



Regional co-design and co-production of research and management actions to support climate change adaptation strategies for managing natural resources in the Northern Great Plains

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# Collabrative efforts to manage for changing climate and water interactions in the Great Plains

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# Great Plains Grassland Summit

April 10-11, 2018 • Grand Hyatt • Denver, Colorado



## CONTRIBUTORS

**Robin O'Malley, Shannon McNeeley, Imtiaz Rangwala, William J Parton, Dannele Peck, Julian Reyes, Richard Conant**



# CLIMATE-WATER-WEATHER

- Good and BAD years are defined by water availability
- Warming across the grassland systems exacerbates water scarcity
  - Numerous independent lines of evidence demonstrate that warming has continued over the past 30 years or more
- Sectoral perspectives of climate impacts
- Collaborative solution strategies
- Approaches
  - Co-production
  - Actionable Science
  - Implementation
  - Monitoring, Assessment

Our communities are already feeling the effects of changing climate and seasonal patterns associated with extreme weather events



# CLIMATE-WATER-WEATHER

- Sectoral perspectives of climate impacts
- Approaches
  - Co-production
  - Actionable Science
  - Implementation
  - Monitoring, Assessment
- Collaborative solution strategies

# Current Challenges

- Dealing with increase weather variability
- Warming is exacerbating lack of water availability
- Interconnecting sectoral issues at the conservation – livelihood nexus
- Complexity is real and part of the solution set
- **Solutions:** Collaborative efforts between private-public partnerships and research and management communities



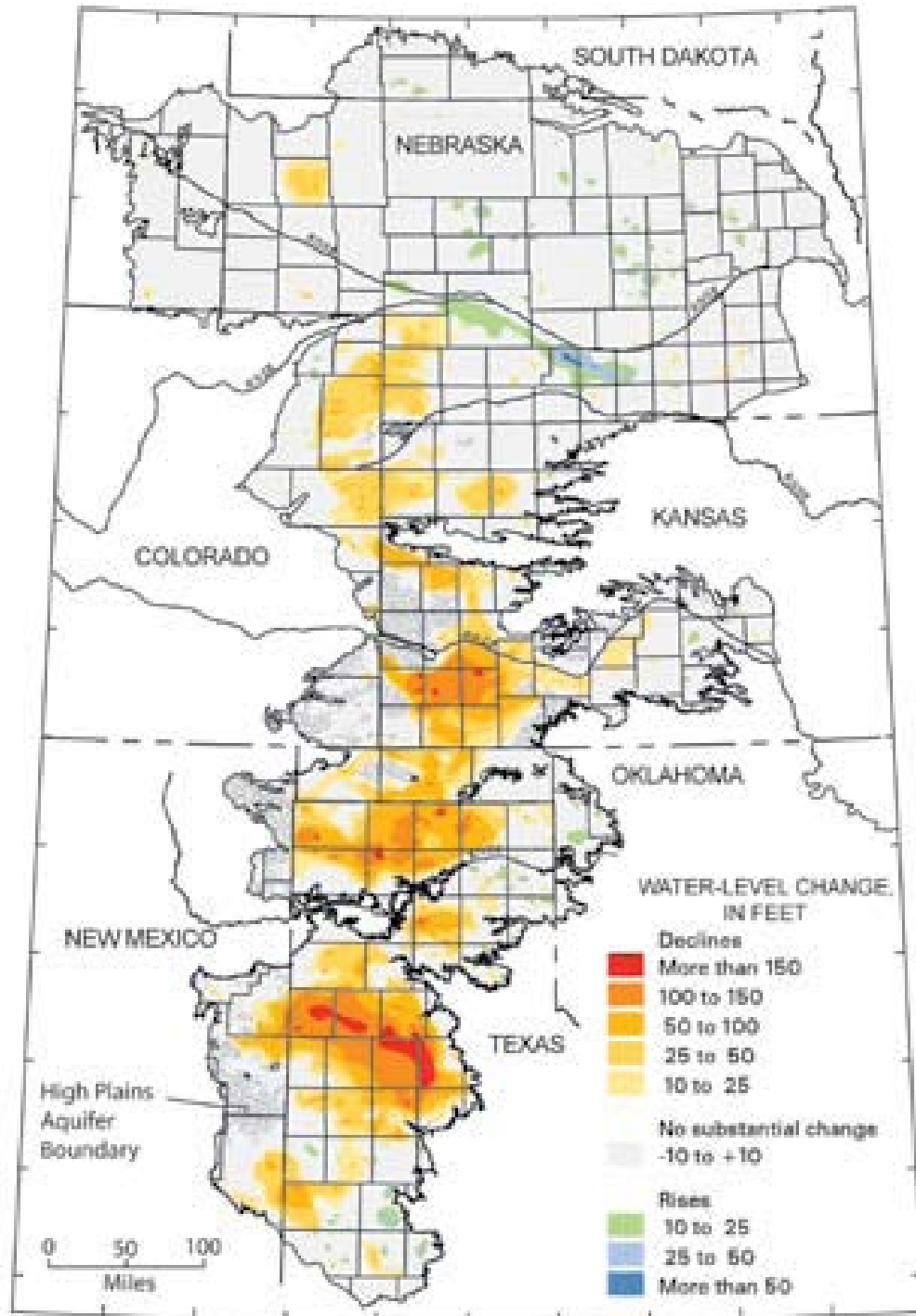
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NATURAL  
RESOURCE  
ECOLOGY  
LABORATORY



