



Persistent Drought, Land Tenure, & Land Cover Change in the Southern Great Plains: A Case Study from Cimarron County, OK & Union County, NM

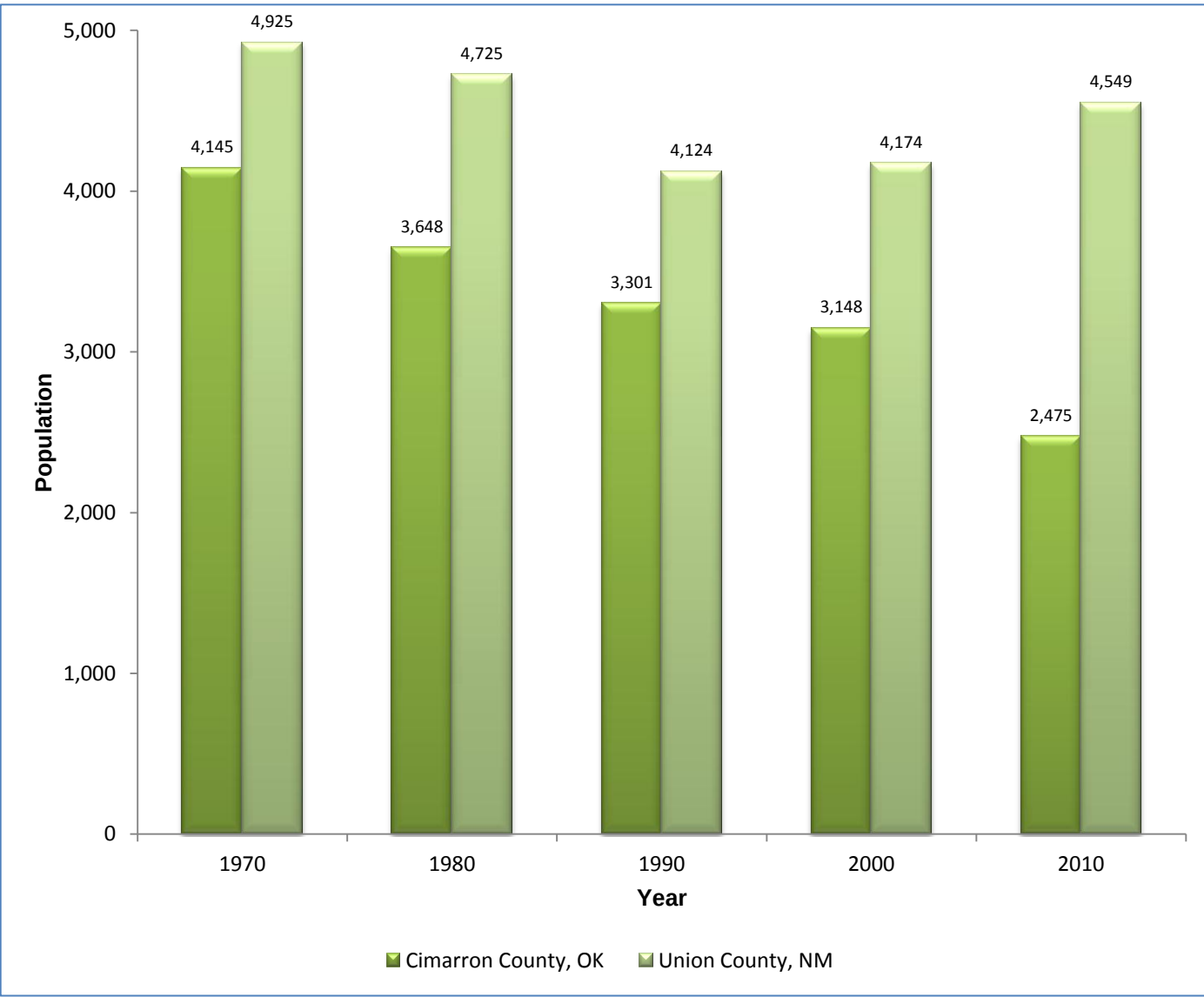
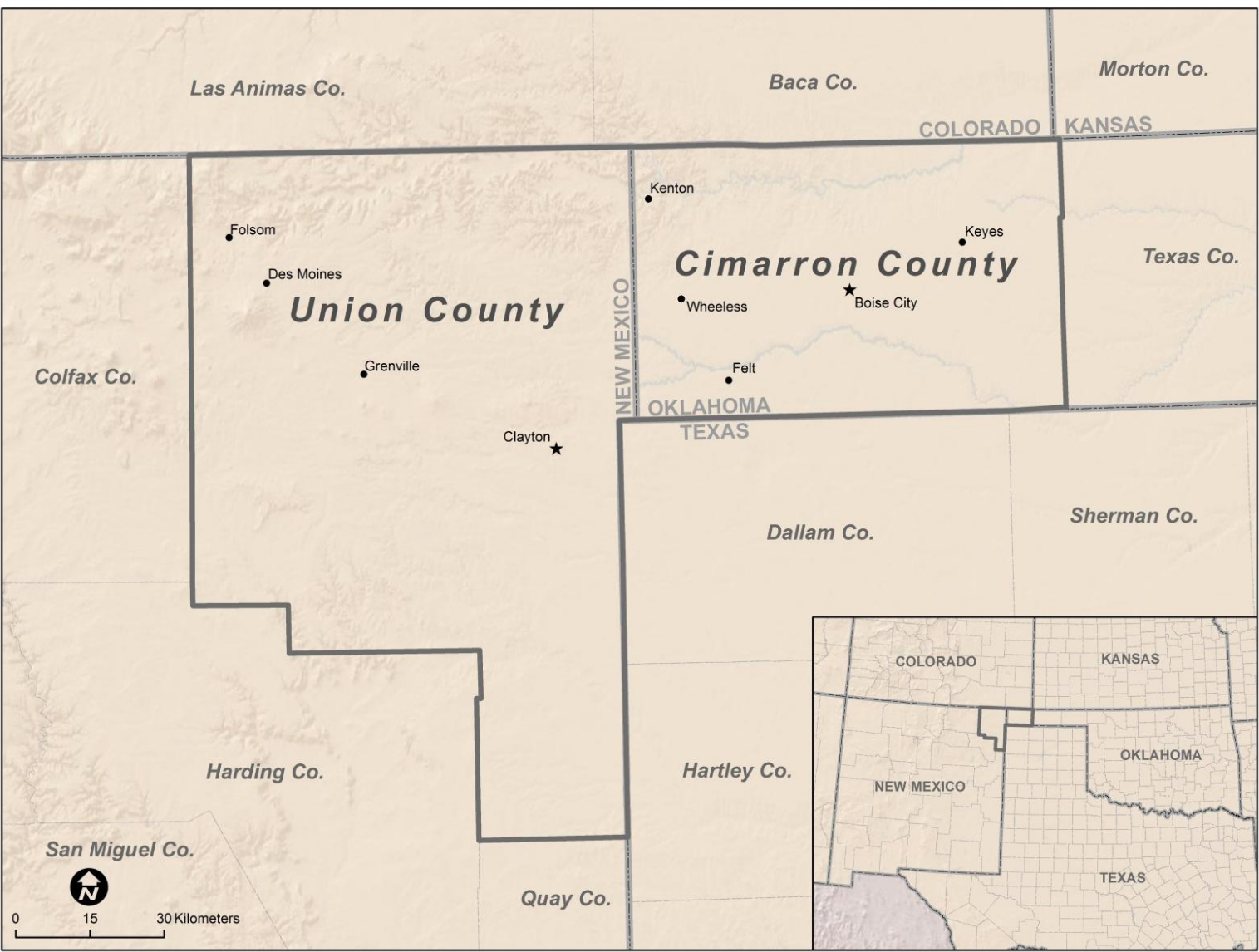
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Overview

