Novel metacommunity modelling approaches highlight the importance of biotic interactions on the speed of the temperate biome shift in response to climate change.

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Abstract

Within the context of rapid on-going climate change, understanding and predicting species and biome range shifts has become a major field of ecology. Biome distributions have already shifted in response to climate change during the last 100 years. Substantial changes are occurring in mid to high latitudes, generally resulting in a upward or northward migration of biomes in the northern hemisphere. However, in response to environmental change, the shift in species distribution would not occur instantaneously. Several mechanisms are likely to create delayed responses of ecosystems to environmental changes. Using novel dynamic models based on the metacommunity concept, we investigated the role of species interactions during the expected northward shift of the temperate biome. We combined empirical and theoretical approaches to study the importance of both plant-plant and plant-herbivore interactions. Our results suggest that plant-plant interactions, as well as demography are more important than dispersal limitation to explain the delay of the northward expansion of the temperate biome. Our work highlights as well the potential role of large herbivores, such as *Alces americanus* or *Odocoileus virginianus*, in generating supplementary lags during the shift of the temperate biome. Together, these results suggest that vegetation dynamics would not be possible to forecast whilst ignoring species interactions and explicit time dynamics. The further development of dynamic modelling approaches will therefore be critical in order to anticipate how biodiversity would respond to climate change.

Keywords: biotic interactions, range shifts, biome limits, dynamic modelling, metacommunity

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