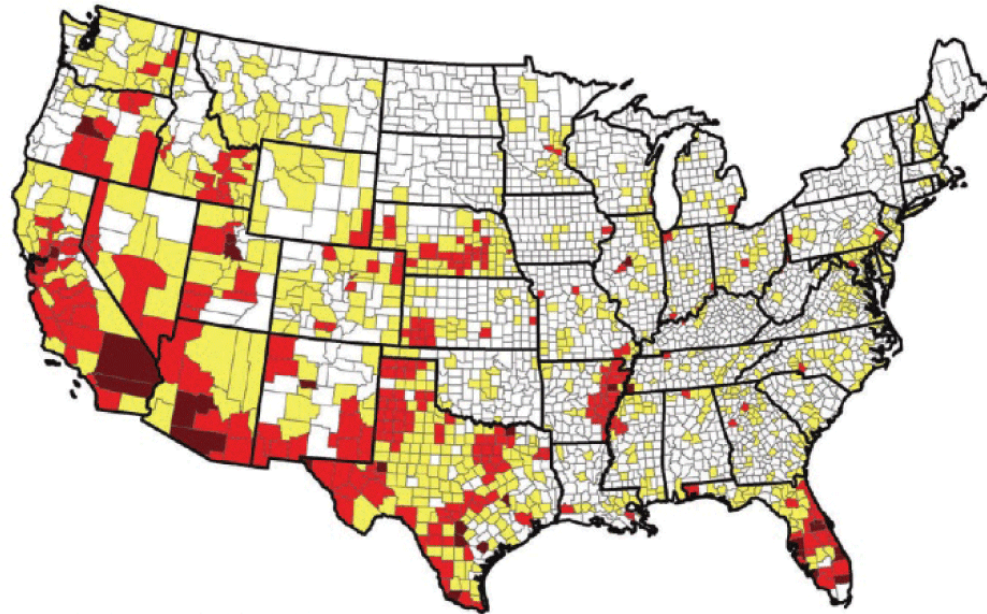


Recent changes  
in ground water  
levels to due  
irrigation use  
in Ogalalla  
Aquifer may have  
constraints on  
grassland and  
rangeland  
productivity

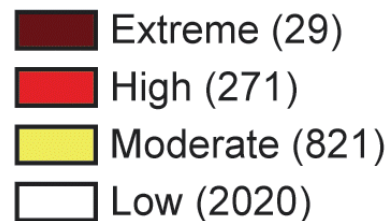


# Water Supplies Projected to Decline

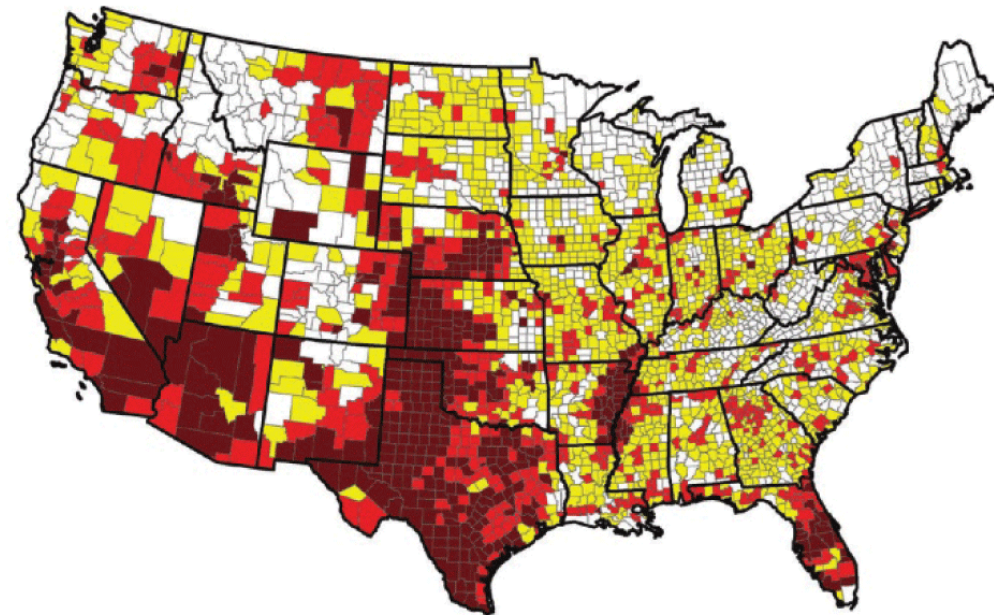
(a) No Climate Change Effects



Water Supply Sustainability Risk Index (2050)

