

Competitive Exclusion and Coexistence in Discrete Population Models

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Competitive interactions between organisms play a significant role in structuring ecological communities. These interactions occur when two or more species rely on the same basic living resources that are in short supply. The question of when do competing species coexist and when do they exclude each other has long intrigued both ecologists and mathematicians. In 1932 Gause formulated the well-known Competitive Exclusion Principle which states that two species competing for the same resources cannot coexist if other ecological factors are constant. Thereafter, experiments and mathematical models (beginning with the Lotka-Volterra model) have been used to support or violate this tenet. The main focus of this talk is to present several discrete population models and to establish conditions under which competitive exclusion occurs and conditions under which coexistence is possible. In particular, we show that when competition efficiencies of different species are similar, competitive exclusion occurs and the winner is the one with an invasion reproduction number (a measure of the ability of one species to invade another which is at an equilibrium state) larger than one. We also show that when competition efficiencies are different then coexistence and bi-stability are possible outcomes.