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Mathematical modeling of an ecosystem with three-level trophic interactions

In this talk, the speaker will discuss the mathematical modeling of the spatio-temporal dynamics of an ecosystem with three-level trophic interactions. In this model, a general trophic function based on the ratio between the prey and a linear function of the predator is used at each level. At the two limits of this trophic function, one recovers the classical prey-dependent (Lotka-Volterra type) predation model and the ratio-dependent predation model, respectively.

The model results in a strongly-coupled system of parabolic partial differential equations. The speaker will analyze the existence, uniqueness, stability and bifurcation of equilibrium (steady state) solutions using the upper-lower solutions method and the topological degree method. He will also interpret some of these results in the context of different predation behaviors (prey-dependent vs ratio-dependent).

The speaker also points out that he and his co-authors have used similar methods to study ecosystems with different predation behaviors and strategies, different spatial features, as well as different species growth patterns. This talk will include a brief survey of some of these results (which have been published in a series of papers in Proc Roy Soc Edinburgh, Proc London Math Soc, J Differential Equations, IMA J Appl Math, SIAM J Appl Math etc).