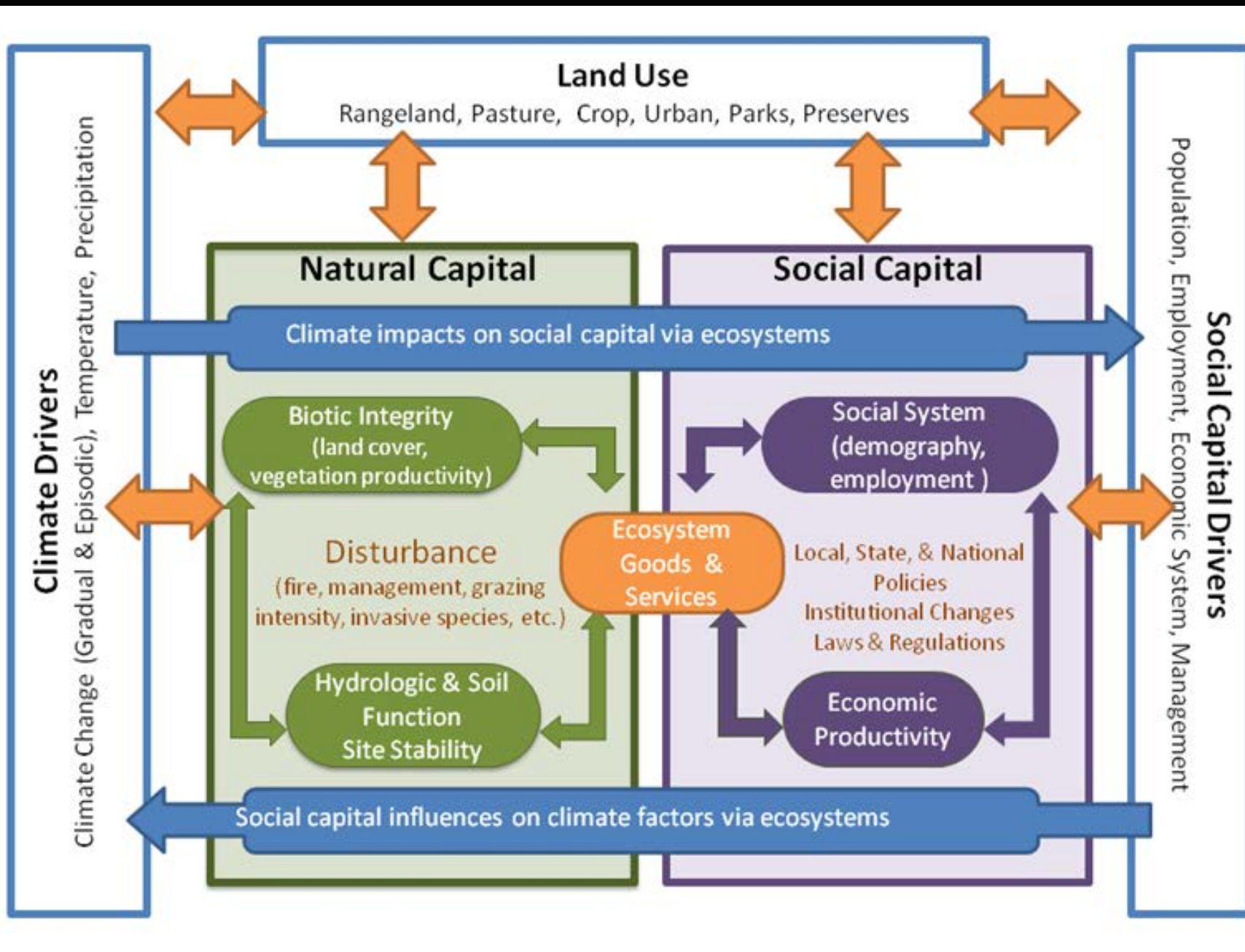


(b) Climate Change Effects



Water Supply Sustainability Risk Index (2050)





# Social Ecological Context Of DROUGHT

- Drought affects managers differentially depending on conservation or management targets
- Spatial and temporal timing of drought affect species, landscapes, and ecosystems in different ways
- Livelihood needs differ relative to adaptive capacity of the household, ranch, community



# How do we monitor DROUGHT

- Drought Forecasts
- Increasing spatial pattern of drought representation
- Spatial and temporal timing of drought affect species, landscapes, and ecosystems in different ways



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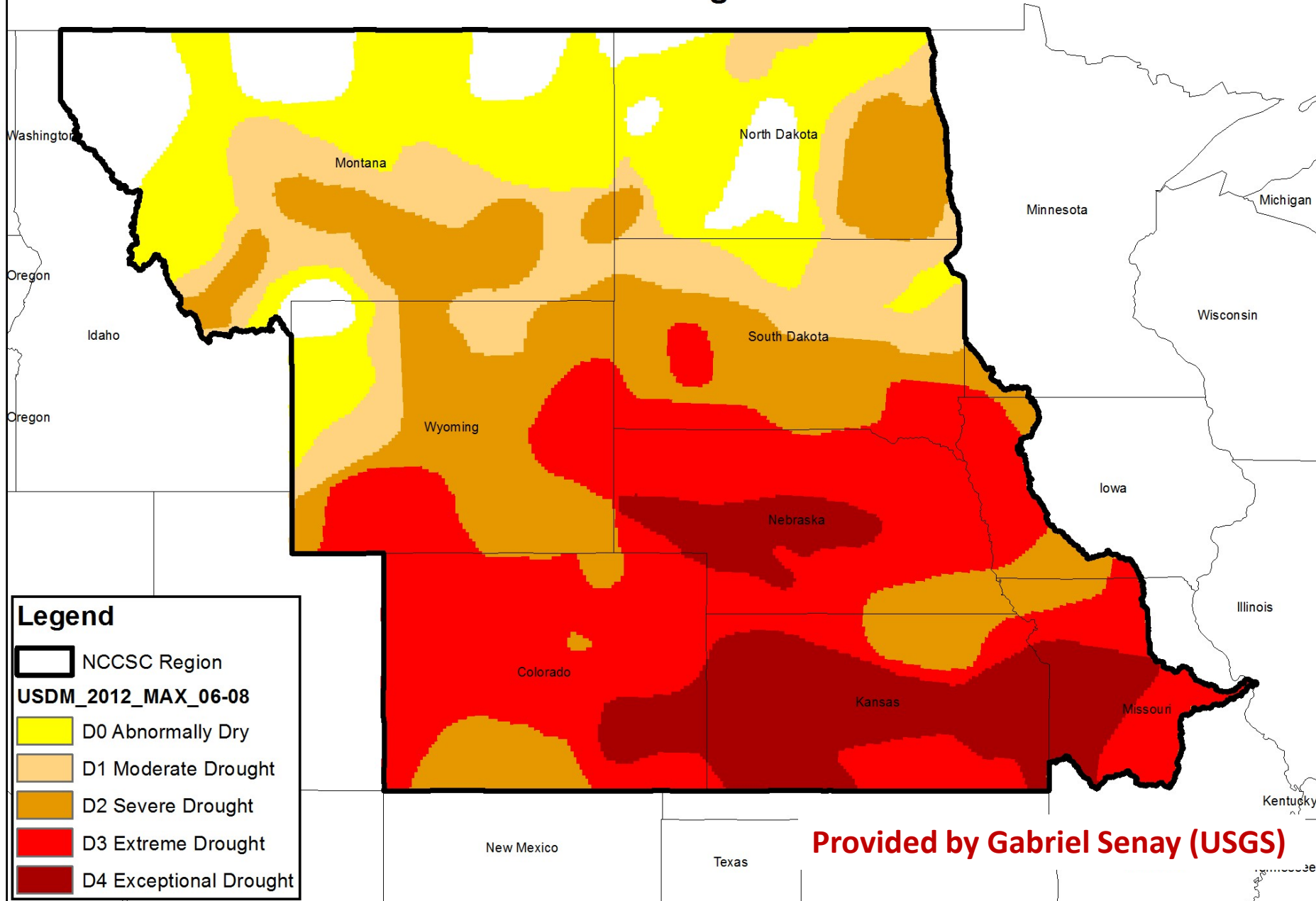
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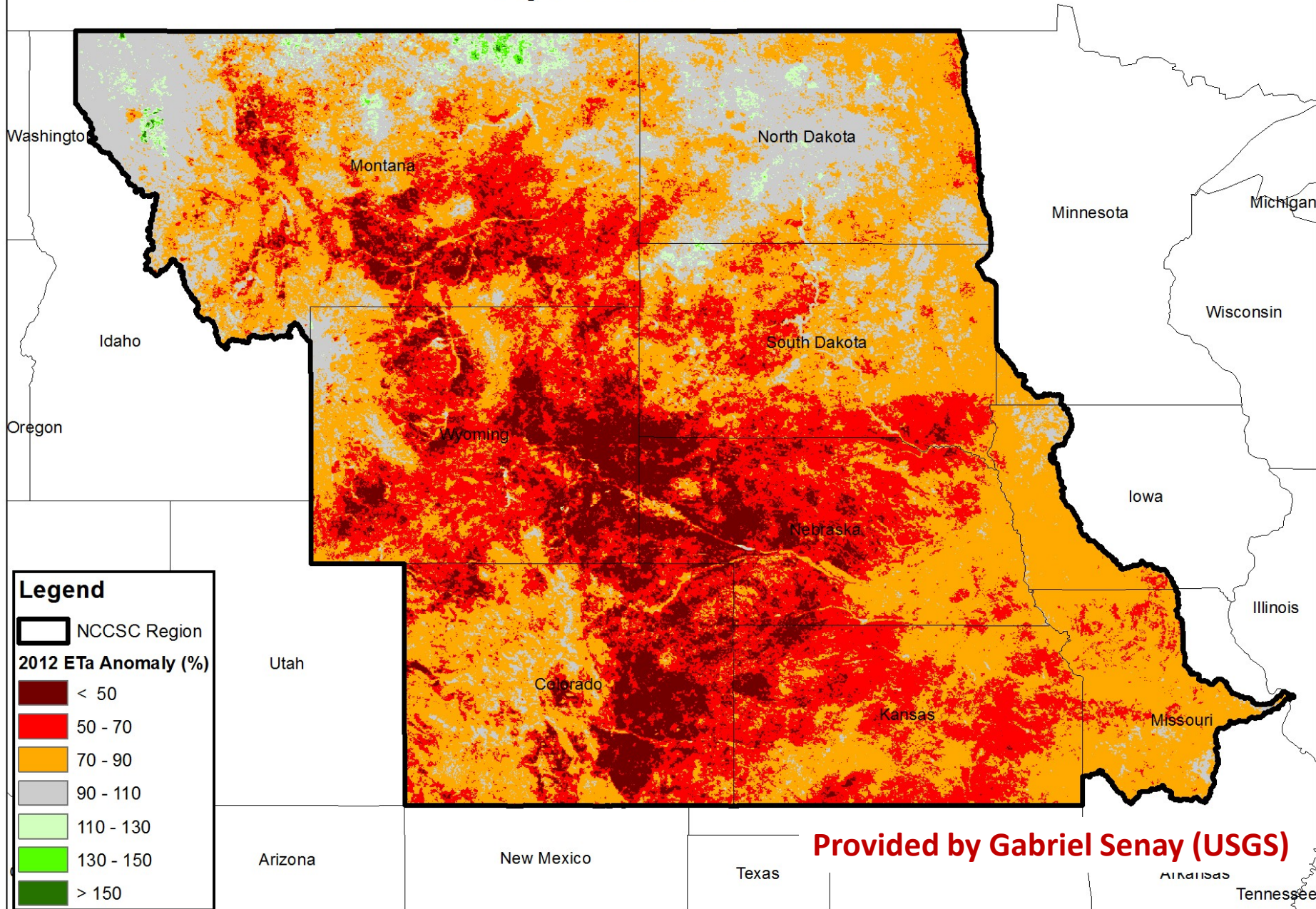


