

The Vegetation Drought Response Index (VegDRI): *A New Approach to Monitoring Vegetation Stress* *from a Local to National Scale*

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VegDRI Project Team Members

NDMC

- Brian Wardlow – remote sensing specialist
- Tsegaye Tadesse – climatologist
- Karin Callahan – remote sensing/GIS specialist
- Chris Poulsen – GIS specialist
- Eric Hunt – Ph.D. student
- Sharmistha Swain – Ph.D. student

USGS

- Jesslyn Brown – remote sensing specialist
- Yingxin Gu – remote sensing specialist
- Danny Howard – geospatial analyst



What is VegDRI?



VegDRI is a new ‘hybrid’ drought index that integrates:

- satellite-based observations of vegetation conditions
- climate-based drought index data
- biophysical characteristics of the environment

to produce 1-km spatial resolution maps that depict

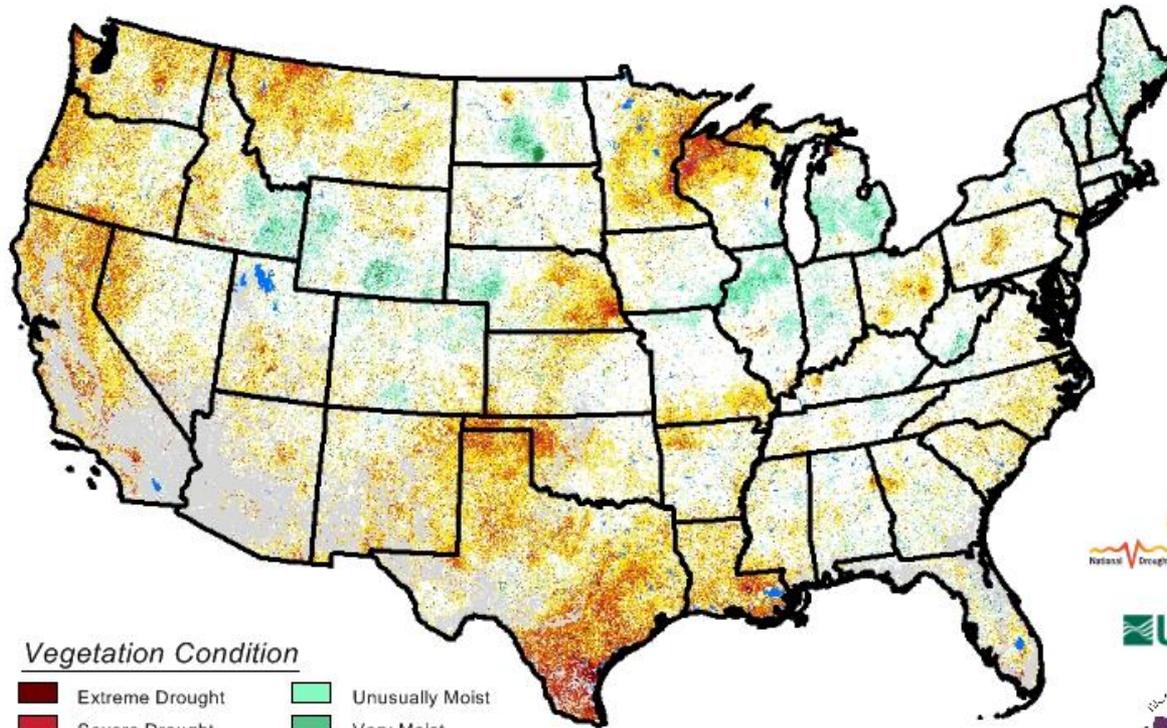
‘*drought-related vegetation stress*’ and are regularly updated (currently at 2-week interval) during the growing season.



What is VegDRI?

Vegetation Drought Response Index
Complete

July 13, 2009



Vegetation Condition

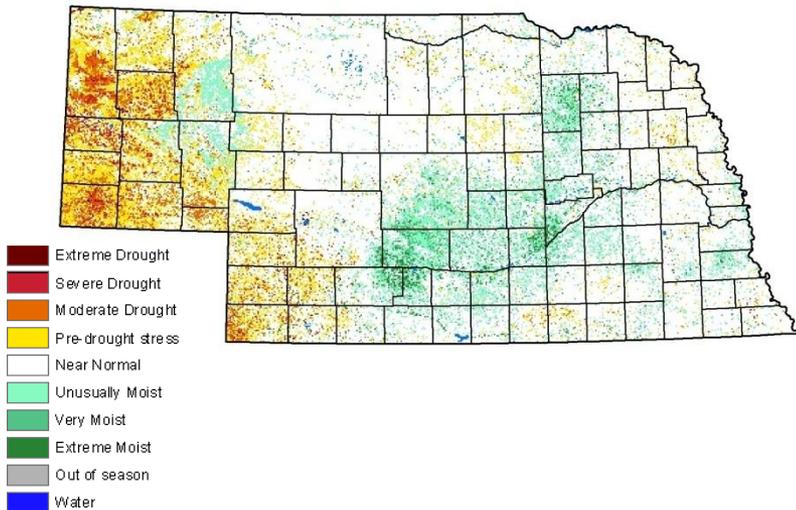
- | | |
|--|---|
|  Extreme Drought |  Unusually Moist |
|  Severe Drought |  Very Moist |
|  Moderate Drought |  Extremely Moist |
|  Pre-Drought |  Out of Season |
|  Near Normal |  Water |



