GE 107 Tinkering Lab

Assignment-3: Google Earth Engine

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Entry Number: 2020EEB1157

Date: 07/04/2022

Objective:

To compute spectral indices such as NDVI, NDWI, NDSI, NDSII, NDGI, NDBI, etc. of any area, study their time series analysis of at least one year by plotting graphs.

Data Used: Modis

Date: 1/1/2016 to 31/12/2016

Place Used: Washington (a state in USA)

Data Sets Used:

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Imports (4 entries)
  var modis: (Deprecated) ImageCollection "MOD09A1.005 Surface Reflectance 8-Day Global 500m [deprecated]"
  var gfsad: (Deprecated) Image "GFSAD1000: Cropland Extent 1km Crop Dominance, Global Food-Support Analysis Data [deprecated]" …
  var gaul: Table FAO/GAUL/2015/level1
  var visParams: nir, red and green from 0 to 5000
```

Modis: MOD09A1.005 Surface Reflectance 8-Day Global 500m [deprecated] - The MODIS Surface Reflectance products provide an estimate of the surface spectral reflectance as it would be measured at ground level in the absence of atmospheric scattering or absorption.

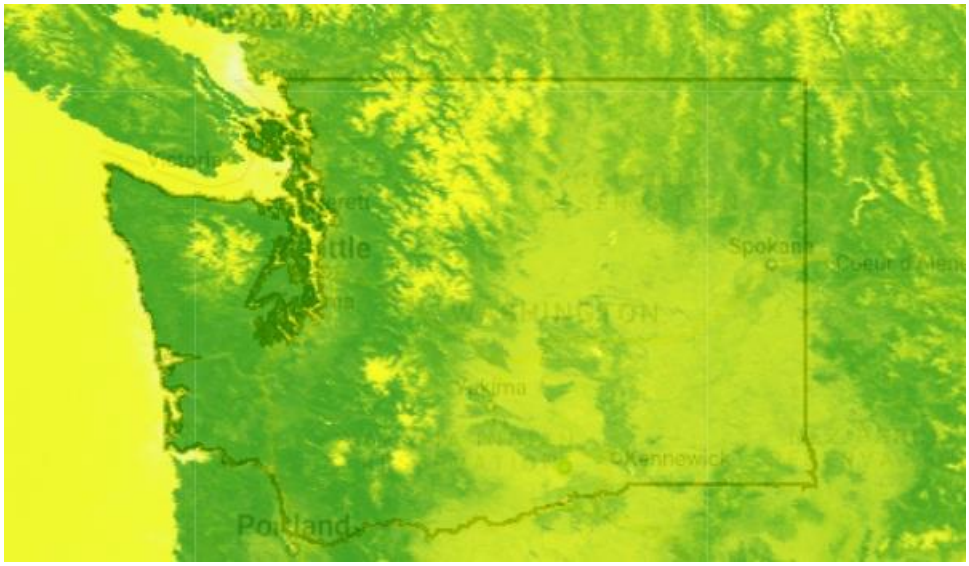
GFSAD1000: Cropland Extent 1km Crop Dominance, Global Food-Support Analysis Data [deprecated]: The GFSAD is a NASA-funded project to provide high-resolution global cropland data and their water use that contributes towards global food security in the twenty-first century.

FAO GAUL 500m - The Global Administrative Unit Layers (GAUL) incorporates and scatters the best accessible data on managerial units for every one of the nations on the planet.

