Drought Management Strategies for Western Great Plains Rangelands: Flexibility for Complex Decision-Making

David J. Augustine

Justin D. Derner

Rangeland Resources Research Unit, Cheyenne, WY and Fort Collins, CO, USA

David.Augustine@ars.usda.gov

Justin.Derner@ars.usda.gov

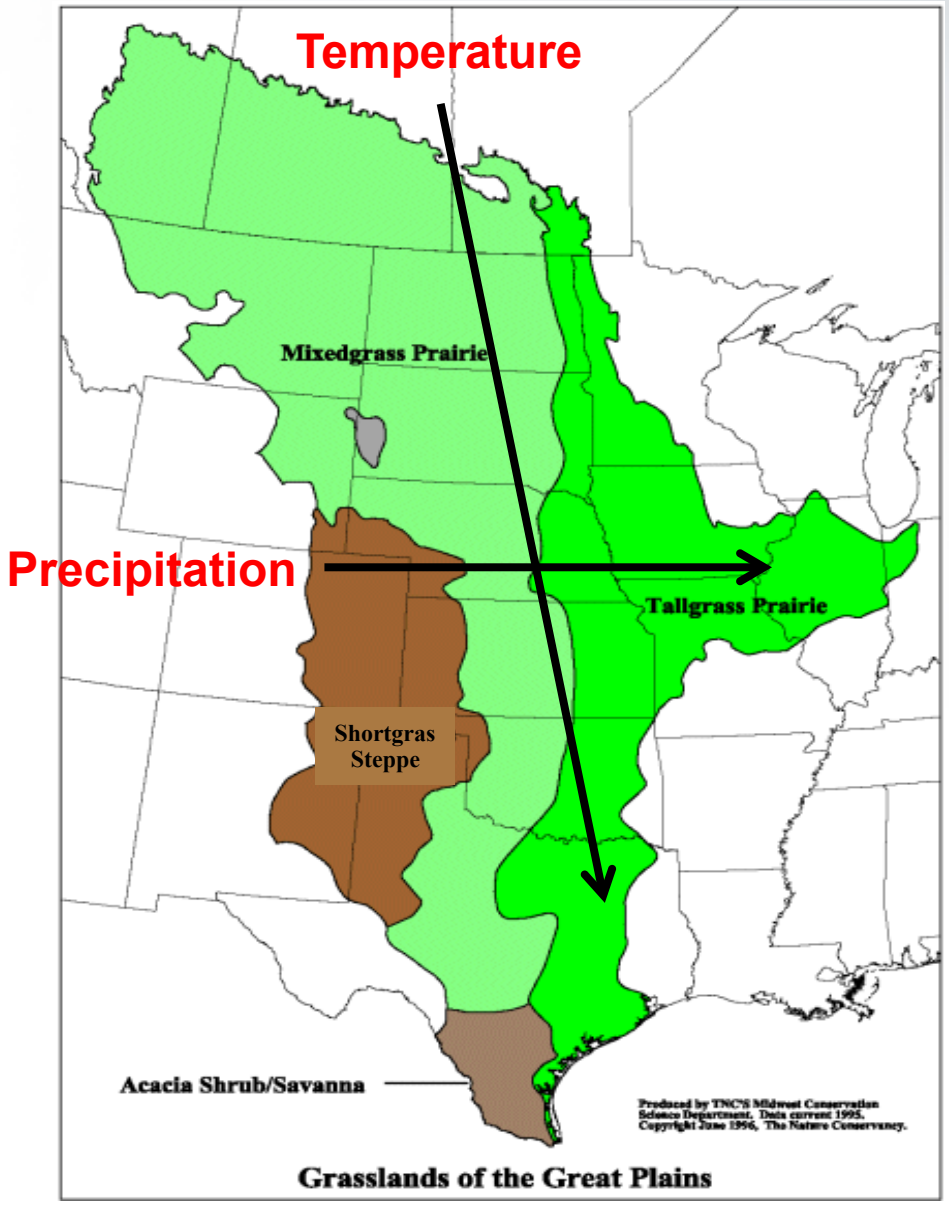
USDA

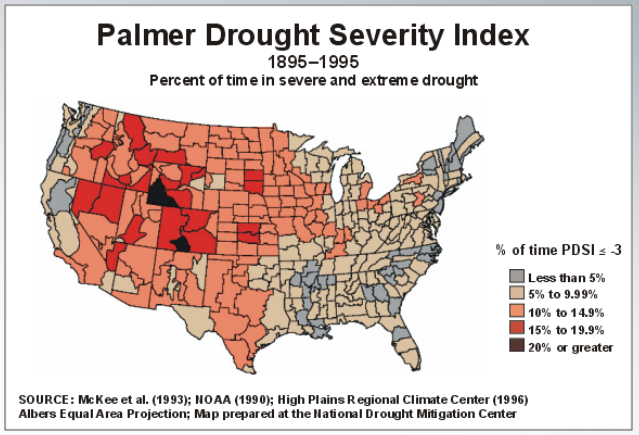
United States Department of Agriculture

Road Map

- Droughts & Deluges: Past & Present
- What management strategies have ranchers used in recent droughts?
- What drought management strategies are underutilized?
- Droughts & Deluges: climate change and the future