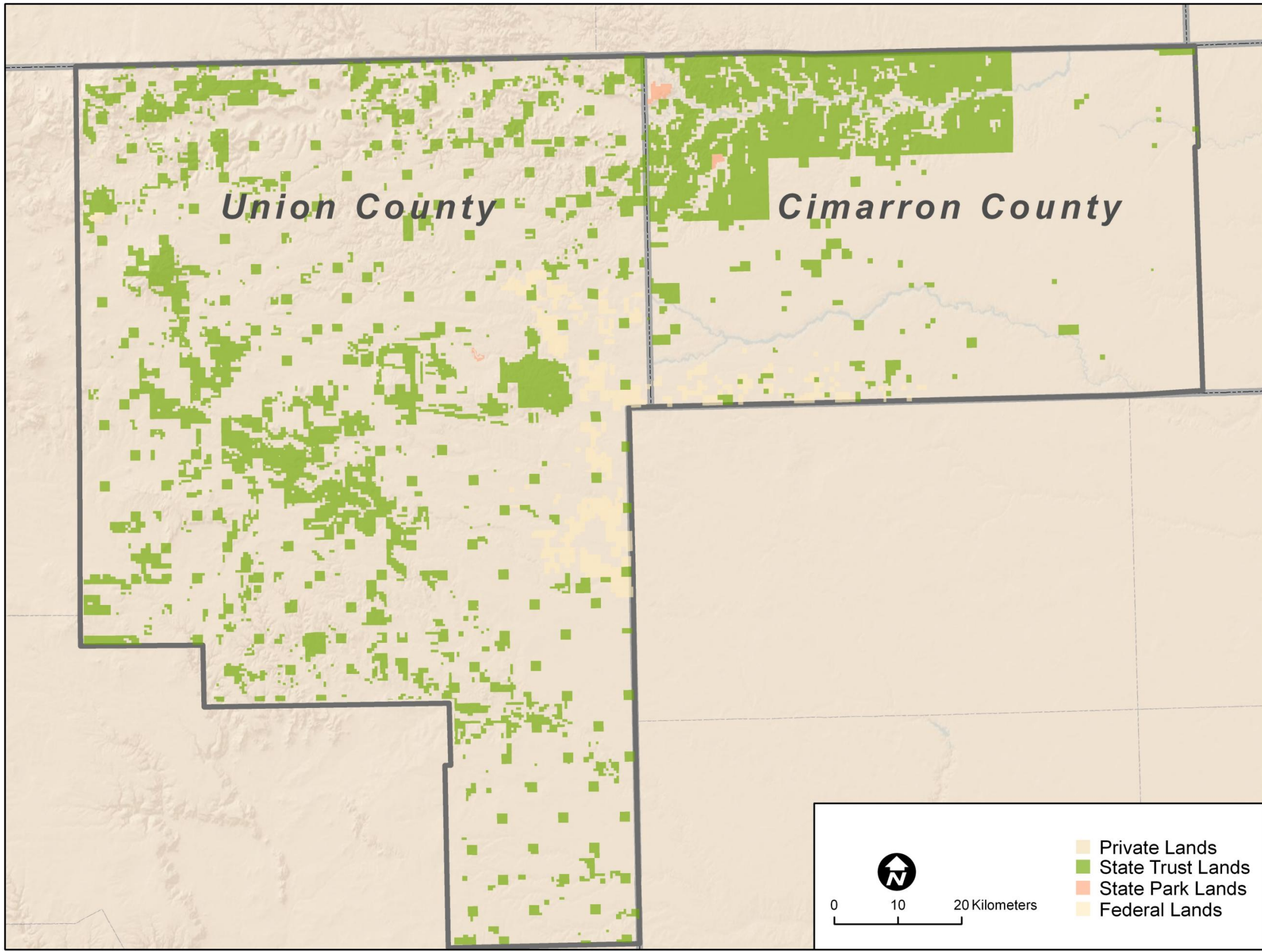
Cimarron County, OK and Union County, NM, adjacent counties in the southern Great Plains, are in the continued midst of severe drought. While the two counties share similarities in geography, climatology, ecology, population densities, and agricultural economy, they differ culturally, demographically, and institutionally (e.g. state policy). During the past century, the region has been subjected to six major drought events: 1890s, 1909-18, 1930-40 (the Dust Bowl), 1952-58, 1962-72, and 2000-present. Despite their similarities, the two counties have responded to these events quite differently. Residents of Cimarron County have received over \$27 million USD in Federal USDA disaster subsidies between 1995 and 2011, while the residents of Union County have only received a fraction thereof, \$8.93 million USD. This raises intriguing questions about the seemingly greater vulnerability to disaster of residents in Cimarron County to Union County. We hypothesize that the answer, in part, may lie in the dramatic difference of state land governance policies. More specifically, New Mexico policy incentivizes better land stewardship through long-term leasing, while Oklahoma policy of open-bidding may inadvertently encourage overgrazing because ranchers have no guarantee of permanency on leased lands.

