
Environmental Modelling

Lecturers/Instructors: Viktor Lagutov

Credits: 2

Duration: 11 weeks (January-March)

Software: STELLA, TBA packages for the case studies

Number of students: 10

Pre-requisites: This course builds on student's own environmental background and some basic mathematical skills. No prior training in math is required.

Course e-learning site: <http://ceulearning.ceu.edu>

Course Description:

The aim of the course is to introduce the idea, methodology and basic tools of environmental modeling. Models are important tools in environmental studies and management nowadays. In order to better understand environmental systems, to predict their behaviour and to develop effective management strategies it is necessary to bring together ecological, socio-economic and technological aspects of environmental problems. Modeling enables such an interdisciplinary analysis by both quantitative and qualitative techniques. Modeling is also used to stimulate consensus-building among various experts/stakeholders and to communicate scientific results to decision-makers in explicit and comprehensible manner. Different modelling approaches will be discussed during the course. The primary attention will be given to process-based simulation and system dynamics as well as scenario development and analysis.

Learning Outcomes

By the end of the course students should

- understand the role of modeling in environmental sciences and management, it's advantages and limitations;
- be familiar with main principles and approaches to modeling of environmental systems;
- be able to develop a process-based environmental model using STELLA package;
- formulate and analyse management strategies and scenarios.

Learning activities/teaching methods:

This course consists of laboratory-based lectures, readings, in-class exercises, homeworks, individual consultations and a major project (assignment). The course is based on "learn-by-doing" approach: basic ideas presented by instructors should be accompanied by substantial students' individual work. Students will develop understanding of complex environmental systems by constructing their own models using STELLA software. This user-friendly visual modelling package allows non-programmers and non-mathematicians to develop and run environmental models. Models could be based upon previous students' academic and professional background and can be used for thesis projects and other assignments.

Educational activities, assessment and estimated workload

Learning outcomes	Assessment	Educational activities	workload, h
Introduction to environmental modelling	Class participation; Exercises	laboratory-based lectures, discussions; readings	6
Modelling case studies	Class participation	discussions	4
Introduction to STELLA software package	Class participation; Exercises	laboratory-based lectures	20
Practical modeling skills	Home works	laboratory -based lectures, In-class exercises and tutorials, Homeworks,	30
Applying modeling skills and methods to environmental problems	Project presentation	Individual work on modelling course project and consultations; Public project defence	50
Critical assessment	Peer-to-peer projects' assessment	Individual project critical assessment	10
Total hours			120

Key topics

Modeling in environmental sciences and management; Types of models; Introduction to STELLA software package; Population modeling; Modeling of material flows through the systems (pollutants transfer, etc); Modeling of cycles in nature (carbon cycle, etc); Causal diagrams; System Dynamics; Positive and negative feedback loops

Grading policy: 20% homework, 70% final project; 10 % critical assessment

Assignment

The final project is 1) to develop a model of some environmental problem/system using STELLA software; 2) to develop and test alternative management/development scenarios; 3) interpret the obtained results.

The critical assessment involves conducting peer-review of projects submitted by other students. The course structure encourages students to start working on the final assignment through a series of home exercises.

Limitations: The number of students is limited to 10.

Readings

- Michael L. Deaton, James Winebrake (2000). Dynamic Modeling of environmental systems. New York: Springer
- Andrew Ford (1999) Modelling the Environment. Island Press
- Owen-Smith, R. Norman. (2007) Introduction to modeling in wildlife and resource conservation. Blackwell Publishing
- STELLA manual
- Journal "Environmental Modeling and Simulation" (1996-2013) available at the CEU Library