

## EOCap4Africa – 9b Raster Analysis

### Sample Solution – Vegetation Indices

#### Project Setup

- Start QGIS and create a new project file.
- Get a background map using **Web -> QuickMapServices -> OSM -> OSM-Standard**.

#### Load Sentinel-2 Bands into QGIS

- Navigate to the Sentinel-2 folder (.SAFE)., where you should select the following bands for this analysis:
  - **B03** (Green, 10m)
  - **B04** (Red, 10m)
  - **B08** (NIR, 10m)
  - **B11** (SWIR, 20m)
- If you are unsure why we need to select these bands, you can go back to the 9a slides and check out the formulas of the Vegetation Indices

## Resample B11 to 10m

- B11, with its 20m resolution, is too coarse compared to our other bands, so we need to resample it. The resampling tool is part of the SCP plugin -> PreProcessing -> Reproject Raster Bands. Simply input B11, set the X and Y resolution to 10 and run the Tool

Remotior Sensus - Reproject Raster Bands

Parameters Log

Input raster list

1 input selected

Align raster [optional]

Same extent as reference [optional]

EPSG code [optional]

X resolution [optional]

10,000000

Y resolution [optional]

10,000000

Resample pixel factor [optional]

Not set

Resampling method

nearest\_neighbour

Output data type

Float32

0%

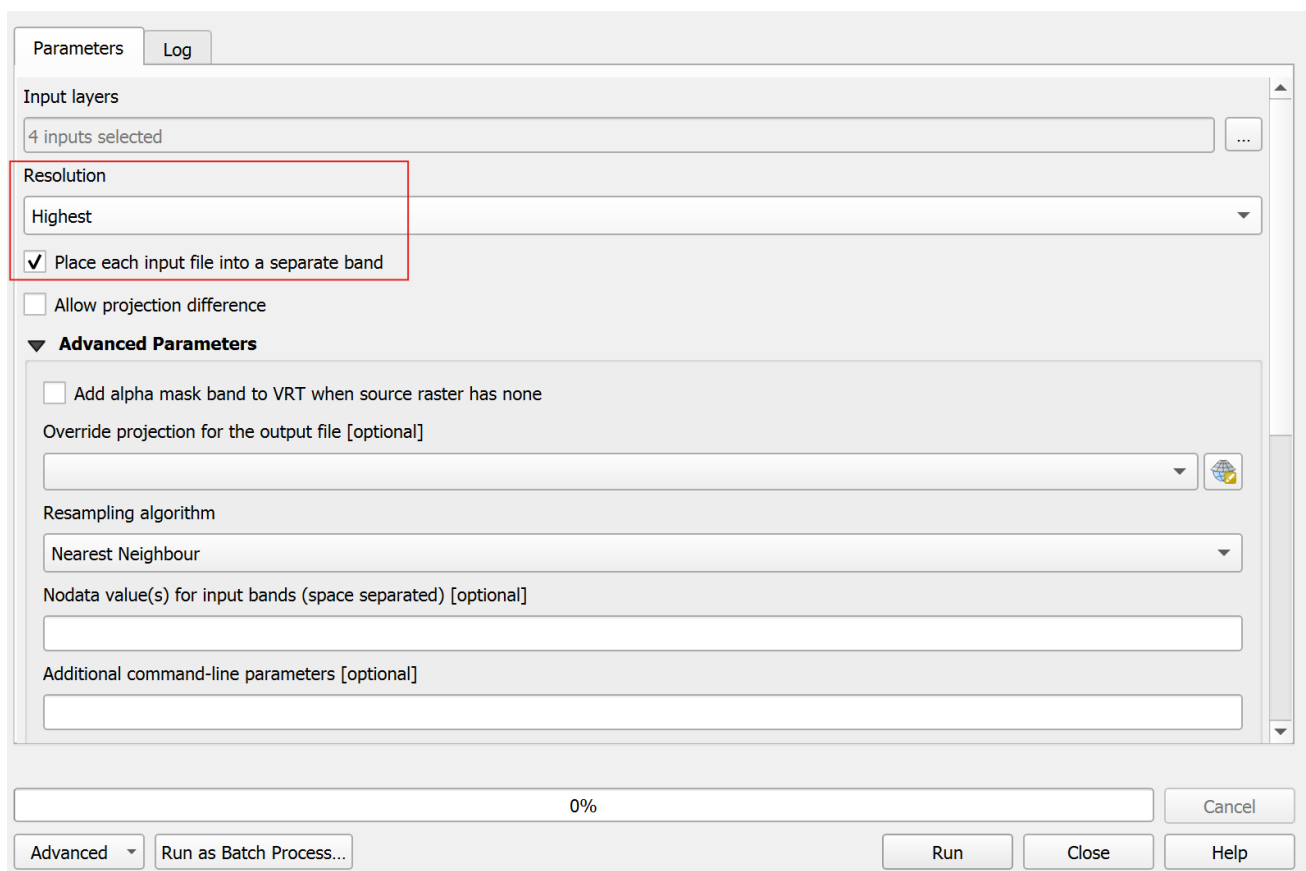
Advanced Run as Batch Process... Run Close