VegDRI vs. U.S. Drought Monitor

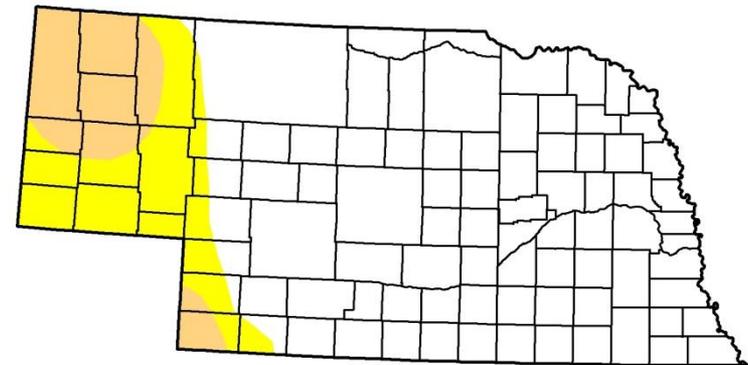
VegDRI

Nebraska – June 30, 2008



U.S. Drought Monitor

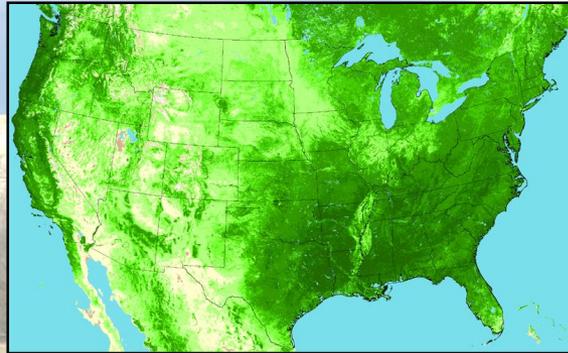
Nebraska – July 1, 2008



Goal of VegDRI Tool: National-level monitoring capabilities with local-scale information (i.e., county to sub-county level) regarding the level of drought stress on vegetation.

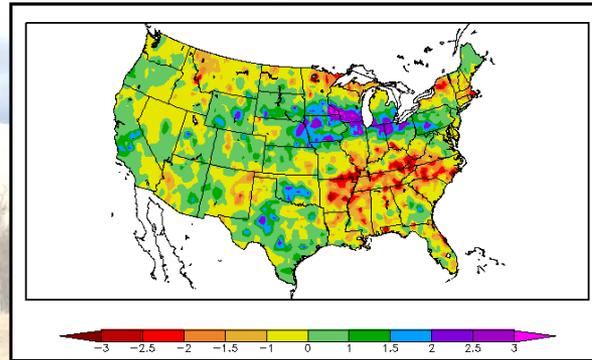
VegDRI - An Integrated Approach

Remote Sensing Component



+

Climate Component



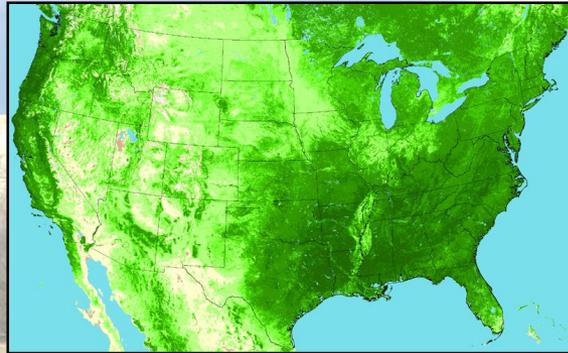
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Biophysical Component



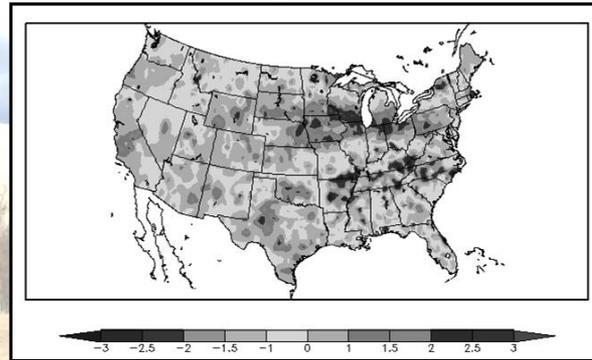
VegDRI - An Integrated Approach

Remote Sensing Component



+

Climate Component



+

Biophysical Component

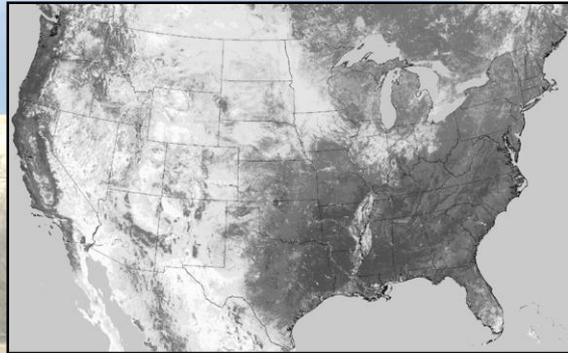


Role: Satellite-based observations provide information on the *spatial distribution and general condition of vegetation.*

- (+) Spatially detailed information about vegetation across large geographic areas.
- (-) Difficult to discriminate drought impacted areas from locations under other types of environment stress (flooding, fire, hail, & pests) or experiencing land cover/use change.

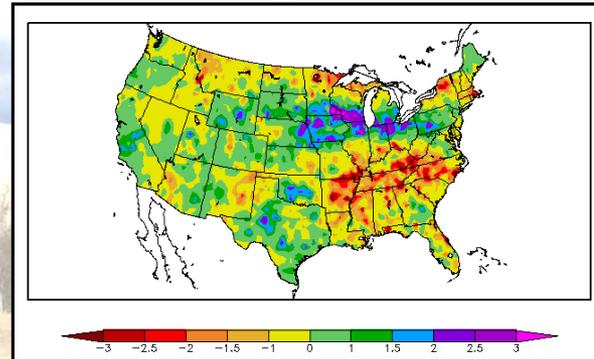
VegDRI - An Integrated Approach

Remote Sensing Component



+

Climate Component



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Biophysical Component

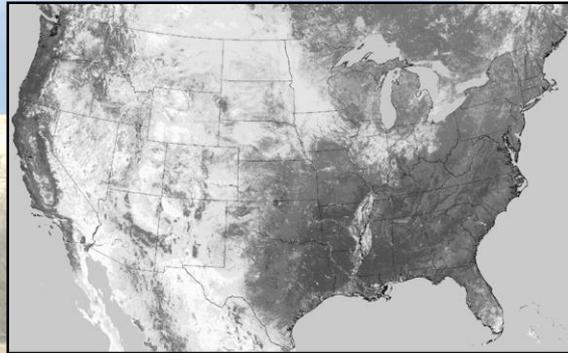


Role: Climate-based drought index maps provide a *'broad-scale' measure of dryness* that can be used for interpretation of the vegetation stress recorded in the satellite observations.

- Drought areas typified by below average vegetation conditions recorded in the satellite data and drier than normal conditions in the climate data.

