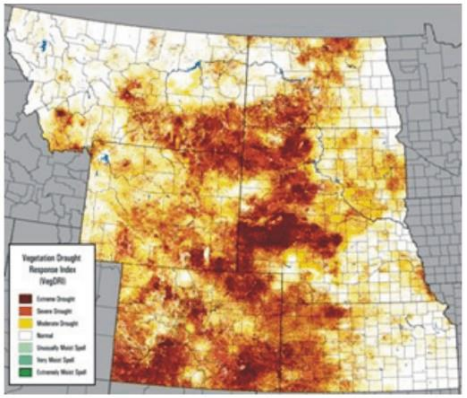

Vegetation Drought Response Index (VegDRI)

Dr. Brian Wardlow, Dr. Tsegaye Tadesse, Dr. Michael Hayes, and Mark Svoboda, NDMC/UNL; Jun Li, HPRCC/UNL; Jesslyn Brown and Yingxin Gu, USGS EROS/SAIC; Ian Cottingham, CSE/UNL; and Karin Callahan, CALMIT/UNL

An Introduction to VegDRI

Dr. Brian Wardlow

National Drought Mitigation Center (NDMC)
University of Nebraska-Lincoln

Walla Walla, WA

November 11, 2008

What is VegDRI?

<u>VegDRI</u> 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.

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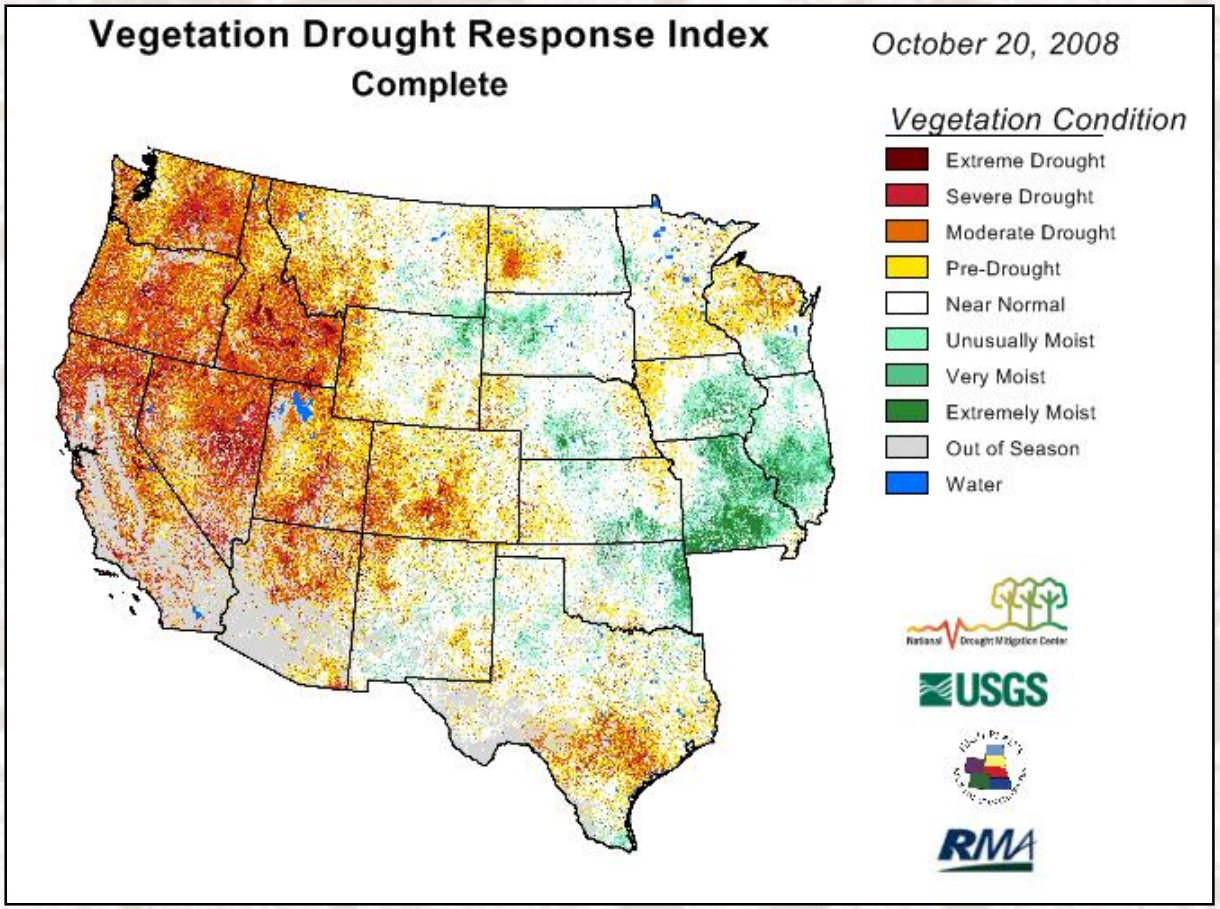
What is VegDRI?