**Reproject raster bands**

Perform the resampling and reprojection of bands.  
[Tool description](#)

## Create a Virtual Raster

- Next, we can merge the 4 bands into one cohesive raster image by using the tool “Create Virtual Raster” in the Miscellaneous tab of the raster tools. Input the bands, select “highest” for resolution, and remember to tick the box that ensures that all input layers will be treated as individual bands.



Parameters Log

Input layers  
4 inputs selected

Resolution  
Highest

☒ Place each input file into a separate band

☐ Allow projection difference

▼ **Advanced Parameters**

☐ Add alpha mask band to VRT when source raster has none

Override projection for the output file [optional]  
[ ]

Resampling algorithm  
Nearest Neighbour

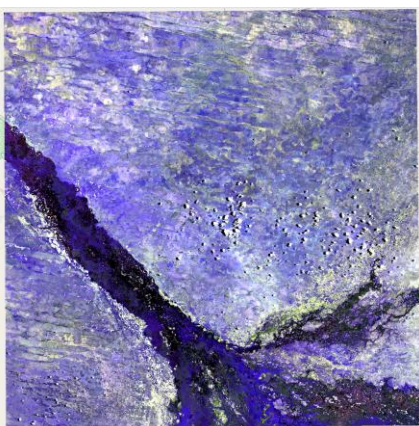
Nodata value(s) for input bands (space separated) [optional]  
[ ]

Additional command-line parameters [optional]  
[ ]

0%

Advanced ▼ Run as Batch Process... Run Close Help

## Result:



## Clip Raster to Study Area

- Now, we can clip the raster to the actual size of our study area to make the analysis more computationally efficient. Use the Clip Raster by Mask Layer Tool under Raster -> Extraction.

Raster Extraction - Clip Raster by Mask Layer

Parameters Log

Input layer  
Virtual\_Raster [EPSG:32734]

Mask layer  
Study\_Area [EPSG:4326]

☐ Selected features only

Source CRS [optional]

Target CRS [optional]

Target extent [optional]  
Not set

Assign a specified nodata value to output bands [optional]  
Not set

☐ Create an output alpha band

☒ Match the extent of the clipped raster to the extent of the mask layer

☒ Keep resolution of input raster

0%

Advanced Run as Batch Process... Run Close Help

## Calculate the NDVI

- For the Vegetation Index Calculations, we can use the Raster Calculator. Use the Formula provided in lecture 9a to calculate the NDVI and save the output as a new Raster file.
- **Formula:** 
$$\frac{(\text{"Raster\_Study\_Area@3"} - \text{"Raster\_Study\_Area@2"})}{(\text{"Raster\_Study\_Area@3"} + \text{"Raster\_Study\_Area@2"})}$$

**Raster Calculator**

**Raster Bands**

- Raster\_Study\_Area@1
- Raster\_Study\_Area@2
- Raster\_Study\_Area@3
- Raster\_Study\_Area@4
- Virtual\_Raster@1
- Virtual\_Raster@2
- Virtual\_Raster@3
- Virtual\_Raster@4

