nov</td>
<td>Ecological Impact Assessment</td>
<td>Thomson Ecology</td>
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<tr>
<td></td>
<td>3rd Dec 10am</td>
<td>* Ecological Impact Assessment Due</td>
<td>Tim Barraclough</td>
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<tr>
<td>10</td>
<td>3 Dec</td>
<td>Biological Control and IPM</td>
<td>Tim Barraclough</td>
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<tr>
<td>11</td>
<td>8 Jan</td>
<td>Winter Exam</td>
<td></td>
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<tr>
<td>12</td>
<td>14 Jan</td>
<td>Generalised linear models</td>
<td>Julia Schroeder</td>
</tr>
<tr>
<td>13</td>
<td>21 Jan</td>
<td>Environmental microbiology I</td>
<td>Tom Bell</td>
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<tr>
<td>14</td>
<td>28 Jan</td>
<td>Environmental microbiology II</td>
<td>Tom Bell</td>
</tr>
<tr>
<td>15</td>
<td>31st Jan</td>
<td><em>Applied Ecology presentation due</em></td>
<td>Tim Barraclough</td>
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<tr>
<td>16</td>
<td>4 Feb</td>
<td>Surrey Wildlife Trust Group Project</td>
<td>Surrey Wildlife Trust</td>
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<tr>
<td>17</td>
<td>4 Mar</td>
<td>Agroecology</td>
<td>Tim Barraclough</td>
</tr>
<tr>
<td>18</td>
<td>11 Mar</td>
<td>Reading Week</td>
<td></td>
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<tr>
<td>19</td>
<td>13 Mar</td>
<td><strong>Microbiology/Biocontrol PostNote Due</strong></td>
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<tr>
<td>20</td>
<td>18 Mar</td>
<td>Reading Week</td>
<td></td>
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<tr>
<td>21</td>
<td>26 Mar</td>
<td>Spring Exam</td>
<td></td>
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<tr>
<td>22</td>
<td>1 April</td>
<td>Research Project Starts (to continue after Easter Break)</td>
<td></td>
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<tr>
<td>23</td>
<td>9 May</td>
<td><em>Taxonomy Diary Due</em></td>
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<tr>
<td>24</td>
<td>29 Aug</td>
<td>Project Hand in (electronic)</td>
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<tr>
<td>25</td>
<td>3 Sept</td>
<td>Project Hand in (hard copy)</td>
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<tr>
<td>26</td>
<td>10-12 Sept</td>
<td>FrEEC Symposium (final presentations)</td>
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<tr>
<td>27</td>
<td>16-20 Sept</td>
<td>Project Vivas (internal and external)</td>
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</tbody>
</table>
2.3 Taught theme descriptions
Course Induction
Monday 1st October—Friday 5th October
Convenor: Amanda Ellis (amanda.ellis@imperial.ac.uk)
The induction and welcome programme for the EA Masters course runs in the first week of term, alongside the first week of the core taught course.

Timetable:

<table>
<thead>
<tr>
<th>Monday 1st October</th>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>0900-1000</td>
<td></td>
<td>Welcome to Silwood Park (Fisher/Haldane)</td>
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<td>1000-1100</td>
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<td>Course-specific Welcome (Fisher/Haldane)</td>
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<tr>
<td>1100-1300</td>
<td></td>
<td>Silwood Treasure Hunt (Silwood Field)</td>
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<tr>
<td>1300-1400</td>
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<td>Buffet Lunch (Hamilton Foyer)</td>
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<tr>
<td>1400-1600</td>
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<td>The Big Picture: Group Discussion (Hamilton Foyer)</td>
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<tr>
<td>Tuesday 2nd October</td>
<td></td>
<td></td>
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<tr>
<td>1000-1100</td>
<td></td>
<td>Introduction to Ecology (Fisher)</td>
</tr>
<tr>
<td>1130-1230</td>
<td></td>
<td>Human Ecology (Fisher)</td>
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<tr>
<td>1330-1630</td>
<td></td>
<td>Ecological and Evolutionary papers (Fisher)</td>
</tr>
<tr>
<td>1700-1900</td>
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<td>Welcome Reception (CPB Seminar Room)</td>
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<tr>
<td>Wednesday 3rd October</td>
<td></td>
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<tr>
<td>1000-1100</td>
<td></td>
<td>Evolution in Action (Fisher)</td>
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<tr>
<td>1130-1230</td>
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<td>Evolution in communities (Fisher)</td>
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<tr>
<td>1530-1700</td>
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<td>Introduction to the Library (Hamilton Computer Room)</td>
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<td>Thursday 4th October</td>
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<tr>
<td>09:30 – 15:30</td>
<td></td>
<td>Fisher/Haldane/CPB Professional Skills Development Programme</td>
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<tr>
<td>15:45 – 17:15</td>
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<td>Fisher/Haldane Silwood Lab Talks</td>
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<tr>
<td>17:30 – 18:30</td>
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<td>First Floor, CPB Networking Plenary and Refreshments</td>
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<td>Friday 5th October</td>
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<tr>
<td>10:00 – 11:00</td>
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<td>Fisher/Haldane Lecture Room Provost's Welcome for PGT and PGR</td>
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<tr>
<td>11:00 – 12:00</td>
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<td>Fisher/Haldane Lecture Room Graduate School Induction Talks</td>
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<tr>
<td>14:00 – 15:00</td>
<td></td>
<td>Fisher/Haldane Lecture Room Safety Induction</td>
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<tr>
<td>15:00 – 15:30</td>
<td></td>
<td>Fisher/Haldane Lecture Room Research Ethics</td>
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</tbody>
</table>

Field Course at Silwood
Monday 8th October—Friday 12th October
Convenor: Catalina Estrada (c.estrada@imperial.ac.uk)
The aims of this module is that you get experience planning and implementing field research, become familiar with a wide range of basic field research methods in Ecology and learn about data management. The course will take place at Silwood Park fields. The campus, with about 100 ha of land, is recognized as an important refuge for wildlife and has several types of natural habitats including grassland, wetland and woodlands. It is also an active place of field research, hosting multiple long-term experiments and study sites for global studies. Please wear the suitable clothes and footwear for outdoor activities and according with the weather forecast. Long trousers, waterproof boots, waterproof jacket, hat, sun cream and water are recommended.

We aim to:
* Learn to plan field research to describe and compare natural communities
* Learn general field sampling techniques for statics and mobile organisms
* Learn basic taxonomic sorting and identification of common organisms in Silwood Park grounds
* Learn to estimate ecosystem productivity
* Get familiar with Silwood Park fields and experiments

Reading:
* http://www.imperial.ac.uk/visit/campuses/silwood-park/research/silwood-lte/- Check this link at Imperial College website to know more about Silwood Park long-term field studies
Biological Computing in R
Monday 15th October — Friday 19th October
Convenor: Josh Hodge (j.hodge@imperial.ac.uk)

In this week, you will learn how to use this freely available statistical software with strong programming capabilities. R has become tremendously popular in Biology due to several factors: (i) many packages are available to perform all sorts of statistical and mathematical analysis, (ii) it can produce beautiful graphics, and (iii) it has a very good support for matrix-algebra (you might not know it, but you use it!). So with R, you have an expanded and versatile suite of biological computing tools at your fingertips, especially for automating statistical analysis and the generation of figures. Therefore, R should become an indispensable component of your biological research workflow.

In this week we will:

* Learn how to use R for data exploration
* Learn how to use R for data visualization and producing elegant, intuitive, and publication quality graphics.
* Learn R data types \\& structures and control flows.
* Learn how to write and debug efficient R scripts and functions.
* Learn how to use R packages.

