Vegetation Drought Response Index (VegDRI)

A New Tool for Monitoring Vegetation Drought Stress at Local to National Scales

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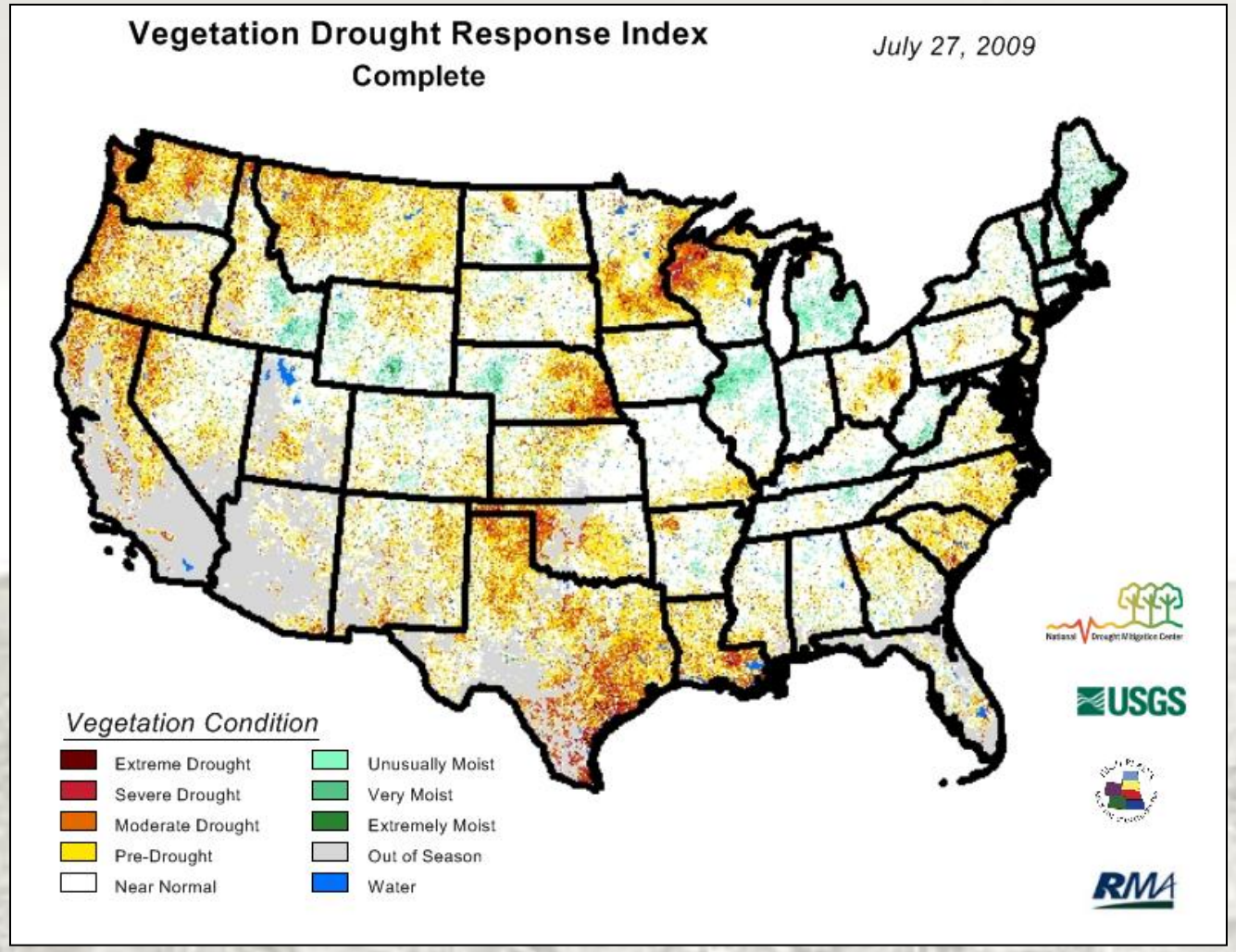
What is VegDRI?

<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.

What is VegDRI?



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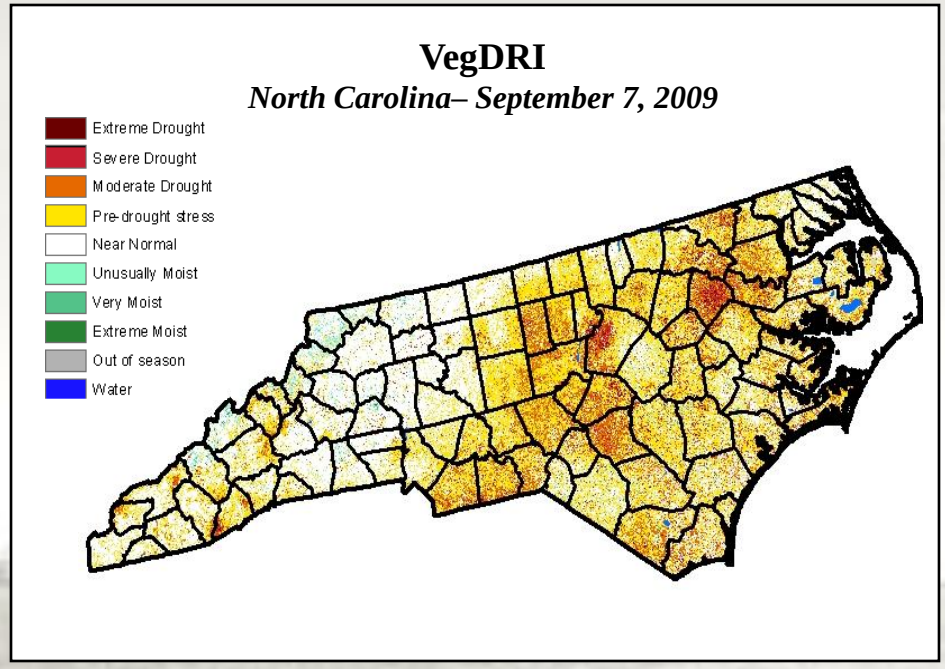
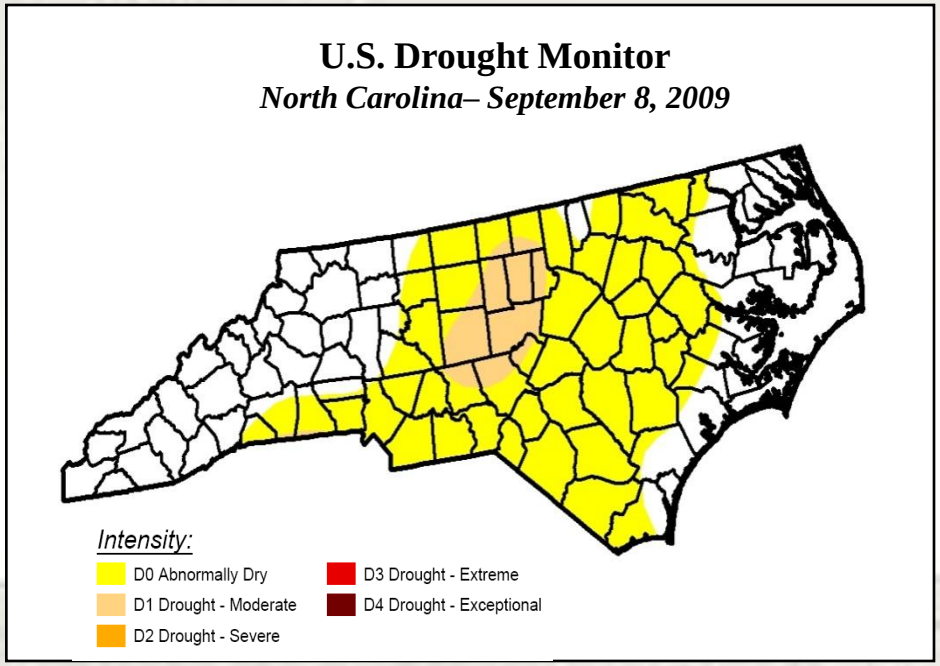
VegDRI vs. U.S. Drought Monitor

