Title:	Influence of the Allee effect on extreme events in coupled three-species systems
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Abstract:	We considered the dynamics of two coupled three-species population patches by incorporating the Allee effect and focused on the onset of extreme events in the coupled system. First, we showed that the interplay between coupling and the Allee effect may change the nature of the dynamics, with regular periodic dynamics becoming chaotic in a range of Allee parameters and coupling strengths. Further, the growth in the vegetation population displays an explosive blow-up beyond a critical value of the coupling strength and Allee parameter. Most interestingly, we observed that beyond a threshold of the Allee parameter and coupling strength, the population densities of all three species exhibit a non-zero probability of yielding extreme events. The emergence of extreme events in the predator populations in the patches is the most prevalent, and the probability of obtaining large deviations in the predator populations is not affected significantly by either the coupling strength or the Allee effect. In the absence of the Allee effect, the prey population in the coupled system exhibits no extreme events for low coupling strengths, but yields a sharp increase in extreme events after a critical value of the coupling strength. The vegetation population in the patches displays a small finite probability of extreme events for strong enough coupling, only in the presence of the Allee effect. Last, we considered the influence of additive noise on the continued prevalence of extreme events. Very significantly, we found that noise suppresses the unbounded vegetation growth that was induced by a combination of the Allee effect and coupling. Further, we demonstrated that noise mitigates extreme events in all three populations, and beyond a noise level, we do not observe any extreme events in the system. This finding has important bearings on the potential observability of extreme events in natural and laboratory systems.
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