deBoer, Rob J. 2016 . *Modeling Population Dynamics: A Graphical Approach*. 193 pp.

http://tbb.bio.uu.nl/rdb/books/mpd.pdf . Accessed 1 April 2023.

From the Preface,

"This book is an introduction into modeling population dynamics in ecology. Because there are several good textbooks on this subject, the book needs a novel ecological niche to justify its existence. Unique features of the book are: (1) an emphasis on "parameter free" phase plane analysis, (2) the usage of the epidemiological concept of an R0 (or fitness) to simplify parameter conditions, and (3) a strong emphasis on model development. The last point is the most important, and makes this book somewhat anti-historical in places. Rather than just explaining the famous classical models, we will first attempt to derive each model ourselves by translating biological processes, like birth, death, and predation, into intuitive graphs. These graphs are subsequently translated into simple mathematical functions. Collecting all functions in systems of differential equations we obtain mathematical models that are typically similar, but often not identical, to the classical models covered in other textbooks.

"What is the reason for this rather laborious procedure for explaining models to students? I think it is important that biologists can identify each term in a mathematical model with a biological process for which they have some knowledge, or at least some intuition. For example, one often needs biological insight to know how, or even whether, birth and death rates depend on the population size. Since, the models we develop by our procedure ultimately resemble the classical models in theoretical ecology, we do obtain a proper mechanistic understanding of the classical model. Sometimes we end up with models with quite different properties, however. These cases are even more important because we learn to be critical of the classical models, and definitely be critical of the conventional procedure of just employing a classical model for any new ecological problem at hand.

"The phrase `a graphical approach' in the title has two connotations. First, we will sketch graphs for the effects of the population density on biological processes like the per capita birth rate and the per capita death rate. Second, most models will be analyzed by sketching nullclines in phase space. Both have the advantage that we can keep the mathematics that is required for analyzing models at a level that should be understandable for motivated students in biology. Most pictures in this book are made with GRIND, which is a computer program that is good at drawing nullclines and phase space analysis. During the course you will work with a version of GRIND in R (see Chapter 15)."

There are 17 chapters ranging including general replication, nonlinear density dependencies, consumption, functional response, competition, stability, persistence, bifurcation, phase plan analysis, SIR, and so much more. Furthermore there is an Appendix with mathematical prerequisites and a 52 page appendix with answers to the exercises.

Many of these exercises would serve as the core of a Modeling Scenario with the answers supporting an author of such a pedagogical effort, enabling one to build with added issues.

Keywords: differential equations, population, population dynamics, model, general replication, nonlinear density dependencies, consumption, functional response, competition, stability, persistence, bifurcation, phase plan analysis, SIR