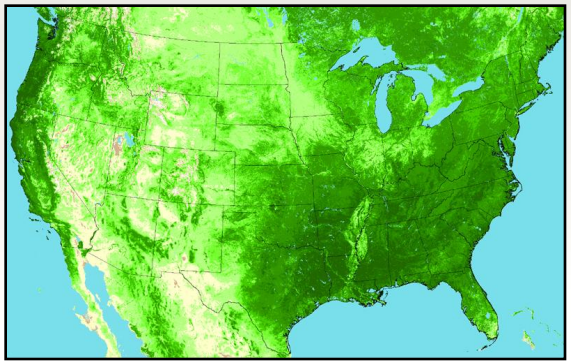




<u>Goal of VegDRI Tool</u>: ***National-level monitoring*** capabilities with ***local-scale information*** (i.e., county to sub-county level) regarding the level of drought stress on vegetation.

VegDRI - An Integrated Approach

Remote Sensing Component



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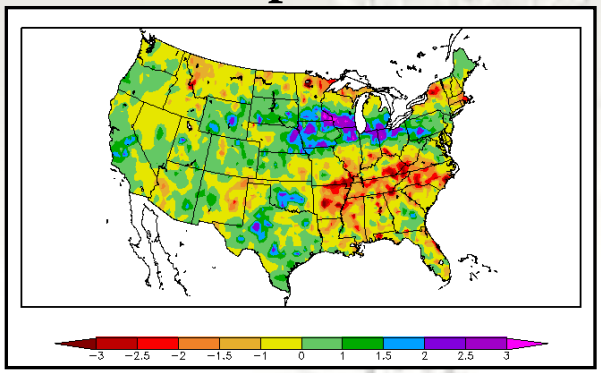
Climate Component



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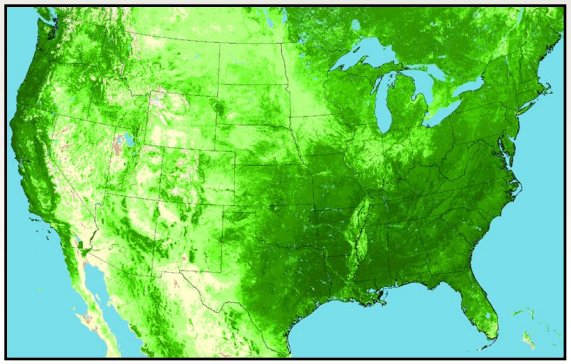
Biophysical Component

VegDRI - An Integrated Approach

Remote Sensing Component



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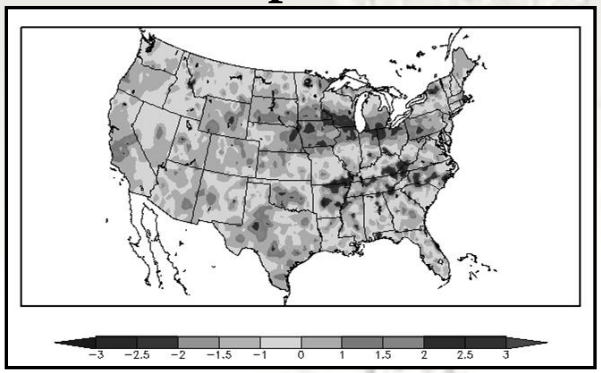
Climate Component



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Biophysical Component

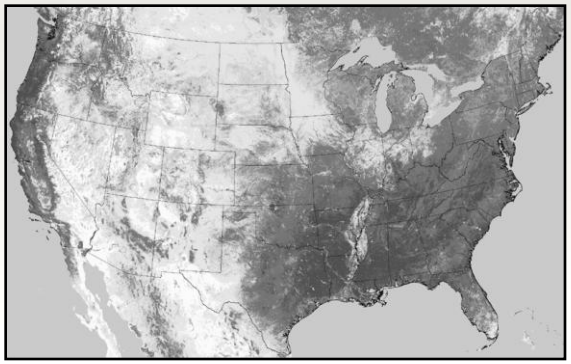
Role: Satellite-based observations provide information on the ***spatial distribution and general condition of vegetation***.

(+) 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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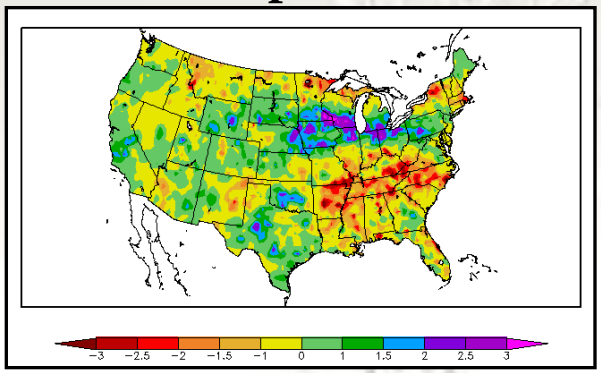
Climate Component



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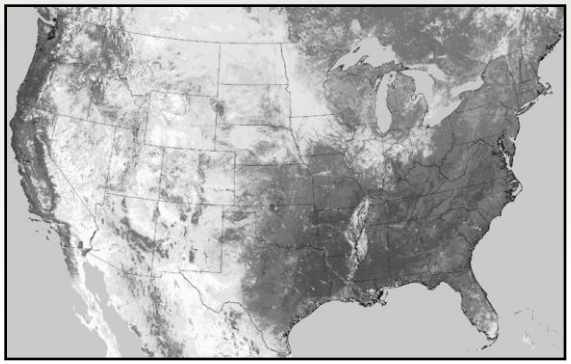
Biophysical Component

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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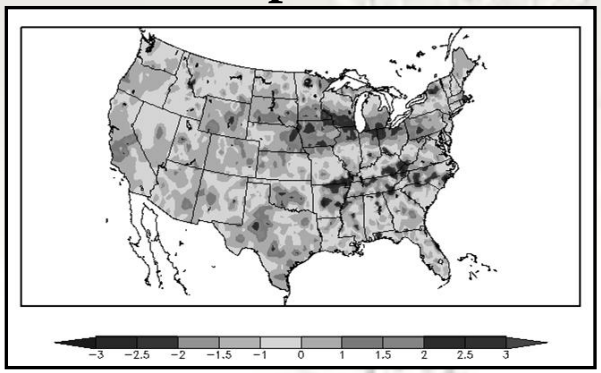
Climate Component



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Biophysical Component

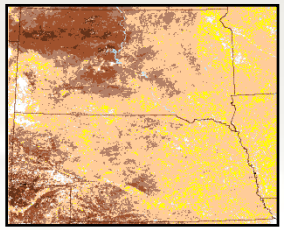
Role: Different characteristics of the environment are considered that influence climate-vegetation interactions.

