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Correlation between stability and resilience in multiple deteriorating environments LEI DAI, Massachusetts Institute of Technology, KIRILL KOROLEV, Boston University, JEFF GORE, Massachusetts Institute of Technology — The recovery rate and the basin of attraction are two important properties that describe the local and global stability of dynamical systems. The idea that loss of stability (i.e. slower recovery) may indicate loss of resilience (i.e. shrinking size of basin of attraction), especially in the context of providing warning signals as a system is close to bifurcations, has been demonstrated before transitions in many systems, such as ecosystems, the climate, neurons and power grids. However, most empirical studies focus on the observation of warning signals with respect to a particular type of environmental change. Here we measure the stability-resilience relationship of laboratory microbial populations in different deteriorating environments (e.g. increasing death rate, nutrient limitation, etc.). We found that the loss of stability is correlated with loss of resilience before population collapsed in multiple scenarios of deterioration, but the warning signals increased with variable levels under different drivers. We mapped out the relationship between stability and resilience by tuning three drivers and also evaluated possible scenarios of environmental change where the positive correlation between the recovery rate and the basin of attraction may break down. Our results suggest the correlation between stability and resilience can be utilized to assess the fragility of dynamical systems under environmental changes; however, the stability-resilience relationship can be complex and will limit our assessment when multiple drivers are involved.

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