VegScape: A NASS Web Service-based U.S. Crop Condition Monitoring System
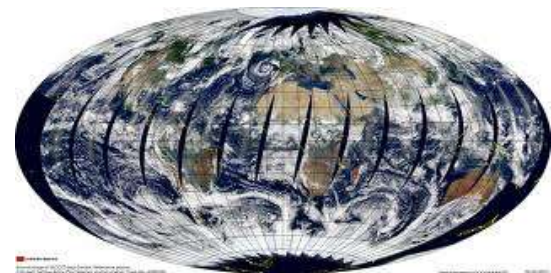
Rick Mueller

National Agricultural Statistics Service

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National Agricultural Statistics Service

Agricultural Outlook Forum 2013
Feb. 21-22 2013

VegScape Goals

- Improve objectivity, robustness, quantification, and defensibility of nationwide crop condition monitoring program
- On-line satellite-based U.S. crop condition vegetation assessment and monitoring
- Provides tools for data exploration and visualization
- Publically disseminates geospatial vegetation condition at *daily, weekly,* and *biweekly* time periods
- Supports ethos of data democratization
  - free and open access to digital geospatial data layers
  - open geospatial standards
  - supporting transparent and collaborative government initiatives

VegScape Components

- Moderate Resolution Imaging Spectroradiometer (MODIS)
  - Daily global coverage
  - 250 meter spatial resolution
  - 13 year historical record
  - Launched/maintained by NASA

- VegScape built on CropScape framework/architecture
  - Web-based interactive mapping
  - Derive daily/weekly/biweekly composites
  - Automated updates
  - Online navigation, zooming, panning, downloading
  - Hosted/maintained by George Mason University/Center for Spatial Information Science and Systems
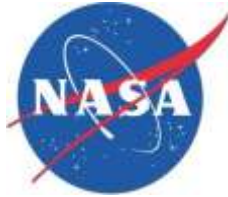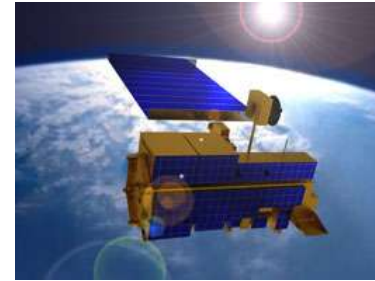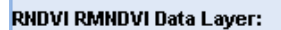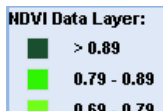
Daily/Weekly/Biweekly Automated Customized US Composites
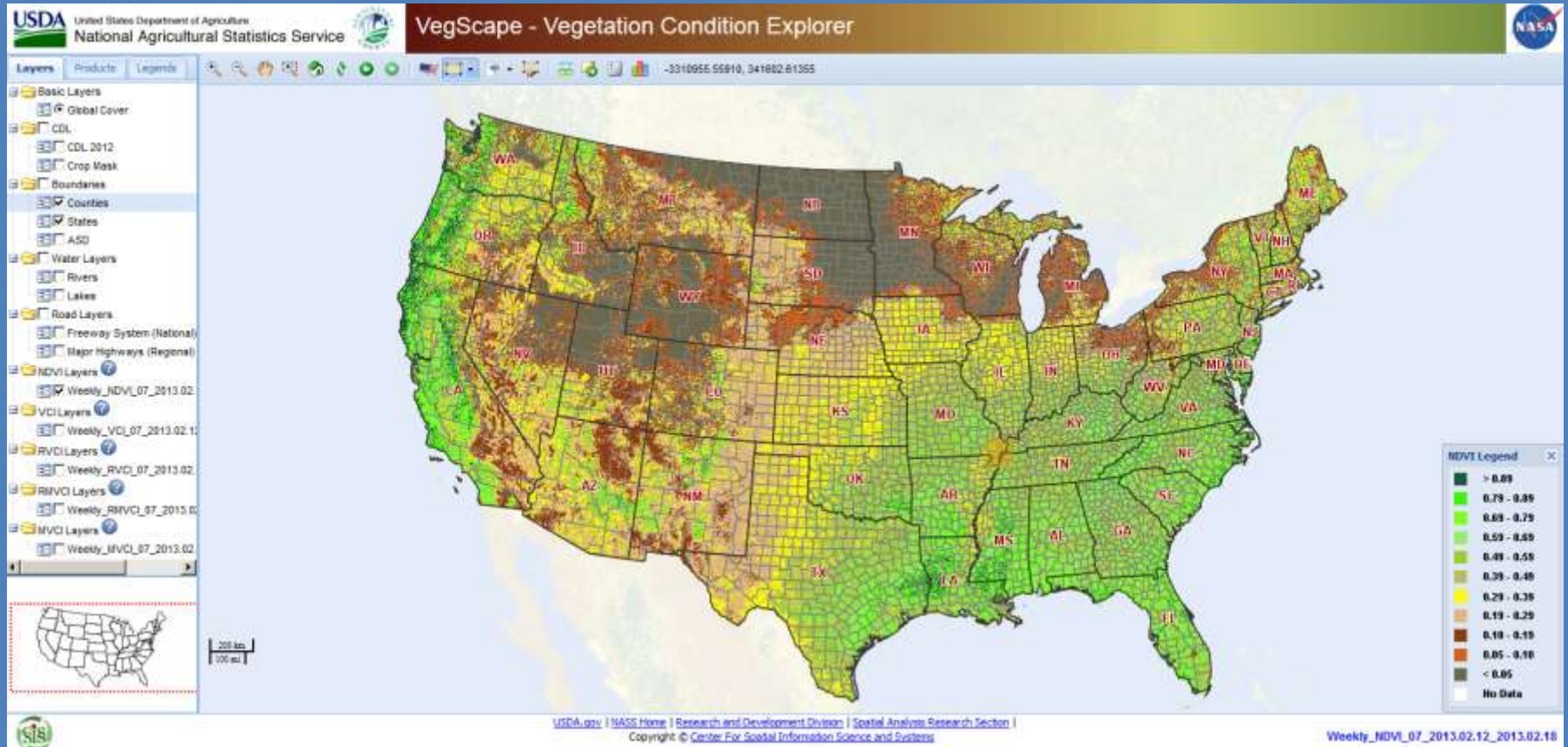
Leverage George Mason Univ/GeoBrain technology (i.e., CropScape)

