Title: Diffusion-induced patterns in stochastic ecosystem dynamics.

Abstract: To understand how climate shapes ecosystem dynamics, we need to explore the role and origins of stochasticity in ecological systems. In this talk, I will introduce the three general types of stochasticity: demographic, environmental, and individual heterogeneity. Using the Levins model, a classic ecological framework, I will demonstrate how these different forms of stochasticity influence ecosystem dynamics. By extending the Levins model, I will illustrate its fundamental significance in analyzing species-rich systems, eco-evolutionary dynamics, consumer-resource interactions and functional responses, and host-parasitoid interactions.

Although spatial environmental stochasticity, or spatial heterogeneity in environmental conditions, often underlies ecosystem dynamics, non-random spatial patterns in species distribution can also arise under uniform environmental conditions. These biologically-driven patterns, known as diffusion-induced or Turing patterns, were first described by Alan Turing, who showed that they develop from a diffusion-induced instability.

I will conclude my talk by examining a host-parasitoid interaction in a coffee plantation, presenting preliminary findings on the variety of spatial patterns produced by this system, and summarizing a general methodology for studying spatially-extended stochastic systems in an accessible manner.