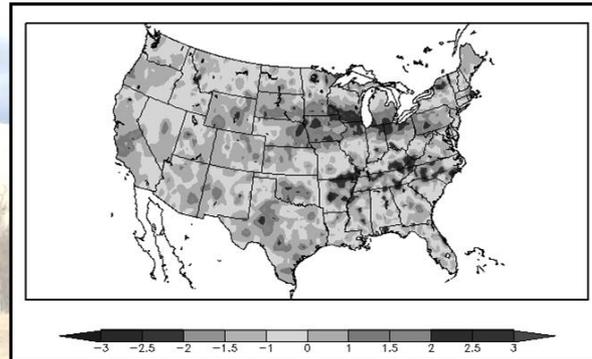
VegDRI - An Integrated Approach

Remote Sensing Component



+

Climate Component



+

Biophysical Component



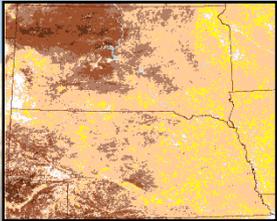
Role: Different characteristics of the environment are considered that influence climate-vegetation interactions.

- land use/land cover type
- irrigation
- soil available water capacity
- elevation
- ecological setting

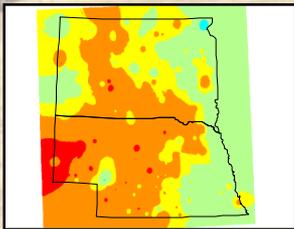
VegDRI Methodology

1. Historical Database Development

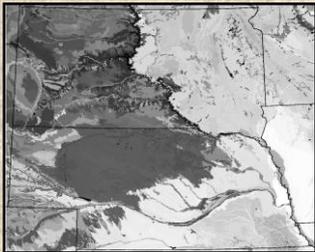
Satellite Data



Climate Data



Biophysical Data



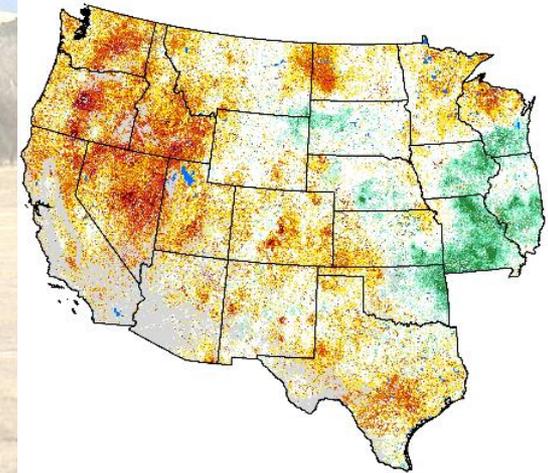
Data Input Variables

- 1) Percent Annual Seasonal Greenness (PASG)
- 2) Start of Season Anomaly (SOSA)
- 1) Palmer Drought Severity Index (PDSI)
- 2) Standardized Precip. Index (SPI)
- 1) land use/ cover type
- 2) soil available water capacity (STATSGO)
- 3) ecoregion type
- 4) irrigation status
- 5) elevation

2. Model Development

Regression
Tree
Model (*)

3. Map Generation

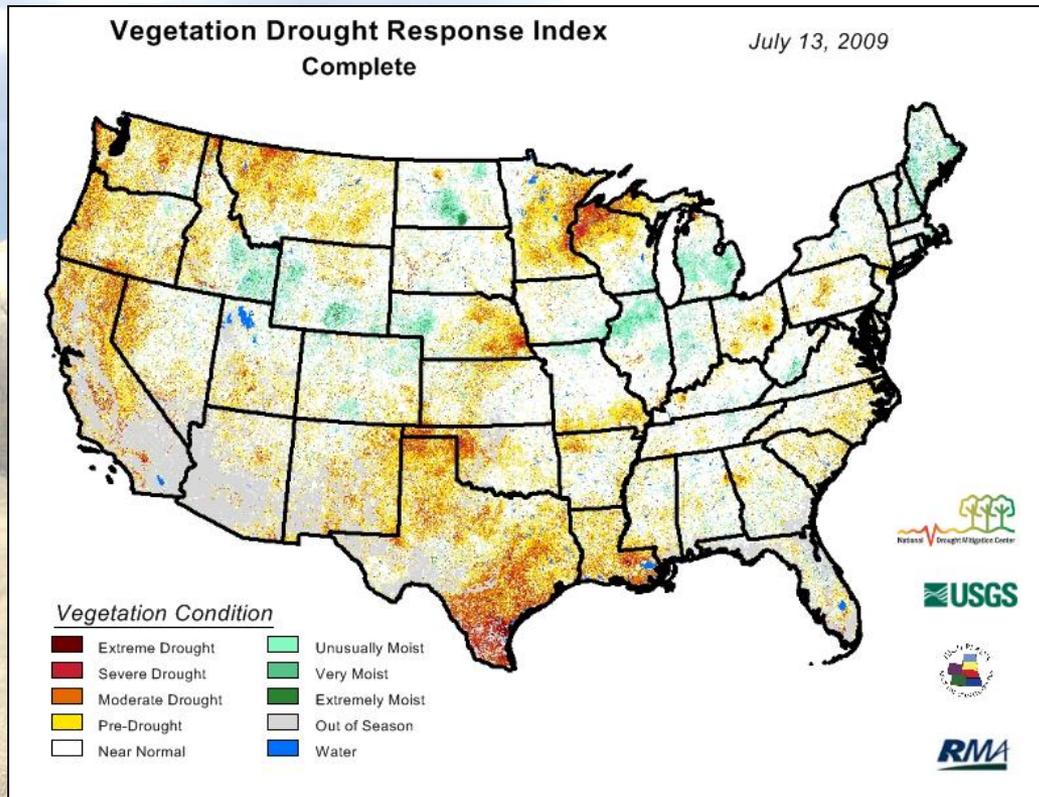


1-km VegDRI Map

(*) Models developed from a 20-year historical record (1989 – 2008) of bi-weekly climate and satellite observations at 2,200+ weather station locations.

Biophysical variables are *static* over time.