# US Drought Monitor - Maximum of June, July, August 2012 for NCCSC Region



Provided by Gabriel Senay (USGS)

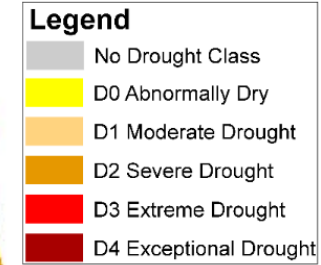
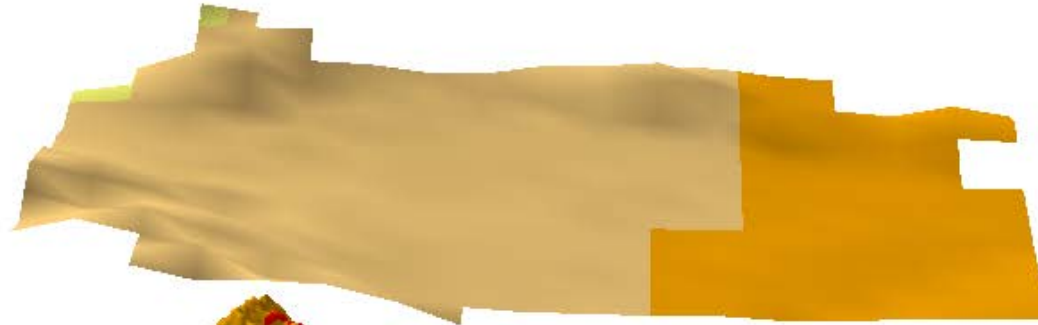
# 8-day Cumulative ETa Anomaly Apr-Oct 2012



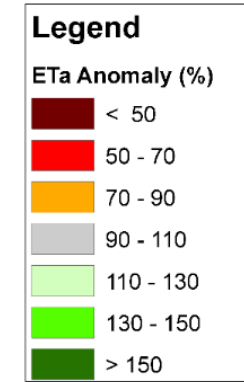
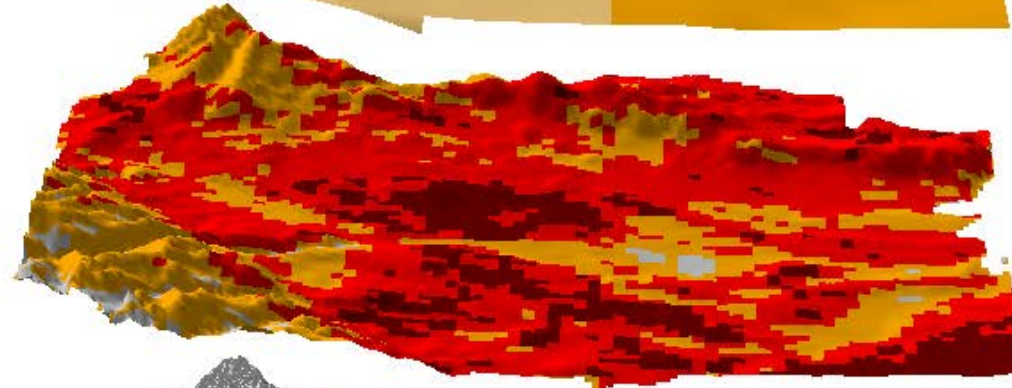
**Provided by Gabriel Senay (USGS)**

