Mundus tropicalis

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FAMES Fonds d'aide à la mobilité dans l'enseignement supérieur

Course list and detailed course descriptions

N.B. The course list may be subject to changes. The course list you will eventually see under your personal course list (TROPIMUNDO AIM-tool, menu 'Courses') will be the correct list. Any new courses in black do not have a course description yet and will be completed soon.

Following feedback of earlier generations of students, the optional course list has been expanded significantly, resulting in the impossibility to schedule them without overlap. Students are responsibilised to verify and choose optional courses with no significant overlaps in schedule. In general rule, optional courses may overlap with one another but are never scheduled in overlap with compulsory courses. Some courses may adopt blended learning techniques. Online schedules[1,2] indicate the date, time slot, campus and lecture room of courses but if missing or if errors are spotted, do not hesitate to contact the respective teacher to know which course parts are taught when and where. Erasmus Mundus Scholarship holders can be selected for any Trajectory. VLIR-UOS Scholarship holders can only be selected for Trajectories indicated by the *Mundus tropicalis* logo. Trajectories running through EU Member States and through Third Countries outside the EU have a limited number of scholarships from resp. Erasmus+ and FAMES. Please consult How to complete your Learning Agreement.

[1] ULB schedules on TimeEdit: https://www.ulb.be/en/schedules

[2] VUB schedules on TimeEdit: https://student.vub.be/en/timetables-and-exam-schedules

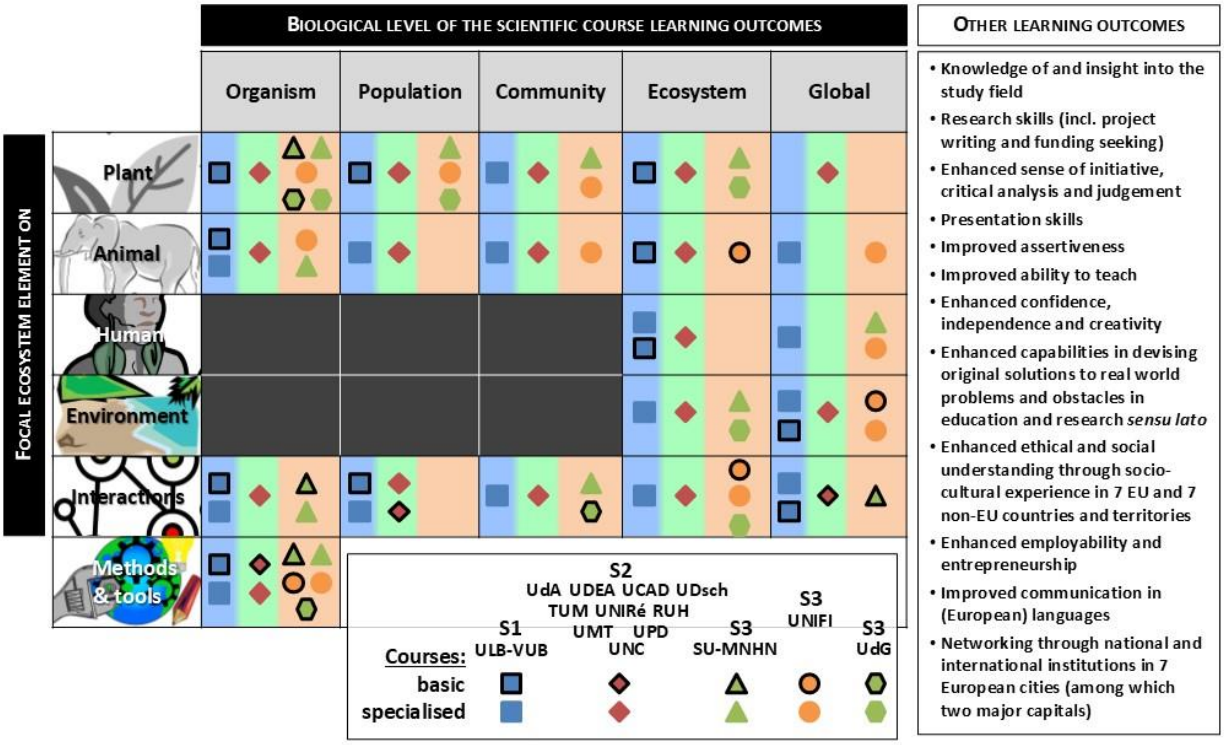

Figure 1. Approximate categorisation of courses with different focal ecosystem elements crossed with the biological level of their scientific learning outcomes. The blue, green and orange background corresponds to S1, S2 and S3 respectively and the symbols indicate whether the courses are basic or specialised and by which institutes they are taught (see legend).

Course list per semester and per Partner Return to TOC

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. Each of these course sheets follows the same TROPIMUNDO Course Sheet Template. 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) Mundus tropicalis	Semester 2 (S2)	Semester 3 (S3) Mundus tropicalis	Semester 4 (S4) Mundus tropicalis
ULB-VUB	UDEA UdA UCAD UDsch UNIRé TUM Mundus tropicalis RUH UMT UPD Mundus tropicalis UNC	SU-MNHN UNIFI UdG	All European Partners

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

Course sheets available on **ULB website:**
https://www.ulb.be/fr/programme/ma-bior
Course sheets available on **VUB website:**
https://www.vub.be/en/studying-vub/all-study-programmes-vub/bachelors-and-masters-programmes-vub/biology/program/master/master-biology-tropical-biodiversity-and-ecosystems

COMPULSORY:

	ECTS
Scientific presentation skills and career planning	3
Social-ecological systems	6

COMPULSORY CHOICE:

	ECTS
MODULE: VUB	
Analysis of biological data	6
MODULE: ULB	
Acquisition et analyse de données	5

OPTIONAL (at least 15 or 16 ECTS to be chosen) :

	ECTS
MODULE: ULB	
The Earth system and its interactions[3]	5
Earth's climate history and the origin of life[3] (from 2026-2027 onwards)	5
The blue planet: ocean, sediments and climate[3] (from 2026-2027 onwards)	5
Analyse et gestion des impacts environnementaux	5
Behavioural ecology in natural and man-made environment	5
Bioéthique et droit de la conservation	5
Biological invasions and management	3
Biology of animal societies	5
Genomics, transcriptomics and epigenomics (Bioinformatics)	5
Marine ecology	5
Pédologie et écosystèmes	5
Plant-soil interactions (not available in 2025-2026)	5
Plant responses to environmental stress	5
Cours ou stage hors ULB	5
Professionnal internship / Stage professionnel	15

N.B. Provided agreement by the inter-university jury the student can choose optional courses outside the proposed module, but accepting the risk of overlapping schedules.

	ECTS
MODULE: VUB	
Agroecology	3
Evolutionary genetics and genomics of sex (from 2025-2026 onwards)	3
Freshwater ecology	6
Global change biology	6
Governance and policy in development and cooperation	3

[3] One of these courses is compulsory if your S3 is at SU, MNHN or UdG (France), and optional if your S3 is at UNIFI. Note that in the latter case you will also have the UNIFI S3 compulsory course 'Tropical climatology'.

	ECTS
Marine ecology	6
Terrestrial Ecology	6
Toxins in amphibians and reptiles	3
Professionnal internship	6
Professionnal internship	12

N.B. Provided agreement by the inter-university jury the student can choose optional courses outside the proposed module, but accepting the risk of overlapping schedules.

COMMON EXTRACURRICULAR COURSES:

	ECTS
MODULE: VUB	
Teaching methodology in Biology I (for students that are aspiring teachers in secondary or higher education)	3
MODULE: ULB	
Language courses	variable

Professional Internship courses can only be selected once throughout all semesters. Since it goes at the expense of theoretical and practical courses, it is subject to authorisation from the COFF. If it is in excess of the minimum number of ECTS credits required in a semester, and provided that the student has obtained good course marks in the past, it will always be authorised.

Please also consult the most recent versions of the course sheets directly on the ULB and VUB websites:
ULB: https://www.ulb.be/fr/programme/ma-bior
VUB: https://www.vub.be/en/study/biology/#programme

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Generic S2 course list (all Partners)

COMPULSORY: Mundus tropicalis

	ECTS
Tropical biodiversity and ecosystems field school (see detailed info below per study pole)	15
Geomatics (see detailed info below per study pole)	3
Skills and qualifications in tropical biodiversity (see detailed info below per study pole)	9
Thesis research proposal	3

S2 FIELD SCHOOL (one to be chosen):

	ECTS
Universidad de Antioquia – UDEA (Colombia) Tropical biodiversity and ecosystems field school: from montane to coastal ecosystems and landscapes	15
Université des Antilles – UdA (Guadeloupe) Tropical biodiversity and ecosystems field school: Caribbean insular ecosystems	15
Université Cheikh Anta Diop de Dakar – UCAD (Senegal) Tropical biodiversity and ecosystems field school: West-African forest, savanna, wetland and other Sahel ecosystems	15
Université de Dschang – UDsch (Cameroon) Tropical biodiversity and ecosystems field school: Central African terrestrial ecosystems	15
Technical University of Mombasa – TUM (Kenya) Mundus tropicalis Tropical biodiversity and ecosystems field school: East-African ecosystems	15

	ECTS
Université de La Réunion – UNIRé (Reunion Island) Tropical biodiversity and ecosystems field school: Tropical forest ecosystems of Reunion Island and the South West Indian Ocean Region (incl. Malagasy terrestrial ecosystems)	15
University of Ruhuna – RUH (Sri Lanka) Tropical biodiversity and ecosystems field school: Sri Lankan terrestrial and aquatic ecosystems	15
Universiti Malaysia Terengganu – UMT (Malaysia) Tropical biodiversity and ecosystems field school: Malaysian mangrove ecosystems	15
University of the Philippines Diliman – UPD (Philippines) Mundus tropicalis Tropical biodiversity and ecosystems field school: Philippines' terrestrial and marine ecosystems	15
Université de la Nouvelle Calédonie – UNC (New Caledonia) Tropical biodiversity and ecosystems field school: biodiversity and habitats of the South-Pacific archipelago of New-Caledonia	15

Detailed S2 course list at Universidad de Antioquia (UDEA)

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: from montane to coastal ecosystems and landscapes	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

The UDEA course offer under **Skills and qualifications in tropical biodiversity** changes every year and might only be known at the onset of S2. The courses will nevertheless be focused on skills or knowledge related to the study and research of the wide variety of tropical biodiversity and ecosystems in Colombia. Some course titles that are recurrently offered are:

	ECTS
Diseño experimental	3
Evolution, ecology and biodiversity of Neotropical birds	3
TBC	3

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Detailed S2 course list at Université des Antilles (UdA)

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: Caribbean insular ecosystems	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of a combination of the following modules (the total must be at least 9 ECTS):

	ECTS
Ecologie comportementale	3
Ecophysiologie en milieu contraint	3
Interactions durables	3
Introduction à l'écotoxicologie	3

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Detailed S2 course list at Université Cheikh Anta Diop de Dakar (UCAD)

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: West-African forest, savanna, wetland and other Sahel ecosystems	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of a combination of the following modules (the total must be at least 9 ECTS):

	ECTS
Agroforesterie	3
Biodiversité et fonctions des insectes dans les écosystèmes tropicaux	3
Biodiversité ichtyologique	3
Biodiversity conservation: issues, challenges and assessment methods	3
Biologie et Écologie des poissons d'eaux douces Africains	3
Biostatistique	3
In vitro culture and cryopreservation at the service of biodiversity	3
Initiation à l'ethnobotanique quantitative	3

Detailed S2 course list at Université de Dschang (UDsch)

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: Central African terrestrial ecosystems	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of a combination of the following modules (the total must be at least 9 ECTS):

	ECTS
Ecosystèmes aquatiques (incl. Ecologie des milieux humides tropicaux)	5
Ecosystèmes terrestres (incl. Ecologie Forestière, Sylviculture tropicale)	5
Ethnobotanique (incl. Plantes mellifères, pollens et production des miels, Plantes Médicinales et ethnopharmacologie, Méthodes et techniques ethnobotaniques)	5
Phylogénie et systématique	5

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Detailed S2 course list at Technical University of Mombasa (TUM)

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: East-African ecosystems	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of a combination of the following modules (the total must be at least 9 ECTS):

	ECTS
Behavioural ecology of tropical wildlife	3
Tropical coastal and marine fisheries resources	3
Tropical coastal biodiversity and resource conservation	3
Tropical coastal resource assessment and monitoring tools	3
Tropical savanna ecosystem and biodiversity	3
Wetland ecology and management	3
Wildlife habitat management	3

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Detailed S2 course list at Université de La Réunion (UNIRé)

Course sheets available on **UNIRé website:**
https://www.univ-reunion.fr/formations/2088/

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: Tropical forest ecosystems of Reunion Island and the South West Indian Ocean Region (incl. Malagasy terrestrial ecosystems)	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of the following modules:

	ECTS
Ecological data analysis	3
Molecular evolution	3
Tropical plant health ecology and management	3

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Detailed S2 course list at University of Ruhuna (RUH)

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: Sri Lankan terrestrial and aquatic ecosystems	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of a combination of the following modules (the total must be at least 9 ECTS):

	ECTS
Biodiversity of wetlands in Sri Lanka, conservation and policies	3
Coastal zone management	3
Ecology of tropical marine systems	3
Ecotoxicology and Environmental science	3
Forest ecology and management	3
Indigenous knowledge on plant science	3
Plant physiology, biochemistry and plant breeding techniques	3
Wood science and technology	3

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Detailed S2 course list at Universiti Malaysia Terengganu (UMT)

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: Malaysian mangrove ecosystems	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of a combination of the following modules (the total must be at least 9 ECTS):

	ECTS
Conservation of marine endangered species	3
Estuarine and mangrove ecology	3
Lake and terrestrial ecology	3
Tropical oceanography	3

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Detailed S2 course list at University of the Philippines (UPD) Mundus tropicalis

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: Philippines' terrestrial and marine ecosystems	15
Geomatics	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of the following modules:

	ECTS
Advanced ecology	3
Biodiversity science and conservation biology	3
Restoration ecology	3

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Detailed S2 course list at Université de la Nouvelle Calédonie (UNC)

Course sheets available on **UNC website:**
https://unc.nc/formations/science-de-la-durabilite-sustainability-science-parcours-changement-climatique-et-durabilite-environnementale-dans-le-pacifique-sud/

COMPULSORY:

	ECTS
Tropical biodiversity and ecosystems field school: biodiversity and habitats of the South-Pacific archipelago of New-Caledonia	15
Geomatics (Digital mapping and remote sensing)	3
Thesis research proposal	3
Skills and qualifications in tropical biodiversity	9

Skills and qualifications in tropical biodiversity is composed of a combination of the following modules (the total must be at least 9 ECTS):

	ECTS
Analyse et traitement de données environnementales multivariées	3
Climate change and biodiversity	6
Digital mapping and remote sensing	3
Pacific studies and gender perspectives	3
Stratégies d'échantillonnage environnemental et apprentissage du logiciel "R"	3

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S3 course list at the Sorbonne Université (SU) and the Muséum National d'Histoire Naturelle (MNHN)

Course sheets available on **SU website:**
https://sciences.sorbonne-universite.fr/formation-sciences/offre-de-formation/masters/master-biodiversite-ecologie-et-evolution-bee
Course sheets available on **MNHN website:**
https://formation.mnhn.fr/fr/master-licence/master-biodiversite-ecologie-evolution-2613

At least 30 ECTS to be chosen: **new structure starting in academic year 2025-2026**

COMPULSORY (1 'Parcours' to be chosen):

PARCOURS: Systématique, Evolution, Paléontologie (SEP) – SU and MNHN

RECOMMENDED COURSES:

	ECTS
Diversité et anatomo-morphologie et histoire des lignées chlorophyliennes (DIVEG)	6
Ecosystèmes Tropicaux (ECOT)	6
Floristique tropicale (FLORATROP)	3
Initiation aux techniques avancées de collecte et d'inventaire systématique (NORMAN)	3

PARCOURS: Ecologie de la Conservation – Ingénierie écologique : Recherche et Expertise (ECIRE) – SU and MNHN

And

PARCOURS: Ecologie Evolutive et Fonctionnelle (EEF) – SU and MNHN

RECOMMENDED COURSES:

	ECTS
Ecologie des sols	6
Ecosystèmes Tropicaux (ECOT)	6
Enjeux professionels en ingénierie écologique et biologie de la conservation (EPIC)	3

PARCOURS: Ecophysiologie et Ecotoxicologie (EPET) – SU

RECOMMENDED COURSES:

	ECTS
Bases en écotoxicologie	3
Ecosystèmes Tropicaux (ECOT)	6
Ecotoxicologie : diversité et écodynamique des toxiques	3
Ecotoxicologie et évaluation des risques (TOXRISK)	3
(éco)Toxicologie réglementaire et appliquée	3

OPTIONAL for all parcours:

	ECTS
Adaptations de la respiration et de l'osmorégulation en milieu marin (AROM)	6
Analyses des séries temporelles en ecologie et dynamique des populations (STEM)	3
Anatomie comparée	3
Biodiversity informatics (BIODIVINFO)	6
Biogéographie et macroécologie (BIME)	6
Biotests et bioressources Marines (B2M2)	2
Conservation ex-situ (CONX)	3
Contaminants chimiques et prolifération biologiques (CCPB)	3
Contaminant Organiques: risques, devenir, transformation (CONT ORG)	3
Crises biologiques: connaitre le passé, comprendre l'actuel	3
Diversité des génomes	3
Ecologie comportementale: base (ECM1)	6
Ecologie comportementale: approfondissement (ECM2)	3
Ecologie de la restauration (ECOR)	3
Ecologie et évolution des intéractions hôte-parasite (REID)	3
Ecologie moléculaire et génétique évolutive des organismes marins (EMGE)	6
Ecophysiologie sensorielle et plasticité comportementale (ECOSENS)	6
Environnement et Eco-innovation végétales (ECOINNOV)	6
Exploration et description de la biodiversité (EXPLOBIODIV)	3
Evolution des cycles de vie chez les organismes marins et microbiens (ECYC)	6

	ECTS
Formalisation des connaissances en systématique et paléobiodiversité et introduction à l'analyse à trois éléments (FORMCON)	3
Fonctionnement et dynamique des socio-écosystèmes (FOSE)	6
Interactions végétaux-milieux biotiques et lutte bio-agresseurs (INTERBIO)	6
Lumière, rythmes biologiques et contrôle des activités biologiques (BIORYTHM)	6
Méthodes phylogénétiques comparées (PHYLOCOMP)	3
Méthodologies d'échantillonnage Faune Flore (METE)	6
Morphologie cladistique (MORPHOCLAD)	3
Morphométrie et analyses des formes (MORPHOM)	3
Outils juridiques et réglementaires en matière de protection de la nature (OJRE)	3
Phylogénie des métazoaires: évolution des plans d'organisation (PHYLOMET)	3
Phylogénie moléculaire et phylogénomique (PHYLOMOL)	6
Physiologie intégrative des micro-organismes (PHYMICRO)	6
Pratiques agricoles et conservation d'espèces menaces (PACE)	6
Propagation, conservation et diversité des organismes végétaux (PCD VEG)	6
Réalisation de son projet professionnel dans les métiers de l'expertise (EXPE)	3
Spéciation des éléments traces (SPECTRA)	3
Taxinomie et nomenclature (TAXONOM)	3
Viabilité des populations et des métapopulations (VIAB)	6
Xylologie-paléoxylologie: systématique et paléoécologie (XYLO)	6

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

Course sheets available on:
UNIFI website: https://e-l.unifi.it/

COMPULSORY:

	ECTS
Applied conservation biology	6
Ecosystem services and climate change biology	6
Advances in tropical botany	6
Tropical climatology	6

OPTIONAL (at least 12 ECTS to be chosen):

	ECTS
Landscape analysis (incl. Methods in landscape analysis and Pedology)	6
Methods in animal ecology and evolution (incl. Analysis of ecological communities and Animal phylogeography)	6
Tropical plants in action	6
Phylogeny of frogs (not available in 2025-2026)	6

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S3 course list at the Université de Guyane (UdG)

Course sheets available on **UdG website:**

https://www.univ-guyane.fr/choisir-sa-formation/dfr-sciences-et-technologies/ecologie-des-forets-tropicales/

COMPULSORY:

	ECTS
Introduction à l'environnement tropical	8
Origine et maintien de la biodiversité	4
Modelisation des systèmes éologiques	4
Botanique évolutive et écologie fonctionnelle	7
Gestion des forêts tropicales	5
Professionalisation	2

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S4 course list at ULB-VUB, SU, MNHN, UNIFI, UdG, UdA, UNIRé and UNC

	ECTS
Master Thesis	30

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TROPIMUNDO Course Sheet Template

Course title: FILL
Course ID: FILL
University: FILL
Faculty: FILL
Department: FILL
Name and e-mail address of the instructor(s): FILL (FILL @ FILL)
Course website: FILL
Semester: S2
Tuition language: FILL
Number of credits (ECTS): FILL

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
FILL where needed							

Course objectives:
FILL

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

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

Course material, text books and further reading:
FILL

Prerequisites: please note the general comment on prerequisites
FILL

Table of contents:
FILL

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

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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 approximately the same order as the above course lists per partner, but aggregate S1 and S3 (*i.e.* all S1 and S3 courses given by one and the same partner are displayed in a single list).

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Specific comments

Specific comment with respect to the course breakdown and hours

The following abbreviations are used:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS

Specific comment with respect to the learning outcomes

In most cases below the learning outcomes are the *educational* learning outcomes of the specific course.

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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 only, or in English and in French and/or Spanish** (depending on the Trajectory) equivalent to Common European Framework of Reference for Languages (CEFR) level B2. However, these two prerequisites 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 degree.

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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 to pass the course. Our consortium works by the principle of an achievement of competences, not by balancing personal forces against personal weaknesses.

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

Course title: Scientific presentation skills and career planning
Course ID: ULB BIOL-F537 / VUB 4018805DNR
University: Université Libre de Bruxelles, Vrije Universiteit Brussel, Sorbonne Université, Muséum National d'Histoire Naturelle, Università degli Studi di Firenze, Université de Guyane, Université des Antilles, Université de La Réunion, Université de la Nouvelle Calédonie
Faculty: Sciences
Department: Biology / Natural sciences
Name and e-mail address of the instructor(s): Farid Dahdouh-Guebas (Farid.Dahdouh-Guebas@ulb.be)
Course website: https://www.ulb.be/fr/programme/m-biore#programme
Semester: S3
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

THE	TP	EX	EXC	STG	PRJ	SEM	PRS
20 hrs					24 hrs		

The project consists of making a slide show of a thesis defence.

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:
1.Scientific proposals:
- Rationale / Background / Problem situation / Context of the subject
- Literature review (source types, Boolean and proximity operators)
- Use of the Internet (what can we trust out there ?)
- Research objectives (disambiguation of purpose, aim, goal, scope, objective, target and ambition)
- Scientific questions and hypotheses
- 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
•Publication conflict avoidance
•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
•Cultivating healthy relationships in research

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 Master thesis (*e.g.* MEMO-F538), 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).

In this course, the use GenAI tools is only permitted to a limited extent. Specific instructions will be communicated via the e-learning platform.

Course title: Social-Ecological Systems
Course ID: ULB BIOL-F4005 / VUB 4018749FNR
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Farid Dahdouh-Guebas (Farid.Dahdouh-Guebas@ulb.be)
Course website:
Semester: S1
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

THE	TP	EX	EXC	STG	PRJ	SEM	PRS
30 hrs		6 hrs	12 hrs		12 hrs		

In the course schedule the exercises will be scheduled on the same time slot as the theoretical lectures. A conference excursion will be organised but the exact date changes every year.

Course objectives:
Aims and objectives:
1. To provide an overview of the constituents and theory (conceptual, analytical) underlying large-scale social-ecological systems (SES);
2. To understand diversity, redundance, stability, hysteresis and resilience in a functional ecological context and in a sustainability context;
3. To understand the ecological and social-ecological functioning of selected SES;
4. To zoom in on the mangrove forest as a SES and:
4A. To understand the ecological and social-ecological relationships within mangroves and between mangroves and adjacent ecosystems;
4B. To understand the consequences of anthropogenic threats to this SES;
4C. To understand the scientific approaches and tools to monitor, manage and restore this SES.

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 understand the constituents of a SES and to track down the ecological consequences on different sublevels (environment, fauna and flora) of anthropogenically induced changes on tropical coastal biodiversity and ecosystems, and must be able to situate the environmental problems in a holistic context (relationship with socio-economical factors).

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.

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.

Ecological and socio-ecological individual-based models

Complexity and social-ecological resilience in dryland systems

Complexity and social-ecological resilience in forest systems

Complexity and social-ecological resilience in freshwater systems

Complexity and social-ecological resilience in oceans and estuarine systems

The mangrove forest as a SES, describing constituents and relationships), the links with man and integrated research.
Part I ▫ Mangrove forests and their biocomplexity ▫ Distribution of mangrove forests,; ▫ Faunal and floral biodiversity, incl. morphological, physiological and ethological adaptations to tropical environments and to intertidal and marine life; ▫ Ecological mutual benefits between between mangrove forests, and their adjacent tropical rainforests, seagrass beds and coral reefs; ▫ Food webs and trophic relationships;
Part II ▫ Ethnobiology and anthropogenical impacts on mangroves and adjacent ecosystems ▫ Social, economical and cultural values and services of mangrove forests – mangroves as a model SES;
▫ Anthropogenically induced threats on one or more ecosystems and the consequences for the other ecosystems; ▫ Local vs. global patterns of change.
Part III ▫ Scientific research tools ▫ Monitoring, modelling and experiments (incl. management, restoration and conservation); ▫ The use of remote sensing and GIS; ▫ Combinatory and multivariate analyses; ▫ Essentials of tropical habitat management ▫ Case-studies and management guidelines with respect to mangroves as a SES.

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 60% (theory, presentation and discussion of a scientific paper and of an individual-based model)
Role-play simulation: 40% (Mangal Play)

In this course, the use of GenAI tools is only permitted to a limited extent for specific components (written assignments related to the Mangal Play). Specific instructions will be communicated via the e-learning platform.

Participation in all events of the Mangal Play is mandatory.

Failure to meet an assignment submission deadline will automatically result in a zero score for the assignment in question.

Incomplete participation (arriving late or leaving early) in the Mangal Play live event may result in a reduction of the grade for this course component, whereas unauthorised absence will result in a zero score. In the event of an authorised absence (e.g., with a medical certificate or clear proof of a significant and unexpected public transport disruption), the professor/assistant may, if feasible, offer an alternative evaluation option. If not feasible (to be determined by the professor/assistant), an alternative calculation method for the final grade will be applied.

Second Examination Opportunity: There is no second examination opportunity for the Mangal Play component. The score obtained for the Mangal Play in the first examination session will be carried over to the second examination session.

Plagiarism: Sanctions for plagiarism can range from a zero score for the examination or paper of the course unit or component in one or more examination periods, to a ban on (re)enrolment for one or more academic years (see Teaching and Examination Regulations).

Recordings: Visual and/or audio recordings of lectures, practical sessions, and excursions are strictly prohibited unless explicit permission has been granted by the professor/assistant.

