TROPIMUNDO

Course list and detailed course descriptions 2016-2019

Course list per semester and per Partner

Courses separated by '**OR**' indicate that students need to choose between these specialised courses. Course and schedule changes may occur from year to year. The detailed course lists per semester can be reached by clicking on the respective partner in the first table below. Likewise, the detailed course descriptions can be reached by clicking on the course title links. However, please note the general comments at the start of the detailed course descriptions. Please refer to the Trajectories to understand the possible choices in the different TROPIMUNDO Trajectories. Finally, note that for certain optional courses student quota may exist or be imposed in a later stage.

Semester 1 (S1)	Semester 2 (S2)	Semester 3 (S3)	Semester 4 (S4)
ULB-VUB	UdA	ULB-VUB	All European Partners
UPMC-MNHN	UDsch	UPMC-MNHN	
UNIFI	UMT	UNIFI	
UdG	UQ	UdG	

S1 course list at the Université Libre de Bruxelles (ULB) and the Vrije Universiteit Brussel (VUB)

COMPULSORY:

	ECTS
MODULE: ULB-VUB	
Analysis of biological data	5
The Earth system and its interactions	5
Social-Ecological Systems	5

OPTIONAL (*15 ECTS to be chosen*) :

	ECTS
MODULE: ULB-VUB	
River and lake ecology (botanical and zoological aspects)	5
Variation and evolution of plants	5
Tropical parasitology and entomology	5
Marine biology	5
Plant-soil interactions	5

S1 course list at the Université Pierre et Marie Curie (UPMC) and the Muséum National d'Histoire Naturelle (MNHN)

COMPULSORY:

	ECTS
Statistiques et traitement des données	3
Problématiques actuelles en biodiversité (tropicale)	3
Bases (avancées) de la taxonomie	6
Bases (avancées) de la phylogénétique	6
Initiation aux milieux tropicaux	3
Langue étrangère	3
Orientation et Insertion professionnelle	3

OPTIONAL (1 Module to be chosen):

	ECTS
MODULE: UPMC	
Climat et biotope (c/o Grandes Questions Environnementales)	3
Géomatique, SIG, Télédétection	3
MODULE: MNHN	
Sciences de la nature et de l'homme: histoire des idées	3
Droit du patrimoine naturel in situ et ex situ	3

S1 course list at the Université de Guyane (UdG)

COMPULSORY:

	ECTS
Introduction à l'environnement tropical	3
Origine et maintien de la biodiversité	5
Théories de l'Ecologie	3
Analyse des données biologiques	6
Botanique tropicale	3
Écologie fonctionnelle	3
Gestion des forêts tropicales	4
Outils pour la recherche	3

S2 course list at Université des Antilles (UdA)

COMPULSORY:

	ECTS
UdA Field school	15
Systèmes d'information géographique et bases de données	3
Thesis proposal	3

OPTIONAL (*9 ECTS to be chosen*):

	ECTS
Introduction à l'écotoxicologie	3
Pollution et écosystèmes marins	3
Ecologie comportementale	3
Interactions durables	3
Réponse fonctionnelle des plantes tropicales	3

S2 course list at Université de Dschang (UDsch)

COMPULSORY:

	ECTS
Ecole de Terrain Ecosystèmes forestiers d'Afrique centrale	15
GIS, remote sensing and landscape management	3
Thesis proposal	3

OPTIONAL (*9 ECTS to be chosen, min. number of students per course required*):

	ECTS
Phylogeny and advanced plant systematics	3
Ecologie des milieux humides tropicaux*	3
Biodiversity conservation*	3
Tropical phytogeography	3
Natural resource evaluation methods*	3
Forest ecology and silviculture	3
Socio-economic analysis and elaboration of a management plan for forests and community forests*	3
Forest management and certification*	3
Plantes mellifères, pollens et production des miels	3
Plantes médicinales et ethnophamacologie	3
Méthodes et techniques ethnobotaniques	3
Ethnobotanique et valorisation des ressources naturelles	3

* decided on a yearly basis whether or not these courses will be taught.

S2 course list at Universiti Malaysia Terengganu (UMT)

COMPULSORY:

	ECTS
UMT Field school	15
Remote sensing and GIS	3
Thesis proposal	3
Estuarine and mangrove ecology	3
Conservation of marine endangered species	3

OPTIONAL (*3 ECTS to be chosen, only 1 of the 2 courses will be taught based on number of selections by the students*):

	ECTS
Tropical oceanography	3
Lake and Terrestrial ecology	3

S2 course list at University of Queensland (UQ)

COMPULSORY:

	ECTS
Australia's terrestrial environment **OR** Australia's marine environment	15
Remote sensing of environment **OR** Geographical information systems	6
Thesis proposal	3

OPTIONAL (*1 course to be chosen*):

	ECTS
Landscape ecology	6
Catchment processes & management	6
Coastal processes & management	6
Marine invertebrates	6
Fish, fisheries and aquaculture	6
Research topic (Environmental Management)	6

S3 course list at the Université Libre de Bruxelles (ULB) and the Vrije Universiteit Brussel (VUB)

COMPULSORY:

	ECTS
Scientific presentation skills and career planning (taught/teleclass by ULB-VUB)	5
Social-Ecological Systems	5
Tropical parasitology and entomology	5

OPTIONAL (1 Module to be chosen):

	ECTS
MODULE ULB	
OPTIONAL (15 ECTS to be chosen):	
Biology of animal societies	5
Behavioural ecology in natural and man-made ecosystems	5
Marine biology	5
Plant-soil interactions	5
River and lake ecology (botanical and zoological aspects)	5
MODULE VUB	
Global change biology	3
Conservation genetics	3
Governance and policy in development and cooperation	3
Guided self-study	6

S3 course list at the Université Pierre et Marie Curie (UPMC) and the Muséum National d'Histoire Naturelle (MNHN)

RECOMMENDED :

	ECTS
Initiation aux techniques avancées de collecte et d'inventaire systématique	3
Diversité et histoire des lignées chlorophyliennes (DIVEG)	6
Xylologie-paléoxylologie: systématique et paléoécologie	3
Floristique tropicale (FLORATROP)	3
Ecologie Tropicale (ECOT)	6

OPTIONAL (*6 ECTS to be chosen*):

	ECTS
Exploration et description de la biodiversité	3
Taxinomie et nomenclature	3
Formalisation des connaissances en systématique et paléobiodiversité	3
Morphologie cladistique informatisée	3
Phylogénie moléculaire	6
Biodiversity informatics	6
Modélisation des formes et analyse des données morphométriques	3
Enjeux patrimoniaux, économiques et scientifiques de la connaissance des espèces	3
Partenaires institutionnels et associatifs de la gestion et de la conservation de la biodiversité	3

S3 course list at the Università degli Studi di Firenze (UNIFI)

COMPULSORY:

	ECTS
Scientific presentation skills and career planning (taught/teleclass by ULB-VUB)	3

OPTIONAL (27 ECTS to be chosen):

	ECTS
Climate change biology	3
Pedology	3
Advances in tropical botany	3
Animal phylogeography	3
Primatology	3
Migrations and orientation in tropical environments	3
Tropical climatology	3
Social insects in tropical environments	3
Data analysis and environmental modeling	3
Biodiversity and conservation	3
Physical Geography of Tropical Environments	3
Marine and coastal biology	3
Ecology	3
Molecular Ecology	3
Bacterial genomics and ecology	3
Coastal morphology and shoreline protection	3
Physical landscape modelling	3
Biological invasions	3

S4 course list at ULB-VUB, UPMC-MNHN, and UNIFI

	ECTS
Scientific presentation skills and career planning[1] (taught/teleclass by ULB-VUB)	3/5
Thesis	30

[1] For students starting at UPMC-MNHN this course will be accounted for in the course list of S3 at ULB-VUB or UNIFI. Students who did their S1 in Brussels or Florence and their S3 in Paris will have the choice to follow the 3 or 5 ECTS variant of the course in order to come to a total of at least 120 ECTS for the Master.

Detailed course descriptions

In addition to the course lists per partner and per semester in the section above, for each course a separate course sheet is displayed on each page below. The courses follow the same order as the above course lists per partner, but aggregate S1 and S3.

Specific comments

Specific comment with respect to the learning outcomes

In a majority of the cases the learning outcomes below are purely the educational learning outcomes of the specific course.

Specific comment with respect to the prerequisites

Each of the courses below require a **Bachelor's degree** (*i.e.* the equivalent of 180 higher education credits) with a **major in Biology**, **Natural Sciences**, **Environmental Sciences**, **or equivalent** from an **accredited university**, as well as **proficiency in English and/or French** (depending on the Trajectory) equivalent to Common European Framework of Reference for Languages (CEFR) level B2. However, these two prerequisite are not repeated for each course due to their self-evidence. Therefore the prerequisites for the courses below only link to TROPIMUNDO-taught courses. 'None' as a prerequisite implies that students do not need to have followed any TROPIMUNDO courses, but as a matter of fact they will still need to hold a Bachelor's degree.

Specific comment with respect to the assessment breakdown

For courses assessed by two different means (*e.g.* written report and oral presentation), the general rule is that the student is required to pass both parts with success in order to pass the course. Our consortium works by the principle of an achievement of competences, not by balancing personal forces against personal weaknesses.

Course descriptions at Université Libre de Bruxelles (ULB) and Vrije Universiteit Brussel (VUB)

Course title: Analysis of Biological data
Course ID: WE-DBIO-10131
University: Vrije Universiteit Brussel
Faculty: Faculteit Wetenschappen en Bio-ingenieurswetenschappen / Sciences and Bio-engineering Sciences
Department: Biologie
Name and e-mail address of the instructor(s): Bram Vanschoenwinkel (Bram.Jasper.Vanschoenwinkel@vub.ac.be)
Course website:
http://www.vub.ac.be/en/study/biology/programme/r/master-of-science-in-biology/27767/emmc-tropical-biodiversity-and-ecosystems
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 13 hrs
- Exercises: 39 hrs

Course objectives:
The aim of the course is to acquire insight in a number of non-parametric tests as an alternative to the parametric approaches for data analysis.
In the second part we will focus on a number of multivariate techniques. The focus is on when and how these techniques can be applied, what kind of conditions that should be verified, and how the results can be interpreted.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

Students should be able to manage numerical information using the main basic elements of data management as well as to identify the properties of the sample space with the aim to apply more structured methods (multivariate analysis, geostatistical analysis, time series analysis). They should be able to use specific statistical software such as Statistica, Statview, and/or SPSS.

Course material, text books and further reading:
Multivariate Data Analysis with Readings, J .F. Hair, R.L. Tatham, R.E. Anderson, W.C. Black, Macmillan Publishing Company, New York, 1998
Applied Multivariate Techniques, S. Sharma, John Wiley & Sons, Inc., New York, 1996.
The analysis and interpretation of multivariate data for social scientists, D.J. Bartholomew, F. Steele, I. Moustaki, J.I. Galbraith, Chapman & Hall, Lonon, 2002, http://www.assess.com/Books/b-82956.htm

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Many biological data do not meet the basic conditions for applying parametric tests (normality of the distribution, homogeneity of the variances, etc...) Non-parametric approaches may offer a solution in those cases. The following non-parametric tests, based on the rank order or the empirical distributions, will be explained: Mann-Whitney, Kolmogorov-Smirnov one-sample and two-sample test, Wilcoxon signed ranks test, Spearman rank order and Kendall rank order correlations.

Many observations and experiments in Biology result in a large number data that require simultaneous analysis. It is here that multivariate analysis provides essential tools for optimal exploration and exploitation of the research results.
This course is an application-oriented introduction to some multivariate techniques that are often used in the field of Biology. The focus lies on the concepts of these techniques without much emphasis on the mathematical background of the methods. For each of the multivariate techniques considered in the course we explain:
- What does the technique do and what is the basic principle of the method?
- For what kind of data is the technique appropriate?
- What are the conditions for applying the technique?
- How can and should we interpret the results?

The course is illustrated with examples from the scientific literature where multivariate analysis was the basic methodology. The following techniques are discussed: multiple regression analysis, principal component analysis, discriminant analysis, logistic regression, cluster analysis. Wherever possible, the course will be illustrated with worked-out examples and output from specific statistical software such as Statistica, Statview, and SPSS.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Variation and evolution of plants
Course ID: BIOL-F-438
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Pierre Meerts (Pierre.Meerts@ulb.ac.be) and Nausicaa Noret (Nausicaa.Noret@ulb.ac.be)
Course website:
http://banssbfr.ulb.ac.be/PROD_frFR/bzscrse.p_disp_course_detail?cat_term_in=201112&subj_code_in=BIOL&crse_numb_in=F438&PPAGE=ESC_PROGCAT_AREREQ&PPROGCODE=MA-BIOR&PAREA=BIOR4A&PARETERM=201011&PTERM=201112
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Practicals: 12 hrs

Course objectives:
To understand plant evolution through the study of evolutionary mechanisms specific to plants.
To provide the methodological basis for non ambiguous identification and correct designation of taxons.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Plant Biological level: Organism

Basics of herbarium taxonomy. Understanding of the general principles, as well as the genetic and evolutionary mechanisms, leading to intra- and interspecific plant diversity. Principles of plant molecular phylogeny. Plant genomes evolution.

Course material, text books and further reading:
Henry RJ. **2005**. *Plant Diversity and Evolution: Genotypic and Phenotypic Variation in Higher Plants*. CAB International, 340 pp.
Wendel JF, Greilhuber J, Dolezel J, Leitch IJ. **2012**. *Plant Genome Diversity Vol. 1: Plant Genomes, their Residents, and their Evolutionary Dynamics.* Springer, 279 pp.

Several articles are also accessible to students via the virtual university website.

Prerequisites: please note the general comment on prerequisites
Elements of botany; basics of genetics.

Table of contents:
Principles of plant nomenclature. Definitions of plant species, intraspecific variations, hybridization, speciation mechanisms. Evolution of plant breeding systems. Structures of nuclear, plastidic and mitochondrial genomes, and their uses in systematic. Genetic and evolution of polyploids.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Conservation genetics
Course ID: WE-DBIO-10951
University: Vrije Universiteit Brussel
Faculty: Faculteit Wetenschappen en Bio-ingenieurswetenschappen / Sciences and Bio-engineering Sciences
Department: Biologie
Name and e-mail address of the instructor(s): Ludwig TRIEST (ltriest@vub.ac.be)
Course website:
http://www.vub.ac.be/en/study/biology/programme/r/master-of-science-in-biology/27767/emmc-tropical-biodiversity-and-ecosystems
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 20 hrs
- Exercises: 13 hrs

Course objectives:
The overall objective of the course is to introduce the students in the genetics of biodiversity (as compared to species and ecosystem diversity). Therefore, basic knowledge about DNA, genes, and genomes are essential. This course will place emphasis on ecological genetics and on conservation genetics (impacts of habitat loss and fragmentation).
The objective of the course is to understand the genetics of populations, the effect of population sizes on inbreeding and drift, the effect of habitat fragmentation and isolation on genetic differentiation, the methods of gene flow, hybrid detection and the estimation of evolutionary significant units within species. Emphasis will be on marine and freshwater populations from both tropical and temperate ecosystems.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Plant Biological level: Population

Understand the genetics of populations, the effect of population sizes on inbreeding and drift, the effect of habitat fragmentation and isolation on genetic differentiation, the methods of gene flow, hybrid detection and the estimation of evolutionary significant units within species. Students should be able to apply these general principles to case studies on various groups of organisms.

Course material, text books and further reading:
Own notes and powerpoint slides are available and mainly based on own case-studies. Recommended textbooks are:
Frankham **Richard**, Ballou Jonathan & Briscoe David (**2010**) *Introduction to conservation genetics*. Cambridge
Allendorf Fred & **Luikart** Gordon (**2006**) *Conservation and the Genetics of Populations*. Wiley-Blackwell
Lowe Andrew, Harris Stephen & Ashton Paul (**2004**) *Ecological Genetics: Design, Analysis and Applications*. Blackwell
Learning materials will also comprise recent research papers (level of international journals Molecular Ecology and Conservation Genetics) for working out an assignment or for exercises on data treatment of allelic data in populations.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

This course gives a brief theoretical and practical introduction to molecular methods used in ecology at population level (Enzyme electrophoresis, RAPD, ISSR, AFLP, nuclear SSRs, chloroplast marker genes, mitochondrial DNA), evolutionary genetics of natural populations and genetic structuring of populations. More detailed topics focus on the evolution in small populations, population fragmentation, loss of genetic diversity in small populations, resolving taxonomic uncertainties, defining management units, case-studies on genetics and the management of wild populations. Selected topics are about: genetic drift and inbreeding; population fragmentation, gene flow and mating systems; quantitative trait evolution, hybridisation and introgression; intraspecific phylogeography; exercises on data treatment using various population genetics freeware.

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 100%

Course title: The Earth system and its interactions
Course ID: GEOG-F-400-B
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Géographie
Name and e-mail address of the instructor(s): Jean-Louis Tison (Jean-Louis.Tison@ulb.ac.be)
Course website:
http://banssbfr.ulb.ac.be/PROD_frFR/bzscrse.p_disp_course_detail?cat_term_in=201112&subj_code_in=GEOG&crse_numb_in=F400&PPAGE=ESC_PROGCAT_AREREQ&PPROGCODE=MA-BIOR&PAREA=BIOR4T&PARETERM=201112&PTERM=201112
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs

Course objectives:
Give a global view of the main characteristics of the fluid envelopes (incl. climate) of the Earth and of the complex interactions that govern their behavior and interactions.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Environment Biological level: Global

Be able to describe Earths water budget and climate and link it to processes on a regional scale described in the table of contents below.

Course material, text books and further reading:
Powerpoint presentation, available for the students on the intranet

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
This course outlines the "modus operandi" of the various fluid envelopes of the Earth (atmosphere, ocean, ice) and discusses their interactions. After a review of the various phenomena involved in the radiative energy balance of the Earth and their consequences on the vertical structure of the atmosphere and the latitudinal distribution of energy fluxes, we describe adiabatic processes in the atmosphere and their implications for clouds formation. The main features of the atmospheric circulation are discussed (Coriolis, winds and pressure, Hadley cells, Walker circulation, subpolar jet stream and associated fronts, local winds). The second section of the course focuses on the Oceans. It introduces the principles of ocean thermodynamics and dynamics, illustrating their application with some simple and concrete examples of ocean circulation: thermohaline circulation, zonal circulation, regional circulations. The third part of the course deals with the study of the Cryosphere. We successively review the processes of natural ice formation, the basic principles of ice dynamics, the thermal regimes of glaciers and ice sheets, and the interactions between the cryosphere and the ocean (ice shelves, sea ice and marine ice). A separate chapter is devoted to the cryospheric archives of the environment, and how they are used to reconstruct many of the past environmental variables (temperature, relative humidity, precipitation, volcanic activity, wind, vegetation cover, atmospheric composition ...). It also briefly discusses the different assumptions for the growth of large ice sheets during the transition from warm interglacials to cold glacials. A final chapter addresses the permafrost regions. It presents their spatial distribution, the temperature profiles with depth and the concept of fossil permafrost, the influence of local configuration (lakes, peat, vegetation, substrate type ...). We also discuss the various process of ice formation in the soil, and how they evolve in favor of

either aggradation or degradation of permafrost, with their associated socio-economic consequences. The practical work involved in this course are exercises on concepts introduced in the theory: radiation balance and cloud types, interpretation of aerologic diagrams, interpretation of ocean T ° / Salinity / Density profiles in terms of hydrodynamic conditions, mass balance and zonation in glaciers, basal conditions in glaciers and melting point, interpretations of isotopic diagrams of deep ice cores, analyses of sedimentary structures

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 100%

Course title: Social-Ecological Systems
New course based on *Tropical biocomplexity: natural dynamics, indigenous interactions and sustainable management* and on *Biocomplexity and Systems Ecology.*
Course ID: BIOLF-4005
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Farid Dahdouh-Guebas (fdahdouh@ulb.ac.be) and Jean-Louis Deneubourg
Course website: http://www.ulb.ac.be/sciences/biocomplexity/education/Tropical_Biocomplexity_BING-F-526/
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs
- Exercises: 6 hrs
- Projects: 12 hrs

Course objectives:
Aims and objectives:
1. To provide an overview of complexity in biology from the level of organisms and their constituents to large-scale social-ecological systems (SES);
2. To understand diversity, redundance, stability, hysteresis and resilience in a functional ecological context;
3. To understand the ecological and social-ecological functioning of a global series of communities and ecosystems;
4. To understand the mangrove ecosystems as a model SES, incl. its constituents, ecology, natural and anthropogenically-induced dynamics, restoration, management and governance incl. scientific methods to monitor these.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

Upon completion of the course a student must be able
i. to situate organisms into their wider functional framework (community/ecosystem/Earth system);
ii. be able to critically assess their resilience in view of natural or anthropogenic change;
iii. to track down the ecological consequences on different sublevels (environment, fauna and flora) of anthropogenically induced changes on a focus SES;
iv. be able to situate environmental chalenges in a holistic context (relationship with socio-economical factors, governance).

Course material, text books and further reading:
- **Berkes**, F., J. Colding & C. Folke, **2003**. *Navigating Social-Ecological Systems. Building resilience for complexity and change*. Cambridge University Press, Cambridge, UK. 393 pp.
- **Carson**, W. & S. **Schnitzer**, **2008**. *Tropical Forest Community Ecology*. Wiley Blackwell, Oxford, U.K. 517 pp.
- **Chapin III**, S.F., G.P. Kofinas, C. Folke & M.C. Chapin, **2009**. *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World*. Springer Science, Dordrecht, The Netherlands. 402 pp.
- **Gunderson**, L.H. & L. **Pritchard** Jr., **2002**. *Resilience and the Behavior of Large-Scale Systems*. Island Press, Washington D.C., US. 287 pp.

- **Gunderson**, L.H., C.R. Allen & C.S. Holling, **2009**. *Foundations of Ecological Resilience*. Island Press, Washington D.C., US. 496 pp.
- **Hogarth**, P., **2007**. *The Biology of Mangroves and Seagrasses.* Oxford University Press Inc., Oxford, UK. 273 pp.
- **Waycott**, M., K. McMahon, J. Mellors, A. Calladine & D. Kleine, **2004**. *A guide to Tropical Seagrasses of the Indo-West Pacific.* James Cook University, Townsville, Australia. 72 pp.
and current international research publications

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The course structure follows a zoom from theoretical introduction (concepts, analytical tools) towards a global overview of SES and finally towards the mangrove forest as a model SES.

Part A: Biocomplexity and Systems Ecology

Understanding change and ecosystem management:
- definitions linked to SES, systems ecology and adaptive cycles;
- ecosystem services.

Social-ecological change, governance and stewardship:
- Ecological resilience and social-ecological resilience;
- Social-ecological governance and transformations in ecosystem stewardship;
- Adaptive management;
- Sustaining, renewing and adapting cultural connections

Ecological and socio-ecological individual-based models

Complexity at several levels in biology and ecology:
- Feedbacks and feedback networks from cells to ecology
- Dynamics and stationarity
- Hysteresis and multistationarity
- Thresholds
- Spatial patterns
- Rhythms
- Waves
- Chaos

Mathematical basis for understanding complexity and change:
- Equations
- Simulations
- Models

Dryland systems
Forest systems
Freshwater systems
Oceans and estuarine systems

Part B: Integrated Coastal Zone Management

The mangrove forest as a SES, describing constituents and relationships), the links with man and integrated research.
Part B I – Mangrove forests and adjacent systems and their biocomplexity: distribution of mangrove forests and adjacent systems; faunal and floral biodiversity, incl. morphological, physiological and

ethological adaptations to tropical environments and to intertidal and marine life; comparison of ecosystem function between mangrove forestsand adjacent systems; ecological mutual benefits between the tropical (coastal) ecosystems; food webs and trophic relationships.
Part B II – Ethnobiology/Socio-ecology and anthropogenical impacts on SES: spatial structures and natural dynamics; social, economical and cultural value and mangrove SES; anthropogenically induced threats on one or more ecosystems and the consequences for the other ecosystems; local vs. global patterns of change.
Part B III – Scientific research tools and approaches to study SES: monitoring, modelling and experiments (incl. management, restoration and conservation); the use of remote sensing and geographic information systems; combinatory and multivariate analyses; essentials of sustainable tropical habitat management**:** case-studies and management guidelines with respect to tropical ecosystems

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 60% (theory, paper discussion, model discussion)
Projects: 40%

Course title: River and lake ecology (botanical and zoological aspects)
Course ID: WE-DBIO-14575 / BIOL-F-458
University: Vrije Universiteit Brussel / Université Libre de Bruxelles
Faculty: Faculteit Wetenschappen en Bio-ingenieurswetenschappen / Sciences and Bio-engineering Sciences / Sciences
Department: Biologie / Biologie des Organismes
Name and e-mail address of the instructor(s): Ludwig Triest (ltriest@vub.ac.be) and Isabelle George (Isabelle.George@ulb.ac.be)
Course website:
http://www.vub.ac.be/en/study/biology/programme/r/master-of-science-in-biology/27767/emmc-tropical-biodiversity-and-ecosystems
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 36

Course objectives:
Review the interactions of abiotic and biotic aspects of rivers and lakes.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

After having successfully completed this course, the student should be able to:
- form an idea of the diversity of the geomorphological aspects and chemical composition of aquatic ecosystems
- know the role of functional groups (bacteria, phytoplankton, macrophytes, periphyton, zooplankton, zoobenthos, fish, birds)
- explain the main processes of a lake ecosystem as a function of seasonal variations and vertical gradients
- understand the way in which running waters function as an ecosystem to organisms
- interpret foodweb interactions and interpret field research results and experimental evidence

Course material, text books and further reading:
All illustrations used and a relevant text will be made available and should be complemented with individual notes. Recommended textbooks are **Kalff** Jacob (**2001**) *Limnology*. Prentice Hall; **Lampert** Winfried, **Sommer** Ulrich (**1997**) *Limnoecology: the ecology of lakes and streams*; Review articles and recent papers from scientific journals

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Selected contents on the introduction in freshwater ecology are about the distribution of water in the biosphere, the origin and age of lakes, the lake morphometry and catchment properties. The abiotic frame of standing or slow flowing aquatic systems is given by the characteristics of water, the salinity and ion composition, dissolved inorganic carbon, light under water, lake stratification and related oxygen conditions, redox reactions and nutrient cycling. The abiotic frame in rivers is given by the structural properties, catchment properties, physical characteristics, the chemical characteristics, daily and seasonal changes in physical and chemical characteristics. The ecology of temperate rivers and lakes are compared to tropical ecosystems.

The considered biotics are the phytoplankton, bacteria and viruses, benthic primary producers, zooplankton, zoobenthos (macroinvertebates in running waters), fish, water birds and amphibia. Their

relationship with abiotics, the osmotic pressure problems for animals, functional groups and biotic interactions are discussed in the context of various food web interactions. Emphasis is on shallow lakes and the concepts of cascading trophic interactions, alternative stable lakes, microbial loop, niche shifts, succession patterns, short term autogenic succession, long term succession, ageing and trophic concept of lakes. The anthropogenic influences on biodiversity and on natural processes are worked out for effects of eutrophication and of highly invasive exotic species. Important applied aspects of limnology are given on the principles of biomonitoring ecological water quality of rivers, the biomanipulation of shallow lakes, the properties of tropical lakes and the aquatic weed management.

