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Drought severity and impact relationships: a multidimensional case study of recent droughts in the south-central semiarid prairies of the United States

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As earth's climate is changing, there is evidence for abrupt shifts to hotter and drier climate conditions in some locations. These changes may be particularly harmful to coupled human and natural systems in semiarid regions because they exist on marginal water availability and can exhibit strong coupling between land surface and atmospheric conditions which can make droughts more persistent. In the south-central semiarid prairie ecoregion of the US, there has been a significant warming trend over the past 120 years. This ecoregion has also experienced some of the most severe drought conditions in the US during recent decades, particularly in southwest Oklahoma and adjacent portions of Texas. These drought conditions have complex, multi-dimensional impacts on coupled human and natural systems, which are often not adequately quantified or understood. Furthermore, even the severity of drought is often poorly or inconsistently measured, in part due to an overreliance on meteorological or remotely-sensed data as opposed to measurements of stored soil water, surface water, and groundwater. The objectives of this research are to 1) accurately measure the severity and multi-dimensional impacts of recent droughts in the south-central semi-arid prairies of the US and 2) clarify the relationships between drought severity and impacts. We utilize a case-study approach focused on southwest Oklahoma where in situ observational datasets allows for quantification of stored soil water, surface water, and groundwater. Drought impact types were recorded by the US Drought Impact Reporter and quantified using appropriate supplemental datasets and models.