# Wind River Reservation - Drought Year 2012 Growing Season ETa vs Drought Monitor

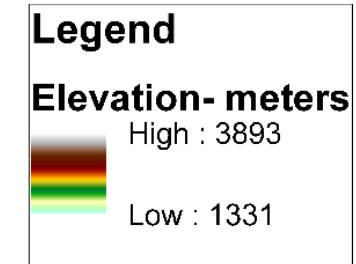
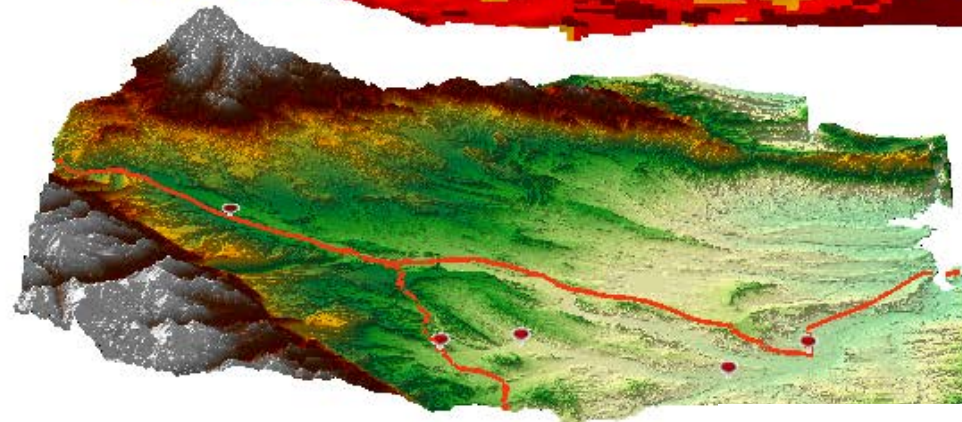
US  
Drought  
Monitor



ETa  
Anomaly

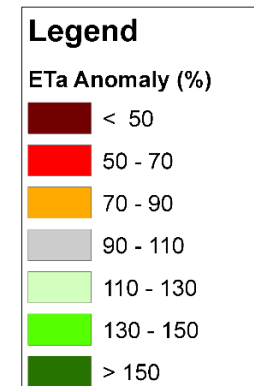
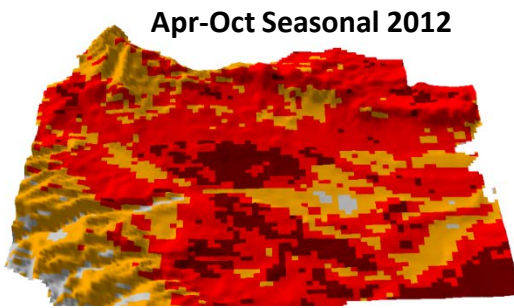
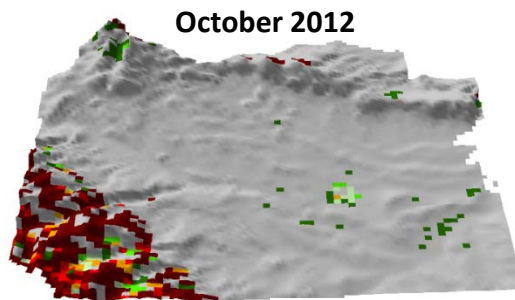
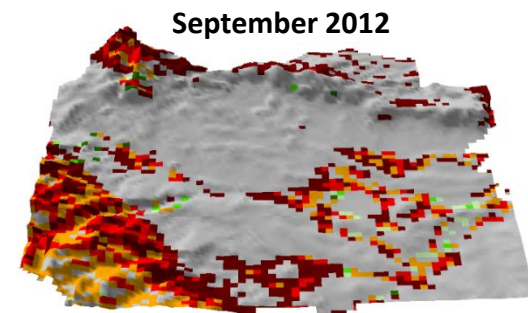
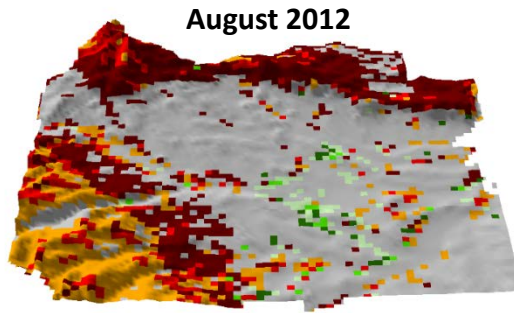
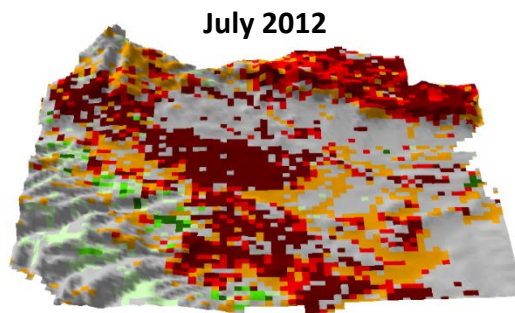
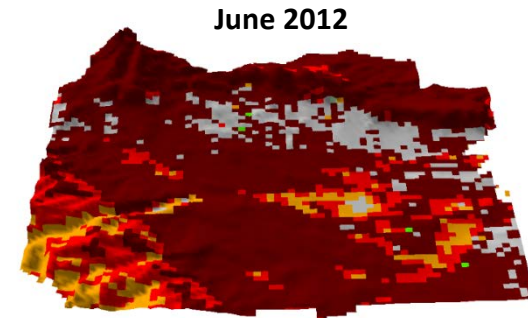
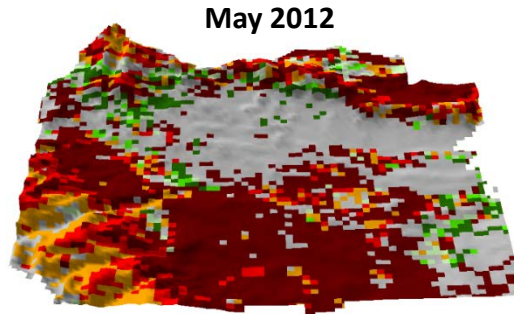
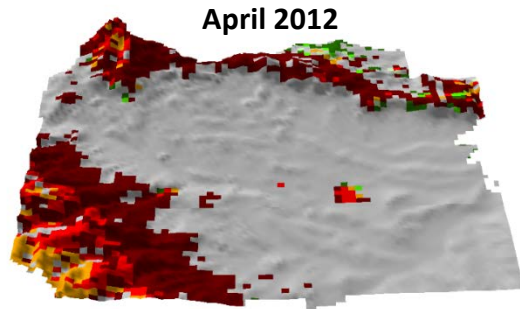