Study Area and Demographics



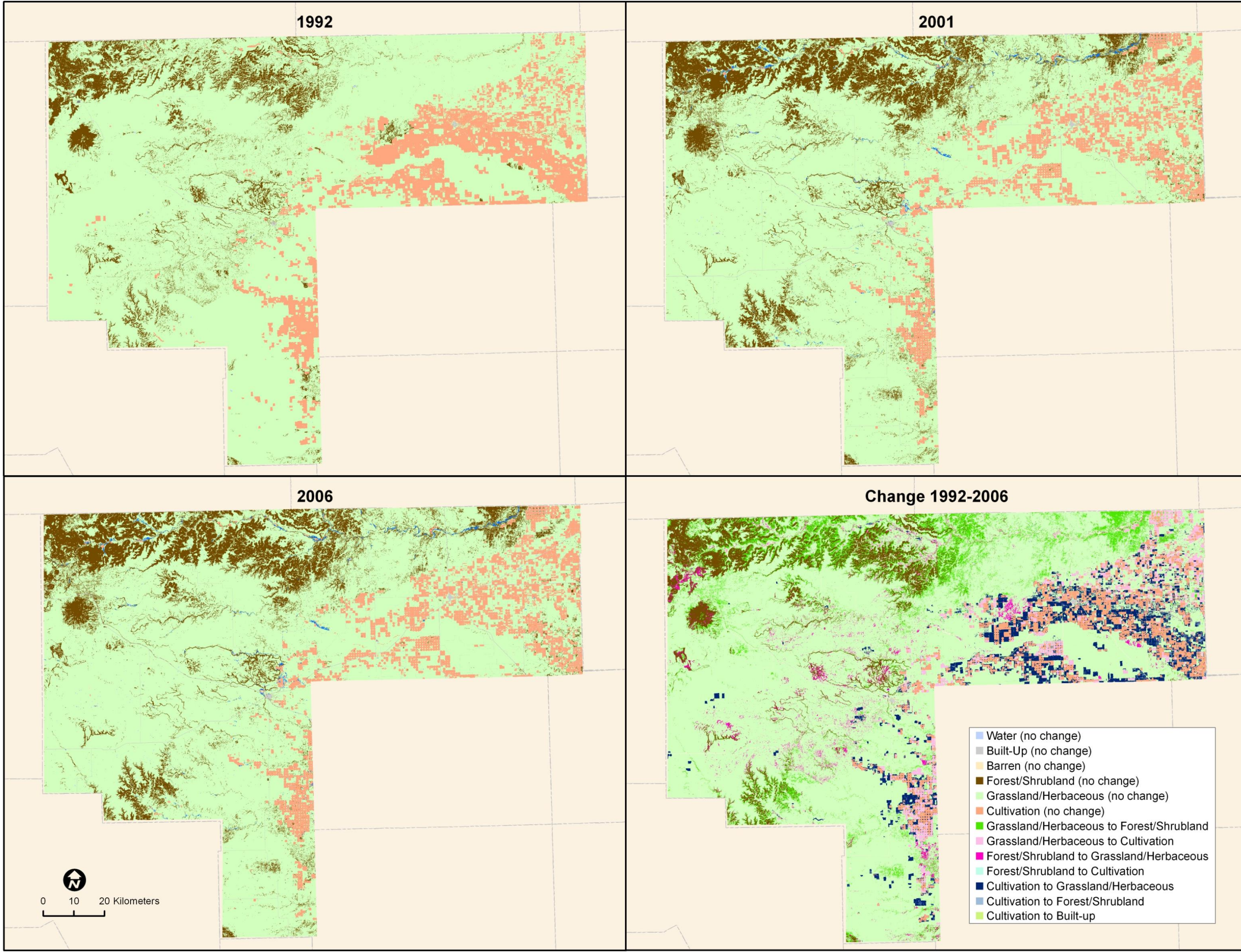
Cimarron County, OK and Union County, NM, located in the semi-arid (Bsk) southern Great Plains, share similar geographical borders, frontier cattle histories, and agricultural economies. The area averages between 40.6 and 43.2 cm of precipitation a year, while average annual temperature are between 11° and 13° C. Since the early 20th C., both counties have transformed into important cattle, agricultural, and grain areas for the United States. However, since the Dustbowl of the 1930s, both Cimarron and Union counties have seen a general decrease in population. Union County covers a larger area than Cimarron County, with a proportionally larger population (4,549 and 2,475, respectively c. 2010). However, both counties have a similar population density of ~2 individuals/km². Data source: U.S. Census Bureau.