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.be)
Course website:
http://www.vub.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): 6

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: Acquisition et analyse de données
Course ID: BING-F4002
University: Université libre de Bruxlles
Faculty: Sciences
Department: Biologie des Organismes / Ecole de Bioingénieurs de Bruxelles
Name and e-mail address of the instructor(s): Simon Dellicour (simon.dellicour@ulb.be) et Marc Dufrêne (marc.dufrene@ulg.ac.be)
Course website: https://www.ulb.be/fr/programme/bing-f4002
Semester: S1
Tuition language: French
Number of credits (ECTS): 5

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 36 hrs

Course objectives:
- Concevoir, planifier, développer et mettre en œuvre un protocole permettant de tester une hypothèse
- Utiliser des outils d'analyse des données y compris statistique pour répondre à une questionscientifique
- Concevoir et mettre en place des approches expérimentales efficientes pour résoudre une question scientifique

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

A l'issue de cette unité d'enseignement, l'étudiant sera capable de :
- choisir une méthode statistique adaptée au traitement des données issues d'un dispositif d'observations ou d'expérience
- adapter et dimensionner un dispositif d'observations ou d'expériences pour répondre à une question biologique
- de mettre en oeuvre et d'interpréter les méthodes statistiques de base

Course material, text books and further reading:
- Crawley MJ (2005). Statistics. An introduction using R. Wiley, Chichester, 327pp
- Legendre P, Legendre L (1998). Numerical ecology (2° edition). Elsevier, Amsterdam, 853pp

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
- Rappels sur la raison d'être des statistiques
- Introduction aux tests d'hypothèse
- Analyse de la variance (ANOVA)
- Régressions linéaires simples et multiples
- Introduction aux tests non-paramétriques
- Observations et design expérimental
- Analyses multivariées, distances et groupements
- Les ordinations
- Cas d'étude multivariés

Assessment breakdown: please note the general comment on assessment breakdown
1ère session: 100% examen écrit

2ème session: 100% examen oral

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): François Fripiat (François.Fripiat@ulb.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): 5

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: Earth's climate history and the origin of life
Course ID: GEOL-F4003
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Earth Sciences
Name and e-mail address of the instructor(s): François Fripiat (François.Fripiat@ulb.be) & Steeve Bonneville (steeve.bonneville@ulb.be)
Course website: TBC
Semester: S1
Tuition language: English
Number of credits (ECTS): 5

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
24						**8**	

Course objectives:
TBC

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

TBC

Course material, text books and further reading:
TBC

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
TBC

Assessment breakdown: please note the general comment on assessment breakdown
TBC

Course title: The blue planet: ocean, sediments and climate
Course ID: GEOL-F436
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Earth Sciences
Name and e-mail address of the instructor(s): Sandra Arndt (sandra.arndt@ulb.be) and François Fripiat (François.Fripiat@ulb.be)
Course website: TBC
Semester: S1
Tuition language: English
Number of credits (ECTS): 5

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
24	12						

Course objectives:
TBC

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

TBC

Course material, text books and further reading:
TBC

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
TBC

Assessment breakdown: please note the general comment on assessment breakdown
TBC

Course title: Freshwater ecology
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): Iris Stiers (Iris.Stiers@vub.be)
Course website:
http://www.vub.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): 5

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
24		12					

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 ecology
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): Anton Van De Putte (anton.van.de.putte@ulb.be) and Marc Kochzius (Marc.Kochzius@vub.be)
Course website:
http://www.vub.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): 5

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: 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.be)
Course website:
Semester: S1
Tuition language: English
Number of credits (ECTS): 5

Course breakdown and hours:
- Lectures: 36 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.be)
Course website:
http://www.vub.be/en/study/biology/programme/r/master-of-science-in-biology/27767/emmc-tropical-biodiversity-and-ecosystems
Semester: S1
Tuition language: English
Student quota: annually variable (contact instructor at the onset of the academic year)
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.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: S1
Tuition language: English
Student quota: max. 10 students
Number of credits (ECTS): 5

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 environment
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.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: S1
Tuition language: English
Number of credits (ECTS): 5

Course breakdown and hours:
- Lectures: 36 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): Thomas Merckx (Thomas.Merckx@vub.be)
Course website: https://www.vub.be/en/study/fiches/55764/global-change-biology
Semester: S1
Tuition language: English
Number of credits (ECTS): 6

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

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

Upon successful 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: Plant responses to environmental stress
Course ID: BIOL-F443
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Organism Biology
Name and e-mail address of the instructor(s): Nathalie Verbruggen (Nathalie.Verbruggen@ulb.be)
Course website:
Semester: S1
Tuition language: English
Number of credits (ECTS): 5

Course breakdown and hours:
- Lectures: 24 hrs

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

Upon susseccful completion of the course the student must have:
the necessary tools to understand mechanisms of plant responses to different environmental stresses.

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:
The course will be a review of plant responses to different types of environmental stress, in particular physiological and molecular analysis. Molecular biology tools have allowed tremendous progress in our understanding of plant responses. Responses of plants to drought salt stress, temperature stress, toxic concentrations of trace metals, biotic stress, ... will be presented. The course will also include advances in the improvement of plant resistance to stress by genetic engineering. General research strategies will be discussed through analysis of case studies.

Assessment breakdown: please note the general comment on assessment breakdown
Written examination (50%) + oral presentation of a personal work (50%)

Course title: Pédologie et écosystèmes
Course ID: BIOL-F4002
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Organism Biology
Name and e-mail address of the instructor(s): Thomas Drouet de la Thibauderie (Thomas.Drouet@ulb.be)
Course website:
Semester: S1
Tuition language: French
Number of credits (ECTS): 5

Course breakdown and hours:
- Lectures: 36 hrs

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

Au terme de l'enseignement l'étudiant sera en mesure :
- De comprendre les principaux processus de formation des sols en relation avec les facteurs du milieu.
- D'élaborer une gestion raisonnée des grands types de sols mondiaux en fonction de leurs propriétés et de leurs aptitudes.
- De reconnaître les contraintes physiques, chimiques et environnementales liées à un grand nombre de types de sol.
- D'intégrer la composante sol dans l'étude des cycles d'éléments, de la diversité biologique et des changements globaux.

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:
Considérations fondamentales sur les interactions entre facteurs du milieu et processus pédogénétiques. Notion de matériaux parents (typologie et méthodes d'étude). Grands types de sols mondiaux (distribution géographique, mode de formation, propriétés et aptitudes, problèmes environnementaux spécifiques : andosols, vertisols, sols isohumiques et érosion, sols calcimagnésiques et processus d'altération physique, sols hydromorphes, sols brunifiés, processus d'altération chimique et bilans d'altération, sols podzolisés et processus de chéluviation, sols ferrallitiques et contraintes agronomiques des sols tropicaux.

Assessment breakdown: please note the general comment on assessment breakdown
Examen oral (60 %) et travail personnel (40 %).

Course title: Genomics, transcriptomics and epigenomics (Bioinformatics)
Course ID: BING-F402
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Organism Biology
Name and e-mail address of the instructor(s): Jean-François Flot (jean-francois.flot@ulb.be) and Matthieu Defrance (matthieu.dc.defrance@ulb.be)
Course website:
Semester: S1
Tuition language: English
Number of credits (ECTS): 5

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises, practicals: 24 hr

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

Upon susseccful completion of the course the student must have:
- explain the different methods used to sequence DNA and RNA as well as to process bioinformatically the resulting data (processing different file formats using the command line, converting data from one format into another, checking the quality of the sequences);
- explain the different methods used to assemble de novo, map and annotate genomic data, as well as to perform genome assemblies and estimate the quality of the result obtained;
- explain the different methods used for phylogenetic network analyses, as well as to apply them to real datasets and to interpret the results in terms of the evolution of organisms and species delimitation;
- perform synteny analyses in order to detect whole-genome duplication events and genomic rearrangements, as well as to detect genome regions evolving under positive or negative selection;
- explain the different approaches used in epigenomic and proteomic studies as well as to analyse the resulting datasets.

Other skills:
- Acquiring the basic concepts and knowledge of informatics and biology required for devising projects in bioinformatics and modelling.
- Mastering the mathematical, statistical and informatic knowledge on which bioinformatic and modelling studies are resting.
- Analyzing critically original research articles in bioinformatics and modelling.
- Understanding the evolution of knowledge on a given subject as well as collecting and managing scientific articles pertaining to it.
- Being able to use existing bioinformatic resources and to develop new programs (algorithms, databases, analytic tools, etc.).
- Write a research report with clarity and rigor.
- Presenting orally in a clear and concise way the results of a work and facing the questions and criticisms of the public.

Course material, text books and further reading:

Course slides and research articles

Felsenstein, 2002. Inferring Phylogenies. Sinauer Associates. 580 pp. ISBN 9780878931774.
Graur, 2016. Molecular and Genome Evolution. Sinauer Associates. 612 pp. ISBN 9781605354699.
Haddock & Dunn, 2010. Practical Computing for Biologists. Sinauer Associates. 538 pp. ISBN 9780878933914.

Wang, 2016. Next-Generation Sequencing Data Analysis. CRC Press. 246 pp. ISBN 9781482217889.

Prerequisites: please note the general comment on prerequisites

The practicals require students to be comfortable with the command line. Here are a few useful tutorials for students who need to brush up their command-line skills:
http://linuxcommand.org/lc3_learning_the_shell.php
http://webext.pasteur.fr/tekaia/BCGA2012/TALKS/FT_Unix.pdf
http://webext.pasteur.fr/tekaia/BCGA2012/TALKS/FT_perl.pdf
http://www.cs.usfca.edu/~parrt/course/601/lectures/unix.util.html
http://cs.nyu.edu/courses/fall06/G22.2245-001/syll/syll.html

Content:
11 sessions:

01. Crash course on command line processing
02. Crash course on omics processing using R
03. Quiz; reference genome and read mapping
04. Genomics and variant calling
05. Transcriptomics and RNA-seq
06. Epigenomics and ChIP-seq
07. 1st oral presentation
08. Sequencing technologies comparison
09. De novo assembly, theory
10. De novo assembly, practical
11. 2nd oral presentation

The sessions combine theoretical lectures, exercices and practicals. Students will also give oral presentations pertaining to the topic of the course

Assessment breakdown: please note the general comment on assessment breakdown
One quiz and two oral presentations
20% for each written assignment, 40% for each oral presentation

Course title: Toxins in amphibians and reptiles
Course ID: 4016550FNR
University: Vrije Universiteit Brussel
Faculty: Sciences and Bio-engineering Sciences
Department: Biology
Name and e-mail address of the instructor(s): Kim Roelants (Kim.Roelants@vub.be)
Course website:
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures Seminars, exercises, practicals, field training: 24 hrs

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

By covering an important and widespread ecological adaptation, this course broadens a herpetologist's general knowledge of amphibian and reptile natural history. Furthermore, the course represents an excellent preparation for any biologist interested in pursuing a research carrier in toxinology, either from a fundamental scientific perspective or from an applied clinical one. After following the 15-hours course, students are expected to:
- have a broad knowledge of the taxonomic diversity of amphibians and reptiles that use toxins for predation, defense or competition;
- know the major molecular classes of toxins in amphibian poisons and reptile venoms, their synthesis, functioning, and similarities to other animal toxins;
- be aware of important genetic and ecological aspects of toxicity and be capable to discuss these in an evolutionary context that extends beyond the field of herpetology.
- be aware of the medical problems of snake envenomation and treatment worldwide, and understand the potential of amphibian and reptile toxins in various clinical application fields.
- be capable to understand and critically analyse any literature published on the various aspects of toxinology, including discovery, pharmacology, and evolutionary genetic and ecological implications.

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:
Toxins represent an important ecological adaptation in a large number of amphibian and reptile species. While in amphibians, toxins are secreted through skin glands as a passive defense weapon (a poison) against predators or pathogenic microorganisms, reptile toxins are actively administered through a bite (a venom) to serve either predation or antipredator defense. Despite these fundamental differences, amphibian poisons and reptile venoms share many functional, structural, and genetic characteristics that allow new insights in the fields of molecular biology, evolutionary biology, ecology and pharmacology. This course introduces students into the fascinating field of amphibian and reptile toxinology and illustrate its multidisciplinary nature, with affinities to research fields as diverse as herpetolology, ecology, evolutionary biology, genetics, biochemistry and pharmacology. By means of numerous recent case studies, it presents a comprehensive and up-to-date overview of:
(1) the taxonomic range of the poisonous amphibians and venomous reptiles (e.g. poison arrow frogs, monitor lizards and pit vipers);

(2) the structural and functional diversity of toxins found in both groups (e.g., alkaloids, steroids, peptides and proteins);
(3) their targets in a prey's or predator's physiological processes (e.g. in neural signal transduction, inflammation and hemostasis);
(4) genetic, ecological and evolutionary phenomena, patterns and hypotheses related to toxicity (e.g., evolutionary convergence, aposematism, toxin resistance, and evolutionary arms races between prey and predator);
(5), snake bite treatment and the application of toxins in disease modeling, diagnostics and drug design.

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment with written preparation (100%)

Course title: Biological invasions and management
Course ID: BIOL-F1715
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Iris Stiers (Iris.Stiers@vub.be)
Course website: https://www.ulb.be/en/programme/2022-biol-f1715
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours: please note the general comment on abbreviations

THE	TP	EX	EXC	STG	PRJ	SEM	PRS
17 hrs					17 hrs		

Course objectives:
This course will examine the theoretical and applied aspects of invasive species ecology and management, including terrestrial and aquatic flora and fauna. Major themes of the course will include: 1) ecological processes and the spread of invasive species; 2) impacts of invasive species; 3) invasive species management; and 4) policies and regulations involving invasive species.

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:
-Explain the history of invasion ecology.
-Outline the stages of the invasion process.
-Describe and critically evaluate the hypotheses to explain biological invasions.
-Summarize the effects of invasions on communities and ecosystems.
-List the possible management strategies for invasions and their pros and cons.
-Frame biological invasions within the science-policy interface
-Understand the added value of education and public awareness for successful prevention and management of invasive species.
-Synthesize and critique about primary literature.
-Discuss literature with fellow scientists and orally present.

Course material, text books and further reading:
No specific textbook is used. Powerpoint slides and relevant scientific and opinion papers will be made available.
The following books can be useful:
-Lockwood et al. Invasion Ecology (2013) Wiley-Blackwell

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
In this human-shaped epoch that is the Anthropocene, the spread and establishment of Invasive Alien Species (IAS) is regarded as one of the main threats to biodiversity worldwide. Highly adaptable and competitive, these invaders spread and establish quickly upon introduction into a novel environment, especially when this is disturbed by anthropogenic activities. This course will cover following subjects:

-An introduction to invasion ecology
-Transport vectors and pathways
-Ecological processes and the spread of invasive species
-Impacts of invasive species
-Management of invasive species
-Policy and legislation involving invasive species
-Education and outreach with regard to invasive species

Guest speakers from various academic and/or professional sectors which are experts in certain invasive taxonomic groups will be invited to illustrate their specific view and approach of the problem.

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 80 %
Projects/Presentations/Reporting: 20 %

Course title: Terrestrial ecology
Course ID: BIOL-Y060 / 4023907ENR
University: Vrije Universiteit Brussel
Faculty: Sciences and Bio-engineering Sciences
Department: Biology
Name and e-mail address of the instructor(s): Harry olde Venterink (harry.olde.venterink@vub.be)
Course website: https://www.ulb.be/en/programme/2022-biol-y060 and https://caliweb.cumulus.vub.ac.be/caliweb/?page=course-offer&id=011849&anchor=1&target=pr&year=2223&language=en&output=html
Semester: S1
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours: please note the general comment on abbreviations

THE	TP	EX	EXC	STG	PRJ	SEM	PRS
12 hrs	12 hrs						

Course objectives:
The course focuses on ecology of terrestrial ecosystems and contains a theoretical and a practical part. The content of the course builds on the ecological knowledge obtained in the Bachelor courses 'Plants & Fungi' and 'Ecology', but these courses are not compulsory since the course is also open for students who did their bachelor study elsewhere.

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
- Obtain knowledge about a wide variety of theories and hypotheses in the field of terrestrial ecosystems ecology and learning to apply this knowledge to newly collected data.
- Learn how to measure and quantify various variables about ecological processes in terrestrial plant communities and ecosystems, and understanding the difference between data collected by monitoring in natural ecosystems and data obtained from experimentally manipulated sites.
- Analyse, process and present ecological data, and practice with working and collaborating in groups.

Course material, text books and further reading:

Digital course material (Required) : Powerpointpresentaties

Handbook (Recommended) : Principles of Terrestrial Ecosystem Ecology, Chapin F.S. III, Matson P.A. & Vitousek P.M., Springer, New York, 2011

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
How do carbon (C), nitrogen (N), phosphorus (P) and energy cycle through terrestrial ecosystems and their food webs, and how are these cycles affected by landscape factors and human activities? How does the balance (stoichiometry) between C, N and P influence plant growth, primary production, decomposition, as well as the competition between plant species and the occurrence of endangered and exotic invasive species? How is plant growth affected by soil microbes, herbivores and carnivores? And how can we apply the landscape of fear principle from African savanna to the recent re-introduction of wolves in Western Europe? Are exotic invasions a major cause for the loss of biodiversity in terrestrial ecosystems, and how

does biodiversity itself influence exotic invasions and ecosystem functionality? How does climate change influence terrestrial ecosystems? And how do novel species interactions from range shifts compare to those resulting from exotic invasions? How does nature management impact terrestrial ecosystems and the conservation of biodiversity, and which factors need to be considered for the restoration of degraded ecosystems? This kind of questions are treated in the course 'Terrestrial Ecology', and various hypotheses, mechanisms and theoretical predictions, mainly from the field of Ecosystems Ecology, are presented to answer these questions. The theory, excursions and practical's, provide insight in the functioning of terrestrial ecosystems, how they are threatened by human activities and global change, and how management can be applied for conservation and restoration.

The theoretical part deals with important topics of ecosystems ecology. The ecological theory, processes and mechanisms will be illustrated with examples from terrestrial ecosystems in Europe, Africa and South- and North America, and Australia. Many examples will be given from own long-term research in Europe, African savanna and the Brazilian Cerrado. The following topics will be covered:

1. Introduction to ecosystems ecology, ecosystem components and stability
2. Cycles of carbon, nitrogen and phosphorus
3. Ecological stoichiometry
4. Primary production and growth limitation
5. Decomposition
6. Plant-soil microbe interactions
7. Plant-herbivore-carnivore interactions
8. Food web ecology
9. Competition and facilitation among species
10. Biodiversity - ecosystem functionality relationships
11. Loss of biodiversity
12. Exotic invasions and novel species interactions
13. Impact of climate change on terrestrial ecosystems
14. Nature conservation, restoration and management

The practical part consists of field excursions to two nature reserves where the results of successful nature restoration projects will be observed, as well as to experimental field sites. During these field visits some of the ecological processes discussed in the oral lectures will be studied by performing measurements and collecting data (4 days). The obtained ecological data will be processed and processed in small groups (1 day) and presented and discussed in the entire group (2 hours).

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 100 %, conditional of participation in the course's practical sessions
The theory presented and explained in the lectures and WPO will be examined in an oral exam. This exam is based on questions which can prepared just before the exam. The oral exam is only open for students that have actively participated in the practical part. Students who missed a part of the WPO must carry out a replacement task.

Course title: Agroecology
Course ID: BIOL-Y061 / 4023854ENR
University: Vrije Universiteit Brussel
Faculty: Sciences and Bio-engineering Sciences
Department: Biology
Name and e-mail address of the instructor(s): Franky Bossuyt (franky.bossuyt@vub.be)
Course website: https://www.ulb.be/en/programme/2022-biol-y061 and https://caliweb.cumulus.vub.ac.be/caliweb/?page=course-offer&id=011815&anchor=1&target=pr&year=2223&language=en&output=html
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours: please note the general comment on abbreviations

THE	TP	EX	EXC	STG	PRJ	SEM	PRS
12 hrs							

Course objectives:
Farming and food systems are intimately related to environmental, social and ethical issues. In this course, students are introduced to agroecology as a science, a practice and a social movement. Students will learn the basics of applying a systems approach in designing and studying agricultural systems and food production chains.

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
- understand the fundamental aspects of sustainable agriculture, agroecosystem management and sustainable food systems
- understand structure and function of complex agroecosystems
- understand some of the most important methods in agroecology, such as agroforestry, food forests, permaculture, alley cropping, sylvopasture…
- explain why agroecological methods are beneficial for the climate, biodiversity and nutrient crisis
- identify the main perennial plants that are used in agroforestry

Course material, text books and further reading:
Powerpoint slides of the lectures (available on CANVAS)
Relevant scientific and opinion papers (available via CANVAS).

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
The course deals with the food system as a whole, from taking care for the soil, over design of agricultural systems, to the organization of societies. It explains how agroecosystems that imitate nature in form and function can provide food and many other needs, and at the same time remediate the climate, biodiversity and nutrient crisis.

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

Course title: Analyse et gestion des impacts environnementaux
Course ID: ENVI-F452
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Environmental Sciences
Name and e-mail address of the instructor(s): Wouter Achten (wouter.achten@ulb.be)
Course website: https://www.ulb.be/fr/programme/2022-envi-f452
Semester: S1
Tuition language: French
Number of credits (ECTS): 5

Course breakdown and hours:

- Lectures: 36 hrs

Course objectives:
La durabilité environnementale est de plus en plus importante pour les décideurs politiques, des entrepreneurs, des consommateurs, et la recherche. Toutes ces parties prenantes sont confrontées aux questions de durabilité sur les développements qu'ils créent ou supportent. Les consommateurs veulent être informés sur les performances environnementales des produits. Les entrepreneurs et les politiciens sont souvent confrontés à leurs responsabilités par rapport d'environnement. À toutes les étapes l'aide à la décision concernant la durabilité environnemental est nécessaire.

Ce cours vise à familiariser les étudiants avec des concepts et outils couramment utilisés pour évaluer et gérer les impacts environnementaux des produits, des projets, des organisations, des stratégies, des politiques, etc.

Les objectifs d'apprentissage

Management environnemental :

Obtenir un aperçu synthétique des pratiques de Gestion Environnementale dans le milieu des entreprises privées, et autorités publiques

Évaluation des impact environnementaux

- Obtenir un aperçu de la pluralité des analyses pour évaluer les impacts environnementaux et les méthodes de gestion

- Obtenir un aperçu des procédures des différentes techniques. Quelles questions peuvent-elles être traitées, quelles données sosont -elles nécessaires, choix méthodologiques qui doivent être pris, ...

- Obtenir un aperçu des points forts, des faiblesses et des pièges, ... des techniques

Aide à la décision multicritère: - Se familiariser avec la structuration d'un problème de décision multicritère (définition des alternatives, des critères, modélisation des préférences, problématiques, etc.) - Expérimenter la résolution d'un problème original à l'aide de la plateforme D-SIGHT WEB (utilisant d'outils visuels interactifs, analyse de sensibilité et robustesse, aspects multi-décideurs, etc.)
Compétences visées

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

Après avoir suivi ce cours, les étudiants doivent être en mesure de

1) identifier les concepts, outils et techniques appropriés pour une problème ou question par rapport à la gestion et l'évaluation environnementale,
2) faire une conception/mise en page d'une démarche de gestion ou de recherche pour une question de gestion ou évaluation d'impact ou une question d'aide à la décision ,
3) évaluer de manière critique la valeur d'un rapport d'évaluation ou gestion d'impact donné.

Course material, text books and further reading:
This will be informed during the first lecture.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

General overview of environmental impact management and evaluation concepts, tools, techniques (thought in English)

Environmental management: ISO 14001 & EMAS, Eco-innovation: cleaner production, life cycle thinking, industrial ecology, cradle to cradle; circular economy (thought in English)

Environmental impact evaluation: Principles, criteria and indicators, material flow analysis, life cycle assessment, footprinting, input-output analysis, environmental extended input-output assessment (Thought in English), Evaluations Environnementales et Analyse multi-critères (enseigné en Français).

Assessment breakdown: please note the general comment on assessment breakdown

Examen écrit: 13/20
- Questions sur connaisances: 4/20
- Question d'application de connaisances: 4/20
- Question lié à la capacité d'analyse: 5/20
- (exemples vont être donnés pendant le cours et pendant la dernière séance du cours).

Rapport aide à la décision: 7/20

Course title: Bioéthique et droit de la conservation
Course ID: BIOL-F448
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Bruno Danis (Bruno.Danis@ulb.be)
Course website: https://www.ulb.be/en/programme/biol-f448
Semester: S1
Tuition language: French
Number of credits (ECTS): 5

Course breakdown and hours:

- Lectures: 20 hrs
- Exercices: 36 hrs
- Seminars : 4 hrs

Course objectives:
Société et le rôle du scientifique et du biologiste en particulier

Learning outcomes : please note the general comment on learning outcomes
Education level: General Ecosystem focus: Methods & tools Biological level: Global

Constituer, entretenir et développer des connaissances dans le domaine des sciences biologiques
Acquérir des savoirs par une recherche personnelle et critique de la littérature scientifique.
Reconnaitre les explications inconsistantes et les généralisations abusives.
Identifier les besoins et trouver les expertises requises.
Faire preuve de polyvalence et intégrer la multidisciplinarité dans la gestion d'un projet.
Communiquer dans un langage rigoureux adapté au contexte et à son public
Développer une argumentation scientifique.
Défendre un projet et un travail de recherche personnel.
Discuter des implications pratiques et théoriques d'une recherche ainsi que de ses perspectives.

Course material, text books and further reading:
Lecture notes

Prerequisites: please note the general comment on prerequisites
Excellentes notions fondamentales en biologie des organismes, évolution et écologie

Table of contents:
Bioéthique: Interaction "Sciences-Société" et rôle de la bioéthique. Réflexions critiques sur l'impact des avancées (et conséquences) des techniques scientifiques dans la société ; comparaisons entre législations.

Droit de la conservation: généralités sur le cadre institutionnel lié à la conservation, aux niveaux national, européen, et international. Éléments de stratégies de conservation.

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

Course title: Cours ou stage hors ULB
Course ID: BIOL-F535
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.be)
Course website: https://www.ulb.be/fr/programme/biol-f535
Semester: S1 (organisationally this can be in S1, S2 or S3, in Belgium or abroad)
Tuition language: French, English, Dutch or Italian
Number of credits (ECTS): 5

Course breakdown and hours:

- Practical training: 60 hrs

Course objectives:
Enabling the student to valorise summer schools, winter schools, monsoon schools, or equivalent

Learning outcomes : please note the general comment on learning outcomes
Education level: specialised Ecosystem focus: variable Biological level: variable

Course material, text books and further reading:
This will be provided by the course organiser

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
This will be provided by the course organiser

Assessment breakdown: please note the general comment on assessment breakdown

This will be provided by the course organiser

Course title: Professionnal internship / Stage professionnel
Course ID: STAG-F034
University: Université Libre de Bruxelles
Faculty: Sciences
Department: Biologie des Organismes
Name and e-mail address of the instructor(s): Denis Fournier (Denis.Fournier@ulb.be)
Course website: https://www.ulb.be/fr/programme/2022-stag-f034
Semester: S1 (organisationally this can be in S1, S2 or S3, in Belgium or abroad)
Tuition language: French, English, Dutch or Italian
Number of credits (ECTS): 15

Course breakdown and hours:
- Practical training: 380 hrs

Course objectives:
• stage dans une structure d'accueil ou il est possible d'etre engagé en tant que biologiste (ONG, ASBL, entreprise/industrie, secteur public ou privé, médias ...)
• en Belgique ou a l'étranger
• mais pas en laboratoire ni dans un centre de recherches
• pas en lien avec le memoire de fin d'etudes: l'expérience doit etre différente de celle vecue lors du MFE.

