

Is it possible to elude catastrophic shifts?

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May 11, 2015

Abstract

Catastrophic shifts are natural phenomena of paramount importance [1, 2]. For instance, socio-economic and socio-ecological systems [3, 4], as well as ecosystems such as lakes, savannas, or oceans can experience, as a consequence of small changes in environmental conditions, sudden collapses after which recovery can be extremely difficult (e.g., desertification, coral reef collapses, and market crashes). Predicting and preventing these abrupt transitions remains a challenging and important task. Usually, simple deterministic equations are used to model and rationalize these complex situations. However, stochastic effects might have a profound effect. Here [5] we use 1D and 2D spatially explicit models to show that intrinsic (demographic) stochasticity can alter deterministic predictions dramatically, especially in the presence of other realistic features such as limited mobility or spatial heterogeneity. In particular, these ingredients can alter the possibility of catastrophic shifts by giving rise to much smoother and easily reversible continuous ones. The ideas presented here can help further understand catastrophic shifts and contribute to the discussion about the possibility of preventing such shifts to minimize their disruptive ecological, economic, and societal consequences.

References

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