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

VegDRI Methodology

1. *Historical Database Development*

Satellite Data

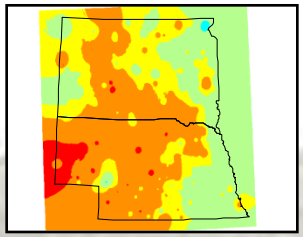


Data Input Variables

1) Percent Annual Seasonal Greenness (PASG)

2) Start of Season Anomaly (SOSA)

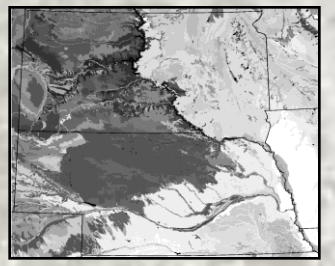
Climate Data



1) Palmer Drought Severity Index (PDSI)

2) Standardized Precip. Index (SPI)

Biophysical Data



1) land use/ cover type

2) soil available water capacity (STATSGO)

3) ecoregion type

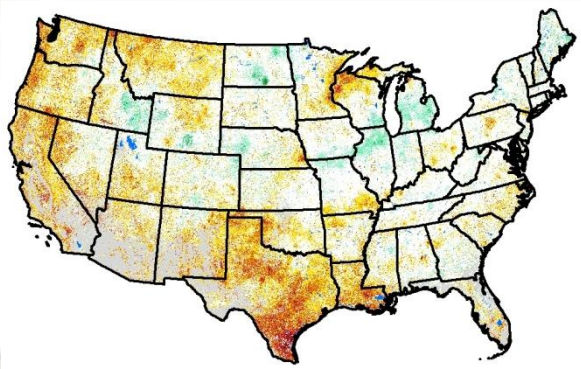
4) irrigation status

5) elevation

2. *Model Development*

Regression Tree Model (*)