Vegetation Indices

- NASS uses NASA's MODIS satellite to identify crop condition throughout the growing season

- Each pixel measures 250 sq. meters or 15 acres/6.25 hectares

- The Normalized Difference Vegetation Index (NDVI) is used to measure and monitor plant growth, vegetative cover, and biomass production

- NDVI values range from 0 to 1, where higher values indicate stronger plant vigor and high chlorophyll content
  - Lower values indicate low vegetative content/plant heartiness

- Additional derivative vegetation indices can be displayed: Vegetative Condition Index; Ratio VCI; Ratio Median VCI; Mean VCI

NDVI Data Layer:

	> 0.89
	0.79 - 0.89
	0.69 - 0.79
	0.59 - 0.69
	0.49 - 0.59
	0.39 - 0.49
	0.29 - 0.39
	0.19 - 0.29
	0.10 - 0.19
	0.05 - 0.10
	< 0.05
	No Data

VCI Data Layer:

	0.82 - 1.00
	0.71 - 0.82
	0.59 - 0.71
	0.47 - 0.59
	0.35 - 0.47
	0.24 - 0.35
	0.12 - 0.24
	0.06 - 0.12
	0.00 - 0.06
	No Data

MVCI Data Layer:

	<= -25%
	<= -15%
	<= -5%
	+/-
	>= +5%
	>= +15%
	>= +25%

RNDVI RMNDVI Data Layer:

|	
	<= -25%
	<= -15%
	<= -5%
	+/-
	>= +5%
	>= +15%
	>= +25%

about NDVI

The Surface Reflectance Daily L2G Global 250m of MODIS is selected as the input for generating normalized difference vegetation index (NDVI). The L2G product has two bands – Band1 (620-670 nm) and Band2 (841-876 nm) that represent respectively red and near-infrared band. Therefore, the equation for computing daily NDVI is as follows:

$$NDVI = \frac{Band2 - Band1}{Band2 + Band1} \times 125 + 125$$

Resulted data are in the range of [0, 250].