Observations:

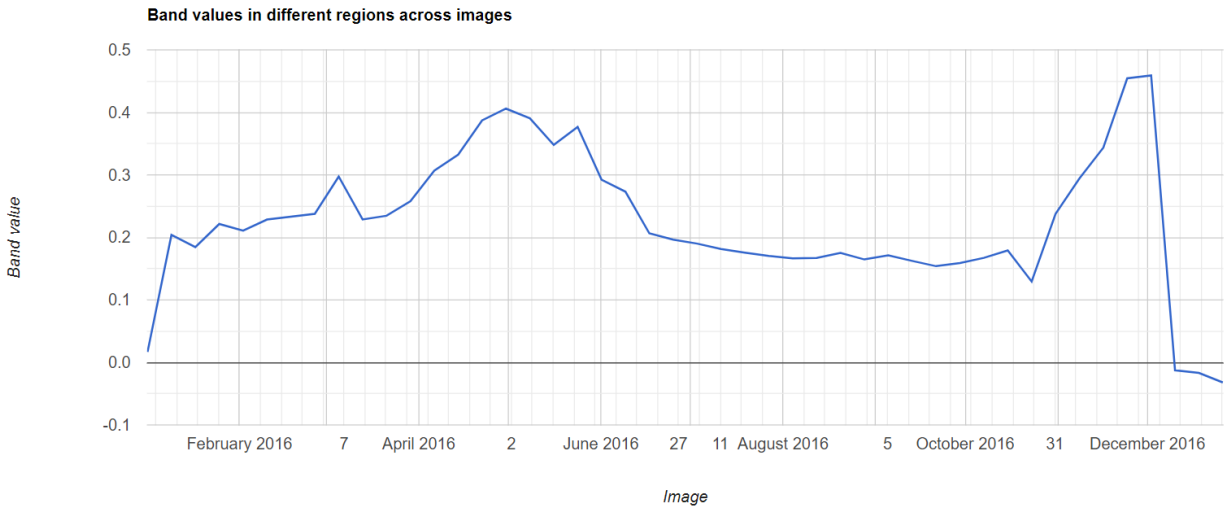
NDVI: NDVI stands for Normalized Difference Vegetation Index. It is a dimensionless index that describes the difference between visible and near-infrared reflectance of vegetation cover and can be used to estimate the density of green on an area of land.

$$\text{Normalized Difference Vegetation Index } (\mathbf{NDVI}) = \frac{(NIR - Red)}{(NIR + Red)}$$



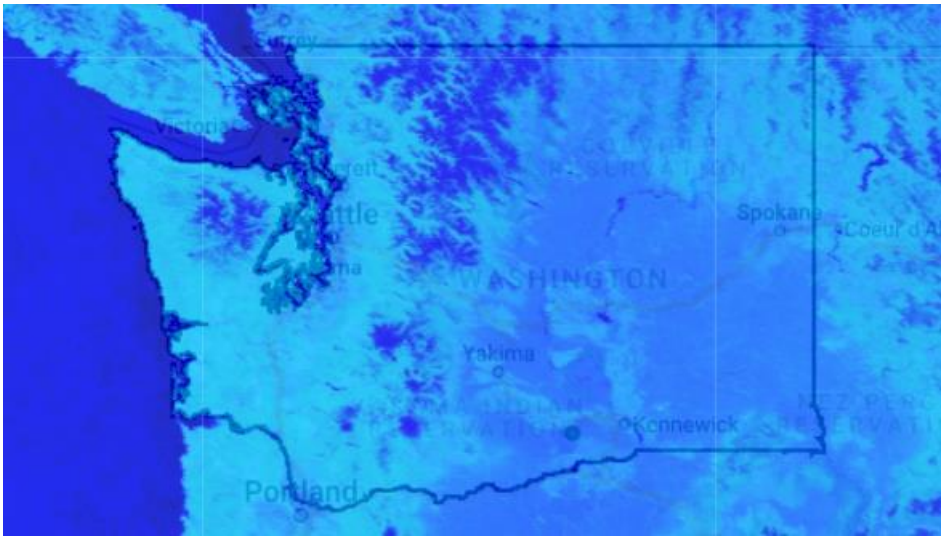
The green area shows high level of vegetation and yellow shows lower level of vegetation.