3. *Map Generation*

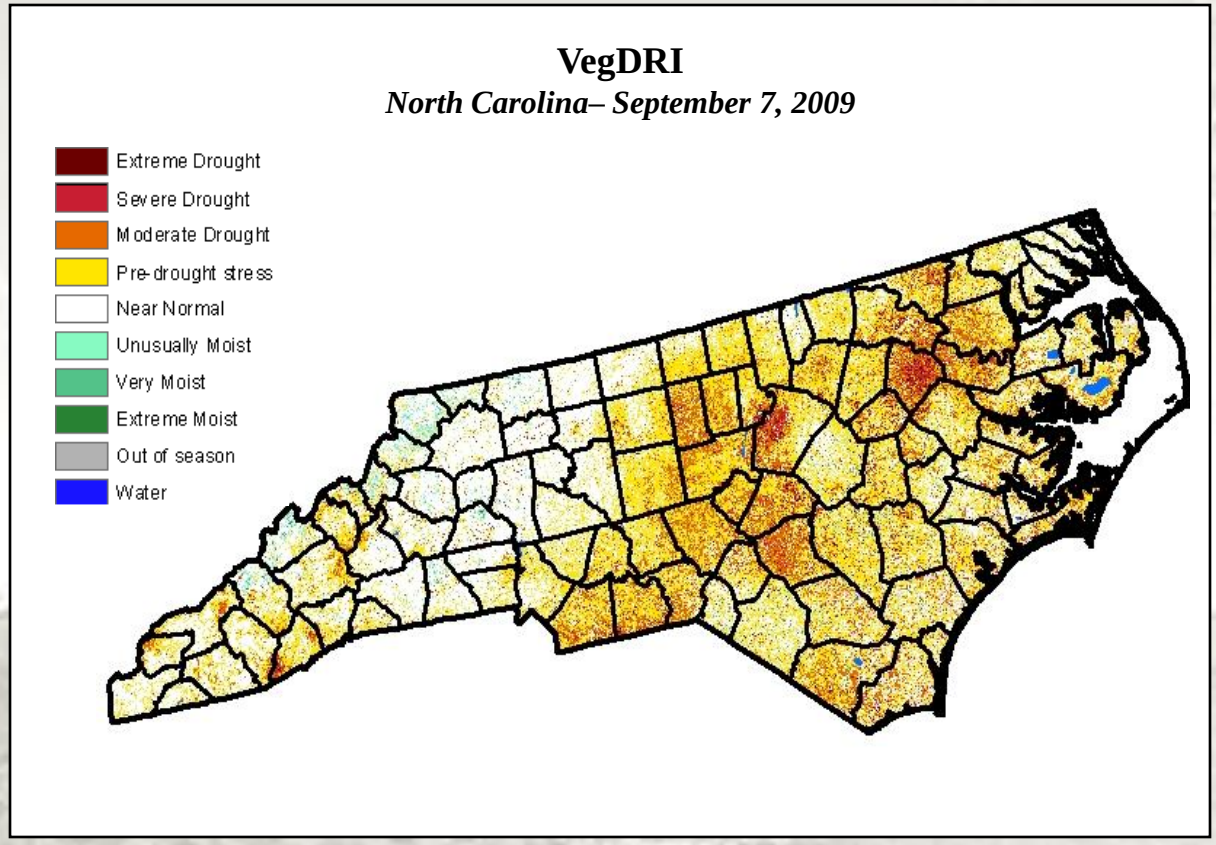


1-km VegDRI Map

(*) 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 VegDRI Production

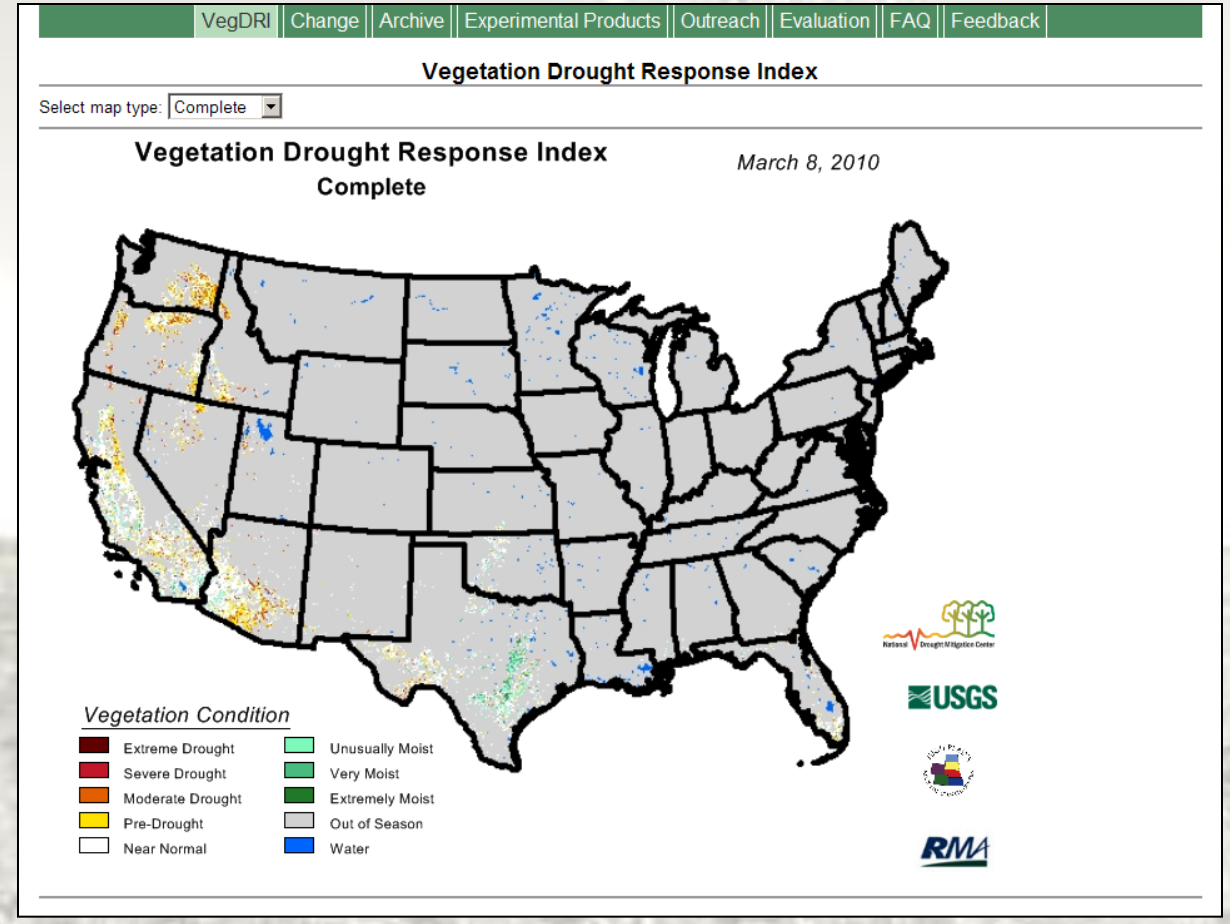


(*) Bi-weekly maps currently available.

- Information currently available for North Carolina:
  - May 2009 to present
- Production of ***a 20-year historical record*** of VegDRI maps in progress. (1989 – 2008)
- ***Weekly map updates*** planned for 2010 in experimental mode.
- Future work to test the production of a ***250-m resolution VegDRI*** product is planned.

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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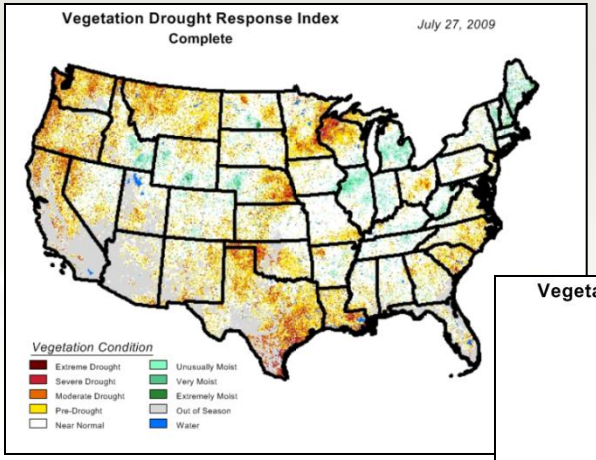
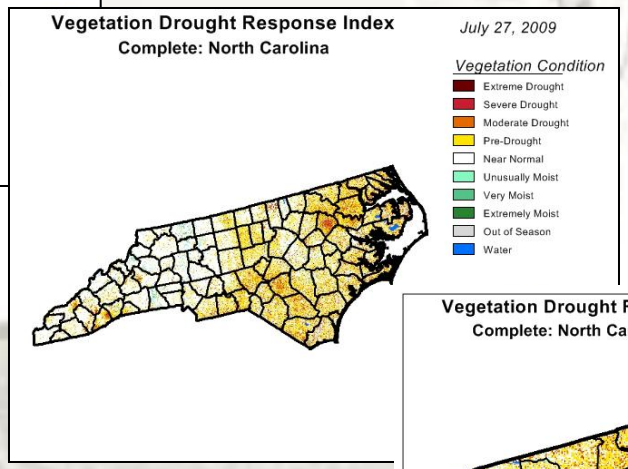
1. VegDRI Quick-View Maps

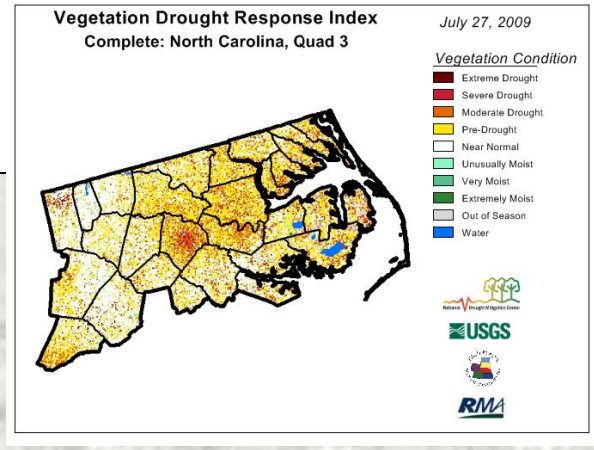
(multiple spatial scales)



Regional-level



State-level



Sub-state level

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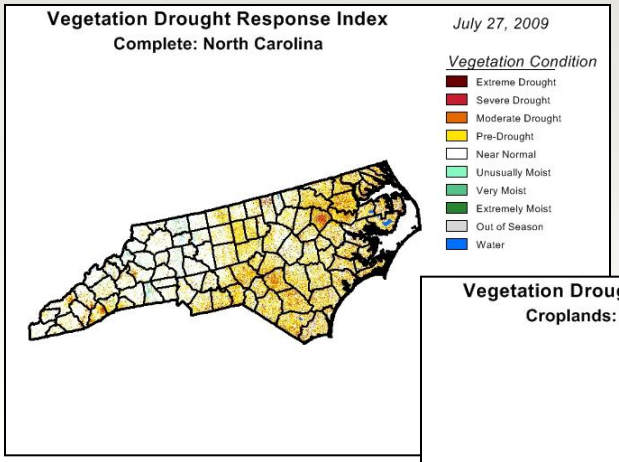
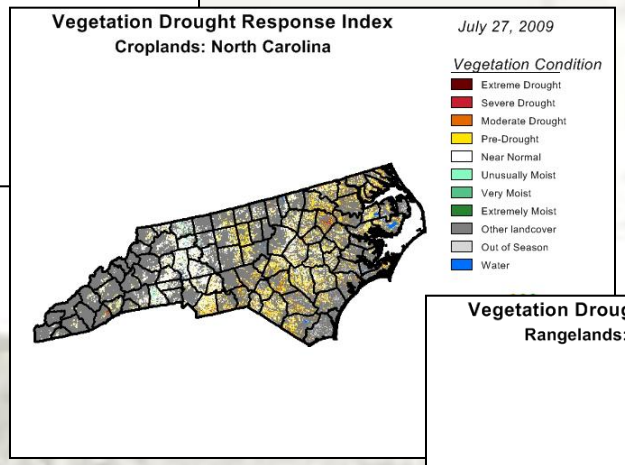
1. VegDRI Quick-View Maps (cont).

(land cover type)

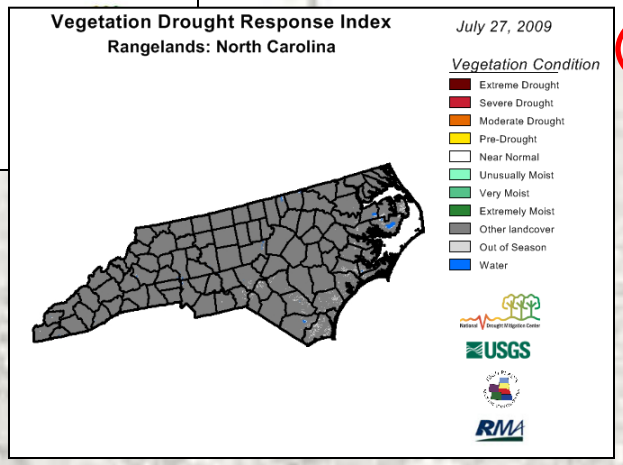


Complete view



Cropland view

'Forest view' option for the eastern U.S.?