Weekly Vegetation Indices 07/24/12 – 07/30/12

Normalized Difference Vegetation Index (NDVI)
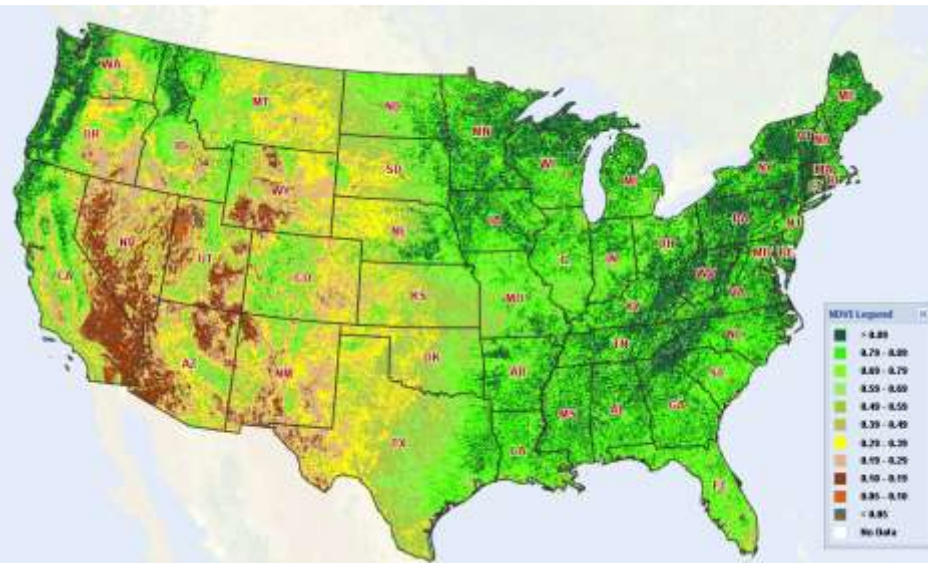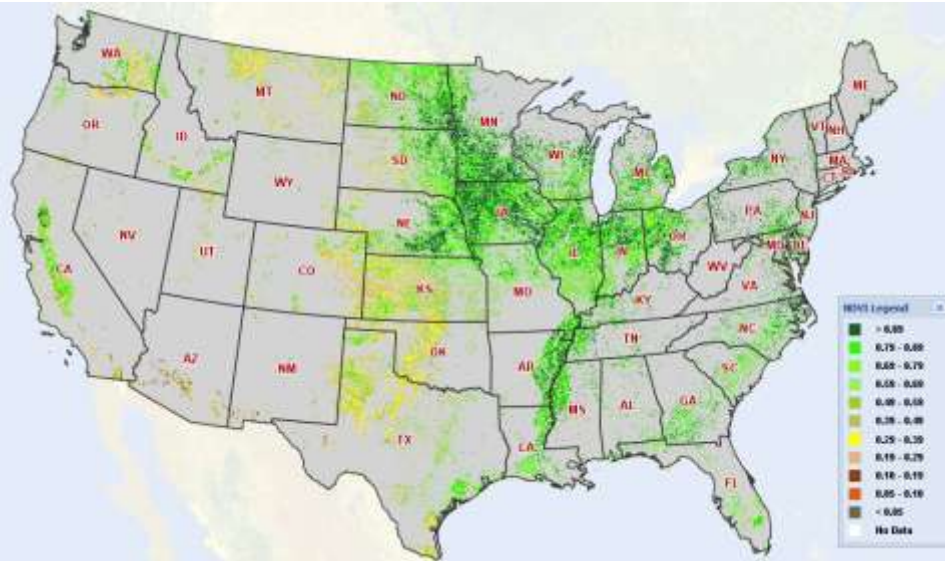
Ratio NDVI or RVCI

Ratio Median NDVI or RMVCI

Mean NDVI or MVCI

Weekly Vegetation Indices 07/24/12 – 07/30/12
Crop Mask Applied

Normalized Difference Vegetation Index (NDVI)

Ratio NDVI or RVCI

Ratio Median NDVI or RMVCI

Mean NDVI or MVCI

VegScape GUI

Labels (toolbar annotations, left to right): Zoom in, Zoom out, Pan, Drag zoom, Home, Refresh, Previous View, Next view, Identify pixel value, Define state/county AOI, Define rectangle AOI, Import AOI, Swipe layer, Download AOI, Clear AOI, Show/hide legend, Statistics
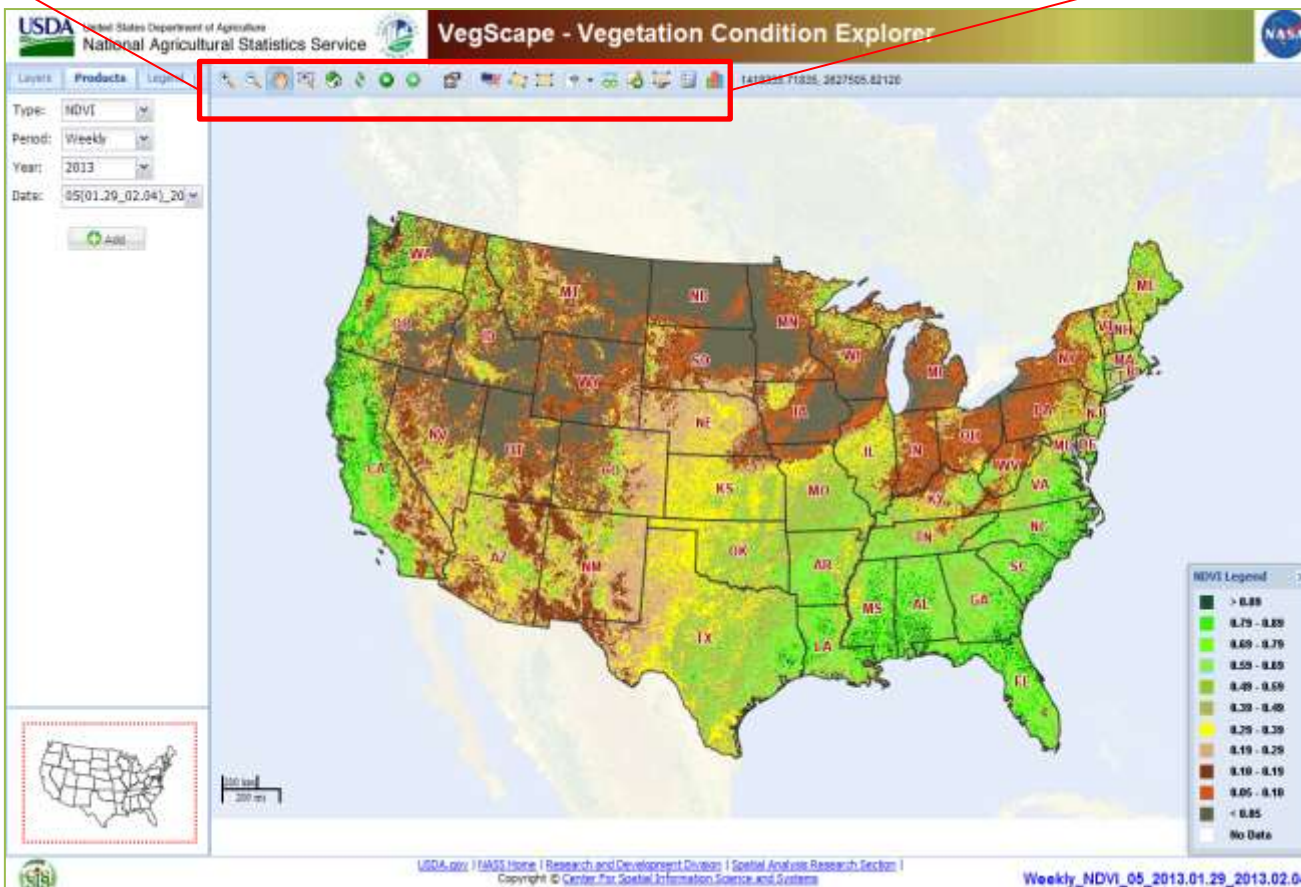
VegScape Layers/Products/Legends Tab