Public/Private Land Matrix



Land Tenure	Cimarron County, OK	Union County, NM
Total Acres	1.2 million	2.44 million
Total Acres Private (%)	931,708 (78%)	1,948,685 (80%)
Total Acres State Trust Lands (%)	239,235 (20%)	436,789 (18%)
Total Acres State Parks (%)	2,607 (0.22%)	315 (0.01%)
Total Acres Federal Lands (%)	14,874 (1%)	58,530 (2%)
State Lands Policy	Cimarron County, OK	Union County, NM
Lease/Term	5 years	5 years+
Open Bidding?	Yes	No. Preference rights attached to surrounding deeded land with renewable leases 5+ years
Sustainability Incentived offered	No	Yes, reduced rents (up to 25% off)

Land Use/Land Cover Change



In order to determine whether differences in state policy may incentivize better land stewardship, we compared land cover change across land tenure types (e.g. public vs. private) in each county to ascertain whether differences exists. For this preliminary assessment, we used reclassified National Land Cover Database Land Cover datasets for 1992, 2001, and 2006. Future work will use repeat aerial photography and satellite imagery and will have a higher thematic resolution. Data Sources: National Land Cover Database.

Results

STATE TRUST LANDS							
Cimarron				Union			
Land Cover	1992	2006	Change	Land Cover	1992	2006	Change
Grassland/Herbaceous	228,806 (95.62%)	189,694 (79.28%)	39,112 (-17.09%)	Grassland/Herbaceous	359,609 (82.37%)	329,758 (75.53%)	29,852 (-8.3%)
Cultivation	5,779 (2.41%)	3,935 (1.64%)	1,844 (-31.91%)	Cultivation	4,521 (1%)	2,606 (0.6%)	1,914 (-42.35%)
Forest/Shrubland	4,502 (1.88%)	43,579 (18.21%)	39,077 (868%)	Forest/Shrubland	72,007 (16.5%)	102,083 (23.38%)	30,075 (41.77%)
PRIVATE LANDS							
Cimarron				Union			
Land Cover	1992	2006	Change	Land Cover	1992	2006	Change