Reading:

- Ben Bolker’s ‘Ecological Models and Data in R’ is also very good.
- For more focus on dynamical models: Soetaert & Herman. 2009 ‘A practical guide to ecological modelling: using R as a simulation platform’.
- There are excellent websites. Besides CRAN (containing all sorts of guides and manuals), you should check out www.statmethods.net and en.wikibooks.org/wiki/R_Programming and google ‘R Graph Gallery’ for various sites showing graphing options and code.

Statistics in R
Monday 22nd October — Friday 26th October
Convenor: Julia Schroeder (julia.schroeder@imperial.ac.uk)

In this week we will build upon the introduction to R you received in “Biological computing in R” week (or the Q/CME Bootcamp: Biological Computing in R week) and learn a core set of statistical methods that are of wide use in research projects. These statistical tests will form the basis for any data analysis you will do in the future. This week is shared with most courses and runs in two blocks A and B.

Aims:

Basic statistics for ecology and evolution, with a focus on applicability. Mostly parametric tests (descriptive statistics, t-test, ANOVA, correlations, linear models, hypothesis testing).

Reading:

There are a wide range of introductory books for R. See later statistics and computing weeks for more specialist texts but, for this week, the following are good introductory and reference texts that are available in Silwood library and as an e-book through Imperial:

Main reference:

A gentler introduction:


Spatial Analyses and Geographic Information Systems (GIS)
Monday 29th October—Friday 2nd November
Convenor: Robert Ewers (r.ewers@imperial.ac.uk)
This week will teach key skills in using and handling GIS data, along with basic remote sensing to generate GIS data and the use of GIS data in a range of applications. We will use the open source GIS program QGIS (http://www.qgis.org/). We will look at creating and georeferencing both vector and raster data and how to use GIS tools to create a workflow to carry out simple analyses.

At the end of this week you should have:
1. Familiarity with a range of GIS data types
2. Confidence in obtaining and handling GIS data
3. Familiarity with open source tools for GIS
4. Practical experience in applying GIS to ecological questions

Reading:

Social context and policy
Monday 5th November—Friday 9th November
Convenor: Colin Prentice (c.prentice@imperial.ac.uk)
This week is designed to encourage students to adopt a broad perspective on the implications of environmental science, especially global change science, for society; and to understand how scientific information feeds in (along with other aspects) to policy making at national and international levels. It includes a discussion element – students will work in groups to present an interpretation of a specific area of controversy, and brief presentations will be followed by collective discussion.

At the end of this week, you should have gained:
An appreciation of the importance, and also the limits, of scientific information for policy making.
An overview of major contemporary issues in climate policy, and climate-change impacts on biodiversity and human health.
Understanding of how land-use influences ecosystems, biodiversity and the carbon cycle.
Knowledge of the history and current status of climate-change mitigation efforts, including the role of the Intergovernmental Panel on Climate Change.

Reading:
The following book is a must-read: insightful and provocative, in the best sense.

Effective conservation programmes require individual people, teams and organisations to make a myriad of decisions, the outcomes of which collectively influence the success of these initiatives. Ensuring that these decisions are defensible is essential because achieving conservation outcomes invariably requires trading-off different and sometimes competing values, costs and benefits of various stakeholder groups. Techniques exist for promoting effective decision-making, and these are increasingly employed by conservation organisations.

By the end of the module a student should be able to:

- Identify a range of decision-making contexts where deployment of strategic decision-making techniques can prove useful
- Understand why and how evidence-based decision-making can be applied
- Discuss the utility of systematic conservation planning as an example of effective decision-making

**Reading:**


**Environmental Impact Assessment**

**Monday 19th November — Friday 30th November**

Convenor: Thomson Ecology and Tim Barraclough ([t.barraclough@imperial.ac.uk](mailto:t.barraclough@imperial.ac.uk))

A Preliminary Ecological Appraisal (PEA) of a proposed development site is the first step an Ecologist takes towards completing an Ecological Impact Assessment. This two week course will give an overview of how to undertake a PEA, i.e. a desk study and an extended Phase 1 habitat survey, and how to produce the associated report in a professional style. Some botany will be covered, as well a description of the habitat classification systems, survey methods and how to write up a report; making it an ideal introduction to impact assessment. The course will involve a practical session at Riverside Park in Guildford, following which you will be given an industry realistic timescale to prepare and submit your reports for final assessment. Experience life as an ecological consultant!