Turn on/off layers

Drape crop mask
View CDL
Political boundaries
Water/road layers
Vegetation indices

Load VegScape Indices
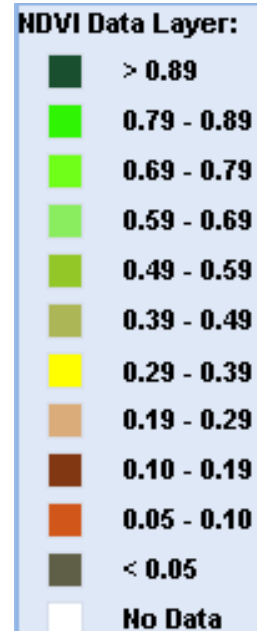
Layers	**Products**	Legend

Type: NDVI
Period: Weekly
Year: 2013
Date: 05(01.29_02.04)_20

⊕ Add

Follow these five steps to add products for analysis

1) Select vegetative index

Products

MVCI
NDVI
VCI
RVCI
RMVCI
MVCI

2) Time period

Type: NDVI
Period: Weekly
Year:
Date:

Daily
Weekly
Biweekly

5) Add

⊕ Add

3) Year

Type: NDVI
Period: Weekly
Year: 2013
Date:

2000
2001
2002
2003

4) Date

Type: NDVI
Period: Weekly
Year: 2013
Date: 05(01.29_02.04)_20

01(01.01_01.07)_2013
02(01.08_01.14)_2013
03(01.15_01.21)_2013

NDVI Data Layer:

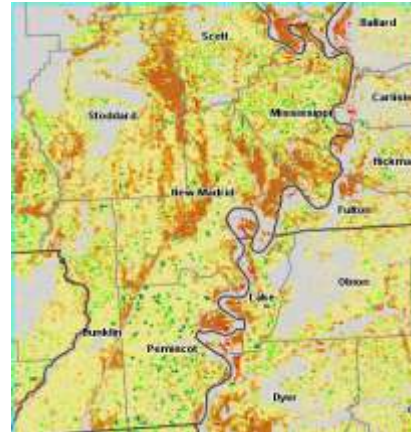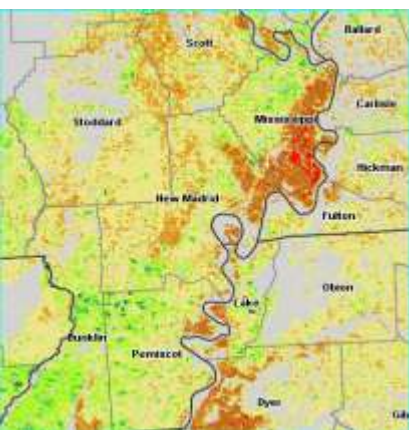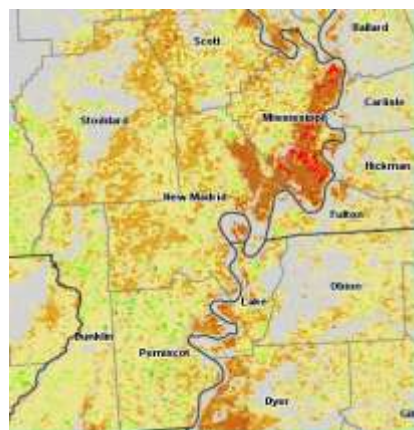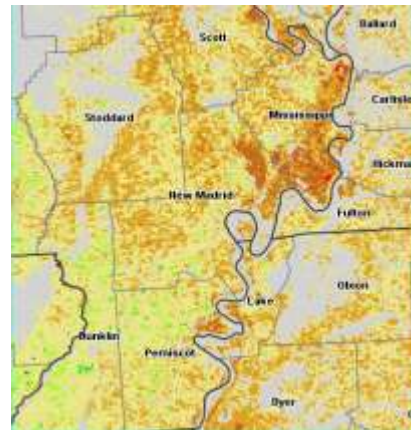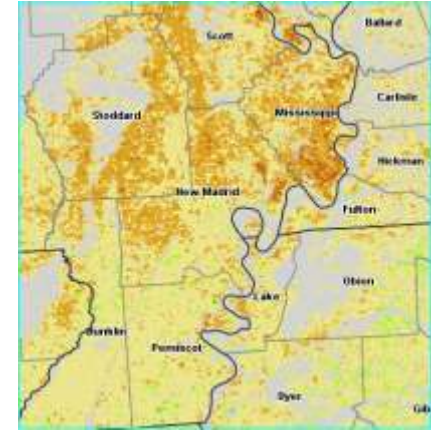|	
■	> 0.89
■	0.79 - 0.89
■	0.69 - 0.79
■	0.59 - 0.69
■	0.49 - 0.59
■	0.39 - 0.49
■	0.29 - 0.39
■	0.19 - 0.29
■	0.10 - 0.19
■	0.05 - 0.10
■	< 0.05
□	No Data