Base  
Elevation



Provided by Rangwala and Dewes (CU/NOAA)

# Wind River Reservation Drought Year 2012 Monthly ET Anomaly for Growing Season



Provided by Rangwala and Dewes (CU/NOAA)



# Additional tools and co-developed data

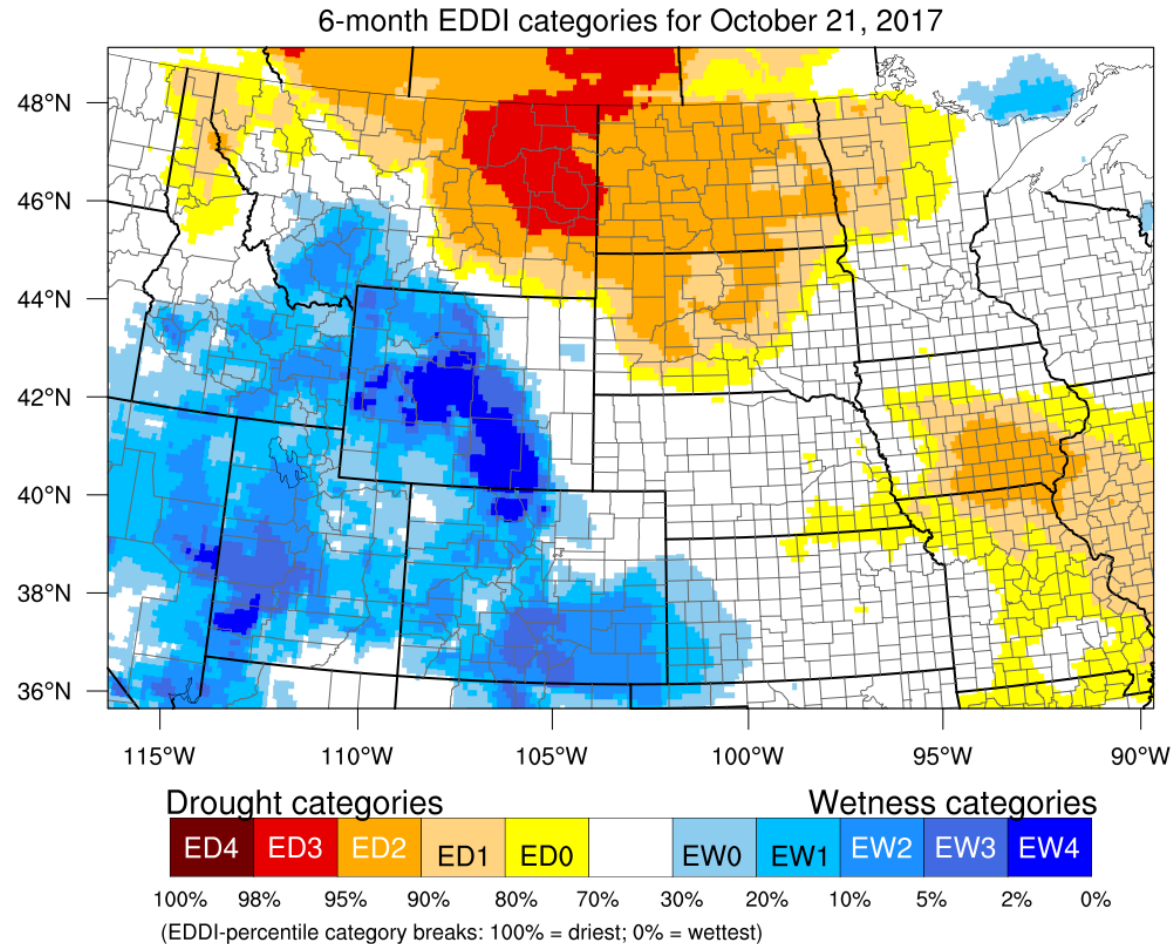
- Drought Forecasts: **Evaporative Demand Drought Index (EDDI)**
- Drought responsive forage predictions: **GRASS-Cast**



# EVAPORATIVE DEMAND DROUGHT INDEX (EDDI)

<https://www.esrl.noaa.gov/psd/eddi/>

- Standardized anomalies in “evaporative demand” (i.e. Penman-Monteith PET)
- Near real-time (i.e., 5 day lag)
- 12km NLDAS-2 meteorological driving variables



