Woods, SR. SR Archer, S Schwinning. 2013. Seedling responses to water pulses in shrubs with contrasting histories of grassland encroachment. ***PLOS One*** In Press

Woody plant encroachment into grasslands has occurred worldwide, but it is unclear why some tree and shrub species have been markedly more successful than others. For example, *Prosopis velutina* has proliferated in many grasslands of the Sonoran Desert in North America over the past century, while other shrub species with similar growth form and life history, such as *Acacia greggii*, have not. We conducted a glasshouse experiment to assess whether differences in early seedling development could help explain why one species and not the other came to dominate many Sonoran Desert grasslands. We established eight watering treatments mimicking a range of natural precipitation patterns and harvested seedlings 16 or 17 days after germination. *A. greggii* had nearly 7 times more seed mass than *P. velutina*, but *P. velutina* emerged earlier (by 3.0 ± 0.3 d) and grew faster (by 8.7 ± 0.5 mg d^{-1}). Shoot mass at harvest was higher in *A. greggii* (99 ± 6 mg $seedling^{-1}$) than in *P. velutina* (74 ± 2 mg $seedling^{-1}$), but there was no significant difference in root mass (54 ± 3 and 49 ± 2 mg $seedling^{-1}$, respectively). Taproot elongation was differentially sensitive to water supply: under the highest initial watering pulse, taproots were 52 ± 19 mm longer in *P. velutina* than in *A. greggii*. Enhanced taproot elongation under favorable rainfall conditions could give nascent *P. velutina* seedlings growth and survivorship advantages by helping reduce competition with grasses and maintain contact with soil water during drought. Conversely, *A. greggii*'s greater investment in mass per seed appeared to provide little return in early seedling growth. We suggest that such differences in recruitment traits and their sensitivities to environmental conditions may help explain ecological differences between species that are highly similar as adults and help identify pivotal drivers of shrub encroachment into grasslands.