04/12-04/18/11

04/19-04/25/11

04/26-05/02/11

05/03-05/09/11

05/10-05/16/11

05/17-05/23/11

05/24-05/30/11

05/31-06/06/11

Cropland
Data
Layer

RMVCI Legend

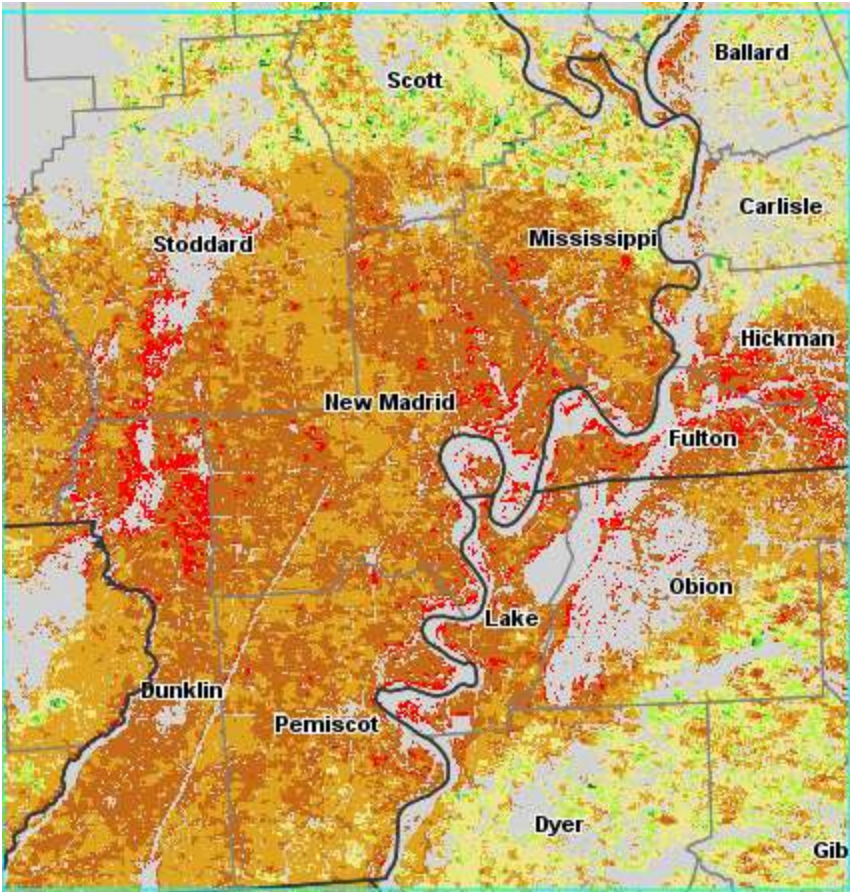|	
🟥	<= -25%
🟧	<= -15%
🟨	<= -5%
🟨	+/-
🟩	>= +5%
🟩	>= +15%
🟩	>= +25%
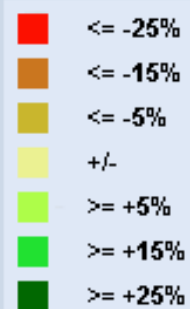
2011 Flood Missouri Bootheel
Ratio Median NDVI
(Median of 10 years NDVI)