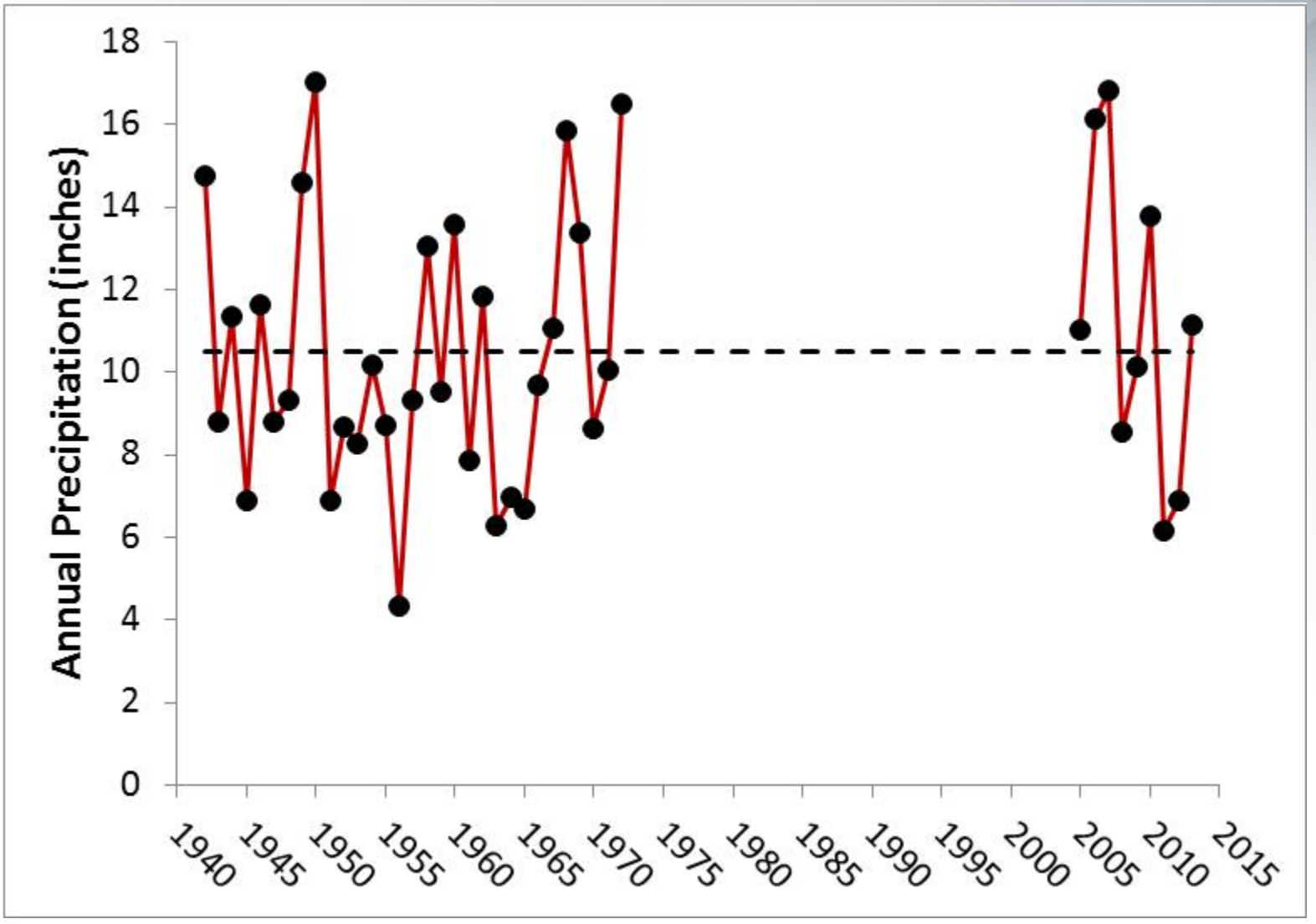
Great Plains Rangeland Ecosystems





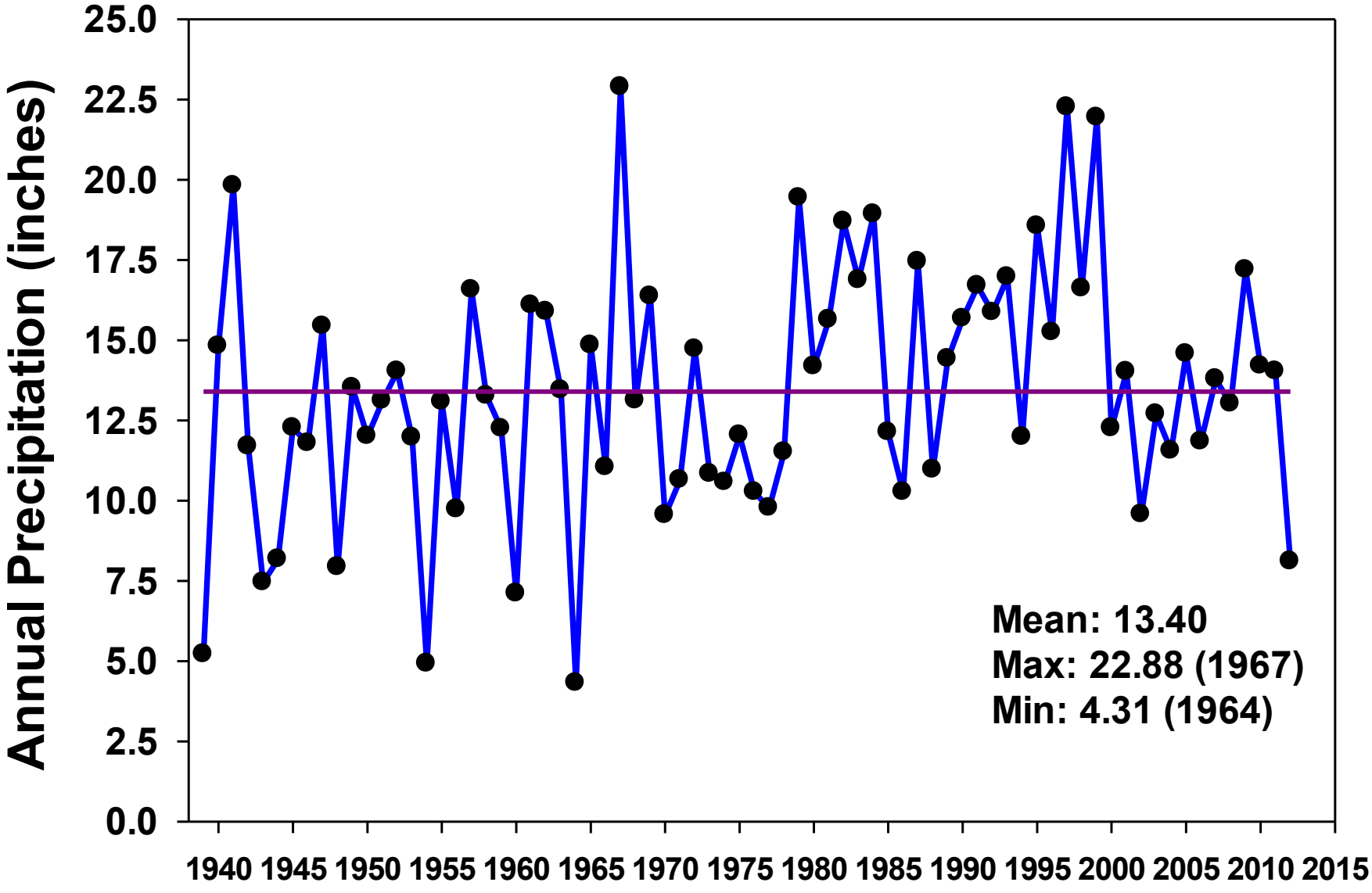
Interannual Variability

Roswell, NM



Interannual Variability

Central Plains Experimental Range, CO



Inter- and Intra-annual variability

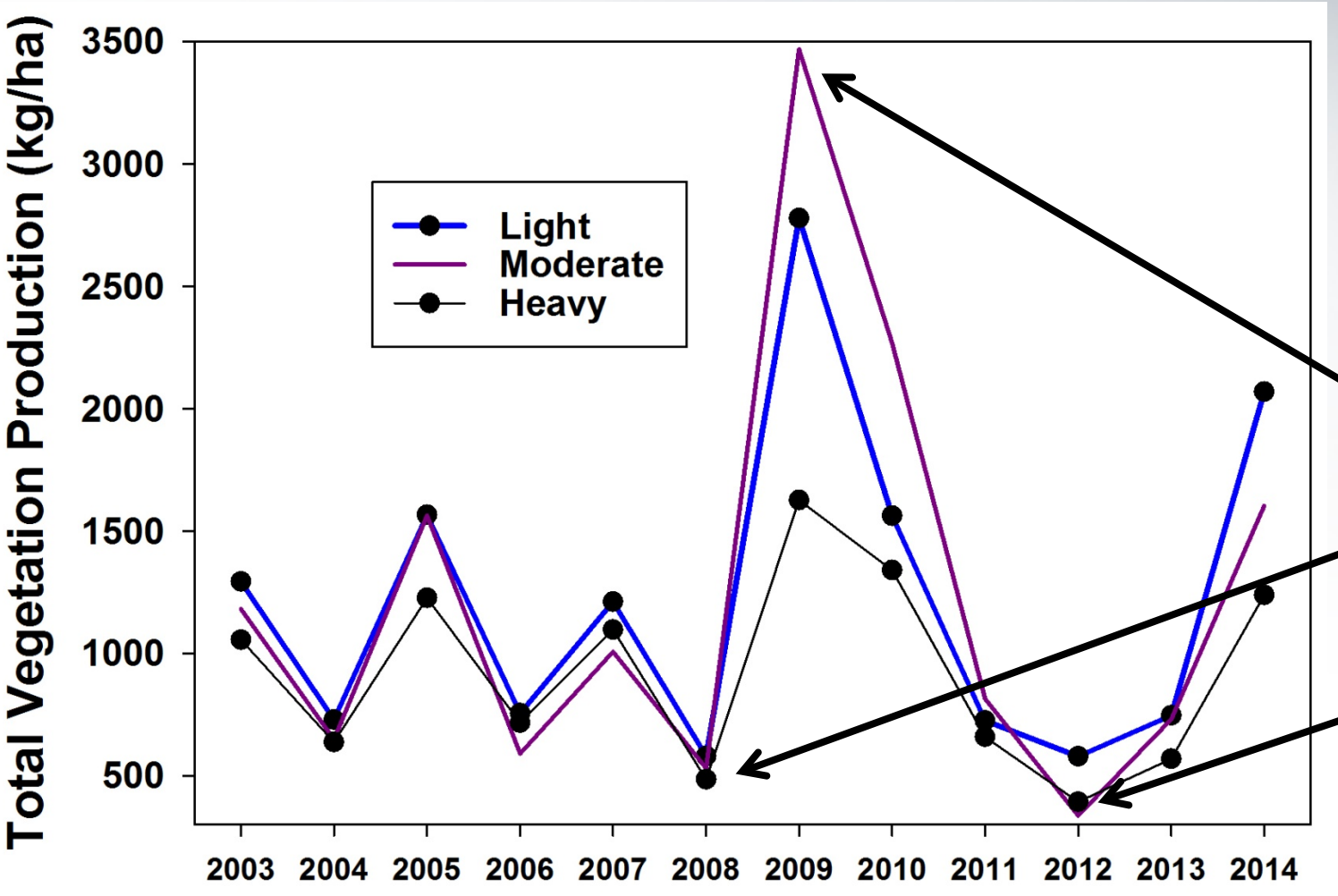
2002

2003

2004

2005

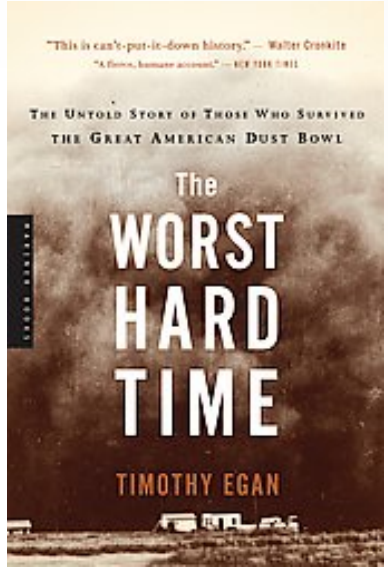
Forage Production Variability

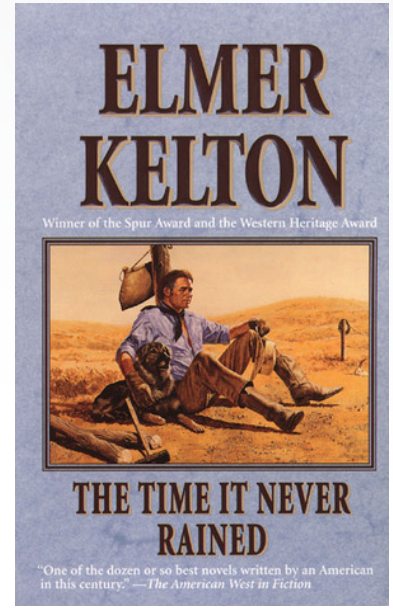


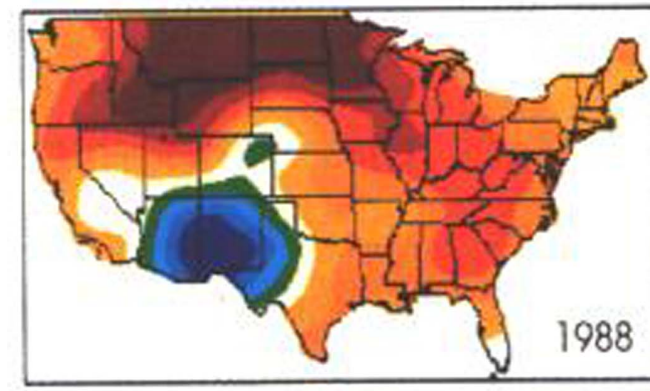
Difficulty for ranchers is matching this forage production variability with animal management flexibility across years.

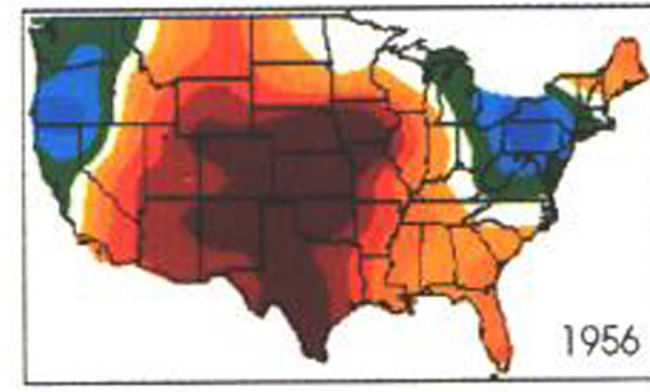
20th Century Droughts

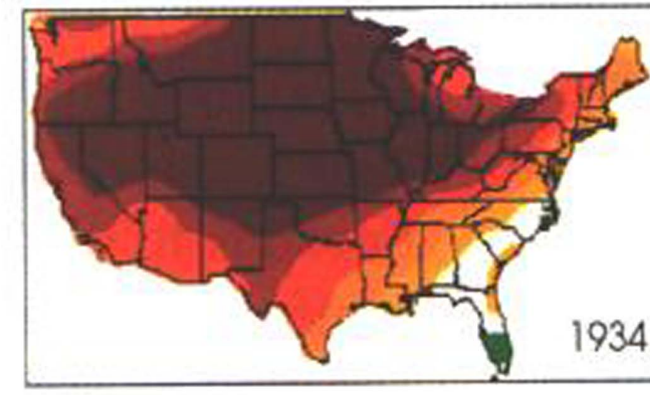
- Three most severe drought years in the 20th century











Woodhouse and Overpeck, 1998

21st Century Drought

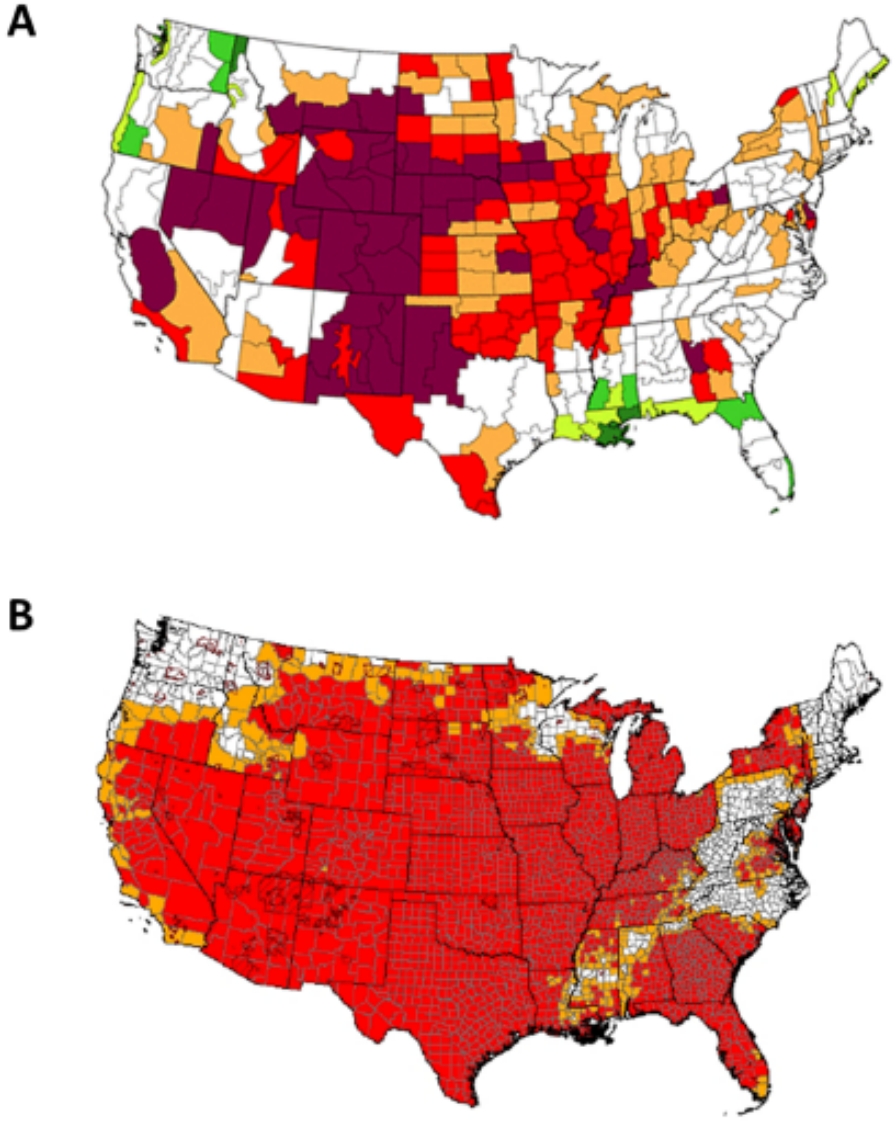
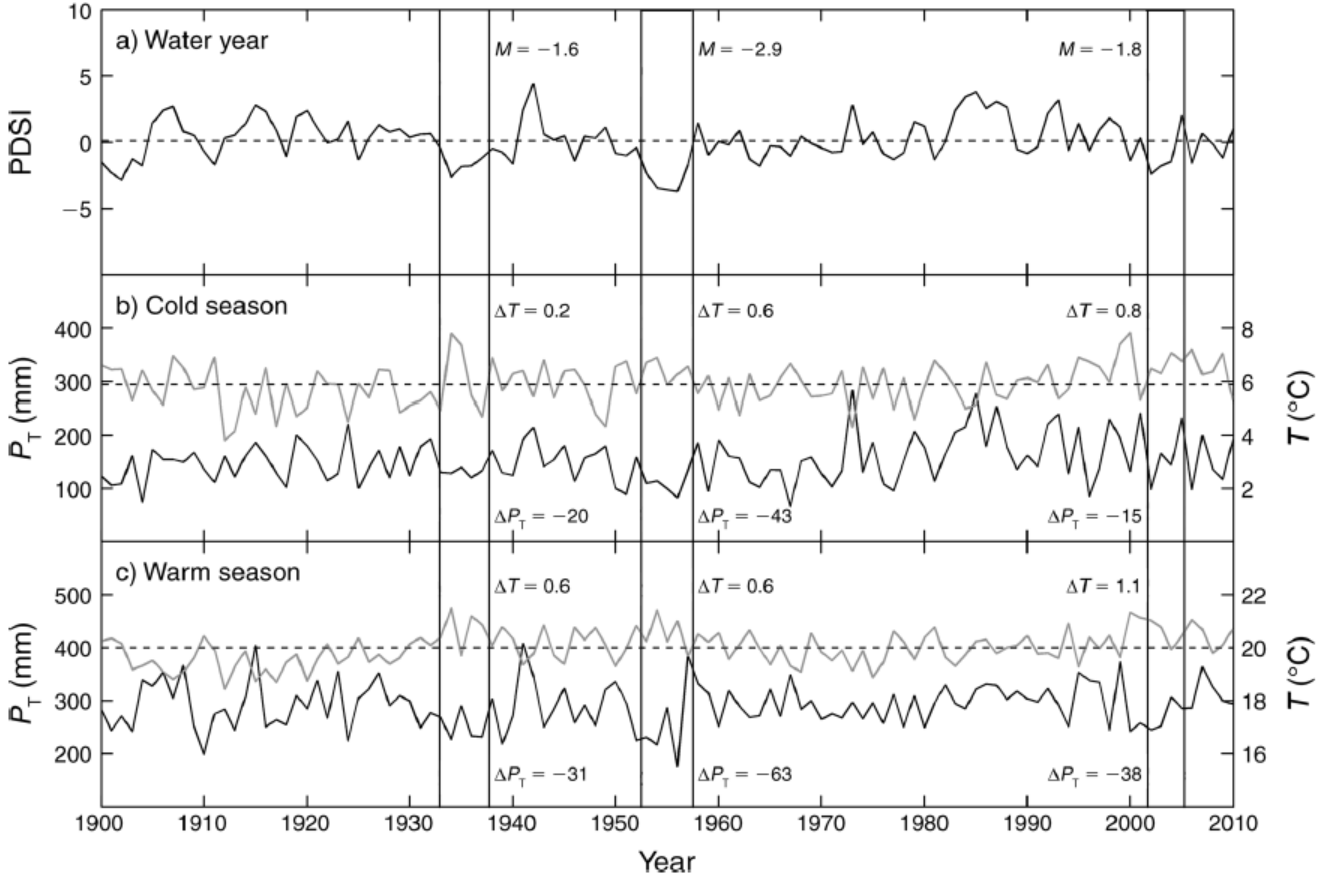