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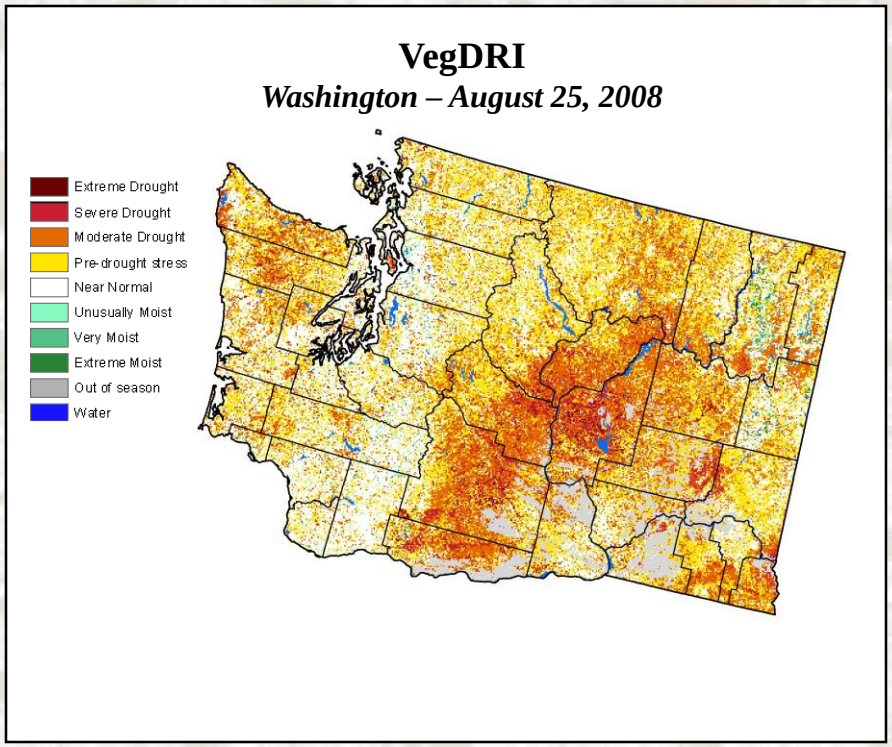
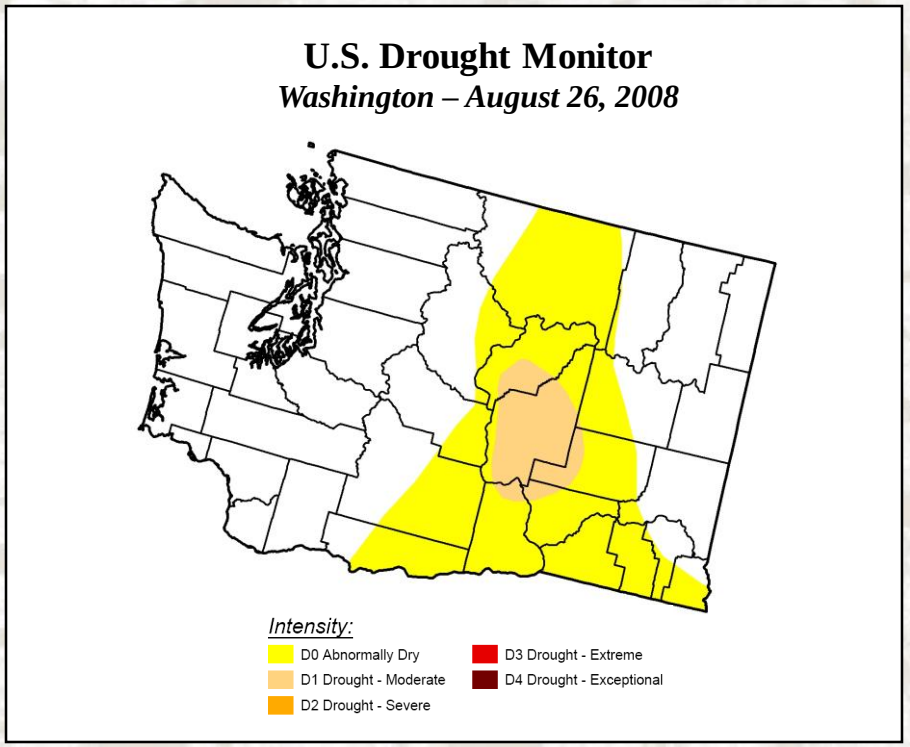
VegDRI vs. U.S. Drought Monitor





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

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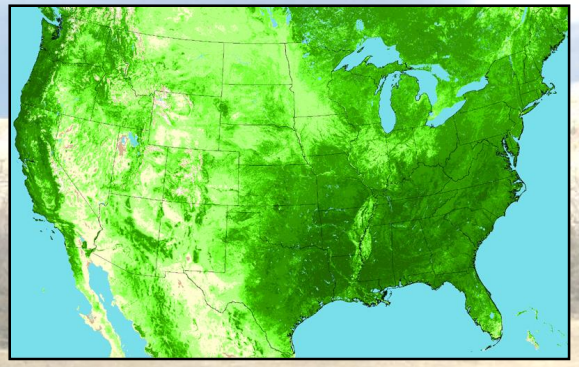
VegDRI - An Integrated Approach

Remote Sensing Component



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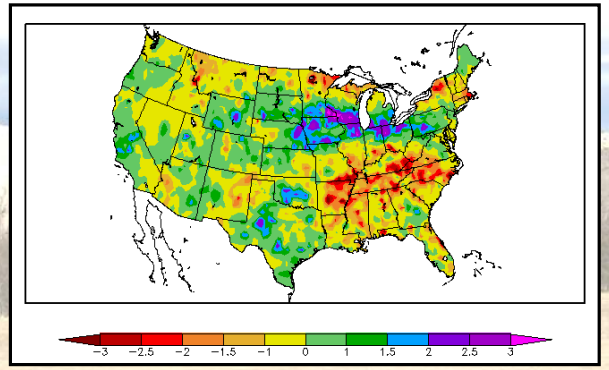
Climate Component



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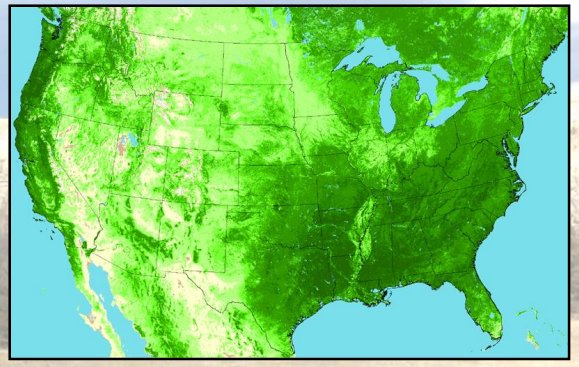
Biophysical Component

VegDRI - An Integrated Approach

Remote Sensing Component



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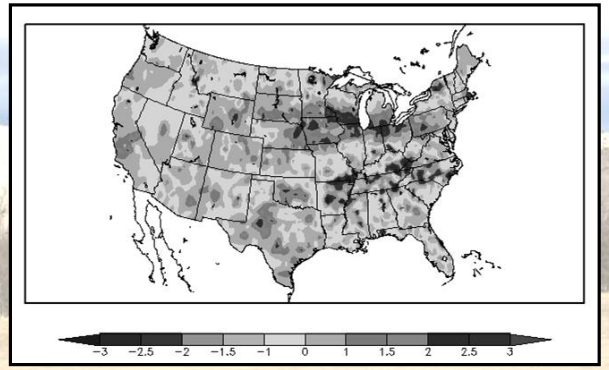
Climate Component



