

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

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

0% Cancel

Advanced Run as Batch Process... Run Close

Create a virtual raster

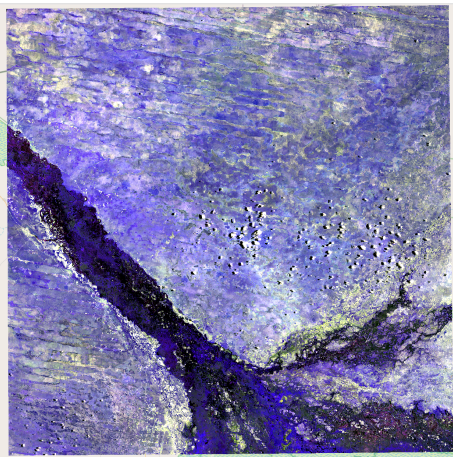
- Next, we can merge the 4 bands into one cohesive raster image by using the tool “Create Virtual Raster” in the Miscellaneous tab of the raster tools. Input the bands, select “highest” for resolution, and remember to tick the box that ensures that all input layers will be treated as individual bands.

The screenshot shows the 'Create Virtual Raster' dialog box with the following settings:

- Parameters** tab is selected.
- Input layers:** 4 inputs selected.
- Resolution:** Highest (highlighted with a red box).
- ☒ Place each input file into a separate band (highlighted with a red box).
- ☐ Allow projection difference.
- Advanced Parameters** (expanded):
 - ☐ Add alpha mask band to VRT when source raster has none.
 - Override projection for the output file [optional]: (empty dropdown).
 - Resampling algorithm: Nearest Neighbour.
 - Nodata value(s) for input bands (space separated) [optional]: (empty text field).
 - Additional command-line parameters [optional]: (empty text field).

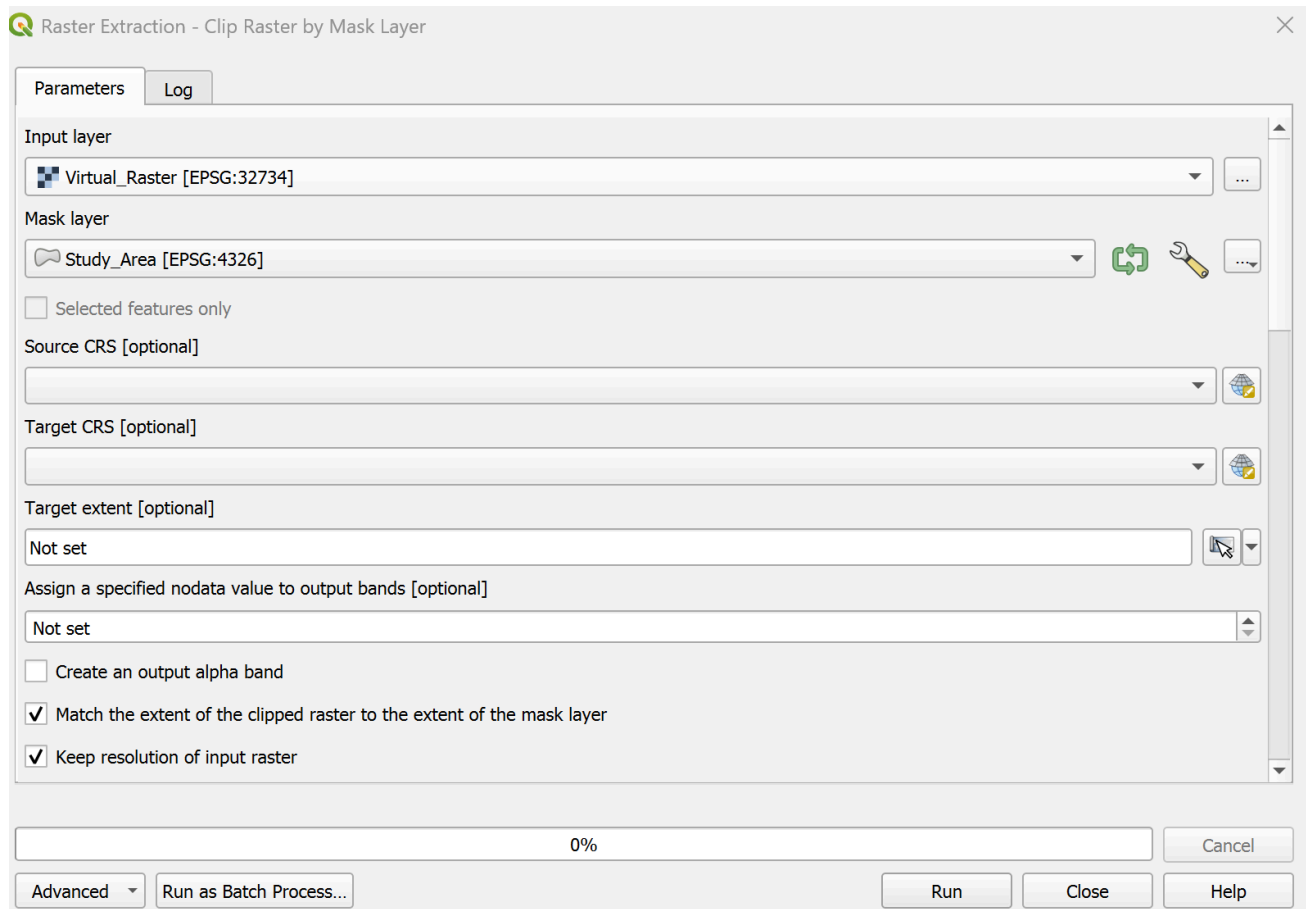
At the bottom, there is a progress bar at 0%, a 'Cancel' button, and a 'Run' button. The 'Advanced' dropdown is set to 'Advanced' and 'Run as Batch Process...' is also visible.