Fig. 1. (A) Much of the United States experienced drought (orange: moderate; red: severe; purple: extreme) in August 2012 according to the Palmer Drought Index, an indicator of long-term drought. (B) Most US counties were eligible to receive drought disaster assistance after the 2012 drought, shown by drought disaster designations (red) and contiguous areas (yellow) in February 2013. Source: NOAA National Climate Data Center; USDA Farm Services Agency.

21st Century Drought



- Similar precipitation defecit as 1930's drought
- Not as severe precipitation defecit as 1950's drought
- Significantly greater warm-season temps compared to both 1930s and 1950s droughts

Droughts in the Shortgrass Steppe over the past 10,000 years

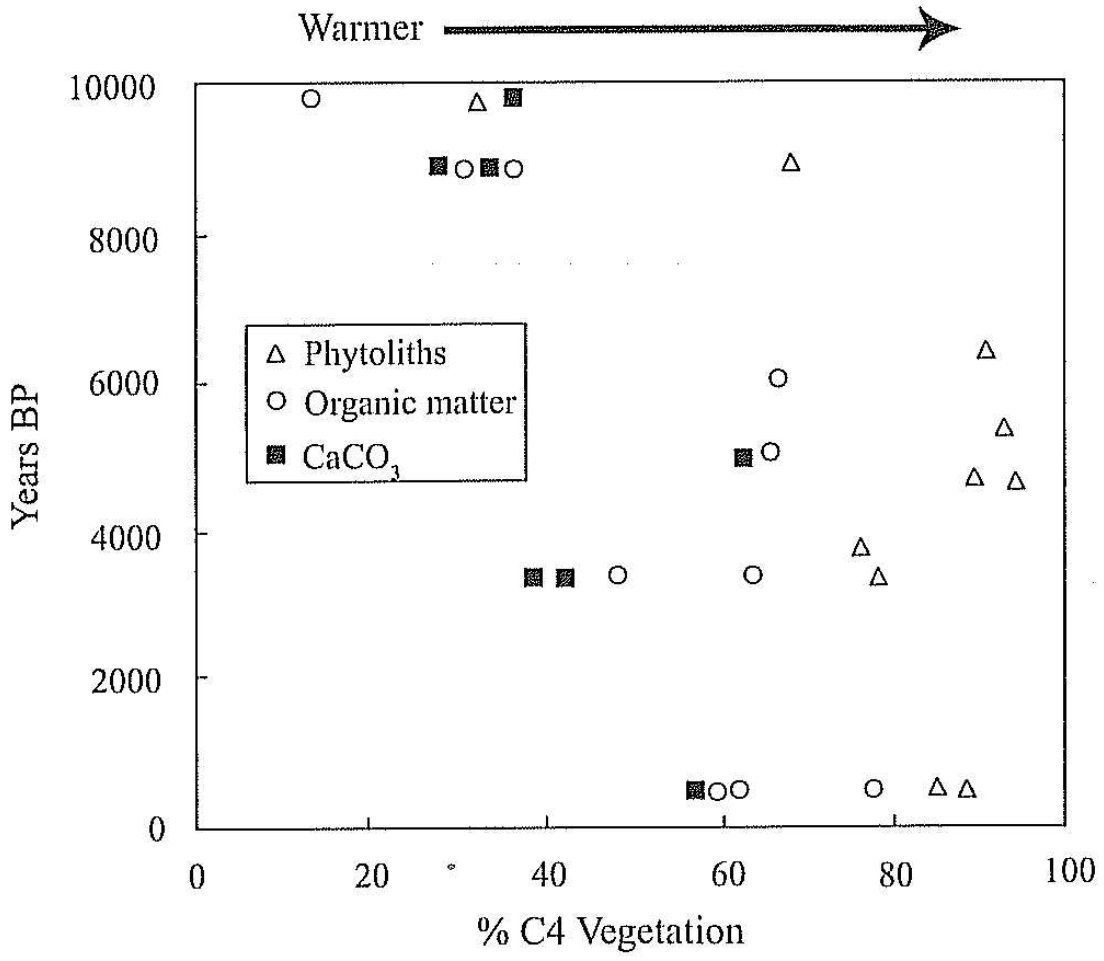
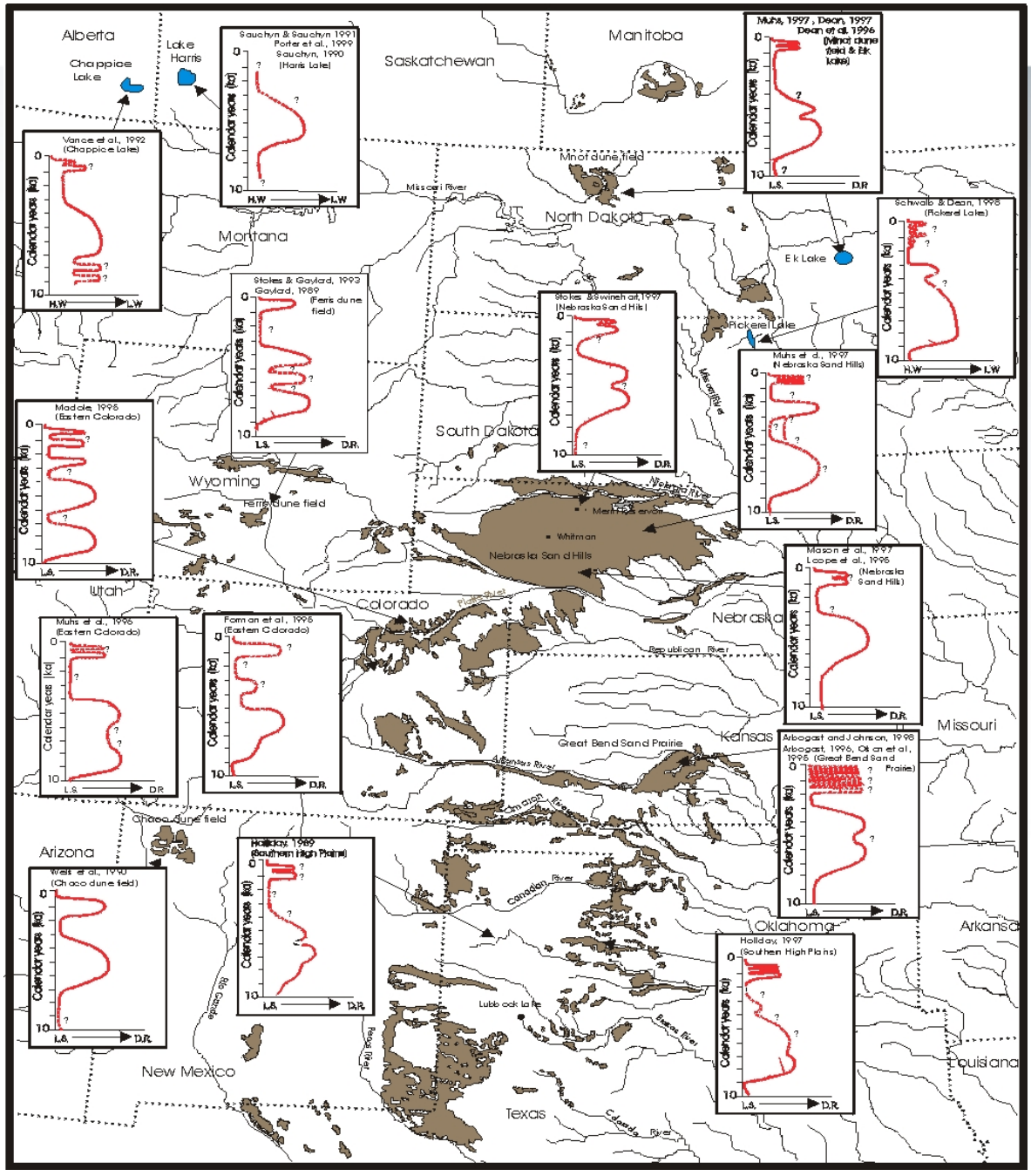
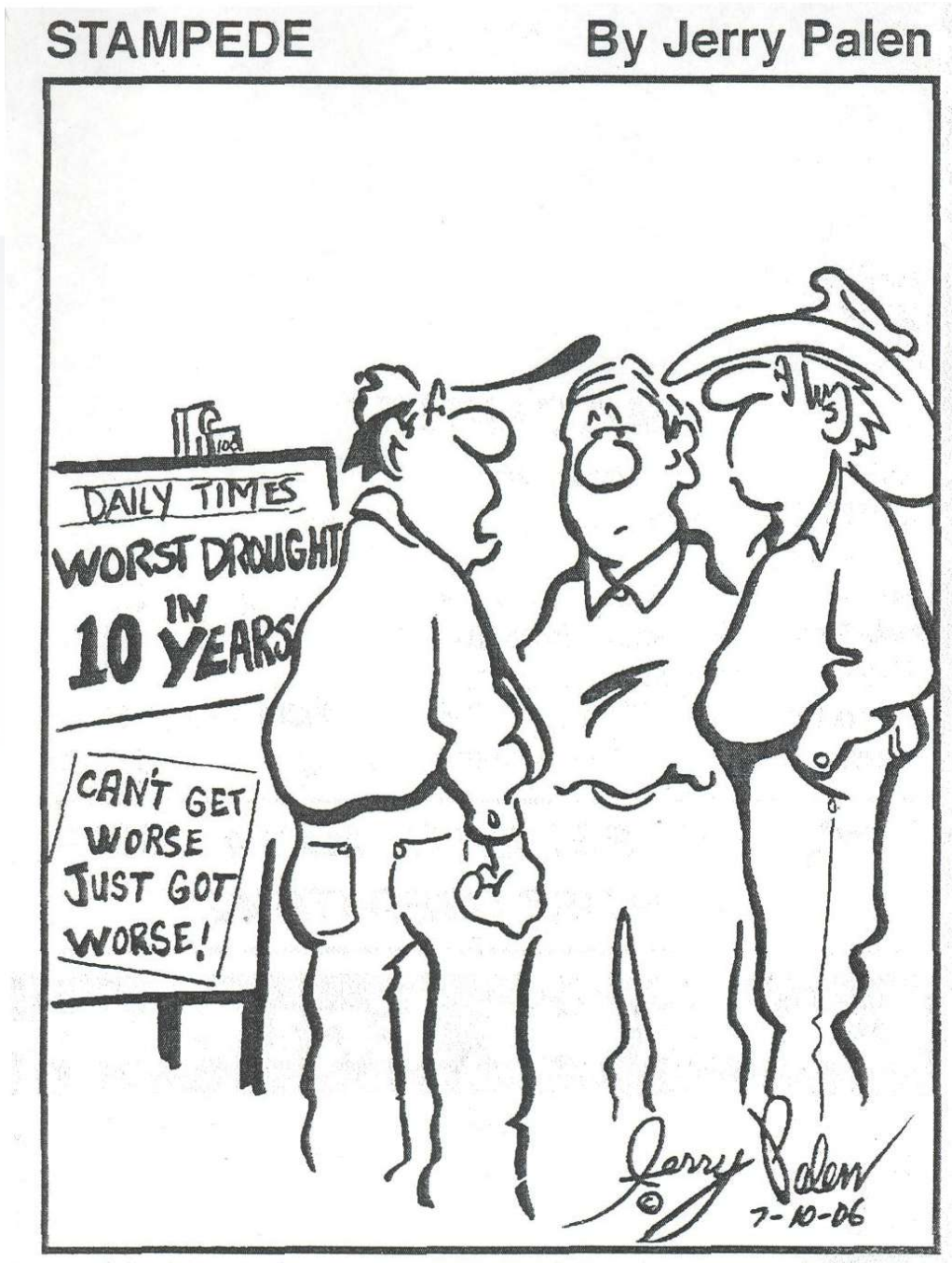


Figure 3.8 The percentage of C_4 vegetation versus time as calculated from stable C isotope ratios and ^{14}C dates, CPER and central Great Plains sites. (After Kelly et al. [1991b].)

