

Mean Field Games and the Ideal Free Distribution

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This talk will present current work in collaboration with R. S. Cantrell, K-Y. Lam, and I. Mazari-Fouquer. The ideal free distribution is an idea in theoretical ecology that was introduced by Fretwell and Lucas in 1970 to model the habitat selection of animal populations. It is based on the idea that individuals can assess their fitness at any location, making allowances for crowding, and will move to optimize it. In the context of the evolution of dispersal, movement strategies that can produce an ideal free distribution have been shown to be evolutionarily stable from the viewpoint of adaptive dynamics in many modeling contexts. In this work we revisit the ideal free distribution from the viewpoint of a habitat selection game in ecology. We specifically use the approach of mean field games, as introduced by Lasry and Lions. In that approach, an individual agent using a given strategy competes with the “mean field” of the strategies used by other agents. We find that the population density of agents converges to the ideal free distribution for the underlying habitat selection game as cost of control tends to zero. Our analysis provides a novel derivation of the ideal free distribution in a dynamical context.

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