Course directory 2017.2018

school of Biology (FBM-BIO)
Master

* your selection

> Biology > Master of Science (MSc) in Behaviour, Evolution and Conservation, Specialisation Computational Ecology and Evolution

UNIL | Université de Lausanne

SUMMARY

NOTICE

This course catalogue was produced using data from the *SylviaAcad* information system of the University of Lausanne. Its database contains all information about courses proposed by the different faculties and their times. This data can also be consulted online at the address :
https://applicationspub.unil.ch/interpub/noauth/php/Ud/index.php.

Web site of the faculty : **http://www.unil.ch/ecoledebiologie/**

Generated on : 25.09.2018

LEGEND

NAME OF THE COURSE

Teacher

Type of course	Status		Hours per week	Teaching language	Hours per year
Semester	Credits				

N: Levels

P: Programme requirements

O: Objective

C: Content

B: Bibliography

I: Additional information

ABBREVIATIONS

TYPE OF COURSE

Attest.	Attestation
C	Course
C/S	Course - seminar
Cp	Camp
E	Exercises
Exc	Excursion
Lg	Guided lecture
S	Seminar
T	Fieldwork
TP	Practical work

STATUS

Fac	Facultative
Obl	Compulsory
Opt	Optional
Fac/Comp/Opt	Facultative, compulsory or optional (according to the study programme)

SEMESTER

Sp	Spring
A	Autumn

Master of Science in Behaviour, Evolution and Conservation
Specialisation Computational Ecology and Evolution
2017-2018

The Master program has a normal duration of 3 semesters and comprises 90 ECTS :

- 15 ECTS : Compulsory courses (Module 1)
- 15 ECTS : First step project (Module 2)
- 15 ECTS : Optional courses (Module 3)
- 45 ECTS : Personal research project (Master thesis) (Module 4)

Modules 2 and 4 have to be in computational ecology or evolution field, validated by head of CEE specialisation

Training objectives are available in its programme regulations.

Specific training objectives: At the end of the course the students will be able to:
• Model population processes.
• Make advanced use of computer and statistical methods in ecology and population biology.
• Use computer programming techniques.

Autumn Semester (semester 1)

Module	Courses / Enseignement	Hours per semester C	E/S	PW	Teaching Staff	ECTS Credits	Limited nb of students
MODULE 1	**Compulsory / *Obligatoires***						
	Advanced Data Analysis in Biology I-II *Analyse de données en biologie I-II : niveau avancé*	12	-	12	**Schütz F.**	4.5	
	Introduction into Scientific Writing *Introduction à la rédaction scientifique*	7	9	-	**Waterhouse R.**	2	
	Molecular Genetics *Génétique moléculaire*	18	-	21	**Sanders I.**, Fumagalli L. Salamin N.	3.5	
	Populations Genetic and Dynamic *Génétique et dynamique des populations*	7	10	-	**Goudet J.**	1.5	
	Programming for Bioinformatics *Programmation pour bioinformatique*	7	14	-	**Salamin N.**	2	
	Seminars of the Dept. of Ecology and Evolution *Séminaires du Dept Ecologie et Evolution*	-	14	-	**Goudet J.**	-	
	Spatial Analysis and GIS in Ecology *Analyses spatiales et SIG en écologie*	7	10	-	**Guisan A.**	1.5	
	Subtotal	58	57	33			
	Total					**15**	

Module	Courses / Enseignement	C	E/S	PW	Teaching Staff	ECTS Credits	Limited nb of students
MODULE 2	**Practical Project / *Travail pratique***						
	First Step Project *Travail d'initiation à la recherche*	-	-	224	**Goudet J., Robinson-Rechavi M.**	**15**	

Computational oriented courses are highlighted in blue

Abbreviations
C = Course
E/S = Exercise/Seminar
PW = Practical Work

ADVANCED DATA ANALYSIS IN BIOLOGY I

Frédéric Schütz

C	Obl/Opt	English	6
A	2.00		

TP	Obl/Opt	English	6
A			

N: Master

ADVANCED DATA ANALYSIS IN BIOLOGY II

Frédéric Schütz

C	Obl/Opt	English	6
A	2.50		

TP	Obl/Opt	English	6
A			

N: Master

INTRODUCTION INTO SCIENTIFIC WRITING

Robert Waterhouse

C	Obl	English	7
A	2.00		

E	Obl	English	9
A			

N: Master

P: Lecturing and paper writing are in English.