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Biophysical Component

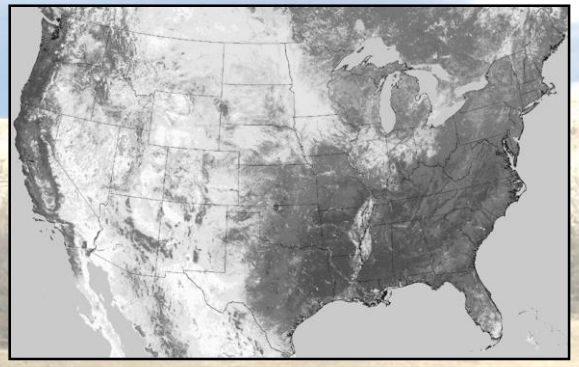
Role: Satellite-based observations provide information on the ***spatial distribution and general condition of vegetation***.

(+) 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 use change.

VegDRI - An Integrated Approach

Remote Sensing Component



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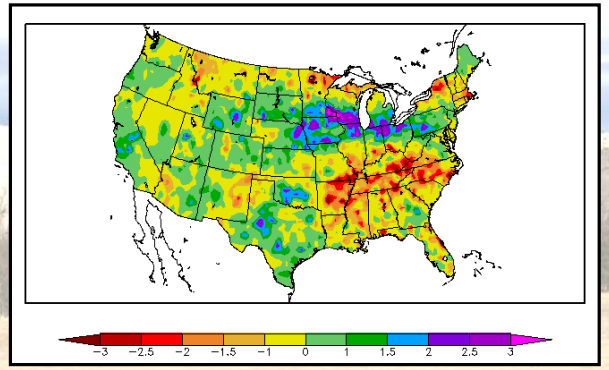
Climate Component



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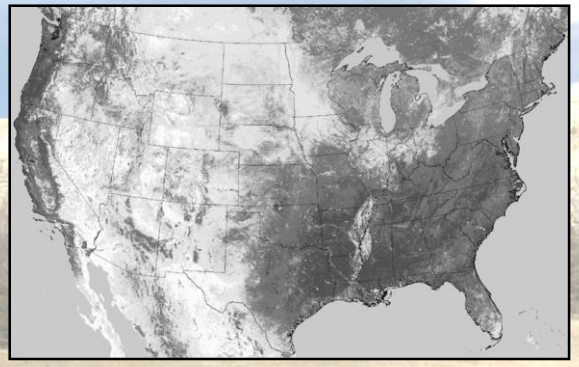
Biophysical Component

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



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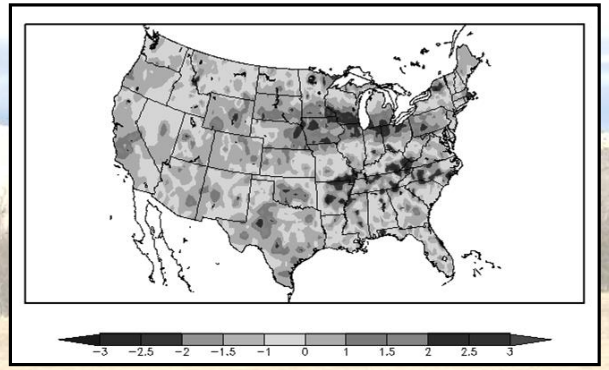
Climate Component



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Biophysical Component

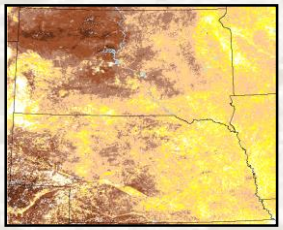
Role: Different characteristics of the environment are considered that influence climate-vegetation interactions.

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

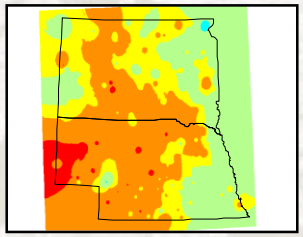
VegDRI Methodology

1. *Historical Database Development*

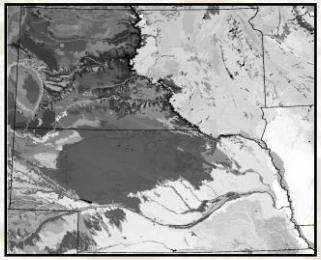
Satellite Data



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

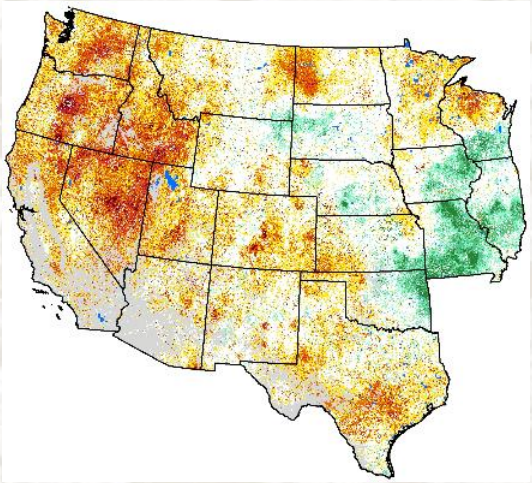
4) irrigation status

5) elevation

2. *Model Development*

Regression Tree Model (*)

