VegScape – A MODIS Based Vegetation Condition Monitoring System

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INTRODUCTION

The USDA National Agriculture Statistics Services (NASS) currently uses a bi-weekly AVHRR normalized difference vegetation index (NDVI) composite to monitor crop vegetation condition. The AVHRR NDVI maps have been proven valuable in providing a spatially complete view of crop's vegetation condition. However, their relatively low spatial resolution of 1km, bi-weekly period, and non geo-referenced JPEG image posting cannot provide crop specific information and cannot meet the timeliness requirement, and are difficult to navigate and to quantitatively analyze as well. Therefore, the NASA 250m resolution MODIS daily surface reflectance data are used to replace the AVHRR NDVI, and a new interactive Web-based vegetation condition monitoring system - VegScape is proposed to automatically obtain and process near real-time MODIS data, to generate various vegetation condition indices, to query, visualize, disseminate, and analyze geospatial vegetation condition data through standard geospatial Web services.

OBJECTIVE

Develop an operational National Crop Condition Monitoring System – VegScape using 250m MODIS daily surface reflectance data (MOD09GQ) to produce crop vegetation condition data products that are complementary to existing NASS crop condition products:

- To improve NASS vegetation condition monitoring spatial and temporal resolution.
- To improve the science, objectivity, robustness and defensibility of nationwide crop vegetation condition monitoring operation at NASS
- To enhance data accessibility, interoperability, online analytics, and dissemination.
- To provide capabilities of automatic near real-time MODIS data retrieval, processing, on-line geospatial crop vegetation condition data access, on-line analytics, dissemination, publishing over the web via interactive maps.

VEGETATION INDICES

$$NDVI = (IR-R)/(IR+R)$$

$$MVCI = \frac{NDVI(x,y) - NDVI_m(x,y)}{NDVI_m(x,y)} \times 100$$

$$RMNDVI = \frac{NDVI_i(x,y) - NDVI_{med}(x,y)}{NDVI_{med}(x,y)} \times 100\%$$

$$RPNDVI = \frac{NDVI_i(x,y) - NDVI_{i-1}(x,y)}{NDVI_{i-1}(x,y)} \times 100\%$$

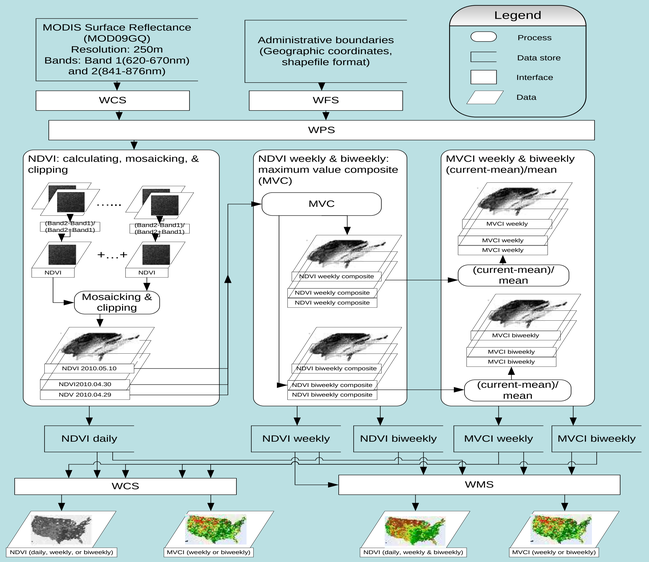
$$VCI = \frac{NDVI(x,y) - NDVI_{min}(x,y)}{NDVI_{max}(x,y) - NDVI_{min}(x,y)} \times 100\%$$

USER REQUIREMENTS

Reasonable performance with no user burden

- No client software development &installation.
- No special software tools needed.
- No specialized knowledge and training needed.
- Interactive vegetation condition mapping.
- On-the-fly data processing and presentation.
- Online crop vegetation condition analytics.