Learning outcomes : please note the general comment on learning outcomes
Education level: specialised Ecosystem focus: variable Biological level: variable

After completion of the internship, the students will have experience in a professional environment. They will have competences in evaluating the scientific and societal relevance, reporting and social communication, problem-solving and insight in real working situation.

Course material, text books and further reading:
None

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Variable

Assessment breakdown: please note the general comment on assessment breakdown

L'evaluation est basee sur quatre elements :
• L'evaluation du travail par le maitre de stage (via la grille d'evaluation)
• Le portfolio (evalue par le superviseur academique)
• Le texte integrateur (5-8 pages max, tourni aux membres du jury)
• L'entretien (face au jury, 10 min de presentation et 10 minutes de questionsreponses)

Course title: Evolutionary Genetics and Genomics of Sex
Course ID: 4024122CNR
University: Vrije Universiteit Brussel
Faculty: Sciences and Bioengineering Sciences
Department: Biology
Name and e-mail address of the instructor(s): Prof. Wen-Juan Ma (wen-juan.ma@vub.be); Dr. Paris Veltsos (paris.veltsos@vub.be)
Course website: https://canvas.vub.be/courses/40121
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Seminar	Excursion	Internship	Project	Personal assignment
13	13			None	None	None	20

Course objectives:

This course will introduce current research in the fields of evolution of sexual reproduction, sex chromosomes and sex determination. You will become familiar with the diverse mechanisms of sex determination and how they evolve across the tree of life.
You will become familiar with a wide range of genetic and comparative genomic approaches to answer these related fundamental evolutionary biology questions. You will also develop critical skills around reading peer-reviewed articles and gain experience in genomic result presentation and interpretation.

Learning outcomes : please note the general comment on learning outcomes
Education level: Master Ecosystem focus: Not specifically Biological level: Genetics, Genomics

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

The overall objective of the course is to introduce the students the current research in the fields of evolution of sexual reproduction, sex chromosomes and sex determination. After following this course, the students are expected to:

- Understand the diverse mechanisms of sex determination, sex chromosome evolution and how they evolve across the tree of life;
- Understand and be able to use a wide range of genetic and comparative genomic approaches to answer the related questions in this field;
- Develop critical skills around reading peer-reviewed articles;
- Gain experience in genomic result presentation and interpretation.

Course material, text books and further reading:
Course lecture powerpoint slides, seminar discussion papers, suggested paper reading list

Prerequisites: please note the general comment on prerequisites
No specific prerequire, but students who have followed ‘Evolution’ and 'Molecular Ecology' will find it easier to follow.

Table of contents:

Sexual reproduction is central to the biology of many organisms, and it is estimated that over 99.9% of eukaryotes reproduce sexually. Understanding the genetic and genomic mechanisms, the evolutionary

forces on what, how and why they reproduce sexually or asexually, the sex chromosome divergence and sex determination across the tree of life, are crucial to solve one of the biggest challenges in the field of evolutionary biology. We will explore questions such as:
i) how and why the vast majority of organisms reproduce sexually, and why some remain asexual;
ii) the genetic basis of how an individual develops as a male or a female, from conception to adulthood;
iii) why sex chromosomes become highly degenerated and small in mammals and birds, but remain identical in size in most reptiles, fishes, amphibians and many flowering plants.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 35%
Written assessment: 30 %
Projects/Presentations/Reporting: 35%

Course title: Professionnal internship
Course ID: coming soon
University: Vrije Universiteit Brussel
Faculty: Sciences and Bio-Engineering Sciences
Department: Biology
Name and e-mail address of the instructor(s): Luc Leyns (Luc.Leyns@vub.be)
Course website: coming soon
Semester: S1 (organisationally this can be in S1, S2 or S3, in Belgium or abroad)
Tuition language: English, Dutch, French or Italian
Number of credits (ECTS): 12

Course breakdown and hours:

- Practical training : 40 days

Course objectives:
During your internship you will be guided and evaluated by a local supervisor who will be in contact with a representative of the Biology Department (typically the coordinator of your master program or the chairman of the Biology Master educational board; now Prof. Kim Roelants). After completing your internship, you write and submit a report on the work you have completed, which will be evaluated and graded by your internship supervisor in dialog with the coordinator of your graduation option, or the chairman of the Biology Master educational board.

Learning outcomes : please note the general comment on learning outcomes
Education level: specialised Ecosystem focus: variable Biological level: variable

After completion of the internship, the students will have experience in a professional environment. They will have competences in evaluating the scientific and societal relevance, reporting and social communication, problem-solving and insight in real working situation.

Course material, text books and further reading:
Digital course material (Recommended) : Professional Internship Guidelines.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Detailed info and guidelines regarding this course can be found in the document 'Professional Internship Guidelines 2019 2020.pdf' on the course pages 'Professional Internship' of the Canvas platform (https://canvas.vub.be/).

The following points explain how to apply for an internship:

1) As a student choosing the course 'Professional internship', you are responsible for finding an internship position. This is an important and valuable part of the course, as it helps you gain experience in job application.

Note: The expenses for daily transport are on the account of the student.

2) Once you have found a possible internship place, download the form 'internship agreement request form' (IARF.doc) from the course page 'Professional Internship' on the Canvas platform (https://canvas.vub.be/). Complete this form and send it by e-mail to:

- the coordinator of the graduation option you are enrolled in;

- the chairman of the educational Board of the Biology Master program, Kim Roelants; (Kim.Roelants@vub.be);
- the secretariat of the Biology department (Bert Vervloessem; biologie@vub.ac.be).

Your request should be approved by the coordinator of the graduation option you are enrolled in, or by the chairman of the Biology Master educational board.

3) After approval, download the relevant internship agreement template (Internship Agreement 6ECTS.doc or Internship Agreement 9ECTS.doc) from relevant course page on the Canvas platform (https://canvas.vub.be/) and fill it in. Print out three hard copies and make sure that both you and your supervisor at the host company/institution sign all copies of the agreement.

4) Send the completed and signed internship agreement to the chairman of the Biology Master educational board (Kim Roelants; Kim.Roelants@vub.be). The chairman will make sure that the agreement is signed by the Faculty Dean and will send you two copies back (one for you, one for the internship supervisor).

Important: The internship agreement should be signed by all parties (you, your internship supervisor and the Dean) BEFORE the start of your internship.

Assessment breakdown: please note the general comment on assessment breakdown

The final grade is composed based on the following categories:
SELF Internship determines 100% of the final mark.

Within the SELF Internship category, the following assignments need to be completed:

Internship report with a relative weight of 1 which comprises 50% of the final mark.

Note: Your internship supervisor will be contacted by the Biology Department during the exam session in which you submitted your report. He/she will be asked to give feedback on your internship and give a score based on your daily work and the final version of your internship report. Your daily work will be valuated based on your motivation, initiative, resourcefulness, punctuality and attitude during your internship. The final version of your internship report will be evaluated by your internship supervisor in dialog with the Department's internship coordinator (the coordinator of your graduation option or the Chairman of the Master educational board) based on its scientific quality, completeness, level of insight, writing style and overall format.
Daily work and performance with a relative weight of 1 which comprises 50% of the final mark.

Your internship supervisor will be contacted by the Biology Department during the exam session in which you submitted your report. He/she will be asked to give feedback on your internship and give a score based on your daily work and the final version of your internship report. Your daily work will be valuated based on your motivation, initiative, resourcefulness, punctuality and attitude during your internship. The final version of your internship report will be evaluated by your internship supervisor in dialog with the Department's internship coordinator (the coordinator of your graduation option or the Chairman of the Master educational board) based on its scientific quality, completeness, level of insight, writing style and overall format.

Course title: Professionnal internship
Course ID: 4016928FNR
University: Vrije Universiteit Brussel
Faculty: Sciences and Bio-Engineering Sciences
Department: Biology
Name and e-mail address of the instructor(s): Luc Leyns (Luc.Leyns@vub.be)
Course website: https://caliweb.cumulus.vub.ac.be/caliweb/?page=course-offer&id=007352&anchor=1&target=pr&year=2122&language=en&output=html
Semester: S1 (organisationally this can be in S1, S2 or S3, in Belgium or abroad)
Tuition language: English, Dutch, French or Italian
Number of credits (ECTS): 6

Course breakdown and hours:

- Practical training : 20 days

Course objectives:
During your internship you will be guided and evaluated by a local supervisor who will be in contact with a representative of the Biology Department (typically the coordinator of your master program or the chairman of the Biology Master educational board; now Prof. Kim Roelants). After completing your internship, you write and submit a report on the work you have completed, which will be evaluated and graded by your internship supervisor in dialog with the coordinator of your graduation option, or the chairman of the Biology Master educational board.

Learning outcomes : please note the general comment on learning outcomes
Education level: specialised Ecosystem focus: variable Biological level: variable

After completion of the internship, the students will have experience in a professional environment. They will have competences in evaluating the scientific and societal relevance, reporting and social communication, problem-solving and insight in real working situation.

Course material, text books and further reading:
Digital course material (Recommended) : Professional Internship Guidelines.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Detailed info and guidelines regarding this course can be found in the document 'Professional Internship Guidelines 2019 2020.pdf' on the course pages 'Professional Internship' of the Canvas platform (https://canvas.vub.be/).

The following points explain how to apply for an internship:

1) As a student choosing the course 'Professional internship', you are responsible for finding an internship position. This is an important and valuable part of the course, as it helps you gain experience in job application.

Note: The expenses for daily transport are on the account of the student.

2) Once you have found a possible internship place, download the form 'internship agreement request form' (IARF.doc) from the course page 'Professional Internship' on the Canvas platform (https://canvas.vub.be/). Complete this form and send it by e-mail to:

- the coordinator of the graduation option you are enrolled in;
- the chairman of the educational Board of the Biology Master program, Kim Roelants; (Kim.Roelants@vub.be);
- the secretariat of the Biology department (Bert Vervloessem; biologie@vub.ac.be).

Your request should be approved by the coordinator of the graduation option you are enrolled in, or by the chairman of the Biology Master educational board.

3) After approval, download the relevant internship agreement template (Internship Agreement 6ECTS.doc or Internship Agreement 9ECTS.doc) from relevant course page on the Canvas platform (https://canvas.vub.be/) and fill it in. Print out three hard copies and make sure that both you and your supervisor at the host company/institution sign all copies of the agreement.

4) Send the completed and signed internship agreement to the chairman of the Biology Master educational board (Kim Roelants; Kim.Roelants@vub.be). The chairman will make sure that the agreement is signed by the Faculty Dean and will send you two copies back (one for you, one for the internship supervisor).

Important: The internship agreement should be signed by all parties (you, your internship supervisor and the Dean) BEFORE the start of your internship.

Assessment breakdown: please note the general comment on assessment breakdown

The final grade is composed based on the following categories:
SELF Internship determines 100% of the final mark.

Within the SELF Internship category, the following assignments need to be completed:

Internship report with a relative weight of 1 which comprises 50% of the final mark.

Note: Your internship supervisor will be contacted by the Biology Department during the exam session in which you submitted your report. He/she will be asked to give feedback on your internship and give a score based on your daily work and the final version of your internship report. Your daily work will be valuated based on your motivation, initiative, resourcefulness, punctuality and attitude during your internship. The final version of your internship report will be evaluated by your internship supervisor in dialog with the Department's internship coordinator (the coordinator of your graduation option or the Chairman of the Master educational board) based on its scientific quality, completeness, level of insight, writing style and overall format.
Daily work and performance with a relative weight of 1 which comprises 50% of the final mark.

Your internship supervisor will be contacted by the Biology Department during the exam session in which you submitted your report. He/she will be asked to give feedback on your internship and give a score based on your daily work and the final version of your internship report. Your daily work will be valuated based on your motivation, initiative, resourcefulness, punctuality and attitude during your internship. The final version of your internship report will be evaluated by your internship supervisor in dialog with the Department's internship coordinator (the coordinator of your graduation option or the Chairman of the Master educational board) based on its scientific quality, completeness, level of insight, writing style and overall format.

Course title: Teaching Methodology Biology 1
Course ID: 4022414DNR
University: Vrije Universiteit Brussel
Faculty: Multidisciplinair Instituut Lerarenopleiding (MILO)
Department:
Name and e-mail address of the instructor(s): Iris Stiers (istiers@vub.be)
Course website: https://caliweb.vub.be/?page=course-offer&id=011019&anchor=1&target=pr&year=2526&language=en&output=html
Semester: S1
Tuition language: English or Dutch (both are available)
Number of credits (ECTS): 3

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
10h				4h			76h

Course objectives:
The main objective is to create a powerful learning environment for biology for pupils in secondary education.

Learning outcomes : please note the general comment on learning outcomes
Education level: basic Ecosystem focus: variable Biological level: variable

Learning Pathway Professional Practice
1) The student shows an open, inquisitive and professional attitude (including planning/preparation of and communication about the internship and minilesson).
2) The student can identify and map the different characteristics of the initial situation of a learning group using a broad observation toolkit.
3) The student can formulate substantiated proposals to constructively use the diversity in a learning group in teaching practice.
4) The student is able to analyse the observed teaching practice on the basis of pedagogical reference frameworks and subject-specific insights.
5) The student can prepare lessons for a teaching group, in which the starting situation, learning objectives and learning and evaluation activities are explicit and attuned to each other.
6) The student can incorporate the pedagogical reference frameworks and subject-specific insights necessary for designing a powerful learning environment in the preparation of a minilesson (including formulating appropriate learning objectives and designing teaching materials and learning and assessment activities in line with the initial situation of a learning group).
7) The student deals constructively with feedback on the preparation and implementation of the minilesson and can give substantiated feedback to peers on their minilessons.
8) The student can look back critically at the given minilesson and participatory observation internship, reflect on it and, if necessary, formulate alternatives.
9) The student handles information about the pupil/ student/ teachers/ school/ supervisors in a respectful and discrete manner.

Learning Pathway Pedagogical Content Knowledge
1)The student shows an open, inquisitive and professional attitude.
2) The student is able to express the essence and the unique social relevance of biology education in the Flemish educational system.
3) The student is able to consult and interpret the curriculum goals in biology education.
4) The student is able to formulate concrete and operational learning objectives based on the curriculum goals that match with the initial needs and strengths of the learning group.

5)The student is able to choose learning content, divide it into learning steps and employ it in meaningful assignments.
6) The student is able to utilize models for teaching and instruction in order to create a powerful learning environment for biology.
7) The student is able to use biology text books and other didactic resources to create a powerful learning environment for biology.
8) The student is able to use classroom activities, learning resources and group settings to create a powerful learning environment for biology.
9) The student is able to utilize current and authentic contexts in order to create a powerful learning environment for biology.
10) The student is able to utilize the framework of 21st century skills in order to create a powerful learning environment for biology.
11) The student is able to utilize the initial needs and strengths of the learning group in order to make classroom activities fit student learning.
12) The student is able to utilize the physical and digital learning environment in order to create a powerful learning environment for biology.
13) The student is able to devise, design, execute and report on the results of pupil experiments in a correct way (OVUR method).
14) The student is able to use elements of subject specific pedagogical research in order to create a powerful learning environment and to account for his/her own didactic choices.
15) The student is able to link the various sub-areas of the subject biology.
16) The student is able to relate biology to other fields of science, including chemistry and physics, and use this to create a powerful learning environment for biology.

Course material, text books and further reading:
Digital course material (Recommended) : Available through Canvas

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Learning Pathway Professional Practice
The internship consists of participatory observation and a minilesson.
- In the participatory observation, students observe classroom practice of the subject biology by a mentor. As much as possible, students actively participate in these lessons (by prior agreement with the mentor). The aim of the participatory observation is to form a broad and nuanced picture of the learning environment. While observing, students therefore thoroughly map different dimensions of the learning environment (initial situation, lesson structure, teaching methods, interaction, etc.). This part of the internship consists of four hours of participatory observation and a final interview with the mentor.
- The students perform a minilesson within the domain of this course.

Learning Pathway Pedagogical Content Knowledge
Within this course unit, in addition to the location of the subject area in current Flemish education, specific attention is paid to translating subject-specific concepts and reference frameworks for creating an optimally powerful learning environment. The students learn how to translate final attainment levels, curriculum files and curricula into practice, but also, for example, how social and political discussions and new scientific insights (can) have an impact on their classroom practice.
The leitmotif throughout this course unit is the step-by-step subject-specific support for the design of a powerful learning environment so that it can be tested at the end of this course unit. Students have the opportunity to give an individual mini-lesson within the domain of biology.

Assessment breakdown: please note the general comment on assessment breakdown
The final grade is composed based on the following categories:

Written Exam determines 60% of the final mark: Course Specific Assignment
Practical Exam determines 20% of the final mark: Participatory observation internship
Other Exam determines 20% of the final mark: Students teach a minilesson outside the examination period (December) for their peers.

A student can only pass the course if:

He has participated in all parts of the evaluation: the assignment, the participatory observation and the minilesson. A final grade can only be calculated if a score was obtained for all these components. Not participating in one or more components results in the mark 'absent' (afw).

He obtained at least 7/20 for each part of the evaluation (assignment, participatory observation and minilesson). If a score lower than 7/20 was obtained for at least one of the components, the final score awarded will be equal to the mark awarded for the lowest scored category.

Not passing the participatory observation or minilesson can only be made up in a subsequent useful session time. In the event of referral to the next useful session, the titular can allow the transfer of the grades of the successfully completed sections.

The use of generative AI is only permitted as support for the assignment on the condition that these tools are used responsibly and with integrity. Any use of generative AI must be indicated appropriately (see guidelines on Canvas).

Course descriptions at Sorbonne Université (SU)
and Muséum National d'Histoire Naturelle (MNHN)

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: S3
Tuition language: French
Number of credits (ECTS): 6

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: Anatomie comparée
Course ID: SEP14/MU517
University: Muséum National d'Histoire Naturelle
Faculty: Enseignement supérieur / Recherche
Department:
Name and e-mail address of the instructor(s): Géraldine Véron (veron@mnhn.fr) & Jean-Denis Vigne (vigne@mnhn.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:
- Projet: 4 hrs
- Excursion: 4 d

Course objectives:
Donner aux étudiants une formation élémentaire en ostéologie comparée, dans une perspective évolutive. L'architecture du squelette, du crâne et des dents, suivie sur la longue durée des ères géologiques et inscrite dans son contexte fonctionnel (musculature, notamment), sera détaillée pour les différents groupes de vertébrés. Les enseignements, essentiellement pratiques, s'appuieront sur les collections de paléontologie et d'anatomie comparée du Muséum ainsi que sur des séances de dissection..

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

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 et matériel en ligne.

Prerequisites: please note the general comment on prerequisites
Aucun

Table of contents:
- Orientation et architecture générale du squelette
- Architecture du crâne des mammifères
- Squelette appendiculaire et membre chiridien
- Adaptations du squelette
- Vertébrés non tétrapodes (« poissons » s.l.)
- Tétrapodes
- Amniotes actuels et fossiles
- Oiseaux
- Structure et évolution dentaire des mammifères.

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

Course title: Initiation aux techniques avancées de collecte et d'inventaire systématique
Course ID: SEP18 / NU826
University: Sorbonne Université 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@SU.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: Sorbonne Université 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@SU.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: Sorbonne Université 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: Sorbonne Université 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@SU.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: Sorbonne Université 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: Sorbonne Université 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 enjeus 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: Sorbonne Université 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: Sorbonne Université 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@SU.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: Sorbonne Université 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: Sorbonne Université 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: Sorbonne Université 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@SU.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: Ecologie moléculaire et génétique évolutive des organismes marins
Course ID: EMGE
University: Sorbonne Université
Faculty:
Department: UMR 7144 SU-CNRS
Name and e-mail address of the instructor(s): Christophe Lejeusne (clejeusne@sb-roscoff.fr)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 6

Course breakdown and hours:
- Lectures : 30 hrs
- Practical exercises and group work: 18 + 22 hrs

Course objectives:
L'objectif de cette unité d'enseignement est de former des étudiants en génétique des populations, génétique évolutive et écologie moléculaire dans le domaine marin. L'étude des modalités de la dispersion, des barrières entre espèces, des effets de la fragmentation de l'habitat sur la connectivité entre populations ou encore des variations des systèmes de reproduction sont au cœur de nombreuses questions abordées dans les recherches fondamentales d'écologie et d'évolution ainsi que dans des domaines plus appliqués comme la gestion des espaces naturels côtiers. Les avancées techniques de marquage moléculaire et les récents développements théoriques de la génétique des populations offrent de puissants outils pour aborder ces questions relatives à l'écologie et à la micro-évolution chez les organismes marins. Ce module présente la double originalité de développer les questions spécifiques au milieu marin et de s'intéresser à la fois aux modèles animaux et végétaux (invertébrés marins et macroalgues).

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

Comprendre les concepts d'espèces et études de phylogéographie en milieu marin, diversité et structure génétique dans des réseaux de populations (flux de gènes et connectivité), modes de reproduction en milieu marin, adaptation et effets des perturbations d'origine anthropiques (exemple : pollutions, fragmentation d'habitats, invasions biologiques).

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:
Rappel de génétique des populations : les statistiques F de Wright
Les marqueurs moléculaires
Limites des concepts d'espèces en milieu marin : illustration par l'étude des zones hybrides
Apport des approches de phylogéographie à la compréhension des profils biogéographiques
Les espèces invasives en milieu marin : apport de la génétique des populations et de l'écologie moléculaire dans la compréhension des processus d'invasion biologique
Influence des systèmes de reproduction et des cycles de vie sur la diversité et la structure génétique des populations d'organismes marins
Adaptation et test de sélection : le cas des espèces hydrothermales et des milieux dits « extrêmes »
Analyses de paternité et de descendances
Séminaires de recherche (5 heures) (intervenants extérieurs).

Assessment breakdown: breakdown Written assessment: 40% Oral assessment: 30% Practical work: 30%	please note the general comment on assessment

Course title: Enjeux professionels en ingénierie écologique et biologie de la conservation
Course ID: EPIC
University: Muséum National d'Histoire Naturelle
Faculty:
Department:
Name and e-mail address of the instructor(s): Nathalie Frascaria-Lacoste (nathalie.frascaria@u-psud.fr), François Sarrazin (sarrazin@mnhn.fr) & Christian Kerbiriou (kerbiriou@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:
Au cours de ce module, les étudiants trouveront des aides à la réflexion pour leur projet professionnel en Ingénierie écologique ou Conservation et gestion de la biodiversité. Un projet, c'est une projection dans le futur. Elaborer un projet professionnel dans ces domaines doit se faire sur plusieurs étapes depuis la connaissance de soi et de ses compétences vers la connaissance des métiers et des institutions ou entreprises, la recherche de l'emploi, la construction du CV et de la lettre de motivation jusqu'à l'entretien de recrutement. Dans ce module, nous vous aiderons à débuter cette construction par le biais de rencontres avec des professionnels mais aussi par l'élaboration personnelle de documents tels qu'un CV et une lettre de motivation.

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

Etre capable de faire un projet professionnel, incl. Un CV et une lettre de motivation.

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:
Les domaines d'activité de l'ingénierie écologique et de la conservation de la biodiversité sont en pleine évolution. L'offre d'emploi est encore peu structurée. Il Ce module présente donc les différents secteurs de l'emploi (Bureaux d'Etudes, concours fonction publique, Parcs, ONG, ONCFS…) par une série d'exposés réalisés par des professionnels. Ces intervenants fournissent des clés pour mieux comprendre les missions de ces organismes, les types d'emplois proposés et les compétences et qualités requises pour y accéder. Par ailleurs, le module comprend aussi les soutenances des étudiants pro de l'année précédente avec l'opportunité d'échanges avec leurs encadrants professionnels..

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

Course title: Les crises biologiques : comprendre le passé et l'actuel
Course ID: SEP51/NUXXX
University: Sorbonne Université et Muséum National d'Histoire Naturelle
Faculty:
Department: Laboratoire de Micropaléontologie
Name and e-mail address of the instructor(s): Silvia Gardin (silvia.gardin@SU.fr) & Annachiara Bartolini (bartolini@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:
Ce module a pour but de faire le point sur nos connaissances autour des crises biologiques du passé mais aussi celle du présent. Au cours de ce module, on abordera les différentes méthodes d'analyses (systématique, paléontologique, écologique…) et leurs limites, pour une lecture critique des modèles proposés, à une comparaison entre les différentes crises biologiques ainsi qu' une discussion sur les prospectives de recherche..

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

Comprendre les crises biologiques dans leur contexte.

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:
- Les crises biologiques : définitions, évolution des concepts, approches méthodologiques.
- L'enregistrement fossile (marin versus continental) des crises biologiques majeures et mineures.
- Approche systématique, paléontologique, écologique et environnementale des crises actuelles et passées.
- Comparaison entre les crises : sévérité taxonomique versus sévérité écologique, l'importance des contraintes temporelles.
- « Modélisation » des crises : débats sur les causes et les mécanismes.

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

Course title: Ecologie de la restauration
Course ID: ECOR
University: Sorbonne Université et Muséum National d'Histoire Naturelle
Faculty:
Department:
Name and e-mail address of the instructor(s): François Sarrazin (sarrazin@mnhn.fr) & Nathalie Frascaria-Lacoste (nathalie.frascaria@u-psud.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:
Si de nombreux travaux en conservation de la biodiversité s'intéressent aux processus de déclin et aux moyens de les enrayer, on voit émerger depuis deux décennies des travaux développés spécifiquement dans un contexte d'écologie de la restauration. Ils concernent différents niveaux d'intégration : population, métapopulation, communautés, écosystèmes. Ces travaux souvent empiriques par le passé s'appuient de plus en plus sur les connaissances les plus récentes en biologie des populations ou dans le fonctionnement des écosystèmes. Cette UE est ainsi destiné aussi bien aux étudiants motivés par des parcours 'recherche' que des parcours 'professionnel' qu'ils soient intéressés directement par les thèmes de la conservation, ou de l'ingénierie écologique, ou souhaitant acquérir une culture générale dans ce domaine.

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

Comprendre les bases et les applications de l'écologie de la restauration.

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:
Restauration en écologie, buts, critères de succès.
- Réintroduction et renforcements de populations (préparation et suivi)
- Fondation des petites populations (aspects démographiques et génétiques)
- Restauration des sols - Restauration des écosystèmes (structure et fonctionnement)
- Exemples d'application.

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

Course title: Fonctionnement et dynamique des socio-écosystèmes
Course ID: FOSE
University: Muséum National d'Histoire Naturelle
Faculty:
Department:
Name and e-mail address of the instructor(s): Lus Semal, Denis Couvet & Anne-Caroline Prevot
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:
Outre la préservation des espèces menacées et la restauration des espaces, les enjeux globaux de conservation réclament aujourd'hui que nous apprenions à mieux concilier activités humaines et biodiversité. La notion de socio-écosystème nous aide à aller en ce sens, en mettant l'accent sur l'intérêt de penser conjointement les enjeux écologiques et sociaux.
L'UE propose des outils d'analyse du fonctionnement des socio-écosystèmes, à partir d'approches interdisciplinaires issues de la biologie de la conservation, de la psychologie de la conservation, des sciences politiques et de l'économie écologique. Ces approches complémentaires nous aideront à questionner l'ampleur des changements sociaux nécessaires pour conserver la biodiversité, en accordant une attention particulière au problème des limites à la croissance.

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

Le cours vise une ouverture à l'interdisciplinarité pour analyser les systèmes socio-écologiques, et à une capacité à construire une grille d'analyse de situations réelles, en intégrant différents angles.

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:
Notion de socio-écosystème (cadre d'analyse d'E. Ostrom).
Idées, acteurs et courants de l'écologie politique
Économie écologique
Psychologie de la conservation et écologie de la réconciliation
Enjeux associés à la biodiversité dans les espaces anthropisés (ville et agriculture)
Représentations multiples de la nature et de la biodiversité, motivations à agir.

