Scaling up Native Seed Production to Improve Plant Restoration Material on the Colorado Plateau

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The Southwest is experiencing unprecedented severe to extreme drought which will have lasting effects on plant germination, production, and regeneration. Wild seed stock limitations are known to occur in the Western U.S., where drought conditions are prolonged and severe and have led to extensive lack of wild native seed for restoration projects. Under these conditions, we also aim to understand how plant traits evolve and are expressed over time. One avenue that traits are passed on is through maternal effects, in which the offspring expresses a phenotypic response driven by its development in its maternal environmental conditions. Over generations, the selecting for certain adaptive traits leads to that maternal effect that persists in the population, such as traits that determine drought resistance. This research examines the utility of maternal effects for the purpose of improving restoration material on a large-scale.

Studying the extent of maternal effects and phenotypic plasticity in multi-generational species like perennial forbs poses challenges in field and greenhouse settings. Consequently, the dynamic expression of adaptive traits within each generation necessitates further research on the persistence and extent of such traits in perennial offspring species. A common garden experiment was conducted in summer 2021 and 2022 to compare traits (i.e., plant height, survivorship, peak flowering, and seed set) of maternal plants that grew in varying arrangements of fertilizer and irrigation treatments to create a manipulated environment the plants experience. In summer 2023, greenhouse experiments will assess offspring traits with those of their maternal lineages. We will assess the degree of maternal effects and their potential heritability to better understand underlying mechanisms of heritability as it relates to provenance. This research aims to enhance restoration materials by providing insights into strategies that can be employed to optimize sourcing plant material for habitat improvement. Large-scale restoration projects often require the propagation and establishment of numerous plant species, and incorporating maternal effects into the selection and cultivation process could improve the performance and resilience of restored ecosystems.

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