Rangeland view

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2. VegDRI Area Statistics (% area)

(currently available at state-level only)

Specific tables available for cropland and rangeland. A forest table option can also be added.

VegDRI | Change | Archive | Experimental Products | Outreach | Evaluation | FAQ | Feedback

VegDRI Statistics for North Carolina (Percent Area)

Complete
- Complete
- Rangeland
- Crops

	Extreme Drought	Severe Drought	Moderate Drought	Pre-Drought	Near Normal	Unusually Moist	Very Moist	Extremely Moist
10/03/08	0.00	0.00	0.01	0.07	0.41	0.13	0.05	0.03
10/02/22	0.00	0.01	0.06	0.16	0.65	0.09	0.03	0.01
10/02/08	0.01	0.05	0.08	0.07	0.53	0.30	0.29	0.31
10/01/25	0.01	0.07	0.16	0.16	0.92	0.35	0.23	0.25
10/01/11	0.00	0.00	0.00	0.00	2.29	0.00	0.01	0.00
09/12/28	0.01	0.03	0.10	0.28	1.46	0.20	0.22	0.02
09/12/14	0.02	0.05	0.14	0.30	1.53	0.24	0.04	0.02
09/11/30	0.06	0.10	0.22	0.60	2.42	0.21	0.09	0.05
09/11/16	0.16	0.60	1.16	2.54	15.96	1.49	0.40	0.18
09/11/02	0.53	1.85	5.76	15.81	57.63	7.52	2.83	0.65
09/10/19	0.61	1.66	6.24	21.03	61.13	4.51	1.63	0.46
09/10/05	0.42	1.34	5.46	18.50	67.77	3.39	0.93	0.09
09/09/21	1.04	3.40	12.65	30.21	48.31	1.94	0.42	0.04
09/09/07	0.98	3.48	13.52	33.35	44.29	1.87	0.57	0.04
09/08/24	0.77	3.03	11.14	30.19	50.73	1.64	0.63	0.06
09/08/10	0.47	2.20	8.35	24.85	59.22	2.20	0.81	0.08
09/07/27	0.43	2.45	9.00	26.69	57.00	1.72	0.55	0.03
09/07/13	0.44	1.69	5.05	17.58	68.91	2.97	0.76	0.12
09/06/29	0.58	1.50	4.85	17.55	69.08	2.88	0.63	0.08
09/06/15	0.45	1.55	4.42	16.85	70.42	2.25	0.50	0.12
09/06/01	0.46	1.69	4.97	20.48	64.82	1.85	0.43	0.17
09/05/18	0.36	1.85	5.76	23.83	57.49	1.44	0.35	0.06
09/05/04	0.26	1.13	3.55	14.35	59.47	1.73	0.46	0.18

Summarize the % area of each VegDRI class for ‘current’ map and all prior dates in the growing season.