Droughts in the Shortgrass Steppe over the past 10,000 years



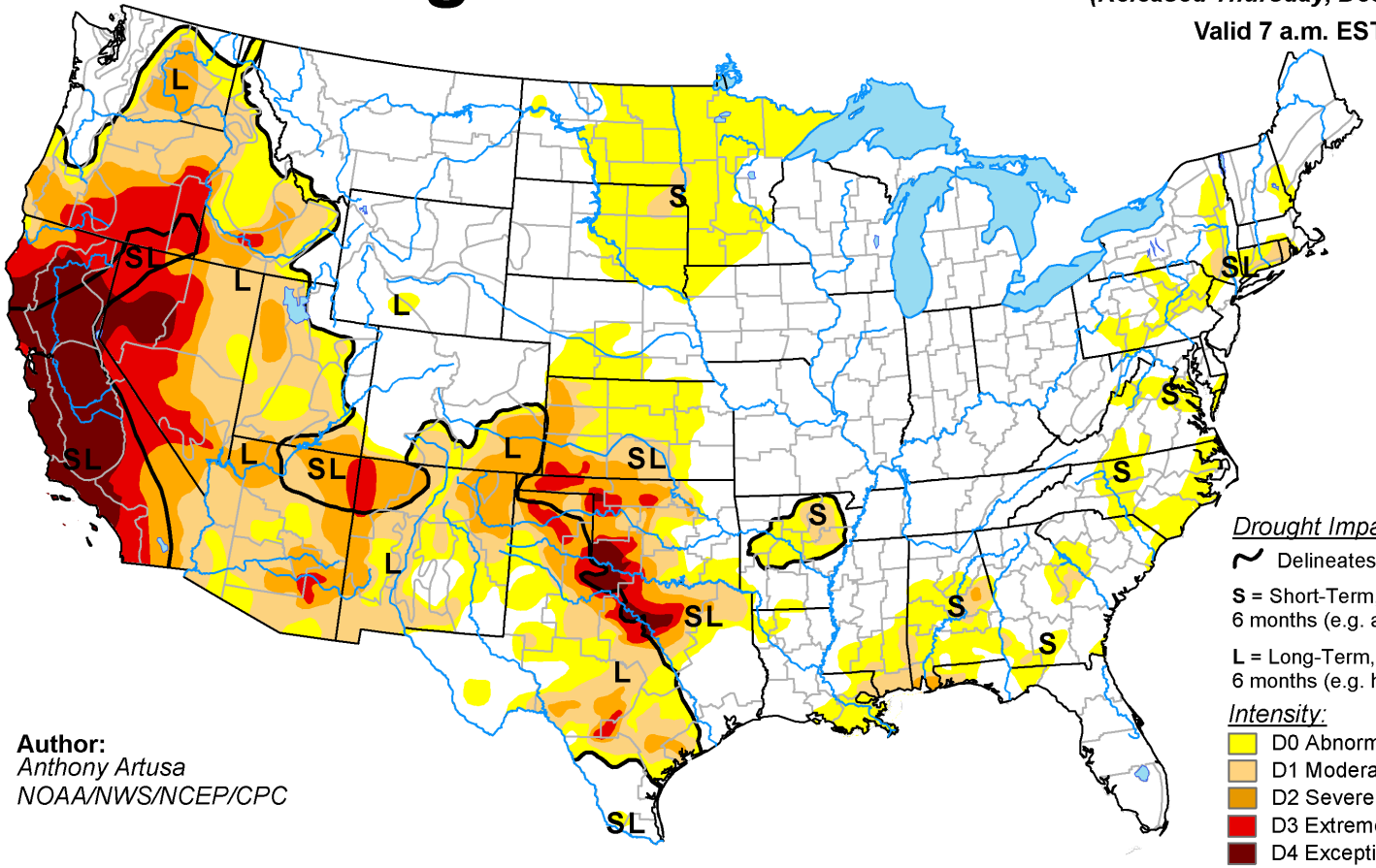


"It'd be nice to just get back to a normal 'droughty' year."

Current Conditions

U.S. Drought Monitor

December 2, 2014
(Released Thursday, Dec. 4, 2014)
Valid 7 a.m. EST



Author:
Anthony Artusa
NOAA/NWS/NCEP/CPC

Drought Impact Types:

Delineates dominant impacts

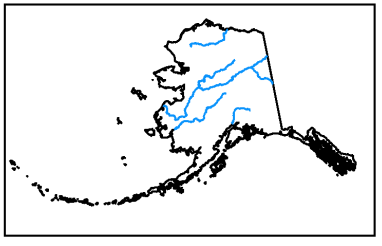
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

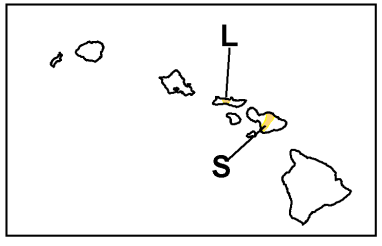
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

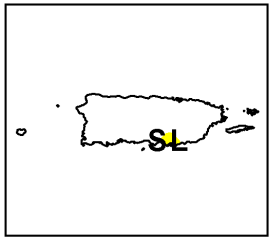
Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.







USDA National Drought Mitigation Center

http://droughtmonitor.unl.edu/

What Drought Management Strategies do Wyoming Ranchers Use?

Drought Planning

How many producers had a drought management plan?

60%

4 in 10 producers do not have a drought plan

Kachergis et al. *Ecosphere* 5(6):77.
http://dx.doi.org/10.1890/ES13-00402.1

Drought: Opportunity?

"..instead of seeing it (drought) as an obstacle, you see it as a catalyst to make changes you might not ordinarily do."

Drought as a Change Agent

"So the last drought was just an expensive education to do something different. I think anybody that went through the last drought and didn't do something before this drought is crazy. And I think most people are doing something."

Drought: Preparing?

"…we do have a drought plan, it's kind of pessimistic plan in that you just figure the drought is going to be here periodically and you keep things at a **conservative level**, so when it does come it doesn't hit so hard. Not that we aren't affected, but we aren't affected as much."

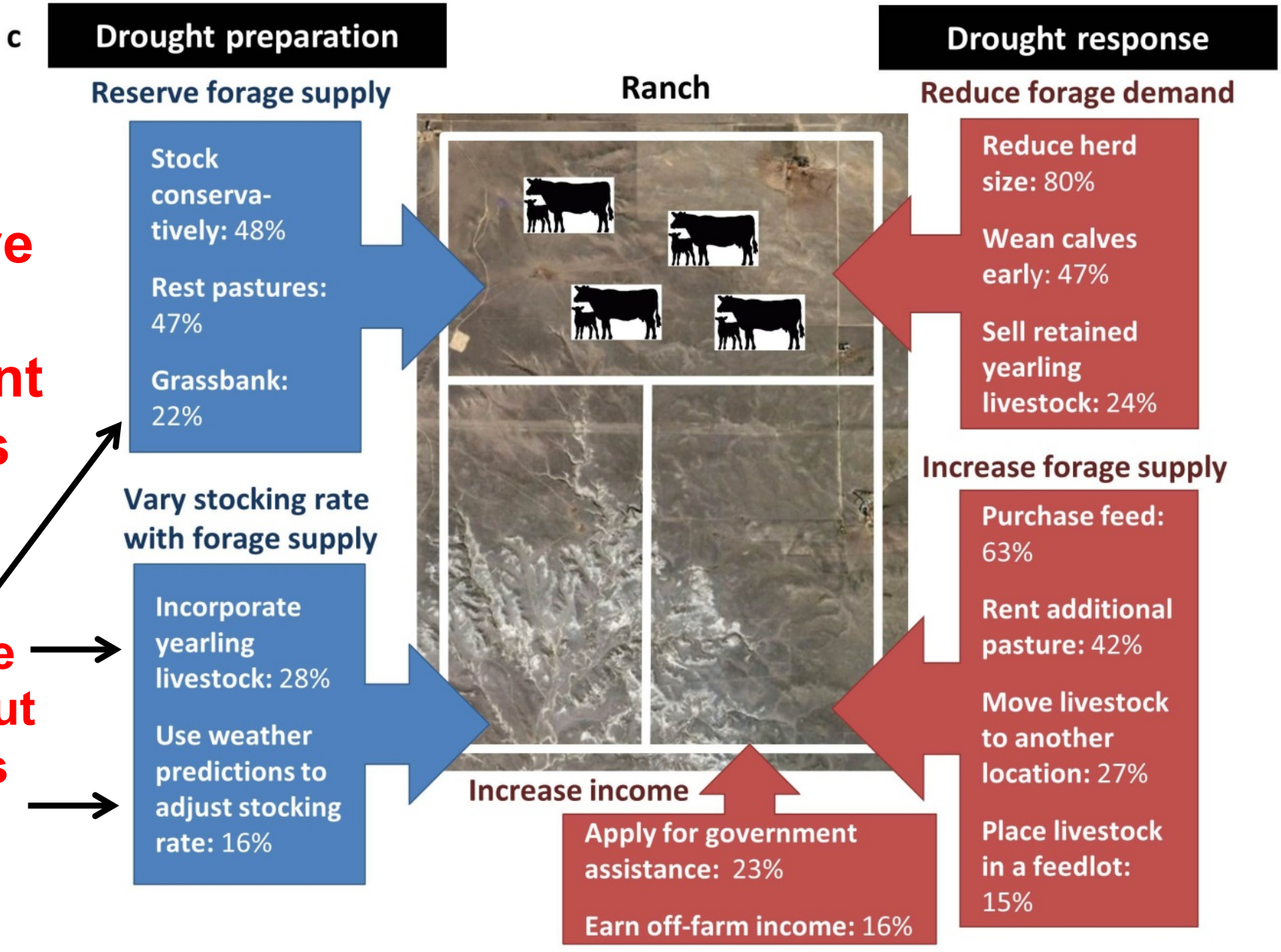
"That's why we run a smaller cow herd. That's why we're kind of under stocked."

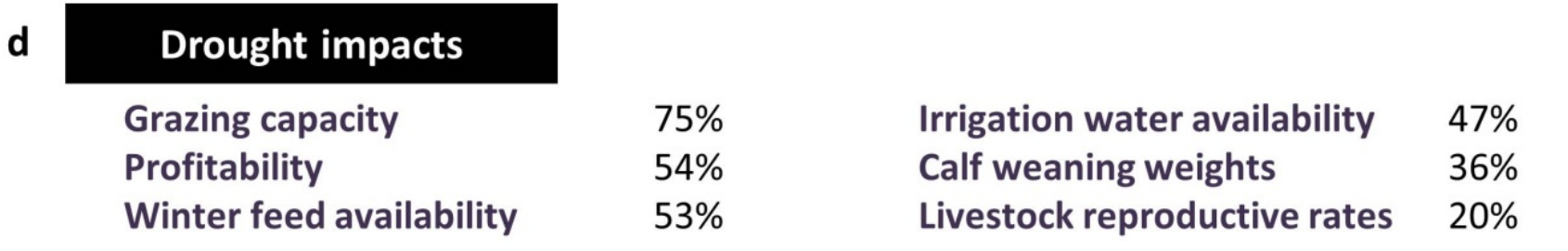
Drought: Flexibility?

