Population Dynamics through metapopulation models: When do cyclic patterns appear?

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ABSTRACT

We consider a theoretical ecosystem divided into an infinite number of identical patches and occupied by an ideal species without competitors. The global state of the system is given by a vector in R2 whose coordinates represent the proportion of empty and non-empty patches at time t. The dynamics of the system is described by a non linear Markov chain whose transition matrix depends explicitly on the state of the ecosystem at time t. This type of models were initially constructed for the study of two-species competition, considering constant probabilities of interaction and disturbances. When the probability of disturbance on the processes of colonization and persistence are not constant, complexity makes necessary to understand first the dynamics of one species, before facing the problem of more species. Barradas & Canziani approached the problem of persistence of one species when the probability of disturbance affecting persistence depends on the proportion of occupied patches and that affecting colonization remains constant. Here we study the symmetric case, i.e. a species is subject with density dependent probability to disturbances affecting colonization, and constant probability of disturbance affecting persistence. We investigate the possibility of existence of periodical solutions when equilibria become unstable, and detect cases in which equilibria always remain stable. Analysis of different cases indicate that given the appropriate conditions all situations may appear: globally stable equilibria, locally stable equilibria, unstable equilibria, and cyclic behavior.