Hydraulic responses of *Cornus drummondii* to fire frequency and drought in a tallgrass prairie

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The increase in abundance and density of woody plants in herbaceous ecosystems (i.e., woody encroachment) is occurring globally and is driven by reduced fire frequency, climate change, and the utilization of deeper, more reliable soil water by woody plants. Thus, a comprehensive understanding of the physiological processes through which woody plants use deep water, particularly in response to different fire and climate regimes, will provide greater insight into the dynamics and consequences of woody encroachment. Our objective was to assess how experimental changes in water availability and fire frequency impact water-use traits in *Cornus drummondii*, the primary encroaching shrub within North American tallgrass prairies. Rainout shelters that either reduce precipitation by 50% (drought) or 0% (control) were built over mature shrubs growing in sites that are burned at 1-year and 4-year frequencies. We assessed the water transport capability of shrubs growing in each water*fire treatment by measuring the maximum hydraulic conductance (K_{max}) of entire root systems, stems, and leaves. We also assessed the vulnerability of stems and roots to loss of function caused by water stress by measuring vulnerability curves and calculating the pressure at which 50% of the maximum hydraulic conductivity is lost (P_{50}). Roots exhibited the greatest K_{max} (0.14 ± 0.01, 0.09 ± 0.003, and 0.06 ± 0.003 $kg^{1}\ s^{-1}\ m^{-2}\ MPa^{1}$ in roots, stems, and leaves, respectively) but were also the most vulnerable to water stress (P_{50}=-0.64 ± 0.24 and -3.95 ± 0.35 MPa in roots and stems). Root K_{max} was lower in 1-year burned shrubs exposed to drought compared to 1-year burned control shrubs (0.08 ± 0.01 vs 0.19 ± 0.04 $kg^{1}\ s^{-1}\ m^{-2}\ MPa^{1}$), but root vulnerability did not differ among water*fire treatments. Conversely, stem K_{max} did not differ among treatments, but 1-year burned stems were more vulnerable to water stress than 4-year burned stems, particularly when exposed to drought (P_{50}=-3.19 and -4.87 MPa for 1- and 4-year burned drought stems). Thus, frequent burning reduced root transport capability and concomitantly increased the vulnerability of stems to water stress, but only under drier conditions. Future work will investigate whether these responses to frequent burning and drought are associated with reduced shrub growth under future climate scenarios.