



Shifts that divide population

Rachata Muneeppeerakul (1,2), Murad Qubbaj (1), Rimjhim Aggarwal (1), John M. Anderies (1,3), and Marco Janssen (3)

(1) Arizona State University, School of Sustainability, United States, (2) Arizona State University, Mathematical, Computational, & Modeling Sciences Center, United States, (3) Arizona State University, School of Human Evolution and Social Change, United States

How does a population of organisms in an ecosystem or of people in a society respond to rapid shifts in the environment? Answers to this question are critical to our ability to anticipate and cope with a changing ecohydrological system. We have developed a generic model of adaptation mechanisms, based on replicator dynamics, in which we derive a simple and insightful threshold condition that separates two important types of responses: 'cohesive transition' in which the whole population changes gradually together, and 'population-dividing transition' in which the population splits into two groups with one eventually dominating the other. The threshold depends on the magnitude of the shift and the shape of the fitness landscape. Division in populations can fundamentally alter the functioning of and induce subsequent feedbacks within the system; knowing the condition that gives rise to such division is thus fundamentally important.