O: Synposis of the major course aims in English:
This short but intensive block course introduces students to the practice of scientific writing (and aspects related to getting published in peer-reviewed scientific journals).
We will discuss questions such as:
Why is it important to publish?
What is good/clear versus bad/unclear (scientific) writing?
How to learn how to write well?
How to structure and write a good scientific manuscript?
The submission, editorial and reviewing process.
How to review someone elses paper?
Publishing is of key importance in scientific research: your job as a scientist is not finished until you have published your results - science is to a very large extent about effectively communicating your results and insights, i.e. what you have learned about how nature works. The ultimate aim of this intensive course is thus to equip students with a solid understanding of how to effectively communicate their research in writing.

C: The course includes both lectures and practical exercises in class, distributed over four half-days. The lectures will give a broad and brief overview of different aspects of scientific writing and publishing; however, the major emphasis of the course is on practical work on part of the students. During the practical parts the students will learn, from scratch, the fundamental structure and essential components of scientific writing, how to write effective outlines/drafts and - most importantly - how to write complete, clear, well-structured papers. These practical exercises will thus require students to do reading and writing assignments, often under a bit of time pressure. At the beginning the exercises will be worked on by teams of 2-4; towards the end, each student will work individually. Finally, to get a grade for this class, students will have to complete 1 written report (homework assignment). For each exercise as well as for the written reports we will give detailed and individualized feedback.

Detailed Program

Day 1: Lecture 1: Writing papers: the basics of why and how. We will discuss the following: Overview of class and organizational things (incl. homework assignments). Why is it important to publish? What is good/clear versus bad/unclear (scientific) writing? How to learn how to write well? [We will also briefly touch upon issues of good scientific practice and conduct, and various ethical issues connected to publishing.] Approx. 1 hour.

Day 1: Practical work 1. How to think of an effective title and how to write a succinct abstract. In groups of 2-3. Read the assigned (stripped down and short) manuscript and come up with a title and with keywords. Then write a short abstract (< 200 words). We will then discuss the solutions you have come up with, and their potential pros and cons, together in class. Approx. 3 hours.

Day 2: Lecture 2: How to write a scientific paper. We will discuss the basics and essentials of writing a scientific paper (and also what not to do!). Specifically, I will explain how a paper should be structured and sub-structured, how to draft a paper (i.e., how to get started), how to build and complete a full manuscript, and then how to improve it by continuous and agressive revising and re-revising. I will also give you hints and tips for effective writing. Approx. 1 hour.

Day 2: Practical work 2. Writing your own paper in a nutshell. I will give you some data/results (e.g., data figures/tables/legends/statistical outcomes) to choose from. Form a team of 2-3. Ask yourself: What do the results/tables/figures/analyses show and mean? Then prepare a very short mini-paper (1 page max), including: Title, Abstract, Introduction, Materials and Methods, Results, Discussion and Conclusion (there are some other components in a paper that we will skip for the sake of this exercise). Each component should be between 1 and 3-4 sentences maximum. We will then discuss your solutions and their potential pros and cons together in class; I will then give you detailed feedback on your papers by e-mail within 1 week of the exercise. Approx. 3 hours.

Day 3: Lecture 3: How to write a scientific paper: recap. We will briefly recapitulate what we have discussed and learned so far. Approx. 30 min - 1 hour

Day 3: Practical work 3: Review a paper. What distinguishes a good from a bad

manuscript? Now you are the reviewer! Being a critical reviewer will help you to learn to distinguish between good and bad writing and thus help you to improve your own scientific writing. You will be given 2 short, stripped-down manuscripts. Team up in groups of 2-3. Read both manuscripts critically, then make pro and contra lists for both manuscripts. Briefly explain why you would accept/reject (or reach some other decision) the manuscript for publication (

MOLECULAR GENETICS

Luca Fumagalli, Ian Sanders

C	Obl/Opt	English	18
A	1.50/3.50/5.00		

TP	Obl	English	42
A			

N: Master

O: The objective of this course is to learn the relevant molecular tools that are currently used in ecology, evolutionary and conservation biology research and understand why and when to apply them.

C: This course covers the reasons why molecular genetics is a necessary tool in many ecology, evolution and conservation biology projects. We study its uses and then look at at selection of techniques, particularly for looking at polymorphism, that are not traditionally taught in molecular cell biology courses. Man of the techniques can only be learnt in the classroom as there is not enough time in a week to practically learn all useful techniques. Therefore, the associated laboratory class cover some of the fast techniques that are useful for studying polymorphisms in populations.

