

Review: EcoBeaker 2.0

EcoBeaker 2.0 by Eli Meir

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<http://www.ecobeaker.com>

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Biology is hard. It is not hard in the sense that it requires huge intellect or a long apprenticeship. Nor is it hard in the sense of being dangerous or requiring huge armies of researchers. It is hard because it involves unravelling found objects, situations and systems that are the result of complicated interactions, perhaps millions of individuals over millions of years. Biology is vast and historic.

This causes some problems. The huge scale of biology doesn't lend itself well to casual exploration and experimentation. It is all too common for students to complete their courses with a vague impression of biology as "a pile of facts": dim memories of the Krebs cycle, the evolution of the horse and a few taxonomic names. Perhaps this is why the teaching of evolution in high schools is still a hot topic when it should be a foregone conclusion. The problem arguably extends even into professional research: it's been noted that the majority of field ecology experiments examine small plots over a few seasons at most (i.e. the attention span of a PhD). It is difficult to make biology convincing.

To this end, students need better ways to engage and interact with the subject. One possibility is computer modelling. *EcoBeaker 2.0* is the latest version of a graphical simulation package that allows users to design and experiment with a variety of ecological models, from individual-based simulations to large-scale ecosystem dynamics. The units of the simulation may be individual organisms, groups of organisms or habitats that reproduce, migrate, compete & even change into other types. Various statistics can be collected and displayed graphically as the simulation progresses.

EcoBeaker 2.0 is primarily intended for undergraduate instruction and to this end it comes with a large number of pre-designed "laboratories" illustrating important

principles. Students can learn by playing with the parameters of the simulation, and observing the outcome. Of particular interest to those teaching conservation biology will be those laboratories depicting island biogeography, conservation corridors and (a less obvious but very useful concept) the effects of different sampling regimes on perceived diversity.

Some would say that simulations are no substitute for fieldwork. This is difficult to argue when balancing the cost of a few afternoons in front of the computer versus lengthy and unpredictable field experiments as a method of education. More correctly, simulations do not substitute for knowledge of the field. A model necessarily rests upon its assumptions and if these are wrong, all is lost. A tool like *EcoBeaker* gives students a handup on the abstract and mathematical basis of the subject. This is becoming important given the need for objective decisions in conservation legislation. Simulations may even be useful tools for demonstrating the basis of recommendations to government bodies.

The postgraduate audience may also find this software useful for serious research. Indeed it is remarkable that it's (apparently) so little used as such, as the program includes a macro language for the extending the behaviour of the program. This allows for a wide variety of possible simulations and saves those wanting to construct computer models from "reinventing the wheel" in having to re-implement a lot of basic behaviour. Even the entire source code for the program is distributed with it. The producers of other computational biology tools could learn a lot from this.

It's difficult to find much to criticise about *EcoBeaker 2.0*: it is a well-designed and user-friendly piece of software with extensive documentation. Indeed, it is far more robust and

has fewer bugs than most software I use regularly. The only significant area for improvement is the manual, which is sometimes laborious in the detail with which it describes running the laboratories. (E.g. the oft-repeated instructions on how to starting *EcoBeaker* and how to start and stop the simulation.) Conversely, although the manual has a good amount of background material on the scenarios modelled, it is essentially still a manual and doesn't pretend to substitute for a good ecology or conservation biology text. (There is a great opportunity here for a new undergraduate text that reinforces its points with *EcoBeaker* simulations...)

In summary, *EcoBeaker 2.0* is an excellent piece of software and a great example of what is needed in undergraduate instruction and professional research. It's even fun to use.

System requirements: MacOS 8 or greater, Windows 95 or greater. QuickTime 3.0, 12 Mb disk space, 5 Mb memory.