"...if you have more of a diverse type of livestock (enterprise), your options of being able to de-stock are so much easier so when you have this abrupt drought…when you have a diverse group of cattle… you're not looking at trying to get rid of pairs, which is hard to do right now. Yearlings are a lot easier to unload, so that's just another reason I have gone the way I'm going is it makes you more flexible in those decisions."

Proactive and reactive drought management strategies

Limited use currently, but potential is high for flexibility





Kachergis et al. *Ecosphere* 5(6):77.

Evaluating Ranching Strategies in the Southwestern US

Hailey Wilmer & Maria Fernandez-Gimenez,

- Interviewed 27 ranches in New Mexico, Arizona, & Colorado

- Research questions:
  - Do distinct approaches to ranch management exist?
  - Do these approaches differ in their approaches to drought decision-making?

- Identified 4 approaches to ranching based on motivations, tenure, & info sources

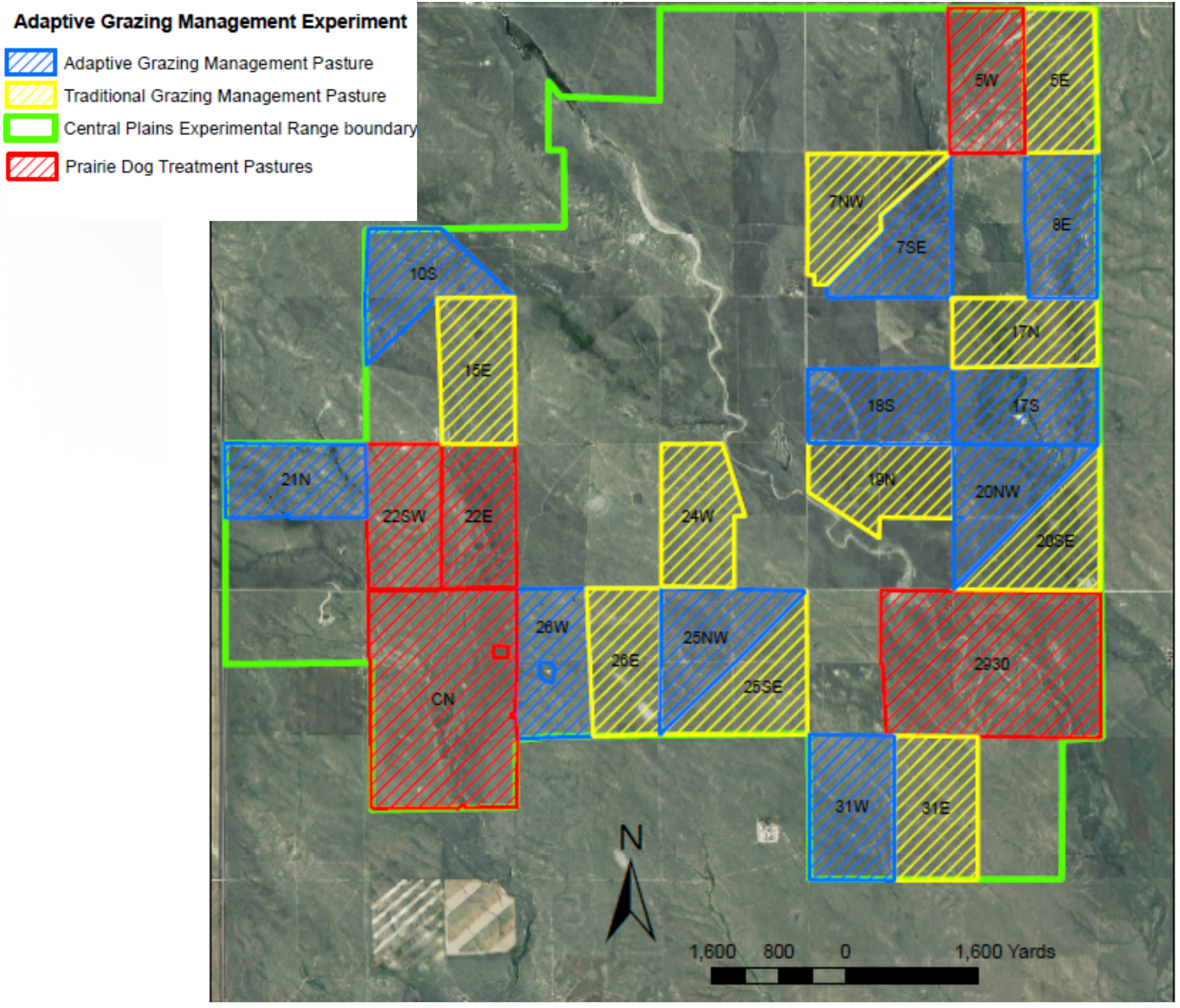
Type of Management	Long-Term Managers	Next-Generation Innovators	Second-Career Innovators	Life-long experimenters
Goals	Maintain **sustainability** of current multi-generational operation "seen a lot of droughts"	**Improve and build efficiency** into existing system Leaders or members of community & social networks	Emphasize natural resource **conservation,** ranching **lifestyle** Rely on Extension and research input	Emphasize **mastery, experimentation, adaptation** "Drought is the new normal." Use diverse network of scientists, lawyers, politicians, national producer groups
Drought decisions	Conservative stocking - **Hold on to the herd**; numbers do not deviate except in severe drought	**Track forage while minimizing financial loss:** Cull, seek alternative forage, help neighbors do the same	Monitoring used to plan for drought, **rely on other income**	Emphasize quality over quantity, build marketing programs; **willing to make big changes** in calving or grazing (adaptive management)

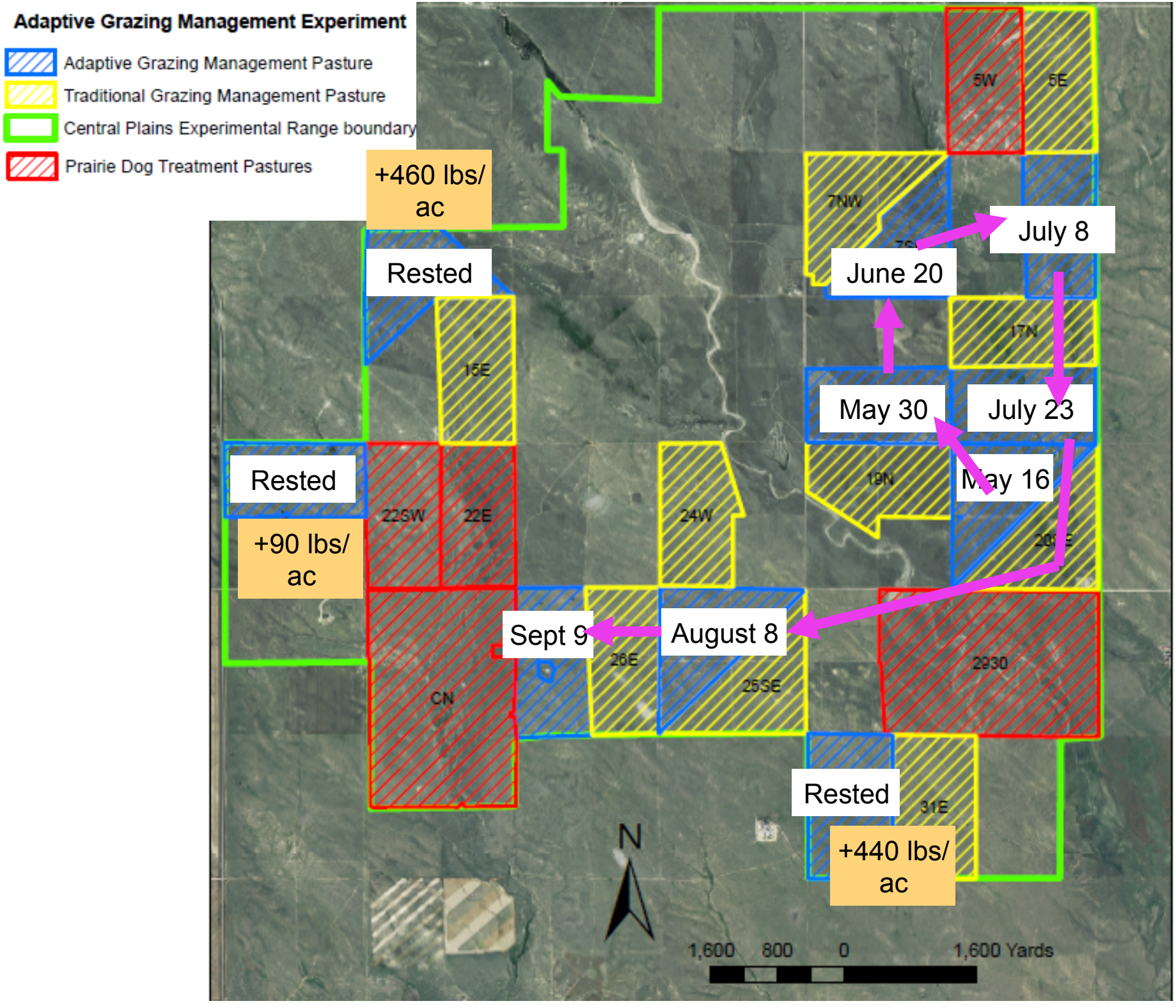
Dealing with Temporal Variation

- Be conservative
- Track it
- Predict it
- Use spatial variability

Dealing with Temporal Variation

- Be conservative (manage for reserve forage)
  - Conservative stocking rates to match forage supply in average or below-average years
  - Resting whole pastures in average or above-average years (grassbanking)


Adaptive Grazing Management Experiment
Adaptive Grazing Management Pasture
Traditional Grazing Management Pasture
Central Plains Experimental Range boundary
Prairie Dog Treatment Pastures
5W
5E
7NW
7SE
8E
10S
17N
15E
18S
17S
21N
22SW
22E
24W
19N
20NW
20SE
26W
26E
25NW
25SE
2930
CN
31W
31E
N
1,600 800 0 1,600 Yards


Adaptive Grazing Management Experiment
Adaptive Grazing Management Pasture
Traditional Grazing Management Pasture
Central Plains Experimental Range boundary
Prairie Dog Treatment Pastures
+460 lbs/ ac
Rested
Rested
+90 lbs/ ac
Rested
+440 lbs/ ac
July 8
June 20
July 23
May 30
May 16
August 8
Sept 9
5W
5E
7NW
17N
15E
19N
22SW
22E
24W
26E
25SE
CN
2930
31E
N
1,600 800 0 1,600 Yards

Dealing with Temporal Variation

- Track it (match cattle numbers to forage availability)
  - Reduce herd progressively with increasing drought
  - Add/remove forage quickly (e.g. lease land, buy feed)
  - Proactively develop capacity to remove/add animals quickly

Track it: Proactive Management

- **Flexibility in splitting forage between cow-calf and yearling enterprises to manage climate variability risk**
  - **Flexible stocking with high quality precipitation forecasts could double economic returns**
    - **Torell et al. 2010 Rangeland Ecology and Management 63:415-425.**