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 100%

Course title: Marine biology
Course ID: BIOL-F-417 / WE-DBIO-5542
University: Vrije Universiteit Brussel / Université Libre de Bruxelles
Faculty: Faculteit Wetenschappen en Bio-ingenieurswetenschappen / Sciences and Bio-engineering Sciences / Sciences
Department: Biologie / Biologie des Organismes
Name and e-mail address of the instructor(s): Philippe Dubois (Philippe.Dubois@ulb.ac.be) and Marc Kochzius (Marc.Kochzius@vub.ac.be)
Course website:
http://www.vub.ac.be/en/study/biology/programme/r/master-of-science-in-biology/27767/emmc-tropical-biodiversity-and-ecosystems
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 18 hrs
- Exercises: 9 hrs
- Excursions: 9hrs

Course objectives:
To provide a sound introduction to biotic and abiotic proceses controlling marine ecosystems

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

After this course the student will have a general overview on oceanography and the most important marine ecosystems and know how to search for data sources to supplement the learning material, make an analysis and synthesis of the course material and present and transfer the acquired knowledge

Course material, text books and further reading:
• Lecture slides
• Castro P, Huber ME (2010) Marine biology. MacGraw-Hill, New York, 8. Edition
• Thurman HV, Trujillo AP (2004) Introductory oceanography. Pearson Prentice Hall, New Jersey, 10. Edition
• Nybakken JW, Bertness MD (2004) Marine biology – an ecological approach. Pearson Benjamin Cummings, San Francisco, 6. Edition
• Kaiser et al. (2005) Marine ecology – processes, systems, and impacts. Oxford University Press, Oxford

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Physical and chemical properties of sea water. Introduction to oceanic circulation and climate impact. Processes controlling pelagic ecosystems. Processes controlling benthic ecosystems. Examples of pelagic and benthic ecosystems: the Antarctic ocean, seagrass beds, coral reefs.

Selected topics in marine biology: adaptations of algae to hydrodynamism; recruitment of marine larvae: a case study with sea urchins; adhesion and adhesive substances in the marine environment, introduction to marine microbiology

This course also provides an overview on the history of marine research and technology, oceanography (incl. intertidal zones, estuaries, the continental shelf, the open ocean and the deep sea) and dicusses human impact on them.

Assessment breakdown:	please note the general comment on assessment breakdown
Oral assessment: 100%	

Course title: Tropical parasitology and entomology
Course ID: BIOL-F-428
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Yves ROISIN (Yves.Roisin@ulb.ac.be)
Course website: http://www.ulb.ac.be/catalogue-ancien/sciences/cours/BIOL-F-428-en.html
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 18
- Projects: 18

Course objectives:
Integrated pest management (IPM) and methods of control avoiding chemical insecticides in tropical regions. To collect and summarize up-to-date information about a particular tropical insect pest problem, with the perspective of eventual management.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Community

To pinpoint and illustrate by examples the special difficulties encountered in tropical regions regarding management of insect pests.

Course material, text books and further reading:
Web site: FAO, Plant production & protection: http://www.fao.org/waicent/st/level_1.asp?main_id=13 Crop Protection Compendium (CD-set). CABI, Wallingford, UK. Handbook of Pest Management in Agriculture (3 volume-set). D. Pimentel (editor). CRC Press, 1981. Pests of Crops in Warmer Climates and Their Control. D.S. Hill. Springer Verlag, 2008.

Prerequisites: please note the general comment on prerequisites
Good notions of general entomology

Table of contents:
Generalities.
Tropical climates.
Particularities of tropical conditions for agriculture.
Pesticide use in the tropics
Generalist pests: mites, sap-sucking insects, generalist moths, migratory locusts, social insects.
Biology, damage, economical impact, control methods
Pests of cereals.
Pests of fruits and fruit trees.
Forestry pests
Examples of recent pest outbreaks
Conclusions.
Precautions and management methods.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Biology of animal societies
Course ID: BIOL-F-455 / WE-DBIO-12585
University: Université Libre de Bruxelles and Vrije universiteit Brussel
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Yves ROISIN (Yves.Roisin@ulb.ac.be)
Course website:
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 12 hrs

Course objectives:
The question behind this course is 'How did animal societies evolve, from loose aggregations or basic mother-offspring groups to highly complex army ant colonies or baboon troops ?'

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Community

Students are expected to acquire (1) an overall view of the diversity of social organization pattrens in animals, (2) a basic theoretical knowledge of how natural selection acts upon animal societies, and (3) the ability to identify such selective pressures through the formulation and testing of hypotheses and predictions.

Illustrated lectures. Personal essay: each student will read in detail a scientific paper related to the social behaviour of a selected animal species, and summarize theoretical background, aim of the study, results and conclusion (take-home message), course taught in English.

Course material, text books and further reading:
Sociobiology: The New Synthesis. E.O. Wilson. Harvard University Press, 1975. Les Sociétés Animales. S. Aron, L. Passera. De Boeck Université, 2000.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Levels of sociality ▫ Theoretical introduction natural selection in animal societies: altruism and selfishness, reciprocity, kinship, inclusive fitness, etc ▫ Levels of sociality ▫ Sociality in Arthropods. From simple parental behaviour to complex termite colonies ▫ Social Hymenoptera: theoretical implications of haplodiploidy ▫ Evolution of highly social bees, wasps and ants ▫ Skew models ▫ Cooperatively breeding vertebrates. Kin selection, parental manipulation, reproductive skew, and importance of ecological conditions: examples from cichlid fishes and birds ▫ Mammals. Examples from social carnivores and primates. Insect-like sociality in rodents (mole-rats). Conclusions: common features of all animal societies. Methods of investigation in sociobiology.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Governance and policy in development and cooperation
Course ID: WE-DBIO-14386
University: Vrije Universiteit Brussel
Faculty: Faculteit Wetenschappen en Bio-ingenieurswetenschappen / Sciences and Bio-engineering Sciences
Department: Biologie
Name and e-mail address of the instructor(s): Nico Koedam (nikoedam@vub.ac.be)
Course website:
http://www.vub.ac.be/en/study/biology/programme/r/master-of-science-in-biology/27767/emmc-tropical-biodiversity-and-ecosystems
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 12
- Exercises: 12

Course objectives:
General
- Evaluate the societal relevance (I)
- Evaluate the scientific relevance (II)
- Report in various ways (III)

Field specific
- Problem solving as a thinking process (IV)
- Extrapolation between different scientific fields (VI)
- Recognize and work out bio-ethical implications (VII)

The course objectives are not targeted to one particular scientific discipline, but intend to set the framework of successful translation of scientific data and scientific theory to governance and policy, with an emphasis on aquatic and semi-terrestrial systems in developing countries.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Global

Course material, text books and further reading:
No specific textbook is used. Besides recent material from the literature and media, the following books can be useful:
Rist G 2008 The history of development. From Western origin to global faith. ZED Books, London
Sachs W (ed.) 2010 The development dictionary. ZED Books, London.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Within the wide field covered by the course title, specifically attention is paid to frameworks that facilitate or impede the translation of science to policy and governance. Target systems and areas for this course are the aquatic and semi-terrestrial systems in tropical and subtropical developing countries. The course is given in the perspective of a scientist and addresses an audience of scientists.

The course covers two different aspects : a conceptual part and a practical part.

For the conceptual part, specific problems that may be dealt with are: scientific uncertainty vs. governance and policy, commons and the public/private debate in environmental management, the scientist's responsibility and the value of science or scientific data, the value of biological resources in view of governance and policy.

For the practical part surveys are made of relevant international bodies, agreements, treaties and other tools, donor agencies.

The work forms comprise: lectures, seminars by or interviews with societal sectors or actors. For the external seminars a wide coverage of political levels and geographical regions is offered (NGO, regional government, national government, EU,…). Since many students already have a professional background, this expertise can be introduced in debate and dialogue.

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 100%

Course title: Plant-soil interactions
Course ID: BIOL-F-444 / WE-DBIO-12596
University: Université Libre de Bruxelles and Vrije Universiteit Brussel
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Pierre MEERTS (Pierre.Meerts@ulb.ac.be)
Course website:
http://banssbfr.ulb.ac.be/PROD_frFR/bzscrse.p_disp_course_detail?cat_term_in=201112&subj_code_in=BIOL&crse_numb_in=F444&PPAGE=ESC_PROGCAT_AREREQ&PPROGCODE=MA-BIOR&PAREA=BIOR5T&PARETERM=201112&PTERM=201112
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 12 hrs

Course objectives:
To analyse the role of plant-soil interactions on plant community structure and ecosystem functioning. To examine the influence of soil limiting factors, especially toxic mineral elements, on plants.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Organism

To be able to critically discuss the role of plant-soil interactions on plant community structure and ecosystem functioning. To be able to propose specific working hypotheses, to design simple experimental protocols to test them, and to propose appropriate statistical tests.

Course material, text books and further reading:
Course notes.
W. H. **Schlesinger**, **1997**. *BIOGEOCHEMISTRY: An Analysis of Global Change*, Academic Press, 1997.
Chapin, Matson, and Mooney, **2002**. *Principles of Terrestrial Ecosystem Ecology*. Blackwell.
Lambers, H., F. S. Chapin III, and T. L. Pons **1998**. *Plant physiological ecology*. Springer-Verlag, Berlin.

Prerequisites: please note the general comment on prerequisites
Elements of ecology
None

Table of contents:
Variation of plant mineral element concentrations: genetic and environmental factors. Influence of plants on biogeochemical cycles in terrestrial environments Adaptation of plants to low nutrient soil. Adaptation and evolution on geochemical anomalies. Biotic interactions in the soil and their role in biological invasions. Influence of soil on species richness of plant communities.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100% (including discussion of scientific paper)

Course title: Behavioural ecology in natural and man-made environments
Course ID: BIOL-F-436 / WE-DBIO-14359
University: Université Libre de Bruxelles and Vrije Universiteit Brussel
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Claire DETRAIN (Claire.Detrain@ulb.ac.be)
Course website:
http://banssbfr.ulb.ac.be/PROD_frFR/bzscrse.p_disp_course_detail?cat_term_in=201112&subj_code_in=BIOL&crse_numb_in=F436&PPAGE=ESC_PROGCAT_AREREQ&PPROGCODE=MA-BIOR&PAREA=BIOR4A&PARETERM=201011&PTERM=201112
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 12 hrs

Course objectives:
To get an overwiew of current trends in behavioural ecology with an emphasis on animal communication and its evolution. To understand the ultimate and proximate causes driving the behaviour of animal species in their natural environement To provide a comparative analysis of the main vectors of information and to discuss about their biological function mainly in insects and vertebrates.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Population

The student should be able:
- to discuss the mechanisms and constraints that impact the behavioral strategies of animals in natural populations
- to form an idea of the diversity of communication at different biological levels (individual, populations, communities)
- to understand how animals process information and make adaptive decisions
- to critically analyze data in the field of behavioural ecology and ethology.

Course material, text books and further reading:
Kreb, J.R. & N.B. Davies, 2000. *An Introduction to Behavioural Ecology*. Wiley Blackwell. 200 pp.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Historical background and main trends in Behavioural Ecology. Analysis of foraging and habitat selection within a behavioural ecology perspective. Definition of communication and language. Comparative study of communication vectors (acoustical, visual, chemical). Sensory channels and perception. Structures and function of signals and cues. Cognition and linguistic abilities in animals. Introduction ot information theory. Information transfer and collective decision in animal societies.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Global change biology
Course ID: 4020582FNR
University: Vrije Universiteit Brussel
Faculty: Sciences and Bio-engineering Sciences
Department: Biology
Name and e-mail address of the instructor(s): Iris Stiers (istiers@vub.ac.be)
Course website: https://www.vub.ac.be/en/study/fiches/55764/global-change-biology
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 13 hrs
- Seminars, exercises, practicals, field training: 6 hrs
- Independent or external form of study: 7 hrs

Learning outcomes: please note the general comment on learning outcomes

Upon sussecful completion of the course the student must have:
- acquired a broad understanding of the connection between human activities and the structure and function of biological systems
- enhanced the ability to engage primary research and synthesize data within research articles
- achieved a higher level of critical thinking that enables proper evaluation and educated decision-making regarding issues in global change

Course material, text books and further reading:
No specific textbook is used.
Course slides and research articles

Prerequisites: please note the general comment on prerequisites
None

Content:
We live in a world where humans are having profound impacts on the global environment. The challenges are formidable and reflected in the view that a geological era, the Anthropocene should be delimited. Climate is warming, the populations of many species are in decline, eutrophication is affecting ecosystems and human health, and human societies now face new risks in terms of food security and natural disturbances. Using case studies, this course will illustrate the concepts of key drivers of global change and the impact on human society and ecological systems. Guest speakers from various professional sectors which are experts in their respective domains illustrate their specific view and approach of the problem.

LECTURES

Drivers of global change:
- human population and consumption
- loss and fragmentation of natural habitats, biodiversity loss
- eutrophication
- biological invasions
- toxic chemical pollution and exposure

Impact on human society and ecological systems:
- community responses (population declines and extinction, adaptation/evolution)
- ecosystem responses
- human society responses (heath, food security, natural disturbances)

Exercises:
Group discussion around case studies based on reading assignments

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment with written preparation: 80%
Participation in group discussions: 20%

Course title: Guided self-study
Course ID: WE-DBIO-14647
University: Vrije Universiteit Brussel
Faculty: Wetenschappen en Bio-ingenieurswetenschappen
Department: Biologie
Name and e-mail address of the instructor(s): President of the Department
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:
- Projects: 72 hrs

Course objectives:
The course aims at understanding the fundamental or applied basis of one particular issue in science related to tropical biodiversity and ecosystems.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Methods and tools

To able to find and discus all necessary scientific information with respect to a scientific topic related to tropical biodiversity and ecosystems, to state and justify the scientific problem and to design ways to assess this by formulating scientific questions and true or expected results. To be able to defend the findings orally.

Course material, text books and further reading:
Scientific literature.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Several possibilities are offered:
(1) A topic can be chosen for an in-depth literature study by the student in agreement with the coordinator and a supervisor. The topic does not have to be in line with the research of the supervisor but must fall within his/her capacity. This study represents about 13-15 days of full-time work for the student with regular supervision sessions to monitor the progress of the student. The student is guided progressively toward one highly specialized research topic (not "a bit of everything approach"). For example, first the student should learn the basis by reading several book chapters on the topic, then a few recent reviews. The student will then read, analyze and fully understand at least 5 detailed recent scientific papers related to the same specialized topic. Topics in the light of MSc or PhD research can be accepted. The student will have to present a written document and present it orally.
(2) For students with particular shortcomings (*e.g.* because of atypical previous studies), it should be a study of a series of book chapters aiming at filling that particular gap of knowledge.
(3) Alternatively, the student can choose to follow a course of his choice external to the TROPIMUNDO program (after approval of the coordinator). The teacher must be informed and must transmit the exam points to the exam coordinator and teacher.
For both (2) and (3) the student will still have to present the topic or the external course as detailed in (1).

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 50%

Oral assessment: 50%

**Course descriptions at Université Pierre et Marie Curie (UPMC)
and Muséum National d'Histoire Naturelle (MNHN)**

Course title: Statistiques et traitement des données
Course ID: TC03
University: Muséum National d'Histoire Naturelle
Faculty: Enseignement supérieur / Recherche
Department: Systématique et Evolution
Name and e-mail address of the instructor(s): Michel Baylac (michel.baylac@mnhn.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 15h
- Exercises: 15h

Course objectives:
The course aims at analysing data using uni-, bi- and multivariate statistics. The course includes an introduction to the statistical package R, with lectures on its langage, its graphical interface and its statistics.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

Students should be able to manage numerical information using the main basic elements of data management as well as to identify the properties of the sample space with the aim to apply more structured methods (multivariate analysis, geostatistical analysis, time series analysis). They should be able to use the statistical software package R for basic data analysis.

Course material, text books and further reading:
Course notes.
Internet R resources.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Based on existing knowledge of the bases of probability and statistics, this course aims to detail the use of statistics applied to the treatment of experiment and observation data in life sciences. The course will present an overview of experimental design, exploratory data analysis, and of the most important tools in parametric and non-parametric statistics.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Problématiques actuelles en biodiversité (tropicale)
Course ID: PAB
University: Université Pierre et Marie Curie
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): François Sarrazin (francois.sarrazin@mnhn.fr) and Régine Vignes-Lebbe (regine.vignes_lebbe@upmc.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 20 hrs
- Exercises: 10 hrs
- Projects: 10 hrs

Course objectives:
Cette unité d'enseignement (UE) a pour objectif de présenter les problématiques actuelles au cœur des travaux de recherche fondamentale ou appliquée consacrés à la biodiversité (tropicale) et ce sur un large spectre de la systématique et la paléontologie à l'écologie des populations, des communautés ou des ecosystèmes (tropicaux) et la conservation. Le but n'est pas ici de fournir des connaissances de base dans tous ces domaines mais de montrer au travers de conférences ou de séminaires ouvrant au débat les enjeux présents et futurs liés à ces recherches.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Interaction Biological level: Community

Pouvoir comprendre et expliquer les problématiques actuelles en biodiversité tropicale en utilisant des exemples écologiques, historiques, comportamentale, climatique ou gestionnaires.

Course material, text books and further reading:
•Hedrick, P. 1995. Gene flow and genetic restoration : the Florida Panther as a case study. Conservation Biology 9, 996-1007.
•Rosenzweig M.L., 2001. The four questions : What does the introduction of exotic species do to diversity ?, in Evolutionary Ecology Research, 3, p. 361-367.
•Simberloff, 1998. Flagships, umbrellas and keystones : is single-species management passé in the landscape era ? Biological Conservation 83, 247-257
•Thomas, C.D. et al. 2004. Extinction risk from climate change. Nature 427, 145-148
•Tilman, et al. 2001. Forecasting agriculturally driven global environmental change. Science, 292, p. 281-284

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Les thèmes possibles sont donnés à titre d'exemple, ces enseignements se voulant très réactifs par rapport à l'actualité scientifique
•Définitions et évaluation de la biodiversité
•Histoire des grands groupes taxonomiques
•Ecologie evolutive
•Ecologie comportementale
•Fonctionnement des écosystèmes

- Relation biodiversité changements globaux
- Interaction durables, coevolution, epidemiologie
- Conservation et gestion de la biodiversité

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 60%
Oral assessment: 40%

Course title: Bases (avancées) de la taxonomie
Course ID: SEP01 / MU202
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Régine Vignes-Lebbe (regine.vignes_lebbe@upmc.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises: 30 hrs
- Projects: 6 hrs

Course objectives:
Enseignement centré sur l'exposé des idées, principes et méthodes de base propres à la systématique, plus que sur la présentation de ses résultats. Les cours concernent l'ensemble des étapes du travail des systématiciens de la collecte des spécimens, à la représentation des phylogénies et des clés d'identification, et sont accompagnés de TD appliqués à des groupes taxonomiques variés.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Interactions Biological level: Organism

Connaitre les bases méthodologiques (taxonomiques) pour une identifier un organisme de façon non ambigue et de designer correctement les taxons (végétales ou animales).

Course material, text books and further reading:
Littérature scientifique sur la taxonomie animale et végétale, sur leur phylogenies, et sur les methodologies de classification.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Les principes de base et les objets de la systématique : organismes, taxons, caractères ; Brève histoire de la systématique et des classifications ; De l'observation des données aux descriptions taxonomiques ; Utilisation, constitution des collections ; Nomenclature biologique ; Clés et autres méthodes d'aide à l'identification ; Introduction à la formalisation et l'informatisation des connaissances (bases de données et de connaissance).

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 50%
Oral assessment: 50%

Course title: Bases (avancées) de la phylogénétique
Course ID: SEP08 / MU203
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Pascal Tassy (pascal.tassy@mnhn.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 6

Course breakdown and hours:
- Lectures: 37 hrs
- Exercises, Praticals and Projects: 23 hrs

Course objectives:
Les bases de la phylogénétique avec une présentation comparatives des différentes méthodes d'analyse (cladistique, phénétique, probabiliste, analyse-à-trois-éléments).

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Plant Biological level: Organism

Comprendre et pourvoir situer la phylogénie des organismes et pouvoir les comparer entre eux. Etre capable d'utiliser des methods d'analyses phylogénétiques.

Course material, text books and further reading:
Raven, P.H., R.F. Evert & S.E. Eichhorn, 2007a. Biologie Végétale. 2ème Edition. De Boeck Université, Louvain-la-Neuve, Belgique. 870 pp.
John C. Avise, 2000. Phylogeography: the history and formation of species. Harvard University Press.
John C. Avise, 2004. Molecular markers, natural history, and evolution. Sinauer Associates, Inc. Pub.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Concepts fondamentaux : notions d'homologie, alignement de séquences, apomorphie-plésiomorphie, mono-paraphylie, mesures de l'homoplasie, enracinements, tests phylogénétiques des scénarios évolutifs, biogéographie, classifications phylogénétiques.
Manipulation en TD de logiciels d'analyse phylogénétiqu.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 60%
Oral assessment: 40%

Course title: Initiation aux milieux tropicaux
Course ID: SEP56 / MU510
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Anne Fournier (anne.fournier@ird.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Projects: 6 hrs

Course objectives:
Ce module introduit, autour de l'idée de biome, quelques grands thèmes qui éclairent les particularités des régions tropicales concernant leur biodiversité et leurs écosystèmes. Ces thèmes sont illustrés par une approche théorique et des études de cas présentées dans un esprit concret et multidisciplinaire.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Ecosystem

Connaitre les elements biotiques et abiotiques des ecosystems tropicaux et comprendre le fonctionnement. Situer les connaissances et la recherche sur la biodiversité et les ecosystems tropicaax d'un côté, et la gestion de ces ecosystems de l'autre côté, dans un cadre pluridisciplinaire.

Course material, text books and further reading:
- Puig, H., 2001. La Forêt Tropicale Humide. Editions-Belin, Paris, France. 448 pp.
- Hogarth, P., 2007. The Biology of Mangroves and Seagrasses. Oxford University Press Inc., Oxford, UK. 273 pp.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Les caractéristiques et fonctionnements des sols et des climats tropicaux sont présentées ainsi que les approches relatives à l'impact des changements globaux sur la végétation et la flore. La question de l'exploitation et de la gestion des milieux végétaux tropicaux et de leurs conséquences est ensuite traitée à l'aide des exemples de l'élevage et des feux de végétation.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Langues etrangères
Course ID: TC02 (MNHN) ou MXAN1 (UPMC)
University: Muséum National d'Histoire Naturelle or Université Pierre et Marie Curie
Faculty: Enseignement supérieur / Recherche
Department: Hommes, Natures, Sociétés (MNHN) or Departement des Langues (UPMC)
Name and e-mail address of the instructor(s): Philippe Hindley (hindley@mnhn.fr), Véronique Charrière (veronique.charriere@upmc.fr)
Course website: to be posted
Semester: S1
Tuition language: French or English.or another language.
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 22 hrs
- Exercises: 8 hrs

Course objectives:
L'objectif est d'améliorer le niveau en langues parlé et écrit des étudiants de master, en particulier dans les domaines scientifiques dans lequel ils ont choisis de se spécialiser.
Apprendre à comprendre un article scientifique et à rédiger rapidement en Anglais.

Les enseignements prendront 2 formes :
- Des applications très concrètes: analyses d'articles scientifiques, écoute et compréhension d'émissions scientifiques, débats, présentations orales (avec correction). Expression orale en petits groupes.
- Des approfondissements spécifiques sur des points de grammaire ou de langage particuliers soulevés lors de ce travail par les étudiants eux-mêmes.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Global

S'améliorer dans une langue (compréhension, parlé, écriture).

Course material, text books and further reading:

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
L'objectif principal du programme anglais scientifique est de rendre les étudiants opérationnels en anglais dans un milieu scientifique. Les étudiants ont 30 heures de cours au premier semestre dispensés en 2 sessions d'une heure et demie chacune par semaine. La première session est assurée par un scientifique. Les étudiants, en utilisant une méthodologie scientifique, apprennent à donner une communication scientifique en anglais en faisant des présentations orales à partir d'articles de recherche. La deuxième session, assurée par un linguiste, est centrée sur la langue. Les étudiants apprennent à : aborder (lecture et écrit) un article de recherche ; concevoir un poster scientifique ; rédiger des emails, des rapports et des lettres formelles. Ils travaillent également leurs compétences de compréhension et d'expression orales dans un contexte scientifique.

Assessment breakdown: please note the general comment on assessment
L'évaluation : travail sur les présentations orales (40%) ; travail sur la langue (20%) et l'examen final (40%).

Course title: Insertion professionnelle / OIP
Course ID: MU552
University: Université Pierre et Marie Curie / Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Fabienne Audebert (fabienne.audebert@upmc.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
Exercises: 20 hrs
Projects: 10 hrs

Course objectives:
Objectifs : Opérationnaliser son projet professionnel, le définir, l'argumenter, trouver les entreprises ou laboratoires en adéquation avec le projet, maitriser les processus de recrutement (CV, lettre de motivation, entretiens…)

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: methods and tools

Savoir définir son projet professionnel et préparer les outils permettant d'accéder aux formations associées ou au marché de l'emploi.

Course material, text books and further reading:
La formation se base sur l'étude des documents (CV, lettres de motivation…) fournis par les étudiants

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Présentation personnelle ; présenter, discuter son projet professionnel et communiquer sur ses compétences ; préparer son projet, évaluer les formations et le marché de l'emploi ; analyse des CV et des lettres de recommandation ; ressources en ligne sur les formations et le marché de l'emploi.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 50%
Oral assessment: 50%

Course title: Climate et biotope (c/o Grandes Questions Environnementales)
Course ID: GQE
University: Université Pierre et Marie Curie
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): H. Chepfer (chepfer@lmd.polytechnique.fr), L. Abbadie (abbadie@biologie.ens.fr) and P. Huchon (philippe.huchon@upmc.fr)
Course website: http://admweb.lmd.polytechnique.fr/M1SDUEE/index.php/Accueil
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Projects: 6 hrs

Course objectives:
L'UE MU002 vise à donner à l'ensemble des étudiants inscrits en 1ère année du Master une vision pluridisciplinaire et transversale des questions sur l'environnement terrestre et planétaire. il s'agit de démontrer que l'approche de l'étude de l'environnement, de sa biodiversité, est liée à des concepts et théories écologiques qu'il est nécessaire de confronter avec les autres sciences afin de proposer des modèles et scénarios de gestion de l'écosystème.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Interactions Biological level: Global

A la fin du cours les étudiants doivent être capable de détailler les modes de variabilité naturelle du climat et les mécanismes mis en jeu: les cycles de Milankovitch (théorie astronomique du climat), l'oscillation Nord-Atlantique, les phénomènes El-Niño / La Niña, les grandes éruptions volcaniques. L'effet de serre atmosphérique et naturel et la température de la Terre. Les activités humaines et les perturbations du climat. Ecrire un modèle simple du bilan radiatif de la Terre, et introduire la notion de « sensibilité climatique ».

