Title: Convergent evolution across environmental gradients: evidence for repeated phenotypic shifts in South African *Protea*

Abstract: Many of the world’s plant biodiversity hotspots are also regions of high environmental heterogeneity. The Western Cape of South Africa, for example, is characterized by extremely steep gradients in elevation and drought, as well as higher species richness than would be expected for its small size and temperate latitude. The evolution of this region’s diverse flora has been linked to geographic complexity in several ways, ranging from extensive geographic isolation and drift to strong divergent selection and local adaptation. In Cape lineages where geographic differentiation is adaptive, its signature could include convergence on similar phenotypes among species or even within widespread species, as a response to common ecological challenges like extreme climates or biotic pressures. My research tests for such patterns in adaptive evolution using the genus *Protea*, which includes several dominant Cape species. I explore evolutionary patterns of phenotypic variation within *Protea* using two classes of traits, pigmentation and morphology, and I measure the consequences of these traits for ecophysiological performance and plant fitness under diverse settings. Current findings suggest that phenotypic diversity in three traits—a pigment polymorphism, leaf size, and stomatal density—reflects a convergent evolutionary response to key environmental gradients including elevation, drought intensity and seed predation. This work provides the most in-depth evidence thus far for wide-spread and parallel adaptive differentiation within a keystone Cape lineage. Further, the extreme intra-specific variation shown here for *Protea* also highlights the importance of including ecotypic differences when assessing climate change vulnerability, which is the focus of upcoming research.