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Delayed and altered post-fire recovery pathways of Mediterranean shrubland under 20-year drought manipulation

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Increasing anthropogenic and natural disturbances have disturbed 75% of global land area, indicating many plant communities are unstable or in recovery process. Increasing water deficits by rainfall reduction may decrease resilience (rate of recovery) and trigger different succession pathways (e.g. delayed, altered mature status and advanced degradation). Knowledge on the effects of future drought on community structure and demographic dynamics is key to project the fate of vegetation and yet it is limited.

Here we assessed the impacts of long-term (20 years) experimental drought (-30% rainfall) on the successional pathways of species diversity, community composition and demographic changes for an early-successional Mediterranean shrubland (4 years after a wildfire). The results indicated that experimental drought significantly decreased species richness and shifted community composition compared to control plots. Significant decreases in abundance and increases in death ratios at both community (all species) and shrub (shrub species) levels were found in experimental drought. However, the abundance of *Globularia alypum* was significantly increased by drought while *Erica multiflora* was not affected; the death ratios for the two species were significantly lower in drought than control plots. Species richness, community composition and abundance followed pathway 2 (altered mature state) while shrubland abundance followed pathway 3 (advanced degradation). Principal Component Analysis (PCA) indicated that the variance in vegetation metrics was notably explained by the first two dimensions (49.4%), mainly related to the death ratio of *G. alypum* and *E. multiflora* (27.3% for PC1) and abundance of community and shrub levels (22.1% for PC2). The space variation in PC1 significantly increased over time, which was orthogonal with PC2. Within two dimensions of PC1 and PC2, the scores in control were significantly higher than drought.

Our findings suggest that drier condition simulated by long-term drought could delay and alter the succession pathways of species diversity, community composition and abundance of the plant communities in Mediterranean ecosystems. The results also imply the importance to analyse long-term drought and extreme events on ecosystem functions (the strength of carbon storage in

vegetation and soil) for such recovering communities.