Operational Production of VegDRI

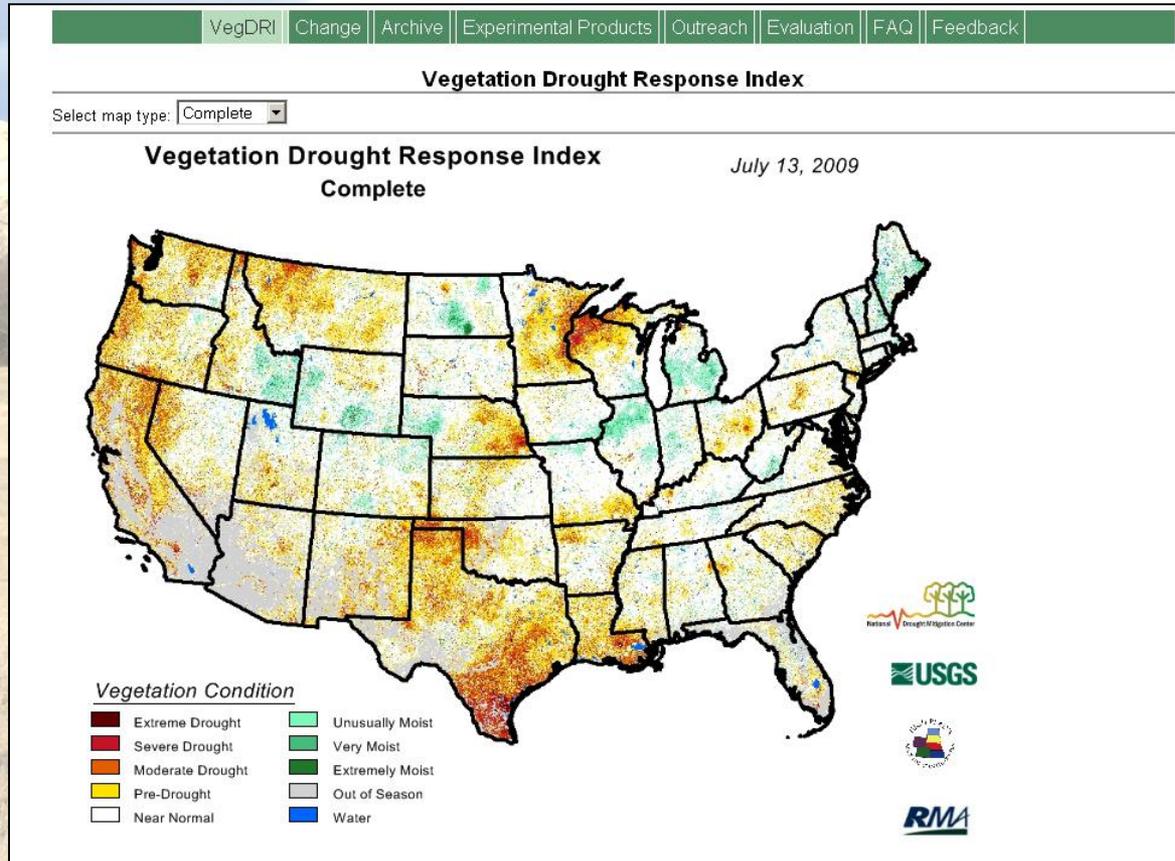


- Year round, bi-weekly updates (once every 2 weeks)
 - Weekly updates planned in near future
- 3 years of information currently available for Nebraska:
 - 2007, 2008, & 2009 growing seasons
- Production of a 20+ year historical record of VegDRI maps (1989 to present)
 - Planned for fall 2009/winter 2010



VegDRI Website and Products

VegDRI products are available at the VegDRI page within the Monitoring section of the NDMC website.



http://www.drought.unl.edu/vegdiri/VegDRI_Main.htm



VegDRI Website and Products

Front page of the VegDRI website below the map include:

1. Map download instructions
2. Project news and announcements
3. “VegDRI Map Highlights” that include a brief, written description of key features and changes in the national VegDRI map above.

The screenshot shows the front page of the VegDRI website. It features a navigation menu at the top with links for Home, About, News, Downloads, and Contact Us. Below the menu, there are two main sections: 'What's New!' and 'VegDRI Highlights for July 13, 2009'. The 'What's New!' section contains a link to 'VegDRI Expands to 48 States in May 2009' and a sub-section for 'VegDRI Workshops Conducted in California, Texas, and Washington'. The 'VegDRI Highlights' section is divided into four regional categories: Western States, Great Plains, Midwest, and Northeast, each with a brief summary of recent rainfall and drought conditions. A footer contains the website's URL and logos for the National Drought Mitigation Center, USGS, and the High Plains Regional Climate Center.

To download the image, right-click [here](#) and select "Save target as...".

To download the pdf, right-click [here](#) and select "Save target as...".

What's New!

[VegDRI Expands to 48 States in May 2009](#)

VegDRI Workshops Conducted in [California](#), [Texas](#), and [Washington](#)

The 2006-2007 Archive is currently being updated. New dates will be added as they become available.

VegDRI Highlights for July 13, 2009

Western States

In the past two weeks, rainfall has been limited over most of the Western states. Parts of eastern Colorado, Montana, and Wyoming received 1+ inches of rainfall. As a result, the dryness signature in these areas lessened as some locations transitioned from pre-drought to near-normal or moist conditions in the VegDRI map. The patterns for the remainder of the West were relatively unchanged from the prior VegDRI map from June 29.

Great Plains

High temperatures and very limited rainfall were received across much of Oklahoma and Texas over the past 14-days, which sustained or future exacerbated the drought conditions across much of these states. The drought signal in the Panhandle and western parts of Oklahoma, as well as, northern Texas intensified in the current VegDRI map. In eastern Nebraska, the drought conditions intensified over the past two weeks in VegDRI with many locations being classified in the pre- to moderate drought classes. Cool temperatures were experienced across eastern Nebraska, but very limited rainfall was received over this part of the state over the past 14 days. The existence and severity of drought conditions depicted in VegDRI for eastern Nebraska is still being assessed by evaluators. The severe to extreme drought conditions in southern Texas continued to persist. Non-drought conditions in most of the Northern Great Plains remained relatively unchanged over the past 2 weeks as rainfall was received over much of central North Dakota and eastern South Dakota.

Midwest

Very limited rainfall was received over drought stricken eastern Minnesota and northwest Wisconsin, which was reflected in an intensification of drought severity in current VegDRI map for these areas. Rain (1+ inches) fell across much of the Corn Belt states over the past 14 days and non-drought conditions continued to be depicted in VegDRI for those locations. Areas of pre-drought in southern Missouri and parts of Ohio remained and are still under assessment by VegDRI evaluators in those locations to confirm their validity.

