Forecasting in the face of ecological complexity: number and strength of species interactions determines forecast skill in ecological communities

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Abstract

The potential for forecasting the dynamics of ecological systems is currently unclear, with contrasting opinions regarding its feasibility due to ecological complexity. To investigate forecast skill within and across system complexity, we monitored a microbial system exposed to either constant or fluctuating temperatures in a five months long laboratory experiment. We tested how forecasting of species abundances depends on number and strength of interactions and on model size (number of predictors). We also tested how greater system complexity (i.e. the fluctuating temperatures) impacted these relations. We found that the more a species interacted, the weaker these interactions were and the better its abundance was predicted. Forecast skill increased with model size. Greater system complexity decreased forecast skill for three out of eight species. These insights into how abundance prediction depends on the embedding of the species within the system and on overall system complexity could improve species forecasting and monitoring.

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