

# IMPACT OF SOIL MOISTURE DEFICIT ON ECOSYSTEM FUNCTION ACROSS THE UNITED STATES

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The cumulative effect of recent prolonged warm drought on regional ecosystem function is still uncertain. Large regions of the United States are experiencing new hydroclimatic conditions with extreme variability in climate drivers such as total precipitation, precipitation patterns (e.g., storm size, intensity and frequency), and seasonal temperatures. In turn, some regions are experiencing prolonged soil moisture deficit, when the average monthly soil moisture drops below the record-long mean for an unprecedented number of consecutive months. These new conditions are eliciting a variety of short- and long-term responses in ecosystem productivity, and thus, generalizations across space and time are rare. Through a series of studies using long-term records of USDA experimental watersheds, ranges and forests, some cross-biome conclusions have been reached, leading to several consistent predictions about ecosystem resilience. A key finding was that soil moisture deficit is a more consistent predictor of ecosystem productivity than climate drivers such as precipitation and temperature. In fact, ecosystems facing prolonged soil moisture deficit were found to reach a threshold associated with recent reports of regional grassland and forest mortality. Such thresholds, driven by the recent extended drought, were observed for both water- and light-limited grasslands in the southern United States. This presentation presents a synthesis of the role that soil moisture measurements play in understanding and predicting the functional response of ecosystems to climate change. Results are based on multi-location analysis of decade-long hydroecological measurements at experimental sites across the United States during the early 21st century drought. These results advance our understanding of ecosystem responses to complex climate variability, and demonstrate the value of new global observations of surface soil moisture with orbiting missions.

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