Course Specifications

Valid as from the academic year 2013-2014

Ecosystem Dynamics (C003322)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0 **Study time 150.0 h** **Contact hrs** 50.0 h

Course offerings and teaching methods in academic year 2013-2014

A (semester 1)	lecture	20.0 h
	seminar: coached exercises	30.0 h

Lecturers in academic year 2013-2014

Verleyen, Elie	WE11	lecturer-in-charge
Verschuren, Dirk	WE11	co-lecturer
Vyverman, Wim	WE11	co-lecturer

Offered in the following programmes in 2013-2014	crdts	offering
Master of Science in Biology	5	A

Teaching languages

English

Keywords

paleoecology, biogeography, migration, extinction, speciation, tectonics, glacial-interglacial cycles, succession, disturbance, alternative stable states, global change, phenology, invasive species

Level

advanced

Position of the course

This course is organized within the framework of the major Global Change Ecology (Master in Biology) and builds on the competences and knowledge obtained within the courses ‘Ecology (1Ba)’, ‘Biogeography (2Ba)’ and ‘Community and Systems Ecology (3Ba)’. Students will obtain a thorough understanding of the nature of long-term and short-term processes and their effect on population cycles, the structure and functioning of ecosystems, the distribution of biota and the biotic components of biogeochemical cycles. The role of long-term processes such as glacial-interglacial cycles, tectonics and climate changes in structuring biogeographic patterns, speciation and extinction and the interaction between humans and their environment during the quaternary will be discussed. The history of the Earth’s biosphere will form the temporal framework. Short-term processes that will be dealt with are disturbance, catastrophes and global change and their effect on the succession of natural communities, population dynamics of invasive species, the occurrence of alternative stable states and the phenology of biota.

Contents

1 Introduction to concepts and models
  a. Ecosystems as complex adaptive systems
  b. Stable states and complexity
  c. Non-linear ecosystem dynamics: population cycles, disturbance (e.g. fires), catastrophes (e.g.
climate extremes and hurricanes), tipping points and alternative stable states
  d. Deterministic chaos and bifurcations
  e. The space-time continuum and ecological dynamics
2 Temporal dynamics of ecosystems on time scale ranging from 1.10^4 to 1.10^6 years
  a. Paleoecology and climate of the past, the evolution of the biosphere and biosphere-geosphere

interactions since the origin of the Earth and its oxygen containing atmosphere
b. Long-term dynamics of terrestrial and marine biomes
c. The interaction between large-scale changes in ecosystems and biogeochemical cycles

3 Temporal dynamics of ecosystems on time scales between 1.10^2 and 1.10^4 years
a. Overview of the climate, paleoecology and ecosystem dynamics during the Quaternary
b. Migration and colonization on a regional and continental scale; glacial (micro- and cryptic) refugia
c. Late Quaternary history of ecosystems in western Europe
d. The interplay between the concentration of greenhouse gasses and ecosystems during glacial-
interglacial cycles
e. The interplay between humans and nature

4 Temporal dynamics of ecosystems on a time-scale between 10s to 100s of years
a. Interactions between rare disturbances, natural succession and metapopulation dynamics
b. Re-organisation of stable states

5 Temporal dynamics of ecosystems on time scale between 0 and 10 years
a. Phenology
b. Food webs and plant animal interactions
c. Migration and invasive species

6 The prediction of ecosystem changes in response to future global change scenarios

Initial competences

Passed the exams of ‘Ecology (Ba1)’, ‘Biogeography (2Ba)’ and ‘Community and systems ecology (3Ba)’ or obtained the relevant knowledge within similar courses

Final competences

- Demonstrating an advanced knowledge on the causes and timing of Quaternary climate changes (natural and anthropogenic) in relation to the long-term history of the biosphere.
- Demonstrating an advanced insight into the importance of (non-linear) temporal dynamics for ecosystem processes, the distribution and evolution of biota and the biotic components of biogeochemical cycles on time scales ranging from hours to millions of years.
- Demonstrating an advanced knowledge on the historical interactions between humans, climate and nature.

The following numbers refer to the program specific learning outcomes master Biology that are being evaluated directly or indirectly within this course: OLR 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 15, 19, 21, 22 and 23.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Guided self-study, lecture, practicum, self-reliant study activities, seminar: coached exercises

Learning materials and price

Powerpoint slides and a selection of supporting scientific publications

References

‘The Holocene: an environmental history’ by Neil Roberts (Blackwell, 1998, ISBN 0-631-18638-7).

Course content-related study coaching

Individual feedback with lecturers, directed PC excersises practical courses with time for interaction between the student and the supervisor

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Participation, assignment, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

Questions regarding the knowledge and insights in the course content during the periodic exam and evaulation of the report for the non-periodic evaluation. Permanent evaluation during the practical courses.

Calculation of the examination mark

75% exam and 25% non-periodic evaluation