Impact of Climate Change on Geographic Movement of Cattle Production

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Introduction

- The United States is the word's largest producer of beef at about 97 million cattle annually
- One of the most important industries in the US
  - $78.2 billion cash receipts (USDA-ERS)

Objective

Investigate the impact of climate change on cattle production

https://www.smallfootprintfamily.com/grass-fed-beef-and-global-warming

Specific Objective

Investigate the impact of climate change on monthly feeder cattle placements

Analysis of Kansas

Source: http://ontheworldmap.com/usa/state/kansas/kansas-location-on-the-us-map.html

Are there any climate change impacts on feedlot placement?

Temperature Increase

- Increase water consumption
- Decrease feed intake and efficiency of feed intake
- Decrease meat production
- Increase animal mortality

Temperature Decrease

- Reduces weight gain and daily weight gain

Precipitation Variation

- Increase stress on cattle creating wet, matted hair coats

Climate change impact on placements continued….

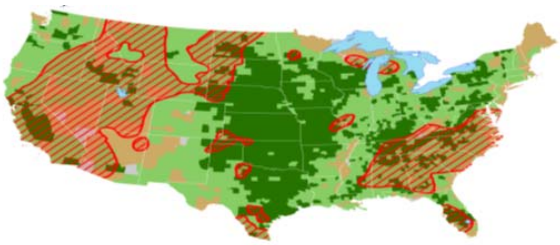
Feed and land resources:

- Imposes risk on volume produce (Wheeler and Reynolds,2013)
- Yield volatility
- Nutritional quality

Changes in cattle performance due to climate change affect feedlot profits

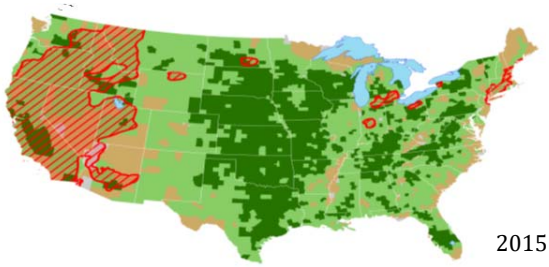
Better understanding about how climate change affect feedlot cattle is important when making placement decision and risk-management decisions

Climate change plays role in Cattle



Cattle areas experiencing drought -2008 (26%)

2013 – 73%



2015 – 12%

Source: Overview of the United States Cattle Industry- USDA (https://usda.mannlib.cornell.edu/usda/current/USCatSup/USCatSup-06-24-2016.pdf)

Will the cattle industry survive with extreme weather?

Drought can cause livestock producers to reduce their herd size and import feed at great cost

Oklahoma lost 23.6% cattle inventory (1.30million head) from 2011-2013

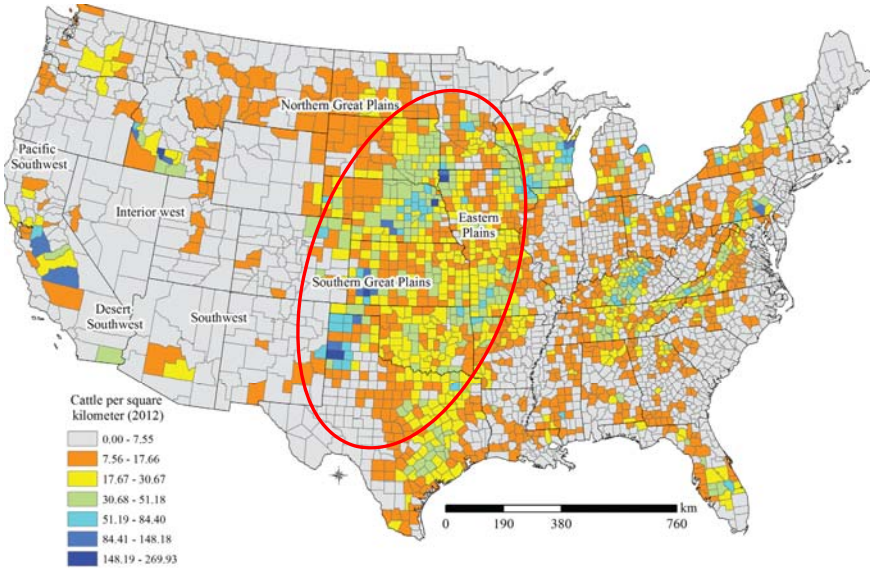
Texas lost 16.5% (2.2 million head) from 2011-2014 (Ripey, 2015)

Extreme weather continued…

Current economic loss due to seasonal depression in weight gain and feed efficiency- $300M in beef herds (Brandeborg, et.al , 2013)

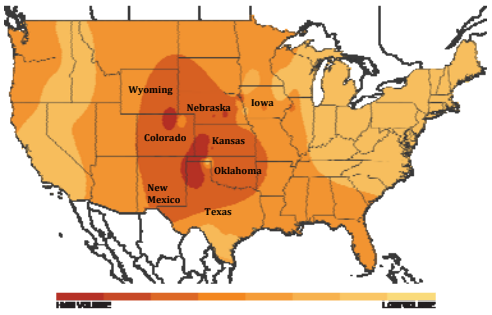
Even greater future losses should be expected if warm season temperatures rise (IPCC)

What parts of the US produce more fed cattle?



