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FOURTH AUTUMN COURSE ON MATHEMATICAL ECOLOGY

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"Text Books on Mathematical Modeling in Ecology"

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These are preliminary lecture notes, intended only for distribution to participants.

Text Books on Mathematical Modeling in Ecology
Compiled from the Internet by Michael Knorrenschild, modified by Louis Gross, Oct. 1994

Anderson, Roy M. and Robert M. May (1986) The Dynamics of Human Host-Parasite Systems Princeton Univ. Press

Beltrami, Edward (1993) Mathematical Models in the Social and Biological Sciences Boston: Jones & Bartlett. 197 p.,
+ 3 (out of 6) chapters on ecological models (incl. a fishery model, measles epidemics, red tide model, pollution model, gray squirrel dispersal model, and a game-theoretical fishery model)

Berg, Howard C. (1983) Random walks in biology. Princeton: Princeton Univ. Press, 142p., ISBN 0-691-08245-6

Bossel, Hartmut (1994) Modeling and Simulation. Wellesley, MA: A. K. Peters, 484 p.
+ a systems dynamics approach to modeling; so most of the applications are drawn from natural resource modeling; great catalog of elementary systems models; comes with software (the SIMPAS simulator, PC-based) as well as STELLA diagrams - no exercises; limited bibliography

Brown D. and P. Rothery (1993) Models in Biology: mathematics, statistics and computing Chichester: Wiley, 688 p., ISBN 0-471-93322-8
+ lots of (ecological) models, statistics and data, many exercises and references, computer supplement available - ignores age structure

Burgman, M.A. and S. Ferson and H. R. Akcakaya (1993) Risk assessment in conservation biology London: Chapman & Hall, (Population and community biology series 12), 314p., ISBN 0-412-35030-0
+ does more than the title might suggest, application of population models to wildlife management Review in Trends in Ecol & Evol., mid 1993

Hal Caswell (1989) Matrix Population Models. Sunderland: Sinauer, 328 p., ISBN 0-87893-094-9, 0-87893-093-0 + extensive references - no exercises

Clark, Colin W. (1976) Mathematical Bioeconomics: The Optimal Management of Renewable Resources. Wiley, 352p., ISBN 0-471-15856-9

Cullen, M. R. (1985) Linear Models in Biology--Linear Systems Analysis with Biological Applications. Chichester: Horwood, 213 p.
ISBN 0-85312-835-9, 0-85312-905-3, 0-470-20206-8, 0-470-20205-X
+ all classic linear methods discussed, most examples from ecology, exercises

DeAngelis, D. L. (1992) Dynamics of Nutrient Cycling and Food Webs.New York: Chapman & Hall, 270 p., Series Population andcommunity biology series 9; ISBN 0-412-29840-6, 0-412-29830-9
+ extensive collection of models, many references - no exercises

DeAngelis, D. L and L. J. Gross (eds.) (1992) Individual-Based Models and Approaches in Ecology. Chapman and Hall, New York. ISBN 0-412-031612, 0-412-03171-X.

Edelstein-Keshet, L. (1988) Mathematical Models in Biology. Random House, New York. ISBN 0-394-35507-5

+ good at how and why models are used, assumes only modest math background, good homework problems, good coverage of continuous models - not solely about in ecology, not so good coverage of discrete models, no stochastic models, many errors in the exercises

France, J. and J. H. M. Thornley (1984) Mathematical Models in Agriculture. Butterworths

Hallam, T. G. and S. A. Levin (eds.) (1986) Mathematical Ecology: an Introduction. Springer, Series Biomathematics 17; 457p., ISBN 3-540-13631-2, 0-387-13631-2

Hannon, B. & Ruth, M. (1994) Dynamic Modeling. New York: Springer, 250p.

systems approach to modeling; covers more than ecological models; is a tutorial in STELLA; comes with software (Mac or Windows); due out soon if not already.

Jeffries, Clark. (1989) Mathematical Modeling in Ecology--a Workbook for Students. Boston: Birkhauser. 193 p., ISBN 0-8176-3421-5

thin, eclectic book; easily covered in a semester; a dynamical systems approach to ecosystem modeling, see review in Ecology Vol. 71:2400-2401 (1990)

+ exercises with solutions - limited references for each chapter

Hoppensteadt, Frank C. (1982) Mathematical methods of population biology. Cambridge: Cambridge Univ. Press (Cambridge studies in mathematical biology 4), 149p., ISBN 0-521-23846-3, 0-521-28256-X + good intro to topic - population dynamics only

Keen Robert E., Spain, James D. (1992) Computer simulation in biology: a BASIC introduction. New York (etc.) : Wiley-Liss, 498p., incl. disk, ISBN 0-471-50971-X

+ assumes only elementary knowledge of calculus and linear algebra, goes from simple growth models to complex simulation models, ecological examples, strong emphasis on programming

- examples are in BASIC

Levin, S. A., Hallam, T. G. and L. J. Gross (eds.) (1989) Applied Mathematical Ecology.Springer, Series Biomathematics 18; ISBN 3-540-19465-7, 0-387-19465-7

Logofet, Dmitrii O. (1993) Matrices and Graphs--Stability Problems in Mathematical Ecology Boca Raton: CRC Press, 308p.

