ES3201 Mapping Assignment

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Introduction

Single-date and multi-temporal transformations for vegetation indices, Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI) were calculated for an area in Tanzania, East Africa. The extent used was 401969.980932, 458951.108324, -1112570.68153, -1068833.81618.

Comparison

The use of NDVI and EVI are compared in the table below. In the formula, the Landsat satellite band designation for NDVI is landsat-4 & 5 Thematic Mapper's Band 4 for Near Infrared (NIR), and Band 3 for Visible Red (RED). The corresponding Landsat satellite band designation for EVI is landsat-8 Operational Land Imager & Thermal Infrared Sensor's Band 5 for NIR, Band 4 for RED, and Band 2 for Visible Blue (BLUE).

<table>
<tr><td></td><td>Normalized Difference Vegetation Index (NDVI)</td><td>Enhanced Vegetation Index (EVI)</td></tr>
<tr><td>Formula</td><td>$\frac{(NIR - RED)}{NIR + RED}$</td><td>$\frac{2.5\ (NIR - RED)}{NIR + 6.0 * RED - 7.5 * BLUE + 1.0}$</td></tr>
<tr><td>Purpose</td><td>Differentiates between vegetated and non-vegetated land.</td><td>Differentiates between vegetated and non-vegetated land as well, but it is sensitive to areas with high biomass.</td></tr>
<tr><td rowspan="2">Shortcomings</td><td>Affected by:
Time of day
Shadowing
Air moisture
Soil variation
(VineView Blog, 2018)</td><td>EVI calculated using additional wavelengths of light to correct for inaccuracies of NDVI

(VineView Blog, 2018)</td></tr>
<tr><td colspan="2">Both are still affected by clouds and aerosols which can block the satellites' view, glare from the sun, and temporary instrument malfunctions (NASA Earth Observatory, 2000)</td></tr>
<tr><td>Landsat satellite band designation</td><td>Landsat-4 & 5 Thematic Mapper</td><td>Landsat-8 Operational Land Imager & Thermal Infrared Sensor</td></tr>
<tr><td>Range</td><td colspan="2">-1 to 1</td></tr>
</table>

Normalized Difference Vegetation Index (NDVI) Change

In the following images (Figure 1 and 2), purple represents low NDVI with lesser vegetation, and yellow represents high NDVI, with more vegetation.

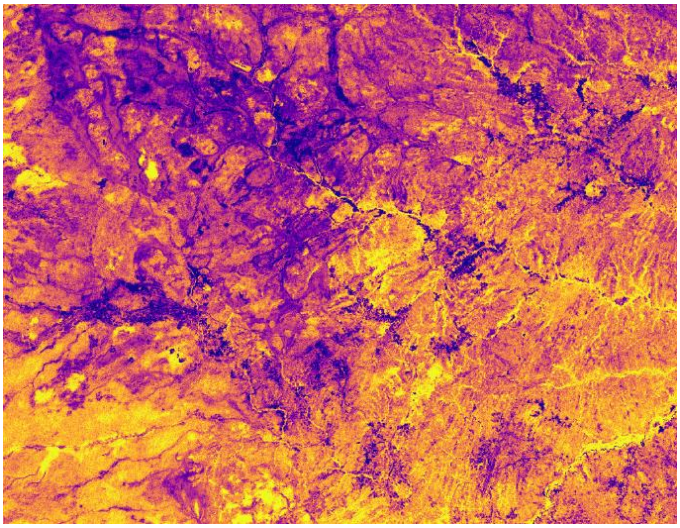

Figure 1. Map showing NDVI of area in 1993.