Time series analysis graph:



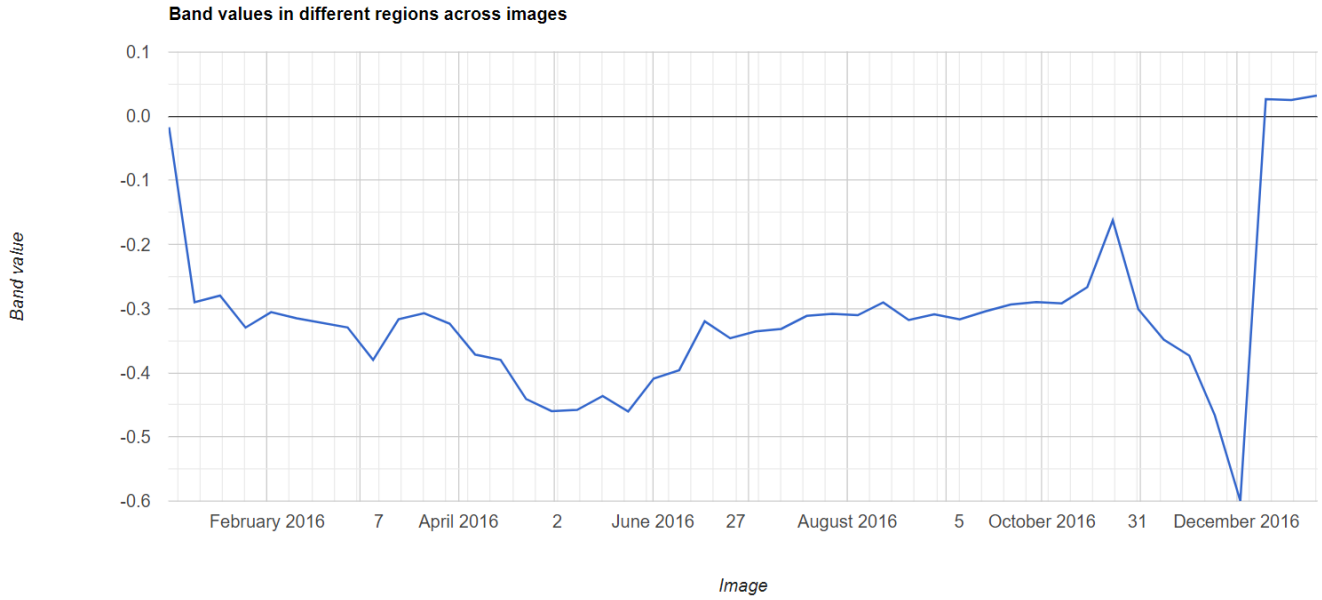
NDWI: NDWI stands for Normalized Difference Water Index. It is a remote sensing-based indicator sensitive to the change in the water content of leaves. NDWI is computed using the near infrared (NIR – MODIS band 2) and the short-wave infrared (SWIR – MODIS band 6) reflectance's.

$$\text{Normalized Difference Water Index } (\mathbf{NDWI}) = \frac{(Green - NIR)}{(Green + NIR)}$$



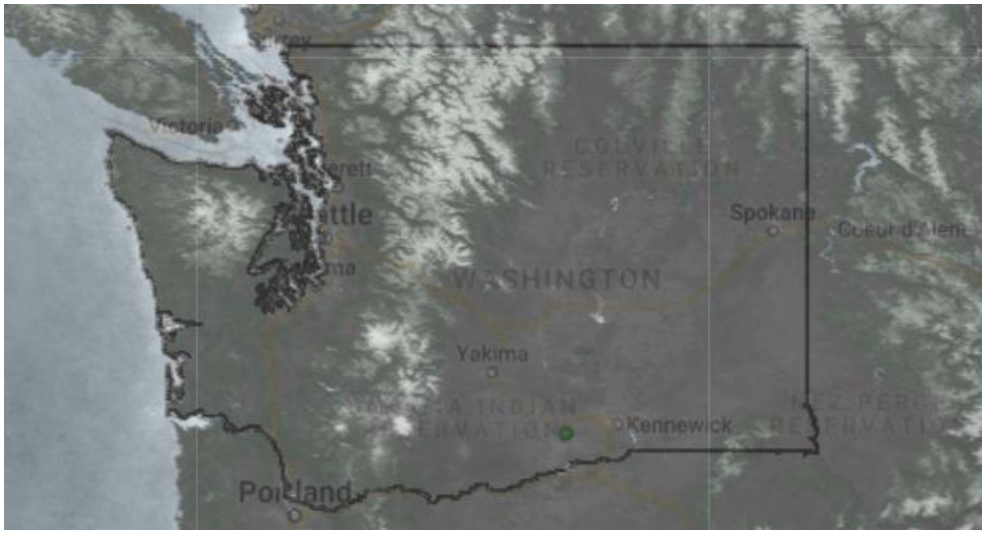
The Dark blue region shows water bodies and in contrast the lighter areas shows areas with lower water content.