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

Course descriptions at Università degli Studi di Firenze (UNIFI)

Course title: Applied Conservation Biology
Course ID: B031838
University: Università degli Studi di Firenze – University of Florence (Italy)
School: Scuola di Scienze Matematiche Fisiche e Naturali – School of Science
Department: Dipartimento di Biologia – Department of Biology
Name and e-mail address of the instructor(s): Prof. Francesco Rovero (francesco.rovero@unifi.it)
Course website: to be posted
Semester: S3
Number of credits (ECTS): 6

Course breakdown and hours:
- Lectures: 32 hours
- Exercises: 16 hours

Course objectives: provide an understanding of the fundamentals of conservation biology and the strategies and methods for biodiversity conservation both at global level and with a focus on tropical rainforests.

Learning outcomes: please note the general comment on learning outcomes
Competence acquired: approaches to quantify biodiversity, methods in quantitative ecology to assess the vulnerability of populations and communities; understanding of the multitude of management approaches at global level.
Skills acquired: capacity to critically assess and evaluate strategies and plans for biodiversity conservation; capacity to engage into inferential studies to assess spatio-temporal variation of populations and communities.

Course material, text books and further reading: material used during the course will consist in slides, scientific papers reviewed during the lectures, web-sites and grey literature and files used for exercises of data analyses (in Excel and R). In addition, the following books will be the main reference ones:
Primack 2014. Essentials of Conservation Biology. Sinauer Associates.
Groom, Meffe e Carroll 2005. Principles of conservation biology. Sinauer Associates.

Prerequisites: please note the general comment on prerequisites
notions of ecology and animal ecology
please note the general comment on prerequisites

Table of contents:
Conservation biology: introduction to the discipline. Biodiversity (focus at species-level): definitions, measures (richness and indices), global distribution of terrestrial biodiversity (hotsposts and other rankings). Value of biodiversity (ecosystem, economic, social, intrinsic and ethical issues). Biodiversity crisis and the sixth extinction: historic, current and future situation, causes and threats (habitat degradation and loss, overexploitation, climate changes, etc.). Overview of the Anthropocene.
Focus on tropical rainforests: key characteristics, threats and conservation issues. Conservation strategies at global level: (1) species protection – focus in-situ, (2) habitat protection, (3) ecosystem management outside protected areas. (1) Fundamentals of quantitative ecology to assess distribution, abundance and vulnerability of populations and communities: sampling (principles of statistical inference) e prime methods with focus on terrestrial mammals (transects, camera trapping, capture-recapture). Relative abundance and indices. Hierarchical approaches to estimate occurrence and abundance of populations. Conservation by proxy (umbrella, charismatic, threatened, indicator species, etc.) and design of monitoring plans to determine temporal trends and vulnerability. The course will include examples of data analyses in R. (2)

Protected areas (terrestrial realm): global situation, criteria to design protected areas. (3) Overview on ecosystem management, connectivity, sustainable development, global scenarios.

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

Course title: Ecosystem services and climate change
Course ID: B031837
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): Stefano Cannicci (Stefano.Cannicci@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:
- Lectures: 18 hrs
- Exercises: 6 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: Landscape analysis (*partim* Methods in Landscape Analysis)
Course ID: B031843
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): Pierluigi Confuorto (Pierluigi.confuorto@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3 (this subcourse contributes 50% of the course **Landscape analysis** of 6 ECTS).

Course breakdown and hours:

THE	TP	EX	EXC	STG	PRJ	SEM	PRS
24							

Course objectives:
This teaching aims to provide the basis for a) knowing various landforms and the geomorphological processes involved in the Earth's surface dynamics; b) understanding the evolution of the territory and landscape, the morphogenetic processes in different geographic and climatic settings; c) knowing the main cartographic systems and the different way of representation of the territory and landscape, also through the use of Geographical Information Systems (GIS) and Earth Observation; d) knowing the best practices to monitor and assess the main geomorphological hazards, aiming at comprehension of the evolution of the territory.

Learning outcomes : please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Global
This teaching aims to provide the basis for analyzing a territory, considering aspects of geomorphological processes that may affect landforms, through the use of modern techniques of numerical morphometric analysis, consultation of GIS databases and Earth Observation techniques and procedures for forecasting processes, construct simple forecasting scenarios for the evolution of slope processes, and know how to select and acquire the basic data necessary for the analysis of large-scale morphogenetic processes.

Course material, text books and further reading:
Lecture notes, slides and scientific articles provided or recommended during the course.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Geomorphological processes, summary and operational examples with exercises. Definition of geomorphological hazard parameters. Hazard analysis and construction of hazard maps for application purposes. Application of GIS and computational tools for hazard definition. Landscape systems, units and elements, with practical exercises. Hydrographic network dynamics, general fundamentals and in-depth study on quantitative geomorphic analysis and its connections with slope evolution. Soil erosion. Causes, effects, analysis and available tools. Empirical and deterministic models for predicting and mapping soil loss. Analysis of soil erosion scenarios using semi-empirical and physical models.

Assessment breakdown: please note the general comment on assessment breakdown

Oral: 70%
Project: 30%

Course title: Landscape analysis (*partim* Pedology)
Course ID: B031843
University: University of Florence
Faculty: School of Mathematical, Physical and Natural Sciences
Department: Department of Earth Sciences
Name and e-mail address of the instructor(s): Anna Andreetta (anna.andreetta@unifi.it)
Course website:
Semester: S3
Number of credits (ECTS): 3 (this subcourse contributes 50% of the course **Landscape analysis** of 6 ECTS).

Course breakdown and hours:

- Lectures: 14
- Exercises:
- Projects: 6
- Lab work:
- Excursions: 4

Course objectives:
This teaching aims to provide the basis for a) knowing the soil and its functional relationships with various environmental compartments; b) understanding the evolution of the soil, the processes of genesis of the different types of soil in relation to time, climate, vegetation, geomorphology and geological substrate; c) knowing the main types of soil present in Tropical and Subtropical countries, their geographical distribution, characteristics, and their primary physical and chemical limits for sustainable management; d) knowing the main threats to the soil due to human impact.

Learning outcomes: please note the general comment on learning outcomes
At the end of the course, students will understand basic soil properties and soil-forming processes, knowing in detail soil types that developed in Tropical and Subtropical countries.
Students will be able to relate soil types to their landscape and environment, recognise soil chemical and physical properties from soil type (USDA and WRB) and individuate principal limits for sustainable management. Students will improve their communication ability by appropriately using technical and pedological terms and critically integrating knowledge.

Course material, text books and further reading:
Lecture notes, slides and scientific articles provided or recommended during the course.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Soil functional relationships with other environmental compartments; the ecological role of the soil.
Soil physical properties. Soil-water relationships. Soil forming factors. Soil profile description and recognition of diagnostic horizons. Principal soil types, following WRB and USDA classification systems, in Tropical and Subtropical countries focus on soils of the littoral environment (mangrove soils), Organic soils (tropical peats) and soils of the rainforests: geographical distribution, characteristics, chemical and physical limits, and sustainable use. Significant threats to the soil. Soil, carbon sequestration and climate change. Presentation of international soil databases such as FAO and ISRIC. Pedo-landscape reading tools: cartography, geographic information systems and Land evaluation.
Evaluation of case studies using R and QGIS for data analysis.

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

Course title: Tropical climatology
Course ID: B031839
University: Università degli Studi di Firenze
School: Agriculture
Department: Scienze delle Produzioni Agroalimentari e dell'Ambiente (DISPAA)
Name and e-mail address of the instructor(s): Simone Orlandini (simone.orlandini@unifi.it) and Leonardo Verdi (leonardo.verdi@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

THE	TP	EX	EXC	STG	PRJ	SEM	PRS
18		6					

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)
Lecture notes edited by the Instructor

Prerequisites: please note the general comment on prerequisites
none

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: Advances in Tropical botany
Course ID: B031836
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):** Alessio Papini (alessio.papini@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 18 hrs
- Exercises: 6 hrs

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: Methods in animal ecology and evolution (*partim* Analysis of ecological communities)
Course ID: B031840
University: Università degli Studi di Firenze – University of Florence (Italy)
School: Scuola di Scienze Matematiche Fisiche e Naturali – School of Science
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
Number of credits (ECTS): 3 (This subcourse contributes 50% of the course **Methods in animal ecology and evolution of 6 ECTS**).

Course breakdown and hours:
- Lectures: 18 hrs
- Exercises: 6 hours

Course objectives:
To provide an understanding of the fundamentals of ecological community analysis using multivariate methods , and of the methods for the analysis of functional traits.

Learning outcomes: please note the general comment on learning outcomes
Knowledge of the main methods for ecological community analysis. To be able to of understand research papers on community structure and functioning. Autonomy in participating to an ecolocical research.

Course material, text books and further reading:
De Bello et al. 2021. Handbook of Trait-Based Ecology: From Theory to R Tools. Cambrdige University Press.
Zuur et al. 2007. Analyzing Ecological Data. Springer
Borchard et al. 2011 Numerical Ecology with R. Springer
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:
Lectures:
Basics of community ecology. Univariate methods for the estimation of species richness and diversity. Indicator Value (IndVal). Introduction to multivariate methods in ecology. Ordination: unconstrained (PCA, nMDS), and constrained (RDA) methods. Permutation based multivariate analysis of variance. Funtional and trait-based analysis: trait selection and standardization. Community metrics: community weighted means, Functional diversity indices, partitioning of functional diversity.
Exercises:
Multivariate analysis using R

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

Course title: Methods in animal ecology and evolution (*partim* Animal phylogeography)
Course ID: B031840
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): Sara Fratini (sarafratini@unifi.it)
Course website: to be posted
Semester: S3
Tuition language: English
Number of credits (ECTS): 3 (This subcourse contributes 50% of the course **Methods in animal ecology and evolution of 6 ECTS**).

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: Tropical Plants in Action
Course ID: B032898
University: Università degli Studi di Firenze
Faculty: School of Mathematical, Physical and Natural Sciences
Department: Biology
Name and e-mail address of the instructor(s): Nadia Bazihizina <nadia.bazihizina@unifi.it>
Course website:
Semester: S3
Number of credits (ECTS): 6

Course breakdown and hours:

- Lectures: 40
- Exercises: 0
- Projects: 0
- Lab work : 12
- Excursions :0

Course objectives:
Plants have shaped the Earth and its environment, and their capacity to adapt and acclimate to wide conditions that make studying them so interesting. Starting from a description of the tropical environments (climate, soils, seasonality) and differences from temperate regions, this course takes students through the parts (organs, tissues and cells) that make up plants, and considers how specific traits enable plants to function and interact with the environment in tropical areas.

Learning outcomes: please note the general comment on learning outcomes
Students will be able to: describe the structure of plants and how each part functions and contributes to the whole; demostrate an understanding of whole plant physiology, including developping skills in measuring net photosynthesis, chlorophyll content, water relations, water transport, ion transport, and plant growth and development. As a result students will gain skills in evaluating plant function, including the dynamic processes of growth, development and the response to the environmental stresses; demonstrate an understanding of the knowledge needed for the conservation and restoration of the tropical landscape

Course material, text books and further reading:
All material is provided during the course.
Textbooks for further reading :
Lüttge, U. Physiological ecology of tropical plants. Springer, 2008
Lambers H, Oliveira RS. Plant physiological ecology. Springer, 2019.
Taiz et al. Plant Physiology and Development. Oxford University Press Inc , 2022

Prerequisites: please note the general comment on prerequisites
None

Table of contents: (i) Tropical environment and differences from temperate regions ; (ii) Ecophysiological responses to drought. Plant hydraulics ; (iii) Responses of tropical forest plants to contrasting light environments ; (iv) Mangroves: Physiological and morphological adaptations ; (v) Ecosystems of coastal sand plains: adaptations to water extremes and salinity ; (vi) Savannas: the role of fire and soil on vegetation ; (vii) Stress-tolerant adaptations in tropical inselbergs.

Assessment breakdown: please note the general comment on assessment

Oral evaluation on the range of topics covered during the course. As a facultative additional evaluation, students can also deliver their own presentations on a chosen topic.

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: S3
Tuition language: French
Number of credits (ECTS): 8

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

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: S3
Tuition language: French
Number of credits (ECTS): 4

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: 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: Modélisation des systèmes écologiques
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: S3
Tuition language: French
Number of credits (ECTS): 4

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 évolutive et 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): Patrick Heuret (Patrick.heuret@ecofog.gf)
Course website: to be posted
Semester: S3
Tuition language: French
Number of credits (ECTS): 7

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 %

Module: 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: S3
Tuition language: French
Number of credits (ECTS): *partim* 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: S3
Tuition language: French
Number of credits (ECTS): 5

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: 50 %

Course title: Professionalisation
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: S3
Tuition language: French
Number of credits (ECTS): 2

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: 0 %
Projects/Presentations/Reporting: 100 %

Course descriptions at the Universidad de Antioquia (UDEA)

UNDER CONSTRUCTION

Course title: Tropical biodiversity and ecosystems field school: from montane to coastal ecosystems and landscapes
Course ID:
University: Universidad de Antioquia
Faculty:
Department:
Name and e-mail address of the instructor(s): F. Blanco Libreros (juan.blanco@udea.edu.co)
Course website:
Semester: S2
Tuition language: Spanish
Number of credits (ECTS): 15
IMPORTANT: The costs for the Course are in part met by the University, but students will be asked to contribute a maximum of 2,000,000 COP for road transport, boat rental and other logistic arrangements**.** Also, students will be asked to share the costs of their food and accommodation.

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS

Course objectives:

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 :

Course material, text books and further reading:

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

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown

Course title: Geomatics (GIS Applications in Biology)
Course ID: 301374
University: Universidad de Antioquia
Faculty: Ciencias Exactas y Naturales
Department: Instituto de Biología
Name and e-mail address of the instructor(s): To be confirmed
Course website: None
Semester: S2
Tuition language: Spanish
Number of credits (ECTS): 3 (+1 ?)

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
36	30						x

Course objectives:
The GIS Applications in Biology course aims primarily to promote the appreciation of spatially explicit information for different purposes in ecology and evolution. The main objective of this course is to train students in the implementation of Geographic Information Systems (GIS), so that it becomes a tool to improve information management, to support decision-making processes and research projects, this with a series of sufficient theoretical-practical knowledge to carry out the cartography and analysis required in a multitude of projects related to Biology, environmental management, planning and territorial planning, within the framework of Spatial Data Infrastructures.
The specific objectives of the course are:
• Understand the importance of considering space in biology studies.
• Train students to apply methodologies oriented towards the capture, processing, storage, and analysis of georeferenced information.
• Promote the reading of scientific articles and the use of databases.

The course offers a versatile tool (Geographic Information Systems) for searching, processing, and analysing spatially explicit information, and presents some of its particular applications in Biology. Spatial information management requires a thorough understanding of its advantages and limitations and presents a general model of how to consider the effect of space on any problem in biology (all things happen in a space).
The course presents methodologies that can be applied to basic or applied science problems. This course will contribute to the development of critical and logical thinking, through the use of a tool that allows us to test conclusions or inferences from other sources.
GIS tools are currently in high demand due to the constant increase in availability of images from remote sensors (cameras, drones, satellites), and therefore, the knowledge of the tool is expected to broaden the horizon of research, applied and educational possibilities.

Learning outcomes : please note the general comment on learning outcomes

Education level: Methodological Ecosystem focus: all Biological level: all

Upon successful completion of this GIS course in biology, students will be able to:

1. Demonstrate proficiency in using GIS software to analyse, manipulate, and visualize spatial data in the context of biological research.
2. Apply GIS techniques to address real-world biological problems, such as habitat suitability modelling, species distribution analysis, and ecological modelling.
3. Collect, integrate, and preprocess geospatial data from various sources, including remote sensing imagery, GPS data, and biological field surveys.

4. Design and execute spatial data queries and spatial analyses to investigate biological phenomena, assess environmental impacts, and make data-driven decisions.
5. Create and interpret maps and other graphical representations of biological data, effectively communicating complex spatial information to diverse audiences.
6. Understand and apply fundamental concepts of cartography and geospatial data visualization, including map design principles and symbology.
7. Evaluate and choose appropriate spatial analysis techniques and tools to address specific biological research questions, taking into consideration the strengths and limitations of each approach.
8. Collaborate with peers to develop and execute GIS-based research projects in biology, integrating spatial data and ecological knowledge to reach meaningful conclusions.
9. Critically assess the ethical and legal considerations related to the collection, use, and sharing of geospatial data in biological research.
10. Apply GIS skills and knowledge to contribute to the field of biology, whether through conservation efforts, wildlife monitoring, ecological assessment, or other related applications.

Course material, text books and further reading:

Blois, J. L., Williams, J. W., Fitzpatrick, M. C., Jackson, S. T., & Ferrier, S. (2013). Space can substitute for time in predicting climate-change effects on biodiversity. Proceedings of the National Academy of Sciences, 110(23), 9374–9379.
Thomassen, H. A., Fuller, T., Buermann, W., Milá, B., Kieswetter, C. M., Jarrín-V, P., et al. (2011). Mapping evolutionary process: a multi-taxa approach to conservation prioritization. Evolutionary Applications, 4(2), 397–413.
Peterson, A. T. (2001). Predicting species' geographic distributions based on ecological niche modeling. Condor, 103:599-605.
Soberón, J. y A. T. Peterson. (2005). Interpretation of models of fundamental ecological niches and species' distributional areas. Biodiversity Informatics, 2:1-10.
Elith, J., Leathwick, J. R., & Hastie, T. (2008). A working guide to boosted regression trees. Journal of Animal Ecology, 77(4), 802–813.
Pio, D. V., Broennimann, O., Barraclough, T. G., Reeves, G., Rebelo, A. G., Thuiller, W., et al. (2011). Spatial Predictions of Phylogenetic Diversity in Conservation Decision Making. Conservation Biology, 25(6), 1229–1239.
Mcknight, M. W., White, P. S., Mcdonald, R. I., Lamoreux, J. F., Sechrest, W., Ridgely, R. S., & Stuart, S. N. (2007). Putting Beta-Diversity on the Map: Broad-Scale Congruence and Coincidence in the Extremes. PLoS Biology, 5(10), e272.
Peterson Gretchen, N. (2009). GIS cartography: a guide to effective map design. Taylor & Francis Group. 224 p.

Prerequisites:
None

Table of contents:

Unit No. 1	Why is it important to take space into account in Biology?
Unit No. 2	Introducción to GIS: What´s a GIS? Types of GIS (raster and vector).
Unit No. 3	Importance of scale in Ecology and Evolution, Importance of spatial autocorrelation.
Unit No. 4	Georefference systems. Modelling the Surface of the Earth in two dimensions.
Unit No. 5	Georrefferencing: Using the GPS.
Unit No. 6	Map editing

Unit No. 7	GIS applications in Ecology and Evolution
Unit No. 8	How to associate environmental information from localities.
Unit No. 9	Ecological niche models and models of geographic distributions.
Unit No.10	Categorisation from remote sensing images.
Unit No. 11	Interpolation
Unit No. 12	Conservation systematic planning
Unit No. 13	Representativity and complementarity
Unit No. 14	Final semester project presentation

Assessment breakdown:
Oral assessment: 5 %
Written assessment: 75 %
Projects/Presentations/Reporting: 20 %

Course title: Diseño Experimental
Course ID: 308100
University: Universidad de Antioquia
Faculty: Ciencias Exactas y Naturales
Department: Instituto de Biología
Name and e-mail address of the instructor(s): To be confirmed
Course website: None
Semester: S2
Tuition language: Spanish
Number of credits (ECTS): 4

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
36	30						

Course objectives:
Objetivo general:

Brindar a los estudiantes del posgrado en Biología elementos avanzados en la aplicación de nuevas herramientas numéricas en sistemas biológicos.

Objetivos específicos:

Comprender las bases fundamentales de los diferentes métodos estadísticos (univariados y multivariados) y aplicarlos correctamente a contextos biológicos.

Desarrollar habilidades en el manejo de software estadísticos para la ejecución correcta de pruebas estadísticas

Interpretar adecuadamente modelos estadísticos específicos en el studio de información asociada a sistemas biológicos para la toma de decisions encaminadas a la investigación y gestión

Adquirir destrezas en la interpretación y análisis de resultados obtenidos de diseños experimentales y del establecimiento de las relaciones entre diferentes variables que puedan incidir en el comportamieto de un fenómeno natural.

Learning outcomes: please note the general comment on learning outcomes

Education level: Methodological Ecosystem focus: All Biological level: All

Al finalizer el curso los estudiantes estarán en capacidad de
1. Generar una vision crítica hacia los mecanismos de recolección de información
2. Plantear métodos y estrategias para el análisis de información adecuadas para alcanzar diversos objetivos.
3. Evaluar e interpretar los resultados obtenidos a través de la aplicación de diversas técnicas de análisis de información, basadas en el diseño experimental.
4. Desarrollar habilidades comunicativas para la transferencia de conocimiento sobre el tratamiento de la información en un contexto de investigación determinado.
5. Tener criterios para la toma de decisiones que involucren la recolección, análisis e interpretación de información en investigaciones con un contexto biológico.
6. Consultar, sistematizar y gestionar información primaria y secundaria experimental y no experimental.

7. Explorar diversas técnicas de análisis de información
8. Interpretar y discutir artículos de investigación en contextos biológicos que involucren técnicas de diseño experimental
9. Usar métodos que contemplan la incertidumbre en la variables de análisis
10. Desarrollar proyectos sobre problemáticas asociadas a fenómenos biológicos implementando métodos de análisis de datos

Education level: Postgraduate Ecosystem focus: All Biological level: All

Course material, text books and further reading:

Dormann, Carsten. (2020). "Experimental Design." In Environmental Data Analysis, 185–205. Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-030-55020-2_14.
Melo Martínez, Oscar Orlando; López Pérez, Luis Alberto; Melo Martínez, Sandra Esperanza. (2020). Diseño de experimentos: métodos y aplicaciones. Universidad Nacional de Colombia. Sede Bogotá.
Mariel, Petr, David Hoyos, Jürgen Meyerhoff, Mikolaj Czajkowski, Thijs Dekker, Klaus Glenk, Jette Bredahl Jacobsen, et al. (2020). "Experimental Design." In Environmental Valuation with Discrete Choice Experiments, 37–49. Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-030-62669-3_3.
R Development Core Team (2020), R: A Language and Environment for Statistical Computing, R Foundation for Statistical Computing, Vienna, Austria, URL http://www.R-project.org/.
Lewis, Jonathan. (2019). "Experimental Design." In Handbook of Research Ethics and Scientific Integrity, 1–16. Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-319-76040-7_19-1.
Berger, Paul D., Robert E. Maurer, and Giovana B. Celli. (2018). Experimental Design. Cham: Springer International Publishing, http://dx.doi.org/10.1007/978-3-319-64583-4.
Cash, Philip, Tino Stanković, and Mario Štorga, eds. (2016). Experimental Design Research. Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-319-33781-4.
Rosner, B. (2016). Fundamentals of Biostatistics, eighth edn, Cengage Learning, Boston.
Bowerman, B.L., R.T. O'Connell, and E.S. Murphree. (2015). Regression Analysis: Unified Concepts, Practical Applications, and Computer Implementation. New York, NY: Business Expert Press.
Christensen, Larry B. (2014). Research methods, design, and analysis. Boston: Pearson.
Lawal, Bayo. (2014). "Experimental Design." In Applied Statistical Methods in Agriculture, Health and Life Sciences, 337–54. Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-319-05555-8_9.
Miranda, Montero Juan Jose. (2012). "Essays on Experimental and Quasi-Experimental Policy Design and Evaluation." http://digitalarchive.gsu.edu/econ_diss/86.
Hall, Ashley. (2011). "Experimental Design: Design Experimentation." Design Issues 27, no. 2 17–26. http://dx.doi.org/10.1162/desi_a_00074-hall.
Bell, G.H., J. Ledolter, and A.J. Swersey. (2009). "A Plackett-Burman Experiment to Increase Supermarket Sales of a National Magazine." Interfaces 39, no. 2, pp. 145–148.
Diseño y Análisis de Experimentos. (2002). Douglas C. Montgomery. Grupo Editorial Iberoamerica.

Prerequisites:
None

Table of contents:

Unit No. 1	Conceptos fundamentales de la estadística. Teorema de Bayes. Introducción a la teoría bayesiana, verosimilitud, método científico.
Unit No. 2	Variables aleatorias, medidas de tendencia central y de dispersión. Análisis de variables cualitativas. Análisis de variables cuantitativas. Medidas descriptoras de distribuciones multivariadas.

Unit No. 3	Estudio de algunas funciones continuas y discretas de probabilidad. Concepto de muestra aleatoria. Estudio de la normal, Distribución binomial y de Poisson, t de student, Distribución Chi cuadrado. Tamaño muestral para la estimación de la media poblacional: Pruebas de Harris, Horvitz y Mood y Prueba de Cochran.
Unit No. 4	Diferencias entre medias. Comparaciones de promedios de dos poblaciones mediante cuatro aproximaciones. Pruebas de t y métodos de Wilcoxon para datos informales.
Unit No. 5	Teoría de la estimación. Estimación puntual y por intervalo. Estimadores mínimos cuadráticos. Estimación de máxima verosimilitud.
Unit No. 6	Principios del diseño experimental. Planificación para la investigación. Vocabulario y nomenclatura. Conceptos de errores. Precisión, exactitud y sesgo. Diseños estadísticos y diseños experimentales. Eficiencia relativa de los diseños experimentales.
Unit No. 7	Pruebas de hipótesis. Clasificación de las hipótesis. Riesgos de malas decisiones. Correspondencia entre pruebas de hipótesis e intervalos de confianza.
Unit No. 8	Análisis de varianza. Teorema de Cochran. Descomposición de la variabilidad. Grados de libertad. Supuestos del ANAVA.
Unit No. 9	Diseño completamente al azar. Transformaciones Comparaciones simples y múltiples. Mínima diferencia detectable. Prueba de potencia de una muestra.
Unit No.10	Modelos I y II del tipo lineal aditivo: Modelo tipo I o fijo. Modelo tipo II. Coeficiente de correlación intraclase.
Unit No. 11	Diseño en bloques aleatorizados. Trabajos prácticos.
Unit No. 12	Arreglos factoriales. Diseños 2^2, 2^3, diseños 2k. Otros diseños factoriales. Modelos de parcelas divididas. Modelos anidados. Análisis de covarianza
Unit No. 13	Medidas repetidas en el tiempo. Modelos mixtos para modelar la estructura de covarianzas. Pruebas de bondad de ajuste y criterios de información.