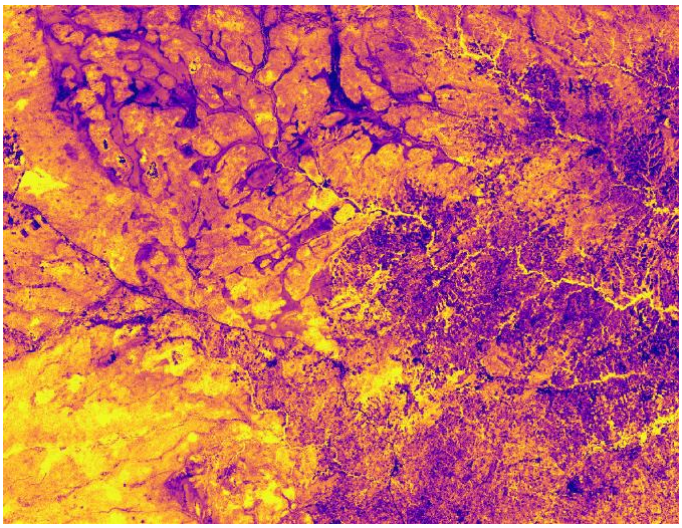

Figure 2. Map showing NDVI of area in 2016.

The following map (Figure 3) shows the change in NDVI from 1993 to 2016. Blue represents NDVI increase and red represents NDVI decrease. There seems to be a general increase in NDVI in the west, and a general decrease in NDVI in the east from 1993 to 2016. A histogram (Figure 4) also shows that there is generally more positive NDVI difference values than negative ones, indicating there is a net increase in NDVI.

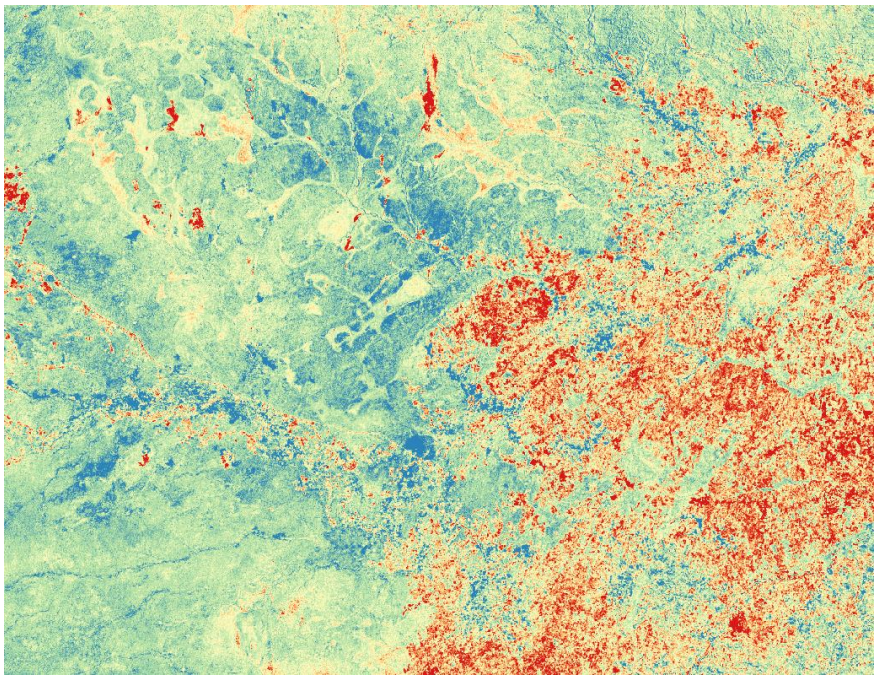

Figure 3. Map showing change in NDVI in area from 1993 to 2016.