Course material, text books and further reading:
Climat d'hier et d'aujourd'hui. (1999) S. Joussaume. CNRS Edition
Is the temperature rising ? (1998) S. G. Philander. Princeton Univ Press
Comprendre le changement climatique. (2007) Editeurs : J.L. Fellous et C. Gautier. O. Jacob
Panorama de la Physique (2007) Ed Belin
Sur les origines de l'effet de serre et du changement climatique, S. Arrhenius, T. C. Chamberlin, J. Croll, J. Fourier, C. Pouillet, J. Tyn

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:

Assessment breakdown: breakdown Written assessment: 50% Oral assessment: 50%	please note the general comment on assessment

Course title: Géomatique, SIG, Télédétection
Course ID: MU012
University: Université Pierre et Marie Curie
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Alain Rabaute (alain.rabaute@upmc.fr) ; Rémi Michel (remi.michel@upmc.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
Lectures: 14 hrs
Exercises: 16 hrs

Course objectives:
Objectifs : Formation des étudiants aux méthodes numériques en appliquant le traitement du signal, de l'image et les SIG à des thèmes et des données issus des Sciences de la Terre et des Sciences de la Vie.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Interactions Biological level: global

Connaître les bases mathématiques et algorithmiques liées aux SIG et à la télédétection, et introduction aux principaux outils et logiciels

Course material, text books and further reading:
Les systèmes d'information géographiques (2004) Jean Denègre et François Salgé, éditions PUF, collection Que sais-je ?
Analyse spatiale de l'information géographique (2011) Régis Caloz et Claude Collet, PPUR

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Que sont les SIG et la télédétection ? Quelles données pour les SIG ? Quels traitements ? Quelles applications en Sciences de la Terre et Sciences de la Vie ?

Assessment breakdown: please ote the general comment on assessment breakdown
Written assessment: 60%
Oral assessment: 40%

Course title: Sciences de la nature et de l'homme: histoire des idées
Course ID: TC01b
University: Muséum National d'Histoire Naturelle
Faculty: Muséum
Department: Régulations, Dévelopement et Diversité Moléculaire
Name and e-mail address of the instructor(s): Pascale Debey (debey@mnhn.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs

Course objectives:
A travers l'histoire de grands courants de la pensée scientifique et leur évolution au cours des siècles, ce module vise à montrer aux étudiants qui feront leur cursus au Muséum quelles ont été les grandes étapes des recherches en Sciences de la Nature et de l'Homme dans lesquelles le Muséum a été impliqué. Il montrera comment se sont entrecroisés et respectivement nourris des domaines de recherche tels que la géologie, la paléontologie, la systématique, la biologie animale et végétale, l'anatomie comparée, la génétique, la génomique, l'anthropologie, l'écologie, l'histoire des sciences, la muséologie.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Global

Acquérir une ouverture intellectuelle et scientifique sur un domaine qui ne concerne pas directement la biodiversité et les environnements tropicaux.

Course material, text books and further reading:
Notes de cours. Livres disponibles au Muséum.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Des conférences de haut niveau dispensées le matin s'accompagnent de visites de collections fossiles et vivantes du Muséum, et de présentations du travail sur ces collections (zoothèque, anatomie comparée, cryptogamie/phanérogamie, Jardin Botanique, Conservatoire Botanique, galerie de Paléontologie, galerie de Minéralogie, collections de préhistoire, etc.).

Thématiques :
Séminaire: Génétique - Gènes - Génomes: introduction pour les non biologists
Séminaire: Evolution des génomes de vertébrés
Excursion: Galerie de Paléontologie
Séminaire: A la découverte de l'origine des mâchoires
Excursion: Galerie d'Anatomie Comparée
Table ronde: Des gènes aux formes
Séminaire: L'origine des éléments chimiques : de la physique nucléaire à la collection de météorites du Muséum
Séminaire: La Crise Crétacé-Tertiaire et la non-extinction des dinosaures
Excursion: Serres du Muséum
Séminaire: Grands singes et hommes : une histoire partagée
Séminaire: Les plus anciens peuplements humains d'Eurasie

Séminaire: Lecture moléculaire de l'histoire de l'Homme
Excursion: Collections de l'Institut de Paléontologie Humaine
Séminaire: Animaux consommés/animaux figurés au Paléolithique supérieur en Europe
Séminaire: Evolution de la biodiversité et anthropisation durant les 10 000 dernières années : les données de l'archéologie
SéminaireLes menaces qui pèsent sur la biodiversité
Séminaire: Les espèces, pierres angulaires de la connaissance de la biodiversité et de la compréhension des origins
Table ronde: Discussion avec les étudiants et présentation des modalités d'évaluation.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Droit du patrimoine naturel in situ et ex situ
Course ID: TC04
University: Muséum National d'Histoire Naturelle
Faculty: Enseignement supérieur / Recherche
Department: Hommes, Natures, Sociétés
Name and e-mail address of the instructor(s): Jean-Dominique Wahiche (wahiche@mnhn.fr)
Course website: to be posted
Semester: S1
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 22 hrs
- Exercises: 8 hrs

Course objectives:
Cet enseignement a pour but de donner aux étudiants les bases et les principes juridiques de la préservation et de la gestion du patrimoine naturel.
L'introduction permettra aux étudiants de disposer des outils indispensables à la compréhension tant du reste du cours qu'au fonctionnement des institutions.
Le patrimoine *in situ*, faune, flore et minéraux, sont dans la nature aujourd'hui protégés en tant que tels. Pourquoi et comment en est-on arrivé là ? Jusqu'où va la protection de l'environnement, de quels moyens dispose-t-on ? Quelle est l'efficacité des dispositifs actuels et quelle évolution peut-on attendre ? Quelles sont les questions actuelles relatives à la biodiversité et aux populations autochtones qui affectent notamment la recherche scientifique, la propriété intellectuelle et les équilibres Nord-Sud ?
Dans le musée, le patrimoine naturel devient patrimoine culturel *ex situ* et change radicalement de statut. S'applique alors largement le droit des collections publiques. Toutefois, les spécimens d'histoire naturelle, une fois dans le musée, gardent certains traits juridiques de leur existence précédente dans la nature.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Global

Comprendre les bases et les principes juridiques de la préservation et de la gestion du patrimoine naturel.

Course material, text books and further reading:
Notes de cours.
Guillot, P.Ch.A., 2006. Droit du patrimoine culturel et naturel. Ellipses. 160 pp.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Qu'est-ce que le Droit ? · La hiérarchie des normes · Histoire et évolution du Droit de l'environnement · Le patrimoine naturel, objet ou sujet de droit ? · Les acteurs du Droit de l'environnement - La responsabilité des Etats · Les grandes conventions internationales relatives à la biodiversité · La convention de Rio sur la diversité biologique : organisation, gouvernance et fonctionnement - La convention de Rio sur la diversité biologique : questions de fond - La recherche scientifique relative à l'environnement : droits et devoirs, accès à la biodiversité, partage des avantages et propriété intellectuelle · Le développement durable et l'agenda 21. La valeur économique de la nature · L'Union Européenne et l'environnement. Les Directives Habitat et Oiseaux · Le droit de la mer et les biotechnologies marines -Le droit des populations autochtones et les connaissances traditionnelles.

Assessment breakdown: breakdown Written assessment: 50% Oral assessment: 50%	please note the general comment on assessment

Course title: Initiation aux techniques avancées de collecte et d'inventaire systématique
Course ID: SEP18 / NU826
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Jean-Yves Dubuisson (jean-yves.dubuisson@upmc.fr) and Christine Rollard (christine.rollard@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Projects: 4 hrs
- Excursions: 4 days

Course objectives:
Approffondir les différentes techniques de collectes et d'inventaires dans des milieux variés ainsi qu'à l'identification à partir de matériel collecté.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Methods and tools

Aquérir des savoirs-faires avancés dans les techniques interdisciplinaires de collectes et de l'inventaire.

Course material, text books and further reading:
Articles scientifiques.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Caractérisation des milieux. Approche géologique des zones prospectées. Aspects écologique, biologique et systématique sur divers groupes zoologiques et botaniques avec apport paléontologique.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Diversité et histoire des lignées chlorophyliennes (DIVEG)
Course ID: SEP04 / NU944
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Jean-Yves Dubuisson (jean-yves.dubuisson@upmc.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 40 hrs
- Exercises: 20 hrs

Course objectives:
Cette unité de recherche se propose de préciser dans un cadre historique et évolutif détaillé l'organisation desprincipaux phylums d'« algues » et de plantes terrestres (Embryophytes) et les événements clés qui ont caractérisé cette évolution. Par exemple, les hypothèses sur l'origine multiple des plastes (et donc des diverses lignées chlorophylliennes), sur l'origine des plantes terrestres ou de la fleur seront détaillées. Les étudiants auront également l'occasion d'observer des organismes fossiles qui seront comparés avec les actuels, afin d'illustrer l'histoire qui a produit la diversité végétale actuelle. Dans un cadre épistémologique, les différentes classifications (systèmes artificiels, classifications naturelles traditionnelles, gradistes ou cladistiques) seront exposées et comparées. La formation pratique intégrera les différentes méthodes d'identification des organismes végétaux.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Organism

Montrer des connaissances approfondi de l'organisation et de l'évolution des principaux lignées chlorophyliennes. Pouvoir lier cette évolution aux événements clés géologiques.

Course material, text books and further reading:
Notes de cours. Articles scientifiques.
Raven, P.H., R.F. Evert & S.E. Eichhorn, 2007. Biologie Végétale. 2ème Edition. De Boeck Université, Louvain-la-Neuve, Belgique. 870 pp.
Raven, P.H., G.B. Johnson, JB. Losos & S.S. Singer, 2007. *Biologie*. De Boeck Université, Louvain-la-Neuve, Belgique. 1250 pp.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Les premières cellules autotrophes et les cyanobactéries - Origine des plastes et endosymbioses - Les principaux phylums d'algues - Diversité et évolution des Embryophytes : des premières plantes terrestres aux Spermatophytes et aux Angiospermes - Notions et méthodologies en identification et floristique (analyse florale). Le niveau de ce cours est avancé.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Xylologie-paléoxylologie: systématique et paléoécologie
Course ID: SEP28 / NU830
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Dario De Franceschi (dario.de-franceschi@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 10 hrs
- Exercises: 15 hrs
- Lab work: 15 hrs

Course objectives:
Le cours vise une reconnaissance des indications fournies par les caractères microscopiques du bois en systématique, phylogénie et écologie. Application aux bois fossiles pour la reconstruction des paléoflores et des paléoenvironnements.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Organism

Reconnaitre les caractères microscopiques du bois (coupe récentes comme fossiles) en systématique, phylogénie et écologie et pouvoir reconstruer des paléoflores et des paléoenvironnements à l'aide de ces cacatères.

Course material, text books and further reading:
Notes de cours. Articles scientifiques.
Baas, P., 2010. *New Perspectives in Wood Anatomy*. Springer, Germany. 264 pp.
Wilson, K. & D.J.B. White, 2006. *Anatomy of Wood: Its Diversity and Variability*. Stobart Davies Limited, 316 pp.
Carlquist, S., 2001. *Comparative Wood Anatomy: Systematic, Ecological, and Evolutionary Aspects of Dicotyledon Wood.* Springer, Germany. 458 pp.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Définition, origine du bois et fonctions assurées par ce tissu. Principes et applications de l'expertise en xylologie. Caractères anatomiques, variabilité individuelle (racine, tronc, branche) et variabilité intra-spécifique. Xylologie, phylogénie et environnement ; importance du bois dans la reconstitution des paléoenvironnements, et applications à quelques gisements fossiles (observations au microscope, interprétations, dessins).

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 50%
Exercise assessment: 50%

Course title: Floristique Tropicale (FLORATROP)
Course ID: SEP / NU832
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Jean-Yves Dubuisson (jean-yves.dubuisson@upmc.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 20 hrs
- Exercises: 6 hrs
- Projects: 4 hrs

Course objectives:
Présenter sous forme d'une série de conférences les grandes problématiques actuelles en biodiversité végétale et botanique tropicale, en incluant les principales méthodes d'investigation, de collection et d'analyse de cette biodiversité.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Organism

Pouvoir détailler les principales méthodes d'investigation, de collection et d'analyse de la biodiversité végétale et botanique tropicale. Connaitre et comprendre les enjeux et les problématiques actuelles de cette biodiversité. Etre capable de trouver les sources scientifiques et médiatiques sur cette thématique.

Course material, text books and further reading:
Notes de cours. Articles scientifiques.
- Primack, R. & R. Corlett, 2005. Tropical Rain Forests : An Ecological and Biogeographical Comparison. Blackwell Science Ltd., Oxford, U.K. 319 pp.
- Puig, H., 2001. La Forêt Tropicale Humide. Editions-Belin, Paris, France. 448 pp.
- Carson, W. & S. Schnitzer, 2008. Tropical Forest Community Ecology. Wiley Blackwell, Oxford, U.K. 517 pp.
- Hogarth, P., 2007. The Biology of Mangroves and Seagrasses. Oxford University Press Inc., Oxford, UK. 273 pp.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Des spécialistes de divers groupes taxonomiques tropicaux représentatifs (« Cryptogames » et Spermatophytes) présenteront l'historique, les projets en cours et les perspectives de la recherche sur ces taxons afin d'illustrer les diverses approches qui sont développées actuellement en floristique tropicale. Des rappels sur les bases de la floristique seront également dispensés en début de l'unité d'enseignement.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 60%
Oral assessment: 40%

Course title: Ecologie Tropicale (ECOT)
Course ID: M2S1
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor: Jacques GIGNOUX, CR, gignoux@biologie.ens.fr
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 48 hrs
- Exercises: 12 hrs
- Projects: 10 hrs

Course objectives: Le but de ce module est d'apprendre aux étudiants à raisonner sur des écosystèmes (1) où s'expriment des mécanismes écologiques différents de ceux qu'ils connaissent en milieu tempéré et (2) où des mécanismes déjà connus s'expriment de façon extrême en raison de l'environnement physico-chimique différent, éventuellement de façon contre intuitive. L'enseignement s'ancre d'une part vers l'écologie de terrain, par une coordination de ce module avec les écoles thématiques d'écologie tropicale (ETET), et d'autre part vers l'écologie théorique, à travers l'analyse des apports de l'écologie tropicale à la théorie écologique. L'objectif ultime est de donner une compétence " système " aux étudiants à travers l'analyse détaillée des écosystèmes tropicaux, valorisable aussi bien pour la recherche (analyse multifactorielle d'un système écologique) que pour l'ingénierie écologique (analyse des moyens d'action possibles sur un écosystème).

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant and Animal Biological level: Organism-Ecosystem

Course material, text books and further reading:
Notes de cours. Articles scientifiques.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Le module comporte trois parties :

- une présentation des milieux et des contraintes climatiques de la zone tropicale (CM : 9 h)
- une analyse approfondie des principaux processus écologiques importants dans le cadre tropical : - processus écophysiologiques (rayonnement, eau, nutriments) et exploitation du milieu physique (CM 12 h) - processus démographiques et structuration spatiale (CM 12 h) - contributions de l'écologie tropicale à l'écologie théorique (CM 6 h)
- une synthèse resituant les écosystèmes tropicaux dans le fonctionnement de la biosphère (CM 9 h).

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 50%
Oral assessment: 50%

Course title: Exploration et description de la biodiversité
Course ID: SEP33 / NU965
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Philippe Bouchet (philippe.bouchet@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 22 hrs
- Projects: 8 hrs

Course objectives:
Présenter l'actualité de la découverte et de la description de nouvelles espèces d'animaux, plantes et champignons.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Community

Comprendre les enjeux scientifiques de la découverte et de la description de nouvelles espèces, y compris les droits de propriété intélectuelle, les droits de propriété indingène et les principes de publication.

Course material, text books and further reading:
Notes de cours. Articles scientifiques.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Nombre mesuré d'espèces connues et projections sur le nombre réel d'espèces de la biosphère. Régions, taxons et écosystèmes sources des espèces nouvelles. Présentation de quelques programmes et initiatives européennes et internationales de catalogues d'espèces. Alpha-taxonomie et exhaustivité documentaire. Relations entre systématique descriptive et facteur d'impact.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Taxinomie et nomenclature
Course ID: SEP20 / NU961
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Alain Dubois (adubois@mnhn.fr) and Frédéric Tronchet (tronchet@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs

Course objectives:
Exposer les fondements théoriques et les grandes lignes du fonctionnement de la taxinomie et de la nomenclature des organismes en zoologie et en botanique.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Organism

Approfondir les connaissances en taxinomie et en nomenclature botanique et zoologique.

Course material, text books and further reading:
Notes de cours. Articles scientifiques.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Taxinomie : principaux paradigmes, bases théoriques, méthodes, espèce et spéciation, relations avec la phylogénie ; bases théoriques des systèmes nomenclaturaux ; nomenclatures zoologique et botanique ; systèmes alternatifs de nomenclature (Phylocode, etc.). Le niveau de ce cours est avancé.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Formalisation des connaissances en systématique et paléobiodiversité
Course ID: SEP38 / NU829
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): René Zaragueta-Bagils (Rene.Zaragueta_Bagils@upmc.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 10 hrs
- Exercises: 15 hrs
- Projects: 5 hrs

Course objectives:
La formalisation des connaissances est au cours de toute démarche méthodologique. Cet enseignement a pour objectif de présenter les objets mathématiques et informatiques au travers desquels sont ensuite présentés et discutés les concepts de la systématique, et des méthodes d'analyse phylogénétique.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Organism

Comprendre et pouvoir appliquer des methods mathématiques et informatiques sur des jeux de données en systématique et phylogénie.

Course material, text books and further reading:
Notes de cours. Articles scientifiques.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Formalisation, modèle, codage Langage et représentation informatique, niveaux d'abstraction, Les objets mathématiques de la classification : distances, arbres, ensembles, graphes Groupes monothétiques et polythétiques La méthode à trois éléments, formalisation et comparaison 3ia/ parcimonie, Hiérarchie et temps, Caractère, homologie, individus/taxa.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 50%
Oral assessment: 50%

Course title: Morphologie cladistique informatisée
Course ID: SEP21 / NU843
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Véronique Barriel (veronique.barriel@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 16 hrs
- Exercises: 8 hrs
- Projects: 4 hrs

Course objectives:
L'objectif de ce module est d'assurer aux étudiants une initiation, la plus complète possible, aux méthodes d'analyses phylogénétiques informatisées. Les différents principes de la reconstruction phylogénétique assistée par ordinateur dans le cadre de la méthode cladistique (systématique phylogénétique) sont présentés avec une initiation au logiciel PAUP. Une présentation théorique succincte des différents éléments de la méthode cladistique est suivie d'exercices pratiques empruntés à la littérature scientifique tant morphologique que moléculaire.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Organism

Connaitre et savoir utiliser les méthodes et logiciels appropriés pour analyser des jeux de données phylogénétiques.

Course material, text books and further reading:
Notes de cours. Manuels de logiciels.
Aricles scientifiques

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Les concepts de la systématique phylogénétique, l'utilisation d'un logiciel de reconstruction phylogénétique (PAUP) et la phylogénie des amniotes. Un des exercices les plus conséquents consiste à confronter les étudiants à l'observation de caractères morphologiques de quelques amniotes (mammifères, tortues, lépidosauriens, crocodiliens et oiseaux). Les caractères sont ensuite codés afin d'établir une matrice morphologique analysée en parcimonie pour discuter des relations de parenté au sein des amniotes.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Phylogénie moléculaire
Course ID: SEP 22
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: Enseignement supérieur / Recherche
Department: Centre Thématique Européen pour la Diversité Biologique
Name and e-mail address of the instructor(s): Nicolas Vidal, MC, MNHN, nvidal@mnhn.fr ; Cyrille D'Haese, CR2, CNRS, cyrille.dhaese@mnhn.fr.
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 60 hrs

Course objectives: Objectifs
Présentation des bases théoriques de la reconstruction phylogénétique à l'aide de l'outil moléculaire et apprentissage de la pratique depuis l'extraction d'ADN jusqu'à l'interprétation des arbres phylogénétiques à l'aide d'un jeu de données obtenu pendant l'UE.

Organisation pédagogique
Cours théoriques sur les différentes approches (distances, parcimonie, approches probabilistes, robustesse, fiabilité)
TP/TD (extraction d'ADN, PCR, nettoyage des séquences, alignement, analyses phylogénétiques)

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Global

Course material, text books and further reading:
Notes de cours. Ressources en ligne.

Prerequisites: please note the general comment on prerequisites
aucun

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown
Évaluation par un rapport écrit. Written assessment: 100%

Course title: Biodiversity informatics
Course ID: SEP41 / NU823
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Régine Vignes-Lebbe (regine.vignes_lebbe@upmc.fr)
Course website: to be posted
Semester: S3
Tuition language: French or English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 15 hrs
- Exercises: 15 hrs
- Projects: 30 hrs

Course objectives:
Apprentissage et application des langages autour du web pour la représentation et la diffusion des données scientifiques (XHTML, CSS, SQL, XML, PHP …) : manipulation de données, échanges de format, communication entre applications scientifiques, diffusion en ligne d'information. Connaissance des grands programmes d'information sur la biodiversité, leurs enjeux et les problèmes informatiques actuels dans ce domaine. Acquisition des compétences techniques permettant de comprendre l'architecture des projets et d'y contribuer.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Organism

Acquérir une maîtrise de l'outil informatique pour la recherche scientifique : manipulation de données, échanges de format, communication entre applications scientifiques, diffusion en ligne d'information …
Connaître les grands programmes d'information sur la biodiversité, les enjeux et problèmes informatiques actuels dans ce domaine.
Acquérir les compétences techniques permettant de comprendre l'architecture des projets et d'y contribuer.

Course material, text books and further reading:
Notes de cours. Manuels de logiciels.
Articles scientifiques.

Prerequisites: please note the general comment on prerequisites

Aucun

Table of contents:
Recherche, information et société. Projets et programmes en Informatique pour la biodiversité - Systèmes d'information, rappels sur les SGBD et SQL. - Diffusion et exploitation des connaissances. Technologie web, web dynamique (HTML, CSS, PHP) - Organisation et gestion de projets. Outils de travail collaboratif - Langage XML et échange de données. Standards internationaux pour la biodiversité - Nouvelles technologies (imagerie) - Automatisation de traitement (batch) - Bases de programmation de scripts - Outil de modélisation (UML).

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 30%

Projet assessment : 40%
Oral assessment: 30%

Course title: Modélisation des formes et analyse des données morphométriques
Course ID: SEP19 / NU955
University: Université Pierre et Marie Curie and Muséum National d'Histoire Naturelle
Faculty: UFR TEB (Terre, Environnement, Biodiversité)
Department: Master de sciences de l'Univers, environnement, écologie
Name and e-mail address of the instructor(s): Michel Baylac (baylac@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 10 hrs
- Exercises: 10 hrs
- Projects: 10 hrs

Course objectives:
Fournir les concepts nécessaires à la compréhension de la littérature morphométrique classique et géométrique et à la mise en oeuvre d'une analyse simple par les méthodes de la morphométrie géométrique. Seront introduits les concepts et méthodes propres aux morphométries classiques et géométriques, avec des exemples d'applications en systématique et biologie évolutive.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Methods and tools

Connaitres les bases théoriques et applications de morphométrique classique et géométrique .

Course material, text books and further reading:
Notes de cours. Articles scientifiques.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Biométrie et morphométrie. Données morphométriques, distances, points-repères, contours et approches morphométriques appropriées, homologie. Acquisition des données. Tailles, formes et conformations, méthodes de partition de la taille, tailles allométriques et tailles isométriques : approches bivariées et multivariées. Les travaux dirigés comprennent toutes les phases d'un traitement morphométrique d'un jeu de données depuis la numérisation jusqu'à l'interprétation en passant par la mise en oeuvre d'analyses morphométriques et statistiques.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Enjeux patrimoniaux, économiques et scientifiques de la connaissance des espèces
Course ID: E2F2 / NU956
University: Muséum National d'Histoire Naturelle
Faculty: Enseignement supérieur / Recherche
Department: Département de Systématique et Evolution
Name and e-mail address of the instructor(s): Jacques Bardat (jacques.bardat@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30

Course objectives:
L'objectif de ce cours est de sensibiliser les étudiants à l'émergence, il y a une dizaine d'années, du mot biodiversité qui a donné une nouvelle dimension à la connaissance des faunes et des flores. En quittant le champ naturaliste pour investir le domaine politique et juridique, la biodiversité est désormais l'objet d'enjeux patrimoniaux (conservation des espèces et des espaces, esthétique des paysages) et économiques (molécules biologiquement actives, ressources génétiques, écotourisme) qui prolongent et amplifient les enjeux scientifiques (inventaire des espèces, relations phylogénétiques, biogéographie).

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Global

Connaitre le cadre international scientifique, economique et patrimonial du concept de biodiversityé et pourvoir l'expliquer et l'illustrer.

Course material, text books and further reading:
Notes de cours.
Articles scientifiques.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:

Introduction au cours

Enjeux patrimoniaux
Les enjeux d'une politique européenne et internationale de connaissance des espèces
Qu'est ce que le patrimoine naturel, du social au juridique
Qu'est-ce qu'une espèce patrimoniale, une espèce déterminante, l'inventaire ZNIEFF
Les enjeux de l'inventaire faune-flore et habitats du futur réseau Natura 2000 dans le processus de mise en oeuvre de la directive habitats en France.
Le concept de livres et listes rouges
Valeurs sociale et culturelle de la biodiversité : application à la gestion durable de la pêche artisanale dans 3 régions forestières.
Conservation de la biodiversité et savoirs naturalistes locaux : les enjeux actuels
Le rôle des organisations de conservation de la nature : le cas de l'IUCN

Enjeux scientifiques
Espèces invasives et conservation de la biodiversité animale

Connaître pour gérer : quels enjeux dans les hydrosystèmes ?
Bryologie et évaluation biocénotique à différentes échelles
Les fondements éthiques de la conservation des espèces et des milieux
Lutte biologique
Utilisation de la biologie des espèces pour l'évaluation de la qualité d'un milieu

Enjeux économiques
La connaissance de la diversité génétique
Les mammifères invasifs et incidences économiques
Plantes invasives, impact économique
conservation et valorisation des espèces, quelques exemples
La recherche des molécules actives
Insectes invasifs & Incidences économiques
Conclusion

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Partenaires institutionnels et associatifs de la gestion et de la conservation de la biodiversité
Course ID: E2F4 / NU957
University: Muséum National d'Histoire Naturelle
Faculty: Enseignement supérieur / Recherche
Department: Centre Thématique Européen pour la Diversité Biologique
Name and e-mail address of the instructor(s): Dominique Richard (drichard@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs

Course objectives:
L'objectif de cette unité d'enseignement est de situer le besoin d'expertise taxinomique par rapport à différents employeurs potentiels ou générateurs indirects d'emplois, institutionnels ou associatifs. De nombreux partenaires institutionnels sont ainsi demandeurs d'une expertise sur la connaissance des espèces et de leurs milieux. Ceci s'exprime de la part des délégués représentant la France dans les négociations et discussions internationales dans le cadre de la Convention sur la Diversité Biologique ; au niveau européen, en soutien à la mise en oeuvre des Directives communautaires mais également pour un suivi de la biodiversité à l'échelle de l'Europe; dans un cadre national (MEEDAT) ou déconcentré (DREAL) pour la mise en oeuvre de politiques et de stratégies de gestion et de conservation du patrimoine naturel ou encore dans des organismes spécialisés publics ou associatifs concernés au quotidien par la gestion d'espèces et de leurs milieux.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Global

Comprendre le besoin d'expertise taxinomique par rapport à différents générateurs directs ou indirects d'emplois, institutionnels ou associatifs. Etre capable de trouver les besoins de ces employeurs potentiels.

