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Effects of drought and warming treatments on CO_2 fluxes in shrubland ecosystems across an environmental gradient: a synthesis of the INCREASE project

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Seasonal changes of net ecosystem exchange (NEE) of terrestrial ecosystems are the result of different interactions between CO_2 assimilation (GPP) and ecosystem respiration (ER) with environmental drivers.
There is still debate about to which extent low soil moisture (drought) and increased temperature (warming) can affect GPP or ER depending on both functional groups and ecosystem climate types. In dynamic systems, such as shrubland ecosystems, these effects can be difficult to predict.
We used the INCREASE network infrastructure "space-for-time substitution" (natural gradient and experimental approach) to quantify the effects of drought and warming on GPP, ER, SR and NEE across 6 European shrublands. The sites ranged from Denmark to Southern Italy along a precipitation and temperature gradient. In addition, INCREASE experimentally manipulates the climate in 20 m2 plots simulating the climate change: reflective curtains are drawn across plots at night preventing heat loss (warming treatment) while other plots are periodically covered by curtains during rain events thereby reducing the water input from precipitation (drought treatment).
The measurements of soil CO_2 efflux (SR), net ecosystem CO_2 exchange (NEE) and total ecosystem respiration (ER) were done according to common protocols using chamber method, while the gross ecosystem photosynthesis (GPP) was estimated by difference between NEE and ER.
Preliminary results indicate large flux variability across the sites and the seasons. The drought treatment tends to limit the loss of CO_2 through the respiratory processes, while the warming treatment seems to stimulate all the processes in most sites, even in the Mediterranean where the temperature has never been considered a limiting factor.