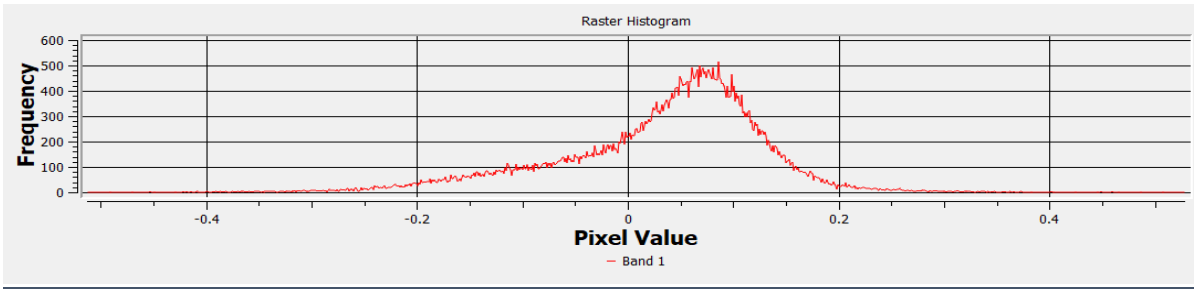

Figure 4. Histogram showing change in NDVI

Enhanced Vegetation Index (EVI) Change

In the following maps (Figure 5 and 6), purple represents low EVI with lesser vegetation, and yellow represents high EVI, with more vegetation.

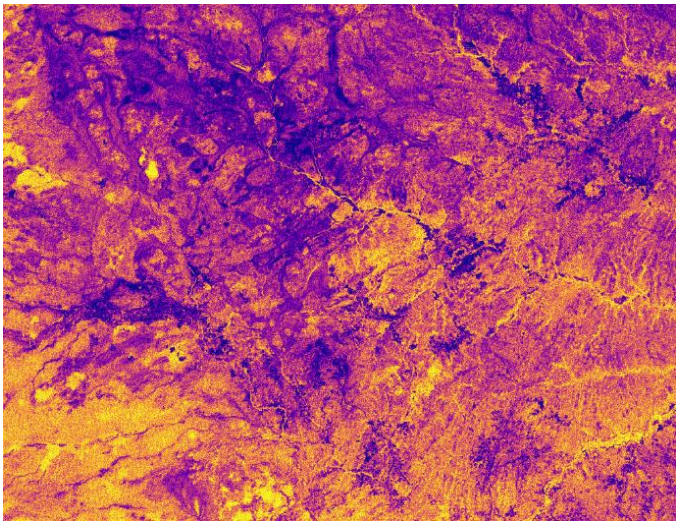

Figure 5. Map showing EVI of area in 1993.

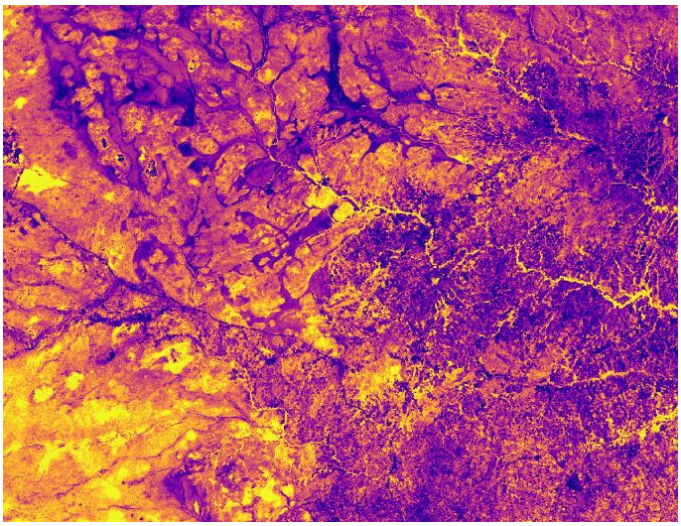

Figure 6. Map showing EVI of area in 201.

The following map (Figure 7) shows the change in EVI from 1993 to 2016. Blue represents EVI increase and red represents EVI decrease. Like NDVI, there seems to be a general increase in EVI in the west, and a general decrease in EVI in the east from 1993 to 2016. A histogram (Figure 8) also shows that there is generally more positive EVI difference values than negative ones, indicating there is a net increase in EVI.