Assessment breakdown:
Oral assessment: 5 %
Written assessment: 50 %
Projects/Presentations/Reporting: 45 %

Course descriptions at the Université des Antilles (UdA)

Course title: Tropical biodiversity and ecosystems field school: Caribbean insular ecosystems
Course ID:
University: Université des Antilles
Faculty: UFR Sciences Exactes et Naturelles
Department: Biology
Name and e-mail address of the instructor(s): E. Bezault (etienne.bezault@univ-antilles.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: Geomatics (Systèmes d'Information géographiques et bases de données)
Course ID:
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: 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:

- 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 en milieu contraint
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 Cheikh Anta Diop de Dakar (UCAD)

Course title: Tropical biodiversity and ecosystems field school : West-African forest, savanna, wetland and other Sahel ecosystem
Course ID:
University : Université Cheikh Anta Diop de Dakar
Faculty: Faculté des Sciences et Techniques et Institut Fondamental d'Afrique noire Cheikh Anta Diop
Departments : Biologie Végétale, Biologie Animale et Institut des Sciences de l'Environnement
Name and e-mail address of the instructor(s): Fatimata Niang Diop (mailto:fatimata7.niang@ucad.edu.sn), Aliou Ndiaye (aliou.ndiaye@ucad.edu.sn aliou.ndiaye@ucad.edu.sn), Alla Manga (alla.manga@ucad.edu.sn), Pape Ibnou Ndiaye (ibnou.ndiaye@ucad.edu.sn>, Abdoulaye Baïla NDIAYE (abdoulayeb.ndiaye@ucad.edu.sn), Oumar Sadio (oumar.sadio@ird.fr), Khady Diouf Goudiaby (khady1.diouf@ucad.edu.sn)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS) : 15
Remarque importante : Les coûts du cours seront en partie pris en charge par l'université. Cependant, une participation financière d'un montant maximum de 328000 XOF pourrait être demandé à chaque étudiant pour les coûts supplémentaires liés au transport, à l'hébergement, à la nourriture, à la logistique sur le terrain etc..

Course breakdown in hours:

Theory	Practical/ Excursion	Exercise		Reporting	Project	Seminar	Personal assignment
	180 heures			180 heures			

Course objectives:
L'école de terrain a pour objectifs de/d' :
- illustrer les enseignements reçus en salle sur les écosystèmes et la biodiversité ;
- mettre en pratique des outils présentés ;
- pratiquer l'approche interdisciplinaire dans des groupes de travail ;
- identifier les principaux facteurs de dégradation des écosystèmes ciblés.

Learning outcomes : please note the general comment on learning outcomes
Education level: specialised Ecosystem focus : West-African forest, savanna, Wetland
Biological level:

Upon completion of the course a student must be able to :
- identifier des composantes des écosystèmes et comprendre leur fonctionnement ;
- utiliser des outils de collecte de données sur les écosystèmes et la biodiversité ;
- travailler en équipe en appliquant l'approche interdisciplinaire ;
- identifier des facteurs de dégradation d'écosystèmes

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

Prerequisites: please note the general comment on prerequisites
Connaissances de base en écologie, biologie et environnement

Table of contents:

Méthodes d'évaluation des écosystèmes et de la biodiversité
Analyse de la biodiversité des écosystèmes concernés
Utilisation du SIG et de la télédétection dans l'étude des écosystèmes et de la biodiversité
Entretiens semi-structurés avec des acteurs locaux
Biens et services des écosystèmes
Conclusion

Assessment breakdown: please note the general comment on assessment breakdown
Examen écrit : 70 %
Évaluation de Project et rapport : 30 %

Course title: Geomatics (SIG et webmapping)
University: Université Cheick Anta Diop
Faculty: Institut fondamental d'Afrique noire Cheikh Anta Diop
Department: Geographie
Name and e-mail address of the instructor(s): Alla Manga (alla.manga@ucad.edu.sn)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
10h	35h	10h	10h		5h		

Course objectives:
Les SIG occupent de plus de en plus une grande place dans tous les domaines (sciences ou activités) notamment la recherche et dans les sciences de la vie et de la terres. Ce cours permettra de familiariser les étudiants au SIG et leur application (utilisation) dans la gestion et le suivi des écosystèmes. Ils pourront apprendre à :
- modéliser (concevoir) une solution SIG par rapport à une thématique ;
- collecter les données nécessaires ;
- structurer, stocker et analyser les données pour proposer une solution ou des solutions pour une meilleure prise de décision ;
- publier les données et les résultats sous forme de carte interactive.

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 :
Les étudiants seront en mesure d'utiliser les outils SIG dans leur projet ou leur travaux afin de bénificier des plus-values offertes par les SIG.

Course material, text books and further reading:
- Bougouss M., Gagnon S. : Formation en Géomatique. Formation donnée au Sénégal par le Cégep Limoilou du 18 au 29 février 2008.
- Brunet R. : La carte, mode d'emploi, Fayard - Reclus, 270 p. 1987.
- Charre J. : Miellet P. Waniez P. : Pratique des systèmes d'information géographique raster, collection Reclus Modes d'emploi N° 18, 50 p.
- Collet C. : Systèmes d'information géographique en mode image, in collection gérer l'environnement N° 7, Presses Polytechniques et Universitaires Romandes, 186 p, 1992.
- Denegre J. Et Salge F. : Les Systèmes d'Information Géographique, PUF n° 3122 Paris, 1996.
- Boris Mericskay : Les Sig et la cartographie à l'ère du géoweb Vers une nouvelle génération de Sig participatifs dans L'espace géographique 2011/2 (Tome 40), pages 142 à 153

Prerequisites: please note the general comment on prerequisites
Les étudiants qui souhaitent accéder à ce cours doivent avoir une bonne connaissance en informatique de base et en géographie en général.

Table of contents:

Théorie:
- Connaissances sur les concepts de base des S.I.G.,
- Données,

- Logiciels et matériels.

Pratique:

- Installation et paramètrage du logiciel
- Modélisation
- Acquisition de données et manipulation des données
- Analyse spatiale et géotraitement
- Publication (cartographie statistique et dynamique).

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment:

Written assessment: 50%

Projects/Presentations/Reporting: 50%

Course title: Biodiversité ichtyologique
Course ID:
University: Cheikh Anta Diop de Dakar
Faculty: Institut fondamental d'Afrique noire Cheikh Anta Diop
Department: Biologie animale
Name and e-mail address of the instructor(s): Oumar SADIO (oumar.sadio@ird.fr) et Khady DIOUF GOUDIABY (khady1.diouf@ucad.edu.sn)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
10h	35h	10h	10h		5h		

Course breakdown in hours:

- Cours théorique : 10 hrs
- Exercices pratiques : 25 hrs

Course objectives:
Apprendre aux étudiants comment étudier la biodiversité ichtyologique :
définition, calcul et interprétation des indices de biodiversité
Apprendre à structurer les peuplements de poissons
Apprendre à utiliser les logiciels de biodiversité

Learning outcomes : please note the general comment on
A la fin du cours, le étudiants seront capables de/d':
- récolter des données liées à l'étude de la biodiversité ;
- calculer les indicateurs de biodiversité ;
- interpréter les résultats des calculs d'indicateurs de biodiversité ;
- étudier la structure d'un peuplement de poisson ;
- Classer les espèces dans des catégories écologiques.

Course material, text books and further reading:
- Vidéoprojecteur
- Support de cours
- Ecran de projection fixe
- Ecran de projection mobile
- Support de tableau de conférence Skin
- Papier pour Flipover
- Marqueur effaçable

Prerequisites : please note the general comment on Bonne
none

Table of contents:

- Introduction à la biodiversité
- Prise en main des logiciels de calcul des indices de biodiversité
- Définition, calcul et interprétation des indices de biodiversité

Assessment breakdown: please note the general comment on assessment breakdown

Travail individual : 5%
Travail en groupe : 5%
Contrôle continu : 30%
Examen final : 60%

Course title: Biodiversity conservation : issues, challenges and assessment methods
Course ID:
University: Université Cheikh Anta Diop de Dakar (UCAD)
Faculty: Faculté des Sciences et Techniques (FST)
Department: Institut des Sciences de l´Environnement (ISE)
Name and e-mail address of the instructor(s): fatimata7.niang @ ucad.edu.sn
Course website: NA
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
30		20			7	8	

Course objectives:
The aim of this course is to introduce students into the issues and challenges related to biodiversity conservation, the status and trends of biodiversity as well as the tools and methods for assessing and conserving biodiversity.

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialized Ecosystem focus: Species and interactions Biological level: Plant communities

Upon completion of the course a student must be able to better understand the different levels and aspects of biodiversity, its value, issues and challenges related to human and natural disturbances. In addition, they will learn how species respond to disturbances and some methods of assessing and conserving biodiversity. Ultimately, this course will allow students to understand the role and capital importance of biodiversity in sustainable development and especially in the survival of planet Earth. They will gain tools for measuring biodiversity.

Course material, text books and further reading:
Books, scientific papers and reports.

Prerequisites: please note the general comment on prerequisites
Basics of Biology and ecology

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 15 %
Written assessment: 60 %
Projects/Presentations/Reporting: 15%

Course title: Biologie et Écologie des poissons d'eau douce Africains
Course ID:
University: Université Cheikh Anta Diop de Dakar
Faculty: Institut Fondamental d'Afrique noire Cheikh Anta Diop
Department: Biologie animale
Name and e-mail address of the instructor(s): Khady DIOUF GOUDIABY (khady1.diouf@ucad.edu.sn)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
20h	30h	10h	12h				

Course objectives:
Donner aux étudiants un aperçu de la faune et des habitas ichtyologiques des milieux continentaux africains et entre, autres, comment étudier les traits de vie des poissons : détermination de l'âge annuel et journalier), des périodes de reproduction et le régime alimentaire.

Learning outcomes : please note the general comment on learning outcomes

A la fin du cours, le étudiants seront capables de/d':
- d'identifier les espèces de poissons ;
- récolter des données liées à la biologie des espèces de poissons ;
- calculer les indicateurs de biologie de reproduction et de la croissance des espèces de poissons ;
- interpréter les résultats des calculs d'indicateurs de biologie de reproduction ;
- étudier la composition et la variation du bol alimentaire d'une espèce de poisson ;
- proposer des mesures de gestion des ressources halieutiques.

Course material, text books and further reading:

- Panfili,]., Pomuai H. (de)., Troadec H., Wright p.]. (éd.), 2002. Manuel de sclérochronologie des poissons. Coédition Ifremer-IRD, 464 p.
- Vidéoprojecteur
- Support de cours
- Ecran de projection fixe
- Ecran de projection mobile
- Marqueur effaçable
- Ichtyomètre, balance, trousse de dissection, alcool, formol, liquid de Gilson, tubes
- Loupe binoculaire
- Microscope
- Mini-bus pour les excursion pédagogiques
- Filets de pêche pour échantillonnages scientifiques

Prerequisites:
None please note the general comment on Bonne

Table of contents:

- La diversité des milieux aquatiques
- Caractéristiques générales de la faune ichtyologique
- Distribution géographique et affinités des poissons d'eau douce africains
- Biogéographie et mise en place des faunes ichtyologiques actuelles

- La diversité des poissons africains
- Taxinomie et systématique
- Les stratégies démographiques
- La reproduction
- Croissance et ontogénie
- Régimes alimentaires et réseaux trophiques
- Réponses aux conditions extrêmes
- L'éthologie
- L'échantillonnage des peuplements de poissons
- Richesse en espèces des peuplements de poissons
- L'habitat des poissons
- Le rôle fonctionnel des poissons

- **Assessment breakdown:** please note the general comment on assessment breakdown
- Written assessment: 60 %
- Practical work: 20%
- Continuous control: 20%

Course title: Biostatistique
Course ID:
University: Cheikh Anta Diop de Dakar
Faculty: Institut fondamental d'Afrique noire Cheikh Anta Diop
Department: Biologie animale
Name and e-mail address of the instructor(s): SADIO Oumar (oumar.sadio@ird.fr)
Course website:
Semester: S2
Tuition language: Français
Number of credits (ECTS): 3

Course breakdown in hours:
- Cours théorique : 15 hrs
- Exercices pratiques : 20 hrs

Course objectives:
Apprendre aux étudiants comment faire des analyses statistiques de données quantitatives et qualitatives à l'aide du logiciel R/RStudio

Learning outcomes : please note the general comment on learning outcomes

A la fin du cours, le étudiants seront capables de/d':

- utiliser les logiciels R et RStudio pour faire des analyses statistiques
- traiter des bases de données
- décrire une variables quelle que soit sa nature
- trouver une liaison entre deux variables
- caractériser des zones, des stations, des sites en fonction des saisons, des paramètres physico-chimiques
- faire des analyses de groupage

Course material, text books and further reading:
- Vidéoprojecteur
- Support de cours
- Manuels de statistique
- Ecran de projection fixe
- Ecran de projection mobile
- Support de tableau de conférence Skin
- Papier pour Flipover
- Marqueur effaçable

Prerequisites: please note the general comment on Bonne
Bonne connaissance en word et Excel
Avoir le niveau de Licence

Table of contents:

OS3: Analyse bivariée

Liaison entre deux variables qualitatives (Tests de Chi-deux)
Liaison entre deux variables quantitatives (Tests de correlation)
Liaison entre deux variables mixtes (Tests de comparaison)

OS4: Analyse multivariée

Analyse en Composantes Principales (ACP)
Analyse Factorielle des Correspondances Simples (AFCS)
Analyse Factorielle des Correspondances Multiples (AFCM)
Classification Ascendante Hiérarchique (CAH)

Assessment breakdown: please note the general comment on assessment breakdown

Travail individual : 5%
Travail en groupe : 5%
Contrôle continu : 30%
Examen final : 60%

Course title: *In vitro* culture and cryopreservation at the service of biodiversity
Course ID:
University: Cheikh Anta DIOP University
Faculty: Faculty of Sciences and Techniques
Department: Plant Biology
Name and e-mail address of the instructor(s): Pr Aliou NDIAYE (aliou.ndiaye@ucad.edu.sn)
Course website:
Semester: S2
Tuition language: French/English
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
30 h	20h	10h					

Course objectives:
- Define the in vitro plant culture conditions
- Study the various stages of plant in vitro culture
- Identify the different in vitro culture methods
- Describe the applications and benefits of in vitro cultures for the biodiversity
- Study the conservation methods (In vitro conservation and plant cryopreservation methods)

Learning outcomes: please note the general comment on
Education level: Knowledge acquired for the *in vitro* culture and plant cryoconservation
Specialization
Biological level: Plant *in vitro* culture and plant cryopreservation

Students will learn the fundamentals of plant biotechnologies and the differents methods of plant biotechnologies. They will learn to choose the appropriate method to solve the problems (plant breeding, Plant propagation, plant sanitation, varital creation, plant cryopreservation…)

Course material, text books and further reading:
Course material**,** Specific papers, websites, and master books
Exemples: - Biotechnologies végétales, Techniques de laboratoire, Robert Haïcour, Editions TEC et DOC; ISBN: 2- 7430-0560-2; ISSN: 0993 -3948 (AUF)
- Biotechnologies végétales au service de la régénération du bamboo; Méthodes de multiplication (culture *in vitro* et propagation horticoles de différentes espèces de bambou Verlag/Editeur: Editions universitaires Européennes (Aliou NDIAYE, 2016)

Prerequisites: bachelor's degree in plant biology please note the general comment on prerequisites:
- plant cell biology
- plant growth and development physiology
- chemistry
- Ecology

Table of contents:
- Introduction: Basic knowledges of plant biology
- History of plant *in vitro* culture
- Culture media
- *In vitro* culture conditions
- *In vitro* culture techniques
- Plant cryopreservation techniques

Assessment breakdown: breakdown Written assessment: 60 % Practical work: 20% Continuous control: 20%	please note the general comment on assessment

Course title: Initiation à l'ethnobotanique quantitative
Course ID:
University: Université Cheikh Anta Diop de Dakar (UCAD)
INSTITUT: Institut Fondamental d'Afrique Noire (IFAN)
Department: Botanique et Géologie
Name and e-mail address of the instructor(s): Doudou Diop (doudou.diop@ ucad.edu.sn)
Course website:
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
20 h	25 h	20 h					

Course objectives:
1. Présenter **les enjeux** et **les intérêts** de la science ethnobotanique
2. Fournir les **outils scientifiques de base** pour la réalisation d'une étude ethnobotanique
3. Fournir les outils scientifiques de base pour une **analyse quantitative des données d'enquête**

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

A la fin du cours, l'Etudiant doit être capable de mener une enquête ethnobotanique rigoureuse et d'en tirer des résultats pertinents

Course material, text books and further reading:
- Houehanou, Thierry & Assogbadjo, Achille & Chadare, F.J. & Zanvo, Stanislas & Sinsin, Brice. (2016). Approches méthodologiques synthétisées des études d'ethnobotanique quantitative en milieu tropical. Annales des Sciences Agronomiques. 20 : 187-205.
- Claudine Friedberg 1968. Les Méthodes d'Enquête en Ethnobotanique. Comment mettre en évidence les taxonomies indigènes ? Journal d'agriculture traditionnelle et de botanique appliquée 15-7-8 pp. 297-324
- Portères Roland, 1961. L'ethnobotanique : Place - Objet - Méthode - Philosophie . In: Journal d'agriculture tropicale et de botanique appliquée, vol. 8, n°4-5, pp. 102-109;
- Sébastien Larrue, « L'homme et l'arbre chez les malinké du Sénégal oriental », Géographie et cultures [En ligne], 56 | 2006. URL : http:// journals.openedition.org/gc/8499 ; DOI : https://doi.org/10.4000/gc.8499
- Pratiques culturelles, Ia sauvegarde et la conservation de Ia biodiversité en Afrique de l'Ouest et du Centre. Actes du Séminaire-Atelier de Ouagadougou (Burkina Faso), du 18 au 21 juin. Sous Ia direction de Innocent BUTARE.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

V.1. Techniques d'échantillonnage
V.2. Méthodes d'inventaire ou de collecte d'informations
V.3. Evaluation des connaissances : les indices ethnobotaniques

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 40 %
Projects/Presentations/Reporting: 60%

Course title: Biodiversité et fonctions des Insectes dans les écosystèmes tropicaux
Course ID:
University: Université Cheikh Anta Diop de Dakar (UCAD)
Faculty: Institut fondamental d'Afrique noire (IFAN)
Department: Biologie animale
Name and e-mail address of the instructor(s): Abdoulaye Baila NDIAYE, abdoulayeb.ndiaye@ucad.edu.sn
Course website: NA
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown in hours:

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment
10	24	20					

Course objectives:
L'objectif du cours est de donner aux étudiants les outils permettant de :
- Situer les insectes du point de vue évolutif (classification du monde vivant) ;
- D'apprécier le niveau de diversité des insectes ;
- D'échantillonner les insectes ;
- S'initier à l'identification des insectes;
- Reconnaitre les groups fonctionnels chez les insectes.

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

L'étudiant qui aura suivi le cours aura les connaissances basiques concernant la classification et la biodiversité des insectes. Il devrait pouvoir reconnaitre les groups taxonomiques et fonctionnels ainsi que leur importance dans les écosystèmes tropicaux.

Course material, text books and further reading:
Support de cours, ouvrages (Delvard G., Aberlenc H. P. (1989). Les insectes d'afrique et d'amérique tropicale : Clés pour la reconnaissance des familles.
PRIFAS, CIRAD, GERDAT, 302p; Aberlenc Henri-Pierre. 2021. Les insectes du monde: Biodiversité, classification, clés de détermination des familles. Editions Quae et Muséo. 1876p.
NAGELEISEN L.-M., BOUGET Ch. et BONNEIL Ph. (2009). L'étude des insectes en forêt: méthodes et techniques; éléments essentiels pour une satndardisation. Office national des forêts, Paris, 144p. Collection entomologique de l'IFAN.
NAGELEISEN L.-M., BOUGET Ch. et BONNEIL Ph. (2009). L'étude des insectes en forêt: méthodes et techniques; éléments essentiels pour une satndardisation. Office national des forêts, Paris, 144p.

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

Table of contents:

- insectes aquatiques
4. Identification des insectes au laboratoire
5. Exposées des étudiants suivis de débats sur les différents groupes
6. Rapport sur les travaux réalisé sur un groupe de choix de l'étudiant

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 25 %
Written assessment: 50 %
Projects/Presentations/Reporting: 25%

Course descriptions at Université de Dschang (UDsch)

Course title: Tropical biodiversity and ecosystems field school: Central African terrestrial ecosystems
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: Geomatics (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:

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

Course title: Phylogeny 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): 5

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: Ecosystèmes aquatiques
Course ID: BIV824
University: Université de Dschang
Faculty: Faculty of Science
Department: Plant Biology
Name and e-mail address of the instructor(s):
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 5

Course breakdown and hours:

- Lectures: 20 hrs
- Projects: 10 hrs

Course objectives:

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Learning outcomes : please note the general comment on learning outcomes

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

Comprendre l'écologie des milieu humides dans les forêts tropicales africaines.

Course material, text books and further reading:

Course notes.

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

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Assessment breakdown: please note the general comment on assessment breakdown

Written and/or oral assessment: 100 %

Course title: SIG et phytogeographie
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): 5

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: Ecosystèmes terrestres
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): 5

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:

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

Course title: Ethnobotanique
Course ID: BIV828
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) and Nicole Guedje (Nicole.Guedje@ulb.be)
Course website: to be posted
Semester: S2
Tuition language: English
Number of credits (ECTS): 5

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.
- 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: Ecosystem

Comprendre les methods et techniques appliquées dans l'étudent ethnobotanique en Afrique.
At the end of the course the student 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
- Notions on traditional medicine
- Notions on medicinal plants
- Selection of plants for extractions of active principles
- Ethnobotany

Course material, text books and further reading:

Course notes.
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
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:

Plantes mellifères, pollens et production des miels
Definitions
Importance of apiculture in the word
Bees' anatomy and Ecology,
Melliferous plants
Practical on bees keeping and honey production
Uses of honey

Plantes médicinales et ethnopharmacologie
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 and/or oral assessment: 100 %

Course descriptions at Technical University of Mombasa (TUM)

Course title: Tropical Biodiversity and Ecosystems Field School: East African Ecosystems
Course ID: AFA 5113
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Dr. Cosmas Munga (ckamunga2014@tum.ac.ke)
Course website:
Semester: S1
Tuition language: English
Number of credits (ECTS): 15

IMPORTANT: The costs for the Course are in part met by the University, but students will be asked to contribute a maximum of 20000 KES for road transport, boat/vehicle rental and other logistic arrangements**.** Also, students will be asked to share the costs of their food and accommodation.

Course breakdown and hours: Total 300 hrs = 25 days
- Excursions : 240 hrs
- Reporting & oral presentation: 60 hrs

Course objectives/purpose:
This course offers an overview of the main aquatic and terrestrial tropical ecosystems and highlights environmental and ecological features of selected ecosystems from marine, coastal and terrestrial environments. This field training offers students the opportunity to gain real experience in the conservation and management of wildlife populations and the integration of state agencies, local communities and other stakeholders in the process. Overall, this course gives an integrated, teambuilding experience based on theoretical and practical field approaches, and adapted to a variety of tropical ecosystems located along the Kenya coast. The trainees gain in-depth knowledge about nature, ecology and wildlife management issues.

Learning outcomes: please note the general comment on learning outcomes
Education level: Specialised Ecosystem focus: Environment Biological level: Ecosystem
Upon completion of the course, the student should be able to:
- Describe the general operations of stakeholders involved in wildlife management
- Identify and describe emerging/contemporary issues in wildlife conservation and management
- Master knowledge and skills for conservation and management of wildlife and biodiversity in terrestrial ecosystems of the tropics
- Design and implement field protocol for biodiversity assessment and management

Course material, text books and further reading:
Core Tex books for the Course
-Paula, J., Bandeira, S., Msangameno, D., Queiroga, H. (2021). Exercises in marine biodiversity and ecology: a training manual using the intertidal habitats of the WIO region. WIOMSA, Zanzibar Town, 360pp
-Telly, E.M., Fiadjoe, A. (1996). Environmental education and training for savannah ecosystem management: a training of trainers manual. ISBN: 9964-72-041-6. 57pp
-Herrick, J.E., Zee, J.W.V., Havstad, K.M., Burkett, L.M., Whitford, W.G. (2009). Monitoring manual for grassland, shrubland and savanna ecosystems. ISBN: 0-9755552-0-0. 36pp

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

Table of contents:
Population descriptive statistics; Correlation and regression of population traits; Group comparisons: abundance spatial structure; Biological diversity measures

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

Course title: Geomatics
Course ID: AFA 5122
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Mr. Stephen O. Odhiambo (stevemtalii@gmail.com)
Course website: TBC
Semester: S1
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 30 hrs
- Exercices: 30 hrs

Course objectives/purpose:

- To introduce the theory, concepts and techniques of Geospatial Information systems and Remote Sensing
- To develop the understanding and technical skills required to analyze geospatial data.

Learning outcomes:
The student is expected to have the following capacities at the end of this course:

- Capacity to carry out mapping and integrate field data to geospatial information systems
- Ability to utilize geospatial techniques in addressing real-world problems in the diverse areas of coastal and marine resource management.
- Capacity to spatially communicate trends and studies in the respective fields.

Course material, text books and further reading:
Core Text books for the Course

- Awange, J.L., Kyalo Kiema, J.B. (2013). Fundamentals of Remote Sensing. In: Environmental Geoinformatics. Environmental Science and Engineering (). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-34085-7_7
- Tolpekin, V., & Stein, A. (2012). The core of GIScience: a process-based approach. (ITC Educational Textbook Series). University of Twente, Faculty of Geo-Information Science and Earth Observation (ITC).
- Fundamentals of Remote Sensing. Canada Centre for Remote Sensing
- Aggarwal, S., & Dun, D. (2005). Principles of Remote Sensing.

Recommended Reference Text Books

- Watt, A. and N. Eng. (2014). Database Design – 2nd Edition. Victoria, B.C.: BCcampus. Retrieved from https://opentextbc.ca/dbdesign01/.
- Mahmoud Hassani and James Carswell. (1992). Transition From Analogue to Digital Photogrammetry, Advances in Remote Sensing vol i. No. 3 – vii.
- T. Schenk, Autumn Quarter 2005, Introduction to Photogrammetry.
- Patra, P. (2010). Remote Sensing And Geographical Information System (GIS). The Association for Geographical studies.
- Https://www.state.nj.us/transportation/eng/documents/survey/chapter7.shtm

Prerequisites: None
Softwares:

- R studio (Data Analysis)
- QGIS (Opensource GIS and Remote Sensing)
- Erdas Imagine(Commercial Remote Sensing)
- ArcGIS(Commercial GIS)

Device specifications:

- Operating system (Any)
- Random Access Memory (4GB and above)
- HDD/SSD (150GB and above
- Access to power

Table of contents:

Basic GIS Concepts and Terminologies; Data capture and encoding; Spatial Analysis Tools and Methods; Data Merging and Integration; Map projections; GIS and Database Management Systems; Remote Sensing (processes); Electromagnetic Radiation Interaction with the Atmosphere; Platforms, Scanners and Sensors; Image Errors/Noises; Remote Sensing (RS) Images
Image Resolution; Image Analysis and Interpretation; Digital Image Processing; Image Classification; Application of GIS on natural resources monitoring and impact assessment.

Assessment breakdown:

Written assessment:
Final exam 60 %
Continous Assessment Tests 20 %
Practicals 20%

Course title: Behavioural ecology of tropical wildlife
Course ID: AFA 5115
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Dr. Mohamed Dhidha (mdhidha71@yahoo.com)
Course website: FILL
Semester: S2
Tuition language: English
Number of credits (ECTS): FILL

Course breakdown and hours:

- Lectures: 60 hrs
- Exercices: FILL hrs
- Excursions : FILL hrs
- Projects: FILL hrs

Course objectives/purpose: To introduce students on behavioural ecology of tropical wildlife.