**Reading:**

- CIEEM EcIA guidelines: [http://www.cieem.net/ecia-guidelines-terrestrial](http://www.cieem.net/ecia-guidelines-terrestrial)

**Biological Control and Integrated Pest Management**

**Monday 3rd December — Friday 7th December**

Convenor: Tim Barraclough ([t.barraclough@imperial.ac.uk](mailto:t.barraclough@imperial.ac.uk))

One of the most economically important applications of ecological knowledge is in the management of pests and invasive species. This is particularly true of management solutions that do not use synthetic pesticides. In this week you will be introduced to the theory of biocontrol and integrated pest management. We will hear from experts actively working in this exciting field.
By the end of this week students should: Be able to discuss the theoretical underpinnings of Biocontrol and IPM. Describe what makes a good candidate for a Biocontrol agent. Discuss how biocontrol can be integrated with more conventional control methods. Be familiar with current applications this theory.

**Reading:**


**Generalised linear models**

**Monday 14th January — Friday 18th January**

**Convenor:** Julia Schroeder ([julia.schroeder@imperial.ac.uk](mailto:julia.schroeder@imperial.ac.uk))

This week builds on the basic linear models introduced in the previous term to introduce some key concepts that allow linear models to be applied to a wider range of research problems. This will include using generalised linear models to handle count and binomial data - where residuals are not expected to follow a normal distribution - and the use of structured models to allow for non-independence in data and to control for known sources of variation in data.

**Reading:**


**Environmental microbiology I and II**

**Monday 22nd January — Friday 1st February**

**Convenor:** Tom Bell ([thomas.bell@imperial.ac.uk](mailto:thomas.bell@imperial.ac.uk))

Bacteria comprise the most abundant and diverse organisms on the planet. Bacteria also provide vital services, such as remediation of pollutants, and also underpin all ecosystems as important primary producers and decomposers. The two weeks will be focused on methods for surveying bacterial communities, as well as isolation and characterisation of target species.

**Reading:**


**Surrey Wildlife Trust Group Project**

**Monday 4th February — Friday 1st March**

**Convenor:** Surrey Wildlife Trust with Tim Barraclough ([t.barraclough@imperial.ac.uk](mailto:t.barraclough@imperial.ac.uk))

In this set of weeks you will work on a group field project to collect data relevant to informing conservation issues at Chobham Common National Nature Reserve. This course will be run in conjunction with Surrey Wildlife Trust who manage this Reserve. Surrey Wildlife will help direct research projects and provide support on site. Students will present results of their findings at the end of the course.

**Timetable:**
You will work together on a group project with a combination of fieldwork, data collection, analysis and report-writing. Expect to work 1000 to 1700 on Monday, Tuesday, Thursday Friday, and 1000 to 1300 on Wednesday. The project will culminate with a presentation to the Chobham Common team on Friday 1st March. More details will be announced in January.

Agroecology  
Monday 4th March—Friday 8th March  
Convenor: Tim Barraclough (t.barraclough@imperial.ac.uk)  
The first part of the week will join with EEC to look at bee behaviour in relation to current ecosystem challenges. The latter part of the week will include a look at new technology for monitoring plant performance and stress within fields, and a visit to Syngenta to find out about their environmental monitoring work.

*For the practicals on Tuesday/Wednesday: we will proceed come rain or shine so please be prepared with appropriate outdoor gear (umbrellas and raincoats!).

Reading List