Shifts that divide populations

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Abstract

If incentive is non-concave,
And the shift is wide,

Then there is a good chance

That population would divide.
How does a population respond to shifts brought about by global climate change and globalization? Answers to this question are critical to our understanding of the social-ecological system and thus ability to manage it toward more sustainable outcomes. We have developed a model of adaptation with a focus on transient dynamics, as opposed to equilibriums. We have derived a simple but 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 structure of the incentive. Division in populations can fundamentally affect the functioning of the social-ecological system—or even prevent it from reaching its potential equilibrium; knowing the condition that gives rise to such division is thus fundamentally important.

Keywords: population dividing, critical transition, replicator dynamics

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