Learning outcomes : please note the general comment on learning outcomes

Education level: FILL Ecosystem focus: FILL Biological level: FILL

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

- Explain and interpret animal behaviour
- Describe effects of environment on wildlife behaviour
- Understand evolution of behaviour in wildlife animals

Course material, text books and further reading:

Core Tex books for the Course

Macedo, R. (2010). Behavioral Ecology of Tropical Animals. Academic Press. ASIN: B004TSBSE6

Berger, O. (2016). Conservation Behavior: Applying Behavioral Ecology to Wildlife Conservation and Management. Cambridge University Press. ISBN 10: 1107690412

Elliot, N. L. (2019). Observing Wildlife in Tropical Forests: A Geosemeiotic Approach. Delome Publications. ASIN: B081D4TX7P

Recommended Reference Text Books

Stutchbury, B. Morton, E. (2022). Behavioral Ecology of Tropical Birds: Academic Press. ISBN 10: 0128238143

Robinson, J. Bennet, E. (2017). Hunting for Sustainability in Tropical Forests: Columbia University Press. ISBN 10: 0231109768

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

Study of behaviour in animals: Physiological approach, experiential approach. Interpretation of animal behavior. Effects of environment on wildlife behavior. Evolution of behaviour in wild animals. Categorization of behaviour in wild animals. Mechanisms of communication in wildlife. Predator-prey

interactions. Social organisation of selected tropical wildlife species and groups. Reproduction and mating patterns. Wildlife migration

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment:
Final exam 60 %
Continous Assessment Tests 40 %

Course title: Wildlife habitat management
Course ID: AFA 5120
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Dr. Mohamed Dhidha (mdhidha71@yahoo.com)
Course website: TBC
Semester: S2
Tuition language: English
Number of credits (ECTS): FILL

Course breakdown and hours:

- Lectures: 60 hrs
- Exercices: FILL hrs
- Excursions : FILL hrs
- Projects: FILL hrs

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment

Course objectives/purpose: To impart students with knowledge on wildlife habitats and their management techniques

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

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

- Describe different types of wildlife habitats
- Integrate wildlife habitat problem solving skills into management
- Apply management skills on the different types of habitats

Course material, text books and further reading:
Core Tex books for the Course
McComb, B. C. (2021). Wildlife Habitat Management. CRC Press. ISBN - 10: 1032098384
Morrison, M. L., Mathewson, H. A. (2015) Wildlife Habitat Conservation: Concepts, Challenges, and Solutions. Johns Hopkins University Press. ISBN 10: 1421416107
Krausman P.R., Cain III J.W. (Eds) (2013). Wildlife Management and Conservation: Contemporary Principles and Practices. Johns Hopkins University Press. ISBN 10: 9781421409863

Recommended Reference Text Books
Patton, D. R., Fox, B. E., Bailey, J. D. (2019). Conserving Forest Diversity through Ecosystem Management: Trees, Forests, Environment, Habitat, and Wildlife: Oxford University Press. ASIN: B07WGQL69W
Degraaf, R., Yamasaki, M., Leak, W. B. (2007). Technical Guide to Forest Wildlife Habitat Management in New England: University Press of New England. ISBN 10: 1584655879

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

strategies, Rangeland management practice. Tropical Wetlands: Types of wetlands in Kenya, Vegetation types within wetlands, Ecosystem services of wetlands, Values of wetlands, Threats facing tropical wetlands, Wetland management practices. Forests: Ecosystem services of forests, Vegetation types within forests, Forest classification, Functions of forests, Threats facing forests in Kenya, Forest ecosystem monitoring**.**

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment:
Final exam 60 %
Continous Assessment Tests 40 %

Course title: Tropical savanna ecosystem and biodiversity
Course ID: AFA 5119
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Dr. Mumini Dzoga (mdzoga2014@tum.ac.ke)
Course website: FILL
Semester: S2
Tuition language: English
Number of credits (ECTS): FILL

Course breakdown and hours:

- Lectures: 60 hrs
- Exercices: FILL hrs
- Excursions : FILL hrs
- Projects: FILL hrs

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment

Course objectives/purpose: To equip students with knowledge of tropical savanna ecosystem.

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

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

- Describe characteristics of savannah ecosystems
- Describe threats to savannah ecosystems
- Understand socio-economic importance of savannah ecosystems

Course material, text books and further reading:
Core Tex books for the Course
Hill, M. J., Hanan, M. P. (2010). Ecosystem Function in Savannas: Measurement and Modeling at Landscape to Global Scales. CRC Press. ISBN -10: 1439804702
Valayil, J. M., Writing, D. S., (2022). Baako's Wild Journey: A STEM introduction to the African Savanna ecosystem. Alacarte Publishers. ASIN: B09SD18Z8B
Mashapa, C. (2019). Human Livelihoods and Sustainable Conservation in a Savanna Ecosystem: Herbivory and Anthropogenic Impacts on Woody Vegetation in Save Valley, Southern Zimbabwe. LAP LAMBERT Academic Publishing. ISBN: 6200318867

Recommended Reference Text Books
Abbadie, l., Gignoux, J., Roux, X., Lepage, M. (Eds) (2006). Lamto: Structure, Functioning, and Dynamics of a Savanna Ecosystem: Springer. ISBN 10: 0387948449
Solbrig, O. T., Medina, E., Silva, J. F. (1996). Biodiversity and Savanna Ecosystem Processes: A Global Perspective: Yale University Press. ISBN 10: 3540579494

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Definition and characteristics of savannah ecosystem: floral and faunal composition, climate, soils and nutrients. The savannah biome. Threats of savannah ecosystem: Anthropogenic threats, natural threats. Socio-economic importance of savannah ecosystem. Case study: The Masaai Mara ecosystem – a trans-boundary savannah ecosystem between Kenya and Tanzania.

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment:
Final exam 60 %
Continous Assessment Tests 40 %

Course title: Wetland ecology and management
Course ID: AFA 5121
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Prof. Ezekiel Okemwa (eokemwa@tum.ac.ke)
Course website: FILL
Semester: S2
Tuition language: English
Number of credits (ECTS): FILL

Course breakdown and hours:

- Lectures: 60 hrs
- Exercices: FILL hrs
- Excursions : FILL hrs
- Projects: FILL hrs

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment

Course objectives/purpose: To equip students with skills on wetland characterization and functional assessment.

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

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

- Determine wetland demarcation
- Describe wetland characteristics
- Conduct functional analysis of wetlands
- Apply wetland regulations in management

Course material, text books and further reading:
Core Tex books for the Course
Messina, M. G., Conner, W. H. (Eds.) (2019). Southern Forested Wetlands: Ecology and Management. Routledge. ISBN -10:1119154049; 13 : 978-0367359225
Hook, D. D., McKee Jr, W. H., Smith, H. K., Gregory, J., Burrell Jr, V. G., DeVoe, M. R., and others (Eds) (2014). The Ecology and Management of Wetlands. Springer. ISBN 10: 1468473948; 13: 978-1468473940
Trettin C. C., (2018). Northern Forested Wetland Ecology and Management. Routledge. ISBN-13: 978-1566701778; 10: 1566701775

Recommended Reference Text Books
Hennawy, M. E. (2016). Ecology and Management of Wetland Ecosystem: LAP LAMBERT Academic Publishing. ISBN- 10: 9783659858512; 13: 978-3659858512
Whigham, D. F., Good, R. E., Kvet, J. (Eds) (1990). Wetland Ecology and Management: Case Studies. Springer. ISBN- 10: 079230893X

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Wetland delineation. Wetland characterization: water, substrate and biota. Especially controversial wetlands. Regulation of wetlands. Lakes origin and classification. Functional classification of wetlands (lakes, deltas and estuaries). East African great lakes (Lake Tanganyika, Lake Victoria and Lake Turkana). Socio-economic importance. Threats facing East African great lakes

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment:
Final exam 60 %
Continous Assessment Tests 40 %

Course title: Tropical coastal biodiversity and resources conservation
Course ID: AFA 5117
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Dr. Gladys Okemwa (gladyokemwa@gmail.com)
Course website: FILL
Semester: S2
Tuition language: English
Number of credits (ECTS): FILL

Course breakdown and hours:

- Lectures: 60 hrs
- Exercices: FILL hrs
- Excursions : FILL hrs
- Projects: FILL hrs

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment

Course objectives/purpose: To equip the student with the knowledge of coastal and marine biodiversity and resources conservation

Learning outcomes : please note the general comment on learning outcomes

Education level: FILL Ecosystem focus: FILL Biological level: FILL

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

- Explain connectivity of the different types of coastal habitats and related biodiversity
- Understand different levels of coastal resource conservation
- Demonstrate practical aspects of coastal resource conservation
- Demonstrate change in coastal habitats due to anthropogenic & natural impacts

Course material, text books and further reading:
Core Tex books for the Course

Linneweber, V. (2013). Mangrove ecosystems: Function and management (Environmental science & engineering). Springer, 2002nd edition. ISBN-10:3540422080. 477pp

Sivaperuman, C., Velmurugan, A., Singh, A.K., Jaisankar, I. (eds). (2018). Biodiversity and climate change adaptation in tropical islands. Academic Press, 1st edition. ISBN: 0128130644. 777pp

Nagelkerken, I. (ed) (2009). Ecological connectivity among tropical coastal ecosystems (Advances in spatial science). Springer, 2005th edition. ISBN-10:9048124050. 1142 pp.

Recommended Reference Text Books

Michael, E. (2013). Marine conservation biology: The science of maintaining the sea's biodiversity. In: Norse, E.A., Crowder, L.B., Soule, M.E. (eds). Island Press. ISBN-10:1559636629. 496pp

Hiscock, K. (2014). Marine biodiversity conservation: A practical approach (Earthscan Ocean). Routledge, 1st edition. ISBN-10:0415723566. 520pp

Claudet, J. (ed) (2011). Marine Protected Areas: A multidisciplinary approach (Ecology, Biodiversity and Conservation). Cambridge University Press, Illustrated edition. ISBN-10:0521766052. 392 pp

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Mangrove ecosystem and associated biodiversity, threats and conservation; Sea grass ecosystem and associated biodiversity, threats and conservation; Coral ecosystem and associated biodiversity, threats and conservation; Sea turtles conservation in Kenya; Marine mammals conservation and surveillance (dugongs, dolphins, whales); Sharks conservation and fisheries management; Impacts of climate change and adaptation strategies; Realizing AICHI Targets; The development of a sustainable blue economy (conventional MPAs, Community Conserved Areas); Progress in trans-boundary conservation of resources between Kenya and Tanzania. Other coastal and marine resources of ecological importance: estuaries and deltas, sand dunes, beaches, pelagic habitats among others. Drivers of coastal and marine resources degradation: high rates of population growth, urbanization, expansion of industrial developments, overexploitation of natural resources and climate change

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment:
Final exam 60 %
Continous Assessment Tests 40 %

Course title: Tropical coastal resources and monitoring tools
Course ID: AFA 5118
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Dr. Mohamed Omar (msaid26474@gmail.com)
Course website: FILL
Semester: S2
Tuition language: English
Number of credits (ECTS): FILL

Course breakdown and hours:

- Lectures: 60 hrs
- Exercices: FILL hrs
- Excursions : FILL hrs
- Projects: FILL hrs

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment

Course objectives/purpose:

- To introduce students on the dynamics of coastal and marine resources due to natural and anthropogenic impacts and how these can be monitored for intervention using standard tools
- To conserve coastal and marine resources by promoting, influencing and catalysing sustainable uses
- To achieve significant improvement in sustaining coastal and marine resources for posterity

Learning outcomes : please note the general comment on learning outcomes

Education level: FILL Ecosystem focus: FILL Biological level: FILL

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

- Identify resources dynamics due to natural or anthropogenic impacts
- Identify and be able to explain the standard tools and methods used for coastal and marine resources assessment and monitoring for intervention
- Apply the assessment and monitoring methods in resource management

Course material, text books and further reading:

Core Text books for the Course

Kennish, M.J. (2017). Practical handbook of estuarine and marine pollution (Marine Science Series). CRC Press, 1st edition. ISBN-10: 0849384249. 508 pp

Taberlet, P. (2018). Environmental DNA: For biodiversity research and monitoring. Oxford University Press, USA, Illustrated edition. ISBN-10: 0198767285. 253pp

Devin, J., Jensen, K.H., Hestetun, J.T., Sjotun, K., Salvanes, A.G.V., Glenner, H. (eds) (2018). Marine ecological field methods: A guide for marine biologists and fisheries scientists. Wiley-Blackwell, 1st edition. ISBN-10: 9781119184300. 240pp

Recommended Reference Text Books

Beatley, T. (2002). An introduction to coastal zone management. Island Press, 2nd edition. ISBN-10: 1559639156. 352 pp

Nguele, G. (2020). Exploitation of marine resources and protection of the environment: From over-exploitation to an integrated approach to the exploitation of marine resources. Our Knowledge Publishing. ISBN-10: 6202720921. 132 pp.
Jennings, S., Kaiser, M.J., Reynolds, J.D. (2001). Marine fisheries ecology. Blackwell Science, 1st edition. ISBN-10: 9780632050987. 432 pp

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Definition of assessment and monitoring for coastal and marine resources. Importance of resource assessment and monitoring. Assessment and monitoring tools for coastal forests and mangroves, sea grass beds, and corals: Different types of resource monitoring including scientific and non-scientific monitoring. Requirements for the different types of resource monitoring in terms of level of scientific expertise, finances and human resource. Survey types such as use of line and belt transects for underwater fish census, use of quadrats, use of permanent monitoring plots, benthic survey tools. Tools such as GIS and remote sensing. Use of local knowledge and citizen science in resource assessment and monitoring. Community livelihoods in coastal areas. Governance of coastal and marine resources use. Indicators of changing ecosystem state: productivity, fish and fisheries, pollution, socio-economics and governance.

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment:
Final exam 60 %
Continous Assessment Tests 40 %

Course title: Tropical coastal and marine fisheries resources
Course ID: AFA 5101
University: Technical University of Mombasa
Faculty: Applied & Health Sciences
Department: Environment & Health Sciences
Name and e-mail address of the instructor(s): Dr. Cosmas Munga (ckamunga2014@tum.ac.ke)
Course website: FILL
Semester: S2
Tuition language: English
Number of credits (ECTS): FILL

Course breakdown and hours:

- Lectures: 60 hrs
- Exercices: FILL hrs
- Excursions : FILL hrs
- Projects: FILL hrs

Theory	Practical	Exercise	Excursion	Internship	Project	Seminar	Personal assignment

Course objectives/purpose: To introduce the student to tropical coastal and marine fisheries resources.

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

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

- Describe different types of tropical coastal & marine ecosystems
- Describe the fisheries resources of tropical coastal & marine ecosystems
- Demonstrate practical management practices in fisheries
- Demonstrate trends in fisheries resources with climate change & physical drivers of production such as currents
- Explain anthropogenic impacts on coastal & marine fisheries resources

Course material, text books and further reading:
Core Tex books for the Course
Phillips, B., Ramirez, M. (2017). Climate change impacts on fisheries and aquaculture: A global analysis. Wiley-Blackwell. ISBN -10:1119154049
Diop S., Scheren, P., Machiwa, J. (Eds.) (2016). Estuaries: A lifeline of ecosystem services in the Western Indian Ocean. ISBN 978-3-319-25368-8
Groeneveld J.C., Koranteng K.A (Eds) (2017). The RV Dr. Fridtjof Nansen in the Western Indian Ocean: Voyages of marine research and capacity development. FAO. Rome, Italy

Recommended Reference Text Books
FAO (2015). Handbook of marine fisheries conservation and management: Oxford University Press. ISBN: 9780195370287
Fagan, B. (2017). Fishing: How the sea fed civilization: Yale University Press. ISBN: 9780195370287

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Definition and characteristics of tropical coastal artisanal fisheries; socio-economic importance of coastal artisanal fisheries. Composition of tropical coastal artisanal fisheries: Coral reef fisheries, Mangrove fisheries, Sea grass fisheries. Status and management of artisanal fisheries in Kenya. Towards ecosystem approach to fisheries (EAF) management. Challenges of tropical coastal fisheries in Kenya and the Western Indian Ocean region, a case study of the bottom trawl prawn fishery. Climate change: threats to ecosystems, adaptations and mitigation; Drivers of fisheries production (coastal currents, monsoon winds, waves and tides); Classification of fisheries: small-scale artisanal and industrial fisheries: Fisheries resources: demersal fishes, pelagic fishes, Crustaceans, Mollusks, Ornamental fisheries. Species Diversity: occurrence and distribution. Trends in Exploitation, Sustainable Management, State of world fisheries resources; Environmental and anthropogenic impacts: Eutrophication, sedimentation, acidification.

Assessment breakdown: please note the general comment on assessment breakdown

Written assessment:
Final exam 60 %
Continous Assessment Tests 40 %

Course descriptions at Université de La Réunion (UNIRé)

Course title: Tropical biodiversity and ecosystems field school: Tropical forest ecosystems of Reunion and the South West Indian Ocean islands (incl. Malagasy terrestrial ecosystems)
Course ID: H4BE206 [FIELDSCHOOL]
University: University of La Réunion
Faculty: Faculté des Sciences de l'Homme et de l'Environnement
Department: Ecologie Terrestre
Name and e-mail address of the instructor(s): THIERRY PAILLER (thierry.pailler@univ-reunion.fr)
Course website: https://ufr-she.univ-reunion.fr/departements/ecologie-terrestre/master-best-bee/m1-best-t
Semester: S2
Tuition language: English
Number of credits (ECTS): 15
IMPORTANT: The costs for the Course (travel, accommodation) are in part met by the University, but students will be asked a maximum of 200 EUR to contribute to shared food and transportation costs if necessary.

Course breakdown and hours:

- Lectures: 42 hrs
- Exercices: 9 hrs
- Excursions : 84 hrs

Course objectives: The field school aims to put the student in real situations of study or analysis as he will meet in a professional environment. The context will be that of field expertise in a natural environment. This course aims to teach the student the mastery of diagnostic tools. Understand biodiversity and the functioning of tropical forest ecosystems through regional case studies of the main biotas of Madagascar's biodiversity hotspot; acquire methodologies for measuring the diversity and dynamics of animal and plant communities in tropical environments; integrate this knowledge into operational programs implemented by natural environment managers. To acquire knowledge on the methods of studies of the chemical mediation intervening in the insect plants interactions. To gain knowledge of the different strategies developed by plants to reproduce with pollinators as well as the evolutionary consequences. Train experts in taxonomy (identification, nomenclature, classification) and evolution (speciation, reproductive biology, adaptation, convergence, biogeography, ...) of flowering plant species in South West Indian Ocean. Mastery of techniques related to expertise in tropical botany (Herbarium, sampling, referencing of specimens, ...).

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

Upon completion of the course a student must be able to understand the functioning of tropical forest ecosystems. Measure the biological diversity of complex systems. Evaluate the impact of natural and anthropogenic disturbances. To know the diversity of the major faunal groups of the hotspot of the South West of the Indian Ocean. Apply this knowledge to studies conducted by natural environment managers. Botanical diagnosis, dissection of plant organs, microscopy, sampling and inventory techniques of plants, collection and referencing of specimens.

Course material, text books and further reading:
Michael Simpson. 2019. **Plant Systematics**. Academic Press. 780pp. ISBN: 9780128126288
John Kricher. 2011.**Tropical Ecology**. Princeton University Press. 704 pp. ISBN 9780691115139.
Pat Willmer. 2011. **Pollination and Floral Ecology**. Princeton University Press ; 778pp.
ISBN: 9780691128610

Prerequisites: please note the general comment on prerequisites

General knowledge in Biology, Ecology ad Evolution at the Bachelor level.

Table of contents:

Plant communities:

Biological diversity: typology of tropical forests, species richness, global distribution, explanatory factors, tropical forests of the SWIO zone,

Structure and functioning of plant communities: spatio-temporal variability (horizontal: disturbances, succession, vertical), regeneration (life cycle, process: dispersal, germination, etc.), plant / plant interactions (facilitation, competition).

Plant / environment interactions:

specific strategies (functional traits), eco-physiology and plant responses to the biotope (illumination, water, temperature, soil),

Animal Communities:

Ecology of arthropods: diversity and functioning of communities, sampling methods, social insects. F

tropical island aunes: native vertebrates of the Madagascar hotspot.

Anthropogenic threats (degradation, deforestation, invasions), consequences (fragmentation, habitat loss, extinctions) and re-mediation (REDD +).

Nature of the interactions (mutualism, symbiosis, antagonism, parasitism, predation), origin of the interactions, interactions animal plants interactions plants microorganisms, role of the interactions in the evolution, specialization of the interactions.

Chemical ecology of insect plant interactions: molecules involved in plant x insect relationships; CGSM: sample collection, principle and analysis of results; Physiology and ecology of the insect plant relationship; EAG: operating principle and analysis of results. Ecology and evolution of interactions: Pollination and dispersal in the islands; Mycorrhizal symbiosis; Evolution of mutualisms in an island environment; Case study: biotic interactions in Apis mellifera;

Species concept and classification.

Taxonomy, Nomenclature, Herbarium: Code of Botany, Description of new species, Management of collections (Databases, Herbarium techniques, DNA library, ...). Classification of large plant families: tools and methods of analysis: (morphology, cytology, plant anatomy), classification principles. Vascular flora of SWIO: Magnoliids: Laurales; Piperales / Monocots: Alismatales; Pandanales; Liliales; Asparagales / Commelinids: Arecales, Poales, Zingiberales: (Core eudicots: Rosids: Fabidae Oxalidales, Malpighiales, Fabales, Rosales / Rosids: Malvidae: Myrtales, sapindales, Malvales / Asterids: Ericales, Gentianales, solanales, Boraginales, Asterales, Escaloniales, Apiales.

FIELD: 1 week in MADAGASCAR and 1 week in REUNION (Marelongue Station): techniques of studies, inventories and sampling of the biodiversity of Madagascar and the surrounding islands: Ecology of plant communities; forest inventories; analysis of different strata and litter; Ecology of pollinator plant interactions, pollinator observation method, characterization of floral biology (morphology, color, odor, nectar), study of the reproductive system and pollen flow; Inventories of the entomofauna; sampling and conditioning technique; identification criteria, Botany

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: 25 %

Written assessment: 50 %

Projects/Presentations/Reporting: 25 %

Course title: Geomatics
Course ID: H4BE207 [GEOMAT]
University: University of La Réunion
Faculty: Faculté des Sciences de l'Homme et de l'Environnement
Department: Ecologie Terrestre
Name and e-mail address of the instructor(s): OLIVIER FLORES (olivier.flores@univ-reunion.fr)
Course website: https://ufr-she.univ-reunion.fr/departements/ecologie-terrestre/master-best-bee/m1-best-t
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 4 hrs
- Exercices: 0 hrs
- Practical Classes : 21 hrs
- Projects: 20 hrs

Course objectives:
The main objective of the course is to learn the principles of geomatics and geographic information systems (GIS) and their use for spatial data analysis.

Learning outcomes :
Education level: Basic Ecosystem focus: Methods & Tools

Upon completion of the course a student must be able to :
– Understand the concepts of geomatics and GIS and how to use a GIS software (QGIS)
– Manipulate, vizualize and analyze spatial data
– Georeference remote sensing images
– Understand spatial data analysis of vector and raster data, including remote
– Master a number of common spatial data analyses
– Use GIS tools to produce synthetic spatial information in thematic maps

Course material, text books and further reading:

Prerequisites:

Table of contents:
- Lectures :
- Introduction to geomatics and geographical information systems (GIS)
- Introduction to remote sensing and satellite image analysis

- Practicals
- First steps in GIS using Quantum GIS (QGIS)
- Exploring and visualizing vector and raster data for thematic maps production
- Image georeferencing
- Creating layers based on GPS data and digitalization
- Spatial analyses based on vector and raster data
- Manipulate and analyze remote sensing images

Assessment breakdown:

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

Course title: Ecological data analysis
Course ID: H4BE208 [ECODATA]
University: University of La Réunion
Faculty: Faculté des Sciences de l'Homme et de l'Environnement
Department: Ecologie Terrestre
Name and e-mail address of the instructor(s): OLIVIER FLORES (olivier.flores@univ-reunion.fr)
Course website: https://ufr-she.univ-reunion.fr/departements/ecologie-terrestre/master-best-bee/m1-best-t
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 10 hrs
- Practical classes : 15 hrs

Course objectives:
The main objective of the course is to complete students training and understanding of common methods for statistical modeling and multivariate analysis applied to the study of ecological data.

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

Upon completion of the course a student must be able to:
– Know how to handle and describe ecological data
– Understand and perform efficient graphical and numerical data exploration
– Perform and validate basic statistical analyses
– Produce standardized statistical results depending on the methods
– Assess and criticize the results (conditions of applications, limits)

Course material, text books and further reading:
– Statistical textbooks

Prerequisites: please note the general comment on prerequisites

Table of contents:
– Correlation analysis
– Principles of statistical modeling applied to multiple linear regression
– Analysis of variance and associated analyses (ANCOVA, MANOVA)
– Generalized Linear Models
– Model evaluation and comparison
– Multivariate analyses : ordination and classification analyses

Assessment breakdown:
Written assessment: 50 %
Projects/Presentations/Reporting: 50 %

Course title: Tropical plant health ecology and management
Course ID: H4BE209 [PLANTHEALTH]
University: University of La Réunion
Faculty: Faculté des Sciences de l'Homme et de l'Environnement
Department: Ecologie Terrestre
Name and e-mail address of the instructor(s): Stéphane Poussier (stephane.poussier@univ-reunion.fr)
Course website: https://ufr-she.univ-reunion.fr/departements/ecologie-terrestre/master-best-bee/m1-best-t
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 16 hrs
- Oral assessment: 3 hrs
- Practical classes: 11 hrs

Course objectives:
The main objective of this course is to acquire knowledge on the ecology, diversity and systematics of the main plant pests (pathogenic microorganisms, insects). The second objective is to understand the different plant protection strategies applied to reduce the socio-economic and environmental impact of plant pests.

Learning outcomes : please note the general comment on learning outcomes
Education level: specialised Ecosystem focus: Plant Biological level: (Micro)Organism

Upon completion of the course a student must be able to:
- design and implement plant protection strategies based on knowledge of diversity, systematics and ecology of major plant pest groups. Ability to
- apply methods of identification / detection of phytopathogenic agents in a laboratory.

Course material, text books and further reading:
Powerpoint presentations, scientific articles

Prerequisites: please note the general comment on prerequisites
Bachelor's degree with a major in Biology, Natural Sciences, Environmental Sciences, or equivalent from an accredited university, as well as proficiency in English and/or French equivalent to Common European Framework of Reference for Languages level B2.

Table of contents:
Presentation of the main socio-economic and environmental impact of plant pests. Ecology, systematic, diversity of the main groups of plant pests: arthropods, fungi, bacteria, phytoplasmas, viruses. Examples of diseases in anthropised environments (cultivated and urban). Diversity and systematics of arthropods of agronomic interest. Plant protection strategies: regulation, diagnostic techniques, prophylaxis, biological control, chemical control, plant defense stimulators ...
TP: Identification / detection of pathogens on plants / seeds. Oral presentation of tropical plant diseases by students.

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

Course title: Molecular evolution
Course ID: H4BE210 [MOLEVOL]
University: University of La Réunion
Faculty: Faculté des Sciences de l'Homme et de l'Environnement
Department: Ecologie Terrestre
Name and e-mail address of the instructor(s): Pascale Besse (pascale.besse@univ-reunion.fr)
Course website: https://ufr-she.univ-reunion.fr/departements/ecologie-terrestre/master-best-bee/m1-best-t
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 18 hrs
- Exercises: 8 hrs
- Practical classes : 9 hrs

Course objectives:
The objective of the course is to provide students with knowledge on the mechanisms of evolution of the different sequences composing a genome. This understanding is necessary to be able to choose appropriate molecular DNA sequences to be used for population genetics studies, to construct molecular phylogenies or to develop barcoding tools. The concepts and limits of the different methods will be presented together with an initiation to molecular phylogeny.