B: The course is mostly based on publications in international journals rather than one specific book. The publications are made available in pdf format at the beginning of the course.

POPULATIONS GENETIC AND DYNAMIC

Jérôme Goudet

C	Obl/Opt	English	7
A	1.50		

E	Obl/Opt	English	10
A			

N: Master

P: An introductory course in population genetics and population dynamics, and a good understanding of the notions developed in Nicolas Perrin's course, "Biologie des populations"

O: Gain an understanding of how genetics and genomics interact with demographic and selective processes.
website:
http://www2.unil.ch/popgen/teaching/PGD16/

C: In the first part of the course, selected papers from the
recent literature are presented by students and discussed in a
journal club format.
In the second part, in groups of 2-3 students you will use
computer simulations and the quantiNemo program (http://www2.unil.ch/popgen/softwares/quantinemo/) to investigate questions such as:
-efficacy of selection in the face of gene flow?
-effect of the number of loci encoding a trait on the speed of
adaptation
-is neutral diversity a good proxy for adaptive diversity?

I: http://www2.unil.ch/popgen/teaching/PGD16/

PROGRAMMING FOR BIOINFORMATICS

Nicolas Salamin

C	Obl/Opt	English	7
A	2.00		

E	Obl/Opt	English	14
A			

N: Master

P: There are not prerequisites for this course. The students are however expected to be familiar with computers. They should have a good understanding of the functioning of a computer (hardware components, operating system/file system). A basic knowledge of UNIX/LINUX would be good, although it is not essential. It will be necessary to install the following software on your own laptop: - python3 with the modules numpy and biopython - a text editor with syntax highlighting (simple one or IDE) - for windows user: a terminal environment (e.g. cygwin or MinGW)

C: We will cover the following aspects of programing in Python:
1) basic syntax
2) data types in Python

SEMINARS OF THE DEPARTMENT OF ECOLOGY AND EVOLUTION

Jérôme Goudet

S	Obl	1	English	14
A				

S	English	14
S		

N: Master

P: All seminars and discussions are in English

O: Learn about the current research of other groups and meet international experts.

C: International experts present their research and answer to questions in public.

SPATIAL ANALYSIS AND GIS IN ECOLOGY

Antoine Guisan

E	Obl/Opt	English	10
A			

C	Obl/Opt	English	7
A	1.50		

N: Master

P: Basics in statistics and ecology

O: Teaching students the basics of GIS and remote sensing, as well as the main spatial methods available in spatial ecology.

C: 1. Introduction to GIS
2. Introduction to remote sensing
3. Raster analyses
4. Neighbourhood analyses
5. Spatial interpolation
6. Detection of spatial structures and patterns

B: Wadsworth, R. & Treweek, J. 1999. Geographical Information Systems for Ecology
Caloz, R. & Collet, C. 2002. Précis de télédetection, vol. 3. Presses Univ. du Québec
Turner, Gardner, O'Neill 2001. Landscape Ecology in Theory and Practice: Patterns and Process. Springer
Dale, Birks, Wiens 2000. Spatial Pattern Analysis in Plant Ecology. Cambridge University Press.
Klopatek, J.M. & Gardner, R.H. 1999. Landscape Ecological Analysis: isuues and applications. Springer.
Hunsaker, C.T., Goodchild, M.F., Friedl, M.A. and Case, T.J. (Eds). 2001. Spatial uncertainty in ecology. Springer.
Hansson, L., Fahrig, L. and Merriam, G. 1995. Mosaic Landscapes and Ecological Processes. Chapman & Hall.

I: http://www.unil.ch/ecospat

FIRST STEP PROJECT

Christian Fankhauser, Jérôme Goudet, Laurent Lehmann, Marc Robinson-Rechavi, Olivier Staub

TP	Obl	English	224
A	15.00		

TP	Obl	English	282
A	15.00		

TP	Obl	English	250
A	14.00		

TP	Obl	English	224
A	15.00		

TP	Obl	English	224
A	15.00		

N: Master

P: Practicals performed during the bachelor (molecular biology, genetics, biochemistry, bioinformatics)

O: - An initiation to the work of a scientist
- Conduct experimental work in research lab (wet bench or in silico)
- Interpretation of research results
- Implement basic principles in experimental design (e.g. include the appropriate controls, statistical significance of the results etc...)
- Present your experimental work in a written report which will be organized like a typical research article (intruduction, results, discussion, materials and methods)
- present your work orally (seminar style)

C: Perform laboratory work for about 12 weeks during the time when the student does not follow theoretical classes. This research project will typically be performed under the guidance of a PhD student or a post-doc from the host laboratory.

