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Unifying relationships between complexity and stability in mutualistic ecological communities

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Highlights

- stability conditions for mutualistic systems are derived from first principles
- Handling time, which partly determines a species rate of resource use (and has received relatively little attention in previous studies), is found to be crucially important in determining the dynamics of mutualistic systems
- Two types of critical transitions are predicted and we describe the controlling factors and consequences of these transitions
- Properties of potential early-warning signals for the two identified transition types are derived, and differences defined and explained
- Previous contradictory evidence suggesting increases in the level of heterogeneity inter-species connections can both increase and decrease stability are shown to be special cases of a more general model
- a number of derived parameters are presented that precisely connect basic ecological parameters to system-level behaviour (largely based on the relative strength of interactions and effects on dominant eigenvalues at critical points)
- trade-offs are explored between abundance and resilience, and predictions from the model are found to be in broad agreement with empirical observations

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