Result:



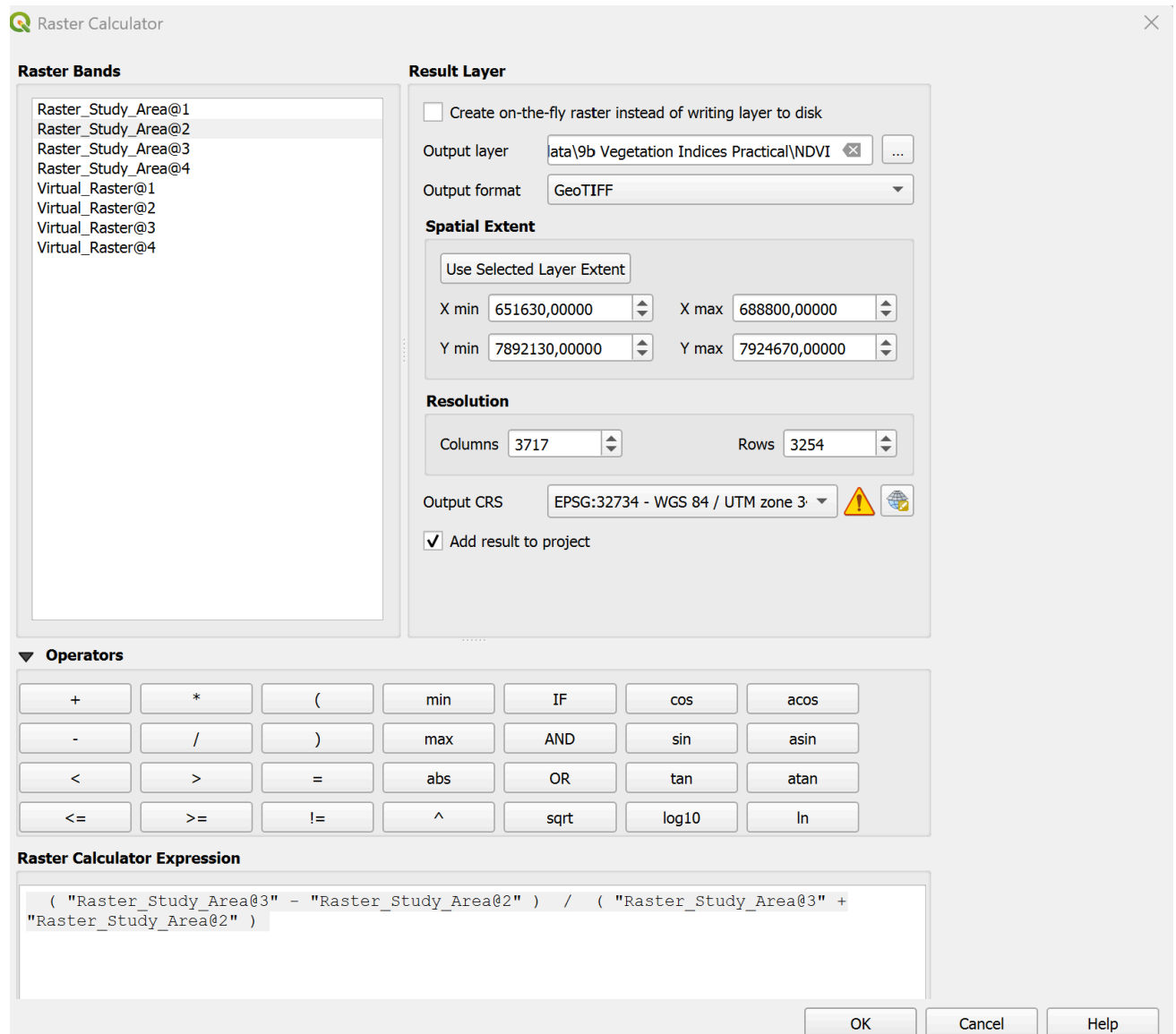
Clip raster to study area

- 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.