Time Series Analysis Graph:



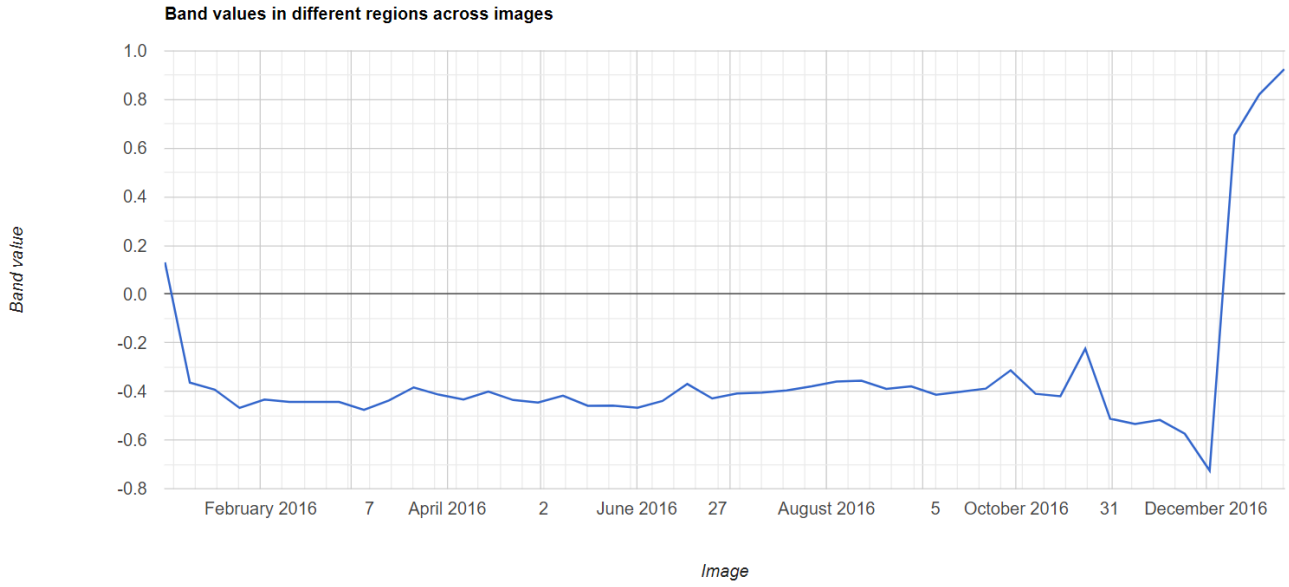
NDSI: NDSI stands for Normalized Difference Snow Index. NDSI is a measure of the relative magnitude of the reflectance difference between visible (green) and shortwave infrared (SWIR). It controls variance of two bands (one in the near infrared or short-wave infrared and another one in the visible parts of the spectrum).

$$\text{Normalized Difference Snow Index } (\mathbf{NDSI}) = \frac{(Green - SWIR)}{(Green + SWIR)}$$



The region with white colour shows areas with snow and black region shows landcover without snow.

Time series graph analysis:

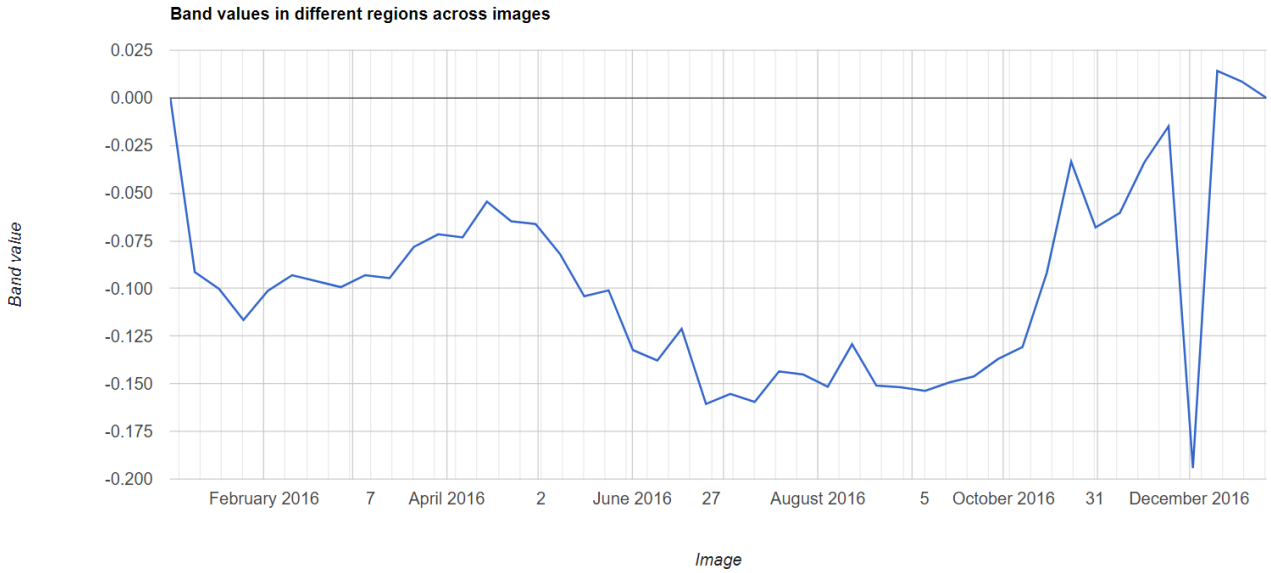


NDGI: NDGI stands for Normalized Difference Glacier Index. It is a numerical indicator that helps to detect and monitor glaciers by using the green and red spectral bands. The main remote sensing applications that NDGI is used are glacier detection and monitoring.

