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Biotic interactions in breeding bird communities drive nonlinear responses to global changes

Empirical studies generally consider that global changes drive population dynamics through their direct effect on species distribution and demography. However, biotic interactions are also likely to shape large-scale species distributions and dynamics because variations in environmental conditions could indirectly influence population dynamics via their biotic interactions. Those Environment-Species Interactions (ESI) are defined as the biotic and abiotic effects of the environment that depend on population size, and are likely to drive non-linearities in species response to environmental variation. Understanding the emergence and drivers of these non-linear responses potential induced by ESI is important because they are likely to impair reliable predictions of species and community responses to global changes.
GjamTime is a probabilistic, dynamic modelling framework for inference that explicitly incorporates abiotic and biotic processes by modeling the combined impacts of environment and species interactions from observational data. This framework based on a lotka volterra model can thus estimate ESI from observed data while including full uncertainty. We here used the GjamTime model with data from a high-resolution, standardized bird monitoring scheme (French Breeding Bird Survey, FBBS) to investigate the following questions :
Whether and how much ESI influences bird population responses to climate and land-use-and-cover changes ?
In which biogeographical context the effects of ESI are the most important in shaping bird population responses ?
The influence of ESI was weak relative to the direct effect of climate and land use change on species distributions. However, they appear sufficient to induce nonlinear responses to global change. Our study pledges for the use of dynamics models allowing us to take into account species interaction in the understanding and prediction of populations' response to global changes.