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Ecole de biologie

Master of Science in Behaviour, Evolution and Conservation
Specialisation Computational Ecology and Evolution
2017-2018

Spring Semester (semester 2)

Courses / Enseignement	Hours per semester C	E/S	PW	Teaching Staff	ECTS Credits	Limited nb of students
Computational optional courses * ***Enseignements computationnels optionnels***						
Advanced Quantitative Genetics *Génétique quantitative avancée*	10	7	-	**Robinson M.**	1.5	
A Genomic Perspective on Early Human Migrations; an Introduction to Coalescent Theory and its Applications (MSc MLS) *Caractériser les premières migrations humaines à l'ère génomique: une introduction à la théorie de la coalescence et à ses applications (MSc MLS)*	11	3	-	**Malaspinas A.-S.**	1.5	
Bioinformatic Algorithms (MSc MLS) *Algorithmes de bioinformatique (MSc MLS)*	15	15	-	**Dessimoz C.**, Gfeller D.	3	
Phylogeny and Comparative Methods *Phylogénie et méthodes comparatives*	7	14	-	**Salamin N.**	1.5	
Predictive Models of Species' Distribution *Modèles de distribution d'espèces et de la biodiversité*	14	14	-	**Guisan A.**	3	
Social Evolution : from Genes to Culture *Evolution sociale : des gènes à la culture*	28	-	-	**Lehmann L.**	3	
Optional courses * ***Enseignements optionnels***						
Applied Ecology *Ecologie appliquée*	14	-	28	**Pellet J.**	3	
Biological Invasions *Invasions biologiques*	14	-	-	**Alexander J., Guisan A.**	1.5	
Co-evolution, Mutualism, Parasitism *Co-évolution, mutualisme, parasitisme*	14	-	-	**Sanders I.**	1.5	
Current Problems in Conservation Biology *Problèmes actuels en biologie de la conservation*	14	14	-	**Wedekind C.**	3	
Ecology of the Fishes of Switzerland *Ecologie des poissons de Suisse*	7	-	10	**Rubin J.-F.**	1.5	
Evolution of Sex Determination *Evolution du déterminisme du sexe*	14	-	-	**Perrin N.**	1.5	8
Evolutionary Consequences of Hybridization and whole Genome Duplication *Conséquences évolutives de l'hybridation et de la duplication de génome*	14	-	-	**Arrigo N.**	1.5	
Honeybee Ecology, Evolution and Conservation *Ecologie des abeilles, évolution et conservation*	14	-	-	**Dietemann V.**	1.5	
Plant Population Genetics and Conservation *Génétique des populations végétales et biologie de la conservation*	7	-	10	**Felber F.**	1.5	
Plant Range Dynamics and Global Change *Dynamique des distributions géographiques de plantes et changements globaux*	7	-	10	**Randin C.**	1.5	
Scientific Mediation and Communication - Scientific Hands-on Workshop Module (in French only) *Communication et médiation scientifique - module atelier scientifique*	8	-	20	**Kaufmann A., Reymond P.,** Ducoulombier D., Trouilloud S.	3	6
Scientific Mediation and Communication - Museum Module *Communication et médiation scientifique - module musée*	28	-	-	**Sartori M.,** Glaizot O.	3	6
Optional Field Courses (1) ***Etudes de terrain optionnel***						
Biological Conservation of the Mediterranean Region *Biologie de la conservation dans les régions méditerranéennes*	-	-	40	**Roulin A., Christe P., Fumagalli L.**	2	
Ecology and Faunistics of the Sea Shore, Roscoff *Ecologie et faunistique du bord de mer, Roscoff*	7	-	49	**Perrin N.**	3	20
Evolution and Biogeography of Semi-arid and Island Floras *Evolution et biogéographie des flores insulaires en zone semi-aride*	-	-	40	**Pannell J.**	2	
Mountain Ecosystems: Patterns and Processes *Ecosystèmes montagnards : patterns et processus*	14	-	40	**Guisan A.**	3	
Total					**15**	

