Social-ecological systems

Lecturer
Farid DAHDOUH-GUEBAS (Coordinator)

Course mnemonic
BIOL-F4005

Language(s) of instruction
English

Course period
First term

Campuses
Plaine and Outside campus ULB

Course content

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

Part A: Biocomplexity and Systems Ecology

Understanding change and ecosystem management:

- definitions linked to SES, systems ecology and adaptive cycles;
- ecosystem services.

Social-ecological change, governance and stewardship:

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

Objectives (and/or specific learning outcomes)

1. To provide an overview of complexity in biology from the level of organisms and their constituents to large-scale social-ecological systems (SES);

2. To understand diversity, redundance, stability, hysteresis and resilience in a functional ecological context;

3. To understand the ecological and social-ecological functioning of a global series of communities and ecosystems;

4. To understand the mangrove ecosystems as a model SES, incl. its constituents, ecology, natural and anthropogenically-induced dynamics, restoration, management and governance incl. scientific methods to monitor these.

Upon completion of the course a student must be able

i. to situate organisms into their wider functional framework (community/ecosystem/Earth system);

ii. be able to critically assess their resilience in view of natural or anthropogenic change;

iii. to track down the ecological consequences on different sublevels (environment, fauna and flora) of anthropogenically induced changes on a focus SES;

iv. be able to situate environmental chalenges in a holistic context (relationship with socio-economical factors, governance).

Teaching method and learning activities

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

Part A: Biocomplexity and Systems Ecology

Understanding change and ecosystem management

Social-ecological change, governance and stewardship

Ecological and socio-ecological individual-based models

Complexity at several levels in biology and ecology

Mathematical basis for understanding complexity and change

Dryland systems

Forest systems

Freshwater systems

Oceans and estuarine systems

Part B: Integrated Coastal Zone Management

The mangrove forest as a SES , describing constituents and relationships), the links with man and integrated research.

Part B I – Mangrove forests and adjacent systems and their biocomplexity: distribution of mangrove forests and adjacent systems;faunal and floral biodiversity, incl. morphological, physiological and ethological adaptations to tropical environments and to intertidal and marine life;comparison of ecosystem function between mangrove forestsand adjacent systems;ecological mutual benefits between the tropical (coastal) ecosystems;food webs and trophic relationships.

Part B II – Ethnobiology/Socio-ecology and anthropogenical impacts on SES: spatial structures and natural dynamics; social, economical and cultural value and mangrove SES; anthropogenically induced threats on one or more ecosystems and the consequences for the other ecosystems; local vs. global patterns of change.

Part B III – Scientific research tools and approaches to study SES: monitoring, modelling and experiments (incl. management, restoration and conservation);the use of remote sensing and geographic information systems;combinatory and multivariate analyses;essentials of sustainable tropical habitat management: case-studies and management guidelines with respect to tropical ecosystems

Contribution to the teaching profile

Human-environment interactions

References, bibliography and recommended 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.

[[table]]

- **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

Course notes

Université virtuelle

Other information

Place(s) of teaching

Plaine and Outside campus ULB

Contact(s)

Prof. Dr. Farid DAHDOUH-GUEBAS

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Evaluation method(s)

Other

Evaluation method(s) (additional information)

Oral and/or written assessment: 60% (theory, paper discussion, model discussion)

Group projects and participation: 40%

Practical exercises or excursions are assessed through continuous evaluation.

N.B. Excursions might be organised during buffer weeks (semaines tampon), holiday periods or public holidays. Students are requested to contact the professor at the onset of the semester to know the dates of the excursion.

Determination of the mark (including the weighting of partial marks)

Oral and/or written assessment: 60% (theory, paper discussion, model discussion)

Group projects and participation: 40%

Practical exercises or excursions are assessed through continuous evaluation.

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the faculty of Sciences

MA-BIOR | Master in Biology of Organisms and Ecology | finalité Research/unit 1, finalité Research/unit 2 and finalité Erasmus Mundus Joint Master Degree in Tropical Biodiversity and Ecosystems - TROPIMUNDO/unit 1, MA-ENVI | Master in Environmental Science and Management | finalité Management of the environment/unit 2, finalité Environmental Science/unit 1 and finalité Environmental Science/unit 2 and MA-IRBA | Master in Agricultural Bioengineering | finalité Professional/unit 2

Programmes proposing this course at the Brussels School of Engineering

MA-IRBA | Master in Agricultural Bioengineering | finalité Professional/unit 2