Dealing with Temporal Variation

- Predict it

Experts say rainfall may lessen drought

By Julia Glick
The Associated Press

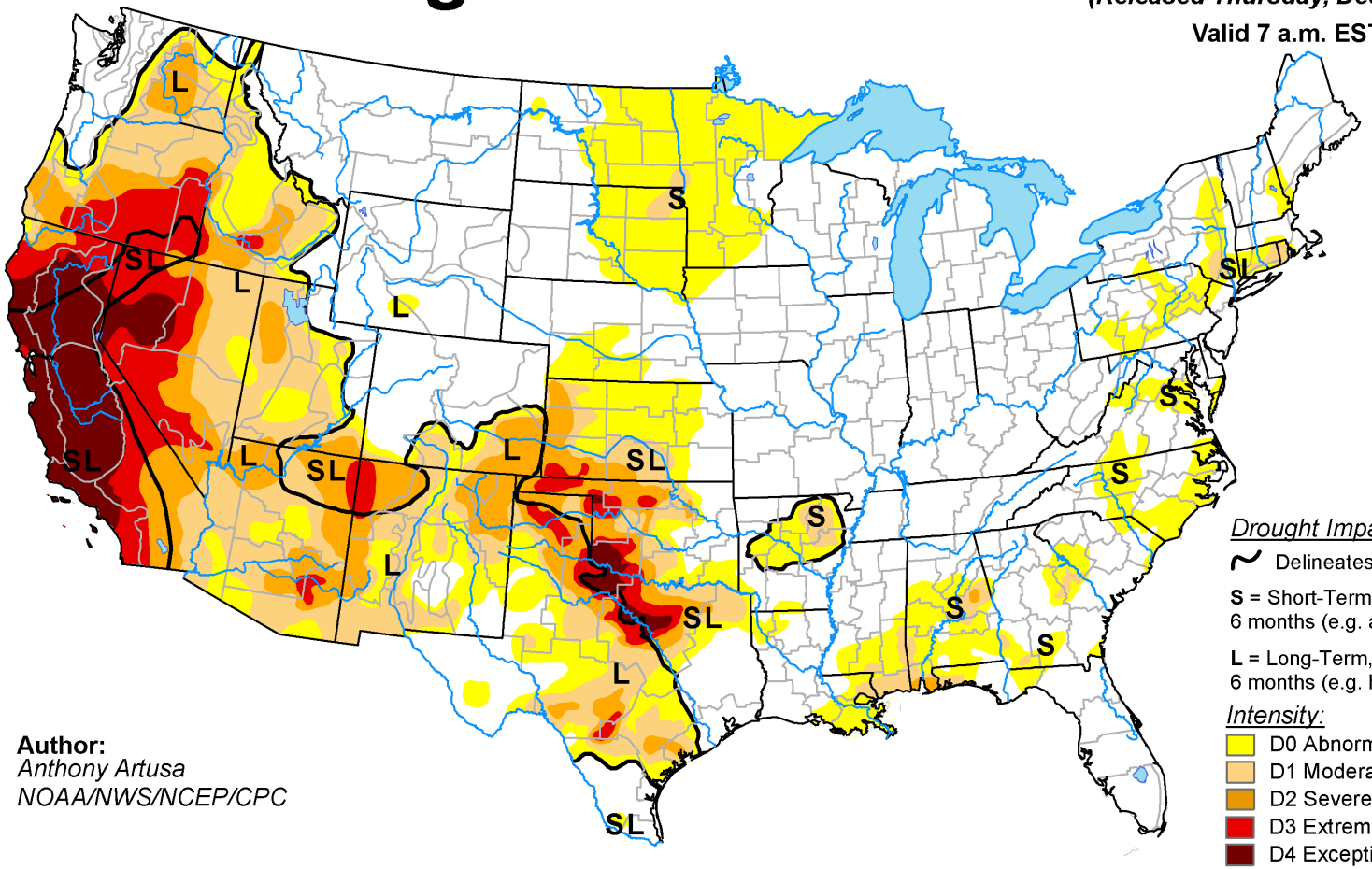
Predict it: Current Conditions

U.S. Drought Monitor

December 2, 2014

(Released Thursday, Dec. 4, 2014)

Valid 7 a.m. EST



Author:
Anthony Artusa
NOAA/NWS/NCEP/CPC

Drought Impact Types:

~ Delineates dominant impacts

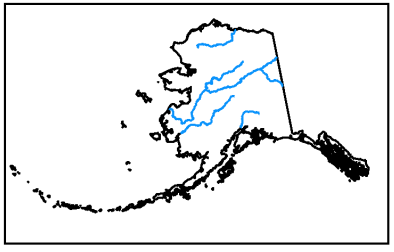
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

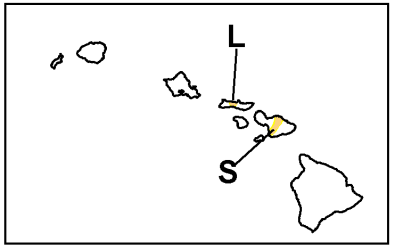
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

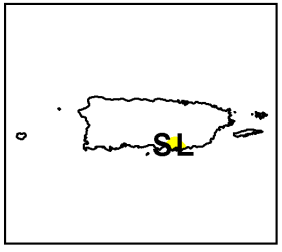
Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



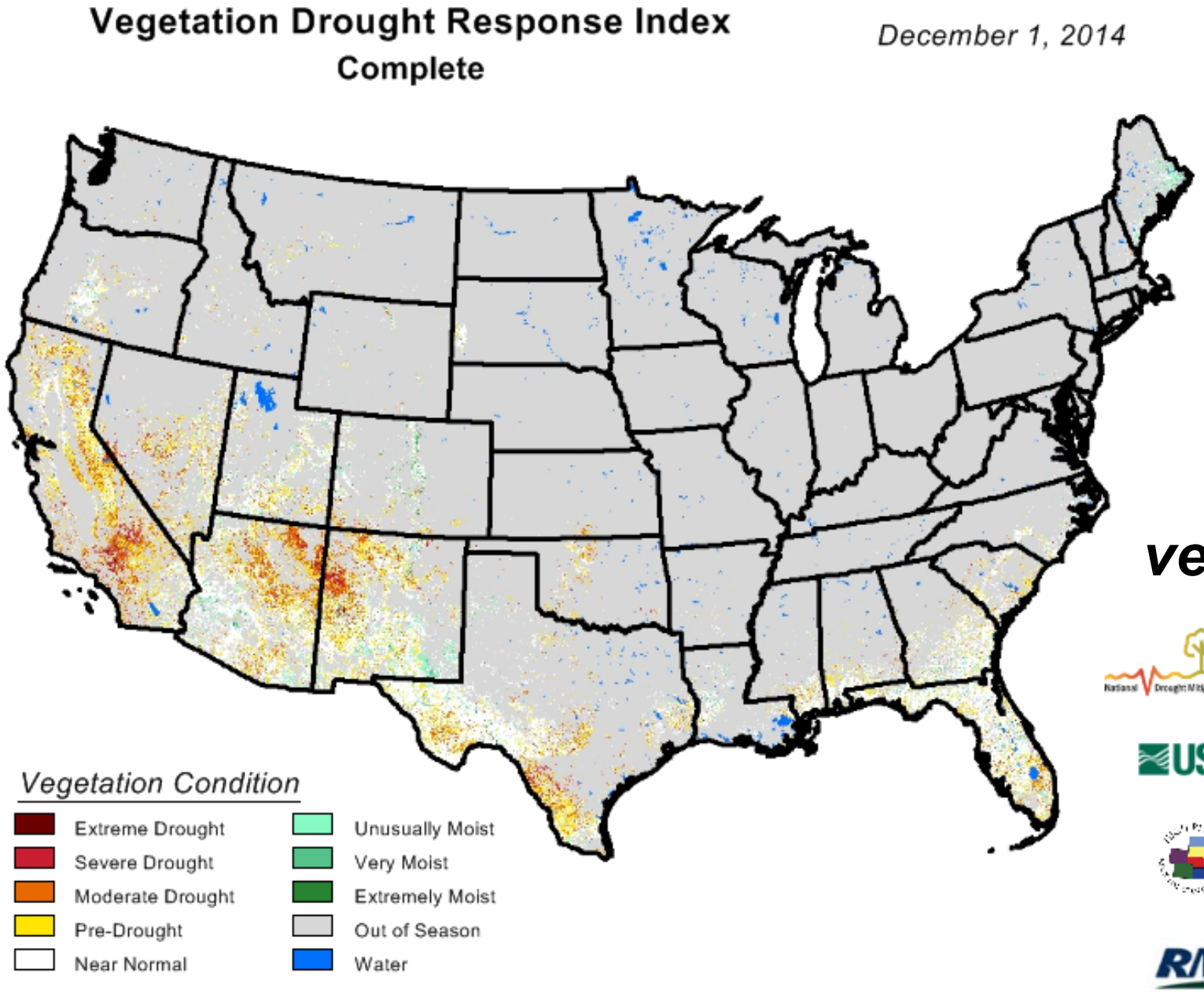




USDA National Drought Mitigation Center

http://droughtmonitor.unl.edu/

Predict it: Current Outlook



vegdri.unl.edu

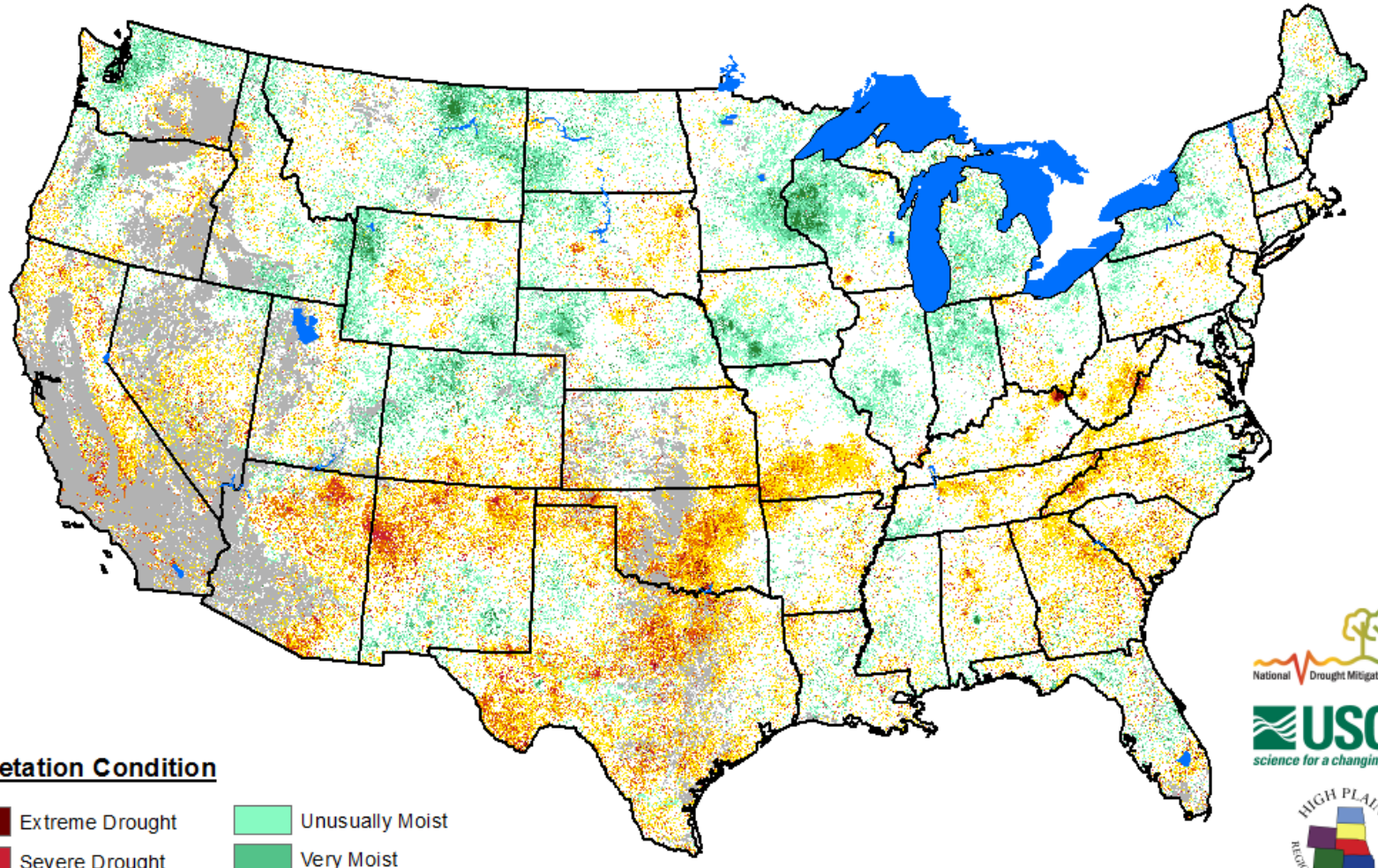
National Drought Mitigation Center

USGS

RMA

Predict it: Current Outlook

2014 Vegetation Drought Response Index (VegDRI)



Vegetation Condition

- Extreme Drought
- Severe Drought
- Moderate Drought
- Pre-drought stress
- Near Normal
- Unusually Moist
- Very Moist
- Extreme Moist
- Out of Season
- Water

