

Outstanding Questions

How do evolutionary networks affect population dynamics and food webs, and ultimately the stability of large meta-ecosystems? How does the genetic architecture underlying complex traits connect to interaction strength between species? For example, if we assume the gene network simple, like quantitative genetics style, versus incorporate the network perspective with epistasis and pleiotropy, does that matter for predicting the interaction strength between species and how the food web behaves? Likewise, if we make the ecological part simple, but the gene network complex, then what do things look like? Gene interaction networks containing pleiotropy and epistatic interactions have been identified in interaction traits that could drive interaction strength between species and the stability of meta-ecosystems. However, genetic and trait data are mostly available for a few model organisms and more data on a wider range of species interactions, environment contexts and traits will be necessary to compare model predictions with empirical patterns.

To what extent does the complexity of gene interaction networks drive intraspecific trait variance and the complexity of ecological networks? How does the interaction between the genetic architecture of defense and attack traits influence the stability of meta-ecosystems? In addition, what is the role of phenotypic plasticity in this regard? How strong is the interdependence among the genetic architecture underlying trait interaction, local community dynamics and spatial connectivity?

Hierarchical networks allow to integrate interactions between genes within genomes, individuals within populations and sub-populations with communities in the same framework. Further studies considering process-based approaches are needed to understand how strong is the interdependence and feedback between trait distributions of interacting species, and how do the interdependence and feedback vary geographically? How do interactions between evolutionary and ecological networks with feedback differ in their behavior from networks without feedback?

What are the main eco-evolutionary network patterns across biological scales? Are multi-nested patterns common? Which are the evolutionary and ecological network processes reproducing such patterns? Are interdependencies and feedback among evolutionary and ecological networks required to reproduce the empirical patterns across biological scales?