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

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.
**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.
**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)

Biophysical Data

1) Palmer Drought Severity Index (PDSI)
2) Standardized Precip. Index (SPI)

Climate Data

3) land use/cover type
4) soil available water capacity (STATSGO)
5) ecoregion type
6) irrigation status
7) 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.
Timeline of VegDRI Expansion Across the U.S.
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/vegdri/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.

http://www.drought.unl.edu/vegdri/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)

Complete view

Cropland view

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

Summary by land cover type.

<table>
<thead>
<tr>
<th>Date</th>
<th>Extreme Drought</th>
<th>Severe Drought</th>
<th>Moderate Drought</th>
<th>Pre-Drought</th>
<th>Near Normal</th>
<th>Unusually Moist</th>
<th>Very Moist</th>
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- 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.

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[Logo images for National Drought Mitigation Center, USGS, and RMA]
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)

- 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.

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

Zoom in to Texas

Overlay county boundaries

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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3. Guide to assist new ranchers better manage their grazing lands and become better land stewards during drought events.