Northeast

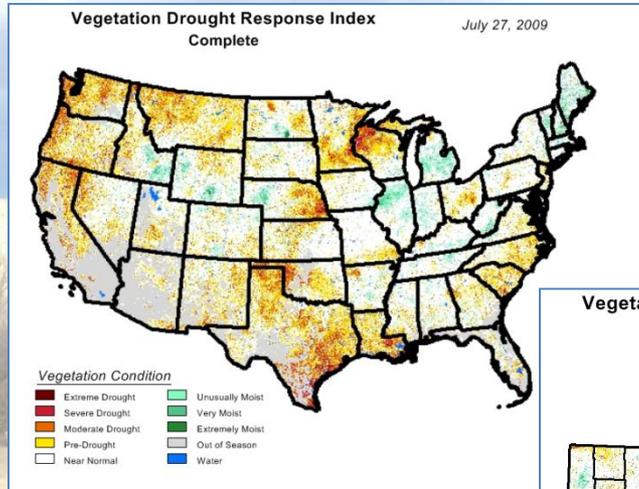
Wide spread rain fell over most northeastern U.S. over the past 2 weeks. Most of the area remained in the near-normal to moist class designations in the VegDRI map. Some local exceptions of pre-drought to moderate drought in central Pennsylvania and northern New Jersey remained, but lessened in severity in the VegDRI map over the past two weeks. The appearance of these drought features in these locations is currently under review by the VegDRI project team.

http://www.drought.unl.edu/vegdiri/VegDRI_Main.htm

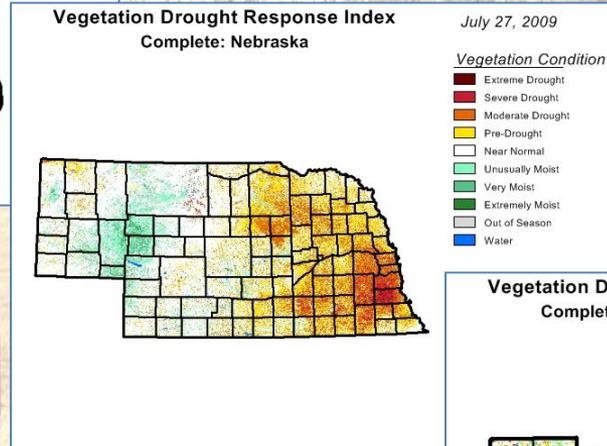


1. VegDRI Quick-View Maps

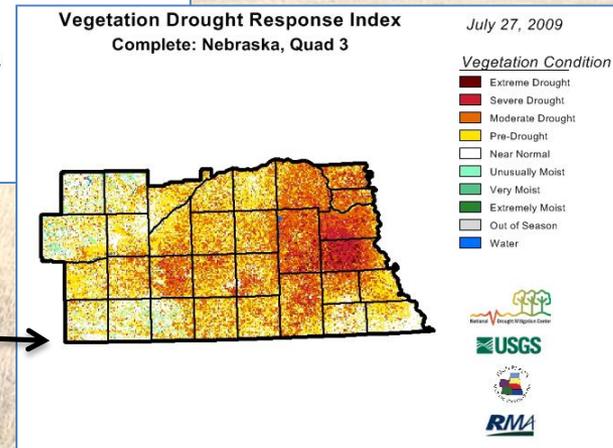
(multiple spatial scales)



Regional-level

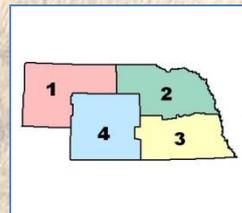


State-level



Sub-state level

Sub-state areas are pre-defined 'quads' for each state.



1. VegDRI Quick-View Maps (cont.)

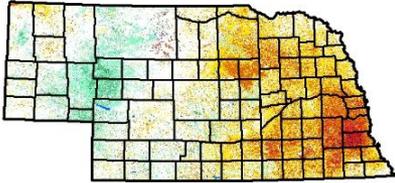
(land cover type)

Vegetation Drought Response Index
Complete: Nebraska

July 27, 2009

Vegetation Condition

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



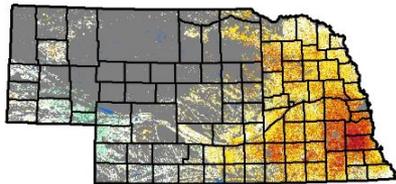
Complete
view

Vegetation Drought Response Index
Croplands: Nebraska

July 27, 2009

Vegetation Condition

- Extreme Drought
- Severe Drought
- Moderate Drought
- Pre-Drought
- Near Normal
- Unusually Moist
- Very Moist
- Extremely Moist
- Other landcover
- Out of Season
- Water



Cropland
view

Vegetation Drought Response Index
Rangelands: Nebraska

July 27, 2009

Vegetation Condition

- Extreme Drought
- Severe Drought
- Moderate Drought
- Pre-Drought
- Near Normal
- Unusually Moist
- Very Moist
- Extremely Moist
- Other landcover
- Out of Season
- Water



Rangeland
view



2. VegDRI Area Statistics (% area) (currently available at state-level only)

Summary by
land cover
type.

Current map
& all prior
maps.

VegDRI Statistics for Nebraska (Percent Area)									
Complete	Extreme Drought	Severe Drought	Moderate Drought	Pre-Drought	Near Normal	Unusually Moist	Very Moist	Extremely Moist	
09/07/13	0.34	2.44	9.21	20.07	55.62	8.73	2.60	0.41	
09/06/29	0.21	0.98	3.24	10.03	73.38	8.98	2.31	0.29	
09/06/15	0.17	0.44	1.35	5.10	76.47	10.80	4.11	0.98	
09/06/01	0.13	0.96	3.25	12.84	71.78	6.98	2.92	0.51	
09/05/18	0.17	0.59	2.39	9.47	76.94	5.70	2.31	0.63	
09/05/04	0.06	0.17	0.60	3.14	55.36	5.62	1.81	0.34	
09/04/20	0.02	0.07	0.21	0.76	23.94	3.99	1.15	0.34	
09/04/06	0.00	0.01	0.06	0.13	3.37	0.30	0.10	0.01	
09/03/23	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	
09/03/09	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	
09/02/23	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	
09/02/09	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	
09/01/26	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	
09/01/12	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	
08/12/29	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	
08/12/15	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	

- Summarize the % area of each VegDRI class for ‘current’ map and all prior dates in the growing season.
- Specific tables available for rangeland and cropland.



