Predicting effects of multiple environmental changes on community respiration in a microcosm experiment.

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Abstract

Predicting the future is a challenge for ecologists, especially in the context of global change, when multiple environmental drivers occur simultaneously. Limited evidence suggests that interactions between two or three drivers are important, affecting all ecological levels of organization. But what happens when the number of perturbations increases?
Using a microbial aquatic ecosystem with algae, bacteria, ciliates and rotifers, we examined interactions among four environmental changes: temperature, inorganic nutrient supply (Nitrogen:Phosphorus ratio), organic carbon supply (Protozoan Pellet) and light availability (using shade cloth), in a fully factorial design. We observed responses of dissolved oxygen concentration at short (resistance), medium (resilience), and long (return time) temporal scales. We tested three hypotheses about how multiple environmental changes combine (additive, interactive and dominant), and compared the predictions to the observations to assess the predictability of the response to multiple environmental changes.
Observations were consistent with three general ecological observations: 1) large effects of one dominant environmental change (Vinebrooke *et al.*, 2004), here the organic carbon supply; 2) predictability is lower at longer temporal scales of response, probably due to feedbacks observed through the increase in the variability within replicates; and 3) the time to recover increases with the number of perturbations occurring (Niemi *et al.*, 1990). With our study, we highlighted the influence of the temporal scale of environmental change, and its importance for predicting effects of many environmental changes happening simultaneously.

Keywords: prediction, multiple environmental changes, respiration, microcosm

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