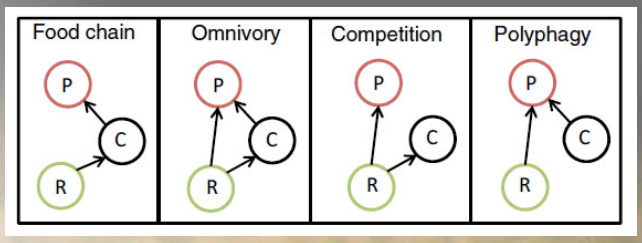
# Towards a mechanistic understanding of temperature and enrichment effects on species interaction strength, omnivory and food-web structure




**Diagrammatic representation of the four possible three-species modules that include an omnivore predator (P), an intermediary consumer (C) and a resource (R). Arrows indicate the direction of energy flows from the resource to higher trophic levels.**

**Ground: Two small larvae of *A. aphidimysa* attacking a young aphid *M. persicae*. © Arnaud Sentis**

Revealing the links between species functional traits, interaction strength and food web structure is of paramount importance for understanding and predicting the relationships between food-web diversity and stability in a rapidly changing world. However, little is known about the interactive effects of environmental perturbations on individual species, trophic interactions and ecosystem functioning. Here, we combined modelling and laboratory experiments to investigate the effects of warming and enrichment on a terrestrial tritrophic system. We found that the food-web structure is highly variable and switches between exploitative competition and omnivory depending on the effects of temperature and enrichment on foraging behaviour and species interaction strength. Our model contributes to identifying the mechanisms that explain how environmental effects cascade through the food web and influence its topology. We conclude that considering environmental factors and flexible food-web structure is crucial to improve our ability to predict the impacts of global changes on ecosystem diversity and stability.

Our results show that enrichment decreases species interaction strength and the occurrence of omnivory, which causes the food web to gradually shift from omnivory to exploitative competition. However, warming leads to the opposite effect by increasing species interaction strength which, in the longer term, could destabilise the network. By scaling up from individual behaviour to community, we have identified some determinant links between organism behaviour, interaction strength, and food-web structure. This suggests that taking into account these links is a crucial step towards a mechanistic understanding of the effects of environmental variations on omnivory modules. Given the importance of omnivory modules for the stability of complex food webs, our findings have implications for the diversity–stability relationship.

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