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Higher decomposer functional diversity bolsters ecosystem gross primary productivity resistance under drought: a three-year ecotron study

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Projected climatic conditions, such as more frequent and prolonged droughts, are expected to become more common in many regions of the world according to the IPCC 2023 report, particularly in the Mediterranean. These conditions can reduce plant CO_2 uptake, gross primary productivity, and decomposition rates, potentially disrupting the carbon cycle. While higher soil biodiversity might mitigate these adverse drought effects by enhancing productivity and decomposition stability, the net effect on ecosystem CO_2 exchange remains largely uncertain, making future carbon cycle predictions challenging.

Using a reconstructed Mediterranean understory model ecosystem, we conducted a three-year experiment in 16 lysimeters (1m³ soil volume, 1m² surface area) at the Montpellier European Ecotron (www.ecotron.cnrs.fr). We tested two levels of decomposer functional diversity (low and high) under ambient summer drought and more intense drought conditions (-30% precipitation and longer drought spells). Our results show that higher decomposer functional diversity maintained up to 25% higher gross primary productivity (GPP) during the early stages of drought. This response was partly due to better water uptake from the deeper soil layers, as indicated by volumetric water content sensors.