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:**
$$\frac{("Raster_Study_Area@3" - "Raster_Study_Area@2")}{("Raster_Study_Area@3" + "Raster_Study_Area@2")}$$



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 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: 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

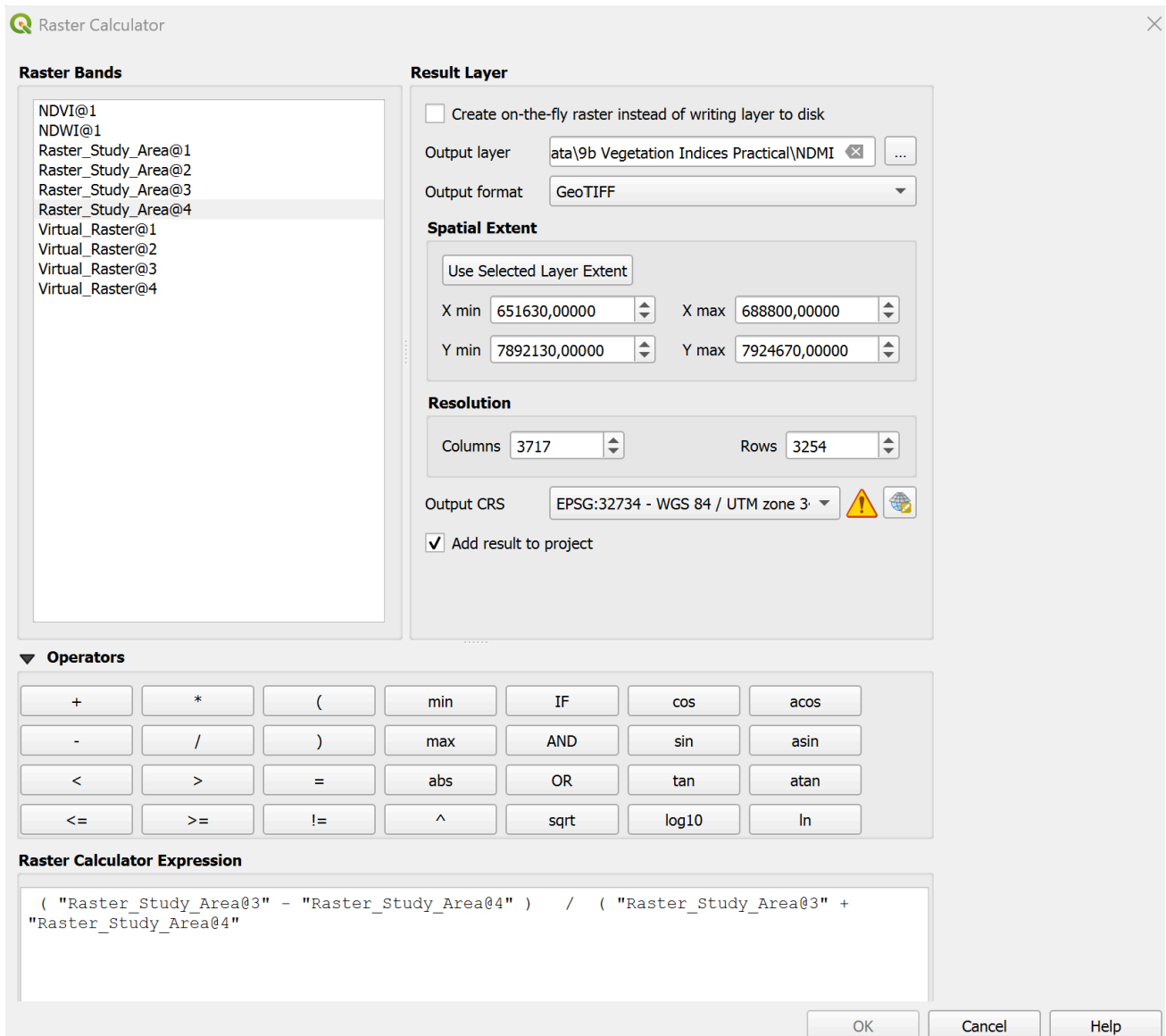
Raster Calculator Expression

```
( "Raster_Study_Area@3" - "Raster_Study_Area@1" ) / ( "Raster_Study_Area@3" + "Raster_Study_Area@1" )
```