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3. Change Maps

3 Types:

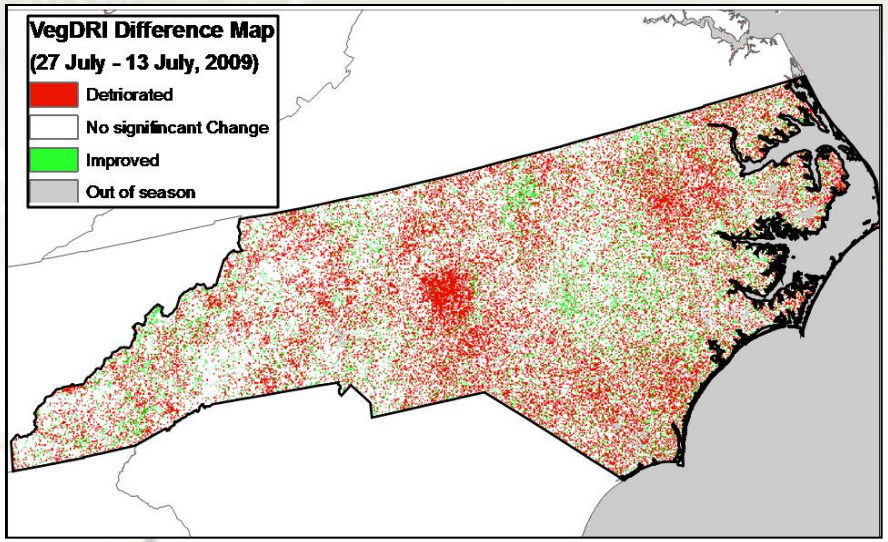
1) **Prior period**

   ex. – July 13, 2009 vs. Sep 27, 2009

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

   (currently not available)*

   ex. – July 13, 2009 vs. Sep 13, 2008

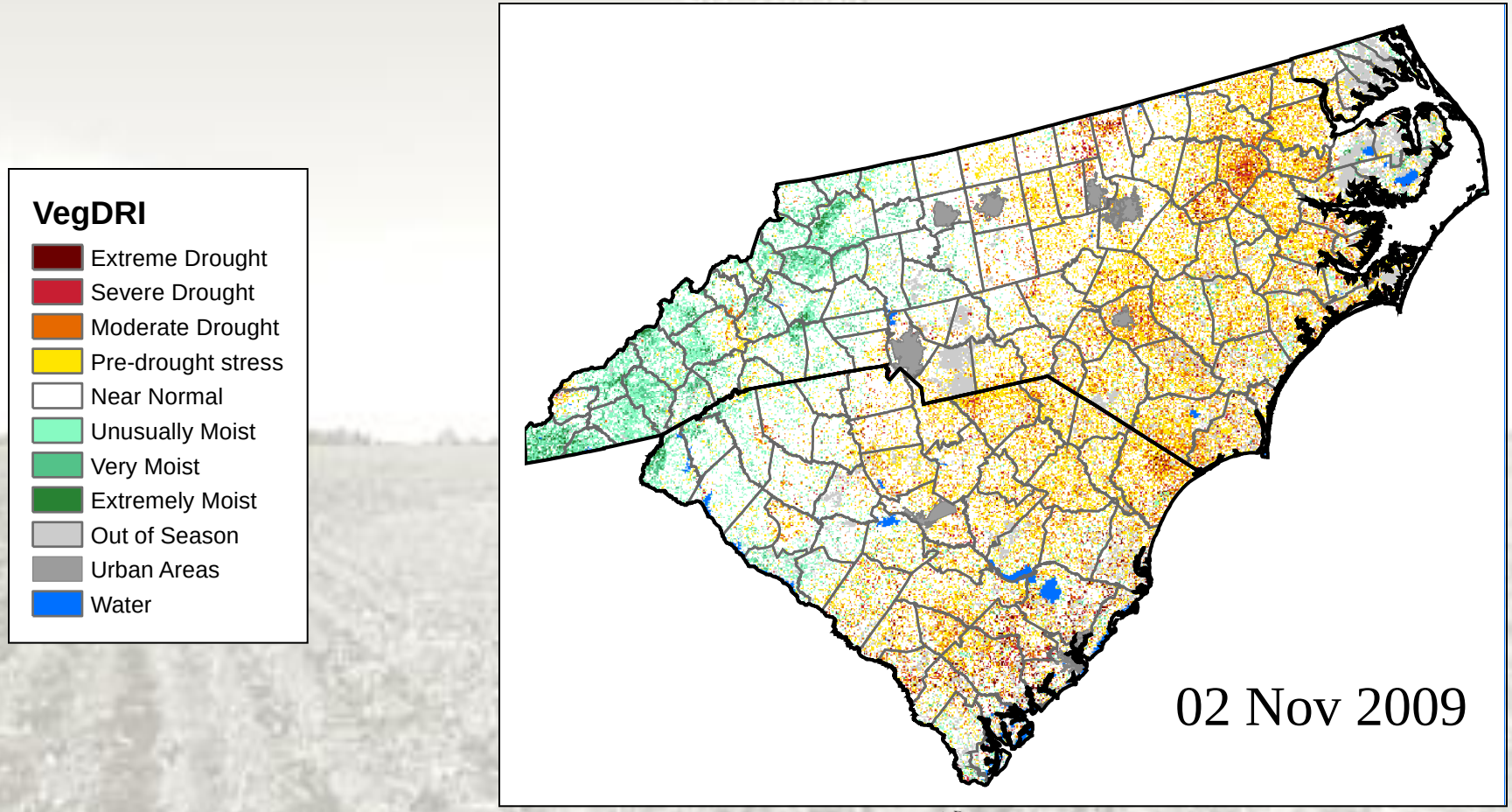


3) **Historical average** *(* currently not available)*

   ex. – July 13, 2009 vs. average for July 13 (1989 through 2008)

4. Animations (in development)

Goal: Visualize spatial and temporal changes in drought patterns across a specific year or multiple years.



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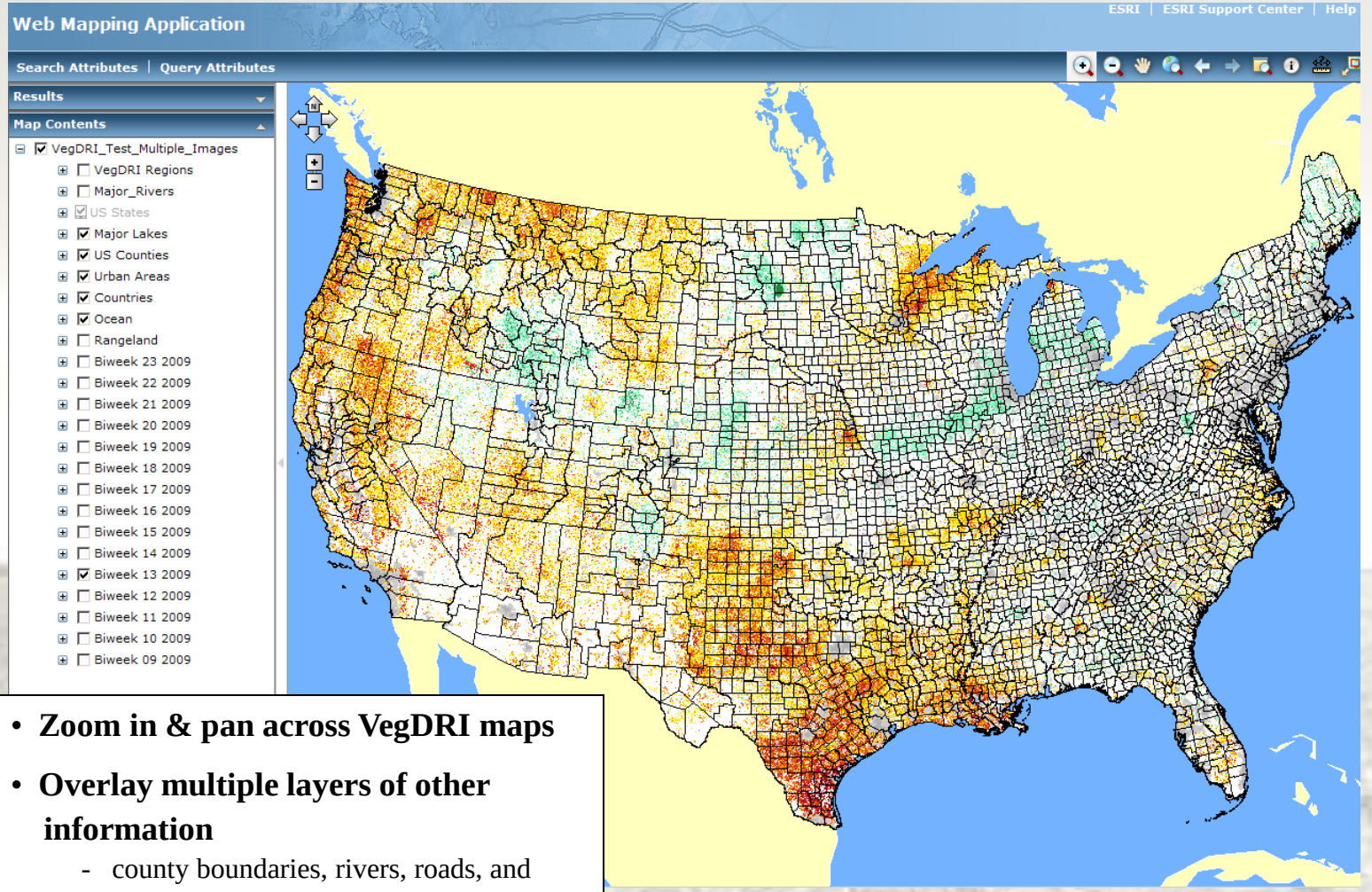
6. Dynamic Map Viewer (in development)



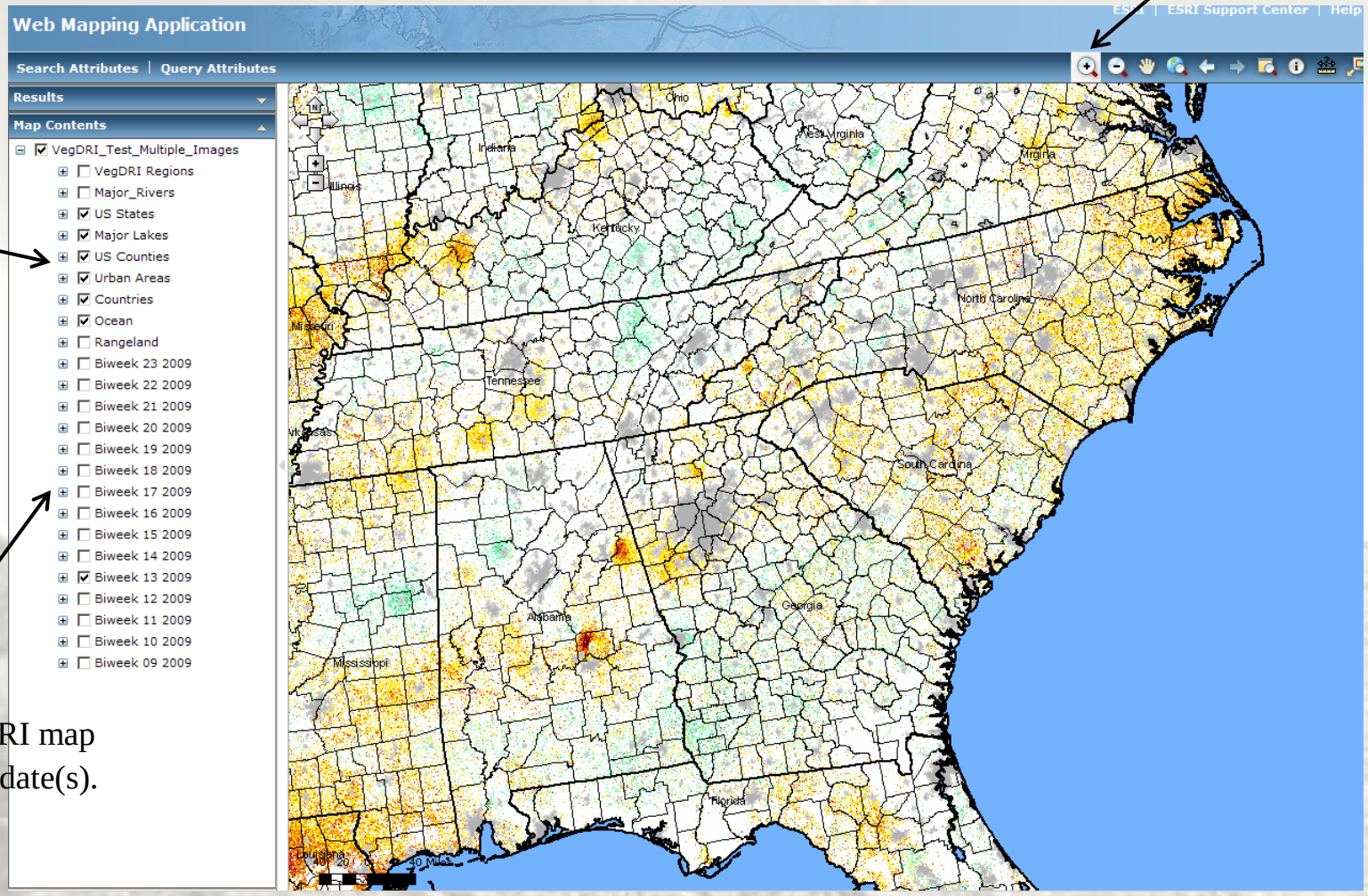
- **Zoom in & pan across VegDRI maps**
- **Overlay multiple layers of other information**
  - county boundaries, rivers, roads, and other boundaries (resource districts, section lines)
  - historical climate maps
  - land cover maps
  - U.S. Drought Monitor maps

