Response diversity in the context of multiple environmental drivers

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Résumé

Response diversity represents the inter- and intraspecific trait variation in organismal responses to the environment. Assemblages composed of organisms displaying large variation in their response to the environment-that is, having high response diversity-are expected to have higher temporal stability of aggregate community and ecosystem properties such as ecosystem functioning (i.e., an insurance effect). Yet, response diversity is not commonly measured in empirical studies, and when it is measured, this is done in different ways. Moreover, most proposed measures of response diversity concern situations with only one driver of environmental change. Thus far, no specific approach exists to measure response diversity in the context of multiple simultaneously changing (multifarious) environmental drivers. Here, we propose a new method to empirically quantify response diversity in the context of multifarious environmental change. First, we illustrate this method using simulated data. Next, we reveal the role of the direction of environmental change in shaping response diversity when multiple drivers of environmental change fluctuate over time. We show that, when the direction of the environmental change is unknown (that is, there is no information or *a priori* expectation about how an environmental condition has changed or will change in future), we can quantify the response capacity for a given community under any possible future environmental change scenario. That is, we can estimate the adaptive capacity of a system under a range of extreme or realistic environmental changes, capturing its complete insurance capacity, with utility for predicting future responses to even multifarious environmental change.

Mots-Clés: response diversity, multiple drivers, directional derivatives, ecological stability, GAMs

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