3. *Map Generation*

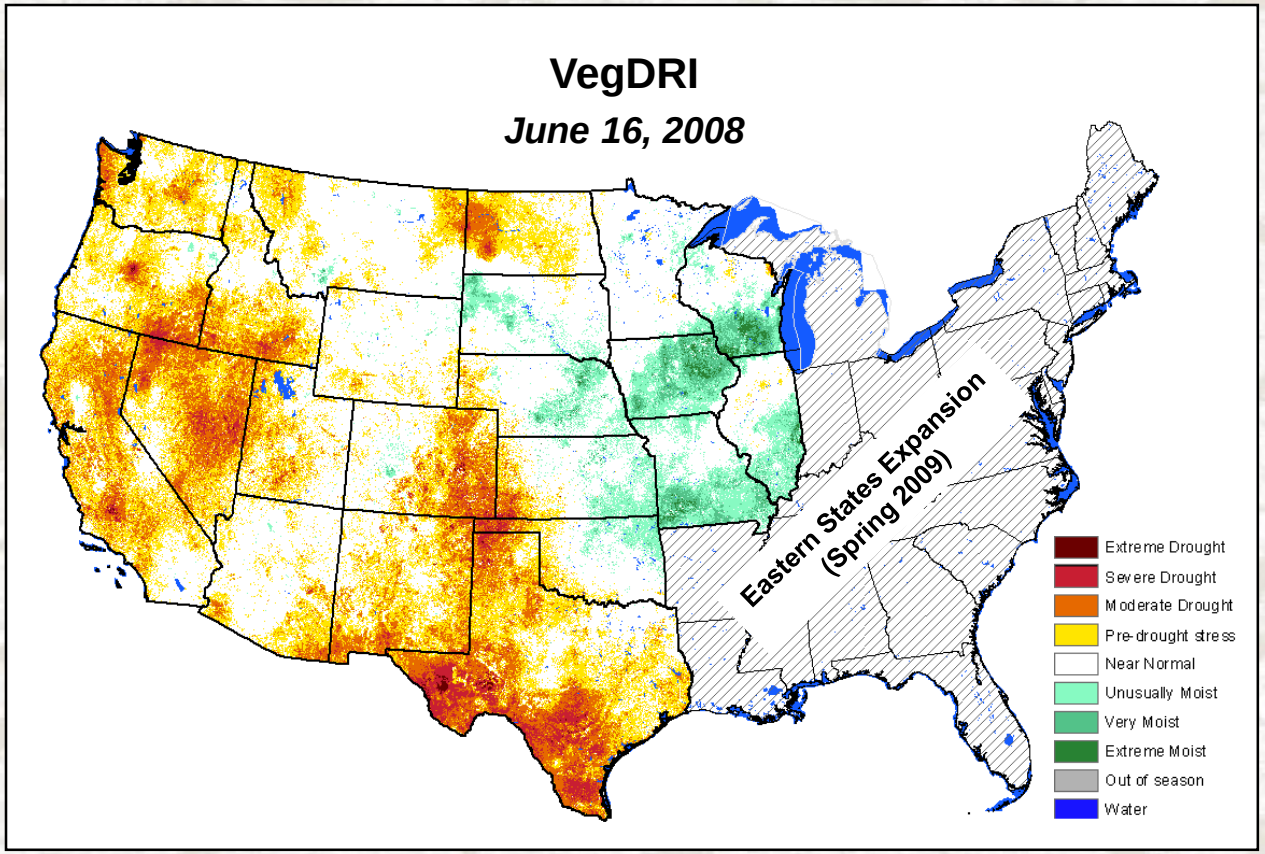


1-km VegDRI Map

(*) Models developed from a 18-year historical record (1989 – 2006) of bi-weekly climate and satellite observations at 2,200+ weather station locations.

Biophysical variables are *static* over time.

VegDRI Expansion Schedule



- Information currently available for Pacific Northwest (ID, OR, & WA):
  - 2007 & 2008 growing seasons
- Production of a 20-year historical record of VegDRI maps. (1989 – 2008)
- Year-round production & weekly map updates planned in 2009.

(*) Bi-weekly maps currently available.

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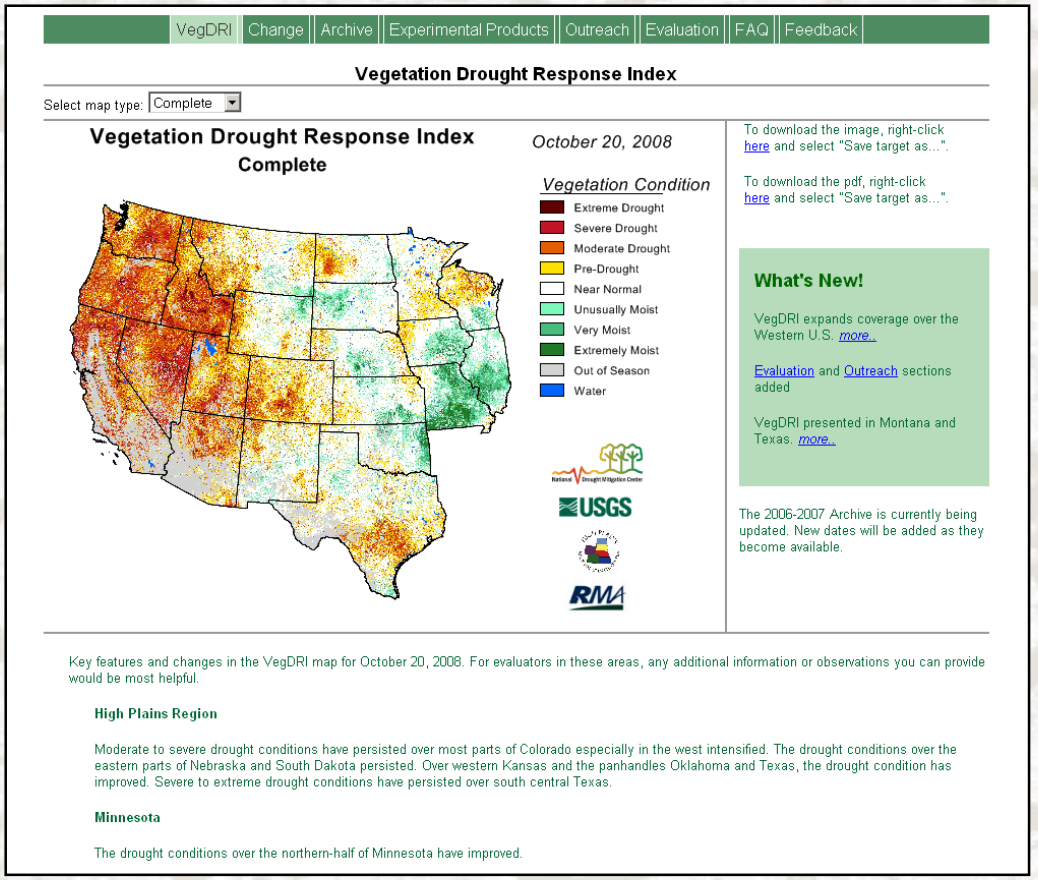
VegDRI Website and Products