$$\text{Normalized Difference Glacier Index } (\mathbf{NDGI}) = \frac{(Green - Red)}{(Green + Red)}$$

The region with white colour shows areas with glacier and black region shows landcover without glacier.

Time series graph analysis:

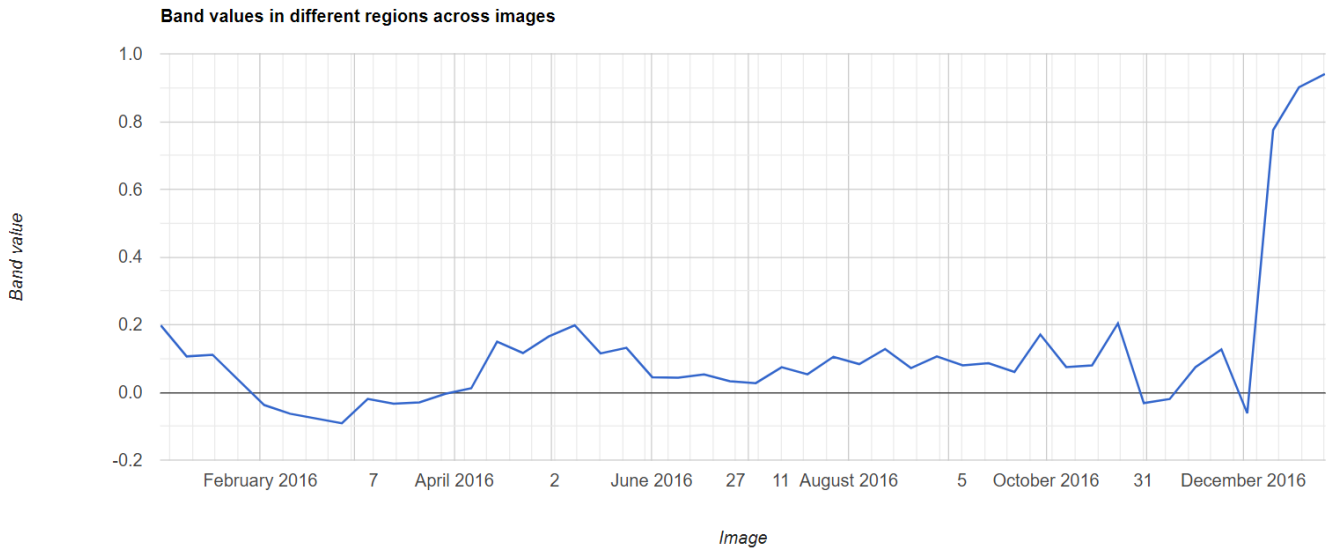


NDBI: NDBI stands for Normalized Difference Builtup Index. This index highlights urban areas where there is typically a higher reflectance in the shortwave-infrared (SWIR) region, compared to the near-infrared (NIR) region.

$$\text{Normalized Difference Builtup Index } (\mathbf{NDBI}) = \frac{(SWIR - NIR)}{(SWIR + NIR)}$$

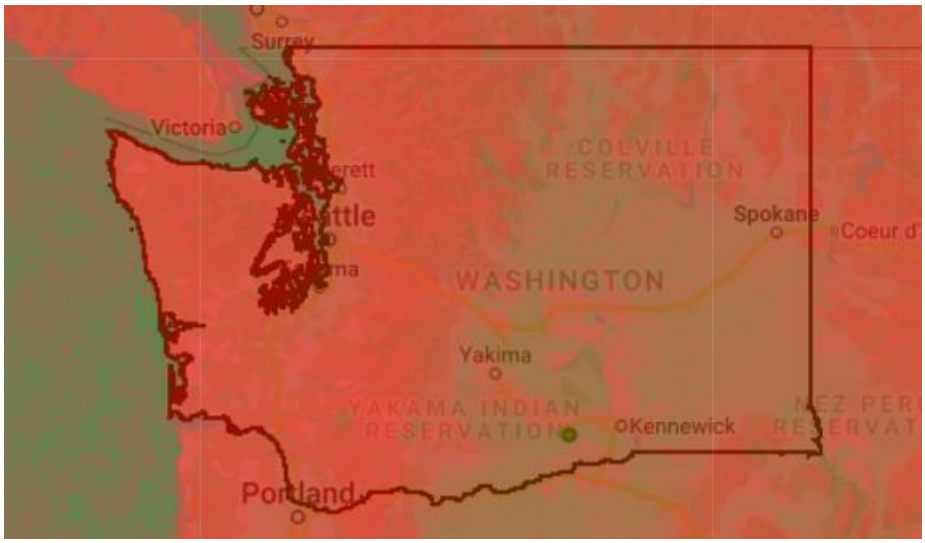
The region with black colour shows areas with high builtup and white region shows landcover with less builtup.