RatioMedian VCI- Area of Interest Statistics

Weekly_RMNDVI_18_2011.05.03_2011.05.09 Data Layer Statistics for the Defined Area of In
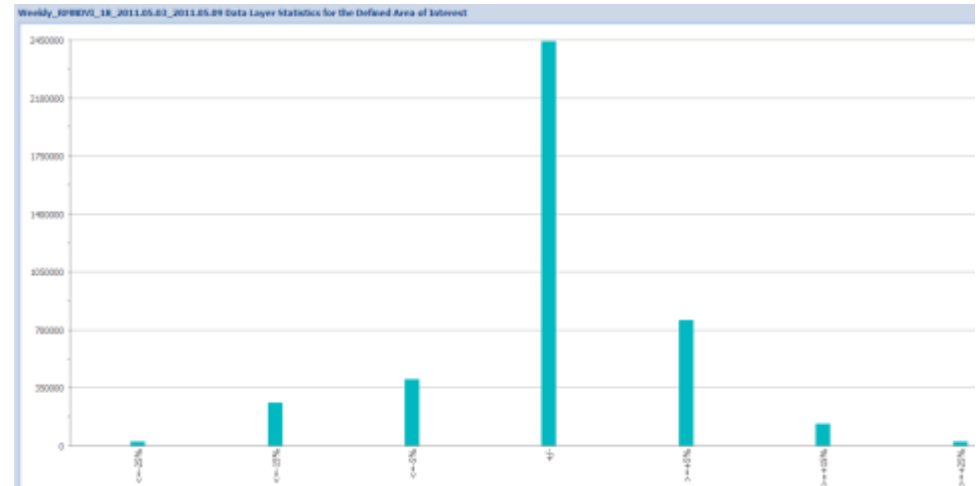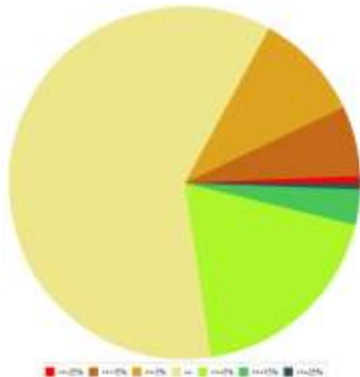
Note: Pixel and acreage counts are not official estimates.

Value ▲	Category	Pixel Counts	Acreage
0	<=-25%	1931	25606.6
1	<=-15%	19647	260535.3
2	<=-5%	30411	403274.7
3	+/-	184180	2442377.2
4	>=+5%	57280	759579.6
5	>=+15%	9910	131414.7
6	>=+25%	1765	23405.3
Total	**7**	**305124**	**4046193.4**

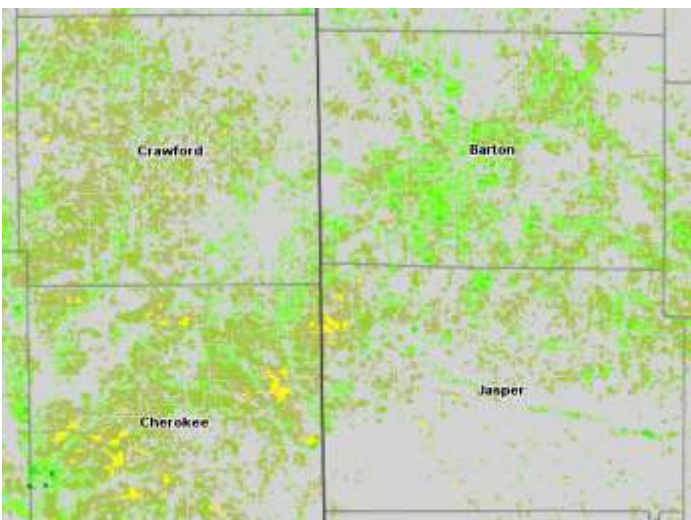04/19-04/25/11

Quantify vegetative area condition

RMVCI Legend
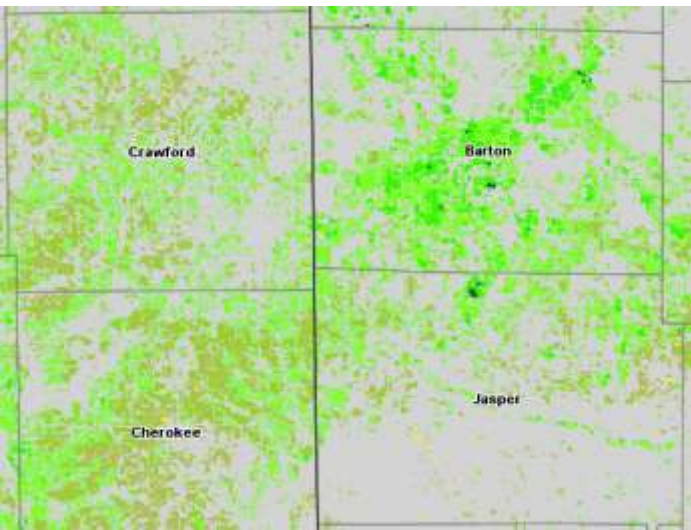
- <= -25%
- <= -15%
- <= -5%
- +/-
- >= +5%
- >= +15%
- >= +25%