Course material, text books and further reading:
Notes de cours. Ressources en ligne.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
Implications de la mise en oeuvre de la Convention sur la Diversité Biologique quant au besoin en expertise taxinomique. Présentation du cadre européen relatif à la conservation de la Biodiversité. Rôle et activités de l'Agence Européenne de l'Environnement. Besoins du MEEDAT et des DREAL pour la mise oeuvre du réseau NATURA 2000 et pour la prise en compte de la biodiversité dans l'aménagement du territoire en général. Gestion d'espaces et d'espèces : Parc naturel régional, forêts, faune sauvage, conservatoire de sites collectivité locale ayant à intégrer la conservation du patrimoine naturel dans la gestion du territoire.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course descriptions at Università degli Studi di Firenze (UNIFI)

Course title: Data analysis and environmental modeling
Course ID: GEO/08
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Department of Earth Sciences
Name and e-mail address of the instructor(s): Antonella Buccianti (antonella.buccianti@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 16 hrs
- Exercises: 12 hrs
- Projects: 8 hrs

Course objectives:
The course provides a basic preparation for the application of graphical and numerical tools to describe and model processes and variability sources in natural environment with special focus on compositional data and observations characterized by time and/or space dependence.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

Students should be able to manage numerical information using the main basic elements of data management as well as to identify the properties of the sample space with the aim to apply more structured methods (multivariate analysis, geostatistical analysis, time series analysis). On the whole they should be able to select appropriate mathematical and statistical tools able to models processes characterizing the evolution of natural environments.

Course material, text books and further reading:
Basic theory explanation and exercise will be provided during the course, being necessary and sufficient for exams. Further reading will be assigned on individual or small group basis, in the frame of exercise activities.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Theory
General concepts on sample space and probability theory. Preparing data for analysis. Graphics to display the data distribution. Statistical distribution measures. Mapping spatial data. Defining background and threshold of data outliers and element sources. Comparing data in tables and graphics. Comparing data using statistical tests. Improving data behavior for statistical analysis by ranking and transformations. Correlation. Multivariate graphics and multivariate outlier detection.
Basic principles of spatial data analysis. Variograms and application of spatial estimation procedure.
Basic principles of time series analysis and monitoring procedures of natural phenomena in time.

Project

Evaluation of real case studies from sampling to data management ; data gathering and their organization in matrices, use of interface with database and GIS applications; realization of a final report to plan further investigation projects.

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment: 50%

Project assessment: 50%

Course title: Tropical botany
Course ID: BIO/02
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
& Centro Studi Erbario Tropicale - CSET (Tropical Herbarium FT)
Name and e-mail address of the instructor(s): Riccardo M. Baldini (rbaldo@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 12 hrs
- Lab work : training at the Tropical herbarium (FT) of University of Florence

Course objectives:
Learn the most important tropical plant families, their morphological features, ecology, adaptations in different tropical areas of the world, interactions between plants and animals.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Plant Biological level: Organism

Use of identification keys of Flora. Knowledge of the general tropical plant diversity and principles of the collecting data and herbarium management.

Course material, text books and further reading:
Textbooks on Tropical Botany (Paleo- and Neo-tropical areas of the world) are available at the Tropical Herbarium Library and at the Botanical Library of the Department of Evolutionary Biology. Consultation of international journals are recommended by free access on internet under the teacher's suggestions. Students will be asked to prepare a topic of their choice and present it to the other students within a "journal club" seminar.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
1) General plant morphology ; 2) Ecological adaptations in a Tropical environments ; 3) Tropical biogeography ; 3-6) Paleotropical plant families ; 7-10) Neotropical plant families ; 11) Specific cases of study in tropical plant systematics ; 12) Nomenclature.

Assessment breakdown: please note the general comment on assessment breakdown
Oral presentation and assessment : 100%

Course title: Biodiversity and conservation
Course ID: BIO/05
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
Name and e-mail address of the instructor(s): Giacomo Santini (giacomo.santini@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures and exercises: 24 hrs
- Lab work: 6 hrs
- Excursions: 6 hrs

Course objectives:
To learn about biodiversity patterns, community structure and functioning at different spatial scales; know the fundamentals of population dynamics and their use in species conservation; identify the main threats faced by ecosystems and understanding their origin.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Animal Biological level: Community

Knowledge of the main causes of species loss and environmental degradation; to be able to understand and analyze conservation plans for species and ecosystems.

Course material, text books and further reading:
Relevant book chapters, reprints of recent scientific papers and lectures handouts will be available to students.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
1) History and aims of conservation biology. 2) Causes of species extinction.3) Conservation of species and populations. Dynamics of small populations, Minimum Viable Populations. Population Viability Analysis: demographic and environmental stochasticity. Metapopulation dynamics. 4) Conservation at the community and ecosystem levels. 5) IUCN categories: red lists. 6) Biodiversity Hotspots. 7) Community analysis for conservation (basics)

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment : 100%

Course title: Tropical climatology
Course ID: AGR/02
University: Università degli Studi di Firenze
Faculty: Agriculture
Department: Plant, Soil and Environmental Sciences
Name and e-mail address of the instructor(s): Simone Orlandini (simone.orlandini@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 10 hrs
- Exercises: 6 hrs
- Projects: 6 hrs

Course objectives:
The aim of the course is to give concepts that form the basis for understanding the climate of tropical environment, monitoring and analysis techniques. At the end of the course the students are expected to be able to evaluate the effects of tropical climate on bio-physical systems.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Environment Biological level: Global

Analysis of meteo-climatic characteristics of tropical environments in relation with different spatial and temporal scales. Methods for climate monitoring and the application of modeling for environmental management and planning. Climatic variables and basic element for data analysis to assess mean and extreme conditions. Climate change impacts, vulnerability, adaptation and mitigation strategies. Exercises dealing with climatic data analysis and bio-physical modeling application.

Course material, text books and further reading:
Guide to Agricultural Meteorological Practices (GAMP) 2010 Edition (WMO-No.134), Geneva (CH)
Applied Agrometeorology, 2010, Kees Stigter (Ed.), Springer (Berlin) (D)
Lessons notes and Didactic material edited by the Instructor

Prerequisites: please note the general comment on prerequisites
S1 course Tropical botany

Table of contents:
Lectures:
Basic knowledge of climatology and meteorology: variables, measurements, bio-physical effects
Reference scales for space and time
Climatology of tropical environment
Climate change: impacts, adaptation and mitigation
Simulation and forecasting models

Exercises:
Sensors, instruments, acquisition systems, data transmission
Software for climate data analysis
Modeling application

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment 50% Project and exercise assessment 50%

Course title: Physical geography of tropical environments
Course ID: GEO/04
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Department of Earth Sciences
Name and e-mail address of the instructor(s): Sandro Moretti; sandro.moretti@unifi.it
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24h

Course objectives:
The target is to make the students able to understand the geo-physical processes affecting tropics, special attention will be address to wetlands. Students are expected to be able to understand and detect geo-physical processes on the landscape and realted to humid ecosystem.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

Students should be able to diagnose the main geo-physical processes and related landscapes in humid tropics by direct field observation and literature reference. They should be able to write specific technical reports.

Course material, text books and further reading:
Basic theory explanation will be provided during the course by using a computer-animated presentation which will be available for students. Textbooks on Physical Geography will be suggested.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The relief of the Earth. Erodability and morphoselection, morphology and structural morphotectonic. The lithology as a factor of morphogenesis. The hydrographic network and its evolution. Processes of azonal modeling erosion. Systems and morphoclimatic zonal processes associated with planation surfaces.

Assessment breakdown: please note the general comment on assessment breakdown
written assessment 100%

Course title: Marine and coastal biology
Course ID: BIO/06
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
Name and e-mail address of the instructor(s): Felicita Scapini (felicita.scapini@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises: 12 hrs
- Lab work : 6 hrs
- Excursions : 6 hrs

Course objectives:
To learn about the marine environments, their physical and biological specificity, the adaptations of the animal organisms of different zoological groups to the marine ecosystems they live in, the life cycles and recruitment in the different marine environments.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Global

Biological dentification skills. Knowledge on the diversity of life in relation with the diversity of marine ecosystems. Capacity of personal study on problems related to environmental changes, both natural and human driven.

Course material, text books and further reading:
A text book on marine biology at choice of each student within a list present at the Zoological Library of the Department. The library also offers free access to most international journals on zoology, marine biology and ecology. Students will be asked to prepare a topic at their choice and present it to the other students within a "journal club" seminar.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The oceans of the world. 2) Periodic (tides) and aperiodic changes in the marine environments. 3) The marine environments and the animal populations. 4) Animal diversity in the oceans. 5) Adaptations to the benthonic environments. 6) Adaptations to the coastal environments. 7) Adaptations to the pelagic environments. 8) Migrations in the oceans. 9) Orientation in the oceans. 10) Orientation on beaches. 11) Life cycles and recruitment. 12) Vulnerability of animal diversity in the oceans.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment : 100%

Course title: Pedology
Course ID: AGR/14
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Department of Earth Sciences
Name and e-mail address of the instructor(s): Stefano Carnicelli (stefano.carnicelli@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 16h
- Projects: 8h

Course objectives:
The target is to make the students able to understand the soils of the humid zones of the tropics, with special focus on the wetlands. Students are expected to be able to gauge soil problems within a given ecosystem and to require and successfully manage specialized assistance.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Interactions Biological level: Ecosystem

Students should be able to diagnose the main soil conservation problems in the humid tropics by direct field observation and literature reference. They also should be able to select appropriate specialist help and to write suitable, technical, terms of reference.

Course material, text books and further reading:
Basic theory explanation and project data will be provided during the course, being necessary and sufficient for exams. Further reading will be assigned on individual or small group basis, in the frame of project activity.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Lectures:
General concepts on soil stability
Soils of the littoral environment; mangrove soils, beach ridge and dune soils
Sulphidic and sulfuric soil materials, development of sulphate acidity
Soil salinity and sodicity
Organic soils, different types of tropical peats and associated alluvial soils
Problems of drainage
Long-term peat subsidence
Soils of the rainforest: Ferralsols, Nitisols, Acrisols, Plinthosols, rainforest Umbrisols and Cambisols
Fertility and acidification of rainforest soils
Soil erosion in the humid tropics

Project:
Evaluation of real field situation; data gathering and organization, with database and GIS applications; drafting a report and a further investigation project.

Assessment breakdown:	please note the general comment on assessment breakdown
Written assessment 50% Project assessment 50%	

Course title: Ecology
Course ID: BIO/07
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
Name and e-mail address of the instructor(s): Guido Chelazzi (Guido.Chelazzi@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 12 hrs

Course objectives:
This course provides an overview of ecology and aims at explaining the fundamentals of patterns and processes underlying populations and communities. The course starts with a first part on demographic characteristics and simple models of population growth and dynamics to include explanations of how communities are structured later.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Animal Biological level: Ecosystem

Upon completion of this course the student should :
To understand ecological patterns and process.
To be able to explain them using simple models.
To be able to conduct sound fieldwork and analyse field data using quantitative methods
To conduct an independent ecological research project.

Course material, text books and further reading:
Chelazzi, G. & G. Santini, 2012. *Ecologia*. Giunti Editore, 192 p.
Cain, M.L, W.D. Bowman & S.D. Hacker, 2011. *Ecology*. Second Edition. Sinauer Associates. 648 p.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment 50%
Oral assessment 50%

Course title: Molecular Ecology
Course ID: BIO/13
University: University of Florence, Italy
Faculty: Faculty of Sciences
Department: Department of Evolutionary Biology
Name and e-mail address of the instructor(s): Claudio Ciofi, claudio.ciofi@unifi.it
Course website: to be posted
Semester: S1
Number of credits: 3

Course breakdown and hours:
- Lectures: 12 Lectures = 24 hours
- Exercises: 12 hours

Course objectives:
The course provides background knowledge on population genetic theory and lab techniques applied to population ecology and management of rare and endangered species with particular concern to tropical and equatorial environment. Teaching includes classes on applied population genetics with integrated laboratory sessions on DNA analysis and tutorials on data processing using dedicated software.

Learning outcomes: please note the general comment on learning outcomes
Molecular genetic theory and techniques for assessment of degree of genetic variation among individuals. Background knowledge of molecular tools applied to population ecology and wildlife management. Improved understanding of the integration of genetic and ecological data for the study of tropical and equatorial species life history and the design of management plans.

Course material, text books and further reading:
ALLENDORF FW, LUIKART G (2006) Conservation and the Genetics of Populations. Blackwell.
HEDRICK P (2009) Genetics of Populations. Jones and Bartlett.
FRANKHAM R., BALLOU JD., BRISCOE DA (2010) Introduction to Conservation genetics. Cambridge University Press.

Prerequisites:
Genetics

Table of contents:
Genetic variability indeces. Nuclear and mitochondrial genomes for population and interspecific analysis of genetic diversity: molecular markers and analysis techniques. Genetic drift, inbreeding, gene flow and models of natural selection. Genetic distance measures, phylogeography and phylogeny. Management units and species concept. Introgression and hybridization. Parentage analysis.

Assessment breakdown: please note the general comment on assessment
Students will be assessed on the basis of class participation, a classroom presentation of individual readings and a final colloquium.

Course title: Social insects in tropical environments
Course ID: BIO/04
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
Name and e-mail address of the instructor(s): Stefano Turillazzi (stefano.turillazzi@unifi.it)
Course website: to be posted
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Projects: 4 hrs
- Lab work: 6 hrs

Course objectives:
Social insects constitute important elements in tropical environments. The course aims to promote the knowledge of the biology of the most important social insects groups and their impact on various tropical environments, especially on forests. The course will focus especially on social Hymenoptera and termites. Evolution of social behaviour will be treated in a general and in particular groups.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Community

Knowledge of Social Insects distribution and biodiversity especially on arguments regarding the importance of these organisms for ecosystems equilibrium. Knowledge of potential exploitation of some species for alimentary purpouses.

Course material, text books and further reading:
Hoelldobler and Wilson : The Superorganism
Additiona readings from current journal articles.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Definition of Eusociality and evolutionary scenarios. Biology and characteristics of the main groups of social insects (Hymenoptera, Isoptera, Aphids, Thrips). Social communication. Social organization and superorganisms. Social insects and man.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment 50%
Project and exercise assessment 50%

Course title: Bacterial genomics and ecology
Course ID: BIO/18
University: Università degli Studi di Firenze – University of Florence (Italy)
Faculty: Scuola di Scienze Matematiche, Fisiche e Naturali – School of Sciences
Department: Dipartimento di Biologia– Department of Biology
Name and e-mail address of the instructor(s): Alessio Mengoni, Department of Biology, UNIFI)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 16 hrs
- Exercises: 8 hrs

Course objectives:

Learning outcomes : please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Interactions Biological level: Organism

Students should be able to :
- understand the basics of microbial ecology and how to study this

Course material, text books and further reading:

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

1. Key issues in microbial ecology. Concept of species in prokaryotes
2. The concept of pangenome in bacteria
3. History of metagenomics and technical issues
4. The hologenome and the microbiome
5. Ecological genomics of bacterial symbioses
6. Mathematical modeling of microbial community dynamics and metabolism
7. Bioinformatic tools for genomic and metagenomic analysis in bacteria
8. Case study: bacterial endophytes and their genomes
9. Case study: the gut microbiome
10. Case study: studying the symbiontic microbiota interactions through network analysis

Assessment breakdown: please note the general comment on assessment breakdown

written assessment 60%
exercise assessment 40%

Course title: Coastal morphology and shoreline protection
Course ID: GEO/02
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Department of Earth Sciences
Name and e-mail address of the instructor(s): Enzo Pranzini (epranzini@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 16 hrs
- Projects: 8 hrs
- Excursions: 8 hrs

Course objectives:
The course aims at giving the students the knowledge on coastal morphology, coastal dynamics and shore protection techniques. Integrated Coastal Zone Management (ICZM) will be the framework in which the course will be developed.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

Students will be able to analyse coastal areas morphologies and processes, both natural and anthropogenic ones. They will also acquire management tools and knowledge of shore protection techniques. They will be able to interact with the different professionals working at Integrated Coastal Zone Management (ICZM).

Course material, text books and further reading:
PowerPoint presentations of each lesson will be provided;
Book list for further studies will be provided as well.
Maps and scientific publications concerning the field trip area will be given.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Coastal classification. Coastal areas climate. The movement of the sea. Tides and Waves. Sea level changes. Sea cliffs. Submerging coasts. Beaches. Coastal dunes. River deltas. The coast in intertropical regions. Beach erosion. Human impact on the coast. Shore protection projects
Field trip along differently protected coastal segments.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Wetland resources evaluation
Course ID: AGR/03
University: Università degli Studi di Firenze
Faculty: Agriculture
Department: Plant, Soil and Environmental Sciences
Name and e-mail address of the instructor(s): Gianluca Stefani (gianluca.stefani@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 10 hrs
- Exercises: 12 hrs

Course objectives:
The aim of the course is to explore the methodology and practical applications of ecosystem valuation and evaluation methods, with particular reference to wetland management. At the end of the course the students are expected to be able to understand the main aspects of economic evaluation and its role in sustainable management of wetlands.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

Students should be able to classify and define wetlands function, uses and values and relate them to the appropriate components of economic value. They should appreciate the relevant characteristics of different valuation techniques, understand the principle of benefits transfer and be able to asses published valuation studies.

Course material, text books and further reading:
Lessons notes and course material provided by the Instructor
Barbier E.B., 1997, *Economic Valuation of Wetlands: A Guide for Policy Makers and Planners*, Ramsar Convention Bureau, Gland.
Turner K. et al. , 2004, *Economic valuation of water resources in agriculture*, FAO, Rome.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Lectures:
Valuation of good and service provided by wetlands
Use of economics values in the management of wetlands
Economic valuation techniques
Benefit transfer

Exercises:
Valuation and Benefit transfer exercises applied to the valuation of Wetlands

Assessment breakdown: please note the general comment on assessment breakdown
written assessment 50%
exercise assessment 50%

Course title: Applied Conservation Biology
Course ID: BIO/07
University: Università degli Studi di Firenze
School: Scienze Matematiche Fisiche e Naturali – School of Sciences
Department: Dipartimento di Biologia – Department of Biology
Name and e-mail address of the instructor(s): Giacomo Santini (giacomo.santini@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:
- Lectures and exercises: 36 hrs
- Lab work: 12 hrs

Course objectives:
To learn about biodiversity patterns, community structure and functioning at different spatial scales; know the fundamentals of population dynamics and their use in species conservation; identify the main threats faced by ecosystems and understanding their origin. This course also aims at explaining the fundamentals of patterns and processes underlying populations dynamics. The course starts with a first part on demographic characteristics and simple models of population growth and dynamics to include explanations of how communities are structured later.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Community

Knowledge of the main causes of species loss and environmental degradation; to be able to understand and analyze conservation plans for species and ecosystems. Upon completion of this course the student should also be able to understand ecological patterns and process, to be able to analyze them using advanced statistical methods and to use basic mathematical population models.

Course material, text books and further reading:
Relevant book chapters, reprints of recent scientific papers and lectures handouts will be available to students.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Module 1) Biodiversity and Conservation: History and aims of conservation biology. Causes of species extinction. Conservation of species and populations. Dynamics of small populations, Minimum Viable Populations. Population Viability Analysis: demographic and environmental stochasticity. Metapopulation dynamics. 4) Conservation at the community and ecosystem levels. IUCN categories: red lists. Biodiversity Hotspots. Community analysis for conservation (basics)
Module 2) Population Ecology: Introduction to population modelling. Simple species models in continuous and discrete time. Models for interacting populations (competition, predation). Analysis o population trends and rates of change.

Assessment breakdown: please note the general comment on assessment
Written assessment : 100%

Course title: Methods in Landscape Analysis
Course ID: GEO/04
University: Università degli Studi di Firenze
School: Scienze Matematiche Fisiche e Naturali – School of Sciences
Department: Dipartimento di Scienze della Terra – Department of Earth Sciences
Name and e-mail address of the instructor(s): Filippo Catani (filippo.catani@unifi.it); Federico Raspini (Federico.raspini@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 32h
- Excercises: 16h

Course objectives:
The target of this course is to present an overview of the basics and methods for modeling and understanding the physical landscape as a dynamic system starting from multi-source data, with special reference to the tropics and wetland ecosystems.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global
At the end of the course, the students should be able to measure and model the main geo-physical processes and related landscapes in humid tropics by direct field observation, analysis of available map or remote sensing data and the literature. They should be able to relate landscape shaping factors to needed data for a successful modeling and understanding of landsurface dynamics.

Course material, text books and further reading:
Basic theory explanation will be provided during the course by using a computer-animated presentation which will be available for students. Textbooks on Physical Geography and will be suggested.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The course is subdivided in two moules: 1) Physical geography and GIS and 2) Physical landscape modelling. The main landsurface processes. Spatial distribution of prevalent sediment erosion, mass wasting, transport and deposition processes in a tropical catchment. Basics of landscape process analysis. Hillslope and floodplain hydrology as related to tropical ecosystems and wetlands. Data acquisition from different available sources for strategic, large-scale studies. Modeling of physical interactions in the tropical environment. Production of modeling scenarios for physical landscape evolution with special reference to the Influence of human impacts on tropical landscapes

Assessment breakdown: please note the general comment on assessment breakdown
written assessment 100%

Course title: Climate change biology
Course ID: BIO/09
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi' **Name and e-mail address of the instructor(s):** Stefano Cannicci (stefano.cannicci@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises: 4 hrs
- Projects: 8 hrs

Course objectives:
Understanding of climate change causes and of its effects on natural ecosystems. Understanding the link between physiological and biological characteristics at organismal level and global changes at ecosystem level.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Global

General information on the effect of climate changes on natural systems. Predictive models about the impacts of global warming, ocean acidification and purported enhanced frequency of hypoxic events on ecosystems. Information on the relationship between the eco-physiological chaacteristics of the species and the effect of climate change.

Course material, text books and further reading:
IPPC, Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007. Avaiable at www.ipcc.ch
Ecoystems and human well-being. Vol 1: Current States and Trends. The Millenium Ecosystem Assessment. Island Press, 2005

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The course will first provide an introduction to climate change science, with a focus on the effects of global change on Tropical ecosystem functions and services, and then it will address the observed and anticipated impacts of global climate change on wetlands, forests and coastal ecosystems. During the course, the students will also acquire an in-depth knowledge of conservation and management issues related to vulnerable tropical ecosystems and of mitigation protocols and scenarios.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course title: Physical landscape modelling
Course ID: GEO/03
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Department of Earth Sciences
Name and e-mail address of the instructor(s): Filippo Catani (filippo.catani@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 16 hrs
- Projects: 8 hrs

Course objectives:
The objective of this course is to present an overview of the basics and methods for modeling and understanding the physical landscape as a dynamic system starting from multi-source data, with special reference to the tropics and wetland ecosystems.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Methods and tools

At the end of the course, the students should be able to measure and model the main geo-physical processes and related landscapes in humid tropics by direct field observation, analysis of available map or remote sensing data and the literature. They should be able to relate landscape shaping factors to needed data for a successful modeling and understanding of landsurface dynamics.

Course material, text books and further reading:
Basic theory explanation will be provided during the course by using slideshow presentations which will be available for students. Textbooks on Physical Landscape modeling will be suggested.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The main landsurface processes. Spatial distribution of prevalent sediment erosion, mass wasting, transport and deposition processes in a tropical catchment. Basics of landscape process analysis. Hillslope and floodplain hydrology as related to tropical ecosystems and wetlands. Data acquisition from different available sources for strategic, large-scale studies. Modeling of physical interactions in the tropical environment. Production of modeling scenarios for physical landscape evolution with special reference to the Influence of human impacts on tropical landscapes.

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 100%

Course title: Biological invasions
Course ID:BIO/05
University: Università degli Studi di Firenze – University of Florence (Italy)
Faculty: Scuola di Scienze MatematicheFisiche e Naturali – School of Sciences
Department: Dipartimento di Biologia– Department of Biology
Name and e-mail address of the instructor(s): Elena Tricarico, elena.tricarico@unifi.it
Course website:
Semester: S3
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 12 Lectures, 24 h
- Exercises: Journal club (4 h)
- Projects:
- Lab work:
- Excursions:

Course objectives:
Learn about biological invasions as major threats to biodiversity; understand modes, vectors and pathways of species introductions; analyze the ecological impacts of alien species and their effects on ecosystem services and human health; investigate the relationships between biological invaders and other drivers of change (degradation/destruction of habitats, climate change, etc.); discuss strategies and methods to prevent introductions and to control/eradicate invasive alien species.

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Global

Knowledge of the threats to biodiversity and ecosystem services. Capacity of analyzing and discussing environmental problems from a scientific perspective.

Course material, text books and further reading:
Several text books are available for consultation at the Science Library. Reading of recent articles from scientific journals will complete learning.

Prerequisites:
Baseline biology and ecology.

Table of contents:
1) Historical overview of invasion biology. 2) Terminology, concepts, theories and methods. 3) Means, vectors and pathways of introductions. 4) The impacts of invasive alien species. 5) Invasive alien species and ecosystem services. 6) Invasive alien species and human health. 7) Invasiveness and invasibility. 8) Relationships between invasive alien species and other drivers of change, including climate change. 9) The behaviour of invasive alien species. 10) Prevention, control and eradication. Case studies of management from different taxa. 11) Legislation. 12) Public perception of biological invasions Citizen science. 13) Risk assessment tools and predictive models. 14) Case studies from the tropical areas.

Assessment breakdown:
Learning will be evaluated through a final written exam and a colloquium. The capacity of critical personal study will be assessedthrough the journal club seminars and an individual presentation on a topic of the course.

Course title: Primatology
Course ID: BIO/08
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
Name and e-mail address of the instructor(s): Roscoe Stanyon (roscoe.stanyon@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 4 hrs
- Projects: 4 hrs
- Excursions: 4 hrs

Course objectives:
Exploration of primate taxonomy and phylogeny. Knowledge of biodiversity, geographic distribution and ecology of primates. Understanding the relationship between ecology and social organization; the structure of social groups; and the evolution of behaviour. Understanding conservation issues in primates and the factors that make many primate species vulnerable to extinction. Appreciation of genetic tools for primate management and conservation.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Organism

Knowledge of primate distribution and biodiversity within an evolutionary framework. Broaden students' understanding of the social dimensions of 'living environments'. Better understanding of conservation issues and capacity to critically discuss and assess issues. Clearer framework of our own species place in nature.

Course material, text books and further reading:
Primate Behavioral Ecology (4th Edition) by Karen B. Strier.
Copies of this textbook and others on Primatology are available at the Anthropology Library. Additional readings from current journal articles.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
1) Primate Taxonomy and phylogeny and biogeography. 2) Primate life histories and reproduction. 3) Primate reproductive units, social organization and communities. 4) Primate habitats and ecosystems. 4) activity patterns, habitat use 5) evolution of primate behaviour and comparison between species. 6) Primate conservation and management.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment 50%
Project, exercise and excursion assessment 50%

Course title: Animal phylogeography
Course ID: BIO/10
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
Name and e-mail address of the instructor(s): Sara Fratini (sarafratini@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 20 hrs
- Exercises: 4 h

Course objectives:
Learn about history and background of Phylogeography. Understand philosophies and methods of molecular data analysis. Learn about species phylogenies and population genetic structure, in terms of theories and statistical methods. Know the principal molecular markers. Discuss study cases and applications to zoological problems.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Organism

Knowledge of the mechanisms of micro and macro-evolution processes. Capacity of analyzing and discussing research papers on phylogeography and population genetic structure. Autonomy in participating to a phylogeography research.