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



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

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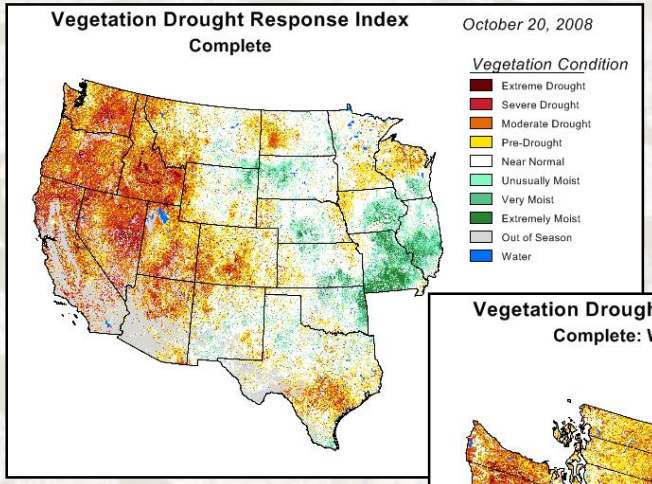
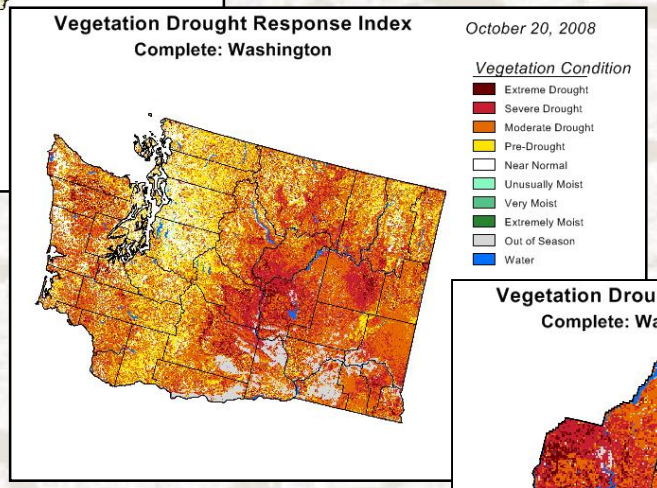
1. VegDRI Quick-View Maps

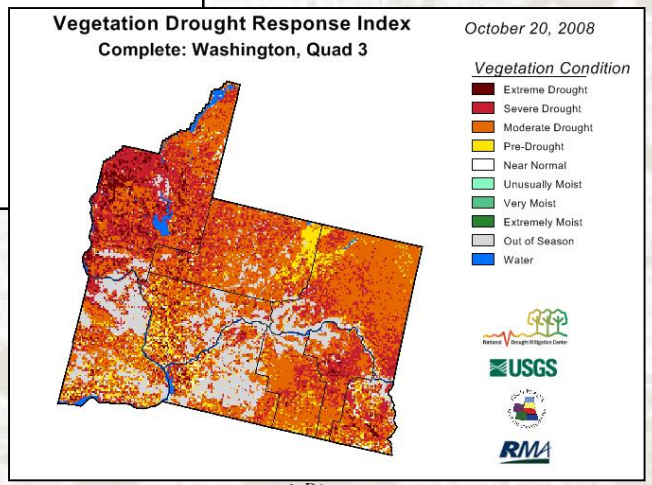
(multiple spatial scales)



Regional-level



State-level



Sub-state level

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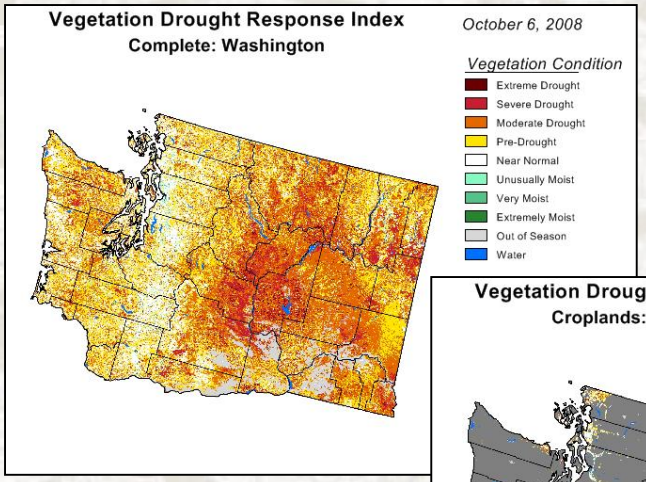
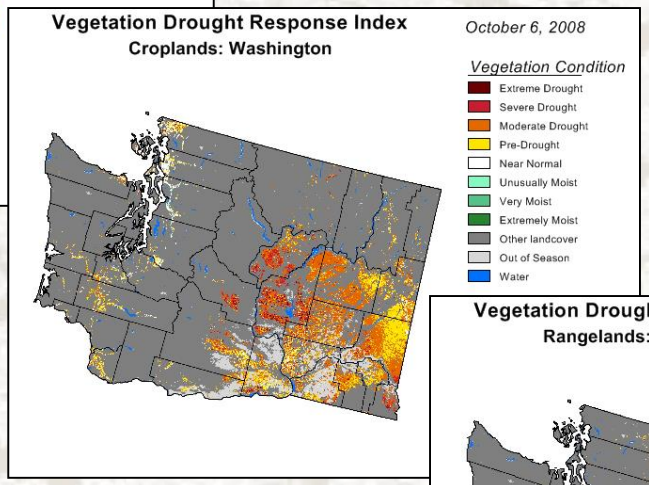
1. VegDRI Quick-View Maps (cont).

