Did a decline in use of work animals lead to regional climate change?

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Transportation and farm operations relied on horses and other work animals throughout most of human history. Since the middle of the 20th century work animals have largely been replaced by motorized equipment in the United States and many other countries. In the central U.S. this led to a pronounced decrease in farmland for producing oats, which had mostly been used as feed for horses, and corresponding increases in other crops such as soybeans. The same period also saw a strong shift of the central U.S. precipitation intensity spectrum toward heavier events. We investigate possible connections between this technology-driven land use change and precipitation intensity by using the WRF-ARW regional climate model coupled with the Community Land Model, CLM 4.5. Crop acreages for maize, soybean, winter wheat, small grains (which includes oats and spring wheat), and other C3 and C4 crops were reconstructed on a decade by decade basis from 1940-2010 using county-level crop planting data. The resulting crop distributions were included in land surface boundary conditions for two multi-decadal regional climate simulations, one with 1940s land use and another with 2010 land use. The change in crop distribution produced a shift in the simulated precipitation intensity spectrum. Simulations using present-day (2010) land use had higher frequencies of heavy precipitation amounts and lower frequencies of light amounts compared to 1940s land use. These results suggest that replacement of work animals by mechanized transport led to land use changes that contributed to the observed trend toward more intense precipitation over the central United States.