6. Dynamic Map Viewer (in development)

Zoom in to the region.

Overlay

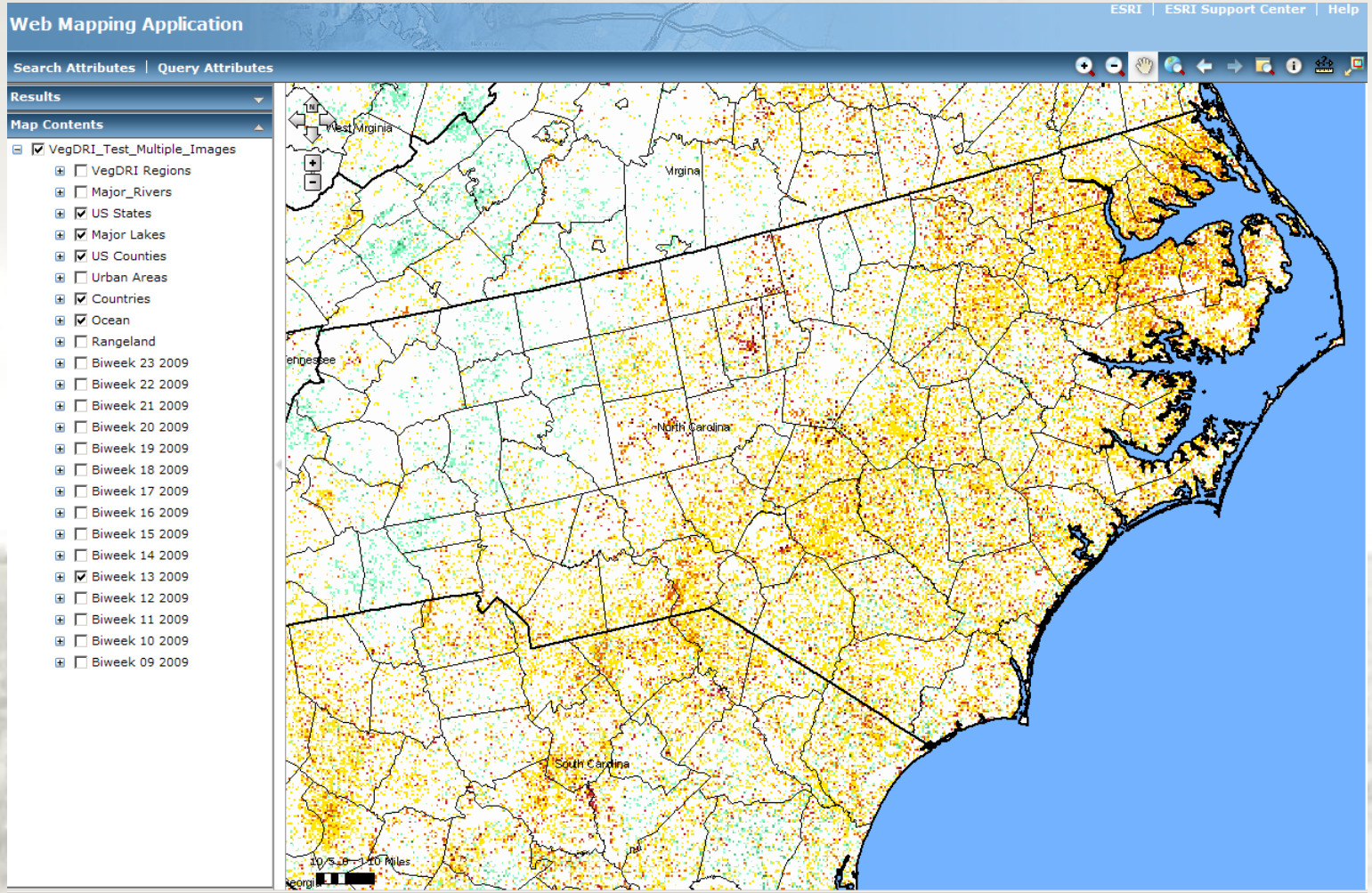
- county boundaries
- rivers & lakes
- urban areas
- roads
- watersheds



View a VegDRI map for a specific date(s).

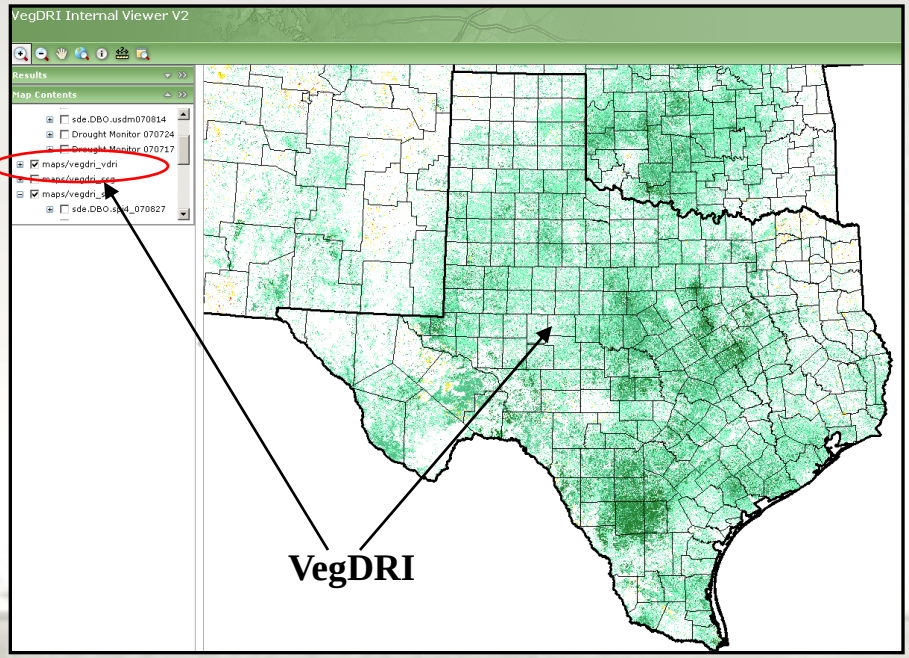
The user customizes the view of the map for their specific needs and interests.

