Project Abstract

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Avoiding collapse: detecting signals for critical transitions in agent-based ecological models

A variety of complex systems have critical thresholds that, once crossed, find these systems shifting abruptly from one state to another. There has been a great deal of theoretical work utilizing statistical and spatially analytic methods for detecting early warnings of such critical transitions across a variety of low-dimensional systems. However, many of these methodologies are contingent on the availability of high resolution data over a sufficiently long period of time, which may not be available in the case of real-world complex ecosystems vulnerable to collapse.

Our goals are two-fold: first, we will analyze whether agent-based models offer a better fit to real world time-series data as opposed to other modeling techniques. Specifically, we are going to analyze time-series data available from the Atlantic Cod (*Gadus morhua*) fisheries to compare our agent-based simulations with a stage-structured discrete time analog based on the standard Ricker model widely used in fisheries management schemes. We will then examine whether or not our models produce early signals for periods of critical transitions. If so, we hope to show that different resource management regimes may be more capable of preventing critical transitions than others.