MODULE 3

* Students can choose optional courses in the field of the Master independently from this study plan for a max. of 3 ECTS credits and at least 6 ECTS in Computational oriented optional courses (marked in blue)

(1) Financial participation by the student required

Spring semester (semester 2) and Autumn Semester (semester 3)

Course / Enseignement		ECTS Credits
Master Thesis CEE *Travail de Master CEE*	Thesis Director	**45**

MODULE 4

ADVANCED QUANTITATIVE GENETICS

Matthew Robinson

C	Opt	English	10
S	1.50		

E	Opt	English	7
S			

N: Master

A GENOMIC PERSPECTIVE ON EARLY HUMAN MIGRATIONS: AN INTRODUCTION TO COALESCENT THEORY AND ITS APPLICATIONS

Anna Sapfo Malaspinas

C	Opt	English	11
S	1.50		

E	Opt	English	3
S			

N: Master

BIOINFORMATIC ALGORITHMS

Christophe Dessimoz

C	Opt	English	15
S	3.00		

E	Opt	English	15
S			

N: Master

PHYLOGENY AND COMPARATIVE METHODS

Nicolas Salamin

C	Opt		English	7
S	1.50			

E	Opt		English	14
S				

N: Master

P: none

O: Phylogenetic reconstruction methods and their application in evolutionary biology. To know and understand phylogenetic reconstruction methods in order to test the processes leading to genes and organisms evolution.

C: The subjects will be presented during lectures as well as practicals.
I. Reconstruction methods
- What is a phylogenetic tree and how to interpret it?
- Tree reconstruction:
a) optimisation criteria and models of evolution
b) search for the optimum tree
c) Bayesian methods
- Can we trust the inferred tree?
II. Uses for phylogenetic trees
- Detecting positive selection in a coding gene
- Testing coevolution and cospeciation
- Macroevolution:
a) dating evolutionary events
b) tempo and mode of evolution
c) testing for key innovations
- Phylogeny and conservation

B: Felsenstein, J. 2003. Inferring phylogenies. Sinauer Associates.
Page, R. 2003. Tangled trees: Phylogeny, cospeciation, and coevolution. University of Chicago Press.
Purvis, A., Gittleman, J.L. and Brooks, T. 2005. Phylogeny and conservation. Cambridge University Press.
Swofford, D.L., Olsen, G.K., Waddell, P.J. and Hillis, D.M. 1996. Phylogeny reconstruction. Pages 407-514 In Molecular Systematics (D.M. Hillis, C. Moritz, B.K. Mable, eds.). Sinauer Associates.
Yang, Z.H. 2006. Computational Molecular Evolution. Oxford University Press.

I: http://www.unil.ch/phylo/teaching/pmc.html

PREDICTIVE MODELS OF SPECIES' DISTRIBUTION

Antoine Guisan

C	Opt	English	14
S	3.00		

E	Opt	English	14
S			

N: Master

P: If possible, course 'Spatial Analyses & GIS' (ANSPAT) in 1st semester of the Master (not strictly required).

O: Species distribution models (SDMs) are increasingly important in ecology and conservation biology. This course proposes an introduction to these models and related concepts and methods. Overview of the main steps of model building. Advantages and limitations. Applications to various domains (climate change, invasions, rare species, ...).

C: Chap. 1. Introduction to species' niche & distributions, and related models. Theory and principles behind these models. Competition and disperal limitations. Types of response variables, main predictive modelling approaches, field sampling design, from predicting species distributions to predicting communities.
Chap. 2. Model calibration. Presence-only versus presence-absence data, statistical theory and methods for presence-only data, regressions and classifications for presence-absence, ensemble modelling and forecasting.
Chap. 3. Model evaluation. Internal versus external evaluation. Data and metrics for evaluation. Crossvalidation, jackknife, bootstrap, uncertainties.
Chap. 4. Assumptions behind these models. Pseudo-equilibrium, niche conservatism, niche completeness, realized niche, and other postulates.

B: Guisan, A. & Zimmermann, N.E. (2000). Predictive habitat distribution models in ecology. Ecological Modelling 135(2-3): 147-186.
Guisan A, Thuiller W (2005) Predicting species distribution: offering more than simple habitat models. Ecology Letters, 8, 993-1009.
Guisan et al. (2013) Predicting species distributions for conservation decisions. Ecology Letters 16: 1424-1435.