Course material, text books and further reading:
John C. Avise, 2000. Phylogeography: the history and formation of species. Harvard University Press.
John C. Avise, 2004. Molecular markers, natural history, and evolution. Sinauer Associates, Inc. Pub.
Scientific papers.
Duplicated lecture notes.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Lectures:
History and background of Phylogeography. Microevolution, macroevolution and speciation. Coalescence theory. The mitochondrial DNA. Principal molecular techniques. Sequence data analysis: sequence alignment, methods for calculation of genetic distance. Genetic trees. Monophlyletic, paraphyletic and polyphyletic groups. Phylogenetic Inference methods (distance method – NJ, UPGMA - e discrete method - maximum parsimony, maximum likelihood, Bayesian Inference). The bootstrap method. The concept of molecular clock. Neutral theory of molecular evolution. Population genetic structure and gene flow: the F-statistics. Historical demographic events: the neutrality test and the mismatch distribution analysis. Phylogeography categories. Phylogeography and conservation genetics: evolutionary significant units and management units. Nested clade analysis.

Exercises:
Principal software for the analysis of sequence data. Case studies.

Assessment breakdown:	please note the general comment on assessment breakdown
Oral assessment: 100%	

Course title: Migrations and orientation in tropical environments
Course ID: BIO/12
University: Università degli Studi di Firenze
Faculty: Facoltà di Scienze Matematiche Fisiche e Naturali – Faculty of Sciences
Department: Dipartimento di Biologia Evoluzionistica 'Leo Pardi' – Department of Evolutionary Biology 'Leo Pardi'
Name and e-mail address of the instructor(s): Alberto Ugolini (alberto.ugolini@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises: 12 hrs

Course objectives:
Learn the fundamentals of animal orientation and circular statistics. In particular, orientation, homing and navigation mechanisms at tropical latitudes will be considered.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Organism

Different strategies and mechanisms adopted by some biological models to solve autoecological problems of spatial and temporal nature.

Course material, text books and further reading:
Currently no textbook is recommended. Students are recommended to attend the lessons. Reading of selected scientific papers should help them in learning.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Kinetic and tactic behaviour : classification and examples ; Strategies to find a goal ; elaboration and interpretation of circular data ; uni- and pluri-directional orientation ; the sun compass and the magnetic compass : their use at tropical latitudes ; homing behaviour and mechanisms ; true navigation ; migrations.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100%

Course descriptions at the Université de Guyane (UdG)

Course title: Introduction à l'environnement tropical
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Stéphane Traissac (Stephane.Traissac@ecofog.gf)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 35 hrs
- Exercices: 12 hrs
- Excursions : 12 hrs
- Projects: 15 hrs

Course objectives:

- Acquérir des bases scientifiques permettant de comprendre le fonctionnement des forêts tropicales et milieux anthropisés.
- Rendre les étudiants conscients des problèmes que pose la conservation de la biodiversité et la gestion des forêts dans les tropiques humides, à partir d'exemples concrets et de témoignages d'acteurs guyanais.

Learning outcomes: please note the general comment on learning outcomes

Education level: Basic Ecosystem focus: Environment Biological level: Ecosystem

Upon completion of the course a student must be able to:
- Comprendre les principes de fonctionnement et de gestion d'une forêt tropicale humide.
- Exécuter collectivement un projet de terrain.
- Acquérir une expérience des tropiques en général, de la forêt tropicale humide et de la Guyane en particulier.

Course material, text books and further reading:
Notes de cours.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:

Cours
- Fonctionnement des forêts tropicales : biogéographie, géomorphologie, pédogenèse, caractérisation des sols et des relations sol-plante, botanique, définition, mesure, et maintien de la biodiversité, dynamique forestière
- Enjeux de la gestion de la forêt en Guyane : présentations des spécificités de la Guyane française, systèmes de production paysans, gestion forestière, filière bois, l'industrie forestière, produits forestiers non ligneux.

Exercice de terrain (3 jours) : projet de groupe au cours duquel les étudiants réaliseront des mesures sur le terrain et analyseront les données obtenues afin de répondre à une question scientifique précise.

Assessment breakdown: please note the general comment on breakdown
Oral assessment: 0 %
Written assessment: 0 %
Projects/Presentations/Reporting: 100 %

Course title: Origine et maintien de la biodiversité
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Stéphane Traissac (Stephane.Traissac@ecofog.gf)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 5

Course breakdown and hours:
- Lectures: 37 hrs
- Exercices: 1.5 hrs
- Excursions: 3 hrs
- Projects: 0 hrs

Course objectives:
- Aborder la biodiversité sous l'angle de sa dynamique dans le temps et l'espace, des interactions entre espèces, des mécanismes de spéciation et l'évolution.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Community

Upon completion of the course a student must be able to:
- Comprendre et appliquer les principales mesures de biodiversité, leur intérêt et leurs limites.
- Comprendre la diversité et les rôles des interactions interspécifiques au sein des écosystèmes.
- Comprendre les modèles de dynamique forestière.
- Comprendre les mécanismes de spéciation.

Course material, text books and further reading:
Notes de cours.

Prerequisites: please note the general comment on prerequisites
- Connaissances générales en écologie
- Connaissances générales en génétique

Table of contents:

Diversité et Evolution :
Entropie des systèmes complexes et mesures de diversité.
Diversité fonctionnelle et phylogénétique.
Écologie évolutive et phylogéographie comparée.

Dynamique Forestière :
Descripteurs collectifs et individuels.
Structuration spatiale des individus et des populations.
Processus dynamiques en forêt tropicale.

Interactions biotiques :
Diversités des interactions biotiques et implication dans le fonctionnement des écosystèmes.
Co-évolution et maintien des interactions.

Assessment breakdown:	please note the general comment on assessment breakdown
Oral assessment: 0 %	
Written assessment: 100 %	
Projects/Presentations/Reporting: 0 %	

Course title: Théories de l'Ecologie
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Bruno Hérault (bruno.herault@cirad.fr)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Exercices: 0 hrs
- Excursions: 0 hrs
- Projects: 0 hrs

Course objectives:

L'objectif de ce cours est de comprendre comment les différentes théories utilisées pour expliquer les patterns de biodiversité observés sont nées, d'en comprendre la philosophie et les fondements mathématiques, de voir les limites de chacune d'elles et de comprendre dans quel contexte scientifique elles ont émergé.

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Forest Biological level: Community

Upon completion of the course a student must be able to:
- Comprendre et appliquer les modèles suivants :
Modèles de compétition
Modèles proies-prédateurs
Modèles de distribution
Théorie neutre
Théorie métabolique

Course material, text books and further reading:
Notes de cours.

Prerequisites: please note the general comment on prerequisites
Ecologie fondamentale
Statistiques descriptives et probabilités
Notions d'utilisation de R

Table of contents:

Epistémologie des théories sur la diversité des espèces.
Construction mathématique et lien entre les modèles.
Modèles de niche et neutralité.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %

Written assessment: 100 %
Projects/Presentations/Reporting: 0 %

Course title: Analyse des données biologiques
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Eric Marcon (eric.marcon@ecofog.gf)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 50 hrs
- Exercices: 0 hrs
- Excursions : 0 hrs
- Projects: 0 hrs

Course objectives:

L'objectif de ce module est de comprendre deux types de modélisation statistique classique en écologie et plus généralement en biologie.

- La partie modèle linéaire propose l'étude des modèles usuels comme l'analyse de la variance, la régression, l'objectif étant d'illustrer la puissance de ces modèles mais aussi leurs limites.
- La partie modèle hiérarchique propose la découverte de la statistique bayésienne qui connaît un grand essor en écologie. L'accent est mis sur la pratique des modèles hiérarchiques, la mise en œuvre des modèles est conduite à l'aide des logiciels WinBugs et R.

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Method and tools

Upon completion of the course a student must be able to:
- Savoir appliquer le modèle adapté à une question scientifique en fonction des données disponibles et de la compréhension du modèle sous-jacent.
- Utiliser concrètement les logiciels nécessaires.

-

Course material, text books and further reading:
Notes de cours
Korner-Nievergelt, F. et al. (2015) *Bayesian Data Analysis in Ecology Using Linear Models with R, BUGS, and Stan.* Academic Press

Prerequisites: please note the general comment on prerequisites
Statistiques descriptives et probabilités
Notions d'utilisation de R

Table of contents:

- Modèles linéaires : analyse de variance, régression multiple, analyse de covariance, modèle linéaire généralisé, modèle mixte.

- Modèles hiérarchiques Bayésiens : statistique Bayésienne, modèles graphiques, modèles usuels et notion de conjugaison, variables latentes.

- Outils mathématiques : fonctions usuelles en biologie, plans d'expérience, techniques de ré-échantillonnages, Statistiques Exploratoires.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %
Written assessment: 70 %
Projects/Presentations/Reporting: 30 %

Course title: Botanique tropicale
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Patrick Heuret (Patrick.heuret@ecofog.gf)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 6 hrs
- Exercices: 3 hrs
- Excursions : 12.5 hrs
- Projects: 0 hrs

Course objectives:

Cette Unité d'Enseignement met à disposition les connaissances nécessaires à l'interprétation des structures et des comportements des plantes dans les contextes forestiers tropicaux. On cherchera à faire apparaître les liens entre l'adaptation, la morphologie, le comportement et l'évolution.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Plant Biological level: Organism

Upon completion of the course a student must be able to:

- Interpréter la structure végétale, la variabilité des formes et leur significativité fonctionnelle ;
- Comprendre le développement d'un végétal dans l'espace et dans le temps et les relations entre structure et fonctions.
- Connaitre les principales familles d'arbres néotropicaux

Course material, text books and further reading:
Notes de cours

Prerequisites: please note the general comment on prerequisites
Connaissances basiques en morphologie végétale

Table of contents:

- Architecture des plantes.
- Systématique évolutive : ce cours ne reprend pas les catalogues mais donne une idée de la famille, et éventuellement du genre en les replaçant dans leur phylum. Les groupes abondamment représentés localement, seront évoqués préférentiellement, à travers la dimension évolutive et adaptative de leurs caractères.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %
Written assessment: 100 %
Projects/Presentations/Reporting: 0 %

Course title: Écologie fonctionnelle
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Sabrina Coste (sabrina.coste@ecofog.gf)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 25.5 hrs
- Exercices: 4.5 hrs
- Excursions: 0 hrs
- Projects: 0 hrs

Course objectives:

L'objectif de ce cours est de dispenser un enseignement en écologie fonctionnelle des arbres et des peuplements forestiers tropicaux fonctionnant en interaction avec le sol et l'atmosphère.

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Organism to Ecosystem

Upon completion of the course a student must be able to:

- Analyser le fonctionnement du sol en interaction avec les plantes.
- Identifier les stratégies fonctionnelles et les mécanismes de régulation liés aux flux d'eau et de carbone à l'échelle de l'individu.

Course material, text books and further reading:
Notes de cours

Prerequisites: please note the general comment on prerequisites
Connaissances basiques en écologie génerale et biologie végétale

Table of contents:

- Interface sol-plante :
Cycle de l'azote, du phosphore et du carbone et microorganismes du sol impliqués dans ces processus. Fonctionnement des symbioses mycorhiziennes et fixatrices d'azote dans les écosystèmes forestiers. Outils de diagnostic de la fertilité des sols forestiers et agricoles. Outils liés à la restauration des systèmes dégradés (ingénierie écologique)

- Interface plante-atmosphère :
Fonctionnement hydrique des plantes. Mécanismes de régulation en situation de contrainte hydrique. Descriptions des potentiels hydriques foliaires, potentiels de perte de turgescence cellulaire foliaire, synthèse de phytohormone (ABA), régulation stomatique et vulnérabilité des plantes à la cavitation.

Assimilation photosynthétique des arbres. Capacités photosynthétiques foliaires. Durée de vie des feuilles et bilan de carbone.
Diversité fonctionnelle

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %
Written assessment: 100 %
Projects/Presentations/Reporting: 0 %

Course title: Gestion des forêts tropicales
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Bruno Hérault (bruno.herault@cirad.fr)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 4

Course breakdown and hours:

- Lectures: 23 hrs
- Exercices: 0 hrs
- Excursions : 0 hrs
- Projects: 15 hrs

Course objectives:

- Acquérir les concepts de base de la biologie de la conservation et se confronter à un cas réel de gestion des milieux
- Comprendre des enjeux scientifiques, politiques et sociétaux de l'impact des changements climatiques globaux sur les forêts tropicales.
- Envisager la gestion forestière tropicale dans l'objectif de la production de bois.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Ecosystem

Upon completion of the course a student must be able to:
- Comprendre les enjeux de la gestion et de la conservation des forêts tropicales.
- Maîtriser les théories principales de la biologie de la conservation.

Course material, text books and further reading:
Notes de cours

Prerequisites: please note the general comment on prerequisites
Connaissances basiques en écologie.

Table of contents:

- Ecologie Appliquée à la Gestion Conservatoire :
Différentes thématiques de la biologie de la conservation seront abordées : dégradation des espèces et des milieux, conservation des espèces, approche écosystémique de la conservation, étapes de la mise en place d'une aire protégée, conservation et gestion des milieux forestiers.
Le module se clôture par une tournée de deux jours pour rencontrer, sur le terrain, les acteurs de la gestion et de la conservation en Guyane.

- Changements globaux : Ce module abordera en introduction, l'institutionnalisation des problématiques liées aux changements globaux et les bases du débat scientifique et politique. La logique des changements d'échelle sera abordée avec l'exemple de l'Amazonie, en mettant l'accent sur les scénarii et les incertitudes à cette échelle. Puis les effets des changements globaux sur les forêts tropicales seront décrits pour chacune

de leurs ressources (carbone, eau, énergie et température, autres facteurs limitants…), illustrés avec quelques modèles.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %
Written assessment: 50 %
Projects/Presentations/Reporting: 50L %

Course title: Outils pour la recherche
Course ID:
University: Université de Guyane française (UDG)
Faculty:
Department: DFR Sciences et Technologies
Name and e-mail address of the instructor(s): Eric Marcon (eric.marcon@ecofog.gf)
Course website: to be posted
Semester: S1+S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 19 hrs
- Exercices: 0 hrs
- Excursions: 0 hrs
- Projects: 0 hrs

Course objectives:

Apprendre les méthodes nécessaires à la pratique de la recherche en écologie:
- analyse des données avec R;
- bibliographie avec un logiciel adapté;
- rédaction d'articles.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Method and tools

Upon completion of the course a student must be able to:
- Effectuer des recherches bibliographiques de façon efficace.
- Gérer sa base de donnée bibliographique.
- Utiliser R pour les analyses de données courantes.
- Rédiger un article scientifique dans les règles de l'art.

Course material, text books and further reading:
Notes de cours
Paradis, E (2005) *R for beginners*. ftp://cran.r-project.org/pub/R/doc/contrib/Paradis-rdebuts_fr.pdf
Kallestinova ED. How to Write Your First Research Paper. *The Yale Journal of Biology and Medicine*. 2011;84(3):181-190.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %

Written assessment: 100 %
Projects/Presentations/Reporting: 0 %

Course descriptions at the Université des Antilles (UdA)

Course title: UdA Field school
Course ID:
University: Université des Antilles
Faculty: UFR Sciences Exactes et Naturelles
Department: Biology
Name and e-mail address of the instructor(s): D. Imbert (daniel.imbert@univ-ag.fr)
Course website:
Semester: S2
Tuition language: English and French
Number of credits (ECTS): 15

Course breakdown and hours:

- Lectures: 20 hrs
- Exercices: 18 hrs
- Excursions : 128 hrs
- Projects: 32 hrs

Course objectives:
This course offers an overview of the main aquatic and terrestrial topical ecosystems, and highlights the specific environmental and biological features of the insular Caribbean Region. It comprises lectures dedicated to the biogeographic, evolutionary and anthropogenic and specificities of these Caribean ecosystems, and a one-month field training highlighting environmental settings, biocenotic structure, ecological functioning, and ecosystem resilience in response to natural or anthropogenic disturbances in the islands.
Overall, this course is intended to give an integrated, teambuilding education based on both theoretical and practical approaches, and adapted to a variety of tropical ecosystems located in one of the major biodiversity hotspots of the world.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

Upon completion of the course a student must be able to :
- Master ecological knowledge on Caribbean island ecosystems
- Design and implement field protocols for biodiversity assessment and management

Course material, text books and further reading:
Woods C.A. and Sergile F.E., 2001. Biogeography of the West Indies
Schnell R., 1987. La lore et la vegetation de l'Amérique Tropicale
Snedaker SC & Snedaker JG, 1984. The mangrove ecosystem: research methods
Monti D., Keith P. & Vigneux É. 2010. Atlas des poissons et des crustacés d'eau douce de la Guadeloupe.

Prerequisites: please note the general comment on prerequisites
Basic knowledge in biology and ecology

Table of contents:
Theory (lectures):
- Caractérisation des principaux écosystèmes des îles de la Caraïbe: approches biogéographiques et évolutives
- Concepts et méthodes d'analyse des systèmes artificialisés (théories de la panarchie et de la viabilité, l'analyse de cycle de vie, bilan carbone analyse émergétique).

Practicals:
One-month teambuilding training sessions (field and lab) on various Caribbean ecosystems:
- coral reefs and seagrass beds,
- mangroves,
- upland forests,
- mountain streams

Project:
Each student will implement a project mainly fed by his own experience along the field training sessions.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %
Written assessment: 50 %
Projects/Presentations/Reporting: 50 %

Course title: Systèmes d'Information géographiques et bases de données
Course ID: EC 73.1
University: Université des Antilles
Faculty: Sciences Exactes et Naturelles
Department: Mathématiques et Informatique
Name and e-mail address of the instructor(s): E. Grandchamp (enguerran.grandchamp @ univ-ag.fr)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 10 hrs
- Exercices: 22 hrs

Course objectives:
Ce cours présente les concepts et outils de base des Systèmes d'Information Géographique ainsi que l'extraction de données en utilisant des critères sémantiques (tables attributaires, création de formules complexes de sélection utilisant un ou plusieurs champs) et des critères spatiaux (formules de sélection mais aussi outils d'analyse spatiale).
Le cours aborde également les principes de base de l'extraction de données dans des rasters.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods & Tools

Upon completion of the course a student must be able to :
Maîtriser les concepts et outils permettant de manipuler des données géographiques, d'en extraire l'information utile et de la représenter selon les conventions usuelles.

Course material, text books and further reading:

Prerequisites: please note the general comment on

None

Table of contents:

Theory (lectures):
- SIG, données spatiales, notion de référentiel et de système de projection, données vectorielles et données raster, analyse sémantique et analyse spatiale
- Analyse sémantique (modèle relationnel, formalisme SQL, requêtes)
- Analyse spatiale (notion de géométrie ensembliste, fonctions spatiales, requêtes)
- Introduction à l'analyse de données raster (histogramme, statistiques, calculs d'indices, masques et profils, 3D)

Practicals:
- Prise en main de QGis
- Analyse sémantique de données avec SQL (filtrage, sélection)

- Analyse spatiale avec SQL (buffers)
- Réalisation de cartes thématiques
- Analyse de données raster

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %
Written assessment: 100 %
Projects/Presentations/Reporting: 0 %

Course title: Introduction à l'écotoxicologie
Course ID: EC 82.3
University: Université des Antilles
Faculty: Sciences Exactes et Naturelles
Department: Biologie
Name and e-mail address of the instructor(s): S. Lemoine (soazig.lemoine@univ-ag.fr)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 12 hrs
- Exercices: 8 hrs

Course objectives:

Description des principaux bio-essais (tests daphnies, microtox, test comet, embryotoxicitéetc…). Avantages et inconvénients de ces tests. Utilisation des EC50, LC 50 pour le calcul de l'indice de risque pour l'environnement. La mise en place et bilan de la DCE. Description de la réglementation. Mise en place d'un test en travaux pratiques (embryotoxicité sur des larves d'huîtres).

Learning outcomes : please note the general comment on learning outcomes

Education level: Basic Ecosystem focus: Interactions Biological level: Global

Upon completion of the course a student must be able to :
Maîtriser l'utilisation des bio-essais standardisés en écotoxicologie.

Course material, text books and further reading:

Prerequisites: please note the general comment on prerequisites

Notions fondamentales de chimie (chimie organique, chime minérale, chiemie des solutions)

Table of contents:

Theory (lectures):

- Description des principaux bio-essais (tests daphnies, microtox, test comet, embryotoxicitéetc…). Avantages et inconvénients de ces tests.
- Utilisation des EC50, LC 50 pour le calcul de l'indice de risque pour l'environnement.
- La réglementation européenne : mise en place et bilan de la DCE. La réglementation.

Practicals:

Mise en place d'un test d'embryotoxicité sur des larves d'huîtres.

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 0 %
Written assessment: 100 %
Projects/Presentations/Reporting: 0 %

Course title: Pollution et écosystèmes marins
Course ID: EC 83.2
University: Université des Antilles
Faculty: Sciences Exactes et Naturelles
Department: Biologie
Name and e-mail address of the instructor(s): S. Lemoine (soazig.lemoine@univ-ag.fr)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 20 hrs
- Exercices: 4 hrs

Course objectives:
Ce cours présente les différentes sources de pollution et le comportement de ces molécules dans le milieu marin

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

Upon completion of the course a student must be able to :
Connaître l'origine des principales molécules contaminant les systèmes marins

Course material, text books and further reading:

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
- Méthodes d'analyse chimiques des différentes familles de polluants (pesticides, HAP, métaux, nanoparticules…).
- Rôle des sédiments marins (granulométrie, teneur en matière organique) dans le stockage des polluants.
- Transport, biodisponibilité, bioaccumulation, voie d'entrée dans les organismes etexcrétion des contaminants.
- Utilisation des échantillonneurs passifs dans le milieu marin.
- Mécanismes de détoxication.
- Réponses aux stress : diversité biologique et structure des communautés. Notion de tolérance et de résistance.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 0 %
Written assessment: 100
Projects/Presentations/Reporting: 0

Course title: Ecologie comportementale
Course ID: EC 82.3
University: Université des Antilles
Faculty: Sciences Exactes et Naturelles
Department: Biologie
Name and e-mail address of the instructor(s): G. Loranger (glorange@univ-ag.fr)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 16 hrs
- Exercices: 8 hrs

Course objectives:
Ce cours a pour but de présenter les principaux concepts théoriques et modes de raisonnement en écologie comportementale et d'illustrer leur application à différents grands domaines. Les enseignements associent une approche évolutive (valeur adaptative, pressions de sélection et contraintes, héritabilité,...) et une présentation des mécanismes en comportement animal (bases physiologique, génétique du comportement, …). Les principaux thèmes abordés sont : les grands concepts de l'écologie comportementale ; l'exploitation des ressources dans l'espace et dans le temps ; la sélection sexuelle; le comportement social.
Les travaux pratiques porteront sur la sélection sexuelle (choix des femelles), la sélection d'habitat et la vigilance et taille de groupe.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Animal Biological level: Population

Upon completion of the course a student must be able to
- comprendre les Grands concepts de l'écologie comportementale
- comprendre l'exploitation des ressources dans l'espace et le temps
- comprendre la sélection sexuelle
- le comportement social

Course material, text books and further reading:

Prerequisites: please note the general comment on prerequisites
Connaissances de base en biologie évolutive (sélection naturelle, dérive génétique)

Table of contents:
Grands concepts de l'écologie comportementale
- Optimisation simple et théorie des jeux
- La Méthode comparative
- Variabilité comportementale et concept de personnalité animale

Exploitation des ressources dans l'espace et le temps
- Stratégies optimales d'exploitation des ressources
- Sélection de l'habitat et dispersion

Sélection sexuelle
- Définition formelle du processus de sélection sexuelle

- Sélection intrasexuelle
- Sélection intersexuelle (modèle de Fisher-Lande, principe du handicap, exploitation sensorielle)
- Sélection sexuelle et spéciation

Comportement social

- Coûts et bénéfices de la vie en groupe
- Organisation sociale de la reproduction et régimes d'appariement
- Evolution de la coopération et de la socialité.
- Polyéthisme et régulations sociales

Travaux Pratiques :

- Sélection sexuelle: analyse du choix des femelles chez le guppy
- Sélection d'habitat chez le bernard l'hermite, *Coenobitaclypeatus*
- Analyse d'articles scientifiques

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 0
Written assessment: 2/3
Projects/Presentations/Reporting: 1/3

Course title: Interactions durables
Course ID: *EC 82.2*
University: Université des Antilles
Faculty: Sciences Exactes et Naturelles
Department: Biologie
Name and e-mail address of the instructor(s): O. Gros (olivier.gros@univ-ag.fr)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 20 hrs
- Exercices: 4 hrs

Course objectives:
A l'aide de d'exemples pris dans divers milieux, nous montrerons que les interactions durables de type symbiose et parasitisme chez les animaux représentent des moteurs forts de l'évolution (notions de co-spéciation, co-évolution). Il s'agira également de montrer la force de ces interactions dans l'adaptation des organismes aux contraintes physiologiques et environnementales auxquelles sont soumis les organismes évoluant au sein d'écosystèmes variés. Nous aborderons également les interactions plantes-animaux.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animal Biological level: Community

Upon completion of the course a student must be able to :
Evaluer la place des interactions durables de type symbiose et parasitisme dans les phénomènes d'adaptation et leur importance au niveau évolutif.

Course material, text books and further reading:

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

le symbiote à s'associer ?
Régulation de la population symbiotique
Symbiose et Evolution

3 Les interactions plantes-insectes
Des stratégies d'exploitation de la plante aux stratégies mutualistes
Défense des plantes contre les insectes.
Des réseaux trophiques plus ou moins complexes autour des plantes *(ex : figuiers, interactions plantes-champignons-phytophages)*
Évolution des interactions insectes-plantes

4 Les interactions biotiques dans le sol
Comment classer les interactions entre organismes dans les sols
La Prédation
La Compétition
Symbiose et Mutualisme (Insectes/Parabasaliens ; Insectes/Champignons)

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 1/3
Written assessment: 2/3

Course title: Ecophysiologie végétale
Course ID: *EC82.1*
University: Université des Antilles
Faculty: Sciences Exactes et Naturelles
Department: Biologie
Name and e-mail address of the instructor(s): M. Dulormne (maguy.dulormne@univ-ag.fr)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 18 hrs
- Exercices: 6 hrs

Course objectives:

Un premier objectif est d'exposer la fixation du carbone à des échelles intégrées (de la cellule aux couverts végétaux), ainsi que les principaux traits physiologiques concernés et les outils d'évaluation de la diversité fonctionnelle des plantes tropicales. Il s'agit aussi de présenter les adaptations morphologiques, physiologiques, et moléculaires des plantes à des stress tels que la salinité et l'hydromorphie.

Learning outcomes : please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Plant Biological level: Ecosystem

Upon completion of the course a student must be able to :

Analyser la réponse physiologique des espèces (résistance, sensibilité, résilience) à différentes échelles (cellule, feuille, plante, couvert) à l'aide d'outils variés (mesures de fixation de carbone, d'isotopie 13C, de fluorescence). Analyser la résistance et l'adaptation des espèces aux contraintes abiotiques (disponibilité en eau, salinité, taux d'oxygène, température).