Time series graph analysis:



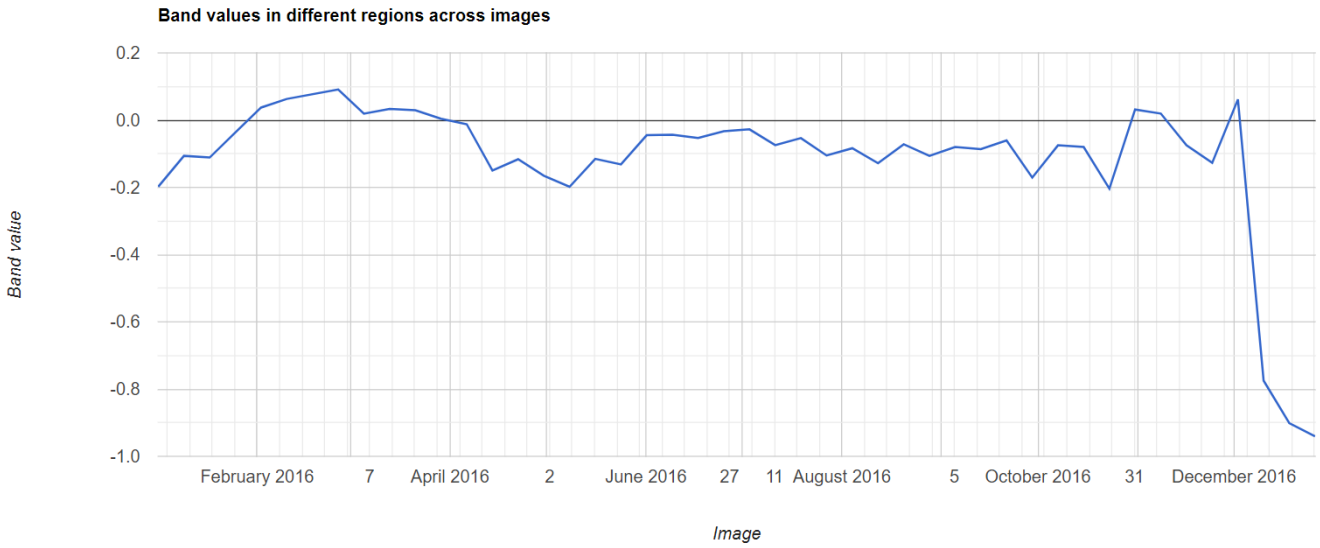
NBR: NBR stands for Normal Burn Ratio. It is used to identify burned areas and provide a measure of burn severity. It is calculated as a ratio between the NIR and SWIR values in traditional fashion.

$$Normalized\ Burn\ Ratio\ (\boldsymbol{NBR}) = \frac{(NIR - SWIR)}{(NIR + SWIR)}$$



The region with green colour shows areas with high burn and red region shows landcover with less burn.

