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CONTENTS

Functional response of graminoid species to changing summer water availability: insight into the effects of climate change in sub-Mediterranean meadows

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Climate change models predict modification of existing precipitation regimes and an increasing summer drought in Mediterranean regions. Especially in fragmented landscapes as semi-natural pastures, climate change has the potential to overwhelm the capacity for adaptation in many plant populations. The consequences are likely to include unpredictable changes in the abundance of species within communities and reduction in their ability to resist and recover from further environmental perturbations. Consequently, understanding adaptation strategies of plants to changes in water availability is of key importance in predicting the response of sub-Mediterranean grasslands to climate change. The main research aim was to investigate how dominant graminoids in sub-Mediterranean meadows (central Apennines, Italy) respond to the variability of weather events, through the assessment of key functional traits that reflect species ecological strategies: specific leaf area (SLA, one-sided leaf area per unit of dry mass) and plant height (the shortest distance between the upper photosynthesizing leaf on a plant and the ground level).

In different fenced plots, we artificially imposed lower and higher summer water availabilities than the average of the previous 30 years; while other plots received only ambient rainfall. We measured leaf area, dry mass and plant height and calculated SLA on randomly collected leaf samples of dominant graminoid species in each plot (three replicates for each treatment), at three times of one growing season, and tested the effect of treatments on these variables, controlling for phenological state of plant, leaf state and time of data collection.

We found that in some perennial late spring/early summer-flowering species (i.e. *Cynosurus cristatus* and *Lolium perenne*), reduced rainfall, jointly with phenological phase and time, affected in the same direction both leaf area and dry mass, leaving SLA values substantially unchanged during the growing season. Additional rain increased significantly SLA in *Cynosurus cristatus*, due to a higher increase in leaf area than in dry mass. In other perennial species (i.e. *Arrhenatherum elatius* and *Elymus repens*) with later reproductive cycle, increase in drought caused a significant decrease in SLA, associated to a reduction in leaf area, especially at the end of the treatment (summer end), indicating a shift of plant strategy to a lower efficiency in resource acquisition and use. Contrariwise, the increase in drought within a growing season, had a modest influence on plant height. These results suggest that response patterns of leaf traits to reduced water availability are species-specific and are probably linked to species' functional structure. This requires further research to understand the relation between leaf traits and other plant traits, including those related to plant flowering strategy. Moreover, as species with high SLA have also a higher nitrogen concentration, the lower SLA associated to drough events would worsen the nutritional value of pastures, representing a threat to livestock rearing.

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The intersection of diversity metrics and spatial mapping: new insights into regional vegetation patterns for complex communities

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Keywords: beta (β) diversity, zeta (ζ) diversity. multivariate analyses, vegetation classification, scale, predictive modelling, regional

Can we combine diversity metrics and mapping to better understand plant community patterns at regional scales for complex plant communities? Diversity metrics (β; ζ; multivariate dispersion) were measured and spatial mapping undertaken and intersected (an approach hitherto not undertaken) as a novel method for assessing complex vegetation patterns. Data from two contrasting survey designs from 69 randomly selected swamps (over 800 quadrats) across a large region with high species diversity and complex vegetation patterns at small spatial scales were used for these analyses. Vegetation patterns at the regional scale were then compared using a novel classification procedure (hybrid classification) informed by small-scale floristic variability as an alternate to a standard classification. It was determined that: 1. Estimates of spatial structure were biased when using standard approaches to survey design (both β and ζ overestimated). 2. The levels of spatial structure among swamps (as measured by β and ζ) were such that swamps were largely unique. 3. A skewed pattern of floristic assemblages (types) was determined such that there were few common floristic assemblages but many uncommon assemblages. 4. Floristic assemblages previously mapped as occurring in discrete parts of the region were found to be widespread. 5. A poor relationship exists between a standard classification approach and a hybrid classification informed by within swamp variability. Small-scale floristic patterns within swamps largely drove regional diversity. These floristic patterns had little relationship to previous classification and mapping for the region using standard mapping procedures based on regional scale variables. The intersection of diversity metrics and spatial mapping can provide critical insights into regional vegetation patterns that otherwise remain obscure. The use of regional scale variables linked to standard mapping techniques can create vegetation mapping that is largely an artefact of survey and classification limitations in these complex communities.