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

Upon completion of the course a student must be able to
apply his-her knowledge on the various sequences composing a genome and their mechanisms of evolution, in order to be able to choose with a critical mind and with discernment the appropriate sequences to be used for specific evolutionary questions and applications (microevolution, macroevolution, barcoding..) in different organisms. They must also be able to use specific software (DNA sequences analyses, phylogeny...) for this purpose.

Course material, text books and further reading:
- Besse, P. (Ed.). (2014). *Molecular plant taxonomy: methods and protocols*. Humana Press.
- Nei, M., & Kumar, S. (2000). *Molecular evolution and phylogenetics*. Oxford university press.
- Page, R. D., & Holmes, E. C. (2009). *Molecular evolution: a phylogenetic approach*. John Wiley & Sons.
- Tamura, K., Stecher, G., Peterson, D., Filipski, A., & Kumar, S. (2013). MEGA6: molecular evolutionary genetics analysis version 6.0. *Molecular biology and evolution*, *30*(12), 2725-2729.

Prerequisites: please note the general comment on prerequisites

Table of contents:
MOLECULAR EVOLUTION :
Nuclear genome: heterogeneity and the C-value paradox, different sequences (tandemly repeated *Satellite, minisatellites, microsatellites, ribosomal DNA, telomeres..* or dispersed_*transposable elements, Lines, Sines.*.). Mode and rate of evolution of these sequences (neutral theory, molecular clock, concerted evolution, genic conversion, unequal crossing over...) Special focus on microsatellite sequences evolution. Role of these sequences (selfish DNA hypothesis...).
Mitochondrial and chloroplast genomes: sequences, rates and modes of evolution.
CHOOSING SEQUENCES:

For population genetics
For phylogeny (and introduction to phylogenetic methods)
For DNA barcoding (in plants and animals, concepts and limits)
Exercises = scientific papers analysis: results analysis, discussion and critical reading.
Practical classes = Phylogenetic analysis of ribosomal DNA sequences, FISH (Fluorescent in situ hybridisation) technique presentation and results analyses.

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

Course descriptions at University of Ruhuna (RUH)

Course title: Field School in Tropical Biodiversity and Ecosystems: Sri Lankan terrestrial and aquatic ecosystems
Course ID: RUH-FSTBE
University: University of Ruhuna, Matara, Sri Lanka
Faculty: Science
Department: Botany
Name and e-mail address of the instructor(s): Senior Prof. LP Jayatissa (lpj@bot.ruh.ac.lk), Dr. KAS Kodikara (kodikara@bot.ruh.ac.lk),
Course website: www.tropimundo.eu
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 100000 LKR for transport, accommodation in shared chalets, etc… Students will also be asked to contribute to shared food costs if necessary.

Course breakdown and hours:

- Lectures: 20 hrs
- Exercises: 15 hrs
- Excursions : 120 hrs
- Projects: 30 hrs (report)

Course objectives:

1. To offer an opportunity to learn Ecology and Ecophysiology of different aquatic and terrestrial tropical ecosystems by giving special attention to the morphological, and physiological adaptations and common biological features
2. Give the understanding on biogeographic and evolutionary trends of these tropical ecosystems
3. Give the field observation on Ecosystem resilience against natural environmental variations and anthropogenic pressure

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 explain the unique Ecology and biological features of different ecosystems and distinguish them by their morphological and eco-physiological features. Also, to build up and discuss different ecosystem resilience strategies and their level of success in response to environmental changes

Course material, text books and further reading:

1. G.A.D. Perera (2014) Ecology of Sri Lankan Dry Forests: Implications for the Conservation Management of Northernmost Dry Forests Proceedings of Jaffna University International Research Conference (JUICE-2012), pp. 263-269, published: March 2014, Sri Lanka
2. Sri Lankan ecosystems (http://www.terrestrial-biozones.net)
3. Gunathilake N. et al (2008). Biodiversity of Sri Lanka. J.Natn.Sci.Foundation Sri Lanka 2008 **36** Special Issue 25-62.
4. Articles published in biology related journals

Prerequisites: please note the general comment on prerequisites

Will be of advantage to students who have studied Plant Ecology, Advance plant Ecology or General biology

Table of contents:

- Introduction to different aquatic and terrestrial ecosystems in Sri Lanka (general Ecology, biological features)
- Field training session on different ecosystems
  Mangroves (Pambala)
  Salt marshes (Negombo)
  Sand dunes (Magama)
  Beach vegetations, lagoons (Matara – Hambantota)
- Vegetation dynamics
  Natural dynamics (Kahandamodara)
  Human induced (Kalametiya, Dondra, Garanduwa)
- Resilience strategies
  Kalametiya, Dondra
- Group wise presentations

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: -
Written assessment: 50 %
Projects/Presentations/Reporting: 50 %

Course title: Geomatics
Course ID: RUH-GEO
University: University of Ruhuna, Matara, Sri Lanka
Faculty: Science
Department: Botany
Name and e-mail address of the instructor(s): Prof. Kanthi Yapa, Mrs. SK Madarasinghe
Course website: www.tropimundo.eu
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 20 hrs
- Exercises: 15 hrs
- Excursions : 12 hrs
- Projects: 03 hrs (report)

Course objectives:
To offer hand-on experience on basic GIS and remote sensing techniques coupling with novel unmanned aerial vehicles (drones) and their application to study vegetation dynamics and biological conservation

Learning outcomes :
Education level: basic Ecosystem focus: methods and tools

Upon completion of the course a student must be able to understand basic concepts of information acquisition, projection and handling with suitable techniques. Also, tools and skills in remote sensing and image processing, data treatment, analysis and interpretation.

Course material, text books and further reading:
1. Reddy MA (2008) Remote sensing and geographical information systems. Third Edition, India
2. Articles published in GIS related journals (case studies)

Prerequisites: please note the general comment on prerequisites
Will be of advantage to students who have studied (any) sciences

Table of contents:
- Introduction to Geographical Information Systems (GIS) [definitions, terminology, Coordinate system)
- Basic principles of Remote sensing (introduction, electromagnetic remote sensing process, Energy interactions, remote sensing platforms, sensors)
- Spatial data modelling (vector GIS models)
- Digital image processing (image resolutions, preprocessing, projections, transformations, image processing, classifications)
- Spatio-temporal change analysis (introduction, area estimation, GIS for coastal zone management)
- Introduction to Global Positioning System (GPS)
- Fundamentals of GPS
- Data collection
-Current issues and trends of GIS and RS
- Case studies

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

Course title: Biodiversity of wetlands in Sri Lanka, conservation and policies
Course ID: RUH-BCPW
University: University of Ruhuna, Matara, Sri Lanka
Faculty: Science
Department: Botany
Name and e-mail address of the instructor(s): Senior Prof. LP Jayatissa (lpj@bot.ruh.ac.lk) and Prof. Saman Chandana (epschandana@gmail.com)
Course website: www.tropimundo.eu
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 15 hrs
- Exercises: 03 hrs
- Excursions : 12 hrs
- Projects: N/A

Course objectives:

1. To understand the basic ecology and biodiversity of the wetlands
2. To give knowledge on different types of wetlands in Sri Lanka, their ecology, development and biodiversity
3. To develop an ability to determine the need of wetland conservation in response to unprecedented habitat degradation
4. To review the policy status relevant to wetland conservation in Sri Lanka

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:
- explain the basic ecological principles and the level of biodiversity of different wetlands, and also to review the policy enforcement in wetland conservation
- identify and differentiate the functioning of different ecosystems
- explain biological interactions in terms of different ecosystem contexts

Course material, text books and further reading:

1. Kotagama S.W. and Bambaradeniya C.N.B. (2006) An overview of the wetlands of Sri Lanka. Central Environmental Authority, Sri Lanka
2. Ramsar wetlands on Sri Lanka (2013) Central Environmental Authority. Sri Lanka
3. Wetland conservation in Sri Lanka (2003) IUCN portals, Sri Lanka
……
4. Fraser, L.H. and P.A. Keddy (Eds). The World's largest wetlands: Ecology and Conservation.
5. Cambridge University Press, UK Kar, Devashish. (2013). Wetlands and lakes of the world Springer. New Delhi, India
……..
Articles in following journals
- Biological Conservation Diversity and Distributions
- Journal of Wetland Ecology
- Wetland Ecology and Management

Prerequisites: please note the general comment on prerequisites

A knowledge in Ecology/Biodiversity and Conservation will be an advantage to students

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown

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

Course title: Wood Science and Technology
Course ID: RUH-WT
University: University of Ruhuna, Matara, Sri Lanka
Faculty: Science
Department: Botany
Name and e-mail address of the instructor(s): Dr. KAS Kodikara (kodikara@bot.ruh.ac.lk)
Course website: www.tropimundo.eu
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 15 hrs
- Exercises: 09 hrs
- Excursions : -
- Projects: 03 hrs (report)

Course objectives:

1. To provide knowledge on structure of wood and associated proprieties
2. To provide basic knowledge on wood seasoning and preservation
3. To provide hand-on experience about wood sectioning, common wood defects and grading

Learning outcomes : please note the general comment on learning outcomes

Education level: specialise Ecosystem focus: Plant Biological level: organism

Upon completion of the course a student must be able to identify different wood structures (both anatomy based and macro-scale). Also, to explain different wood seasoning and preservation techniques and their common uses in wood technology.

Course material, text books and further reading:

-Brown HP., Panshin AJ., Forsaith CC. Textbook of Wood Science, Commercial timbers of United States.
-Bc. Vladislava Muselíková, Wood technology, Faculty of Education, Masaryk University, Brno
-Maclain T., Brown T. Wood Science and technology, Department of Wood Science and Engineering
Articles published in peer-reviewed journals related to wood science and technology

Prerequisites: please note the general comment on prerequisites

Will be of advantage to students who have studied plant sciences/biological Sciences

Table of contents:

- Structure of wood,
- Physical properties of wood,
- Mechanical properties of wood,
- Grading of woods/timber,
- Common and specific uses of woods,
- Wood seasoning and wood preservation
- Defects of woods,
- Wood based industries in Sri Lanka

Assessment breakdown: please note the general comment on assessment breakdown

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

Course title: Plant physiology, biochemistry and plant breeding techniques
Course ID: RUH-PBB
University: University of Ruhuna, Matara, Sri Lanka
Faculty: Science
Department: Botany
Name and e-mail address of the instructor(s): Dr. N.P. Dissanayake; Dr. KAS Kodikara (kodikara@bot.ruh.ac.lk
Course website: www.tropimundo.eu
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 15 hrs
- Exercises: 09 hrs
- Excursions : -
- Projects: 03 hrs (report)

Course objectives:

1. To provide knowledge on key physiological steering processes, biochemical interactions
2. To provide key practical skills in the fields of Plant Physiology and Biochemistry

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 explain the variations of internal water transportation under different environmental conditions, the behavior of stomatal physiology and its plasticity in response to changing environmental conditions (as a function of stomatal conductance). Also, should be able to analyze the natural variation of allelochemical profiles quantitative and qualitative changes in allelo-chemicals of some selected invasive plant species and to apply different growth hormones to improve germination, growth and the productivity in plants.

Course material, text books and further reading:

1. S.K. Singh (2009) Plant physiology, published by Campus Books International (2009)
2. V. Verma (2008), Text book of Plant Physiology, Ann Books in India (2008), Bidwell, Plant physiology , McMillan publishers, New York

Articles published in plant physiology related peer-reviewed journals

Prerequisites: please note the general comment on prerequisites
Will be of advantage to students who have studied plant sciences/biological sciences

Table of contents:

- Plant water relations
– Cell water relations,
- Soil water relations,
- Stomatal physiology,
- Mineral nutrition,
- Phloem translocation.
- Energy relations in cells and plants
- Respiration,
- Photosynthesis,
- Nitrogen metabolism, fatty acid metabolism.

- Plant growth and development – plant growth and growth measurements,
- Plant growth hormones and their applications,
- Photoperiodism and vernalization, plant movements, physiology of flowering, seed and bud dormancy
- Antioxidants and free radicals (stress physiology)
- Conventional breeding methods)
-

Assessment breakdown: please note the general comment on assessment breakdown

Oral assessment: -
Written assessment: 70 %
Projects/Presentations/Reporting: 30 %

Course title: Ecotoxicology and Environmental science
Course ID: RUH-EEC
University: University of Ruhuna, Matara, Sri Lanka
Faculty: Science
Department: Botany
Name and e-mail address of the instructor(s): Prof. Mangala De Silva
Course website: www.tropimundo.eu
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 21 hrs
- Exercises: 09 hrs
- Excursions : 06 hrs
- Projects: 03 hrs (report)

Course objectives:

1. To provide knowledge on major sources of pollution and their impacts on living environment
2. To provide knowledge on methods in assessing environmental pollution, level of toxicity etc.
3. To improve analytical thinking on different remedies over environmental pollution

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 explain major sources of pollution and their assessments. Also, to come up with different practically working remedies in mitigating level of pollution in different ecosystems.

Course material, text books and further reading:

- Spoolman BM. (2012). Environment Science, 8th Edition.
- Wright RT., Boorse DF. Environment Science towards a sustainable future, 13th Edition
- Levin SA., Harwell MA., Kelly JR., Kimball KD. (Eds.). Ecotoxicology: problems and approaches

In addition,
Articles published in peer-reviewed journals related to Environment science and Ecotoxicology

Prerequisites: please note the general comment on prerequisites
Will be of advantage to students who have studied plant sciences/biological sciences

Table of contents:

- Introduction to Ecotoxicology and environmental science (terminology and basic concepts)
- Environmental pollution and contamination (sources/Impacts/control)
- Toxicity and toxicity testing
- Fate of toxicants (under different environmental conditions)
- Bio-indicators and bio-monitoring,
- Bio-toxins (including major phyto-toxins)
- Environmental impact assessment (EIA) (with some case studies)
- Global environmental issues with special reference to Sri Lanka,
- Introduction to waste treatment methods,
- Bioremediation
- Environmental issues (local/global)
- Case studies (wetland pollutions): Kalametitya, Negombo

Assessment breakdown: breakdown Oral assessment: 30% Written assessment: 50 % Projects/Presentations/Reporting: 20 %	please note the general comment on assessment

Course title: Coastal zone management
Course ID: RUH-ECZM
University: University of Ruhuna, Matara, Sri Lanka
Faculty: Science
Department: Botany
Name and e-mail address of the instructor(s): Senior Prof. LP Jayatissa (lpj@bot.ruh.ac.lk)
Course website: www.tropimundo.eu
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 12 hrs
- Exercises: 03 hrs
- Excursions : 12 hrs
- Projects: 03 hrs

Course objectives:

1. To learn about integrated approach in coastal zone management aiming the sustainability of coastal ecosystems
2. To develop an ability to understand all the aspects related to best practices in conservation and management of coastal ecosystems.
3. To give a skill to plan an integrated management program for a coastal ecosystem/area under threat.

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

- explain the sustainable development of coastal ecosystems and follow the integrated approach in management of the coastal ecosystems which are at risk
- understand the different components of the coastal ecosystem, their functions and interactions/inter-dependence
- understand and explain the biology of coastal ecosystem and its uses and the way of maximizing the uses through integrated coastal management activities

Course material, text books and further reading:

1. Cicin-Sain, C. and Knech, R.W., Integrated coastal and Ocean management; concepts and practices, Island Press, Washington D.C.
2. White A.T., Deheregoda C.K.M., Coastal zone and fisheries management in Sri Lanka: prospects for integration. University of Jayawardenapura, Colombo, Sri Lanka
3. Coastal zone management plan, Coastal conservation and coastal resource management department, Sri Lanka
4. Yuan Li., Zhenming G., Fan X., Zhang L. (2014). Ecosystem based coastal zone management: a comprehensive assessment of coastal ecosystems in the Yangtze Estuary coastal zone. Ocean Coast Manag 95:63–71
5. Ecosystem-based and integrated coastal zone management - challenges and possibilities, Stockholm resilience centre, Sweden
6. Ecosystem based integrated coastal zone management for Tuticorin coast, Asian coast examples, India

Articles in following journals

- Journal of Wetland Ecology
- Wetland Ecology and Management

Prerequisites: please note the general comment on prerequisites
Knowledge in Ecology, and Environmental Science will be of advantage to students

Table of contents:

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 30 %
Written assessment: 50 %
Projects/Presentations/Reporting: 20 %

Course descriptions at Universiti Malaysia Terengganu (UMT)

Course title: Tropical biodiversity and ecosystems field school: Malaysian mangrove ecosystems
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) (Course coordinator)
Dr. Nursalwa Baharuddin (nursalwa@umt.edu.my)
Dr. Fatin Izzati Minhat (fatinminhat@umt.edu.my)
Dr. Siti Tafzilmeriam Binti Sheikh Abdul Kadir (sititafzil@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 students will be asked to contribute a maximum of 2000 MYR for road transport, boat rental and other logistic arrangements**.** Also, students will be asked to share the costs of their food and accommodation.

Course breakdown and hours:

- Planning and arrangements : 72 hrs
- Lecture and scientific discussions : 24 hrs
- Field excursions and exercises : 312 hrs -
  1. Hands-on module with different scientific equipment for Physico-chemical water quality, land elevation and vegetation inventory measurements
  2. Visit to mangrove charcoal production and export companies
  3. Ecotourism assessment
  4. Community based mangrove awareness program/interaction
  5. Visit to different aged mangrove stands and check for thinning and clear-felling operations
  6. Mangrove herbarium
  7. Mangrove associate fauna collection and identification (e.g. molluscs, benthic foraminifera)
  8. Cage/pond aquaculture systems, fish hatchery and commercially important fisheries
  9. Spotting of marine endangered species (e.g. dolphins)
  10. Stratigraphic analysis of the mangrove sediment
  11. Promotion of TROPIMUNDO, etc.
- Vegetation data collection from different aged stands in managed and unmanaged mangrove ecosystems: 48 hrs
- Result analyses, comprehensive report preparation and submission on time: 174 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 would 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.
Tomlinson 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) in 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)

Practical:

1. Ecotourism in mangroves
2. Observation 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. Phenology in different mangrove species
9. Mangrove species distribution vs. inundation frequency (along the river/creek)
10. Mangrove zonation
11. Exposure to Canopy cover and EarthTrack mangrove Mobile Apps.

Projects:

1. Community based mangrove awareness, interaction and management
2. Ecotourism as part of the sustainable mangrove management
3. Mangrove stakeholder analyses (perceptions, livelihood, etc.)
4. Comparison of vegetation structure and biomass between the sites with different ages
5. Comparison of mangrove fauna and its biomass between the sites with different aged forest stands
6. Remote sensing data application for mangrove monitoring, conservation and management

Assessment breakdown: please note the general comment on assessment breakdown

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

1. Student participation and attitude 10%
2. Mangrove herbarium 10%
3. Open evaluation of the Filed School report / scientific insights / Q&A 10%
4. Submission of comprehensive reports / Lab work
    i) Mangrove report (20 pages) 50%
    ii) Mollusc report (5 pages) 10%
    iii) Foraminifera lab 5%
    iv) Fishing gear experiment 5%

Course Title: Geomatics (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) (Course coordinator)
Dr. Mohammad Shawkat Hossain (shawkat@umt.edu.my)
Mr. Mohd Nasir Bin Mohamad (m.nasir@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 students will be able to:

1. recognize and explain GIS framework, cincluding map project and data models at a basic level;
2. recognize and describe principles of remote sensing, including the characteristics of electromagnetic spectrum (EM); the radiation, relfection, and scattering of EM; how EM radiation interacts with media/substances, geometries; properties of aerial photographs and imagery;
3. recognize and explain remote sensing data acquisition techniques, storage and basic processing;
4. apply statistical relationships describing computational principles related to remote sensing;
5. identify key applications of marine, acquatic and terrestrial remote sensing approaches and datasets;
6. demonstrate practical skill and conceptual understanding in using GIS and remote sensing image analysis software through lab excercises and reports;
7. describe remote sensing application and summarize methods and results in a written assignment.

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:
Part I
- 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

Part II
- Introduction to Remote Sensing
- Introduction
- Elements of Remote Sensing
- Principles of Remote Sensing
- Physical Basis of Remote Sensing
- Digital Image Processing
- Introduction
- Digital Data and Image Resolution
- Remote Sensing Data Analysis
- Digital Image Processing
- Radiometric Corrections
- Image Classification
- Remote sensing and its integration in GIS for coastal zone management
- Introduction
- Basic Map Concepts and Database Design
- Data Capture and Implementation
- Database Management
- Performing satellite image analysis for watershed management, mapping flood affected areas, monitoring environment and other coastal and marine-based applications
- Presentation of documents consisting of text, maps, graphs and tables to present the method used in data processing and findings useful for coastal zone management.

Practical:
Lab Exercises:
Part I
- Introduction to ArcGIS
- Digitizing and Georeferencing
- Forest planning for sensitive wildlife species
- Timber harvest planning using GIS

Part II
- Introduction to IDRISI
- Image enhancement
- Image rectification

- Image classification
- Ground truthing and accuracy assessment
- Change detection

Assessment breakdown: please note the general comment on assessment

Module-based assessment in the Lab (10 x 5; for 5 modules) = 50 marks
Written exam based on theory = 25 marks
Oral presentation of project group work = 25 marks

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):
Assoc. Prof. Dr. Mohd Fadzil Mohd Akhir (mfadzil@umt.edu.my) (Course coordinator)
Assoc. Prof Dr. Ong Meng Chuan (ong@umt.edu.my)
Dr. Nur Hidayah Binti Roseli (nurhidayahroseli@umt.edu.my
Dr. Nurulnadia Mohd Yusoff (nurulnadia@umt.edu.my)
Dr. Fatin Izzati Minhat (fatinminhat@umt.edu.my)
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:
- Lectures: 24 hrs
- Exercises: 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
8. Bischof, J. (2000). Ice drift, ocean circulation and climate change. Springer Science & Business Media.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Introduction to the Tropical Ocean
- Importance of Tropical Ocean Reserach
- Instrumentation for Physical Oceanography

Physical Forcing
- Air-sea interaction
- Heat budget

Ocean Circulation
- Ekman Dynamics
- Gyre Circulation
- Global Ocean conveyor belt
- Regional Current system

Upwelling Dynamics
- Large scale upwelling system
- Regional scale upwelling

South China Sea and other case studies
- Current Circulation and monsoon influence
- Influence of climate on tropical seas dynamics

Seawater chemistry in tropical sea
- Seawater composition
- Salinity variations
- Nutrient cycle
- Carbon cycle

Primary Productivity
- Productivity processes
- Distribution of primary productivity

Pollution
- Marine pollution
- Emerging pollutants
- Heavy metals pollution
- Current issues – global and Malaysia

Paleocenography
- The history Quaternary sea level
- Geological records for future predictions
- Sea level changes

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 10 %
Written assessment: 50 %
Projects/Presentations/Reporting: 40 %

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. Dr. Behara Satyanarayana (satyam@umt.edu.my) (Course coordinator)
Dr. Wan Nurzalia Wan Saelan (wannurzalia@umt.edu.my)
Dr. Izwandy Bin Idris (izwandy.idris@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 breakdown and hours:
- Lectures (in class): 28 hrs
- Exercises (practicals in the campus) : 12 hrs
- Projects (seminar, lab report preparation and submission) : 30 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
6. To share local policy enforcement and limitations for mangrove conservation in Malaysia

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:
Tomlinson 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:

2. Introduction to different estuaries and wetlands
3. Introduction to mangrove and mangrove ecosystem
4. Factors influencing the mangrove establishment and growth
5. Mangrove landforms
6. Mangrove forest categories
7. Zonation in mangrove forests
8. Mangrove distribution in Malaysia
9. Mangrove conservation and management
10. Mangrove ecosystem functions, services and its Inter-connectivity
11. Current issues on the mangrove ecosystem in Malaysia and other regions
12. Mangrove carbon sequestration and response to climate change
13. Legislation, Policy implementation and limitations for mangrove conservation and management in Malaysia
14. Research and updates

Assessment breakdown: please note the general comment on assessment breakdown

1. Lab report 10%
2. Mangrove activity with local community 30%
3. Group seminar 20%
4. Final exam 40%

TOTAL: 100%

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):
Assoc. Prof. Dr. Saifullah A. Jaaman (saifullahaj@umt.edu.my) (Course coordinator)
Assoc. Prof. Dr. Zainudin Bachok (zainudinb@umt.edu.my)
Dr. Mohd Uzair Bin Rusli (uzair@umt.edu.my)
Semester: S2
Tuition language: English
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 24 hrs
- Exercises: 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.

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. Biology of sea turtles (phylogeny, population genetics, reproduction, physiology, locomotion, migration and habitat utilization), 3 hrs
3. Research and management of sea turtle for conservation, 2 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. Perspective on coral reef, 2 hrs
12 Coral reef resilience and analysis, 2 hrs

Practical/Field work (will be conducted at Matang waters, Chagar Hutang Turtle Sanctuary and around Bidong and Redang Islands)**:**

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 Daily Boat Survey Effort Record
Iii. Marine Mammals 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 (15%)
2. Final exam (35%)
3. Report/assignments
   - Turtle (practical and field trip report) (15%)
   - Coral (practical and field trip report) (20%)
   - Marine mammal (assignment and field trip report) (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. Dr. Mhd Ikhwanuddin bin Abdullah (ikhwanuddin@umt.edu.my) (Course coordinator)
Prof. Emeritus Dr. Faizah Sharoum (faizah@umt.edu.my) (Advisor)
Dr. Nor Azman Kasan (norazman@umt.edu.my)
Dr. Chong Ju Lian (julian@umt.edu.my)
Dr. Nik Mohd Shibli Bin Nik Jaafar (nik.shibli@umt.edu.my)
Dr Bryan Raveen Nelson, a/L Nelson Bernett (bryan.nelson@umt.edu.my)
Assoc Prof. Dr Gopalasamy Reuben Clements (reubenc@sunway.edu.my)

Semester: 2
Tuition language: English
Number of credits (ECTS): 3
Important: This course may in part be taught during the fieldwork

Course breakdown and hours:

- Lectures (Classroom, 10 weeks): 20 hrs.
- Exercises (Practical): 30 hrs.
- Projects (Assignments): 16 hrs.
- Presentation (Oral): 4 hrs.

Total: 70 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 lacustrine and terrestrial ecosystem
2. Biodiversity of terrestrial and aquatic ecosystem
3. Lake carrying capacity and ecology support system
4. Lake and terrestrial conservation and management

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

None C:\Documents and Settings\Farid\My Documents\DATAVIP\BIOGRAFY\PROJECTS\INTERNATIONAL\EC\ERASMUS_MUNDUS\TROPIMUNDO_Course_List.docx - UNIFI_BIO03

Table of contents:

Lectures schedule:

No.	Lecture
1.	Introduction to course on lake and terrestrial Ecology (examination scheme and other regulations)
2.	Introduction to the history and definition of lake and terrestrial ecosystem
3.	Factors influencing lake and terrestrial ecosystem
4.	Lake research and updates
5.	Integrated catchment management: carrying capacity and issues
6.	Natural and man-made Lakes
7.	Lake stratification
8.	Terrestrial biodiversity surrounding lakes
9.	Forest conservation and management
10.	Threats to the lake and terrestrial ecosystem
11.	Lake associated fauna
12.	Large animals biodiversity, conservation and management

Assessment breakdown:

Oral assessment: 20 %

Written assessment: 40 %

Final Examination: 40 %

Course descriptions at the Unibersidad ng Pilipinas (UP)

Course title: Tropical biodiversity and ecosystems field school: Philippines' terrestrial and marine ecosystems
Course ID: BIO 397
University: University of the Philippines Diliman
Institute/College: Institute of Biology/College of Science
Name and e-mail address of the instructor(s):
Dr. Jonathan A. Anticamara (jaanticamara@up.edu.ph)
Dr. Mariano Roy M. Duya (mmduya1@up.edu.ph)
Dr. Carmela P. Española (cpespanola@up.edu.ph)
Dr. Francis S. Magbanua (fsmagbanua@up.edu.ph)
Dr. Lillian Jennifer V. Rodriguez (lvrodriguez@up.edu.ph)
Dr. Severino G. Salmo III (sgsalmo@up.edu.ph) (Course Coordinator)
Dr. Christine Jewel C. Uy-Yabut (ccuyyabut@up.edu.ph)

Semester: S2
Tuition language: English
Number of credits (ECTS): 15
IMPORTANT: The costs for the Course are in part met by the university, but students will be asked to contribute a maximum of 30,000 PHP for road transport, boat rental and other logistical arrangements. Also, students will be asked to share the costs of their food and accommodation.