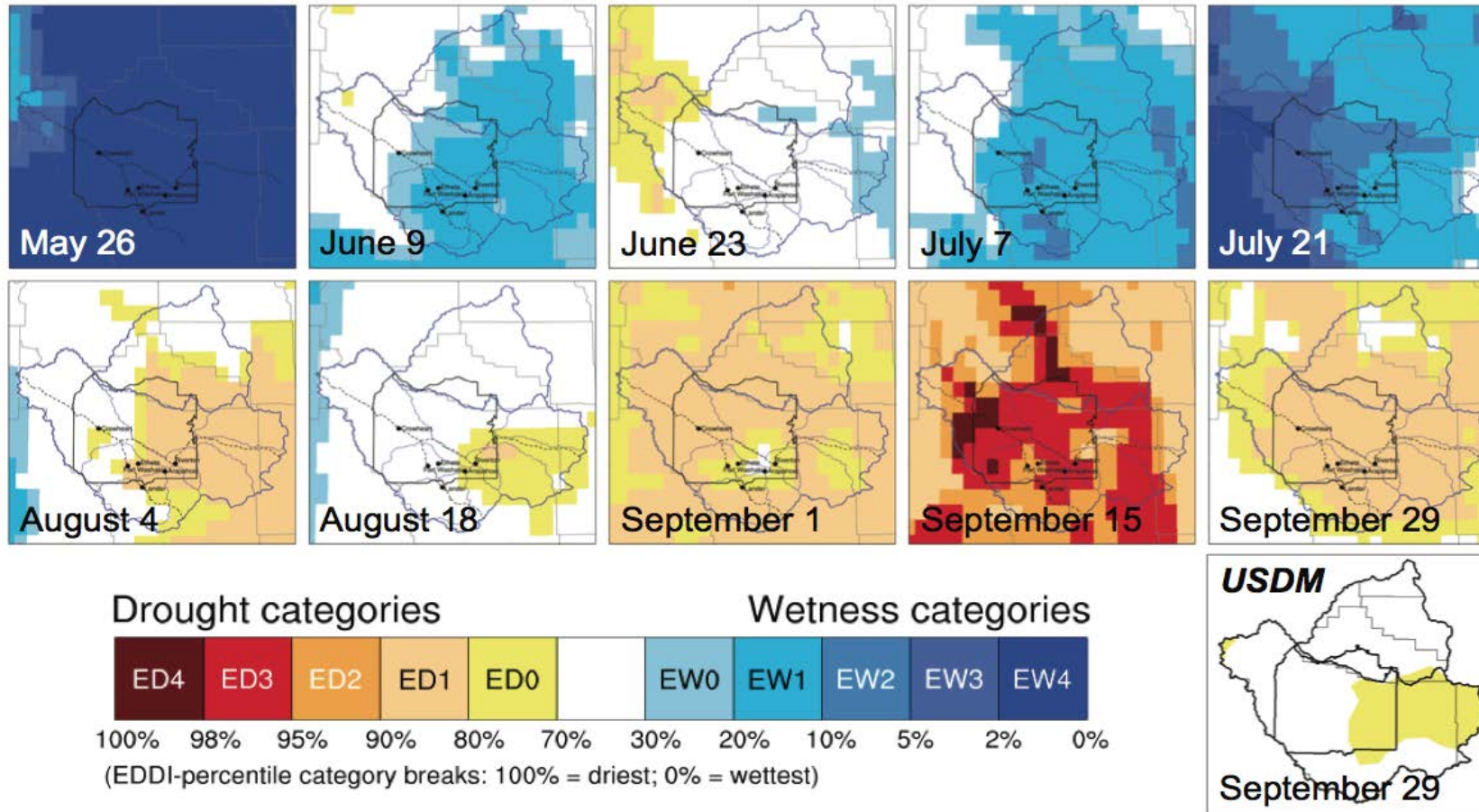
Provided by Rangwala (CU/NOAA)

# Why EDDI?

Particularly strong in capturing precursor signals of drought at weekly to monthly timescales

## 2-week EDDI

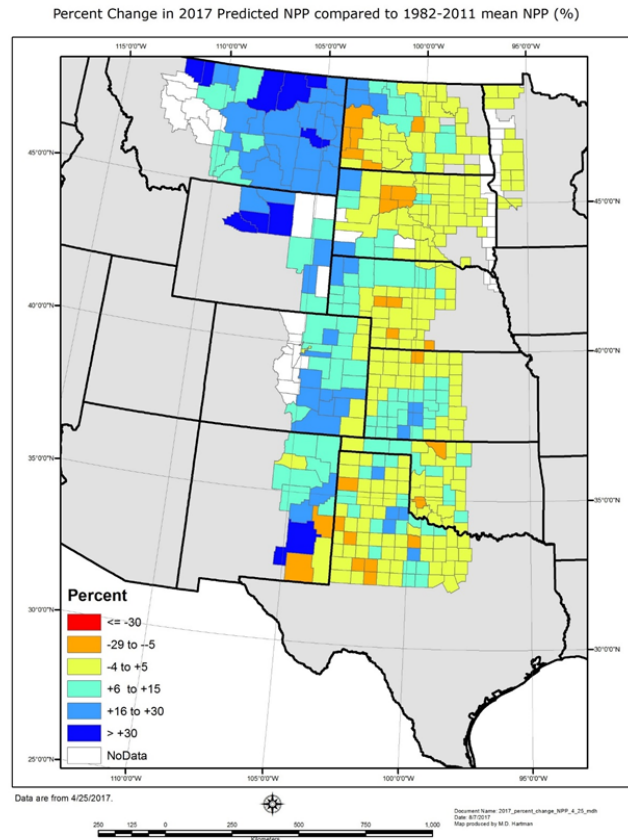
### 2015 Growing Season in Wind River Indian Reservation, WY



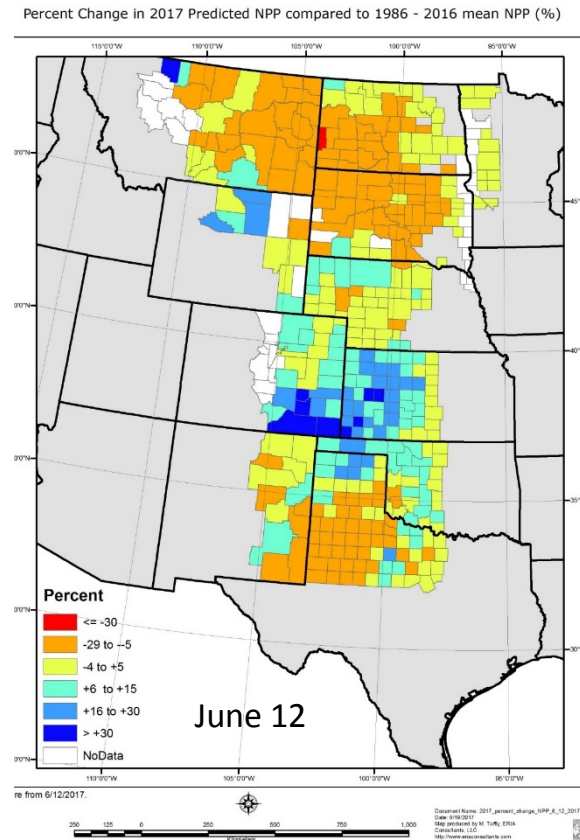
# GRASS-CAST Great Plains forage projections for 2017

Ecosystem model (Daycent model) based predictions for growing season forage production based on current weather condition Projections started picking up flash drought conditions starting May