3. Change Maps

3 Types:

1) Prior period

ex. - Sep 4, 2007 vs. Sep 10, 2007

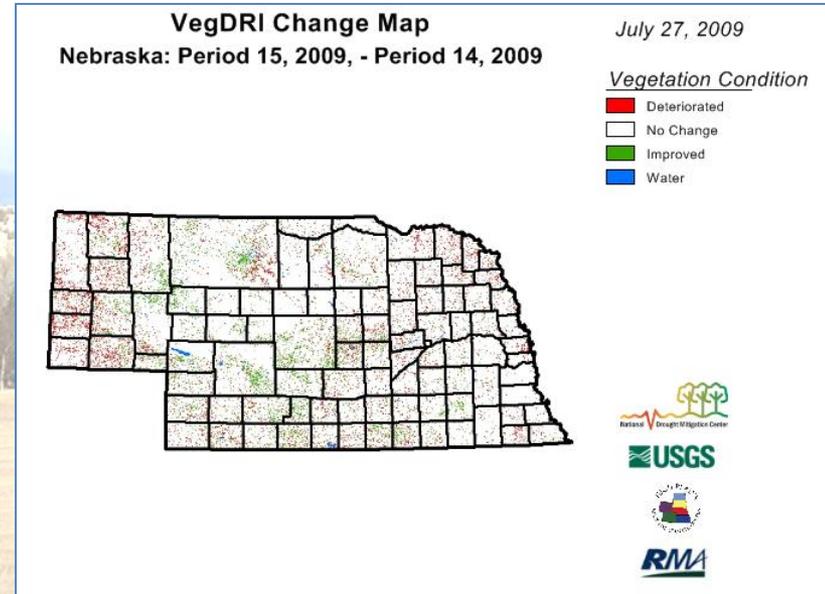
2) Same period from the prior year or a specific year in past

(* currently not available)

ex. - Sep 24, 2007 vs. Sep 24, 2006

3) Historical average (* currently not available)

ex. - Sep 24, 2007 vs. average for Sep 24 (1989
through 2006)

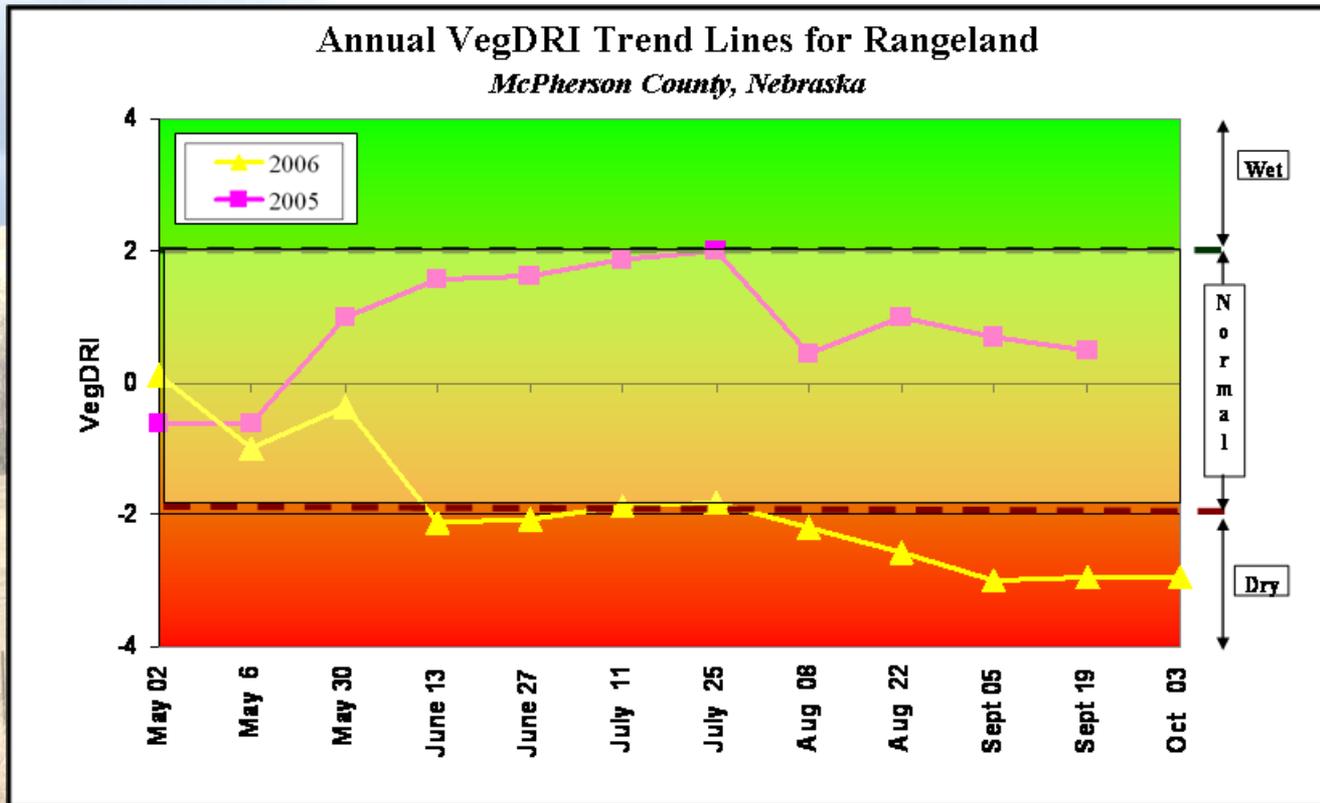


4. Animations

Goal: Visualize spatial and temporal changes in drought patterns across a specific year or multiple years for a state or sub-state region.



5. Trendlines (in development)



Plots the average VegDRI values over the growing season for a specific geographic area (e.g., county) and land cover type (e.g., cropland and rangeland). Comparisons of VegDRI could be made between specific years and/or the long-term average condition.