DATA PROCESSING FLOW

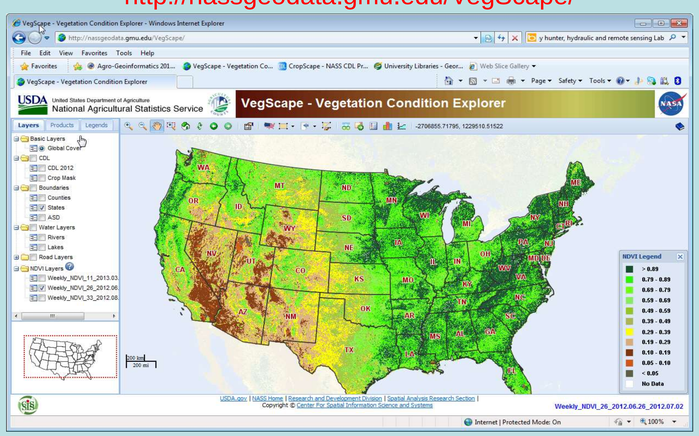


TECHNOLOGIES

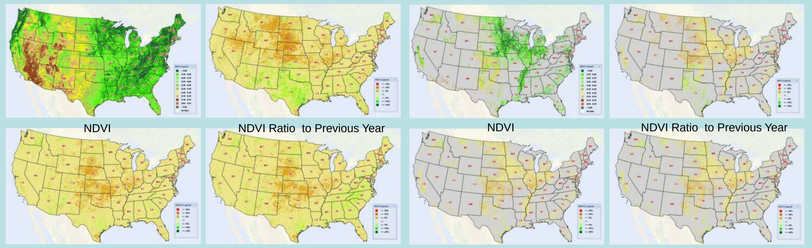
- OGC specifications and standards: WFS, WMS, WPS, WCS etc.
- Web service based service oriented architecture
- Service workflow integration - BPEL, BPEL execution engine, integrates data through interoperable services into decision support information (reports, tables, views, charts, maps etc.).
- Scalable, Robust, and Reusable

VegScape - Vegetation Condition Explorer

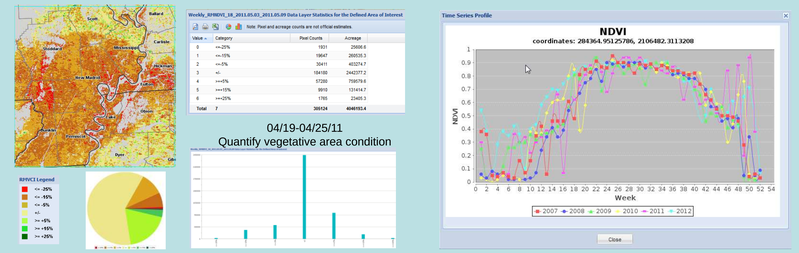
http://nassgeodata.gmu.edu/VegScape/

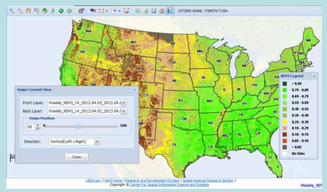


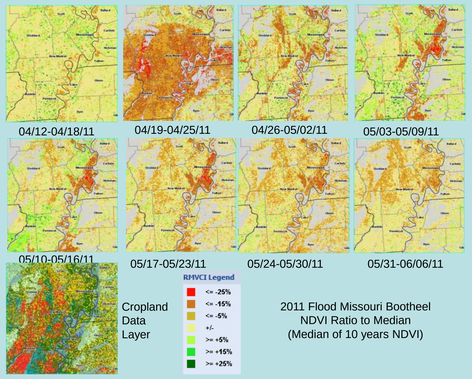
VegScape VEGETATION INDEX & CROP MASKED MAPS

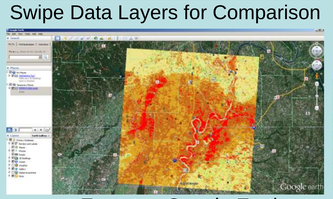


VegScape FUNCTIONS & APPLICATION HIGHLIGHT









VegScape Application Example

CONCLUSION

- MODIS offers high spatial/temporal resolution & data continuity for cropland vegetation condition monitoring.
- Irregular, ad-hoc data retrieval and processing for emergency assessment/reporting
- Web-based interactive mapping enabled online geospatial data equal accessing, data exploring, navigation, querying, visualization, and dissemination, and greatly improved user experiences.
- The service oriented architecture allows scalability.
- The open GIS technology is robust and has better performance.
- It greatly enhanced geospatial crop vegetation condition information for decision support.