The Maximum Entropy Principle to predict forager spatial distributions: an alternate perspective for movement ecology

The Maximum Entropy Principle (MaxEnt) is a powerful inference principle to determine the probability distribution that describes a system on the basis of the information available, usually in the form of averages of observables (random variables) of interest for the system, and the assumption of maximal ignorance (maximum entropy) beyond the stated prior information. In this talk, I focus on the use of MaxEnt in the context of spatial ecology for building theory to predict equilibrium foraging distributions. This represents a new application of MaxEnt and a novel approach to compute spatial foraging distributions, which is able to incorporate mechanisms such as resource-depletion, optimality of the foraging strategy, travel costs, information uncertainty, and inter-specific and intra-specific competition into the statistical inference. I will show how our model predictions can resemble both, the predictions of optimal and random foraging, and give a simple quantitative way to connect these two extreme foraging behaviours. In addition, I will talk about the capability of modelling using energy and entropy arguments to relax most of the basic assumptions of the Ideal Free Distribution of ecology to expand its range of applicability. In the end, I will further discuss the potential applicability of MaxEnt to build theory in other contexts of ecology, such as to formulate population dynamics models, and the potential use of the dynamic form of MaxEnt, i.e. the Maximum Caliber Principle, to develop further theory on dynamical systems in spatial ecology.