Grasslands/Herbaceous	607,988 (65.25%)	606,863 (65.12%)	1,124 (-0.18%)	Grassland/Herbaceous	1,672,918 (85.88%)	1,555,023 (72.83%)	117,896 (-7.05%)
Cultivation	310,783 (33.35%)	240,397 (25.8%)	70,387 (-22.65%)	Cultivation	76,598 (3.93%)	70,623 (3.63%)	5,975 (-7.8%)
Forest/Shrubland	10,515 (1.13%)	49,230 (5.28%)	38,715 (368.19%)	Forest/Shrubland	194,837 (10%)	298,410 (15.3%)	103,573 (53.16%)

Conclusions

During the period of investigation, both the grassland/herbaceous and cultivation classes showed an overall decline throughout the study area, while the forest/shrubland cover class showed a dramatic increase (showing an almost ten-fold increase from 1992 to 2006). This increase in woody plant abundance comes primarily at the expense of grassland/herbaceous vegetation, though some areas previously classified as cultivation are also affected. Woody plant encroachment (mainly, invasive Juniper) is strongly tied to overgrazing of livestock. Cattle grazing reduces native grass species, and fuel for native fire regimes. As a whole, Cimarron County showed a greater increase in woody plant abundance than Union County. When viewed across land tenure regimes, state trust lands in Oklahoma showed the greatest increase in woody plant abundance, followed by private lands in Oklahoma. Both state trust and private lands in Union County also showed an increase in woody plant abundance, but not nearly to the degree as those lands in Oklahoma. Differences between 2001 and 2006 were negligible and, therefore, not included here. Listed values are in acres.

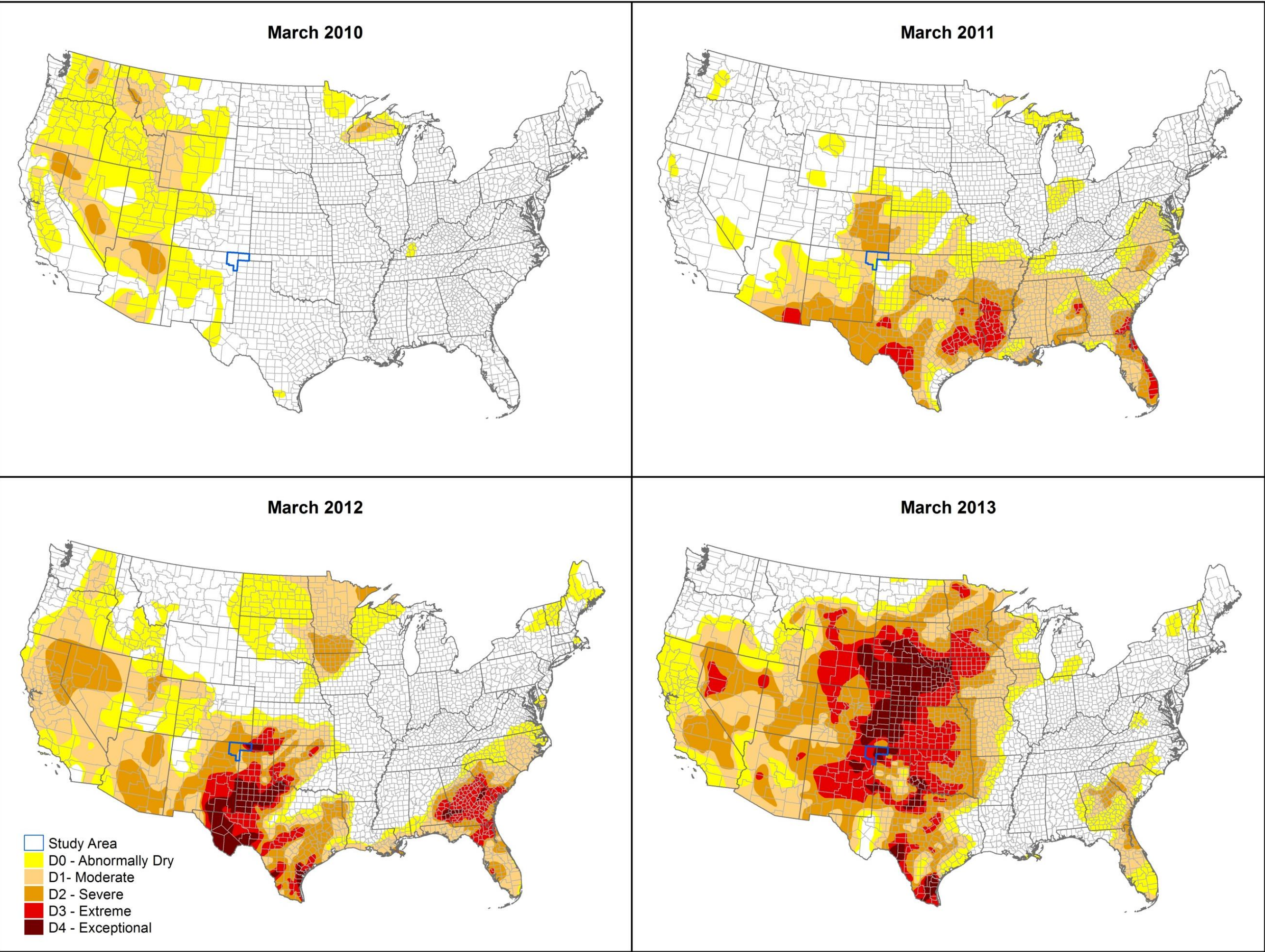
While these results are tentative, they seem to indicate that differences in land policy may, indeed, inadvertently foster poor land stewardship.

