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Most ecological communities are at the limit of structural stability: the evidence

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An ecological community is called *structurally unstable* if it is feasible (a positive equilibrium exists) but feasibility is sensitive to changes in parameters, external pressures, or species composition. Absent such sensitivities, a feasible community is called *structurally stable*.
Mathematically one can show that, due to amplification of perturbations through indirect interactions, structural stability of ecological networks declines with increasing species richness (a negative complexity-stability relation). At some limiting richness structural instability sets in, thus imposing an inherent limit to sustainable biodiversity. Under sustained invasion pressure this limit is naturally reached, stabilizing species richness despite ongoing temporal turnover in composition.
We argue that the combined mathematical, numerical and empirical evidence strongly suggests that most natural ecological communities are indeed close to this limit. This applies to both local and regional scales. At local level, structural instability mechanistically explains, e.g., observed biodiversity patterns across trophic levels and body size; the observed magnitude of indirect interactions; the known high parameter sensitivity of food-web models; and the absence of clear complexity-stability relations in realised communities. At regional level, structural instability mechanistically explains, e.g., observed species area relations and range-size distributions. We urge ecologists to devote more research to the study of ecological network models at the limit of structural instability, because these tend to have particular properties that are commonly found in nature, but not in their structurally stable counterparts.

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