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A collective phase in resource competition in a highly diverse ecosystem[1] MIKHAIL TIKHONOV, Harvard Univ, REMI MONASSON, Ecole Normale Superieure, Paris — Recent technological advances uncovered that most habitats, including the human body, harbor hundreds of coexisting microbial "species". The problem of understanding such complex communities is currently at the forefront of medical and environmental sciences. A particularly intriguing question is whether the high-diversity regime (large number of species N) gives rise to qualitatively novel phenomena that could not be intuited from analysis of low-dimensional models (with few species). However, few existing approaches allow studying this regime, except in simulations. Here, we use methods of statistical physics to show that the large-N limit of a classic ecological model of resource competition introduced by MacArthur in 1969 can be solved analytically. Our results provide a tractable model where the implications of large dimensionality of eco-evolutionary problems can be investigated. In particular, we show that at high diversity, the MacArthur model exhibits a phase transition into a curious regime where the environment constructed by the community becomes a collective property, insensitive to the external conditions such as the total resource influx supplied to the community.

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