Source: National Agricultural Statistical Survey 2014 (Density of beef cattle per $km^{2)}$

Cattle is on the move



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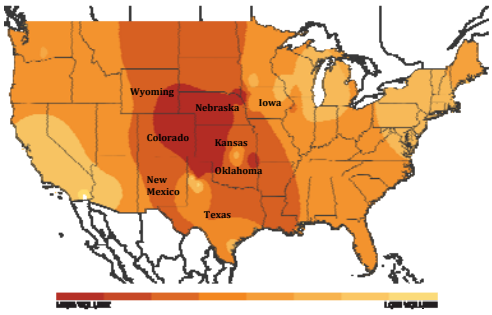
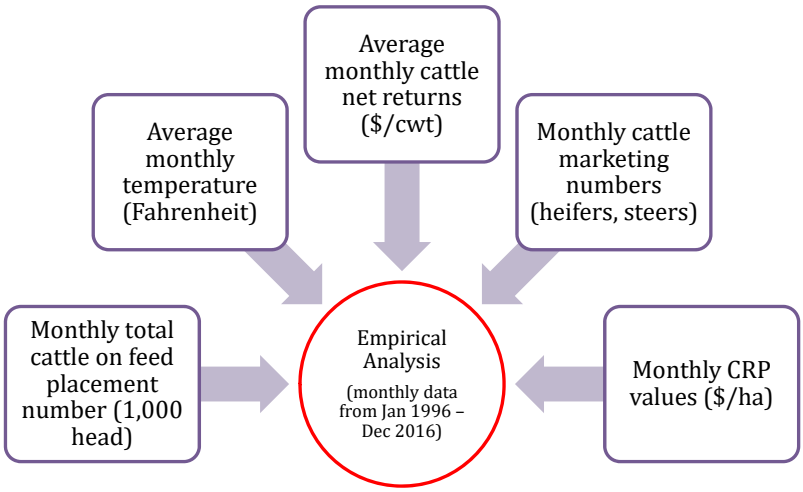


2014

Source: Dry Age Beef (http://dryagebeef.meatingplace.com)

Methods



Question: Is there a climate change impact on monthly feeder cattle placements?

Average impact of covariates

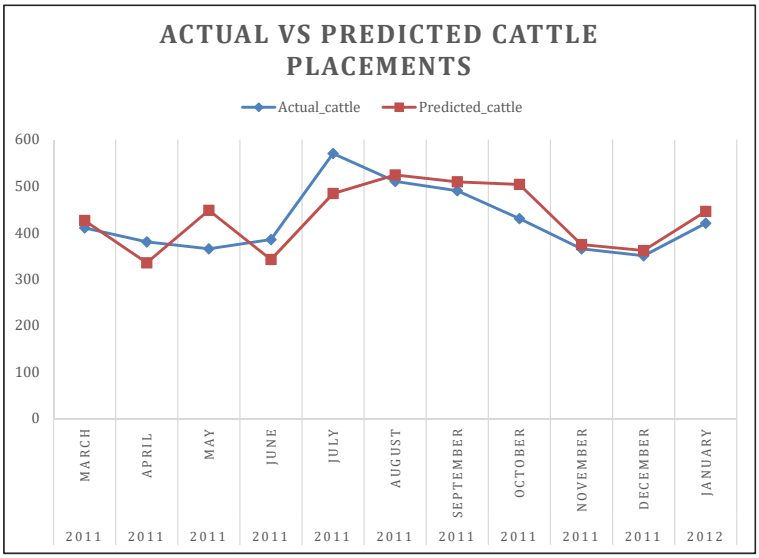
Variable	Coefficient
Temperature $_{t=0}$	0.860(0.233)***
Temperature $_{t-3}$	2.185(0.621)***
Temperature $_{t-9}$	1.569(0.636)**
CRP $_{t-7}$	-1.945(1.136)*
Heifer ratio $_{t-8}$	159.443(53.562)***
Month 2 dummy	-71.253(12.881)***
Month 4 dummy	-109.344(12.981)***
Month 6 dummy	-126.811(12.407)***
Month 11 dummy	-96.224(12.365)***
Month 12 dummy	-71.550(13.767)***
Time trend	-0.205(0.047)***
Intercept	114.615(108.091)

Notes: Standard errors are in parentheses.* and * denote statistical significance at 0.10 and 0.01 levels. R^2=70.03%**

Estimated elasticities

Variable	Elasticity
Temperature (short-run)	0.085**
Long-run elasticities	
Temperature	0.640***
CRP	-0.321*
Heifer ratio	0.142***

Elasticities are calculated at the mean values of the explanatory variables. Long-run elasticities capture both contemporaneous and lagged effects. * ,**, and *** denote elasticities significantly different from 0 at 10%, 5%, and 1% levels, respectively.



Conclusions

Analysis mainly focused on capturing climate change impact on cattle placement in Kansas

Temperature, CRP prices and heifer ratio explain most of the observe variability in cattle placements

The analysis provides evidence that cattle production affect not only by the intensity of temperature but its timing with respect to cattle production cycle

This analysis can be used to capture the climate change impacts on other major cattle producing states

Can be extended to capture the geographic movement of cattle production within the US

Thank You