VegScape Swipe Function

NDVI 07/24/12 – 07/30/12 Crop Mask
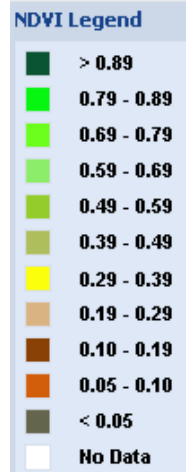

NDVI 07/26/11 – 08/01/11 Crop Mask

Swipe Current View

Front Layer: Weekly_NDVI_30_2012.07.24_2012.07.3

Back Layer: Weekly_NDVI_30_2011.07.26_2011.08.0

Swipe Position

50   0 —————————[I]———————— 100

Direction: Vertical(Left->Right)

Close

Swipe/fade widget back & forth
Vertical or horizontal motion

NDVI Legend

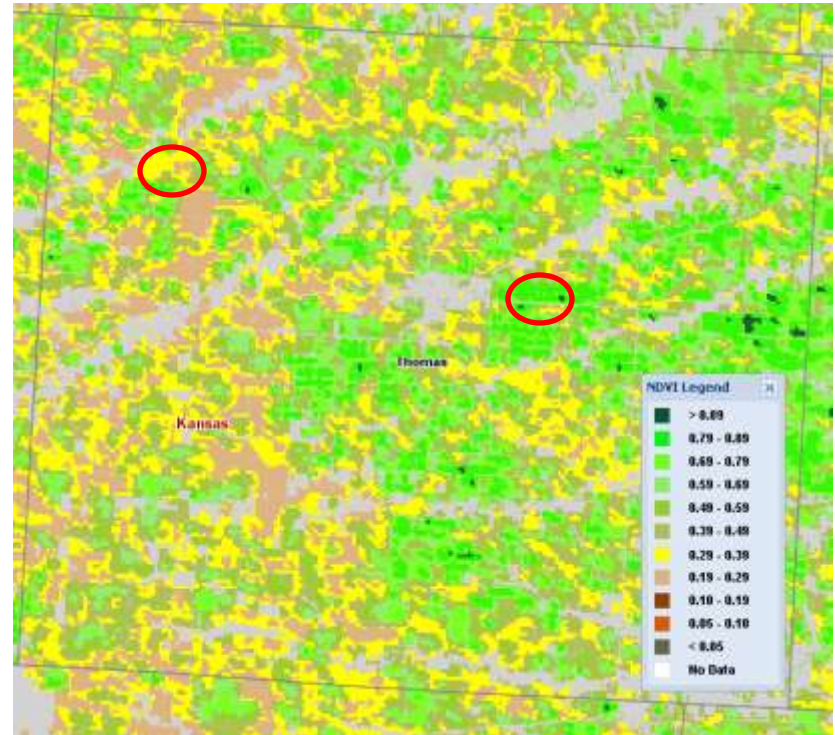|	
	> 0.89
	0.79 - 0.89
	0.69 - 0.79
	0.59 - 0.69
	0.49 - 0.59
	0.39 - 0.49
	0.29 - 0.39
	0.19 - 0.29
	0.10 - 0.19
	0.05 - 0.10
	< 0.05
	No Data