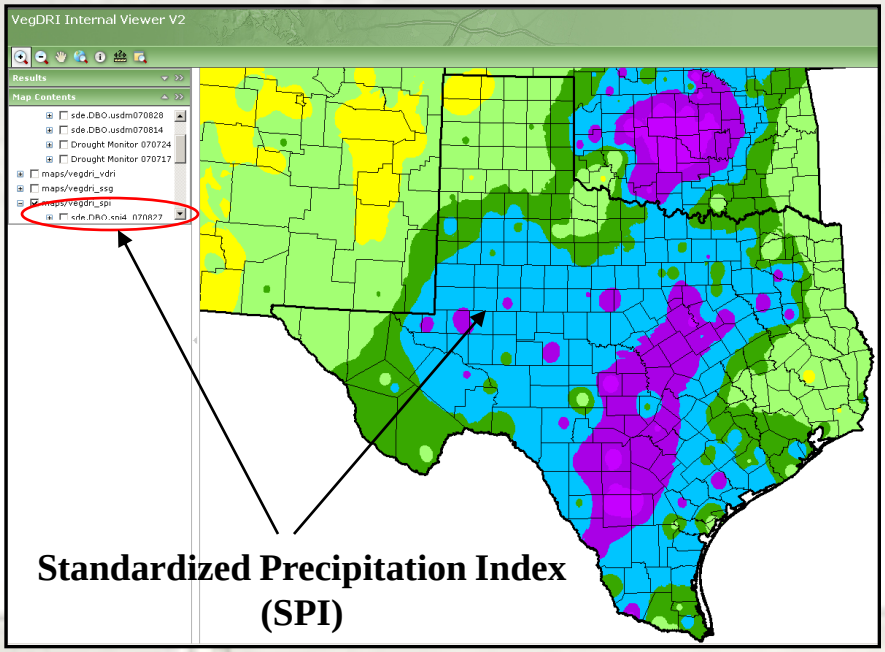
6. Dynamic Map Viewer (in development)



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

6. Dynamic Map Viewer (in development)





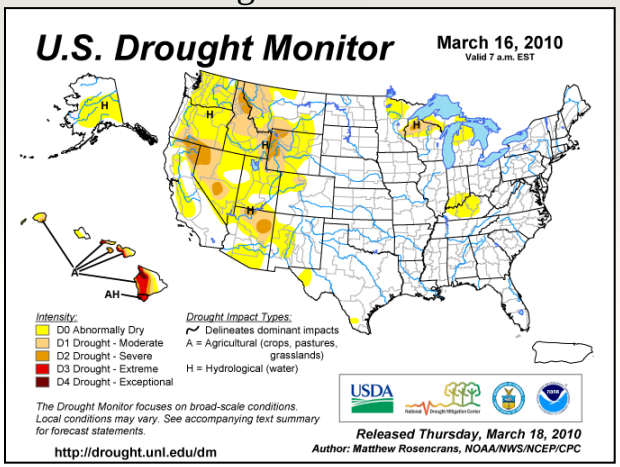
View VegDRI maps in combination with other types of maps.

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

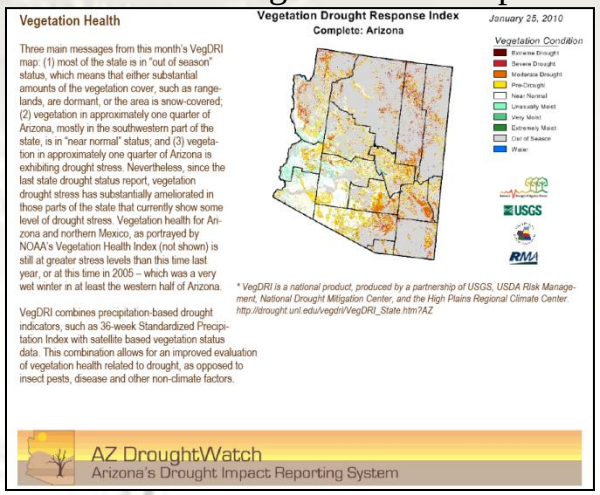
Who is Using VegDRI?

Examples…

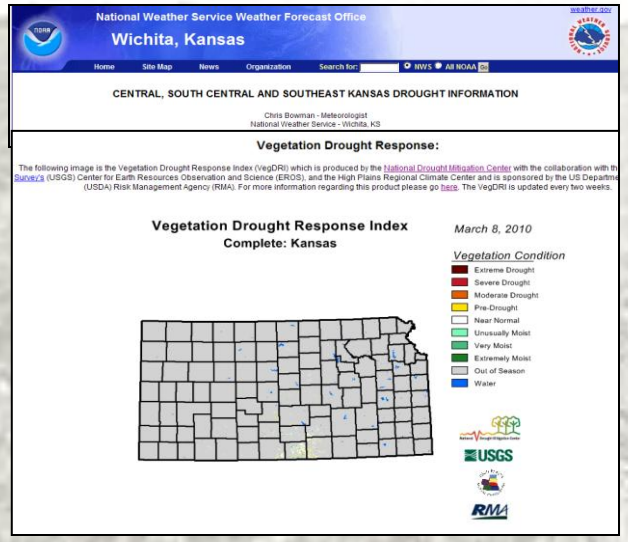
U.S. Drought Monitor authors



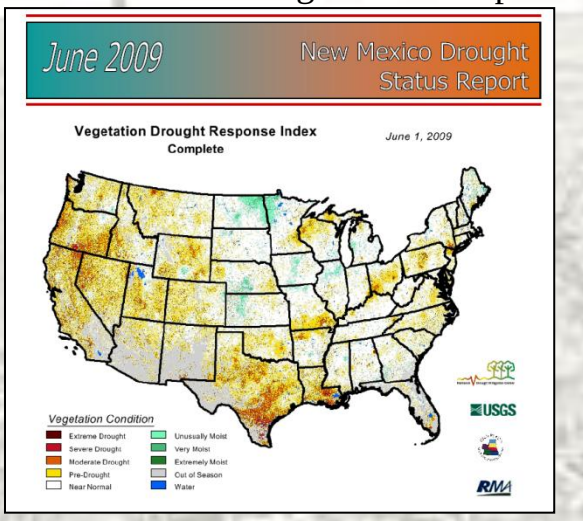
Arizona Drought Monitor Report

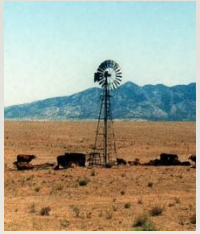


National Weather Service Drought Reports - Kansas



New Mexico Drought Status Report





Possible Uses of VegDRI Information

Agricultural Producer Perspectives

1. Justify sub-county declarations for agricultural losses (e.g., decreased crop yields and reduced forage).
2. Gauge agricultural conditions in other states to assist in operational management decisions.
3. Additional indicator of ‘fire risk’.

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Thank you for your attention.

For more information about VegDRI, please visit:

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

or

contact Brian Wardlow at the NDMC:

bwardlow2@unl.edu

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