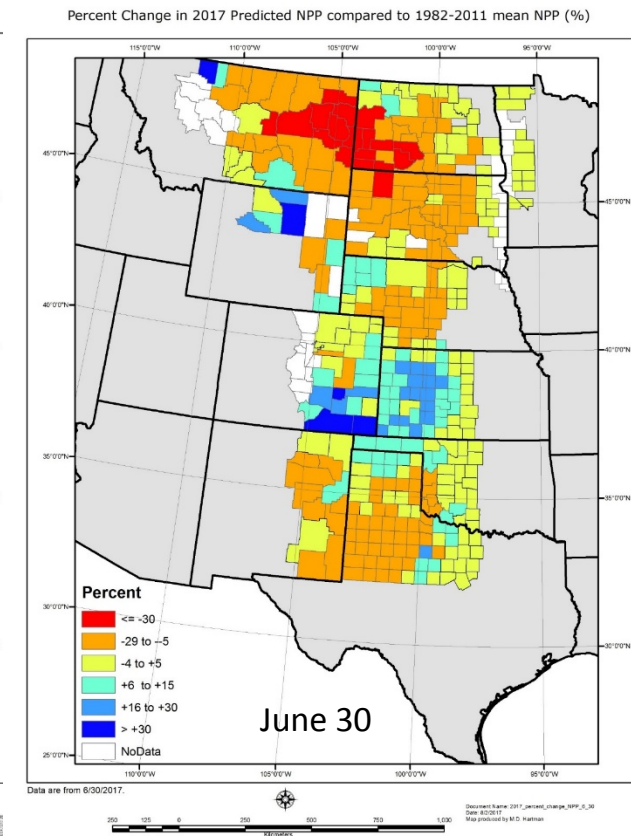
**April 25, 2017**



**June 12, 2017**



**June 30, 2017**



Figures and results provided by Bill Parton, CSU

# New Pathways of Research and Practitioner Partnerships

Through efforts which incorporate aspects of Co-Production, which may contribute to “ACTIONABLE SCIENCE”

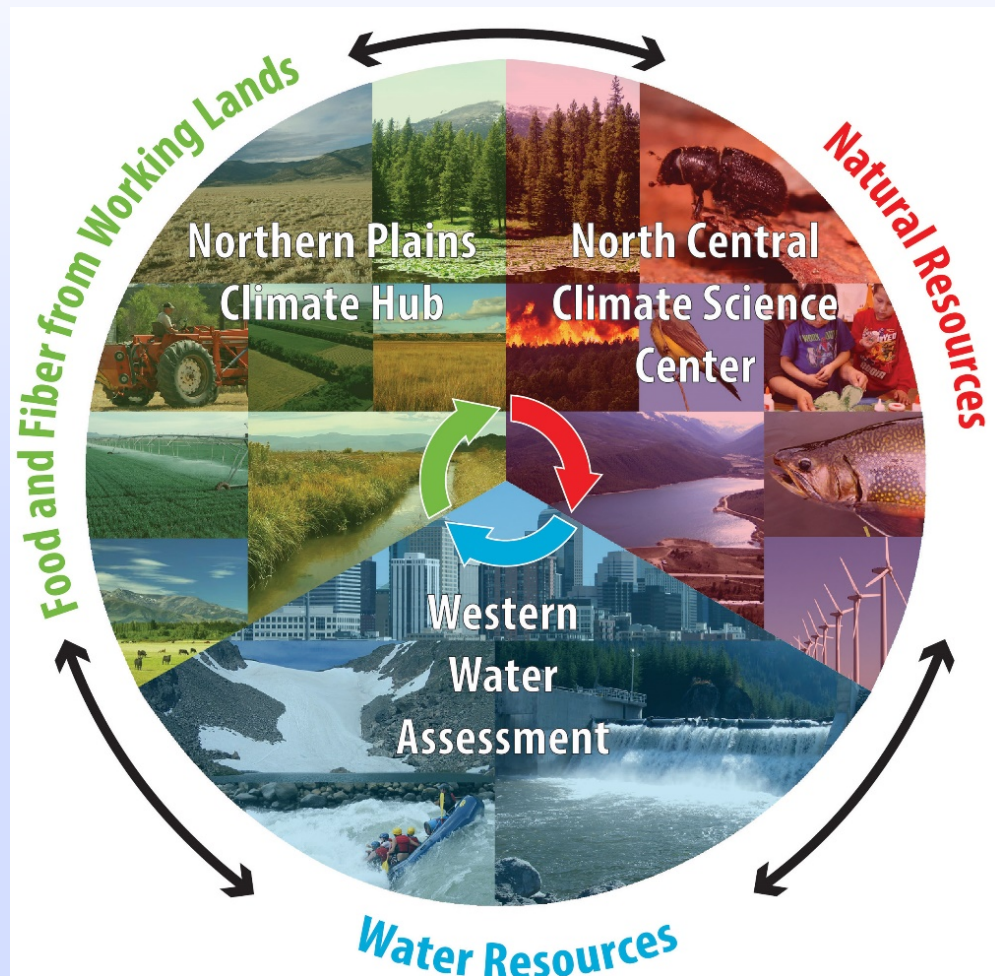
## Actionable Science

- Provides data, analyses, projections, or tools that can support decisions regarding the management of the risks and impacts of climate change.
- It is ideally co-produced by scientists and decision-makers and creates rigorous and accessible products to meet the needs of stakeholders.

## Co-Production

Collaborative, knowledge-sharing engagement between research and management groups solving a common problem through research, adaptive management practices, monitoring and assessment

# Regional Collaboration to Enabling Actionable Science



USDA Hub, NOAA RISA, and  
DOI CASC collaboration

## Guiding principles:

- Coordinate to realize efficiencies where possible
- Respect the trust relationship each has established through our agencies constituents
- Look for opportunities to develop holistic understanding and solution where there are competing requirements.

## In practice:

- Shared personnel
- Bi-annual retreats, no “dog and pony” but rather details and “in the weeds” discussion
- Developed a table defining the three entities based on stakeholders, agency support, mission, etc.

# Next Steps

- We are developing various drought indicators for different natural resource managers in federal, tribal, and state agencies.
- These efforts have enhanced our collaborative efforts with partners at the universities, NOAA and USDA
- Developing joint efforts to further explore ecosystem dynamics at various landscape and seasonal scales to assess drought affected areas linked to management needs using ecosystem models, remote sensing, and local knowledge



# SUMMARY

- Collaborative efforts to develop adaptive management practices to grassland conservation targets with the applicable research
- Incorporate climate considerations in managing for drought and other cross-sectoral management goals
- New tools: Remote sensing and ecosystem modeling products can provide improved spatial and temporal insights of of changing landscapes







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# THANK YOU

<http://nccsc.colostate.edu/>

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