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**A spatially extended trophic chain model with recycling :
how spatial structure determines the matter cycle?**

In this work, we study spatially extended trophic chain models. We focus on the role of nutrient recycling on the food chain dynamics. Top predators recycling is known to have some positive effects on the primary producers and that the importance of these effects can be compared to the role that top predators have on primary producers by regulation of herbivores. The role of recycling is here investigated by means of two models with different levels of details. Then these models are spatially extended to understand how the spatial structure affects the trophic chain dynamics. The spatial scales are assumed to be small enough to allow individuals to move fast with respect to local population dynamics. We aim to provide a mathematical formulation of the functional responses at the global scale, which can be suggested as the functional responses to use at larger scales. The global functional responses integrate the spatial effect and the recycling effects.