6. Dynamic Map Viewer (in development)

VegDRI Internal Viewer V2

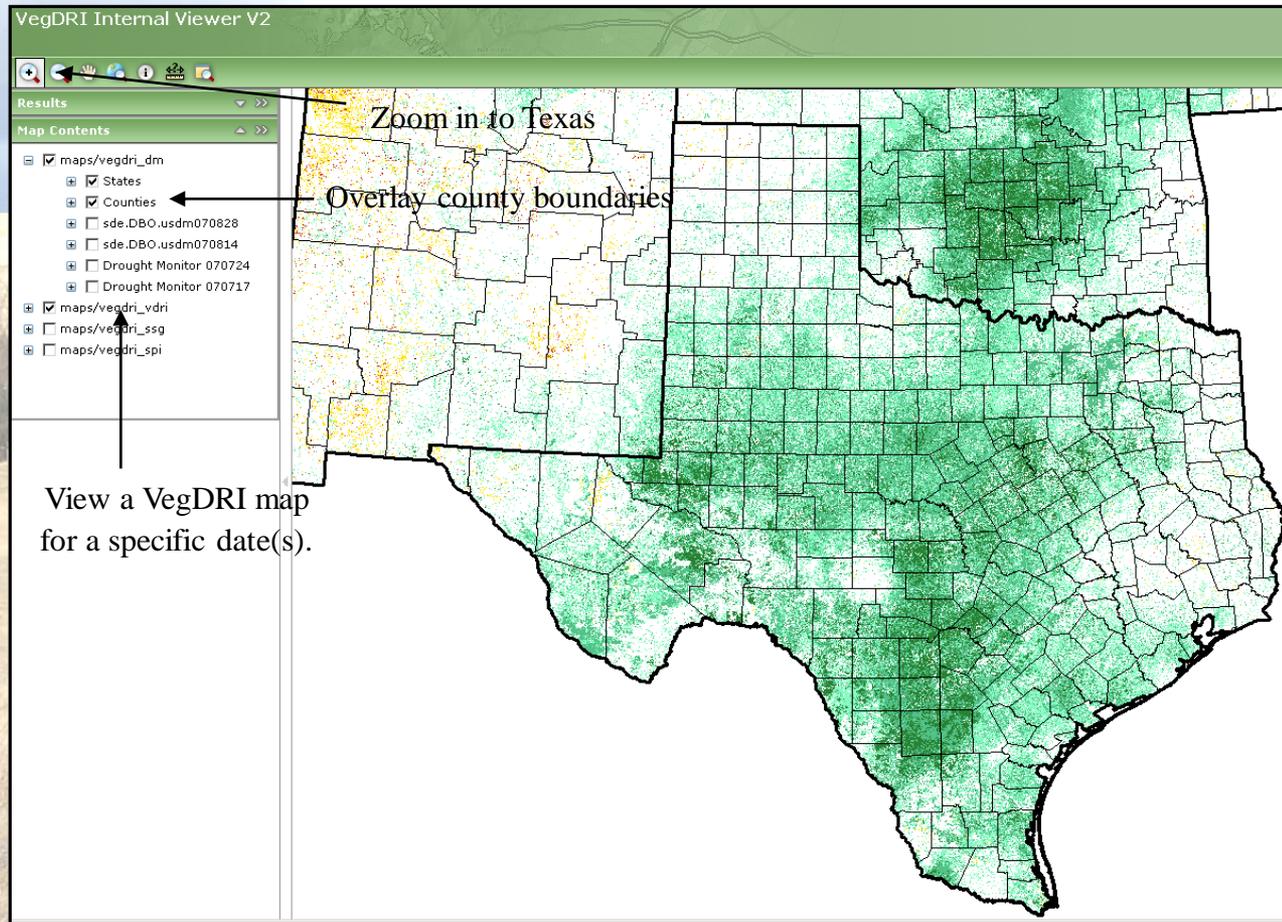
Results

Map Contents

- maps/vegdrv_dm
 - States
 - Counties
 - sde.DBO.usdm070828
 - sde.DBO.usdm070814
 - Drought Monitor 070724
 - Drought Monitor 070717
- maps/vegdrv_vdri
 - sde.DBO.vdri4_070827
 - sde.DBO.vdri8_070827
 - sde.DBO.vdri_070827

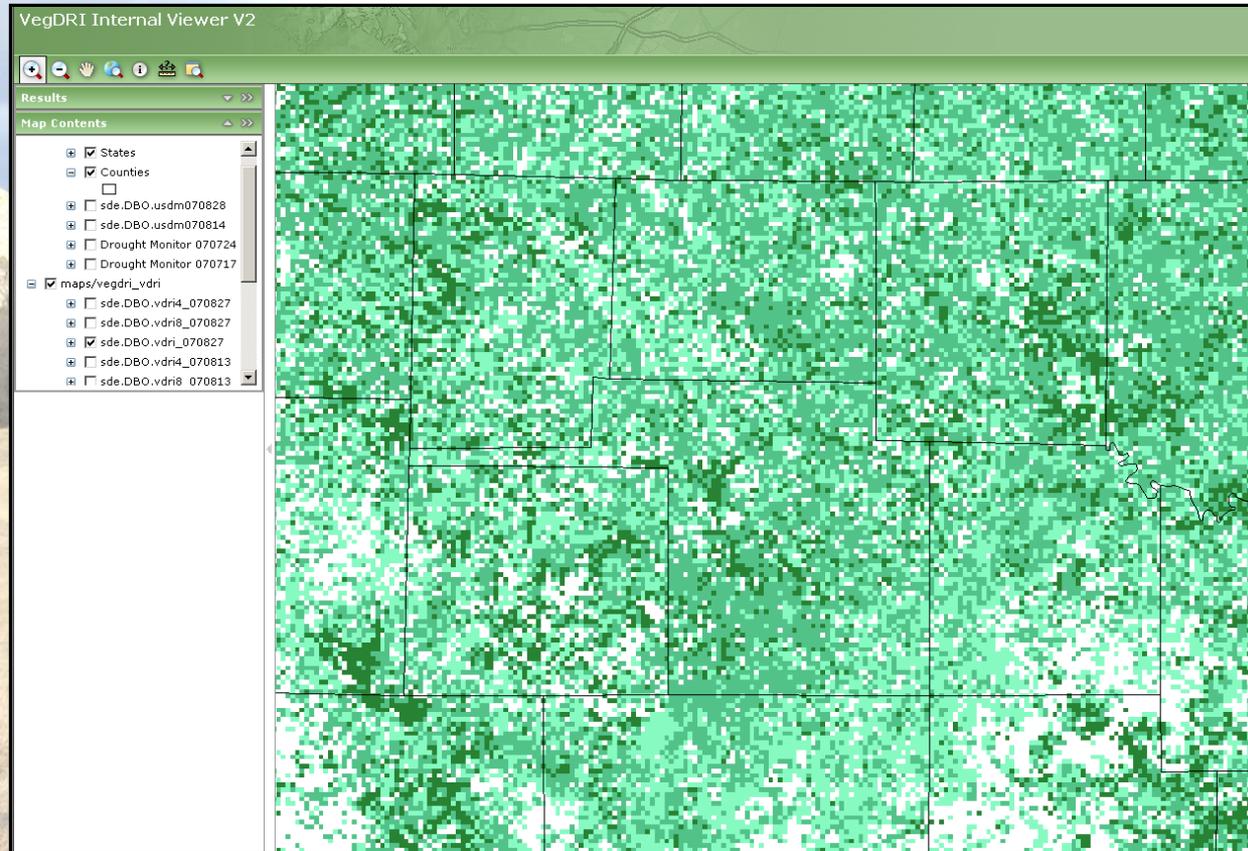
- **Zoom in & pan across VegDRI maps**
- **Overlay multiple layers of other information**
 - county boundaries, rivers, roads, and other boundaries (resource districts, section lines)
 - historical climate maps
 - land cover maps
 - U.S. Drought Monitor maps

