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Carbon assimilation limitations during and after the European 2022 drought and heat wave

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In 2022, Europe experienced a widespread severe summer edaphic drought and heat event. We explore how the gross primary productivity (GPP) was affected by this dry spell by contrasting 2022 with previous years, using high-frequency Eddy-Covariance and meteorological monitoring from 16 ICOS forest stations spanning across Europe. With the exception of Scandinavian forests, all monitored stations experienced a reduction of GPP ranging from 5 to 60% and a reduction of evapotranspiration ranging from 10 to 62% during summer. GPP reduction was predominantly attributed to a decrease in the maximum apparent carboxylation rate rather than a direct effect of soil water content limitation on stomatal aperture at the canopy scale. Some sites showed more GPP than usual after the drought due to abnormally hot and wet autumn conditions. However, most severely affected sites did not fully recover to normal GPP levels after the drought, suggesting a potential lagged effect of the adverse summer conditions.