Time Series Graph Analysis:

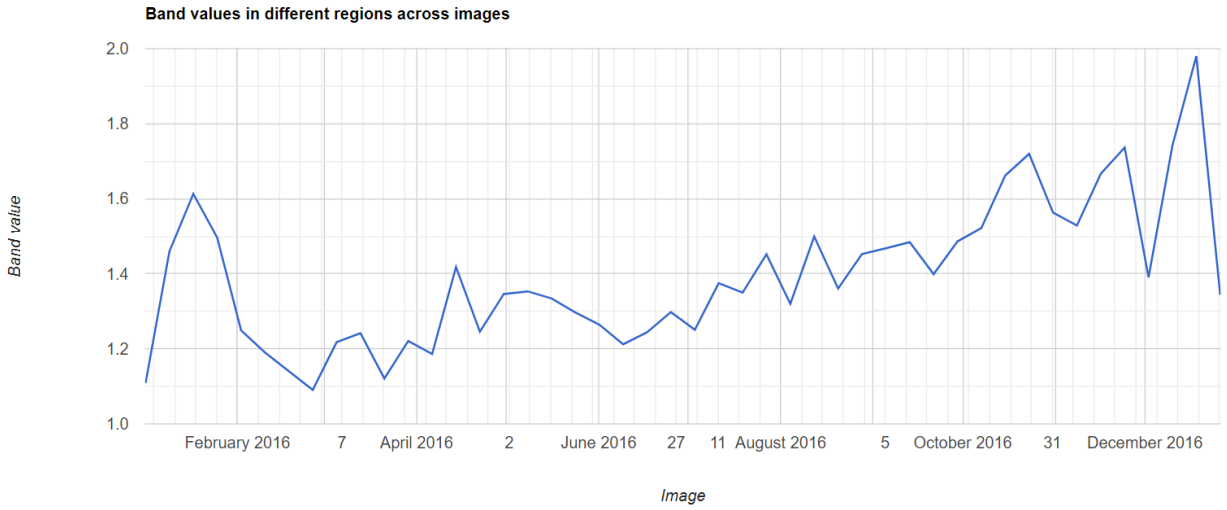


CMR: CMR stands for Clay mineral ratio. The clay ratio is a ratio of the SWIR1 and SWIR2 bands. This ratio leverages the fact that hydrous minerals such as the clays, alunite absorb radiation in the 2.0–2.3micron portion of the spectrum.

$$\boldsymbol{Clay\ Minerals\ Ratio} = \frac{SWIR-1}{SWIR-2}$$

The region with blue colour shows areas with high clay and green region shows landcover with less clay.

Time Series Graph Analysis:

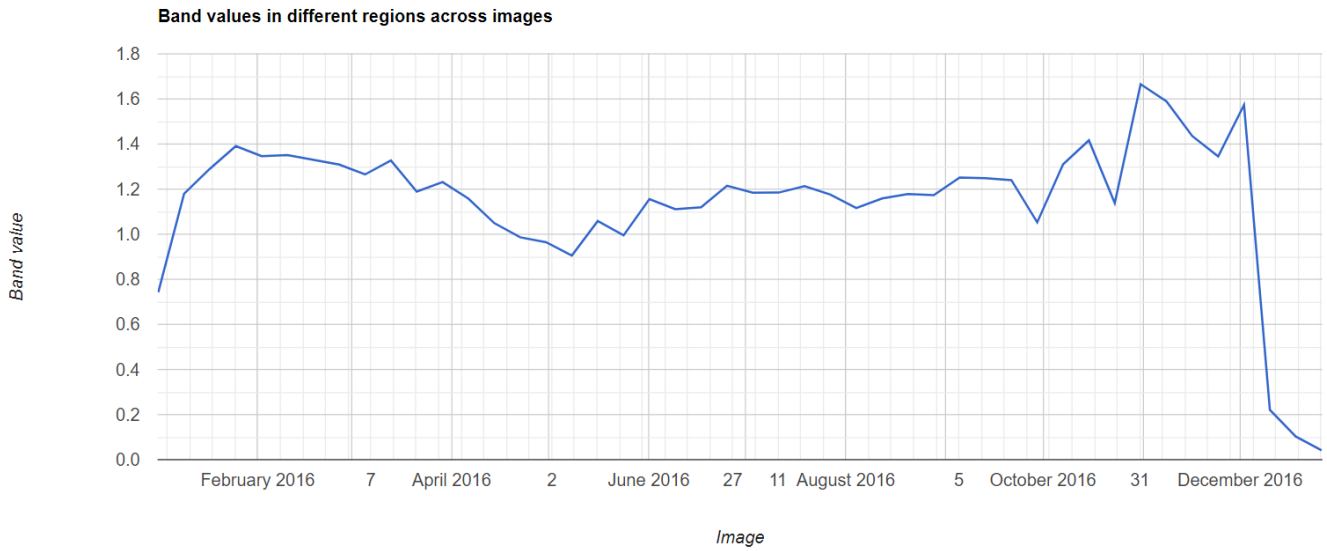


FMR: FMR stands for Ferrous Mineral Ratio. It is a geological index for identifying rock features containing some quantity of iron-bearing minerals using the shortwave infrared (SWIR) and near-infrared (NIR) bands.

