Curriculum for APLORI Master of Science Course

Timetable

Semester 1: September–December
Semester 2: January–March
Semester 3: April–October

Course outline

Each of the first two semesters of approximately eleven weeks has two mainly theoretical lecture modules and two mainly practical modules. On average there are two lectures per module per week in late morning. Each student has a reading list associated with each lecture, which must be read by the end of the week. Each student will then summarise and lead a discussion on one of papers in the reading list. Each week there will be field practicals in the early morning and lab practicals in the afternoon. There will be one essay of 1500 words every second week, relating to the lectures and/or practicals of the period. The third semester of twelve weeks consists of two independent study projects and a presentation of one of them, that will comprise a major part of the examination process for the Master's degree.

Semester 1:

1. Evolution (Lecture course LC)
2. Ecological principles (LC)
3. Field Techniques (Practical course PC)
4. Computing skills (PC)

Semester 2:

5. Conservation biology (LC)
6. Experimental design and hypothesis testing (LC)
7. Statistics (PC)
8. Writing and presentation skills (PC)

Semester 3:

9. Research project (PC)
10. Research dissertation (PC)
11. Research presentation (PC)

Course modules

1.Lecture course: Evolution

1. The theory of evolution
    a. History
    b. Natural selection
    c. Sexual selection
    d. Speciation
2. Genetics
    a. DNA and genes
    b. Measuring genetic variation
    c. Distribution and spread of alleles in populations
3. Taxonomy
    a. Principles and cladistics
    b. Molecular phylogenies
    c. Comparative method
4. Life on earth
    a. History of life on earth
    b. Review of major plant and animal groups
    c. Bird families and species as examples of evolutionary processes

2. Lecture course: Ecological principles

1. Basic ecological processes
    a. Definitions
    b. Abiotic components of ecosystems
    c. Nutrients and soils
    d. Plant-herbivore interactions
2. Population dynamics
    a. Measuring birth and death rates; life tables
    b. Demographic stochasticity
    c. Environmental stochasticity
    d. Competition
    e. Predation
    f. Parasitism
    g. Mutualism
    h. Understanding and predicting population change
3. Behavioural ecology
    a. Foraging behaviour
    b. Anti-predation behaviour
    c. Breeding systems and mate choice
    d. Communication
    e. Social behaviour
    f. Life history theory
    g. Individual based population models
4. Terrestrial ecosystems
    a. Review of major terrestrial ecosystems
    b. Role of history and geology
    c. Keystone species and functional groups
    d. Ecosystem engineering
5. Anthropogenic effects on ecosystems
    a. Pollution
    b. Introduced species
    c. Global warming
    d. Genetically modified crops
    e. Urban habitats

3. Practical course: Field techniques

1. Bird identification
    a. Bird topography
    b. Field marks
    c. Descriptions
    d. Use of field guides
    e. Use of bird calls and playback
2. Bird census techniques
    a. Species lists
    b. McKinnon lists
    c. Transects
    d. Point counts
    e. Distance sampling in the field
    f. Analysis of data using DISTANCE
3. Behavioural sampling
    a. Behavioural measures
    b. Field craft
    c. Focal sampling
    d. Scan sampling
4. Habitat measurements
    a. Vegetation density
    b. Vegetation characteristics
    c. Invertebrate sampling

    d. Measurement of abiotic factors

4. Practical course: Computing skills

1. PC file management
2. Word processing
3. Reference databases
4. Internet resources and search skills
5. Spreadsheets, databases and principles of data input
6. File management and data synthesis in SPSS
7. Graphics packages
8. PowerPoint

5. Lecture course: Conservation biology

1. Biodiversity
    a. Biodiversity on earth
    b. Extinctions
    c. Measuring biodiversity
    d. Biodiversity hotspots
2. Metapopulation biology
    a. Habitat fragmentation
    b. Island biogeography
    c. Modern metapopulation theory
3. Conservation genetics
    a. Problems of small populations
    b. Captive breeding
    c. Prioritisation of conservation of genetic resources
4. Sustainable exploitation and development
    a. Sustainability: meanings and values
    b. Unsustainable exploitation of wild populations
    c. Global economy and multilateral governance
    d. Introduction to environmental economics
    e. Cost benefit analysis
    f. Ecotourism
5. Site based conservation
    a. Habitat fragmentation: edge effects
    b. Nature reserve design
    c. Habitat management
    d. Habitat creation

6. Lecture course: Experimental design and hypothesis testing

1. The scientific method
    a. Philosophy of science
    b. Certainty and probability
2. Hypothesis testing
    a. Null hypotheses
    b. Type I and Type II errors
    c. Falsifiability of hypotheses
3. Experimental design
    a. Independence of data and sample size
    b. Replication and pseudo-replication
    c. Sampling bias and random sampling
    d. Spatial scale
    e. Observer biases and errors
    f. Simple and clear experimental design
    g. Observational studies
4. Using statistics
    a. How not to lie with statistics
    b. Abuse of statistics

    c. Standard statistical techniques
    d. Applying knowledge of statistical limitation when designing experiments
5. Presentation of statistics
    a. Degrees of freedom
    b. Understanding tables of statistics and common terms
    c. Understanding probability and P values
    d. Using appropriate graphs
    e. Residuals

7. Practical course: Statistics

1. Distributions and measures of central tendency
    a. Normal and non-normal distributions
2. Non-parametric statistics
    a. Frequency analysis
    b. Exact probability and binomial tests
    c. Correlation
    d. Mann-Whitney U tests
    e. Matched pair tests
    f. Kruskall-Wallis one-way ANOVA
3. Regression
    a. Linear regression
    b. Multiple regression
    c. Residualising
    d. Non-linear regression
    e. Binary logistic regression
    f. Poisson regression
4. General linear modelling
    a. Factors versus covariates
    b. Limits to analysis and power
    c. One-way ANOVA
    d. Repeated measures and random factors
5. Programming in SPSS
    a. Syntax files
    b. Organising analysis
    c. Advanced data manipulation and selection

8. Practical course: Writing and presentation skills

1. Scientific writing
    a. Structure
    b. Editing
    c. Preparation of figures
    d. The process and requirements of scientific publishing
    e. Peer review and refereeing
2. Writing for a non-scientific audience
    a. Popular journalism
    b. Press releases
    c. Report writing
3. Broadcasting
    a. Being interviewed
4. Seminar presentation
    a. Techniques
    b. Use of PowerPoint and other multimedia aids
    c. Dealing with questions

9. Research project

This will be a field-based, usually ornithological research project designed, implemented and written up a scientific paper (as if for publication) by the student. Previous project titles have included:

1. "Farmland and Birds: a comparison of bird biodiversity in forest compared to cleared farmland”
2. "The wintering ecology and habitat requirements of Common Whitethroats”
3. “Bird biodiversity in a rapidly degrading forest reserve”
4. "Food sources depletion and habitat classification during the dry season measured with giving up densities"
5. "The Ecology of the endemic Rock Firefinch"
6. "The influence of time of day and weather on bird activity "

10. Research dissertation

This will be based on the student's own reading and based on a subject related to the science of conservation biology. The student will write 5,000 words on their chosen subject. Example titles are:

1. “How birds differ in their behaviour and life history in Africa compared to other tropical areas and temperate regions”.
2. “The problems with a site based conservation approach”
3. “What makes a successful species based conservation project?: a review and meta-analysis”
4. “Measuring bird/habitat association in Africa”

11. Research Presentation

The student will present either their research project or their research dissertation as a 45 minute lecture, followed by a 15 minute discussion.