Course material, text books and further reading:

Farineau J, Morot-Gaudry J-F, 2011. Photosynthèse : processus physiques, moléculaires et physiologiques, ed Quae

Farquhar G D, Ehleringer J R, and Hubick K T, 1989. Carbon Isotope Discrimination and Photosynthesis. Annual Review of Plant Physiology and Plant Molecular Biology. Vol. 40: 503-537. DOI: 10.1146/annurev.pp.40.060189.002443

Jenks MA, Hasegawa PM, 2014. Plant Abiotic Stress, 2nd Edition

Maxwell k and Johnson GN, 2000. Chlorophyll fluorescence—a practical guide. J. Exp. Bot. 51 (345): 659-668.

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment:0 %
Written assessment: 100 %
Projects/Presentations/Reporting: 0 %

Course descriptions at Université de Dschang (UDsch)

Course title: Ecole de Terrain Ecosystèmes forestiers d'Afrique centrale
Course ID: BIO-Y-020
University: Université de Dschang
Faculty: Agronomy and Agricultural Sciences / Sciences
Department: Forestry and Plant Biology
Name and e-mail address of the instructor(s): Marie-Louise Avana Tientcheu (avanatie@yahoo.fr) and François Nguetsop (vfnguetsop@yahoo.fr)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 15
IMPORTANT: Additional cost (*ca.* 20 000 XAF for transport, 200 000 XAF for accommodation and 133 333 XAF for food, amounting to *ca.* 530 EUR) will be payable by the students.

Course breakdown and hours:
- Exercises: 1 week
- Projects: 3 weeks
- Excursions/Practicals : 4 weeks

Course objectives:
The field course is an interdisciplinary rainforest-oriented workshops with as main goal to put educational theory into educational practice *in situ by giving to student field experience within a rainforest context*.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Ecosystem

Upon successful completion of this course the students will be able to apply:
- Tools and principles of systematics in the rainforest environment;
- tools and principles of participatory research;
- tools of species, habitat and ecosystem assessment
- floristic inventory in forest ecosystems
- assessment of agroforestry initiatives

Course material, text books and further reading:
Course notes. Field course manual.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
- data collection in the rainforest,
- analysis of rainforest biodiversity
- biomass and natural resources
- protocols for describing new species
- use of remote sensing and geographic information systems in analysing forest dynamics, anthropogenic impacts on the rainforest
- forests products and services uses and management

Assessment breakdown: please note the general comment on assessment breakdown

Written exam: 70%
Project assessment: 30 %

Course title: GIS, remote sensing and landscape management
Course ID: IAGR41A3
University: Université de Dschang
Faculty: Agronomy and Agricultural Sciences
Department: Forestry
Name and e-mail address of the instructor(s): Roger Ndjila Ntankouo (roger.njila@gmail.com)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 15
- Exercises: 5
- Practicals: 25

Course objectives:
The goal of the course is to give to students concepts of geo-referencing, remote sensing and geographical information systems (GIS) and their application to natural resource management.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

Upon completion of the course the students understand:
- Concepts of information acquisition, projection and geo-referencing systems, scale, layers and entity
- Tools and skills in remote sensing and geo-referencing
- Treatment, analysis and stocking of GIS data.

Course material, text books and further reading:
Alexandria Digital Library on the web of University of Santa Barbara, California
Burrough P.A. 1986. Principle of Geographic Information Systems for Land resources assessment. Clarendon Press.
Collet, C. 1992. Système d'Information Géographique en mode image. Lausanne, Presses Polytechniques et Universitaires. Coll. « Gérer l'environnement ».

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Introduction to remote sensing and GIS and their applications in landscape management
Definition, functions, uses of remote sensing and GIS
Information acquisition
Required skills and notions in GIS and remote-sensing
Representing GIS data
Setting up a GIS: modelling and conceptual representation
Treating, analysing and stocking GIS data: MAPINFO and ARCVIEW (ARCGIS)
Cases studies

Assessment breakdown: please note the general comment on assessment breakdown
Written exam: 70%
Project assessment: 30 %

Course title: Phylogeny and advanced plant systematics (African rainforest)
Course ID: BIV38 / BIOL-Y-022
University: Université de Dschang
Faculty: Faculty of Science
Department: Plant Biology
Name and e-mail address of the instructor(s): Louis Zapfack (lzpafack@yahoo.fr)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 30 hrs
- Exercises & student individual work: 10 hrs
- Lab work: 5 hrs

Course objectives:
The course aims at familiarizing the students with the systematics and classification of plants of the African Congo Basin rainforest and to review their history. This course refreshes the student with those parts of plant systematics needed for the Mbalmayo field course. In addition, it is a basis for each of the modules chosen.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Organism

The student at the end of the course should be able to know the systematics of the African Congo Basin rainforest, use diagnostic characters of African Congo Basin rainforest plants and classify them, and use modern methods of vegetation studies and floristics.

Course material, text books and further reading:
Course notes.
Determination keys for African Congo Basin rainforest plants.
Herbarium and live plant specimens.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
History of plants classification
Nomenclature and principles of African Congo Basin rainforest plant taxonomy
Herbarium management, herbariums and botanical gardens
Identifications of vascular plants, floristic studies
Literature on botanical systematic

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 80 %
Practical and exercise assessment: 20 %

Course title: Biodiversity conservation
Course ID: MSRN51I3/BIOL-Y-026
University: Université de Dschang
Faculty: Agronomy and Agricultural Sciences
Department: Forestry
Name and e-mail address of the instructor(s): Martin Tchamba (mtchamba@yahoo.fr)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 20h
- Projects: 10h

Course objectives:
The aim of this course is to introduce students into biodiversity evaluation methods, biodiversity threats and conservation strategies using a fundamental and applied approach.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Community

Upon completion of the course students will understand:
Different levels and aspects of biodiversity
Human impacts on biodiversity uses and eradication
Approaches of valuing biodiversity

Course material, text books and further reading:
Relevant book chapters, reprints of recent scientific papers and lectures handouts will be available to students.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
concepts definitions: genetic and specific; ecosystems biodiversity;
biodiversity evaluation at different scale of biosphere
geographic variation of biodiversity
concepts of endemism, species scarcity and threatened
scale and strategy of biodiversity conservation

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 70%
Project evaluation and attendance: 30%

Course title: Tropical phytogeography
Course ID: BIV36, BIOL-Y-021
University: Université de Dschang
Faculty: Faculty of Science
Department: Plant Biology
Name and e-mail address of the instructor(s): Jonas Yves Pinta (jonasypinta@yahoo.fr)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs
- Exercises and projects: 10 hrs
- Lab work: 5 hrs

Course objectives:
Define and show to students how different plant formations are distributed over the world. Explain and discuss the causes and consequences of this distribution.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Global

The student at the end of the course should be able to know
- The main vegetation types that are found in the world and their localisation
- The main biological forms that are fond in each vegetation type
- The factors that can explain the distribution of plant formations
- The consequences of the present days distribution of plants formations

Course material, text books and further reading:
Text books related to Biogeography
Maps showing the distribution of plants on the world, in different continents
Particular point is given the Phytogeography of Cameroon. See Letouzey, Phytogeographie du Cameroun (1968)
Video or films related to the topic

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Definition of current terms in phytogeography
Plant biological forms
Main plant formation and their distribution in the world
Phytogeography of Africa and Cameroon

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 80 %
Lab work and excursion: 20 %

Course title: Natural resource evaluation methods
Course ID: MSEV2E4/ENVI-Y-020
University: Université de Dschang
Faculty: Agronomy and Agricultural Sciences
Department: Forestry
Name and e-mail address of the instructor(s): Tsi Evaristus Angwafo (tsievaristus@yahoo.co.nz)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs
- Excursions/Practicals: 15 hrs

Course objectives:
The main goal of this course is to give to students' tools, methods and parameters used in biophysical evaluation of natural resources and mainly biodiversity. The course also covered sampling techniques, data collection and analysis.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Methods and tools

Upon successful completion of this course the students understand:
- Tools and methods of floristic and fauna inventory;
- Theories, concepts and practices of natural resources assessment and valuation;
- Concepts of sustainability in natural resources evaluation;
- Species, habitat and ecosystem level of assessment.

Course material, text books and further reading:
Course notes. Scientific articles of case-studies.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
- Difference in collecting data on fauna and flora;
- Methodological approaches in filed inventory of Biota;
- Deductive and inductive methods in natural resources
- Measurability of biodiversity;
- The sustainability triangle;
- Species and habitat assessment of biodiversity;
- Case study of faunistic evaluation
- Foundation of value theory

Assessment breakdown: please note the general comment on assessment breakdown
Written exam: 70%
Project assement and attendance: 30 %

Course title: Forest ecology and silviculture
Course ID: BIV44, BIOL-Y-027
University: Université de Dschang
Faculty: Faculty of Science
Department: Plant Biology
Name and e-mail address of the instructor(s): Grace Mendi (ngracemendi@yahoo.com) and Marie-Louise Avana Tientcheu (avanatie@yahoo.fr)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 20 hrs
- Exercises & student individual work: 20 hrs
- Lab work: 10 hrs

Course objectives:

- To learn deeply notions on sylviculture and forest ecology.
- To learn more about the sustainable management of forest biodiversity.

Learning outcomes : please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Plant Biological level: Community

The student at the end of the course should be able to know

- About regeneration of forest taxa in situ or ex situ. Main techniques used in Sylviculture.
- About forest resources,
- Linkages between forest compartments (biotic and abiotic factors).
- Sustainable Forest management

Course material, text books and further reading:
Text books related to Sylviculture, Forest Ecology and Forest management

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Ecological particularities of the main forest in the world,
Plant communities in forest ecosystems
Matter and energy transfers
Principles of forest regeneration
Forest exploitation in Cameroon

Assessment breakdown: please note the general comment on assessment breakdown
Wittren assessment: 80 %
Labwork and fieldwork assessment: 20 %

Course title: Socioeconomic analysis and elaboration of a management plan for forests and community forests
Course ID: IFFO42D2/ENVI-Y-024
University: Université de Dschang
Faculty: Faculty of Agronomy and Agricultural Sciences
Department: Forestry
Name and e-mail address of the instructor(s): Serges Bobo Kadiri (bobokadiris@yahoo.com) and Therese Fouda Moulende (agesfo@camnet.cm / agesfosiege@yahoo.fr)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 20 hrs
- Exercises: 10 hrs
- Projects: 10 hrs
- Excursions: 5 hrs

Course objectives:
The objectives of this course are to:
- learn how to conceive a participatory management plan for conservationist and rural developers taking in account needs and constraints of all stakeholders;
- plan an integrated management of biodiversity
- learn how to use and apply national and international policies and regulations to natural resources management

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Community

Upon completion of this course students will be able to:
- elaborate a management plan for forestry and community forestry project;
- proposed an integrated management strategy for natural resources;
- understand and apply forest policies and regulations for sustainable natural resources management

Course material, text books and further reading:
Textbooks on basics of forest management
National and international policy instruments on forests resources management

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
- Socioeconomic study of protected areas and borders environment;
- Evaluation of faunistic and Floristic biodiversity of forest land
- Guidelines for integrated management of natural resources in forest area
- Elaboration of a management plan for protected area and buffer zones

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 70%
Projects and attendance: 30%

Course title: Forest management and certification
Course ID: MSRN51G1/ENVI-Y-022
University: Dschang
Faculty: Agronomy and Agricultural Sciences
Department: Forestry
Name and e-mail address of the instructor(s): Serge Bogo Kadiri (bobokadiris@yahoo.fr)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 20 hrs
- Projects: 10 hrs
- Excursions: 15 hrs

Course objectives: the gaol of the course is to highlight concepts and principles of sustainable forest management. Discuss challenges and opportunities of forest governance and certification of forest products.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Global

Upon completion of the course the students understand:
- Concept of sustainability in forest products uses;
-tools and parameters in forests management
- tools, challenges and opportunities of existing Certification systems.

Course material, text books and further reading:
Textbooks on basics of forest management.
National and international policy instruments on forests resources management.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
History of management: principles of sustainable management forest resources
Forests Dynamic and management methods and parameters
Definition, genesis and evolution of the concept of forest certification;
Analysis of existing certification systems
Certification audits and guidelines
Certification and the value and chain of wood products
Market trends of certified forest products

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 70%
Project assessment and attendance: 30%

Course title: Plantes mellifères, pollens et production des miels
Course ID: BIV46, BIOL-Y-031
University: Université de Dschang
Faculty: Faculty of Science
Department: Plant Biology
Name and e-mail address of the instructor(s): Jonas Yves Pinta (jonasypinta@yahoo.fr)
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs
- Exercises, Practicals & individual work: 20 hrs

Course objectives:
To permit to students to know the different melliferous plants and acquire aptitude in bee keeping. They will ultimately learn how to extract different products such as honey, propolis and miellat from the hive.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

The student at the end of the course should be able to know about:
- Identifying melliferous plants
- Biology and ecology of *Apis mellifera*
- Functioning of the hive
- Product of the hive and their uses

Course material, text books and further reading:
Gould, J.L. & C.G. Gould, 1995. *The Honey Bee*. Scientific American Library, New York, U.S.A. 239 pp
and other text books related to Apiculture, bee keeping
Videos on the topic of bee hives, apiary, honey extractors

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 80%
Lab work and field work: 20%

Course title: Plantes médicinales et ethnophamacologie
Course ID: BIV47, BIOL-Y-032
University: University of Dschang
Faculty: Faculty of Science
Department: Plant Biology
Name and e-mail address of the instructor(s): Jonas Yves Pinta (jonasypinta@yahoo.fr) and Nicole Guedje (Nicole.Guedje@ulb.ac.be)
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 30 hrs
- Exercises, Practicals & individual work: 20 hrs

Course objectives:
To introduce students to traditional medicine and the use of local plants to cure diseases. The student will also learn about the methodology and research on phytotherapy

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Plant Biological level: Organism

The student at the end of the course should be able to know about:
- Notions on traditional medicine
- Notions on medicinal plants
- Selection of plants for extractions of active principles
- Ethnobotany

Course material, text books and further reading:
Text books related to medicinal plants such as
Adjanohoun, E., M.R.A. Ahyi, L. Ake Assi, J. Baniakina, P. Chibon, G. Cusset, V. Doulou, A. Enzanza, J. Eymé, E. Goudoté, A. Keita, C. Mbemba, J. Mollet, J.- M. Moutsamboté, J. Mpati, P. Sita, 1988. Contribution aux études ethnobotaniques et floristiques en République populaire du Congo. Agence de coopération culturelle et technique, (A.C.C.T.), Paris, 605 p. and many other works by Adjanohoun et al.
Videos on the topic
Visits to the medicinal plants garden

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Historical review
Methods and techniques for medicinal plants
Scientific evidences on the efficiency of some medicinal plants, advantages and inconvenients
Plant selection for extraction of active principles
Common medicinal plants

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 80%
Lab work and field work: 20%

Course title: Ethnobotanique et valorisation des ressources naturelles
Course ID: MSRN51H4/BIOL-Y-034
University: Université de Dschang
Faculty: Faculty of Agronomy and Agricultural sciences
Department: Forestry
Name and e-mail address of the instructor(s): Jonas Yves Pinta (jonasypinta@yahoo.fr) and Marie-Louise Avana-Tientcheu (avanatie@yahoo.fr)
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 15 hrs
- Exercises & student individual work: 10 hrs
- Lab work /project: 5 hrs
- Excursions: 5 hrs

Course objectives:
To introduce students to ethnoscience apply to plants. The student will also learn about the research methodology on ethnobotanical survey , quantitative and qualitative data analysis

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Human Biological level: Ecosystem

The student at the end of the course should be able to know about:
- Notions of traditional or local classification systems of plants
- services and products from plants
- quantitative vs qualitative ethnobotany/biological vs anthropological ethnobotany
- principle and practices of ethnobotanical survey

Course material, text books and further reading:
Martin, G.J., **2004**. *Ethnobotany : a methods manual.* Earthscan Publications Ltd., London, U.K. 268 pp.
Cunningham, A.B., **2001**. *Applied Ethnobotany : people, wild plant use and conservation*. Earthscan Publications Ltd., London, U.K. 300 pp.
Videos on the topic
Visits to the medicinal plants garden

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Definition and history of ethnosciences, ethnobotany and related field
Services and products from plants
principles and practices of ethnobotanical surveys
quantifying ethnobotanical data
ethnobotanical surveys for plant resources valorization (domestication and bioprospection)

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 70 %
Lab work and field work: 30 %

Course descriptions at Universiti Malaysia Terengganu (UMT)

Course title: UMT Field School
Course ID: UMTROP 401
University: Universiti Malaysia Terengganu
Institute/School: Institute of Oceanography and Environment (INOS)
Name and e-mail address of the instructor(s):
Assoc. Prof. Dr. Behara Satyanarayana (satyam@umt.edu.my)
Assoc. Prof. Sulong Bin Ibrahim (sulong@umt.edu.my)
Assoc. Prof. Dr. Zainudin Bachok (zainudinb@umt.edu.my)
Semester: S2
Tuition language: English
Number of credits (ECTS): 15
IMPORTANT: The costs for the Course are in part met by the University, but each student will be asked to contribute a maximum of 2000 MYR for transport, accommodation in shared chalets, etc… Students will also be asked to contribute to shared food costs if necessary.

Course breakdown and hours:

- Planning and arrangements : 72 hrs
- Lecture and scientific discussions : 24 hrs
- Exercises (e.g. visit to charcoal production and export companies, ecotourism with open-ended questions, creating awareness on TROPIMUNDO, etc.) : 48 hrs
- Excursions (hands-on module with different scientific equipment, data collection and visit to different mangrove management sites, etc.): 240 hrs
- Projects (result analyses, comprehensive report preparation and submission on time): 240 hrs

Course objectives:

- to expose the students to mangrove environment
- to recognise and identify mangrove biodiversity and its association patterns
- to test /apply mangrove theoretical knowledge/concepts in the field
- to validate mangrove loss and gain scenarios practically
- to appreciate 'sustainability' in mangrove forest resources use and management

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

Upon completion of the course a student must be able to -

- become conversant with both qualitative and quantitative sampling techniques for mangrove surveillance
- assess any mangrove ecosystem for appropriate conservation and management directives
- provide scientific direction to the local mangrove managers and policy makers
- frame his/her own research ideas for pursuing a higher academic qualification (e.g. Ph.D.)

Course material, text books and further reading:

Samuel C.S., Jane G.S. (eds.), 1984. The mangrove ecosystem: research methods. UNESCO.
Tomlison P.B., 1986. The botany of mangroves. Cambridge University Press.
Saenger P., 2002. Mangrove ecology, silviculture and conservation. Kluwer Academic Publishers.
Singh V.P. , Odaki K., 2004. Mangrove ecosystem : structure and function. Scientific Publishers.
Kathiresan K., Qasim S.Z., 2005. Biodiversity of mangrove ecosystems. Hindustan publishing corporation.
Mazda Y., Wolanski E., Ridd P.V., 2007. The role of physical processes in mangrove environments. Manual for preservation and utilization of mangrove forests. Terrapub.
Clough B., 2013. Continuing the journey amongst mangroves. ISME, Mangrove Educational Book Series No. 1.
Ong J.E., Gong W.K., 2013. Structure, Function and Management of Mangrove Ecosystems. ISME, Mangrove Educational Book Series No. 2.

Baba S., Chan H.T., Aksornkoae S., 2013. Useful products from mangrove and other coastal plants. ISME, Mangrove Educational Book Series No. 3.

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

The exact course content may slightly change but will focus on one or more of the following topics.

Theory:

1. Environmental settings (water, sediment) at the mangrove wetland
2. Mangrove taxonomy and characteristics
3. Mangrove conservation and management (with sustainable use and exploitation)
4. Invited talk (e.g. Matang mangroves after a century of conservation and management)

Practicals:

1. Ecotourism in mangroves
2. Determination of the physico-chemical conditions of water and sediment
3. Visit to replanted, thinning and clear-felling mangrove sites
4. Mangrove charcoal production and export
5. Mangrove dependent population and their livelihood
6. Role of local communities in mangrove conservation and management (including local knowledge on ethnobotany and ethnomedicine)
7. Vegetation inventory
8. Fecundity (seed production) in different mangrove species
9. Mangrove species distribution vs. inundation frequency (along the river/creek)
10. Mangrove zonation (transect across the forest)

Projects:

1. Determination of mangrove fecundity (as per the fruiting season)
2. Mangrove vs. sea level rise

Assessment breakdown: please note the general comment on assessment breakdown

Student participation and attitude + Projects/Presentations/Comprehensive report: 100 %

Course Title: Remote Sensing and GIS
Course Id: UMTROP402
University: Universiti Malaysia Terengganu
Institute/School: Institute of Oceanography and Environment (INOS)
Name and e-Mail Address Of The Instructor(S):
Assoc. Prof. Dr. Aidy @ Mohamed Shawal Bin M. Muslim (aidy@umt.edu.my)
Mr. Idham Khalil (idham@umt.edu.my)
Semester: S2
Tuition Language: English
Number of Credits (Ects): 3

Course Breakdown and Hours:

- Lectures: 21 hours
- Exercises: 33 hours
- Excursions : 24 hrs
- Projects: 6 hrs

Course objectives:

1. To introduce the concepts of earth observation and remote sensing data acquisition techniques
2. To introduce the concepts of digital spatial data manipulation, processing and visualisation
3. To apply satellite data manipulation and visualisation methods to terrestrial, coastal and marine areas

Learning outcomes: please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods & Tools

Upon completion of the course a student must be able to:

1. Describe the physical nature of coastal environments, their dynamic geomorphology and the key attributes which must be considered for coastal management
2. Analyze the ground, air, satellite and marine based sensor platforms
3. Apply appropriate data manipulation and visualisation methods for a number of Earth Science applications, including Geographical Information Systems (GIS)

Course material, text books and further reading:

Cracknell A.P. (1983) Remote sensing applications in marine science and technology. D. Reidel Pub. Co.
Lillesand T.M., Ralph W.K., 1999. Remote sensing and image interpretation. John Wiley & Sons.
Sabins F.F., 1997. Remote sensing: principles and interpretation. W.H. Freeman & Co.
Sample V.A., 1994. Remote sensing and GIS in ecosystem management. Island Press.
Lunetta R.S., Lyon J.G., 2004. Remote sensing and GIS accuracy assessment / edited by Boca Raton, Fla.: CRC Press.
Richardson L.L., Ellsworth F.L., 2006. Remote sensing of aquatic coastal ecosystem processes: science and management applications. Dordrecht: Springer.
Lillesand T.M., 2008. Remote sensing and image interpretation. Hoboken: John Wiley.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Lecture topics:
- Introduction to Geographical Information System (GIS)
    - Background and Definition of GIS
    - Components and Application of GIS
- Geographic Data Concepts

- Introduction
- Spatial Data Model
- Geo-Relational Vector Data Model
- ESRI Vector Data Model
- Topological Data Model
- Tin Data Model, Region, Routes
- Raster Data Model

- GIS Data Source
  - Introduction
  - Data Transfer, Geographic Data Format
  - Data Conversion and Photogrammetric
  - GPS and DGPS
- Spatial and Network and 3-D Analysis in GIS
  - Introduction
  - Spatial Analysis and Network Analysis
  - 3-D Analysis
- Introduction to Remote Sensing
  - Introduction
  - The Elements of Remote Sensing
  - Principles of Remote Sensing
  - Physical Basic of Remote Sensing
- Digital Image Processing
  - Introduction
  - Digital Data and Image Resolution
  - Remote Sensing Data Analysis
  - Digital Image Processing
  - Radiometric Corrections
  - Image Classification
- GIS for Coastal Zone Management
  - Introduction
  - Basic Map Concepts and Database Design
  - Data Capture and Implementation
  - Database Management
  - Performing Geographic Analysis
  - Presentation of Results
- Introduction to Global Positioning System (GPS)
  - Fundamentals of Reference Systems and Frames
  - Basic Principles of GPS Operations: Ranging From Space.
  - Basic Types of GPS Observable: Pseudo Ranges (P-Code, C/A-Code), L1 and L2 Phases.
  - GPS Error Sources and Error Handling Procedures
  - Position Determination with Phases and Pseudo Ranges
  - Data Collection and Field Procedures: Data Transfer, Processing and Result Interpretation; Residual and Covariance Analysis.
  - Static Vs. Kinematic GPS Applications.
  - GPS applications in survey and mapping, GIS, air and land navigation and precision farming, integration with other sensors, Inertial Navigation System (INS) and image sensors.

Practical:
Ground truthing
Image rectification
AOI selection
Image classification and accuracy assessment
Noise reduction and map production

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 20%
Written assessment: 50 %
Projects/Presentations/Reporting: 30%

Course title: Tropical oceanography
Course ID: UMTROP403
University: Universiti Malaysia Terengganu
Institute/School: Institute of Oceanography and Environment (INOS)
Name and e-mail address of the instructor(s):
Dr. Mohd Fadzil Mohd Akhir (mfadzil@umt.edu.my),
Assoc. Prof. Dr. Suhaimi Suratman (miman@umt.edu.my)
Dr. Peter Robertson Parham (parhamp@umt.edu.my)
Prof. Dr. Mohd Lokman Bin Husain (mlokmn@umt.edu.my)
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Exercices: 4 hrs
- Excursions : 24 hrs
- Projects: 18 hrs

Course objectives:

1. Describe the basic concepts related to the physical, chemical and geological processes of the ocean especially near the tropical region.
2. Provide understanding on the dynamics of oceanic processes and its influence towards productivity and nutrients.
3. Provide understanding on the paleooceanography and changes in sea-level in different time scale
4. Provide guidance in equipment handling techniques, analysis and presentation of physical oceanographic data.

Learning outcomes : please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Environment Biological level: Global

Upon completion of the course a student must be able to:

1. Explain and make conclusions about the physical processes that influence the distribution of sea water characteristics and circulation.
2. Explain the basic concepts of the relationship between ocean processes and productivity/nutrients.
3. Explain the theories of sediment distribution and sea level changes
4. Communicate effectively and master writing skills and presentation.
5. Master skills of information technology for oceanography information processing.
6. Master skills in conducting physical oceanography equipment and data analysis software.

Course material, text books and further reading:

1. Tom Garrison. (2001). Essentials of Oceanography (2nd edition). USA.
2. S. Pond and G.L. Pickard, 1983. Introductory Dynamical Oceanography. Elsevier
3. Robert H. Stewart, 2007. Introduction To Physical Oceanography. Dept. of Oceanography, Texas A & M University.
4. Riley, J.P. and R. Chester, 1971. Introduction to Marine Chemistry. Academic Press. London.
5. R. Chester and T.D. Jickells, 2013. Marine Geochemistry. Wiley-Blackwell
6. Jim Murray, 2001. Chemical Oceanography Lecture Note. Univ. Washington.
7. John. H. Sampson and J. Sharples, 2012. Introduction to the Physical and Biological Oceanography of Shelf Seas. Cambridge University Press

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 20 %
Written assessment: 60 %
Projects/Presentations/Reporting: 20 %

Course title: Estuarine and Mangrove Ecology
Course ID: UMTROP404
University: Universiti Malaysia Terengganu
Institute/School: Institute of Oceanography and Environment (INOS)
Name and e-mail address of the instructor(s):
Assoc. Prof. Sulong Bin Ibrahim (sulong@umt.edu.my)
Assoc. Prof. Dr. Behara Satyanarayana (satyam@umt.edu.my)
Semester: S2
Tuition language: English
Number of credits (ECTS): 3
Important : This course may in part be taught during the UMT Field School

Course breakdown and hours:

- Lectures (in class): 18 hrs
- Exercises (practicals in the campus) : 27 hrs
- Projects (seminar, lab report preparation and submission) : 25 hrs.

