

A graphical theory of resource competition in a weakly mixed environment

Alexey B. Ryabov

ICBM, University Oldenburg, Germany, a.ryabov@icbm.de

Resource competition in heterogeneous weakly mixed environments is still an unresolved problem of theoretical ecology. In this presentation we advance a new graphical framework for analyzing the competition of two consumers for two resources, assuming that the resources are supplied from opposite sides, which is typical for many systems such as water columns, sediments or interfaces between different environments. We show that the magnitudes of resource gradients become a crucial factor which can weaken or strengthen competitive advantages and that the outcome of competition can be derived comparing the resource gradients in the presence of each competitor solely. We derive an analytic criterion for the invasion threshold, which admits a simple graphical interpretation in the resource plane. We demonstrate that some statements, which hold for well-mixed systems do not necessarily apply to non-uniform environments. In particular, a specific ratio of consumption rates, which leads to coexistence in a hemostat, may favor alternative stable states in a weakly mixed system and vice versa. Furthermore, in terms of our graphical approach we show that under certain conditions a specimen with higher resource requirements can stably coexist with another one, which has lower resource requirements. Applying our method to a phytoplankton model we demonstrate possible shifts in the community structure that can be induced by a change in the system parameters.