Vegetation Drought Response Index (VegDRI)
2009 Update and Ongoing Activities

Brian Wardlow
Remote Sensing Specialist/ GIScience Program Area Leader
National Drought Mitigation Center (NDMC)

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What is VegDRI?

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

1. **satellite-based observations of vegetation conditions**
   - percent annual seasonal greenness (PASG)
   - start of season anomaly (SOSA)

2. **climate-based drought index data**
   - Standardized Precipitation Index (SPI)
   - self-calibrated Palmer Drought Severity Index (PDSI)

3. **biophysical characteristics of the environment**
   - land use/land cover type
   - soils
   - ecological setting
   - elevation

to produce 1-km spatial resolution maps that depict ‘drought-related’ vegetation stress.
Tool with **national-level monitoring** capabilities that provides **local-scale information** (i.e., county to sub-county level) regarding the level of drought stress on vegetation.
Recent Accomplishments

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2. VegDRI map coverage expanded to 48-states coverage in May 2009.
Timeline of VegDRI Expansion

**VegDRI Project Team**

**NDMC**
- Brian Wardlow
- Tsegaye Tadesse
- Karin Callahan
- Chris Poulsen
- Sharmistha Swain
- Eric Hunt

**USGS EROS**
- Jesslyn Brown
- Yingxin Gu
- Danny Howard
Recent Accomplishments

3. VegDRI map were added to NIDIS Map Viewer.

VegDRI also available at:
1) VegDRI webpage (http://www.drought.unl.edu/vegdri/VegDRI_Main.htm)
2) USGS Drought Viewer (http://gisdata.usgs.net/website/Drought_Monitoring/viewer.php)
Recent Accomplishments

4. Expanded the VegDRI evaluator network, particularly in the eastern U.S., to a total of 185 evaluators.
VegDRI Evaluation Results
Statistical Testing of National Model

“Hold-out year’ Cross Validation Approach

• 2,234 weather station locations
• Results from a model based on 19-years (e.g., 1990 – 2008) of historical data were compared with the observed VegDRI values for a specific year (e.g., 1989).
• Average r² value for each period is the mean coefficient of determination value across 20 years of testing.
### VegDRI Accuracy

**The Evaluators’ Perspective**

1. How accurately does the VegDRI map reflect conditions in your county or region?

2. How much better or worse are the vegetation conditions in your area compared to the VegDRI map?

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![Graph showing the accuracy of VegDRI maps over time]

- **Very Accurate**
- **Very Inaccurate**

Sample size \((n)\) of respondents typically ranges between 20 – 35 evaluators (10-20% participation rate) during the year.
“I’m just back from Kemmerer (Lincoln County) and they have had a very abundant precipitation this year and VegDRI is pretty accurate there. Drove through Carbon County and the green/dark green looks quite good. Biomass values are at least double of long-term average.”

- USDA ARS Scientist

“The NW corner of Valley County is showing that things are pretty good, but I have to say that the grasses and non-agricultural areas look as though it’s already late July/early August. I’ve had reports that ranchers were digging posts, and went down 4 feet with an auger and it was just dry as a bone.”

- NWS
Many counties in western North Dakota, which were classified to be under moderate to severe drought conditions by VegDRI for much of the 2008 growing season, had hay production levels near 20-year lows.
Assessment of VegDRI in 2009

Use of Drought Impacts from the Media

“In Calhoun County, pastures are expected to have an 85% loss, winter wheat a 65% loss, and corn, cotton, and soybeans will be down at least 50%.”
- The Port Lavacawave Newspaper in Calhoun County (August 19, 2009)

“Bare cotton fields resulted in not a single boll of cotton is being ginned in Refugio County.”
- Refugio County Press (August 21, 2009)

“In Nueces County, more than 95% of cotton crops failed this year, corn losses are at 80% and grain is at 50%.”
- Action 10 News, Texas (August 26, 2009)

“Drought has claimed the entire cotton production of Kleberg County.”
- Reuters (August 29, 2009)
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Out of Season – Issues in the Southern U.S.

**Goal:** Exclude VegDRI calculations over areas that do not exhibit a signal of photosynethically active vegetation to avoid a ‘false positive’ drought designation. Apply an objective, quantitative technique (Reed et al., 1994) to time-series satellite NDVI data to identify the start and end of season for each 1-km pixel.

**The ‘Good’**

Winter wheat belt accurately identified as ‘out of season' in later summer when the fields are idle.

**The ‘Work in Progress’**

Perennially green areas of the southern U.S. were mid-identified as out of season for several periods into year.
USGS’ eMODIS system enables ‘weekly’ VegDRI maps for the conterminous U.S. to be generated in near real-time to meet the information requirements of the U.S. Drought Monitor community.

- Preliminary product currently under internal review.
- Transition to operational eMODIS VegDRI by early 2010.
Current vs. eMODIS VegDRI

(The Tale of the Tape)

<table>
<thead>
<tr>
<th></th>
<th>Current VegDRI</th>
<th>eMODIS VegDRI</th>
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<tbody>
<tr>
<td><strong>R.S. Data Source</strong></td>
<td>AVHRR (NOAA)</td>
<td>MODIS (NASA)</td>
</tr>
<tr>
<td><strong>Variable</strong></td>
<td>NDVI</td>
<td>NDVI</td>
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<tr>
<td><strong>Spatial resolution</strong></td>
<td>1-km</td>
<td>1-km</td>
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<tr>
<td><strong>Update cycle</strong></td>
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<td>Weekly</td>
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<tr>
<td><strong>Delivery time</strong></td>
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<td>Monday (~7:45 a.m.)</td>
</tr>
<tr>
<td><strong>Processing system</strong></td>
<td>Manuel</td>
<td>Automated</td>
</tr>
</tbody>
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* The MODIS instrument provides a higher quality data stream with more rigorous atmospheric, geometric, and radiometric corrections applied to the spectral data used to generate the NDVI data.
Other Planned Activities

1. Historical time series of VegDRI maps (1989 – present)
   - ranking or percentile maps
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   - various sources of qualitative and quantitative information

3. Retrospective analysis of VegDRI’s response to documented drought events in the past.
Thanks for your attention!

For further questions or information about VegDRI, please contact:

Brian Wardlow
bwardlow2@unl.edu

Or visit the VegDRI webpage at:
http://www.drought.unl.edu/vegdri/VegDRI_Main.htm