

Human-Nature Interaction in World Modeling with Modelica

Rodrigo Castro^{1,2}, Peter Fritzson³, François Cellier⁴,
Safa Motesharrei⁵, Jorge Rivas⁶

¹Department of Environmental Systems Science, ETH Zurich, Switzerland

²Department of Computer Science, University of Buenos Aires
and CIFASIS-CONICET, Argentina

³Department of Computer and Information Science, Linköping University,
SE-581 83 Linköping, Sweden

⁴Computer Science Department, ETH Zurich, Switzerland

⁵National Socio-Environmental Synthesis Center (SESYNC)
Annapolis, MD, 21401, USA

⁶Department of Political Science, University of Minnesota
Minneapolis, MN 55408, USA

rodrigo.castro@usys.ethz.ch, peter.fritzson@liu.se, fcellier@inf.ethz.ch,
ssm@umd.edu, jorgerodrigorivas@gmail.com

It is our predicament that we live in a finite world, and yet we behave as if it were infinite. Steady exponential material growth with no limits on resource consumption and population is the dominant conceptual model used by today's decision makers.

This is an approximation of reality that is no longer accurate and started to break down. The World3 model, originally developed in the 1970s, includes many rather detailed aspects of human society and its interaction with a resource-limited planet. However, World3 is a rather complex model.

Therefore it is valuable for pedagogical reasons to show how similar behavior can be also realized with models that are much simpler.

This paper presents a series of world models, starting with very simple exponential growth and predator-prey systems, then investigates a minimal human-nature model, Handy, and ends with a brief account of the World3 model.

For the first time, a simple human-nature interaction model is made available in Modelica that distinguishes between dynamics of Elite and Commoner social groups.

It is shown that Handy can reproduce rather complex behavior with a very simple model structure, as compared to that of world models like World3.