6. Dynamic Map Viewer (in development)



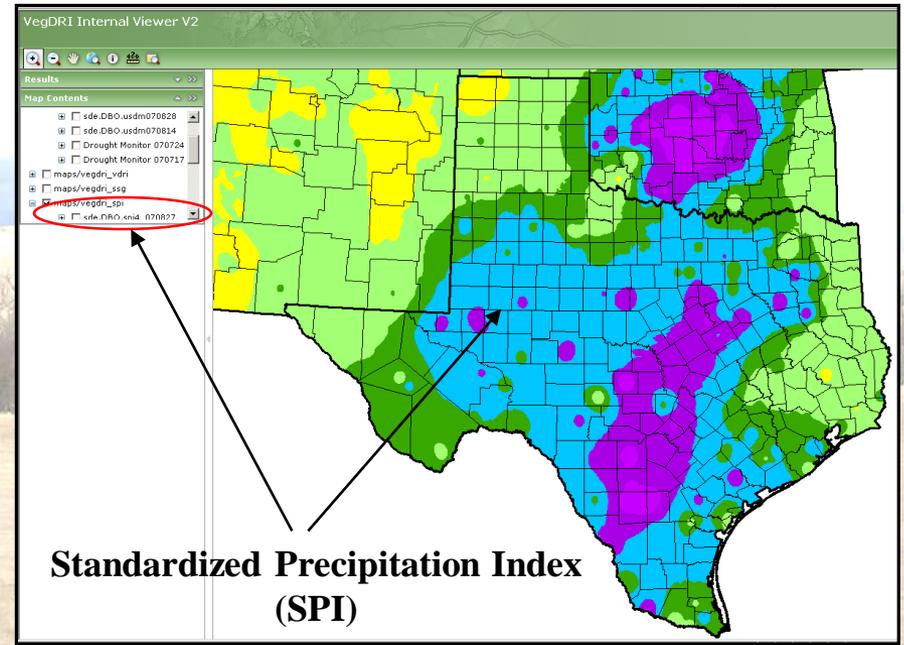
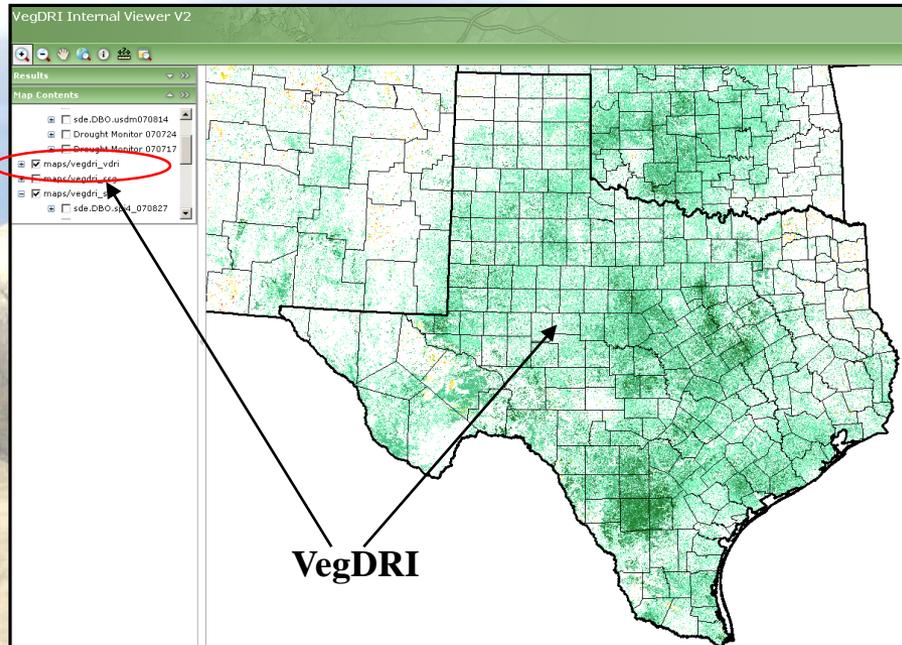
The user customizes the view of the map for their specific needs and interests.

6. Dynamic Map Viewer (in development)



Capability to visualize information at the local level for a county or multiple counties.

6. Dynamic Map Viewer (in development)



View VegDRI maps in combination with other types of maps.

- Examples:*
- climate-based drought indices (SPI and PDSI)
 - U.S. Drought Monitor
 - land use & land cover type



Possible Uses of VegDRI Information by Agricultural Producers:



1. Justify sub-county declarations for the release of CRP lands for emergency grazing for parts of counties that might be severely impacted by drought.





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2. Gauge rangeland and haying conditions in other states to determine locations to move cattle for grazing and purchase hay and other feed





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1. Justify sub-county declarations for the release of CRP lands for emergency grazing for parts of counties that might be severely impacted by drought.
2. Gauge rangeland and haying conditions in other states to determine locations to move cattle for grazing and purchase hay and other feed.
3. Guide to assist new ranchers better manage their grazing lands and become better land stewards during drought events.