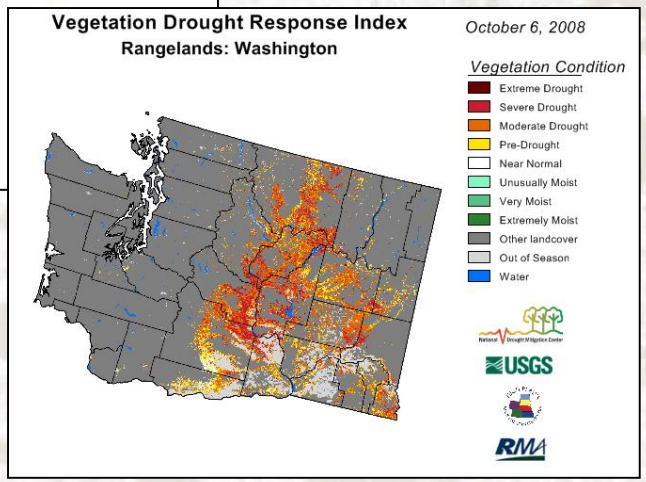
(land cover type)



Complete view



Cropland view



Rangeland view

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2. VegDRI Area Statistics (% area)

(currently available at state-level only)

VegDRI Statistics for Washington (Percent Area)

Complete
Complete
Rangeland
Crops

Week	Extreme Drought	Severe Drought	Moderate Drought	Pre-Drought	Near Normal	Unusually Moist	Very Moist	Extremely Moist
08/10/20	3.26	19.72	38.22	21.21	10.63	0.45	0.09	0.02
08/10/06	1.13	11.07	30.59	28.49	21.12	0.65	0.22	0.11
08/09/22	2.12	16.63	33.67	24.69	15.33	0.43	0.16	0.06
08/09/08	1.45	11.05	29.17	28.21	21.94	0.52	0.33	0.05
08/08/25	0.73	5.98	22.69	29.71	31.85	1.00	0.38	0.27
08/08/11	0.72	5.21	21.82	29.75	34.18	1.10	0.34	0.26
08/07/28	0.86	5.84	22.77	32.99	30.35	1.13	0.37	0.22
08/07/14	0.83	5.75	23.07	32.84	28.35	0.92	0.45	0.09
08/06/30	1.37	6.90	23.51	32.26	30.58	0.88	0.28	0.08
08/06/16	1.22	4.34	17.72	32.90	37.02	1.07	0.45	0.31
08/06/02	1.00	3.89	15.67	31.62	36.52	0.99	0.45	0.20
08/05/19	1.01	3.83	15.48	29.98	29.29	0.72	0.26	0.21
08/05/05	0.86	3.57	12.29	23.21	22.22	0.49	0.15	0.14
07/10/08	0.48	4.93	20.17	31.21	31.85	1.01	0.23	0.13

- 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.
- Tables are currently available only at state level.

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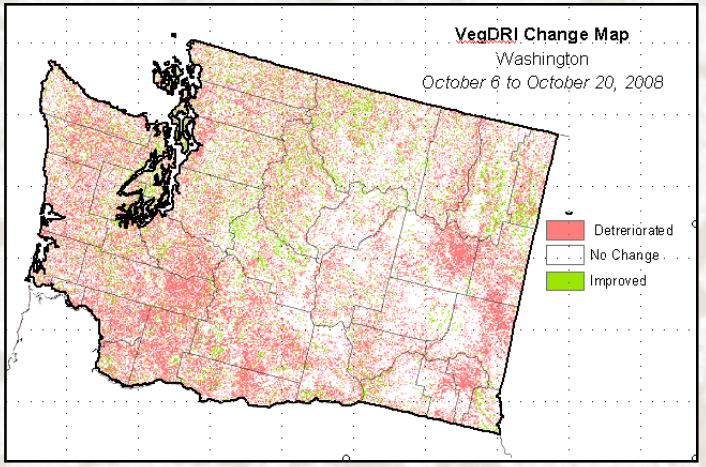
3. Change Maps

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)

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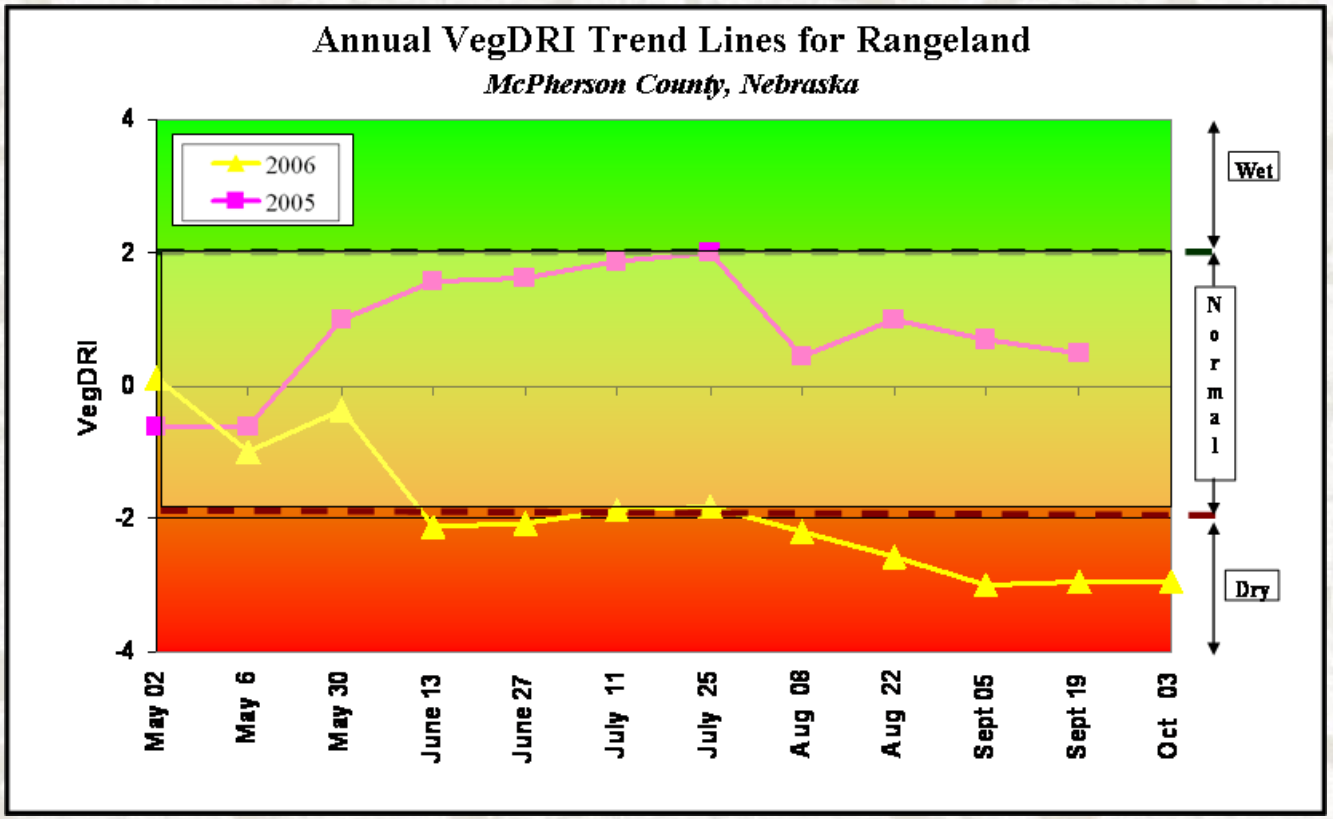
4. Animations

