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ECOSYSTEM COMPETITION AND PREDATION MODELLING AND MODEL ANALYSIS

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We will discuss the analysis of simple food webs where stoichiometry plays a role in modelling competition for resources and predator–prey interactions. We start with re-analyzing the problem of competition of two species for two resources in a chemostat environment [1, 2]. The case of perfect-essential resources (Liebig's minimum law where the most limiting resource determines the growth rate of the consumer population) has been extensively discussed using Tilman's representation in resource quarter plane plots. We will show that a bifurcation analysis gives the same (equilibrium) results. However, this approach is not restricted to a particular model but also works for a large class of models, also with other trophic interaction formulations. This is illustrated by the analysis of a model considering complementary resources [3]. The Liebig's minimum law and complementary formulations predict similar results. We also discuss supersaturation where the number of species is larger than the number of resources, [4, 5], in the case of oscillatory dynamics. Finaly we present results for a three level ecosystem. A generalist predator is introduced which consumes two substitutable prey populations each consuming the two either substitutable or complementary resources. This additional predator-prey trophic interaction allows for non-equilibrium dynamics at high resource input rates, related to the paradox of enrichment. In that regime with perfect-essential resources the Liebig's minimum law and complementary formulations give stricking different results.

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