Introduction to Satellite Derived Vegetation Indices

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What is Vegetation Index?

A Vegetation Index is an indicator that describes the greenness — the relative density and health of vegetation — for each pixel in a satellite image. (Laymen Definition)

What is Vegetation Index? (Contd....)

Some mathematical combination or transformation of spectral bands that accentuates the spectral properties of green plants so that they appear distinct from other image features. (Scientific Definition)

What Vegetation Indices Does?

• Indicate the **AMOUNT** of vegetation (e.g., %cover, LAI, biomass, etc.);
• **Distinguish** between soil and vegetation;
• **Reduce** atmospheric and topographic effects if possible.
Spectral Reflectance Curve

Normalized Difference Vegetation Index (NDVI)

- To determine density of green vegetation;
- Observe the distinct colors of visible and near-infrared light reflected by the plants.

False Color Composite (FCC) of a satellite image showing the different characteristics of the image features

Reference: http://www.cawa-project.net/system/files/image/story/body_img/ScreenShot_rapidEye.png
NDVI (Contd....)

- NDVI calculated from the visible and near-infrared light reflected by vegetation;
- Healthy vegetation (left) absorbs most of the visible light that hits it, and reflects a large portion of the near-infrared light;
- Unhealthy or sparse vegetation (right) reflects more visible light and less near-infrared light.

Reference: https://earthobservatory.nasa.gov/Features/MeasuringVegetation/measuring_vegetation_2.php

NDVI Range

- NDVI for a given pixel always result in a number that ranges from minus one (-1) to plus one (+1);
- No green leaves gives a value close to zero. A zero means no vegetation and;
- High NDVI Values, +1 (0.8 - 0.9) indicates healthy vegetation;
- Low NDVI values, -1 indicates less or no vegetation.
NDVI for the period from March to October 2017
Source: GISTDA

Period of Coverage:
Mar/Apr/May/Jul/Oct

Mapping Paddy Areas in Cambodia

Kandal & Prey Veng Province Wet Season 2010 (MODIS)  Kandal & Prey Veng Province Dry Season 2010 (MODIS)

Deshapriya et al., 2010
Brief Methodology Used

- Selecting Images in Cultivating Period and Harvesting Period
- Preprocessing and calculate NDVI
- Classification of Temporal NDVI Images
- Calculate Statistics and Accuracy Assessment

Comparison of Paddy Area from MODIS based Results and Ground based Statistics

Deshapriya et al., 2010

Crop Intensity Map

Kandal & Prey Veng Province Crop Intensity Map 2010 (MODIS)

Deshapriya et al., 2010
Normalized Difference Water Index (NDWI)

- Satellite-derived index estimating the leaf water content at canopy level;
- Derived from the Near-Infrared (NIR) and Short Wave Infrared (SWIR) channels;
- NDWI product: varies between -1 to +1.

Paddy Area Distribution in Cambodia for Wet Season (2014)

Deshapriya et al., 2010
NDWI (Contd....)

• High values of NDWI
  • Correlate to high vegetation water content and to high vegetation fraction cover

• Low NDWI values
  • Correlate to low vegetation water content and low vegetation fraction cover.

NDWI for the period from March to October 2017
Source: GISTDA

Period of Coverage:
Mar/Apr/May/Jun/Jul/Oct
Soil Adjusted Vegetation Index (SAVI)

- Modification of the NDVI to correct the influence of soil brightness when vegetative cover is low;
- SAVI is structured similar to the NDVI but with the addition of a “soil brightness correction factor”.

SAVI (Contd....)

Reference: A joint project of the USDA-ARS Jornada Experimental Range, the BLM-AIM Program, and the Idaho Chapter of The Nature Conservancy
Vegetation Condition Index (VCI)

• Compares the current NDVI to the range of values observed in the same period in previous years;
• VCI expressed in %;
• Lower and higher values indicate bad and good vegetation state conditions, respectively.


VCI Global (NOAA AVHRR), 4 km, 7-day Composite

Reference: http://www.ospo.noaa.gov/Products/land/vhp/VCI.html
Where can you find Satellite data for Drought Studies?

NOAA AVHRR (1-km & 4-km, 7-day Composite)

USGS Earth Explorer
https://earthexplorer.usgs.gov/

Landsat Data Access
https://landsat.usgs.gov/landsat-data-access

Land Processes Distributed Active Archive Center
https://lpdaac.usgs.gov/data_access/data_pool/