Welcome to Ecological modeling (BI382)

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- Hello Chris, … We have been intentionally vague on the modeling course because we want to make sure that we can recruit and hire a great person without boxing them in too much. We would prefer a broad course that introduces students to the concept of ecological modeling and includes both mathematical and computational approaches. *Our students are just figuring out the role that modeling can play in scientific inquiry.*

Professional discussion on mathematics in ecology

- url: https://dynamicecology.wordpress.com/2014/10/20/what-math-should-ecologists-teach/

- “Here’s my list of topics that a very well-trained mathematical ecologist would need (beyond a 1st year calculus sequence):

1. Multivariate calculus simplified (partial derivatives, volume integrals)
2. Matrix algebra and eigenvectors
3. Dynamical systems (equilibrium analysis, cycling and chaos)
4. Basic probability theory and stochastic processes (especially Markov chains with brief coverage of branching processes and master equations)
5. Optimization theory focusing on simple calculus based optimization and Lagrange multipliers (and numerical optimization) with brief coverage of dynamic programming and game theory”

How computers help us

An equation published by me

$$\frac{1}{N_1}\frac{dN_1}{dt} = r_1 - \alpha_1 N_1^{\theta_1} + \beta_1 N_2$$

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An equation published by Denise Bruesewitz in ES

$$\frac{dP}{dt} = G \times P - Zgp - Pm \times P - Pl \times G \times P$$

$$\frac{dZ}{dt} = Zgp \times Zep + Zgb \times Zeb + Zgd \times Zed - Ze \times Z - Zm \times Z$$

$$\frac{dBA}{dt} = Bdone + Bnhe - Zgb - BAm \times BA$$

$$\frac{dNN}{dt} = DNN - G \times Fnn \times P$$

$$\frac{dNH}{dt} = DNH - G \times Fnh \times P - Bnhe + BAm \times + \left(\frac{3}{4} \times Ze \times Z\right) + \left(\frac{2}{3} \times Zm \times Z\right)$$

$$\frac{dDON}{dt} = DDON + Pl \times G \times P + c \times D + \left(1 - \frac{3}{4}\right) \times Ze \times Z - Bdone - s \times DON$$

$$\frac{dD}{dt} = (1 - Zep) \times Zgp + (1 - Zeb) \times Zgb - Zgd \times Zed - c \times D + Pm \times P + \frac{1}{3} \times Z$$

$$Ae = e^{-a \times NH}$$

$$Fnn = \left(\frac{NN \times Ae}{NN + Knn}\right)$$

$$Fnh = \left(\frac{NH}{NH + Knh}\right)$$

$$e = Zgpp \times P + Zgpb \times BA + Zgpd \times D$$

$$Zgp = Zg \times Z \times (Zgpp \times P)/(h + e)$$

$$Zgb = Zg \times Z \times (Zgpb \times B)/(h + e)$$

$$Zgd = Zg \times Z \times (Zgpd \times D)/(h + e)$$

$$G = Pg \times (Fnn + Fnh)$$

$$Bdone = \frac{BAe \times BA \times DON}{Kba + DON + NH}$$

$$Bnhe = \frac{BAe \times BA \times NH}{Kba + DON + NH}$$