$$\textbf{\textit{Ferrous Minerals Ratio}} = \frac{SWIR}{NIR}$$

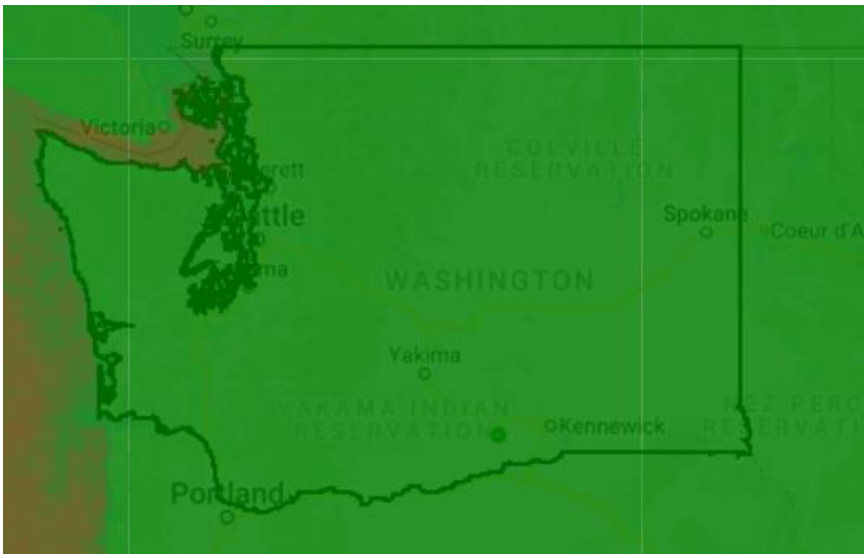
The region with green colour shows areas with high ferrous mineral and red region shows landcover with less ferrous mineral.

Time Series Graph Analysis:



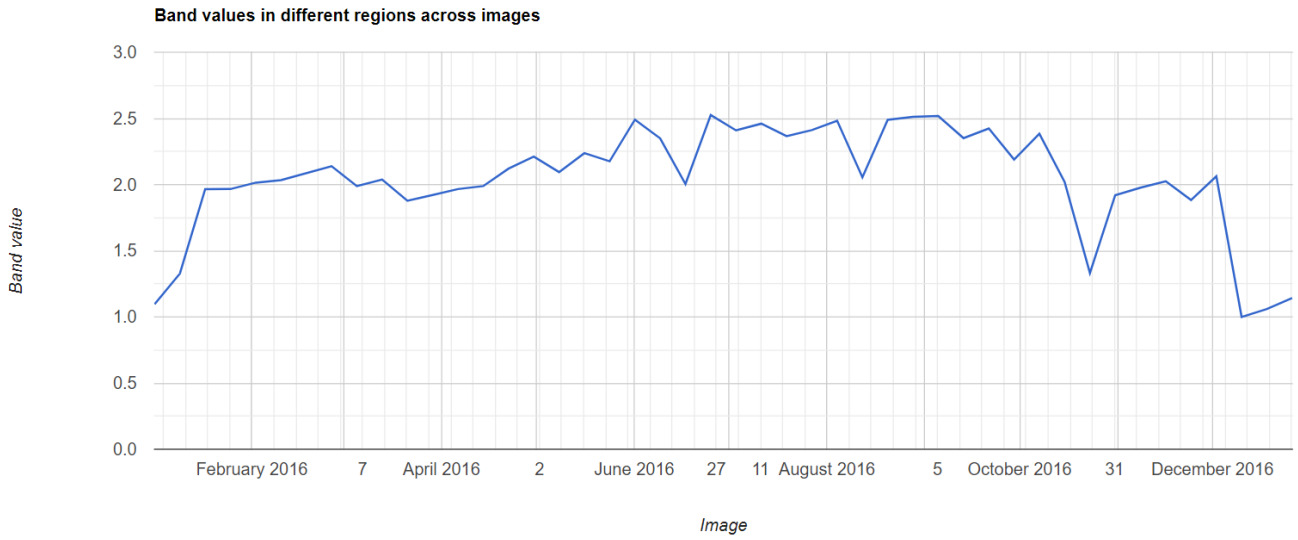
IOR: IOR stands for Iron Oxide Ratio. It measures the presence of iron ore.

$$\textbf{\textit{Iron Oxide Ratio}} = \frac{Red}{Blue}$$



The region with green colour shows areas with high iron ore and red region shows landcover with less iron ore.

Time series graph analysis:



Conclusions:

- We studied the different indexes for Washington(a state in USA).