I: http://www.unil.ch/ecospat

SOCIAL EVOLUTION: COOPERATION AND CONFLICT FROM GENES TO CULTURE

Laurent Lehmann

C	Obl/Opt	English	28
S	3.00		

N: Master

O: What makes us such a unique species, able to cooperate in large-scale societies, organize social interactions, and dominate ecologically the Earth? The main goal of this course is to provide the foundations of social evolution, which consists of two main ingredients in humans: cooperation and cumulative cultural evolution. On one side, the course will thus focus on studying the main forces favoring and maintaining cooperation (mutually beneficial interactions, altruism) and conflict (cheating, malevolence, warfare) in group-structured populations. On the other side, we will study the forces behind cultural evolution, where behavior in interactions depends on genetic determinants, social learning, and individual learning ("gene-culture coevolution"). This will allow discussing the major steps in human social organization evolution, from primate autarky to division of labor in large-scale societies.

C: The course will be composed of five main parts and more focused on human behavior than the "Ecology and Evolution" class on which it builds:
(1) Cooperation and conflict in well-mixed populations. Here, we will study the evolution of cooperation (and cheating) in well-mixed population (no division into groups). We will study the standard one-shot social dilemmas illustrating the tension between self-interest and group-interest, like the prisoner's dilemma and the stag-hunt game. We will then investigate various settings of repeated interactions, where reputation dynamics between individuals are crucial to sustain long-term relationships.
(2) Cooperation and conflict in group-structured population. Here, we will study the forces shaping cooperation when interactions occur in group-structured populations (the rule in humans), and where the localization of the social interactions generates in the same time novel incentives to cooperate and novel incentives for spiteful behavior. We will also consider conflicts between groups and study warfare in small-scale hunter-gather societies.
(3) Social learning and gene-culture coevolutionary theory. Here, we will study the main modes of social learning ("cultural transmission"), which underlies cumulative cultural evolution that is the main determinant of the human lineage ecological success. We will also study gene-culture coevolution and how social learning impacts the dynamics of cooperation within groups.
(4) Individual learning and preferences. Here, we will discuss the main modes of individual learning that allow individuals to learn information about the relevant behavior to express on their own (e.g., trial-and error learning and related decision heuristics, maximizing behavior). We will investigate the conditions under which evolution may and may not lead individuals to become equipped with goal functions ("utility maximization behavior").
(5) Major transition from small to large-scale societies. Here, we will discuss the main evolutionary steps that took the human lineage in a 6 million year long co-evolutionary gene-culture ride from self reliant primate social organizations ("autarky") to large scale societies with extreme division of labor ("catallaxy"). This transition involved a zizag path from dominance, to egalitarianism, to inequality again.

APPLIED ECOLOGY

Jérôme Pellet

C	Opt	English	14
S	3.00		

TP	Opt	English	28
S			

N: Master

P: BSc level in biology, including ecology

O: Applied ecology is a young crisis discipline undergoing a major effectiveness revolution. In most situations, urgent action is necessary, even in the absence of reliable information. How do we gather sound ecological information? How do we use it to plan natural communities conservation? In the process of answering these questions, wildlife ecologists often realize that research and practice are just two sides of the same coin.

C: The goal of the course is to teach students some of the skills they will need as evidence-based conservationists. Practical examples will be drawn from various ecosystems, communities and species. The course will revolve around the stages of adaptive management:
monitoring ecological resources, monitoring occupancy and abundance
research syntheses (systematic reviews and meta-analyses)
ecological triage (systematic conservation planning and red lists)
natural communities conservation planning and legislative context.
Field-based case studies will provide students an opportunity to apply and discuss some of the principles illustrated in the course. Practical work will include meeting with practitioners, discussing and analyzing their approach and methods through the prism of adaptive management.
« There is no such thing as a special category of science called applied science; there is science and its applications, which are related to one another as the fruit is related to the tree that has borne it. » Louis Pasteur

BIOLOGICAL INVASIONS

Jake Alexander, Antoine Guisan

C	Opt	English	14
S	1.50		

N: Master

O: 1. Explain core theory and concepts underlying the spread and impacts of non-native species.
2. Give key insights emerging from invasions as natural experiments in ecology and evolution.
3. Design an empirical study using non-native species as a model system.