CropScape/VegScape Integration

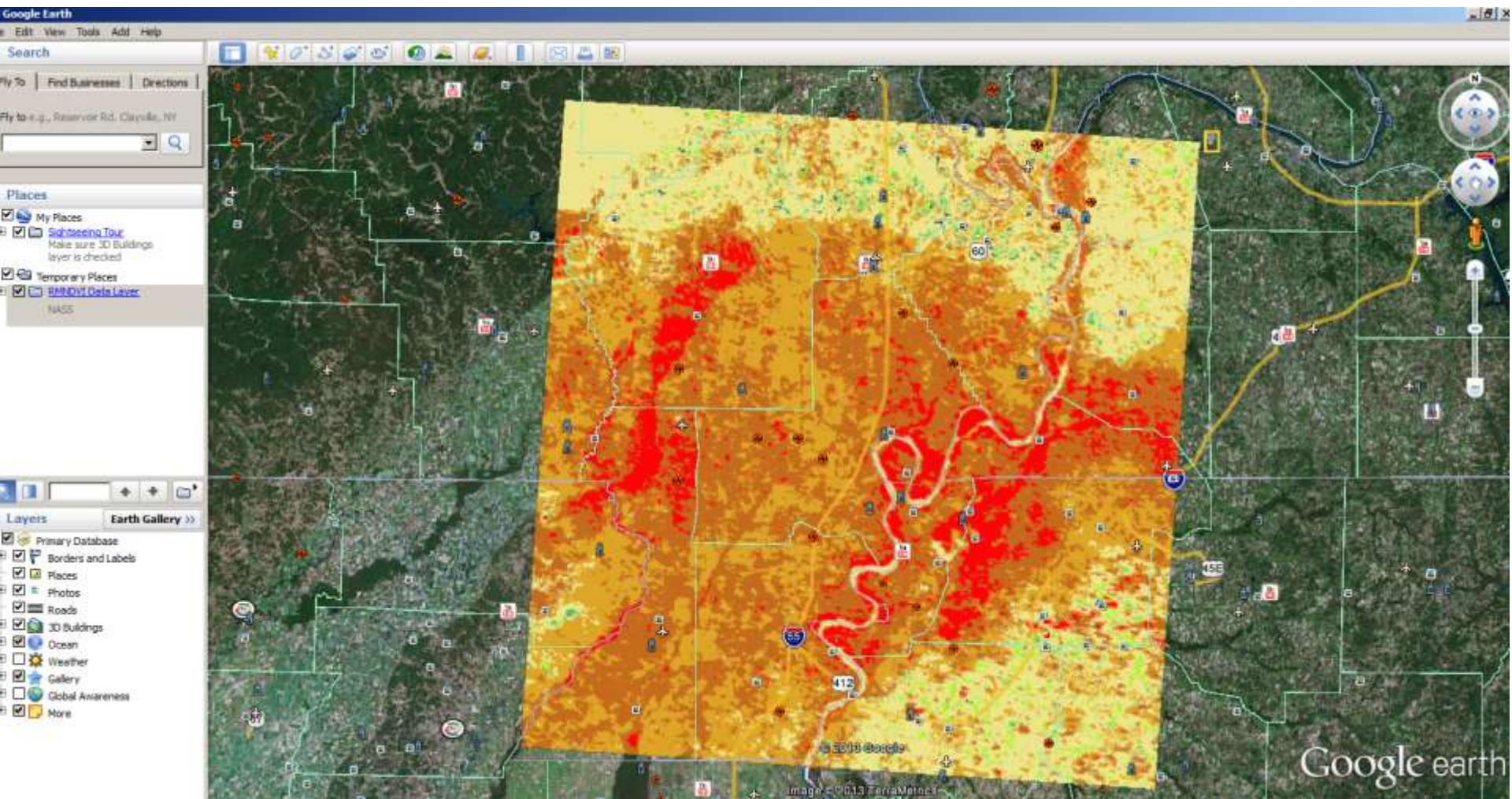## VegScape also serves the latest 2012 CDL product
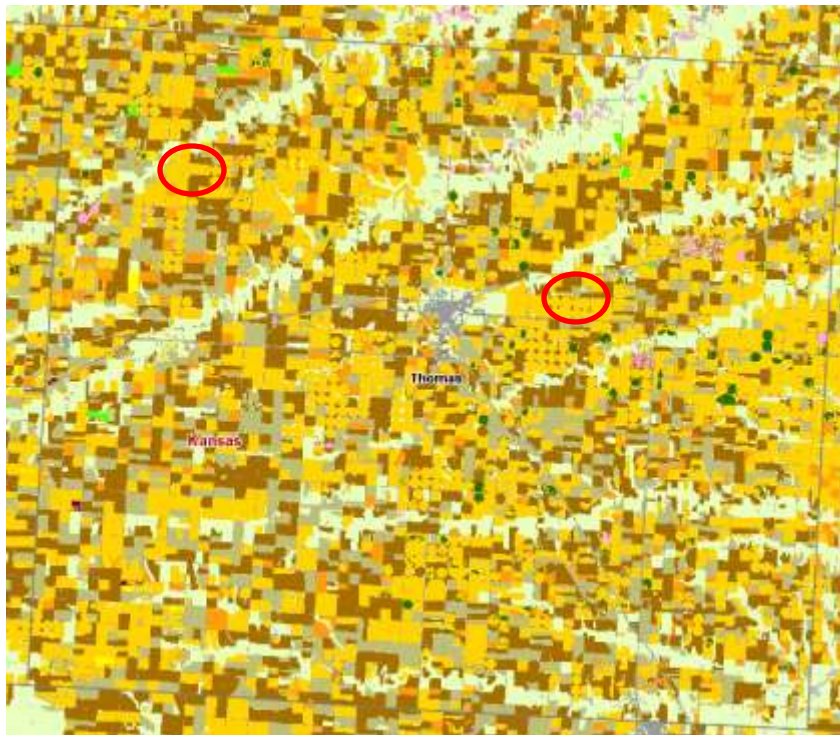
2012 Cropland Data Layer
The 2012 Cropland Data Layer
(CDL) product depicts land cover

7/24/12 – 7/30/12 NDVI
Vegetative condition indicates crops under
stress from the 2012 drought

Web Mashup

Download any selected index data directly into Google Earth

VegScape Conclusion

- MODIS offers high spatial/temporal resolution & data continuity
- Web-based dynamic interactive mapping
  - Online navigation, zooming, panning, downloading, on-the-fly processing
  - Leveraging CropScape framework/architecture
  - Automatic data retrieval, processing, publishing, and dissemination
- Irregular, ad-hoc data retrieval and processing for emergency assessment/reporting
  - NDVI, VCI, MVCI, RMVCI, RVCI
- Assessing crop condition and identifying the areal extent of floods, drought, major weather anomalies, and vulnerabilities of early/late season crops

- Consider VegScape operational upon start of 2013 growing season!
- Future enhancements such as soil moisture...

Just bing it!

VegScape - Vegetation Condition Explorer
nassgeodata.gmu.edu/VegScape
VegScape - Vegetation Condition Explorer USDA.gov | NASS Home | Research and Development Division | Spatial Analysis Research Section | ...

http://nassgeodata.gmu.edu/VegScape