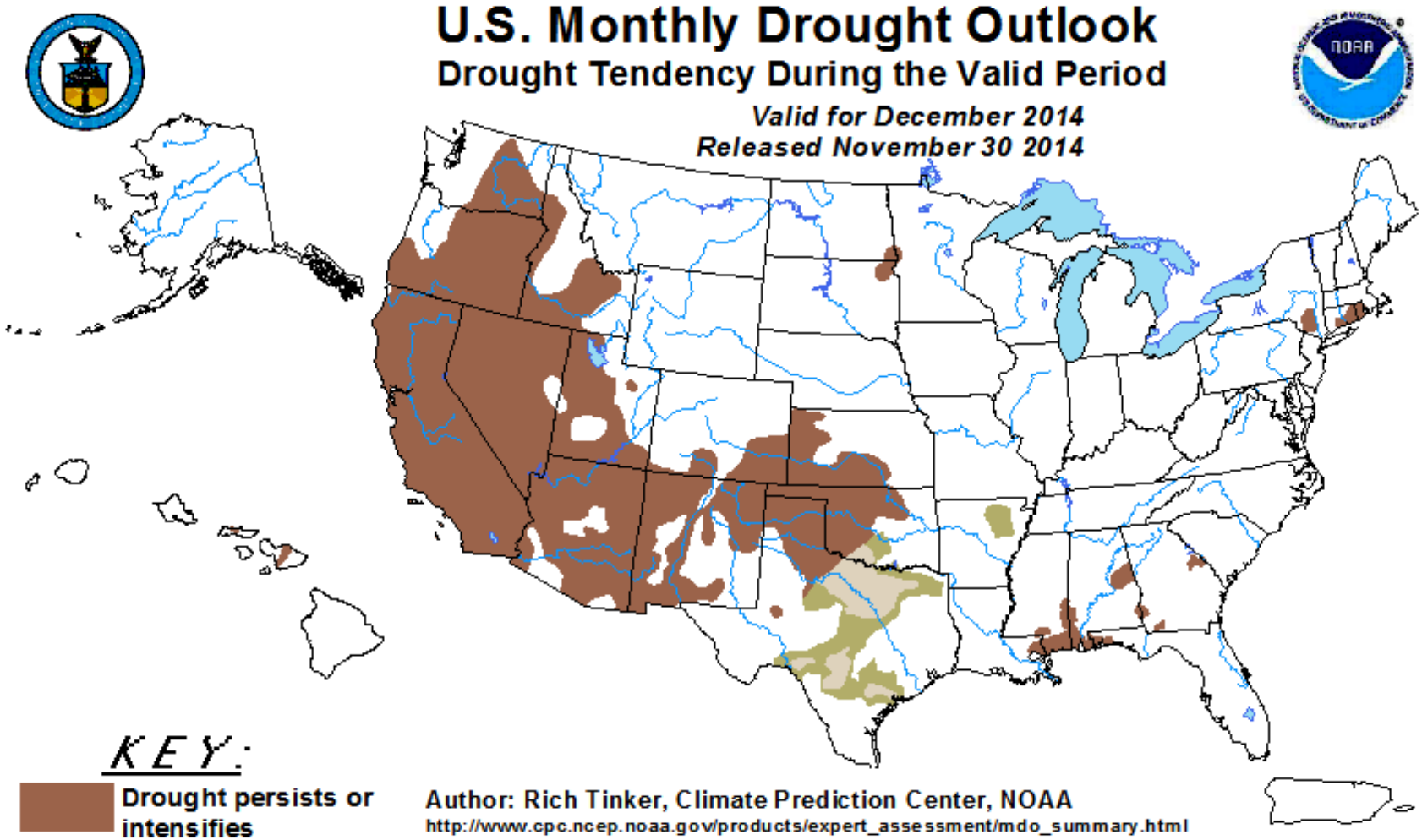
National Drought Mitigation Center

USGS science for a changing world

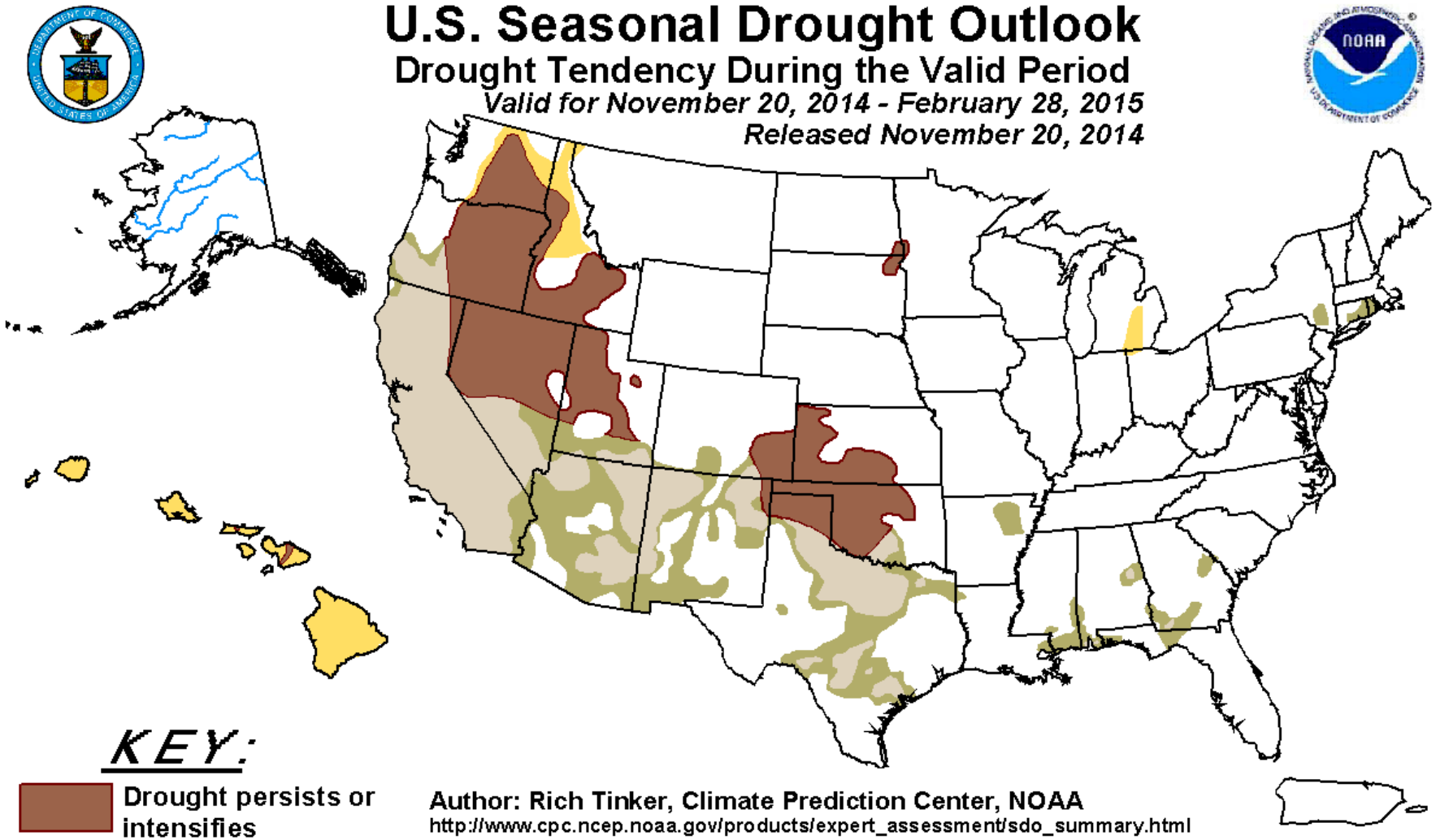
HIGH PLAINS REGIONAL CLIMATE CENTER

RMA

Predict it: Current Outlook



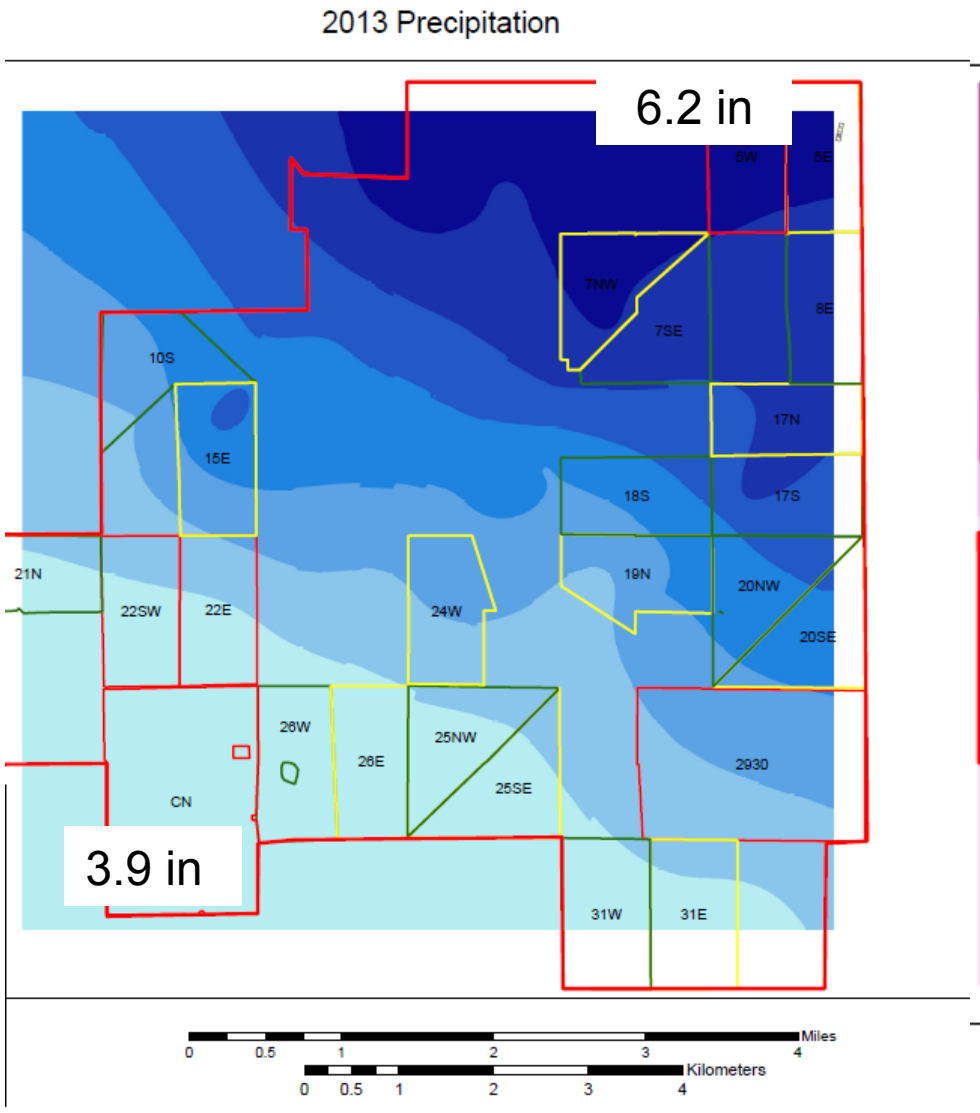
Predict it: Current Outlook

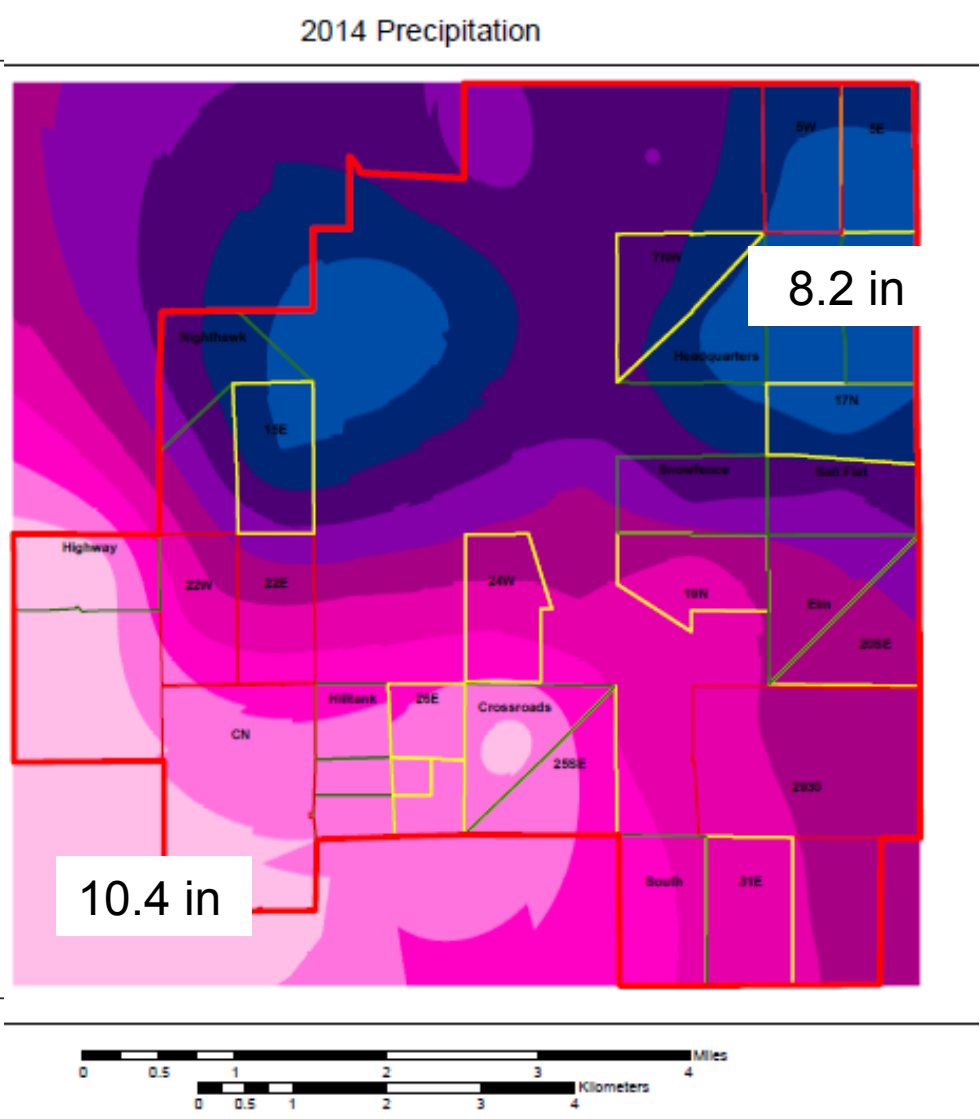


Dealing with Temporal Variation

- Take advantage of spatial variability

Spatial Variability in Precipitation



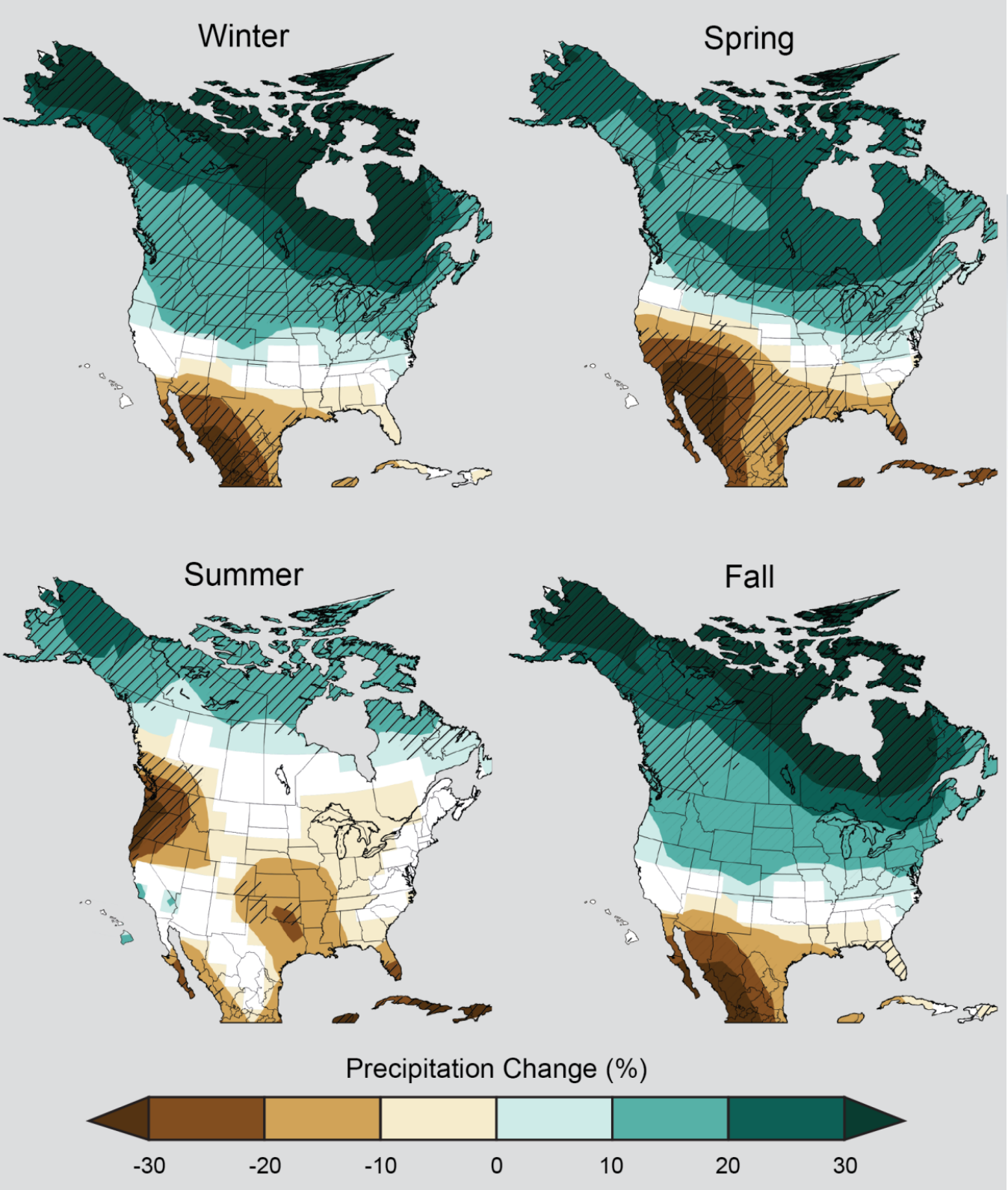


Dealing with Temporal Variation

- Take advantage of spatial variability
  - Understand sources and scale of local variabilty
    - Rainfall: can be important in some years (e.g. across distances of 5 miles, differences of 2 inches precip in 50% of years)
    - Soils/Topography
  - Embraced by the “Next-generation innovator”
    - Work with other ranchers (neighbors) to secure alternative forage sources, share info

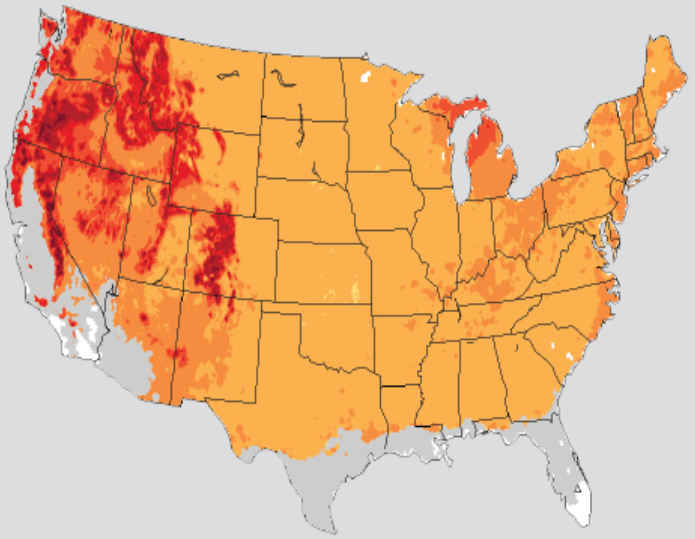
Recent/Projected Climatic Changes

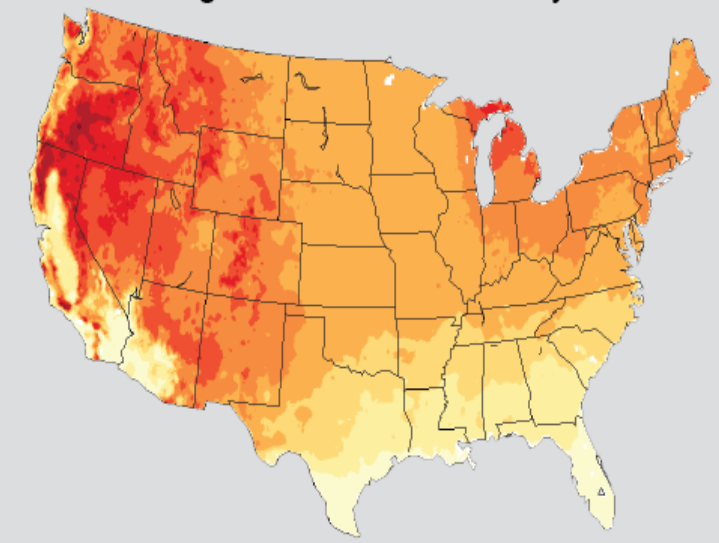
Third National Climate Assessment:
Droughts, Deluges and Extreme Events

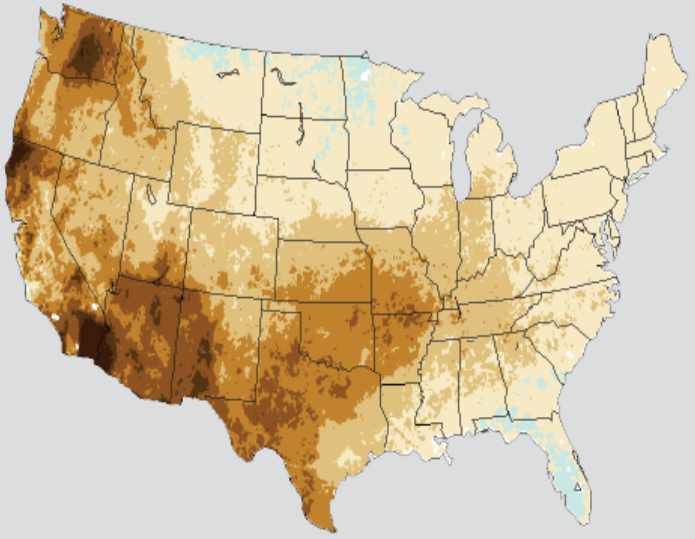


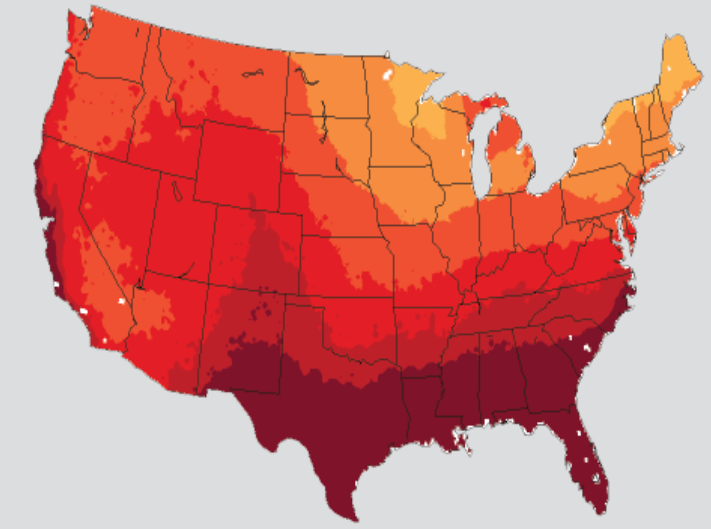
Northern Plains: wetter winters, springs, and falls, and slightly drier summers.

Southern Plains: drier or no change in all seasons.









Longer and warmer growing seasons, with warmer nights.

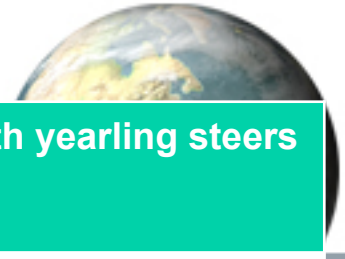
Adaptation to a Changing and Uncertain Environment

- **Dealing with Temporal Variation:**
  - Track it
  - Predict it
  - Manage for reserves
  - Use spatial variability

- **Drought Management Planning Resources:**
  - http://drought.unl.edu/ranchplan

Questions?

David.Augustine@ars.usda.gov
Justin.Derner@ars.usda.gov