OK Cancel Help

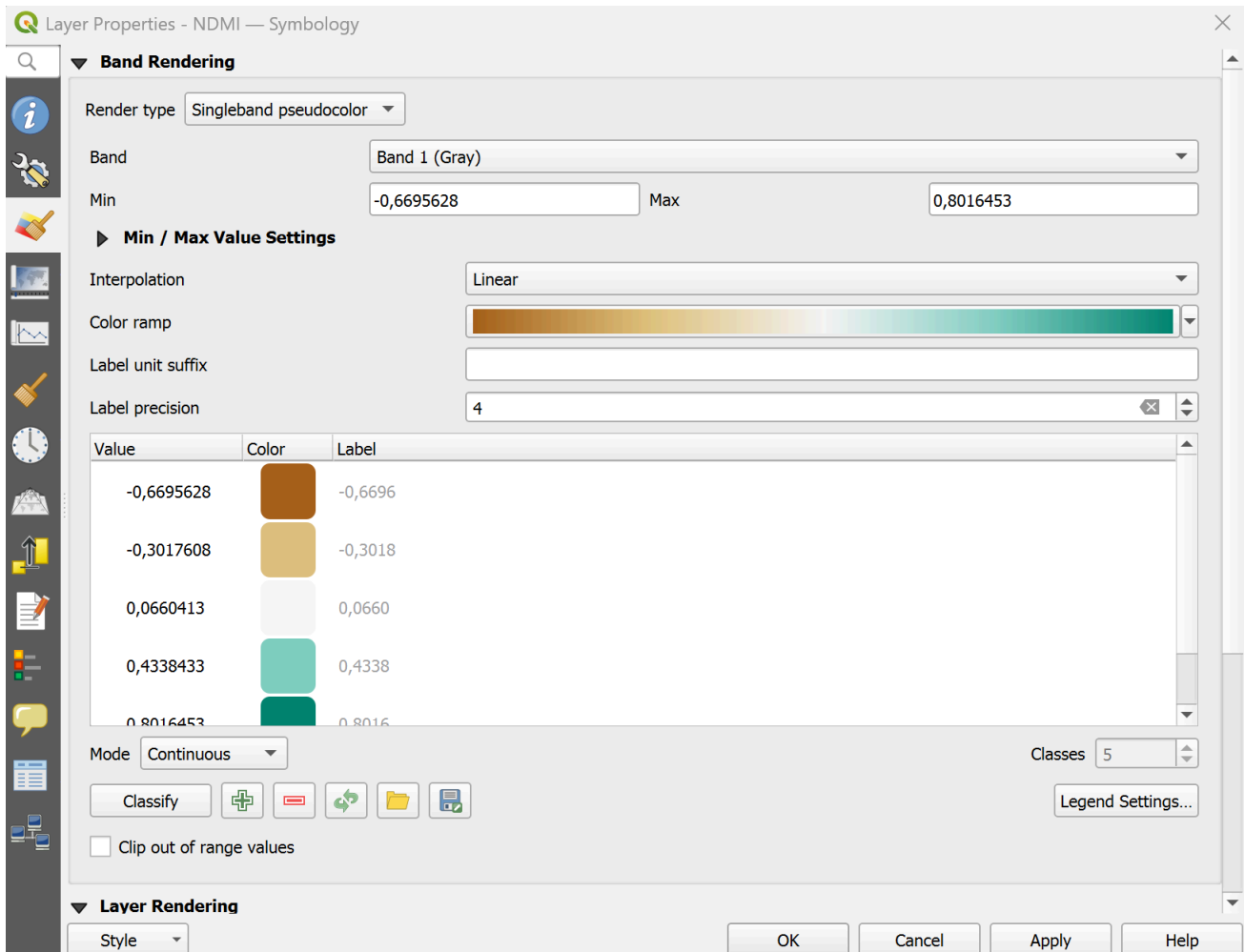
Calculate the NDMI

- 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:**
$$\frac{("Raster_Study_Area@3" - "Raster_Study_Area@4")}{("Raster_Study_Area@3" + "Raster_Study_Area@4")}$$



Designing the map

- In the Layer properties, set the Symbology to Singleband Pseudocolour and choose a fitting colour 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!