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
		312					

• Planning and arrangements: 72 hrs
• Lecture and scientific discussions: 24 hrs
• Field excursions and exercises: 312 hrs
1. Hands-on module with different scientific equipment for physico-chemical water quality and vegetation inventory measurements
2. Visit to terrestrial and/or marine ecosystems
3. Ecotourism assessment
4. Community based environmental awareness program/interaction
5. Visit to terrestrial/marine protected areas
6. Terrestrial sampling (biodiversity and ecology)
7. Coastal/marine sampling (biodiversity and ecology)
8. Promotion of TROPIMUNDO, etc.

Course objectives:
- To expose the students to tropical terrestrial and/or marine environment
- To document and assess terrestrial/marine biodiversity and its associated patterns
- To test/apply ecological concepts in the field
- To document and learn sustainable/community-based management.

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

Upon completion of the course, a student would be able to:
- Become conversant with both quantitative and qualitative sampling techniques for terrestrial/marine sampling

- Assess terrestrial/marine ecosystems for conservation and restoration programs
- Provide scientific direction to the local mangrove managers and policy makers
- Formulate terrestrial/marine research and management frameworks.

References:

Alongi, D.M., 2021. Tropical marine ecology. Wiley-Blackwell, ISBN: 978-1-119-56892-6, 688p.
Goulletquer, P., Gros, P., Boeuf, G., and Weber, J., 2014. Biodiversity in the marine environment. Springer, 214 pp.
Kricher, J.C., 2011. Tropical ecology. Princeton University Press.
Mitra, A., and Zaman, S., 2016. Basics of marine and estuarine ecology. Springer (India)
Wiersma, Y.F., 2022. Experimental landscape ecology. Springer Nature Switzerland.

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. Terrestrial/marine ecology
2. Terrestrial/marine biodiversity
3. Landscape/seascape ecology
4. Conservation and restoration
5. Environmental management

Practical:

1. Field experimental design
2. Terrestrial/marine ecology sampling
3. Terrestrial/marine biodiversity assessment
4. Natural and anthropogenic disturbances
5. Ecotourism
6. Role of local communities in environmental management

Projects:

1. Comparison of vegetation structure and biomass between protected and non-protected sites
2. Comparison of faunal assemblages between conserved and disturbed sites
3. Carbon stock and sequestration assessment

Assessment breakdown: please note the general comment on assessment

Student participation + Projects/Report: 100 %

1. Student participation 10%
2. Field work/sampling 50 %
3. Submission of comprehensive field report/Lab work 40 %

Course Title: Geomatics (Remote Sensing and GIS) **– under construction pending negotiation with other institutes/colleges**
Course Id:
University: University of the Philippines Diliman
Institute/School:
Name and email of the Instructor(s):
Semester: S2
Tuition Language: English
Number of Credits (Ects): 3

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS

Course objectives:
-

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

Upon completion of the course, a student would be able to:
-

References:

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

Assessment breakdown: please note the general comment on assessment

Course Title: Biodiversity science
Course ID: BIO 397 (Special Topics)
University: University of the Philippines Diliman
Institute/School: Institute of Biology/College of Science
Name and email of the Instructors:
Dr. Jonathan A. Anticamara (jaanticamara@up.edu.ph)
Dr. Severino G. Salmo III (sgsalmo@up.edu.ph)
Semester: S2
Tuition Language: English
Number of Credits (ECTS): 3

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
24		4	24		24		

Course Objectives:
1. Describe and quantify biodiversity, its distributions, and the factors and processes that influence spatio-temporal biodiversity trends on earth.
2. Illustrate the relevance of sound biodiversity science in real world biodiversity conservation.
3. Critically evaluate current knowledge gaps in biodiversity science: biodiversity functions and services.
4. Contribute to the understanding of biodiversity patterns and processes: from past, present, and future through integrative assessment and scenario analyses.

Learning Outcomes: please note the general comment on learning outcomes
Education level: Specialized Ecosystem focus: Interactions Biological level: Ecosystem
At the end of the course the students will achieve the following:

1. Comprehensive understanding of current advances in biodiversity concepts, research, and applications (including the different causes of biodiversity change at various spatio-temporal scales and their consequences).
2. Gain familiarity of various experimental and analytical tools in biodiversity science/conservation.
3. Apply knowledge learned to develop a Special Project on a selected topic on biodiversity science/conservation in the Philippines.
4. Comprehensive understanding of biodiversity functions and services based on synthesis of recent scientific knowledge on these subjects
5. Apply knowledge learned to develop a Special Project on a selected topic on biodiversity functions and services in the context of the Philippines - the trends and plausible futures
6. Gain familiarity of the various tools, databases, and institutions that are actively being used or are engaged in biodiversity functioning.

Course materials:
Alves-Pinto, H., Geldmann, J., Jonas, H. et al. 2021. Opportunities and challenges of other effective area-based conservation measures (OECM) for biodiversity conservation. Perspectives in Ecology and Conservation, doi: 10.1016/j.pecon.2021.01.004.
Anderson, C.B. 2021. Biodiversity monitoring, earth observations and the ecology of scale. Ecology Letters 21: 1572-1585.
Groombridge, B. and Jenkins, M. 2002. World Atlas of Biodiversity. University of California Press. California.
Curry, G.B. and Humphries, C.J. 2007. Global Biodiversity Databases. CRC Press. New York.
Magurran, A.E. 2004. Measuring Biological Diversity. Taylor and Francis.

Cardinale, B.J., Duffy, J.E., Gonzalez, A., Hooper, D.U., Perrings, C., Venail, P., Narwani, A., Mace, G.M., Tilman, D. and Wardle, D.A. 2012. Biodiversity loss and its impact on humanity. Nature **486**:59-67.
Chandra, A. and Idrisova, A. 2011. Convention on biological diversity: a review of national challenges and opportunities for implementation. Biodiversity and Conservation **20**:3295-3316.
Dallimer, M., Irvine, K.N., Skinner, A.M.J., Davies, Z.G., Rouquette, J.R., Maltby, L.L., Warren, P.H., Armsworth, P.R. and Gaston, K.J. 2012. Biodiversity and the feel-good factor: understanding associations between self-reported human well-being and species richness. BioScience **62**:47-55.
Ellwood, E.R., Sessa, J.A., Abraham, J.K., et al. 2021. Biodiversity science and the twenty-first century workforce. BioScience 70(2): 119-121.
Giam, X., Ng, T,H., Yap, V.B. and Tan, H.T.W. 2010. The extent of undiscovered species in Southeast Asia. Biodiversity and Conservation **19**:943-954.
Heller, N.E. and Zavaleta, E.S. 2009. Biodiversity management in the face of climate change: a review of 22 years of recommendations. Biological Conservation **142**:14-32.
Hooper, D.U., Adair, E.C., Cardinale, B.J., Byrnes, J.E.K., Hungate, B.A., Matulich, K.L., Gonzalez, A., Duffy, J.E., Gamfeldt, L. and O'Connor, M.I. 2012. A global synthesis reveals biodiversity loss as a major driver of ecosystem change. Nature **486**:105-108.
Jung, M., Arnell, A., de Lao, X., et al. 2021. Areas of global importance for conserving terrestrial biodiversity, carbon and water. Nature Ecology and Evolution, doi: 10.1038/s41559-021-01528-7
Kursar, T.A. 2011. What are the implications of the Nagoya Protocol for research on biodiversity? BioScience **61**:256-257.
Lane, D.J.W. 2010. Tropical islands biodiversity crisis. Biodiversity and Conservation **19**:313-316.
Levin, P.S., Kaplan, I., Grober-Dunsmore, R., Chittaro, P.M., Oyamada, S., Andrews, K. and Mangel, M. 2009. A framework for assessing the biodiversity and fishery aspects of marine reserves. Journal of Applied Ecology **46**:735-742.
Mace, G,M., Norris, K. and Fitter, A.H. 2011. Biodiversity and ecosystem services: a multilayered relationship. Trends in Ecology & Evolution **27**:24-31.
Magurran, A.E., Baillie, S.R., Buckland, S.T., Dick, J.M.P., Elston, D.A., Scott, E.M., Smith, R.I., Somerfield, P.J. and Watt, A.D. 2010. Long-term datasets in biodiversity research and monitoring: assessing change in ecological communities through time. Trends in Ecology & Evolution **25**:574-582.
Maron, M., Juffe-Bignoli, D., Krueger, L., et al. 2021. Setting robust biodiversity goals. Conservation Letters. e12816.
Midgley, G.F. 2012. Biodiversity and Ecosystem Function. Science **335**:174-175.
Mittermeier, J.C., Correia, R., Grenyer, R., Toivonen, T., and Roll, U. 2021. Using Wikipedia to measure public interest in biodiversity and conservation. Conservation Biology 35(2): 412-423.
O'Connor, M., Mori, A.S., Gonzalez, A., et al. 2021. Grand challenges in biodiversity - ecosystem functioning in the era of science-policy platforms require explicit consideration of feedbacks. Proceedings of the Royal Society B 288: 20210783.
Pandit, R., Laband, D.N. 2009. Economic well-being, the distribution of income and species imperilment. Biodiversity and Conservation **18**:3219-3233.
Pata, P.R. and Yñiguez, A.T. 2021. Spatial planning insights for Philippine coral reef conservation using larval connectivity networks. Frontiers in Marine Science 8: 719691.
Reyers, B., Polasky, S., Tallis, H., Mooney, H.A., Larigauderie, A. 2012. Finding common ground for biodiversity and ecosystem services. BioScience **62**:503-507.
Sodhi, N.S., Posa, M.R.C., Lee, T.M., Bickford, D., Koh, L.P. and Brook, B.W. 2010. The state and conservation of Southeast Asian biodiversity. Biodiversity and Conservation **19**:317-328.

Prerequisites: please note the general comment on prerequisites
None

Table of contents:

D. Biodiversity in Marine, Inland Waters, and Terrestrial Ecosystems
II. Biodiversity Conservation:
A. Biodiversity and Society/Policy
B. Biodiversity Conservation Approaches
C. Assessment/Monitoring of Biodiversity Conservation
D. Challenges and Opportunities in Biodiversity Conservation Program
III. Biodiversity Functions, Services, and Databases
A. Biodiversity Functions
B. Biodiversity Services
D. Global Biodiversity Databases
E. Long-Term Biodiversity Monitoring and Networks

Assessment Breakdown: please note the general comment on assessment
Discussion/reports, 30%
Participation in class discussions, 10%
Written research proposal, 30%
Written research paper, 30%

Course Title: Restoration ecology
Course ID: BIO 397 (Special Topics)
University: University of the Philippines Diliman
Institute/School: Institute of Biology/College of Science
Name and email of the Instructors:
Dr. Jonathan A. Anticamara (jaanticamara@up.edu.ph)
Dr. Francis S. Magbanua (fsmagbanua@up.edu.ph)
Dr. Severino G. Salmo III (sgsalmo@up.edu.ph)
Semester: S2
Tuition Language: English
Number of Credits (ECTS): 3

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
24		12	24		24		

Course objectives:
To understand basic concepts about restoration ecology and the practice of ecological restoration.

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

Upon completion of the course, a student would be able to:
- Explain the basic theoretical underpinnings of restoration ecology.
- Distinguish the various ecological principles (from population biology, community ecology, soil science, ecosystem ecology, and landscape/seascape ecology) used to inform ecological restoration.
- Explain the role and value of science in restoration ecology/ecological restoration, including the use of reference ecosystems as endpoints for ecological restoration.
- Discuss current and future research foci and needs in restoration ecology/ecological restoration (as inputs to restoration planning).
- Constructively critique the methods, results, and interpretation of scientific publications (as inputs to restoration planning).

References:
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Dickens, S.J.M., Mangla, S., Preston, K.L., and Suding, K.N. 2016. Embracing variability: environmental dependence and plant community context in ecological restoration. Restoration Ecology 24(1): 119-127.

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Holl, K.D. 2020. Primer of ecological restoration. Island Press, Washington DC, USA. 219 pp.

Holle, B., Yelenik, S., and Gornish, E.S. 2020. Restoration at the landscape scale as a means of mitigation and adaptation to climate change. Current Landscape Ecology Reports 5: 85-97.

Hughes, A.R., Grabowski, J.H., Leslie, H.M., Scyphers, S., and Williams, S.L. 2017. Inclusion of biodiversity in habitat restoration policy to facilitate ecosystem recovery. Conservation Letters 11(3): 1-8.

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Miller, J.R., and Hobbs, R.J. 2007. Habitat restoration: do we know what we're doing? Restoration Ecology 15(3): 382-390.

Palmer, M.A, Zedler, J.B., and Falk, D.A. (eds.). 2016. Foundations of restoration ecology. 2nd ed. Island Press, Washington DC, USA. 584 pp.

Perring, M.P., Standish, R.J., Price, J.N. et al. 2015. Advances in restoration ecology: rising to the challenges of the coming decades. Ecosphere 6(8): 131.

Pittman, S.J., Yates, K.L., Bouchet, P.J., et al. 2021. Seascape ecology: identifying research priorities for an emerging ocean sustainability science. Marine Ecology Progress Series 663: 1-29.

Reinke, B.A., Miller, D.A.W., and Janzen, F.L. 2019. What have long-term field studies taught us about population dynamics? Annual Review of Ecology, Evolution, and Systematics 50: 261-278.

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Rebugio, L.L. et al. 2007. Forest restoration and rehabilitation in the Philippines. In D.K. Lee (Ed.), Keep Asia Green Volume I "Southeast Asia". IUFRO World Series Volume 20-I. Vienna, 241 p.

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Prerequisites: please note the general comment on prerequisites

None

Table of contents:

Assessment breakdown: please note the general comment on assessment

Discussion/reports, 30%
Participation in class discussions, 10%
Written research proposal, 30%
Written research paper, 30%

Course Title: Advanced Ecology
Course ID: BIO 260
University: University of the Philippines Diliman
Institute/School: Institute of Biology/College of Science
Name and email of the Instructors:
Dr. Jonathan A. Anticamara (jaanticamara@up.edu.ph)
Dr. Francis S. Magbanua (fsmagbanua@up.edu.ph)
Dr. Severino G. Salmo III (sgsalmo@up.edu.ph)
Semester: S2
Tuition Language: English
Number of Credits (ECTS): 3

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
24		12	24		24		

Course objectives:
This course will provide students with (1) insights and understanding of current themes and developments in ecological research that would enable them to discuss these insights in a broader context, (2) skills in the methodological and statistical approaches and technological developments in the field of ecology, (3) ability to discuss and interpret ecological research at a higher level, and (4) knowledge and skills in designing their own ecological research.

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

Upon completion of the course, a student would be able to:
- Discuss foundational concepts and seminal papers in ecology;
- Integrate ecological concepts and principles to solve environmental problems;
- Analyze and critically evaluate evidence and conclusions in the primary literature;
- Lead and facilitate discussions;
- Formulate and communicate constructive feedback on a peer's work;
- Design, execute, and complete an independent, hypothesis-driven study in ecology; and
- Develop scientific writing and presentation skills.

References:
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van Heezik, Y., & Brymer, E. (2018). Nature as a commodity: What's good for human health might not be good for ecosystem health. Frontiers in Psychology, 9.

Woodbridge, J., Fyfe, R., Smith, D., Pelling, R., de Vareilles, A., Batchelor, R., . . . Davies, A. L. (2021). What drives biodiversity patterns? Using long-term multidisciplinary data to discern centennial-scale change. Journal of Ecology, 109(3), 1396-1410. https://doi.org/10.1111/1365-2745.13565

Woodruff, D. S. (2010). Biogeography and conservation in Southeast Asia: how 2.7 million years of repeated environmental fluctuations affect today's patterns and the future of the remaining refugial-phase biodiversity. Biodiversity and Conservation, 19(4), 919-941. doi:10.1007/s10531-010-9783-3

Prerequisites: please note the general comment on prerequisites

None

Table of contents:

Assessment breakdown: please note the general comment on assessment

2 Long Exams	30% (15% each)
Student-led discussions	10%
Attendance & participation in class discussions	15%
Weekly summary of peer-reviewed papers	10%

Special project:	
-proposal	5%
-progress report	5%
-oral presentation	10%
-final written report	15%

Course descriptions at the Université de la Nouvelle Calédonie (UNC)

Course title: Tropical biodiversity and ecosystems field school: biodiversity and habitats of the South-Pacific archipelago of New-Caledonia
Course ID: TROPIMUNDO
University: University of New-Caledonia
Faculty: Sciences and Technologies
Department: Biology and Ecology
Name and e-mail address of the instructor(s):
Course website: www.unc.nc (MOOLE/ MASTER SDSS).
Semester: 2
Tuition language: English
Number of credits (ECTS): 15
IMPORTANT: The costs for the Course are in part met by the University, but students might be asked to contribute a maximum of 30,000 CFP for road transport, boat rental and other logistic arrangements**.** Also, students will be asked to share the costs of their food and accommodation.

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
30			80		20		

Course objectives:
In this field school the undergraduate students will discover an overview of the main aquatic and terrestrial ecosystems of New-Caledonia. This archipelago of the southern Pacific Ocean is exceptional either for its threaten biodiversity (2nd hotspots in species number), its variety of ecosystems resulting of its complex geological history, and for its lagoon classified at the World Heritage Site (UNESCO). In addition to unique ecosystems, like the mining maquis or more generally all the New Caledonian lateritic environment, this archipelago hosts all the specific environmental and biological features of the Insular Pacific Region that are however stressed by the anthropogenic and extensive mining activities. Accordingly, this course comprises lectures dedicated to the biogeographic, evolutionary and specificities of the New-Caledonian ecosystems, knowledges that will be put in perspective with the geological substrate and geomorphological originalities of their immediate environment. The influence of mining and anthropogenic activities on these ecosystems, but also its counterpart, the ecosystems restauration, will also be discussed. This course will also include a two weeks field training highlighting the distinct environmental settings of New Caledonia, biocenotic structure, ecological functioning, and ecosystem resilience in response to natural or anthropogenic disturbances in New-Caledonia.

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 :
- have an overview of the different ecosystems of New-Caledonia and to :
- Master ecological knowledge on tropical island ecosystems and lateritic environments
- Analyse the links between the environmental characteristics of a tropical region and its ecosystems functioning
- Design and implement field protocols for biodiversity assessment and management

Course material, text books and further reading:

Will be available on the Master's WEBSITE (MOODLE).

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

Table of contents:

Theory (lectures):
- Characterization of the main New Caledonian ecosystems

Practicals:
Two-weeks teambuilding training sessions (field and lab) on various New-Caledonian ecosystems:
- coral reefs and lagoon environment,
- coastal and mangroves,
- terrestrial including mining maquis, lateritic environments, humid and dry forest, bush-like environments;

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

Course title: Geomatics (Digital mapping and remote sensing)
Course ID: CCSE-UE8 – EC 7.2
University: New-Caledonia
Faculty: Sciences
Department: Sciences and Technologies
Name and e-mail address of the instructor(s): Pascal DUMAS (pascal.dumas@unc.nc)
Course website: www.unc.nc (MOOLE/ MASTER SDSS).
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

- Lectures: 18 hrs
- Exercices: hrs
- Excursions /practical work: 16 hrs
- Projects: 0 hrs

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
18	16		16				

Course objectives: Digital mapping: Assimilate the basics of cartography, know the semantics use for the creation of cards and knowing how to visualize a message obtained thanks to a system geographic information.
Remote sensing: Know the characteristics of the aerospace images available and their application areas. Present the basic techniques of digital processing of pictures. **Digital mapping:** Be able to design a cartographic product from databases geographical.**Remote sensing:** Present the basic techniques of digital processing of images and particularly the tools most commonly used to improve the image (contrast, noise), detect and recognize the main structures that make up (outlines, textures, areas).

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

Present an overview of the techniques used in the field of digital mapping, remote sensing, digital mapping (acquisition, processing and use);

Course material, text books and further reading: powerpoint presentations
Will be available on the Master's WEBSITE (MOODLE).

Prerequisites: please note the general comment on prerequisites
None

Table of contents:
Digital mapping: Cartographic representation, Traditional representations of relief, The fourth dimension of the card, Writing and positioning, Project or production management,Application Specifications, Cartographic Design, Specifications, The Chain of digital cartography from data acquisition to printing.
Remote sensing : Physical bases of remote sensing, reflectance, backscattering, Notions on sensors: spectral resolution, spatial resolution, temporal resolution, aerial photographs, space images, processing of

optical satellite images, radar systems (notions of synthetic aperture images and scatterometer), signatures spectral and temporal.
Specific remote sensing applications: radar image processing, image geometry, multi-spectral image classification, 3D reconstruction.
General thematic applications (agriculture, forestry, coastline, urban planning, natural environments, epidemiology and health, geomorphology, etc.).

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

Course title: Stratégies d'échantillonnage environnemental et apprentissage du logiciel "R"
Course ID: CCSE-UE2 – EC 5.1
University: New-Caledonia
Faculty:
Department: Sciences and Technologies
Name and e-mail address of the instructor(s): Laurent Wantiez, Guillaume Wattelez, Maximillien Mathian, France Pattier, Michael Meyer (laurent.wantiez@unc.nc; guillaume.wattelez@unc.nc; maximilien.mathian@unc.nc; france.pattier@unc.nc; michael.meyer@unc.nc)
Course website: www.unc.nc (MOOLE/ MASTER SDSS).
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
14		10			4		

Course objectives: Develop your ability to analyze environmental data

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

Upon completion of the course a student must be able to analyse some qualitative and quantitative data: statistical techniques relevant to the analyzes, factorials, multiple correspondence analyses.

Course material, text books and further reading: powerpoint presentations
Will be available on the Master's WEBSITE (MOODLE).

Prerequisites: please note the general comment on prerequisites
Basics knowledge in statistics

Table of contents:
Environmental sampling strategies (with Biology or Geology TP data); multivariate data analysis and processing; learning and use of R
*This subject will include a tutored project (4H) to be submitted in English in the form of a poster and/or oral communication using the TP data sampled in CE 4.2.

Assessment breakdown: please note the general comment on assessment breakdown
Oral assessment: 20%
Written assessment: 80 %
Projects/Presentations/Reporting: %

Course title: Analyse et traitement de données environnementales multivariées
Course ID: Elément constitutif 5.2 (EC 5.2)
University: University of New-Caledonia
Faculty: Sciences
Department: Sciences, Technologies & Health
Name and e-mail address of the instructor(s): Pr Nazha SELMAOUI-FOLCHER (nazha.selmaoui@unc.nc)
Course website: www.unc.nc
Semester: S2
Tuition language: French
Number of credits (ECTS): 3

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
12	14						

Course objectives:
Learn techniques for analyzing qualitative and quantitative data (discrete or continuous)

Learning outcomes : please note the general comment on learning outcomes
Education level: M1 Ecosystem focus: Methods and tools Biological level: Ecosystems

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

Course material, text books and further reading:
Online course material

Prerequisites: please note the general comment on prerequisites
Basics knowledge in statistics

Table of contents:
Quantitative data analysis: univariate and multivariate analysis, regression and linear multiple autoregression. Principal component analysis, discriminant analysis and classification.

Qualitative data analysis: statistical techniques based on factorial analysis, multiple correspondence analysis.

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

Course title: Pacific studies and gender perspectives
Course ID: DDPS 2
University: University of New-Caledonia
Faculty:
Department: Sciences and Technologies
Name and e-mail address of the instructor(s): Valerie Burtet (valerie.burtet@unc.nc)
Course website: www.unc.nc (MOOLE/ MASTER SDSS).
Semester: 2
Tuition language: English
Number of credits (ECTS): 4

Course breakdown and hours:

Theoretical lectures	Practical training	Exercices	Excursions	Internships	Projects	Seminars	Personal assignments
THE	TP	EX	EXC	STG	PRJ	SEM	PRS
40							

Course objectives:
Developping a common pacific vision and culture

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 :
- have an overview of the different pacific nations, organisations, populations and culture/custody.

Course material, text books and further reading:
Will be available on the Master's WEBSITE (MOODLE).

Prerequisites: please note the general comment on prerequisites
Basics knowledge in statistics

Table of contents:
- Diversity and complexity of the island states and territories of the Pacific region.
- The Contemporary Pacific: Society, Politics and Development;
- Main challenges that Pacific populations are facing in regard to SustainableDevelopment

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

Course descriptions for courses common to Université Libre de Bruxelles (ULB), Vrije Universiteit Brussel (VUB), Sorbonne Université (SU), Muséum National d'Histoire Naturelle (MNHN), Università degli Studi di Firenze (UNIFI), Université de Guyane (UdG), Université des Antilles (UdA), Université de La Réunion (UNIRé) and Université de la Nouvelle Calédonie (UNC) and related to the Master Thesis

Course title: Thesis research proposal
Course ID: BIOL-Y-119
University: ULB, VUB, SU, MNHN, UNIFI, UdG, UdA, UNIRé & UNC
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: https://www.ulb.be/fr/programme/m-biore#programme
Semester: S2
Tuition language: English
Number of credits (ECTS): 3
Important notice:
The thesis research proposal is due by the end of S2 but there is no *a priori* relationship between the thesis research proposal and the S2 country or S2 institute. As will be explained upon your arrival, the thesis research 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: 36 h

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.
A Thesis Research Proposal template is provided along with Thesis Guidelines.

Assessment breakdown: please note the general comment on assessment breakdown
100% Scientific presentation exercise (oral presentation and/or written document)

Course title: Masters thesis
Course ID: MEMO-F538
University: ULB, VUB, SU, MNHN, UNIFI, UdG, UdA, UNIRé & UNC
Faculty: Sciences
Department: Biology / Natural sciences
Name and e-mail address of the instructor(s): Supervision by selected teaching staff members.
Course website: https://www.ulb.be/fr/programme/m-biore#programme
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 research 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: 360 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
McNeill, J., F. Benitez-Capistros, F. Dahdouh-Guebas, E. Deboelpaep, J. Hugé, N. Mukherjee, T. Van der Stocken, K. Van Puyvelde & N. Koedam, **2024**. Living the viva: the oral examination in practice. *International Journal of Educational Methodology* 10(4): 629-643. https://doi.org/10.12973/ijem.10.4.629.
Peer-reviewed scientific papers in the field of the thesis.

Prerequisites: please note the general comment on prerequisites
S2 course Thesis research 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
70% Scientific mark (incl. oral defence and response to questions)
30% Written form and style
The oral form and style will be evaluated under Scientific Presentations Skills and Career Planning (BIOL-F537).