



Summer School

Agent-based modelling in ecology – a basic introduction to model development in C++ and ALMaSS

Coimbra, Portugal 28th September – 9th October 2015

cfe.uc.pt/courses/



Department of Life Sciences – University of Coimbra



Centre for Functional Ecology



Instituto do Ambiente Tecnologia e Vida



AARHUS
UNIVERSITY

Department of Bioscience, Denmark

Aims:

This course aims to provide participants with the basic skills to be able to construct ecological agent-based models using object-oriented programming methodology in a standard programming environment (C++). The skills learned will be transferable to any ecological or behavioural agent-based modelling domain. This is very much a hands-on course with the focus on getting a basic introduction to using professional software development environments to create agent-based simulation models from scratch.

The course is targeted towards scientists and post-graduate students who want to develop their own agent-based models. C++ programming experience is not necessary to join the course, but some basic programming knowledge is expected.

Fees and Registration:

Registration fee – 500 €

Limited to 15 participants

Fees include attendance, course material and coffee breaks (does not include lunches)

Registration at: cfe.uc.pt/courses/



Programme:

The course is composed of lectures, as well as hands-on practical model development:

T1) Topics for ABMs & examples in Ecology: Introduction to ABMs; Types of ABMs and approaches; Examples of ABMs in ecology; Key issues with ABMs (space/time/feedbacks/complexity); Social-ecological systems simulation.

T2) Topics for ABM development: Model design; The Modelling Cycle; Pattern-oriented modelling and model testing; Model communication, documentation and code sharing; Sensitivity/uncertainty; Programming tools (compilers, SVN, structural tests);

T3) Topics in programming (C++): Basic C++; Object-oriented programming;

Practical: Covers using tools and approaches for building models during development of an agent-based model within the ALMaSS framework. Morning lectures will provide the theoretical and practical information necessary to make progress in developing models in the afternoon.

See detailed programme in the next pages

Complementary information

Participants should bring their own lap-top. This machine will be used to run powerful compilation programs and models and should be as fast with as much RAM as possible. The better this machine is the more easily the practical exercises will run.

Prior to the course downloading and installation instructions will be provided for obtaining a compiler, documentation tools, the libraries used to build ALMaSS and the ALMaSS code to run the practical. C++ experience is not necessary, but some programming experience will be necessary (e.g. R, Basic, Java or NetLogo), such that the basic concepts of variables, program control loops and conditional statements are already understood. Familiarity with statistical and graphing software (such as Excel or 'R') will be needed to evaluate and present model test results.

Organization:



Centre for Functional Ecology



INSTITUTO DO AMBIENTE
TECNOLOGIA E VIDA



Department of Life Sciences - University of Coimbra

Coordination:

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DETAILED PROGRAMME:

WEEK 1 - Key concepts, starting with OOP, first ALMaSS model steps

Lecturers:

Chris Topping, Department of Bioscience, University of Aarhus, Denmark

Lene Jung Kjær, Reto-Moto, Copenhagen, Denmark

Week 1	Morning	Afternoon
Monday 28 th September	9:30 – 12:30 <ul style="list-style-type: none"> Welcome Introduction the course ABM introduction Introduction to the compiler and other tools needed to build models 	14:00 – 17:30 <ul style="list-style-type: none"> First steps with ALMaSS and model design A basic ABM population set-up – starting to write and build code
Tuesday 29 th September	9:00 – 12:30 <ul style="list-style-type: none"> Modelling and programming, SVN Variables, pointers Loops and control structures 	14:00 – 17:30 <ul style="list-style-type: none"> Practical model development part 1 – implementing the prey population
Wednesday 30 th September	9:00 – 12:30 <ul style="list-style-type: none"> Languages: OOP vs structured Classes, data hiding and access Inheritance & polymorphism 	14:00 – 17:30 <ul style="list-style-type: none"> Practical model development part 2 - Improving the prey population, creating different types of prey with different characteristics
Thursday 1 st October	9:00 – 12:30 <ul style="list-style-type: none"> Key issues with ABMs (space/time/feedbacks/complexity) I/O streams Structural tests & debugging 	14:00 – 17:30 <ul style="list-style-type: none"> Practical model development part 3 - Improving the prey population and making our first baseline scenarios
Friday 2 nd October	9:00 – 12:30 <ul style="list-style-type: none"> Modelling cycle POM and calibration 	14:00 – 17:30 <ul style="list-style-type: none"> Practical model development part 4 - Designing and integrating the predators



WEEK 2 – Model testing, developing more complex ABMs

Lecturers:

Chris Topping, Department of Bioscience, University of Aarhus, Denmark

Lene Jung Kjær, Reto-Moto, Copenhagen, Denmark

Week 2	Morning	Afternoon
Monday 5 th October	9:00 – 12:30 <ul style="list-style-type: none"> • Round-up/Review of last week • Sensitivity & uncertainty 	14:00 – 17:30 <ul style="list-style-type: none"> • Practical model development part 5 – Improving the interactions between predators and prey
Tuesday 6 th October	9:00 – 12:30 <ul style="list-style-type: none"> • Types of ABMs and approaches • Examples of analytical and complex ABMs in Ecology 	14:00 – 17:30 <ul style="list-style-type: none"> • Practical model development part 6 - Evaluating and testing our model
Wednesday 7 th October	9:00 – 12:30 <ul style="list-style-type: none"> • Model communication • Model documentation • Code sharing, open-source, licenses 	14:00 – 17:30 <ul style="list-style-type: none"> • Practical model development part 7 – Improving and documenting the model
Thursday 8 th October	9:00 – 12:30 <ul style="list-style-type: none"> • Towards systems simulation • False inclusions and false exclusions in model design 	14:00-17:30 <ul style="list-style-type: none"> • Practical model development part 8 - Improving and documenting the model
Friday 9 th October	9:00 – 12:30 <ul style="list-style-type: none"> • Student presentation of models developed during the course • Evaluation of the modelling exercise 	14:00-17:30 <ul style="list-style-type: none"> • Modelling workshop - advice on own models