Scope and Limitations

These results are preliminary. Our land change analysis, based on NLCD Land Cover Data, has several limitations. Changes in mapping methodology and thematic classes between 1992 and 2001 make direct comparisons between the earlier dataset and the later datasets problematic. In order to overcome these known limitations, we reclassified each land cover dataset to broader land-use/land-cover (LULC) classes by aggregating various classes. In order to ensure consistency across data sets, future analysis will utilize a longer time sequence, will incorporate data from more sources, and will consist of more thematic classes. Lastly, we will explore whether other factors (beyond the public-private land matrix) that may account for observed changes.



Persistent Drought



Cimarron and Union counties are in the continued midst of what the U.S. National Drought Mitigation Center calls an "extreme" (D3) to "exceptional" (D4) drought. Consequently, land managers must make land use decisions based on complex economic and policy influences. For instance, during intense drought, native grasses for grazing become insufficient to support cattle, often forcing ranchers to cull herds. Lease and use of state public lands also influences land managers' decisions. Data source: National Drought Mitigation Center.

References

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Land Tenure

Both counties are an amalgam of public and private lands, the former consisting of federal (e.g. National Grasslands and Bureau of Land Management lands) and state (e.g. state parks and state trust lands) lands interspersed among privately held properties. However, the manner in which the state trusts lands are managed differ considerably. Since 1982, Oklahoma has had an open-bidding, five-year lease policy with no set maximum lease prices. In New Mexico, preference rights are attached to a household's deeded land. New Mexico also offers financial incentives for practicing sustainable agricultural practices, while Oklahoma does not. Data source: Protected Areas Database of the U.S.

1. Oklahoma State University, Department of Geography
2. University of Oklahoma, Department of Geography and Environmental Sustainability
3. Oklahoma Biological Survey/Oklahoma Natural Heritage Inventory
4. Oklahoma State University, Department of Political Science