C: Biological invasions are considered one of the most important global threats to biodiversity. Understanding the processes shaping the success of species outside of their native ranges is therefore a major goal of conservation research. However, the spread of invasive species can also be seen as natural experiments on a grand scale, giving important insights into the regulation and functioning of populations, communities and ecosystems. In this course, we elucidate the main hypotheses explaining the success and spread of invasive species, whilst emphasising the insights that biological invasions have given us into basic ecological and evolutionary processes.

B: See English pages of the course

CO-EVOLUTION, MUTUALISM AND PARASITISM

Ian Sanders

C	Opt	English	14
S	1.50		

N: Master

P: Must understand english and be prepared to give presentations

O: To understand the evolutionary consequences of organisms living together in mutualism or parasitism and how to investigate it experimentally

C: The course comprises some introductory talks given by me about concepts in co-evolution and theoretical frameworks for studying co-evolution. Afterwards, students give presentations on chosen key publications in this field and the group discusses these subjects after the presentations.

B: : All bibliography is made availble in pdf format before the course begins. For an example of the publications discussed you can find last years publications in my docunil public folder.

CURRENT PROBLEMS IN CONSERVATION BIOLOGY

Claus Wedekind

C	Opt	English	14
S	3.00		

E	Opt	English	14
S			

N: Master

P: Lectures, discussions, and proposal writing in English.

O: Introduction into
- some important problems of conservation biology
- funding opportunities for conservation projects
- the planning, writing, and reviewing of grant proposals in the context of the course

Own ideas shall be developed, presented and discussed in class.

C: Some current research topics within the field of conservation biology will be further introduced in lectures, guest lectures, and discussion in class. Each student then develops an own idea of a research project within these topics. After an introduction into funding agencies and the planning and writing of grant proposals, each student (or groups of two) write(s) up an own proposal and present(s) it to the class. The proposals of colleagues will then be peer-reviewed after an introduction into peer-reviewing of grant proposals.

ECOLOGY OF THE FISHES OF SWITZERLAND

Jean-François Rubin

C	Opt	English	7
S	1.50		

TP	Opt	English	10
S			

N: Master

P: none

O: Recognize the different habitats and species
Know the biology of the principal species
Identify the problems linked to the management of these habitats and species

C: Generalities on water
Lakes
Watercourses
Plankton and plants
Systematic of fish
Anatomy of fish
The fish of Switzerland

EVOLUTION OF SEX DETERMINATION

Nicolas Perrin

C	Opt	English	14
S	1.50		

N: Master

EVOLUTIONARY CONSEQUENCES OF HYBRIDIZATION AND WHOLE GENOME DUPLICATION

Nils Arrigo

C	Opt	English	14
S	1.50		

N: Master

HONEYBEE ECOLOGY, EVOLUTION AND CONSERVATION

Vincent Dietemann

C	Opt	English	14
S	1.50		

N: Master

O: This series of lectures will show the complexity of insect societies, taking the honey bee as an example. It will give the opportunity to see how concepts learned elsewhere by the students can be placed within the context of a single species.

C: Since honeybees are economically important insects, they have been studied early in history and the knowledge we possess about them is greater than for any other social insect. Our understanding of the honeybee reveals the complex organisation reached by insects when they form societies. This series of lectures will present some aspects of this complexity that will be replaced within its evolutionary context. Various aspects of honeybee ecology and evolution, including geophylogeny, biology, reproduction at individual and colony level, division of labour, communication, economical value, pathogens will be presented.
After a general introduction of this model species describing the diversity and biogeography of the taxon, we will dissect the communication abilities of European honeybees and compare it with related Asian species. We will see how this communication is used to organise foraging tasks sustaining colony growth. Reproductive conflicts will be described to show that the altruism commonly attributed to the colony members is tainted by selfishness. Honeybee health is a current concern and we will review the pathogens affecting them and comment the role of humans in their spread and control in an evolutionary context. Since honeybees are globally threatened, we will see what economical losses their decline could have and some conservation projects to invert the trend will be put in context.

B: Seeley T, 1985. Honeybee Ecology. Princeton University Press.
Seeley T, 1995. The wisdom of the hive. Harvard University Press.
Moritz RFA, Southwick EE, 1992. Bees are superorganisms. Spiringer Verlag
Oldroyd B, Wongsiri S, 2006. Asian Honey Bees. Harvard University Press.
Koeniger N, Koeniger G, Tingek S, 2010.Honey Bees of Borneo. Natural History Publications
Winston ML, 1987. The Biology of the honey bee. Harvard University press.