Course objectives:

1. To explain the ecological significance of estuaries and mangroves
2. To teach mangrove biodiversity and distribution
3. To provide knowledge on mangrove facilitating areas, seed establishment and growth
4. To enlighten the natural and the anthropogenic threats to the mangrove ecosystems
5. To teach mangrove conservation and management

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

Upon completion of the course a student must be able to:

1. Educate others on the ecological importance of the mangrove ecosystems and adjacent estuaries
2. Deal with mangrove taxonomy
3. Assess mangrove diversity and distribution
4. Extend support for mangrove conservation and management efforts

Course material, text books and further reading:

Tomlison P.B., 1986. The Botany of Mangrove. Cambridge University Press.
Hogarth P.J., 1999. The biology of mangroves. Oxford University Press.
Kathiresan K., Qasim S.Z., 2005. Biodiversity of mangrove ecosystems. Hindustan publishing corporation.
Singh V.P., Odaki K., 2004. Mangrove ecosystem : structure and function. Scientific Publishers.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

9. Mangrove associated fauna
10. Threats to the mangrove
11. Mangrove restoration
12. Mangrove Research and updates

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 25%
Written assessment: 50%
Projects/Presentations/Reporting: 25%

Course title: Conservation of Marine Endangered Species
Course ID: UMTROP405
University: Universiti Malaysia Terengganu
Institute/School: Institute of Oceanography and Environment (INOS
Name and e-mail address of the instructor(s):
Dr. Juanita Joseph (juanita@umt.edu.my),
Assoc. Prof. Dr. Hii Yii Siang (hii@umt.edu.my),
Prof. Dr. Saifullah A. Jaaman (saifullahaj@umt.edu.my),
Assoc. Prof. Dr. Wan Izatul Asma Wan Talaat (wia@umt.edu.my)
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercices: 4 hrs
- Excursions : 36 hrs
- Projects: 6 hrs

Course objectives:
i. To provide an introduction to the biology of sea turtles, conservation and research techniques, as well as to provide practical experience by participating in the ongoing sea turtle conservation and research at Redang Island.
ii. To provide an introduction to the biology and ecology of cetacean and sirenian, and to discuss current issues on the interactions between animals and man and prospects in ecotourism.
iii. To introduce coral reef biology and its importance to marine ecosystem.
iv. To understand the legal framework in the conservation of marine endangered species.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

Upon completion of the course a student must be able to explain, discuss and debate intelligently issues pertaining to the conservation of marine endangered species, and the challenge faced by the international conservation efforts.

Course material, text books and further reading:
Charles R. C. Sheppard, Simon K. Davy, Graham M. Pilling. 2009. The biology of coral reefs. Oxford University Press, 339 p.
Eckert, K.L., K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly. 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.
Gales, N. et al. 2003. Marine mammals: fisheries, tourism, and management issues. Collingwood, Vic. : CSIRO.
Isabelle M. Côté, John D. Reynolds. 2006. Coral Reefs Conservation (Conservation Biology 13). Cambridge University Press, Cambridge 568 p.
Jaaman, S. A. 2010. *MARINE MAMMALS IN EAST MALAYSIA: Distribution and Interactions with Fisheries*. VDM Verlag Dr. Muller Aktiengesellschaft & Co. KG., Saarbrucken, Germany. ISBN: 978-3-639-22208-1. 284 pages.
Jefferson, T. A., Webber, M. A. and Pitman R. L. 2008. *Marine Mammals of the World: A Comprehensive Guide to Their Identification*. San Diego: Academic Press.
Lutz, P. L. and J. A. Musick 1997. Biology of Sea turtles. CRC Press.
Lutz, P. L., J. A. Musick and J. Wyneken. 2003. Biology of Sea turtles Vol. II. CRC Press.
Roberts, Julian. 2007. Marine Environment Protection and Biodiversity Conservation, Springer: London .
Rodgers, Christopher. 2013. The Law of Nature Conservation, Oxford: London.

Stephen A. Bortone. 2014. Interrelationships Between Corals and Fisheries. CRC Press, 321 p.
Wyneken, J., K.S. Lohmann and J.A Musick. 2013. Biology of sea turtles Vol. lll. CRC Press.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Lectures:

No. Topic

1. The concept of marine biodiversity and importance of conserving marine endangered species (turtles, marine mammals & corals), 1 hr
2. Evolution, phylogeny and current status of sea turtles (taxonomy and classification, current status), 2 hrs
3. Reproduction in sea turtles (life cycles, reproductive behavior, natal homing, eggs and hatchlings), 3 hrs
4. Threats to sea turtles (natural threats, human impacts) , 2 hrs
5. Biology and ecology of cetaceans, 2 hrs
6. Biology and ecology of sirenians, 2 hrs
7. Interactions between marine mammals and man, 2 hrs
8. Status and conservation of marine mammals in Malaysia, 1 hr
9. Introduction to coral reef (distribution, biology of coral formation), 3 hrs
10. Inter-connectivity of corals and other marine organisms, 2 hrs
11. Conservation efforts and the status of coral reef ecosystem in the Tropics, 2 hrs

12 International Legal Framework for the Protection of the Marine Environment, 2 hrs

Practical/Field work (will be conducted at Chagar Hutang Turtle Sanctuary and around Redang Island)**:**

Topic

Research and management of sea turtles for conservation, 12 hrs :
i. Tagging
ii. Monitoring of sea turtle nesting and data recording
iii. Eggs and hatchlings

Dedicated boat sighting survey of cetaceans, 12hrs :
i. Systematic line transect method.
Ii. Marine Mammals and Whale Shark Daily Boat Survey Effort Record
Iii. Marine Mammals and Whale Shark Sighting Form

Coral reef underwater video survey and the use of corals health index in coral reefs conservation, 12 hrs

Assessment breakdown: please note the general comment on assessment **breakdown**

1. Mid-term exam (20%)
2. Final exam (20%)
3. Report/assignments
   - Turtles (field trip report) (15%)
   - Coral (assignment) (15%)
   - Marine mammal (assignment) (15%)
   - Legislation (assignment) (15%)

Course title: Lake and terrestrial Ecology
Course ID: UMTROP 406
University: Universiti Malaysia Terengganu
Institute/School: Kenyir Research Institute
Name and e-mail address of the instructor(s):
Prof. Emeritus Dr Faizah Sharoum (faizah@umt.edu.my)
Dr Nor Azman Kasan (norazman@umt.edu.my)
Dr Chong Ju Lian (julian@umt.edu.my)
Semester:
Tuition language: English
Number of credits (ECTS): 3
Important: This course may in part be taught during the UMT Field School

Course breakdown and hours:

- Lectures (in class): 18 hrs
- Exercises (practicals in the campus) : 27 hrs
- Projects (seminar, lab report preparation and submission) : 25 hrs.

Course objectives:

1. To explain the significance of lakes and terrestrial ecology
2. To teach lacustrine biodiversity and distribution
3. To provide knowledge on terrestrial and aquatic biodiversity in lake ecosystem
4. To enlighten the natural and the anthropogenic threats to the lake and terrestrial ecosystems
5. To teach terrestrial and lake conservation and management

Learning outcomes: please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Environment Biological level: Global

Upon completion of the course a student must be able to:

1. To impart knowledge on the ecological importance of the lake and terrestrial ecosystem
2. Deal with taxonomy of terrestrial and aquatic biodiversity of lakes
3. Assess lake and terrestrial diversity and distribution
4. Extend support for lake and terrestrial conservation and management efforts

Course material, text books and further reading:

1. James S. A., Firooza P. and Susan A. 2012. Wetland Environments: A Global Perspective. Wiler-Blackwell. United Kingdom.
2. Nor Azman Kasan. 2012. Wetland's Nutrient Retention Capacity. 1st Edition, LAP LAMBERT Academic Publishing, Saarbrucken, Germany
3. Kenneth N.B., Peter F.F. and Joseph A.M. 2012. Hydrology and the Management of Watersheds, 4th Edition. Wiley-Blackwell. United Kingdom.
4. Ian M., Atle H., Paul K. and Paul, J.W. 2013. Ecohydraulics: An Integrated Approach. Wiley-Blackwell. United Kingdom.

Prerequisites: please note the general comment on prerequisites

S1 course Tropical biocomplexity: natural dynamics, indigenous interactions and sustainable management, Integrated coastal zone management: mangroves, seagrass beds and coral reefs, Initiation aux milieux tropicaux, Wetland plant communities, Marine biology **OR** Marine and coastal biology

Table of contents:

Assessment breakdown:

Oral assessment: 25%
Written assessment: 50%
Projects/Presentations/Reporting: 25%

Course descriptions at University of Queensland (UQ)

Course title: Australia's Terrestrial Environment
Course ID: BIOL2001
University: University of Queensland
Faculty: Science
Department: School of Biological Science
Name and e-mail address of the instructor(s): Dr Steven Salisbury (s.salisbury@uq.edu.au)
Course website: http://www.uq.edu.au/study/course.html?course_code=BIOL2001
Semester: S2
Tuition language: English
Number of credits (ECTS): 15
IMPORTANT: The majority of costs for the Course are met by the University. Students will be asked to contribute to food and ancillary costs. The maximum cost to each student will be 600 AUD.

Course breakdown and hours:

- Lectures: 31 hrs
- Tutorial Exercises: 32 hours
- Projects: 27 hours
- Excursions: 8 Days

8 days of field trips will combine 31 hours of lectures **plus** tutorials, projects and lab work

Course objectives:

Introduce students to Australia's terrestrial animals and plants and those factors (both present and historical) that make Australia's terrestrial environments unique.

Through lectures, field trips and written assignments, assist students to develop an understanding of ecological principles and processes, in particular those that are specific to Australia.

Provide students with an understanding of principles that will enable them to assess impacts of human development and activities on Australian ecosystems, along with the impact that exoctic plants and animals are having on our native biota.

Introduce students to a range of management strategies that are currently being used to conserve Australia's terrestrial animals, plants and ecosystems.

Provide students with experience in conducting field work, through the collection, analysis and interpretation ecological data during a four day field trip to Fraser Island World Heritage Area.

Learning outcomes : please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

After successfully completing this course you should be able to:
Identify and describe representatives of the main groups of animals and plants that inhabit Australia's terrestrial environments; Explain those historical factors that have helped shaped Australia's unique terrestrial biota and ecosystems; Evaluate those climatic and geographical factors that are unique to Australia and how these influence ecological relationships between animals and plants in different terrestrial habitats; Describe and evaluate management strategies that are used in the conservation of Australia's terrestrial animals, plants and ecosystems; Evaluate and critically assess the impact that humans and exotic species have had on Australian terrestrial ecosystems; Apply a basic set of survey techiques to collect, analyse and interpret ecological data in the field; Demonstrate an understanding of the ways in

which information about terrestrial environmental science is communicatedDeliver clearly written reports using presentation styles and standards appropriate for scientific communication

Course material, text books and further reading:
Required Resources:
Augee, M., and M. Fox. 2000. Biology of Australia and New Zealand. Pearson Education, Sydney
Available from UQ Bookshop. Additional copies are available for extended loan from the library.
In addition to readings from the course textbook, references will be recommended by individual presenters. We will also recommend some field guides to assist with the field components of the course.

Access to required and recommended resources, plus past central exam papers, is available at the UQ Library website. The University offers a range of resources and services to support student learning. Details are available on the myServices website. Students also have access to the Faculty of Science computer labs and Interactive Learning spaces.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The Antipodean Ark (Lecture): Steve Salisbury
This lecture covers the evolution of the Australian continent and the palaeobiogeographic events associated with the fragmentation of Gondwana
Splendid isolation (Lecture): Steve Salisbury
This lecture looks at the animals and plants that inhabited Australia during the the Cenozoic Era (the Age of Mammals)
Circum Antarctic flora on UQ Campus (Optional): Steve Salisbury
UQ campus has some fantastic examples of the Circum Antarctic flora. This walk around campus will help you to become familiar with some of the plants discussed in classes that have been used to reconstruct the Supercontinent Gondwana.
The rise and fall of Australia's megafauna (Lecture): Steve Salisbury
This lecture looks at Australian terrestrial environments during the Quaternary (the last 1.3 million years), with a particular focus on 'megafauna'
A sunburnt country: Australian landforms and soil (Lecture): Steve Salisbury
In this lecture you will learn about some fundamental aspects of Australian geology and landforms, and the implications they have for ecology.
A land of extremes - Australian climate (Lecture): Steve Salisbury
In this lecture you will learn some of the fundamentals of Australian climate; what drives it and the way it affects terrestrial environments.
'Botany Bay' - Australian vegetation (overview) (Lecture): Susanne Schmidt
The goal of this lecture is to introduce you to Australian vegetation and habitat types. The 'typical' Australian vegetation is introduced along with some of its major 'players'.
Brisbane Forest Park (Field Work): Steve Salisbury
This full day excursion to Brisbane Forest Park includes a visit to Walkabout Creek Wildlife Centre, followed by a rainforest walk at Boombanna and an overview of Brisbane from Jolly's Lookout. A great chance to see some of the local Brisbane fauna and experience south-east Queensland's magnificent rainforest.
NB. A short assignment relating to this field trip is assessable. Cost ($30) includes transport to and from UQ and entrance to Walkabout Creek Wildlife Centre. You will need to bring a packed lunch. Afternoon 'billy' tea will be provided at Jolly's Lookout.
Australian rainforests (Lecture): Susanne Schmidt
The goal of this lecture is to introduce you to rainforests in general, and to the rather unique understanding of and definition that Australians apply to rainforests.
The phoenix continent (Lecture): Susanne Schmidt
In this lecture you will learn about the important role fire plants in Australian ecosystems.

Australian plants - the spirit of endurance (Lecture): Susanne Schmidt
In this lecture you will learn about typical Australian vegetation, which is low-nutrient, fire-ridden, drought-resistant and burns frequently.
The Never Never - Australia's arid vegetation (Lecture): Susanne Schmidt
In this lecture you will learn about the vegetation of Australia's arid zone, and some of special adaptations that these plants have evolved in order to cope with the life in some of the continent's most extreme environments.
Challenges for Australian flora (Lecture): Susanne Schmidt
This lecture will provide an overview of how exotic plants, land clearing and agriculture have affected Australia's flora.
Australian insects (Lecture): Myron Zalucki
This lecture will introduce you to the diversity of Australia's insects.
Fraser Island (Group 1) (Field Work): This field trip is aimed at providing students with a hands-on 'wilderness' experience to further their understanding of the ecological principles and processes discussed in the lectures.

The field trip will provide students with an appreciation of the plants, animals & ecological communities that comprise Fraser Island - the world's largest sand island and one of Australia's most awe-inspiring natural areas.

Specifically, the goals of the field course are to:

1. Introduce students to the uniqueness of Fraser Island's habitats and geology;
2. Provide students with a basic knowledge of the plants, animals and ecosystems of the island;
3. Teach students standard techniques used in ecological sampling, wildlife surveying and comparative habitat assessments;
4. Provide students with first hand experience in the field with collecting, analysing and interpreting ecological data; and
5. Assist students to further their understanding of ecological principles and processes, at World Heritage listed Fraser Island.

The field trip cost ($425 bunkhouse or $385 camping) covers the entire trip to and from Fraser Island (departing UQ) including all travel (to from and on the island), food, accommodation and excursions.

Assessment breakdown: please note the general comment on assessment breakdown

Field Report: Brisbane Forest Park Field Report 5%
Report: skills in science communication 5%
Mid-semester exam 25%
Field Report: Fraser Island Field Report 30%
End of semester exam 30%

Course title: Australia's Marine Environment
Course ID: MARS2005
University: University of Queensland
Faculty: Science
Department: School of Biological Science
Name and e-mail address of the instructor(s): Dr Selina Ward (s.ward@cms.uq.edu.au)
Course website: http://www.uq.edu.au/study/course.html?course_code=MARS2005
Semester: S2
Tuition language: English
Number of credits (ECTS): 15
IMPORTANT: The majority of costs for the Course are met by the University. Students will be asked to contribute to food and ancillary costs. The maximum cost to each student will be 900 AUD.

Course breakdown and hours:

- Lectures: 30 hrs
- Tutorial Exercises: 32 hours
- Projects: 27 hours
- Excursions: 8 Days

8 days of field trips will combine 31 hours of lectures **plus** tutorials, projects and lab work

Course objectives:
The purpose of this course is to bring you to a level of understanding where you can ask meaningful questions about the diversity and sustainability of the world's oceans, coasts and estuaries from a foundation of knowledge obtained ruing your study of Australia's marine systems.

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Interactions Biological level: Ecosystem

After successfully completing this course you should be able to:
Describe the nature, diversity, values and importance of marine environments under Australian control; Demonstrate your understanding of the ways in which information about marine science is communicated; Devise basic marine research topics for investigation by either field investigation or literature review; Deliver clearly written reports using presentation styles and standards appropriate for scientific communication; Visit any marine environment in the world and use basic principles to interpret prevailing environmental conditions, assess the sources of primary production, the structure of the food web, the vulnerabilities of that system to anthropogenic impacts

Course material, text books and further reading:
Lecture slides are provided via Blackboard. However, these should be viewed as an outline of the lectures rather than the whole content. Note-taking during lectures is good academic practice: It instils much deeper learning and makes revision at exam time easier, and your recall and understanding in future much more natural. Therefore attendance at lectures is highly recommended.
There are no set texts for the course, but recommended is Oceanography by Garrison as an excellent, interesting and useful book. You are also advised to make extensive use of on-line search engines to reinforce your understanding of course content. The assessment items rely heavily on and assume an ability to use scientific literature search mechanisms via the UQ Library.

Access to required and recommended resources, plus past central exam papers, is available at the UQ Library website. The University offers a range of resources and services to support student learning. Details are available on the myServices website. Students also have access to the Faculty of Science computer labs and Interactive Learning spaces.

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

Introduction: Program outline, use of Blackboard, how to sign up for field trips, how to submit assessment items. Selina Ward

Australia's marine environment 1: Introduces the geography of the world's oceans, major current patterns, Australia's coastline,nomenclature of marine habitats.

Australia's marine environments 2: Topics include sediment transport, tide curves and the effects of latitude on biodiversity and productivity.

Estuaries and tropical foodwebs: Estuaries, sediments, turbidity, bioturbation, detrital foodwebs, diversity

Rocky and sandy shores: Covers the habitats, life and relationships that are common on intertidal areas

Marine Invertebrates I: What are invertebrates. The protists, sponges and cnidarians

How science is done: hypotheses and falsification: How to approach critical analysis of literature, frame hypotheses and arguments in science.

How to write an effective research report: Discusses how to structure research reports, essays and literature reviews.

Deadly Sea Creatures: Discusses the more dangerous members of Australia's reef communities, including some sensible advice and basic first aid.

Moreton Bay Research Station Group 1 (Field Work): Examination of a variety of marine environments of Moreton Bay: sheltered sediment, sheltered rocky and semi-exposed shores, plus Moreton Bay catchment area.

Marine Invertebrates II: The worms - Platyhelminthes, Nemertea, Annelida, Sipunculida. The Arthropods - crustaceans.

Marine Invertebrates III: More fascinating groups of invertebrates. The Molluscs, the echinoderms and few of the chordates.

Biology of corals: This lecture explains what coral is and how it works. You will understand the role of zooxanthellae, how coral bleaching works and how corals feed, reproduce and defend themselves.

Darwin's Paradox and symbiosis in reef systems: What is Darwin's paradox? Learn about the amazingly complex and interesting symbioses that occur in reef systems and how these are related to the clear, oligotrophic waters in which reefs grow.

Marine reptiles: Sea snakes and sea turtles

Sea Birds : The diversity and distribution of seabirds including migrations and trophic adaptations.

Heron Island Research Station - Group 1 (Field Work): Geomorphology, terrestrial ecology, management, marine biology and ecology of coral reefs.

Group Project Presentations (Workshop)

Biogeography of Coral Reefs Describes the distribution of reefs and the factors that are important to determine these distributions

Climate change and coral reefs Coral reefs are susceptible to various aspects of climate change including increased temperature, ocean acidification , increased severity of storms and sea-level rise.

Threats to Coral Reefs There are many difficulties outside of climate change that coral reefs face. We will discuss coastal developments, agricultural land use, shipping, destructive fishing, overfishing, coral disease and pests

Question and answer session (Workshop): Assesses and assists with barriers to understanding. Answer Student questions regarding reports and content.

Marine plants 1 Photosynthesis, algae, phytoplankton, algal blooms

Marine plants 2: Angiosperns (seagrass, saltmarsh, mangroves)

Life in the Open oceans Covers life in the surface waters of the sea, plankton, adaptations, food chains and life at depth

Fishes I Evolution of fishes, anatomy and basic biology of sharks and rays

Fishes II The teleost fishes: evolution, form and function

Sex in Reef Fish Looks at the strange sex lives of reef fishes

Predatory Fishes in Reef Looks at the role of plankton feeders, benthic carnivores and considers the importance of large carnivores in reef communities

Predatory Fishes in Reef Systems Looks at the role of plankton feeders, benthic carnivores and considers the importance of large carnivores in reef communities

Grazers in Reef Systems Considers the role of grazing organisms in the delicate balance of reef systems

Tutorial session on fish lectures SOPHIE DOVE and JANET LANYON
Marine Mammals (Lecture): (Seals, Sealions) Seacows, Whales and Dolphins
Biology of dugongs (Lecture): JANET LANYON

Assessment breakdown: please note the general comment on assessment
Report: skills in science communication 5%
Report: Coastal Marine Environments 20%
Report: Coral Reef Environments 25%
End of semester exam 50%

Course title: Remote sensing of environment
Course ID: GEOM7000
University: University of Queensland
Faculty: Science
Department: Geography, Planning and Environmental Management (GPEM)
Name and e-mail address of the instructor(s): Stuart Phinn (s.phinn@uq.edu.au)
Course website: https://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=46125
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 26 hrs
- Exercises: 32 hrs
- Projects: 32 hrs
- Excursions: 8 hrs

Course objectives:

The content objectives of the course are to understand: (1) how remotely sensed images are acquired from satellites and aircraft; and (2) how remotely sensed images can be used to map biological and physical properties of the earth's environments. The process objective develops skills that would enable you to address an environmental monitoring problem by selecting an appropriate remotely sensed data set and applying the relevant image analysis and interpretation techniques.

The objectives of the course are achieved through (1) understanding of the lecture content and related reading material, (2) active participation of a field trip, (3) development of practical image analysis and processing skills in tutorials, and (4) synthesis of and reflection on achieved knowledge in compilation of assignments and an exam or a remote sensing application review.

Learning outcomes : please note the general comment on learning outcomes

Education level: Basic Ecosystem focus: Methods and tools

After successfully completing this course the student should be able to:
- Explain how electromagnetic radiation is transferred through the atmosphere and interacts with atmospheric, oceanic, vegetation and terrestrial features
- Identify the types of information able to be extracted from remotely sensed data on an environment(composition, configuration, biophysical and dynamics) and the methods used to do this in qualitative and quantitative forms.
- Plan, obtain, analyse and link field measurements with remotely sensed images at different spatial scales to produce maps of land cover and biophysical parameters
- Understand the concepts of spatial, spectral, radiometric and temporal resolutions of remotely sensed data and how these concepts relate to remote sensing applications in different environments;
- Identify the range of commercially available airborne and satellite remotely sensed data sets, their geometric and radiometric properties, their limitations and how to acquire them.
- Identify, explain and apply the fundamental image interpretation elements (e.g., tone, texture, size, shape, pattern, site and association)
- Apply basic image pre-processing operations to produce image data sets that can be integrated with other forms of digital spatial data.
- Interpret images provided by optical (cameras, broad-band, hyperspectral and thermal) and active (imaging radar) sensors and explain the steps used to convert an image into a thematic map (e.g.land-cover) or quantitative map (e.g. water depth).
- Describe how remotely sensed data are applied in commercial, public-sector and research applications

Course material, text books and further reading:

Required
Jensen, J. (2007) *Remote Sensing of the Environment, An Earth Resource Perspective*
Recommended
American Society of Photogrammetry (3rd) Manual of Remote sensing, 3rd Edition, ASP, Falls Church.
Avery, G.T. and Berlin, G.L. (1992) *Fundamentals of remote sensing and airphoto interpretation*. 5th Ed., MacMillan Publishing Company.
Barrett, E.C. and Curtis L.F. (1992) *Introduction to environmental remote sensing*. 3rd ed., Melbourne, Vic. : Chapman & Hall.
Campbell, J. B. (1996) *Introduction to remote sensing*. 2nd Ed. The Guilford Press, New York
Cracknell A. and Hayes L. (1991) *Introduction to remote sensing*. London: Taylor & Francis.
Curran, P.J. (1985) *Principles of remote sensing*. Longman.
Drury, S.A. (1990) *A guide to remote sensing: Interpreting images of the earth*. Oxford University Press
Harris, R. (1987) *Satellite remote sensing : an introduction*. London: Routledge & Kegan Paul.
Harrison, B.A. and Jupp , D.L.B. (1989) *Introduction to remotely sensed data*. Canberra : CSIRO, Division of Water Resources.
Jensen, J.R. (2005) *Introductory digital image processing: a remote sensing perspective*. 3rd Ed. Prentice Hall.
Richards, J.A. and Jia, X. (2006) *Remote sensing digital image analysis: an introduction*. 4th Ed. Springer Verlag.
Schott, J.R. (1997) *Remote sensing: the image chain approach*. Oxford University Press
Journals
There are a number of remote sensing texts in the Social Sciences & Humanities, and Physical Sciences and Engineering (PSE) Libraries which can be used for the course.
The main journals which will be useful for the course include:
Canadian Journal of Remote Sensing , Geocarto International, International Journal of Remote Sensing, IEEE Transactions on Geosciences and Remote Sensing, Photogrammetric Engineering and Remote Sensing, Remote Sensing of Environment, Journal of Applied Remote Sensing, Journal of Geophysical Research
Educational Sites
NASA On-line text for remote sensing and image processing: http://rst.gsfc.nasa.gov/

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Solving problems with remote sensing & field data
Electromagnetic radiation
Radiation transfer theory
Passive sensors - multi- & hyper-spectral
Passive sensors - airborne systems
Active sensor systems - Radar & Lidar
Image and photo interpretation & analysis
Image processing fundamental & overview
Image pre-procerssing & analysis
Marine & coastal remote sensing applications
High resolution image processing
Future directions & course summary

Assessment breakdown: please note the general comment on assessment breakdown
Written assessment: 40%
Tutorial Exercise #1 Linking field and image data: 30%
Tutorial Exercise #2 Image Processing and Analysis: 30%

Course title: Geographical information systems
Course ID: GEOM7005
University: University of Queensland
Faculty: Science
Department: Geography, Planning and Environmental Management (GPEM)
Name and e-mail address of the instructor(s): David Pullar (d.pullar@uq.edu.au)
Course website: https://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=46211
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises and lab work: 32 hrs
- Projects: 34 hrs
- Excursions: 8 hrs

Course objectives:
This course aims to equip students with the core skills and conceptual understanding required to apply GIS technologies to solve geographical problems and with an appreciation of the broad range of applications of GIS technologies, including applications in the geographical, environmental and social sciences.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

After successfully completing this course students should be able to:
- Describe and explain how spatial locations and objects are represented in a GIS
- Describe and explain how data are organised and modelled in a GIS
- Identify, interpret and apply methods for GIS data capture, for spatial data analysis, for decision-making and for spatial visualistion using GIS
- Integrate GIS methods to solve geographical problems
- Evaluate a broad range of applications of GIS and the current and future roles that GIS technology plays in society

Course material, text books and further reading:
Required Resources: Course notes and readings (a list of readings will be available on the library website)
Recommended Resources: Longley, PA, Goodchild, MF, Maguire, DJ, Rhind, DW. 2011. *Geographic information systems and science, 3rd Edition,* John Wiley & Sons, Chichester, UK.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

- One day field trip to introduce the GIS project involving the conducting of a landuse planning exercise using GIS
Practical: GIS Project (Problem Definition and Data Exploration)
- Lecture: Decision making - Practical: GIS Project (Analysing the Decision Problem)
- Lecture: Geovisualisation - Practical: GIS Project (Visualising your Data and Results)
- Lecture: Future Directions in GIS - Practical: GIS Project (Flexible)
- Lecture: Course Summary and Revision

Assessment breakdown: please note the general comment on assessment breakdown
Quiz: 15%
Tutorial Exercise: 20%
Project report assessment: 30%
Written Assessment: 35%

Course title: Landscape ecology
Course ID: CONS6017
University: University of Queensland
Faculty:Science
Department: Geography, Planning and Environmental Management (GPEM)
Name and e-mail address of the instructor(s): Patrick Moss (patrick.moss@uq.edu.au)
Course website: https://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=47426
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises & Lab work: 32 hrs
- Projects: 34 hrs
- Excursions: 8 hrs

Course objectives:
The aim of the course is to provide students with an understanding of selected aspects of landscape ecology and of management issues and strategies relevant to landscape ecology.
These goals are achieved through understanding and reflection on the content of lectures, observations and analysis made during practicals and/or field trips, and research and knowledge synthesis achieved in compilation of the assignments, and study for the examination.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

After successfully completing this course you should be able to:
- Understand how landscapes are characterized in terms of concepts and methods that are used to identify and measure spatial patterns
- Become familiar with how spatial processes, such as dispersal and nutrient flow across ecological boundaries, are affected by landscape patterns and how these processes are identified, measured and modelled;
- Consider the fundamental feedbacks by which landscapes of organisms are reproduced, how landscape change and how this change can be studied
- Have an understanding of how landscape ecological principles can be applied in conservation;
- Apply critical thinking to a range of environmental issues and problems;
- Employ verbal and written communication skills to effectively articulate your knowledge; and
- Reflect on your own learning experiences within the course.