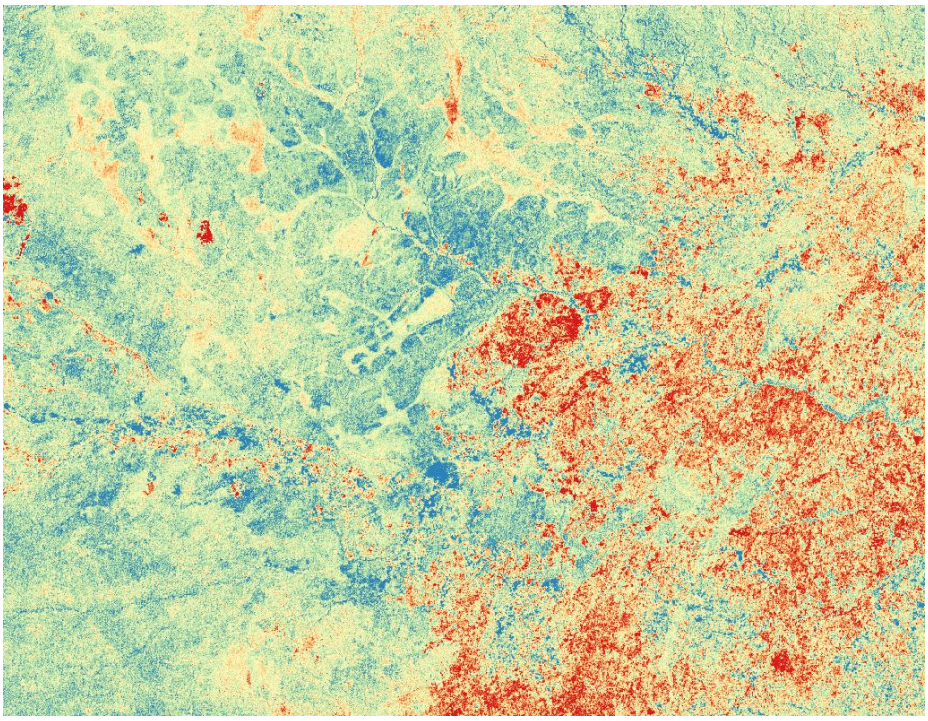

Figure 7. Map showing change in EVI in area from 1993 to 2016.

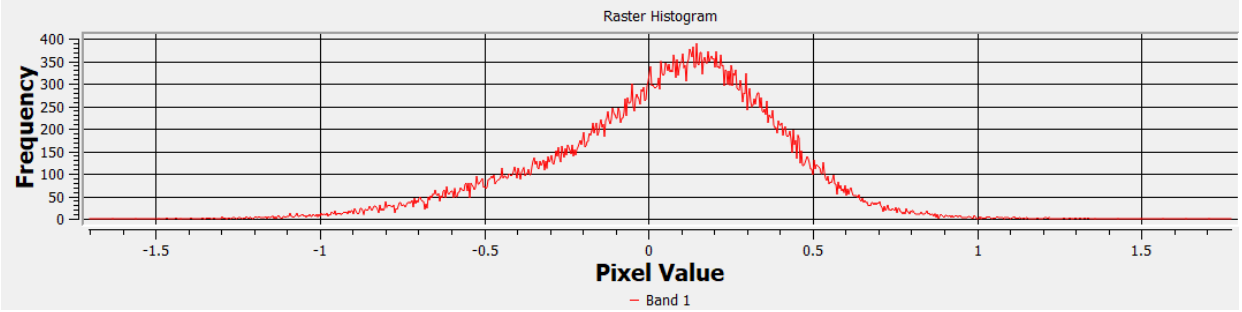

Figure 8. Histogram showing change in EVI

Bibliography

NASA Earth Observatory, 2000. *Measuring Vegetation (NDVI & EVI) - NASA Earth Observatory.* [Online]
Available at: https://earthobservatory.nasa.gov/features/MeasuringVegetation/measuring_vegetation_4.php
[Accessed 31 March 2019].

VineView Blog, 2018. *EVI vs NDVI: What's the difference? | VineView Blog.* [Online]
Available at: https://www.vineview.ca/2018/04/evi-vs-ndvi-whats-difference/
[Accessed 31 March 2019].