**Result Layer**

☐ Create on-the-fly raster instead of writing layer to disk

Output layer: ata\9b Vegetation Indices Practical\NDVI

Output format: GeoTIFF

**Spatial Extent**

Use Selected Layer Extent

X min: 651630,00000 X max: 688800,00000

Y min: 7892130,00000 Y max: 7924670,00000

**Resolution**

Columns: 3717 Rows: 3254

Output CRS: EPSG:32734 - WGS 84 / UTM zone 3

☒ Add result to project

**Operators**

|    |    |    |     |      |       |      |
|----|----|----|-----|------|-------|------|
| +  | *  | (  | min | IF   | cos   | acos |
| -  | /  | )  | max | AND  | sin   | asin |
| <  | >  | =  | abs | OR   | tan   | atan |
| <= | >= | != | ^   | sqrt | log10 | ln   |

**Raster Calculator Expression**

( "Raster\_Study\_Area@3" - "Raster\_Study\_Area@2" ) / ( "Raster\_Study\_Area@3" + "Raster\_Study\_Area@2" )

OK Cancel Help

## Calculate the NDWI

- For the Vegetation Index Calculations, we can use the Raster Calculator. Use the Formula provided in lecture 9a to calculate the NDWI and save the output as a new Raster file.
- **Formula:** 
$$\frac{(\text{"Raster\_Study\_Area@3"} - \text{"Raster\_Study\_Area@1"})}{(\text{"Raster\_Study\_Area@3"} + \text{"Raster\_Study\_Area@1"})}$$

**Raster Bands**

- Raster\_Study\_Area@1
- Raster\_Study\_Area@2
- Raster\_Study\_Area@3
- Raster\_Study\_Area@4
- Virtual\_Raster@1
- Virtual\_Raster@2
- Virtual\_Raster@3
- Virtual\_Raster@4

**Result Layer**

☐ Create on-the-fly raster instead of writing layer to disk

Output layer: a\9b Vegetation Indices Practical\NDVI.tif

Output format: GeoTIFF

**Spatial Extent**

☒ Use Selected Layer Extent

X min: 651630,00000 X max: 688800,00000

Y min: 7892130,00000 Y max: 7924670,00000

**Resolution**

Columns: 3717 Rows: 3254

Output CRS: EPSG:32734 - WGS 84 / UTM zone 3

☒ Add result to project

**Operators**

|    |    |    |     |      |       |      |
|----|----|----|-----|------|-------|------|
| +  | *  | (  | min | IF   | cos   | acos |
| -  | /  | )  | max | AND  | sin   | asin |
| <  | >  | =  | abs | OR   | tan   | atan |
| <= | >= | != | ^   | sqrt | log10 | ln   |

**Raster Calculator Expression**

( "Raster\_Study\_Area@3" - "Raster\_Study\_Area@1" ) / ( "Raster\_Study\_Area@3" + "Raster\_Study\_Area@1" )

OK Cancel Help

## Calculate the NDMI

- For the Vegetation Index Calculations, we can use the Raster Calculator. Use the Formula provided in lecture 9a to calculate the NDMI and save the output as a new Raster file.
- **Formula:** 
$$\frac{(\text{"Raster\_Study\_Area@3"} - \text{"Raster\_Study\_Area@4"})}{(\text{"Raster\_Study\_Area@3"} + \text{"Raster\_Study\_Area@4"})}$$

**Raster Calculator**

**Raster Bands**

- NDVI@1
- NDWI@1
- Raster\_Study\_Area@1
- Raster\_Study\_Area@2
- Raster\_Study\_Area@3
- Raster\_Study\_Area@4
- Virtual\_Raster@1
- Virtual\_Raster@2
- Virtual\_Raster@3
- Virtual\_Raster@4

**Result Layer**

☐ Create on-the-fly raster instead of writing layer to disk

Output layer: ata\9b Vegetation Indices Practical\NDMI

Output format: GeoTIFF

**Spatial Extent**

X min: 651630,00000 X max: 688800,00000

Y min: 7892130,00000 Y max: 7924670,00000

**Resolution**

Columns: 3717 Rows: 3254

Output CRS: EPSG:32734 - WGS 84 / UTM zone 3

☒ Add result to project

**Operators**

|    |    |    |     |      |       |      |
|----|----|----|-----|------|-------|------|
| +  | *  | (  | min | IF   | cos   | acos |
| -  | /  | )  | max | AND  | sin   | asin |
| <  | >  | =  | abs | OR   | tan   | atan |
| <= | >= | != | ^   | sqrt | log10 | ln   |