Course material, text books and further reading:
Required Resources
Gergel, S.E. & Turner M.G. Eds. (2002) Learning Landscape Ecology: A practical guide to concepts and techniques. Springer, New York.
Course notes.
Recommended Resources
Farina, A. (2006) Principles and Methods in Landscape Ecology: Towards a Science of Landscape, Springer, The Netherlands.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Lecture 1: Introduction to the course and to landscape ecology
Lecture 2: Patches & Patch Shape -Tutorial 1: Practical Module 1 Session:"Simulating Landscape Patterns"
Lecture 3: Corridors & Networks
Lecture 4: Matrix - Tutorial 2: Practical Module 2 Session:"Landscape Metrics"
Lecture 5: Mosaic Patterns
Lecture 6: Land Transformation & Fragmentation
Lecture 7: Landscape Ecology and Decision Making - Tutorial 3: Practical Module Session 3: "Creating Landscape Pattern"
Lecture 8: Landscape Ecology and Wildlife (Lecturer Dr Martine Maron)
Lecture 9: Landscape Ecology and Genetics 1 - Tutorial 4: Practical Module Session 4: "Prioritizing Reserves for Acquisition"
Lecture 10: Landscape Ecology and Genetics 2 (Dr Rachael Dudaniec)
Lecture 11: Past Landscapes
Lecture 12: Landscape Ecology and Sustainability/Course Revision

Assessment breakdown: please note the general comment on assessment breakdown
Practical assessment:
Module 1: Simulating Change in Landscape Patterns – 15%
Module 2: Landscape Metrics 15%
Module 3: Creating Landscape Pattern 15%
Module 4: Prioritizing Reserves for Acquisition 15%
Project assessment: 40%

Course title: Catchment processes & management
Course ID: ENVM7201
University: University of Queensland
Faculty: Science
Department: Geography, Planning and Environmental Management (GPEM)
Name and e-mail address of the instructor(s): TBC, Joshua LARSEN ()
Course website: http://www.uq.edu.au/study/course.html?course_code=ENVM7201
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises & Lab work: 32 hrs
- Projects: 34 hrs
- Excursions: 8hrs

Course objectives:

The aim of the course is for students to expand their knowledge of biophysical processes and an appreciation of social/governance dimensions as the basis evaluating catchment processes and management.

Learning outcomes: please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Environment Biological level: Global

After successfully completing this course you should be able to:
-Demonstrate comprehension of key principles within the geomorphology field and how these affect and constrain catchment management;
Demonstrate comprehension of key principles within the hydrology field, particularly related to the aspects of streamflow that are critical to catchment and ecological processes and how principles of environmental flows are incorporated to catchment management planning;
Demonstrate comprehension of key principles and paradigms within the ecology field, and apply them to evaluate stream condition, causes of degradation, and apply them in a considered evaluation of management options;
Synthesise examples of planned and unplanned human interaction with the landscape and river channel in terms of the impact on biophysical processes, how these impact catchment function and health, and evaluate management attempts and options in this context;
Analyse the interaction of science, policy and the public in terms of governance models and frameworks for catchment management in contemporary Australia, with a specific focus the role of community-based, government and non-government natural resource management organisations;
Demonstrate the ability to evaluate the likely effectiveness of catchment management methods, plans or approaches through considered analysis of the social/governance, economic and environmental dimensions of an issue.

Course material, text books and further reading:

Readings for the course are delivierd through a range of formats. Students are encouraged to purchase one of the two recommended course text books. Other readings are from journal articles, with interactive learning modules delivered weekly in the early part of the course via a Google-Earth interface, and student must also complete the associated on-line quizes.
Charlton, R. 2007. *Fundamentals of Fluvial Geomorphology*. Routledge.

This text is more suitable for students who want an outstanding reference text that explores fluvial

geomorphology as the basis for applied river management, and of use to student who is taking a program or courses in physical geography.

Gordon, N.D., McMahon, T.A. Finlayson, B.L., Gippel, C.J., Nathan, R.J. 2004. *Stream Hydrology: An introduction for Ecologists*. Wiley.

This text is more suitable for students who want an outstanding reference text that covers and discusses the principles of geomorphology, hydrology and ecology as they apply to river management, particularly for students who are interested in an applied stream ecology or aquatic management perspective for this course and in their other studies.

Access to required and recommended resources, plus past central exam papers, is available at the UQ Library website. The University offers a range of resources and services to support student learning. Details are available on the myServices website

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
History and origin of Catchment Management & Course
Geomorphic Basis of River Management
Hydrology, Streamflow and Catchment Management
Vegetation, Riparian Zone Processes and Remote Sensing.
Environmental Flows, River Ecology and Management.
Field trip to Moggill Creek - FULL DAY
Applied River Management & Analysis of Field Data
Guest Lecture: River Science and Management - The Big Flood: will it happen again?
Governance, Catchment Management & NRM in Australia
The Great Barrier Reef - Managing connected systems
Murray Darling Challenge
Complex Catchment Management - Principles, Solutions and Challenges.

Assessment breakdown: please note the general comment on assessment breakdown
Reading & Quiz – online quiz: 15%
Tutorial Exercises: 5%
Field Report: 40%
Exam: 40%

Course title: Fish, fisheries and aquaculture
Course ID:
University: University of Queensland
Faculty: Science
Department:
Name and e-mail address of the instructor(s):
Course website:
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures:
- Exercises & Lab work:
- Projects:
- Excursions:

Course objectives:

Learning outcomes: please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Environment Biological level: Global

Course material, text books and further reading:

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown

Course title: Research Topic (Environmental Management)
Course ID: ENVM7109
University: University of Queensland
Faculty: Science
Department: Geography, Planning and Environmental Management (GPEM)
Name and e-mail address of the instructor(s): Dr Brad Witt (bwitt@uqg.uq.edu.au)
Course website: http://www.uq.edu.au/study/course.html?course_code=ENVM7109
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:
No formal classes;
Contact by arrangement with adviser;
This course is for self-directed learning in a topic approved by the relevant supervisor.

Course objectives:
The course aims are:
* To enable advanced students to pursue in-depth study in a chosen research field;
* To enhance students' capacity for independent research;
* To enable students to acquire research skills appropriate to an area of specialisation.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

After successfully completing this course you should be able to demonstrate:

enhanced content knowledge in the chosen research field.
enhanced information resource access skills
enhanced data base access and interrogation skills (if applicable
enhanced field research skills (if applicable);
enhanced laboratory research skills (if applicable);
enhanced skills in critical thinking and/or logical analysis;
enhanced written and/or oral communication skills (as applicable).

Course material, text books and further reading:
No required resources.
Laboratories:
The School offers extensive resources in several laboratories in the Chamberlain Building. These facilities are used for teaching, tutorials and practicals, training courses, research and general computing for study related work.
The **computer laboratories** in the Chamberlain Building are:
the **Geographic Information Systems and Remote Sensing Lab** (GIS&RS Lab in Room 401, 38 PCs)
the **General Lab** (in Room 432 – 31 PCs).
These labs provide applications, including SPSS, NVIVO, demographic or climatological analysis software; GOOGLE SKETCHUP PRO, image editors; Remote Sensing (multi-user licenses of Leica Imagine, including Virtual GIS and the Leica Photogrammetry Suite; ENVI/IDL image processing); GIS (all ESRI ArcGIS products via the UQ site license); town planning schemes. Various other applications may be available as requested for practicals etc.
Data used in a course is stored in the shared disk space. Various data CDs are also shared from a file server, including the UBD, Mapview aerial ortho images and others. Several gigabytes of spatial GIS data, including Census data, and airborne/satellite images are accessible from either the file server or data CDs.
Students also have access to the Faculty of Science computer labs and Interactive Learning spaces in Building 69 (see http://www.uq.edu.au/ilc/ for more information).

Library contact

In the first instance students can contact the Research Help desk in person or by phone. In the Social Sciences and Humanities library the contact number is: 3346 4312. Students can also use the email and chat service available from the library home page.

Equipment:

The following equipment is available for student use: A4 and an A3 scanners, an A0 scanner, A4 and A3, colour and monochrome duplex laser printers, access to a 1500mm wide (poster size) large format inkjet printer, located in Room 432.

Learning resources:

The School has developed a range of useful academic resources that clarify the expectations of the School in relation to a range of assessment tasks that you may be required to undertake. These are available on the School of GPEM intranet at http://www.gpem.uq.edu.au/student-resources. You should consult this material before submitting assessment items within the School. Resources available here include handbooks on: **essay writing**, **report writin, graphic presentation, referencing styles using Harvard and Chicago and *Student Academic Resources* -** This includes a comprehensive listing of relevant resources available in the school and university, in the areas of research, academic writing, computing, computer programs, referencing and plagiarism, bibliographic software, presentations, group work, exam preparation, time management, personal development and general support services. Included are lists of workshops, websites and contact information.

Several online tutorials have been specifically developed for GPEM students. Please consult the following:

Academic Integrity (www.uq.edu.au/integrity). This is a compulsory tutorial for all students within the School and university

Graphic Presentation (http://ww2.gpem.uq.edu.au/graphics)

Referencing using Harvard and Chicago (https://ww2.gpem.uq.edu.au/Referencing)

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

This course is for self-directed learning in a topic approved by the relevant supervisor. Departmental consent is required. Prior to obtaining consent, intending students must discuss their project with, and obtain agreement to supervise that project from an appropriate member of academic staff. A consent form must be completed and submitted. Download consent form at:
http://www.gpa.uq.edu.au/students/forms/ResearchTopicApprovalForm.doc

Assessment breakdown: please note the general comment on assessment

Research Proposal 10%

Final Report 90%

Course title: Coastal processes & management
Course ID: ENVM7200
University: University of Queensland
Faculty: Science
Department: Geography, Planning and Environmental Management (GPEM)
Name and e-mail address of the instructor(s): David Neil (d.neil@uq.edu.au)
Course website: https://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=38263
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises & Lab work: 32 hrs
- Projects: 34 hrs
- Excursions: 12 hrs

Course objectives:
The aim of the course is to provide students with an understanding of selected aspects of the coastal environment and of management issues and strategies relevant to coastal problems.
These goals are achieved through understanding and reflection on the content of lectures, observations and analysis made during field trips, and research and knowledge synthesis achieved in compilation of the assignments, and study for the examination.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global

After successfully completing this course you should be able to:
- understand and explain the historical context of coastal landscapes and management;
- understand and explain the processes which determine the characteristics of the the coastal zone;
- be aware of the nature and scope of human use of, intervention in, and modification of coastal systems
- understand and explain the coastal management environment in Queensland, Australia and internationally; and
- apply the principles and practices of Coastal Zone Management.

Course material, text books and further reading:
Carter, R.W.G., 1988. *Coastal environments: an introduction to the physical, ecological and cultural systems of coastlines.* Academic Press.
Harvey, N and Caton, B. 2003. *Coastal management in Australia*. Melbourne, Oxford UP
Kay, R and Alder, J. 2003. *Coastal Planning and Management*. London, Spon.
Masselink, G and Hughes, GH. 2003. *Coastal processes and geomorphology*. London, Arnold.
iles, H and Spencer, T, 1995. *Coastal problems: geomorphology, ecology and society at the coast*. Edward Arnold.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Lecture: Introduction to Coastal Zone Management: An introduction to the course form, content and work expectations, including guidelines for writing assignments; Introduction to coastal problems and issues.
Lecture: Physical Processes in Coastal Systems: Characteristics of physical processes in the coastal zone. interactions between terrestrial and marine physical processes interact. Implications for coastal zone use and management.

Lecture: Ecological Processes in Coastal Systems: Physical and biological principles and coastal ecosystem processes; Coastal ecosystem services; land-sea linkages; anthropogenic impacts; extreme events and coastal ecosystems; monitoring for change in coastal ecosystems
Lecture: Coastal processes and management – Barrier island case study:Geomorphic and ecological characteristics and processes; land use and development history; contrasting approaches to management.
- Field trip: field visit to investigate some of the issues facing the Gold Coast, including beach loss and management, training wall and groyne construction, sand bypassing systems – the Tweed River bypassing system and the Gold Coast Seaway, and effects of urban development on the coastline.
- Lecture: Coastal processes and management – Venice case study:
Environmental history, coastal structures, catchment impacts and management, resource exploitation, coastal subsidence, storm surge, management response – ecological and engineering solutions, sustainability.
- Field trip: Half-day field visit to investigate coastal management issues and strategies on the western shoreline of Moreton Bay, particularly port development issues.
- Lecture: Indigenous Marine and Coastal Management. Understanding the issues facing indigenous coastal communities; the concept of 'country'; coastal and marine planning and management framework. Case Study: Cape York Peninsula Land and Sea Management.
- Lecture: Coastal Zone Management in Queensland:
History, Queensland State and Regional Coastal Management Plans - why they were developed, how they were developed, what they do, how they do it, what they don't do, what's needed for evaluation.
- Lecture: Decision making on complex coastal issues: How to minimise unintended outcomes. Interactive analysis of coastal problems and coastal decision making processes (e.g. rational optimization and recognition primed decision making). Case Studies: Coastal Protection Advisory Council; Fitzroy Basin and the GBR Water Quality Protection Plan; and Tuvalu.
- Lecture: Coastal Protection, Structures, Ethical Issues:
Approaches to Coastal Protection - soft engineering, storm surge barriers - examples from North America and Europe, etc; Adaptive structures for vulnerable coastal environments; Thoughts on ethics and values in coastal protection - East Anglia (UK) case study.
- Coastal Hazards; Course overview; Exam preparation.

Assessment breakdown: please note the general comment on assessment breakdown
Field Report assessments: 15%
Essay assessment: 35%
Oral Poster & Presentation assessment: 10%
Written assessment: 40%

Course title: Marine invertebrates
Course ID: BIOL3211
University: University of Queensland
Faculty: Science
Department: School of Biological Science
Name and e-mail address of the instructor(s): Bernie Degnan (b.degnan@uq.edu.au)
Course website: http://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=85339
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises & Lab work: 32 hrs

Course objectives:

Biology of tropical and subtropical Indo-Pacific marine invertebrates. We explore structural, functional & life history adaptations of invertebrate body plans to the marine environment to explain ecological and evolutionary patterns of diversity.

Learning outcomes : please note the general comment on learning outcomes

Education level: Specialised Ecosystem focus: Animals Biological level: Global

After successfully completing this course you should be able to use structural, functional & life history adaptations of invertebrate body plans to the marine environment to explain ecological and evolutionary patterns of diversity.

Course material, text books and further reading:

Required Resources

Recommended Resources

Prerequisites: please note the general comment on prerequisites

Basic Zoology

Table of contents:

Marine Invertebrate Biodiversity gives students the opportunity to obtain a fundamental understanding of animal relationships and diversity through the comparison of morphological, physiological, developmental, ecological and life history characteristics of marine invertebrates. This comparative approach allows for explanation of natural patterns of biodiversity. Students also will gain an appreciation of the biological classification, systematics and phylogenetic relationships of all the major animal phyla and many of the minor phyla.

Assessment breakdown: please note the general comment on assessment breakdown

Mid semester exam, laboratory & field assignments

Course title: Fish, fisheries and aquaculture
Course ID: BIOL3340
University: University of Queensland
Faculty: Science
Department: School of Biological Science
Name and e-mail address of the instructor(s): Andrew Barnes (a.barnes@uq.edu.au), Anthony Richardson (Anthony.Richardson@csiro.au), and Ian Tibbetts (i.tibbetts@uq.edu.au)
Course website: http://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=89357
Semester: S2
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures, Exercises & Lab work: 23 contact moments (see course website for details)

Course objectives:
Fisheries and aquaculture represent the largest source of dietary protein and are pivotal in current food security. The science of sustainable management of these precious resources is therefore critical in the global grand challenge of sustainable future food security. This course provides advanced level content in the biology and mathematics of fisheries and aquaculture, including fish reproductive biology and dispersal, mathematical modeling and stock assessment, fish nutrition, health and genetics in aquaculture and fisheries.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Animals Biological level: Global

After successfully completing this course you should be able to:
1 Link key features of aquatic animal biology (genetics, reproduction, movement, feeding, predator/prey) to natural environment and contained system productivity
2 Use mathematical skills to model and predict performance of fisheries and aquaculture production systems
3 Write accurate and balanced, well supported science for a general educated and scientifically literate audience appropriate to communicating a rationale argument around sustainable development
4 Use online information sources to work case studies in small groups to solve problems based on food security and sustainability
5 Effectively interpret and evaluate complex field-specific written material and articles

Course material, text books and further reading:
Required Resources

Recommended Resources

Prerequisites: please note the general comment on prerequisites
Biostatistics and Experimental Design or equivalent course
Marine Science or equivalent course

Table of contents:
The contribution of fisheries and aquaculture to current and future food security is substantial and currently represents the largest single source of dietary protein. The science of sustainable management of these precious resources is therefore critical in the Global Grand Challenge of sustainable food security.

Students will produce a cohesive, evidence-based scientific discourse on the potential placement of fish and fisheries, both capture and aquaculture, in future global food security and poverty alleviation. For this they will draw extensively on the relevant biological sciences and mathematics and show adaptability and application in a changing economic and ecological framework. Excellent students should be able to demonstrate substantial unexpected extension in their critical analysis and thinking and in how they apply their in-depth knowledge and communicate it to a broader scientifically literate audience.

Assessment breakdown: please note the general comment on assessment breakdown

Reports & written exam (see course website for details)

Course descriptions for courses common to Université Libre de Bruxelles (ULB), Vrije Universiteit Brussel (VUB), Université Pierre et Marie Curie (UPMC), Muséum National d'Histoire Naturelle (MNHN) and Università degli Studi di Firenze (UNIFI) and related to the Master Thesis

Course title: Scientific presentation skills and career planning
Course ID: BIOL-F-537
University: Université Libre de Bruxelles, Vrije Universiteit Brussel, Université Pierre et Marie Curie, Muséum National d'Histoire Naturelle and Università degli Studi di Firenze
Faculty: Sciences
Department: Biology / Natural sciences
Name and e-mail address of the instructor(s): Farid Dahdouh-Guebas (fdahdouh@ulb.ac.be)
Course website:
http://www.ulb.ac.be/sciences/biocomplexity/education/Scientific_presentation_skills_and_career_planning_BIOL-F-537/
Semester: S2
Tuition language: English
Number of credits (ECTS): 3/5

Course breakdown and hours:
- Lectures: 14h
- Projects: 24h

Course objectives:
This course aims at teaching students how to find and select essential scientific information to make a scientific presentation (e.g. preparation of research proposal, writing of an assignment, report or thesis, thesis findings to be presented in an international conference), under which form to present methods and results (text, tabulation, illustration and their content and layout) and how to defend them assertively. It also introduces common standards and practices and explains why it is important to follow them in Sciences. A huge chapter is spent to writing and layout skills and to plagiarism. This course also prepares you for stay within academia (academic career) or for the challenges young graduates face on the employment market (non-academic career).

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

Upon finalising this course the student should master presentation skills (designed and spoken) and assertiveness in defending own research results. In addition the student should be fully aware of scientific standards and procedures in the career of a scientist or beyond academia.

Course material, text books and further reading:
Course entirely based on experience and course material available on the Internet. All information will be given in class.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

•A selection of 24 examples of logical fallacies
•What does 'a model' mean and what is 'modelling' ?
•Planning a research strategy and schedule

2. Fieldwork, desk work and analysis in scientific research:
•What precedes my research ?
•Methodology
•Field- and labwork
•Samples and sampling strategies (categories)
•Analysis tools
•Making a deadline
•Back-up your data

3. Writing and layout skills:
•Basic components of a paper, thesis or proposal (in-depth overview per section from the front cover page to the back cover)
•Scientific and biological standards
•How to work and write scientifically (managing your work, scientific standards from different domains, ISO standards for official codes)
•Citation, paraphrasing and plagiarism (rigorous overview with examples, regulations and penalties)
•How to present data and how to present data badly (text and non-text illustrations in written documents and posters)
•Reference systems (Copyrights, Creative Commons, Plagiarism-detection software)

4. Scientific publication:
•Extracting a manuscript from a thesis
•The peer-review process (from what precedes writing of a paper to its final publication)
•Selecting an appropriate scientific journal (incl. Open Access and Open Source)
•Quality indices (common bibliometric measurements for evaluation of journals, researchers and institutes)
•Internet sources for scientific publishing and indexing
•Popular scientific articles
•Talking to the media

5. Pre- and post-research presentation and defence skills:
•Public speaking skills (from waht you say to how you say it))
•Public presentation of data
•Use of didactical material
•Presentation and defence (of proposals, of finished research)
•Q&A

6. Academic currencies:
•The academic career
•Grading systems
•Scientific publications (SLOSS, FIORI,...)
•Conference presentations
•Awards
•Curriculum vitae design for academic and non-academic purposes (how to advertise your skills ?)
•Time management

7. National and international funding:
•Privileged partners
•Conventions
•Networks
•Sources for funding
•Project budgets

Assessment breakdown: please note the general comment on assessment breakdown

100% Oral presentation and defence of the written thesis, irrespective of the scientific level or difficulty. The evaluation can be in the form of a scheduled presentation and Q&A session (such as an oral presentation at a scientific symposium) or in the form of an informal poster presentation with Q&A (such as a poster presentation at a scientific symposium).

Course title: Thesis proposal
Course ID: BIOL-Y-119
University: Université Libre de Bruxelles, Vrije Universiteit Brussel, Université Pierre et Marie Curie, Muséum National d'Histoire Naturelle and Università degli Studi di Firenze
Faculty: Sciences
Department: Biology / Natural sciences
Name and e-mail address of the instructor(s): Joint supervision by selected teaching staff members of the S3 and S4 HEI.
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 3
Important notice:
The thesis proposal is due by the end of S2 but there is no *a priori* relationship between the thesis proposal and the S2 country or S2 institute. As will be explained upon your arrival, the thesis proposal depends on the research lab in which you will carry out your thesis and may even have links outside the TROPIMUNDO Consortium.

Course breakdown and hours:
- Projects: 30

Course objectives:
This course is merely a preparation to the Master thesis and aims at clearly formulating what the student intends to investigate and place it into a literature-based context.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

Upon finalising this course the student should know what his MSc thesis will cover and how to execute it.

Course material, text books and further reading:
Knisely, K. (2009). *A Student Handbook for Writing in Biology.* Third Edition. W.H. Freeman and Sinauer Associates. 224 pp.

Prerequisites: please note the general comment on prerequisites
Scientific Presentation Skills and Career Planning

Table of contents:
Depending on the exact topic.

Assessment breakdown: please note the general comment on assessment breakdown
100% Scientific presentation exercise (oral presentation and/or defence of a written document)

Course title: Masters thesis
Course ID: MEMO-F-504
University: Université Libre de Bruxelles, Vrije Universiteit Brussel, Université Pierre et Marie Curie, Muséum National d'Histoire Naturelle and Università degli Studi di Firenze
Faculty: Sciences
Department: Biology / Natural sciences
Name and e-mail address of the instructor(s): Joint supervision by selected teaching staff members of the S3 and S4 HEI.
Course website: to be posted
Semester: S4
Tuition language: English
Number of credits (ECTS): 30
Important notice:
The thesis is due by the end of S4 but there is no *a priori* relationship between the thesis and the S2 country or S2 institute. As will be explained upon your arrival, the thesis proposal depends on the research lab in which you will carry out your thesis and may even have links outside the TROPIMUNDO Consortium.

Course breakdown and hours:
- Projects: 324 h

Course objectives:
To design, carry out, present and defend scientific research.

Learning outcomes : please note the general comment on learning outcomes
Education level: Basic Ecosystem focus: Methods and tools

Upon finalising the thesis the student should be able to design research questions and fieldwork protocols and to carry them out in an independent way. The student will know how to analyse raw data or metadata using appropriate methods and tools and how to present the results clearly and interpret them in a wider context using an in-depth survey literature of peer-reviewed scientific literature. The student will also have learnt to extract the essential for a summary. Finally the student will have gained assertiveness by defending his research findings.

Course material, text books and further reading:
Course Scientific presentation skills and career planning
Knisely, K. (2009). *A Student Handbook for Writing in Biology.* Third Edition. W.H. Freeman and Sinauer Associates. 224 pp.
Peer-reviewed scientific papers in the field of the thesis.

Prerequisites: please note the general comment on prerequisites
S2 course Thesis Proposal
All other courses of S1, S2 and S3 of the student's Trajectory.

Table of contents:
Depending on the exact topic.

Assessment breakdown: please note the general comment on assessment breakdown
50% Written document
50% Oral presentation