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

Other information

Place(s) of teaching

Plaine and Outside campus ULB

Contact(s)

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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