PLANT POPULATION GENETICS AND CONSERVATION

François Felber

C	Opt	English	7
S	1.50		

TP	Opt	English	10
S			

N: Master

PLANT RANGE DYNAMICS AND GLOBAL CHANGE

Christophe Randin

C	Opt	English	7
S	1.50		

TP	Opt	English	10
S			

N: Master

SCIENTIFIC MEDIATION AND COMMUNICATION - SCIENTIFIC HANDS-ON WORKSHOP MODULE

Alain Kaufmann, Philippe Reymond

C	Opt	French	8
S	3.00		

TP	Opt	French	20
S			

N: Master

SCIENTIFIC MEDIATION AND COMMUNICATION - MUSEUM MODULE

Michel Sartori

C	Opt	English	28
S	3.00		

N: Master

P: None

O: This is a theoretical and practical course which will teach you how to write a text for an exhibition (scientific popularization). From original articles and textbooks to the exhibition content, several steps are required to make the exhibition attractive and accessible to a large audience. During this course, you will learn the basics of exhibition building, from content development to the elaboration of a mediation concept and a communication strategy.

C: The thematic proposed this year is « species extinction and conservation" . The Museum is presently preparing an exhibition on this vast topic, ranging from extinction's mechanisms to local or global conservation efforts. Students will be asked to develop one or several sub-chapters in agreement with the teachers. Students' works may actually be selected and materialized in the exhibition planned by the Museum early 2019.

BIOLOGICAL CONSERVATION OF THE MEDITERRANEAN REGION

Alexandre Roulin

T	Opt	English, French	40
A S	2.00		

N: Master

P: Financial participation required by the student.

O: Faunistic knowledge on birds, insects, crustaceans, mammals and reptiles with an emphasis on conservation issues. We will visit several places (Extermadura, Andalucia around the Doñana national parc, Tarifa and Brazo del Este) where the fauna is fundamentally different and habitats have suffered from human activities to different degrees.

C: Excursions and group field work. Discussion of scientific articles about conservation issues of Spanish endangered species. Additionnally, each student shall be responsible for the study of one endangered species. Discussion of projects that could be carried out in Spain to answer questions on evolutionary biology, behavioural ecology and conservation.

B: Polycopié distributé aux participants

ECOLOGY AND FAUNISTICS OF THE SEA SHORE, ROSCOFF

Nicolas Perrin

T	Opt	English, French	49
S	3.00		

C	Opt	English, French	7
S	3.00		

N: Master

P: Financial participation required by the student.
!!! Please, contact the person in charge before your inscription !!!

O: To allow a first, integrated approach of the itertidal biotope, and to understand the role played by the tides, the substrate and other conditions on the faunistic composition of littoral communities and on the physical and behavioural adaptations of the species.

C: Lecture (6 h): Introduction to intertidal ecology.
Excursions and group field work: analysis of zonation and biodiversity in various habitats (sand beach, rock, estuaries and so on). Additionnally, each student shall be responsible for the study of one taxonomic group.
Lab experimentations: experimental design and realisation of an experiment in etho-ecology illustrating adaptative behaviour of an intertidal species.

EVOLUTION AND BIOGEOGRAPHY OF SEMI-ARID AND ISLAND FLORAS

John Pannell

T	Opt	French	40
S	2.00		

N: Master

P: Financial participation required by the student.

MOUNTAIN ECOSYSTEMS: PATTERNS AND PROCESSES

Antoine Guisan

C	Opt	English	14
S	3.00		

T	Opt	English	40
S	3.00		

N: Master

P: Bachelor in environmental and/or biological sciences.

O: To offer an interdisciplinary vision of mountain environments and elevation gradients through the lens of different questions in ecology and evolution.

C: Two fields retreats of 2-days and 3-days, with courses and practical works and exercises, with 14C of lectures by different teachers in-between. Content of the lectures:
1. Adaptations to marginal environments
2. Reproductive systems along elevation
3. Patterns of micro-organisms along elevation
4. Biological invasions in mountains
5. Impact of climate change on mountain species and communities - field observations and experiments
6. Impact of climate change on mountain species and communities - spatial modelling
7. Human-wild fauna conflicts in mountain regions

B: See English pages of the course

I: See English pages of the course