Timeline	Cow-calf only "normal or wet year"	Cow-calf only "dry year"	Cow-calf with yearling steers "normal or wet"	Cow-calf with yearling steers "dry year"
Fall	Sell steer calves, retain heifer calves, sell open cows	Sell steer calves and bottom cut of heifers calves, sell open cows and poor performing cows	Sell yearling steers, retain steer and heifer calves, sell open cows	Sell yearling steers, sell bottom cut of steer calves and bottom cut of heifers calves, sell open cows and poor performing cows
Early spring (mid April)	Consider resting pastures for improvement, adding additional grazing animals and plan to breed all replacement heifers	Consider selling older cows identified in winter, plan to synchronize and AI (or bull breed) replacement heifers for short time (week) and then pregnancy test after 21 days to identify non-pregnant heifers to sell	Consider resting pastures for improvement, adding additional steers for grazing animals and plan to breed all replacement heifers	Consider selling rest of steer calves (thus, no yearling steers for grazing in this summer) and older cows identified in winter. Don't buy new steers. Plan to synchronize and AI (or bull breed) replacement heifers for short time (week) and then pregnancy test after 21 days to identify non-pregnant heifers to sell
Mid-summer	Relax about range conditions and worry about cattle markets (calf side)	Consider early weaning of calves to reduce forage demand by cows, pregnancy check cows early and sell open cows to further reduce forage demand	Relax about range conditions and worry about cattle markets (both yearlings and calves)	Consider early weaning of calves to reduce forage demand by cows, pregnancy check cows early and sell open cows to further reduce forage demand