

## The effect of altered rainfall seasonality on C<sub>4</sub> grass expansion in the Cape Floristic Region

Climate projections in many Mediterranean-type ecosystems, including the Cape Floristic Region, predict changes in rainfall seasonality. Winter rainfall is decreasing, but there has not been a corresponding decrease in summer rains, raising the relative contribution of rain in summer. Moreover, these rainfall changes are associated with increasing temperatures. Warmer temperatures during the wet winters and additional summer rainfall, may favour warm-season C<sub>4</sub> grasses relative to cool-season C<sub>3</sub> vegetation. Palaeo-ecological evidence suggests that C<sub>4</sub> grasses may have expanded at the expense of Fynbos, following changes in rainfall seasonality. In this study we investigated the effects of rainfall seasonality changes on C<sub>4</sub> grass invasion into the Fynbos. We conducted a greenhouse experiment and a field-based rainfall manipulation design to test the response of C<sub>4</sub> grass recruitment and establishment (growth and survival) to increased summer rainfall in different soil types in the Fynbos. The nested hierarchical experimental design of both the greenhouse and field experiments required the use of mixed models to investigate study outcomes. Our findings show that recruitment and establishment were promoted by resource availability (moisture, soil nutrients) during the growing season. However, grass growth was comparatively lower in the field due to slow-growth and high mortality rates, than in the greenhouse. Nevertheless, these results suggest that moisture, edaphic factors, or the interaction of both may influence the potential to invade. This could provide useful generalizations on the mechanisms and limitations of C<sub>4</sub> grass invasion in different vegetation types in the Cape Floristic Region and may inform future grassland management practices.