Deals only with issues of multicomponent and multispecies assemblages with emphasis on Lyapunov stability. Topics include: Leslie models, graph-theoretical analysis, food webs, competition, spatial distribution - no exercises

Marcus-Roberts, H. and M. Thompson (eds.) (1983) Life Science Models. Springer, 366p., ISBN 0-387-90739-4, 3-540-90739-4

Maynard Smith, John (1968) Mathematical Ideas in Biology.Cambridge: Cambridge Univ. Press, 152p.

Maynard Smith, J. (1974) Models in Ecology. Cambridge: Cambridge University Press. 146 p.
+ old, but a classic, insightful text - no exercises.

Maynard Smith, John (1982) Evolution and the Theory of Games. Cambridge: Cambridge Univ. Press, 224p., ISBN 0-521-24673-3, 0-521-28884-3

Murray, J. D. (1989) Mathematical Biology. Springer, Series Biomathematics 19, 767p., ISBN 3-540-19460-6, 0-387-19460-6

R.M.Nisbet, W.S.C.Gurney (1982) Modelling Fluctuating Populations. Chichester: Wiley, 379p., ISBN 0-471-28058-5
+ good for discrete models - out of date

Okubo, Akira (1980) Diffusion and ecological problems: mathematical models. Springer (Biomathematics, vol.10), 254p., ISBN 3-540-09620-5, 0-387-09620-5

Pielou, E. C. (1977) Mathematical Ecology. New York: Wiley; 385 p., ISBN 0-471-01993-3
covers stochastic and deterministic population models, spatial models, predation, competition, diffusion models, diversity, as well as multivariate statistical techniques such as ordination, CCA, and discriminant analysis. + a classic, good reference - out of date, no exercises

Pielou, E. C. (1974) Population and Community Ecology: Principles and Methods. New York: Gordon and Breach. 424 p., ISBN 0-677-03580-2
+ lower-level more widely ranging coverage of mathematical ecology than her "Mathematical Ecology"; very clear development of theory. - no exercises.

Renshaw, Eric (1991) Modelling biological populations in space and time. Cambridge Cambridge University Press, (Cambridge studies in mathematical biology 11) 403p., ISBN 0-521-30388-5 (hard-cover 1991), ISBN 0-521-44855-7 (paperback 1993)
An advanced book. Covers discrete and continuous, deterministic and stochastic models. Covers all the standard topics (competition, predator-prey, birth-death processes, epidemics) plus population growth models with time lags and spatial population models - no exercises

Roberts, Fred S. (1976) Discrete Mathematical Models, with applications to Social, Biological and Environmental Problems. Prentice-Hall

Rose, Michael R. (1987) Quantitative Ecological Theory--An Introduction to Basic Models. Baltimore: J. Hopkins Univ. Press, 203 p., ISBN 0-7099-2289-2, 0-7099-2288-4

Essentially the lecture notes for a course in theoretical ecology. Topics include population growth, competition, predation, simple ecosystems, complex ecosystems, and migration. + very clear, intuitive development of the mathematics - no exercises, primitive typesetting.

Roughgarden, J. (1989) Perspectives in ecological theory. Princeton: Princeton Univ. Press, 394p., ISBN 0-691-08507-2, 0-691-08508-0

Segel, Lee A. (1984) Modeling Dynamic Phenomena in Molecular and Cellular Biology. Cambridge Univ. Press.

Smitalova, Kristina & Sujan, Stefan (1991) A Mathematical Treatment of Dynamical Models in Biological Science. New York: Ellis Horwood, 183p., ISBN 0-13-221771-6, 80-224-0245-1

Deals exclusively with the mathematical theory of community models-- single species, two-species, and n-species ending with a chapter on chaos theory in ecology. + many references - no exercises

Starfield T. M. and A. L. Bleloch (1986) Building models for conservation and wildlife management. New York: Macmillan, (Biological resource management) 253p., ISBN 0-02-948040-X

+ easy to read, plenty of good explanation

Starfield, A. M., Smith, K.A. & Bleloch, A.L. (1990) How to model it: problem solving for the computer age. New York: McGraw-Hill, 206p., ISBN 0-07-005897-0

+ good introduction to the modelling process in general, comes (in the 2nd ed.) with a disk that contains the spreadsheet examples and WinEXPERT (a small expert system)

Suter, G. W. (ed. and principal author; contrib. authors: L. W. Barnthouse et al.) (1993) Ecological Risk Assessment. Lewis Publishers, Chelsea, Michigan 48118 USA

Thornley, John H. M. and Ian R. Johnson (1990) Plant and Crop Modelling. Clarendon Press, Oxford,

Tuchinsky, Philip M. (1981) Man in Competition with the Spruce Budworm--An Application of Differential Equations. Boston: Birkhauser, 77 p.

+ careful derivation of one of the classic mathematical models in ecology, exercises with solutions

Vandermeer, J. H. (1981) Elementary Mathematical Ecology. Wiley and Sons, NY, 294p. 1981 Malabar, Fla: Krieger, 1990, 294p., ISBN 0-89464-465-3

programmed learning text + lots of exercises with solutions - boils away a great deal of the biology in favor of the math, holes in coverage

Yodzis, Peter (1989) Introduction to theoretical ecology.New York (etc.): Harper & Row, 384 p., ISBN 0-06-047369-X

+ good intuitive development of the equations, many exercises and references