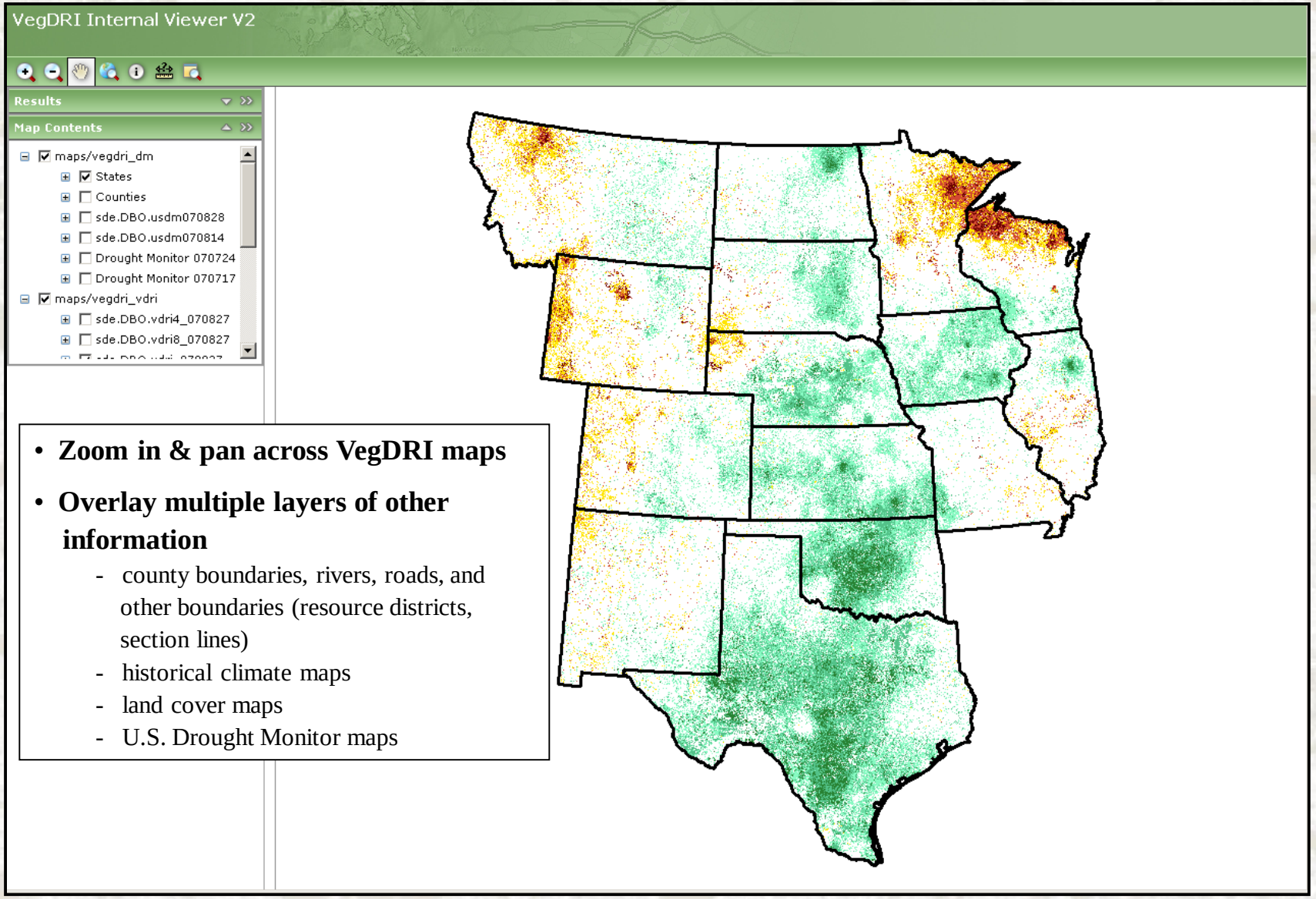
Goal: Visualize spatial and temporal changes in drought patterns across a specific year or multiple years for a state or sub-state region.

