

Past, current, and future climate trends on rangeland production and quality

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Climate trends influence rangeland production and quality in the Great Plains. Past climate influences of major droughts (1930s Dust Bowl, mid-1950s) provide benchmark contexts for land managers regarding exceptionally low rangeland productivity due to associated soil disturbance and loss. Using information on long-term (decadal) climatological influences involving the phases (warm/cool) of the Pacific Decadal Oscillation (PDO) and Atlantic Multidecadal Oscillation (AMO) provide land managers with knowledge of drought frequencies and therefore expected reductions in rangeland production. Current climate trends are overlain on landscapes with continued multi-decadal vegetation recovery from past droughts and changing vegetation dynamics including increased abundance of eastern red cedar and invasive annual grasses. Quality of rangeland forage declines as the growing season progresses, with land manager decisions on stocking density influencing diet quality for livestock. Future climate trends include projections for continued increases in atmospheric carbon dioxide (CO₂) concentration and temperatures. A unique field research experiment evaluated the interaction of these two directional projections in native prairie of the western Great Plains. The combination of increasing atmospheric CO₂ and warming representing the mid-21st century conditions, improved rangeland production by about 35%, but forage quality of this rangeland production was reduced by about 13%. Incorporating these results into a livestock weight gain model resulted in estimates of a 30-pound reduction per head for yearling steers grazing these “projected futuristic rangelands” over the grazing season. This suggests that land managers may need to incorporate higher-level adaptive management of stocking rates and alterations to forage quality (e.g., prescribed fire, legumes) to maintain livestock production.