Maud Menten Institute / Mathematical and Statistical Biology Seminar

Monday, September 16, 2024
12 pm PST (in person)
David Strong Building (DSB) C-130
Join Zoom Meeting
https://uvic.zoom.us/s/84818303141
Meeting ID: 848 1830 3141

Jane MacDonald

Department of Mathematics
Simon Fraser University

The development and application of computational approaches to moving-habitat models in one and two dimensions

Moving-habitat models provide insight into the mechanisms that support local persistence of species within their suitable habitats which shift polewards or upwards in altitude as the planet warms. A species' suitable habitat is described through the species' net growth; where the specie's net growth is positive, the habitat is suitable. Beyond temperature, topographical changes in space present obstacles and barriers that change the shape of the suitable habitat. With conservation in mind, we ask, when does a species persist and can we identify when a species is at high risk of extinction. Reaction-diffusion equations provide one framework to study how the density of a population changes in space and time over these climate-driven moving-habitats. In their simplest form, they provide fundamental insight into persistence ability, studied through asymptotic analysis assuming a constant shift of the suitable habitat. To capture the temporal and spatial complexities of these moving habitats, we introduce two numerical methods, the first for spatially one-dimensional systems, the second for spatially two-dimensional systems. Our methods can capture complex movements of the suitable habitat, like deformation, accelerating shifting speeds, and jumps in density across the interface of suitable and unsuitable habitat resulting from habitat dependent dispersal rates and habitat bias. We analyse our numerical methods and demonstrate their strength in application, particularly focusing on time variable suitable-habitat sizes.