5. Trendlines (in development)



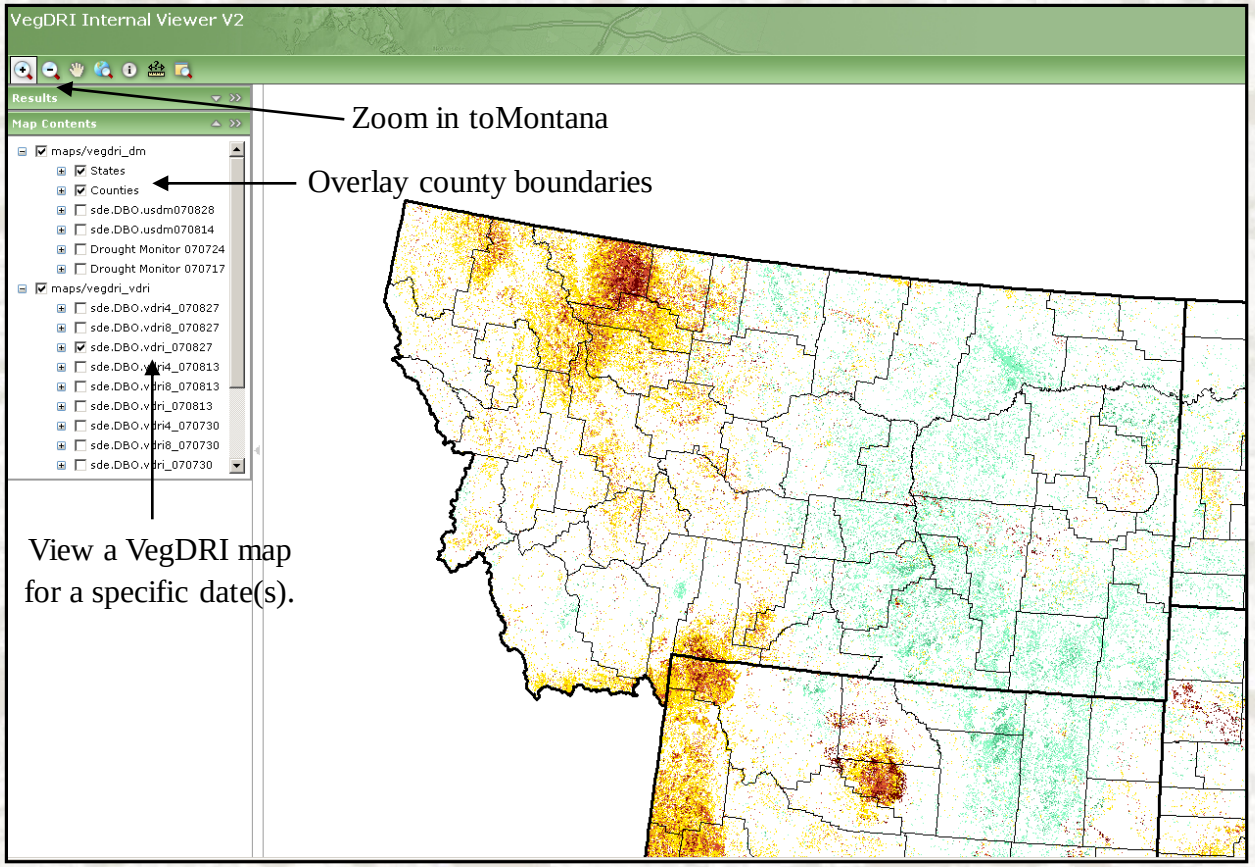
Plots the average VegDRI values over the growing season for a specific geographic area (e.g., county) and land cover type (e.g., cropland and rangeland). Comparisons of VegDRI could be made between specific years and/or the long-term average condition.

6. Dynamic Map Viewer (in development)



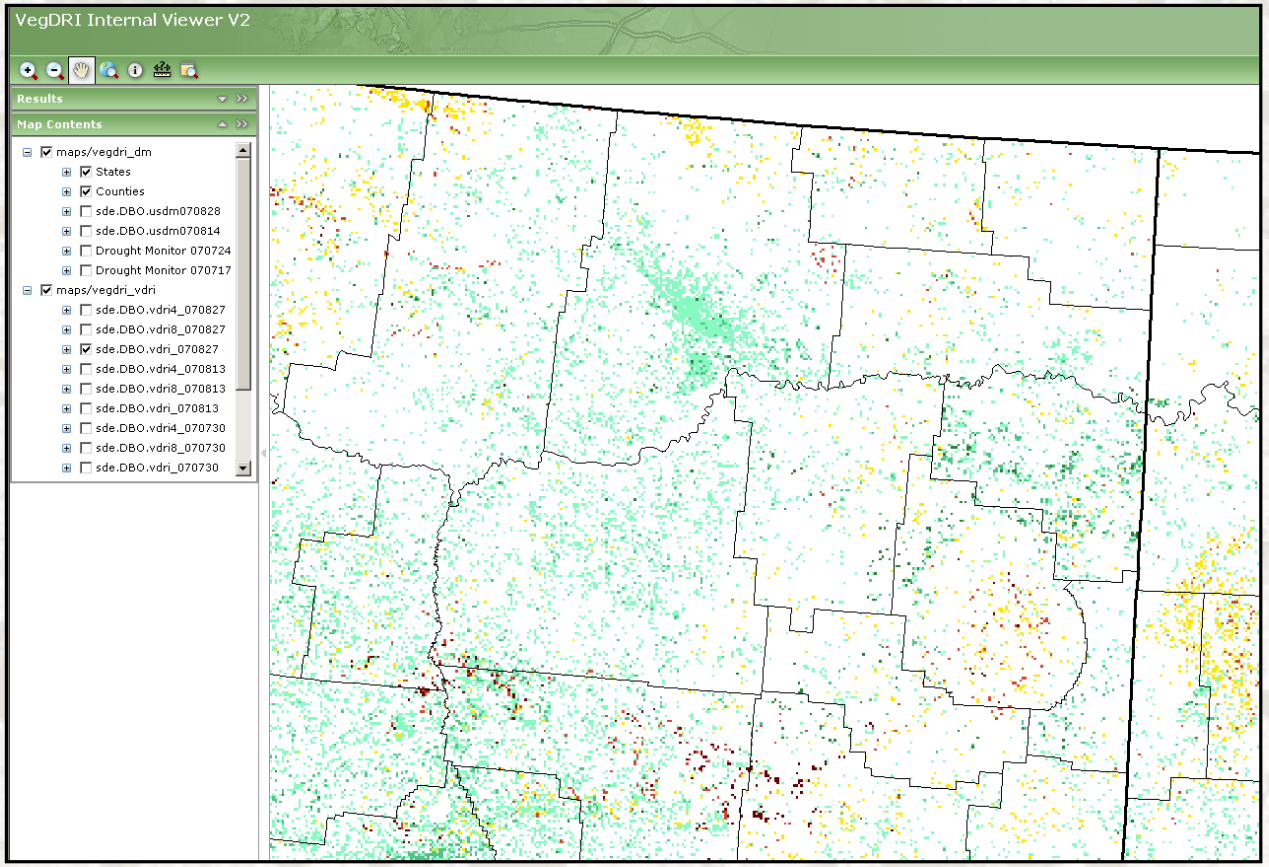
- **Zoom in & pan across VegDRI maps**
- **Overlay multiple layers of other information**
  - county boundaries, rivers, roads, and other boundaries (resource districts, section lines)
  - historical climate maps
  - land cover maps
  - U.S. Drought Monitor maps

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.

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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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.
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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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.
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.

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