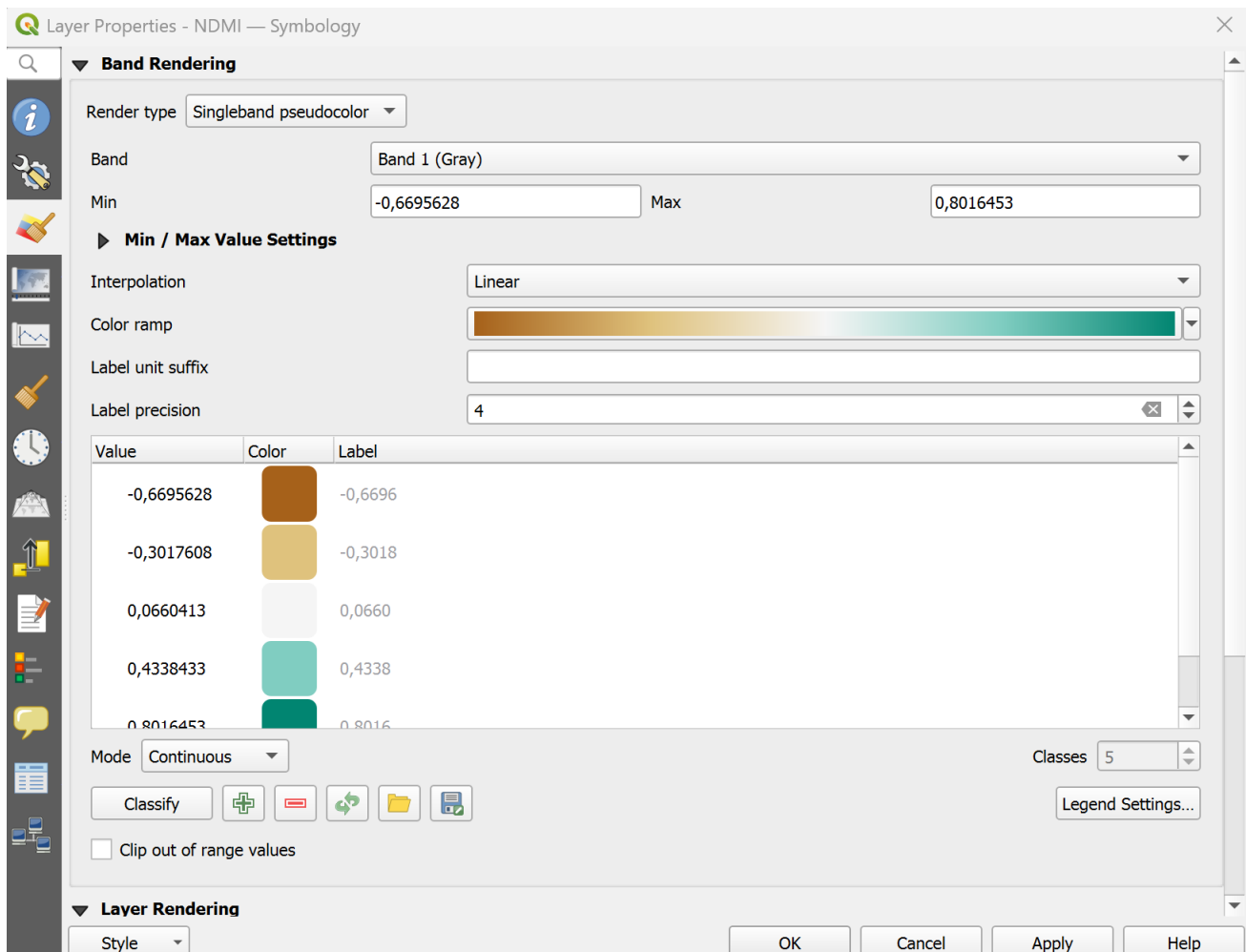
**Raster Calculator Expression**

```
( "Raster_Study_Area@3" - "Raster_Study_Area@4" ) / ( "Raster_Study_Area@3" + "Raster_Study_Area@4" )
```

OK Cancel Help

## Designing the Map

- In the Layer properties, set the Symbology to Singelband Pseudocolor and choose a fitting color ramp for your Index, eg. NDVI is traditionally red to green!



Now all that is left to do is create a map showing the three vegetation Indices side by side!