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Watershed and ecosystem responses to invasive grass establishment and dominance across a desert grassland watershed

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Compared to aridland systems that have undergone rapid change in dominant vegetation growth form, the consequences to watershed and ecosystem processes following a shift in dominance between similar growth forms have not been well-studied. Following a five year drought period, strong summer monsoon rains in 2006 across the USDA-ARS Walnut Gulch Experimental Watershed near Tombstone, AZ, were accompanied by widespread native perennial grass mortality, a transient increase in annual forbs, followed by establishment and sustained dominance by the invasive South African bunchgrass, Lehmann lovegrass (Eragrostis lehmanniana) across a semiarid grassland watershed (Kendall grassland, WS#112). This loss of ecological diversity occurred across a watershed already instrumented for quantifying long-term climate, watershed, hill-slope, and ecosystem-level gas exchange. Salient findings from these data sets were: 1) annual watershed sediment discharge rapidly returned to pre-invasion levels following a large spike in 2006 that accounted for 65% of the total sediment yield summed over 35 years, 2) plot-level experimental runoff studies showed hill-slope sediment yields consistently doubled, as did growing season soil evaporation contributions to ET, and 3) the grassland was a carbon sink during dry conditions under lovegrass dominance. These findings show that while some aspects of watershed and ecosystem function rapidly re-established (i.e. sediment yield and net primary productivity), processes acting at lower spatial and temporal scales have been negatively impacted by lovegrass dominance. We believe these lower-order processes underlie the strong ecological effects associated with Lehmann lovegrass invasion, and may also accelerate landform processes and change the basic ecohydrological characteristics of semi-arid grassland watersheds.