ICIMOD

Empowering Women in Geospatial Information Technology

Remote Sensing based Indices

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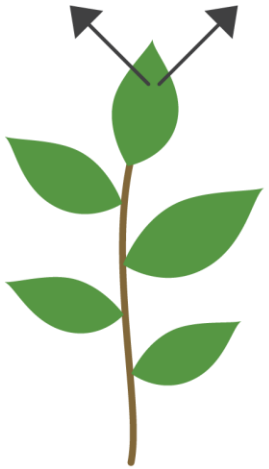
NDVI calculation

HEALTHY
VEGETATION REFLECTANCE

50% NIR 8% RED



NDVI = 0.72

STRESSED
VEGETATION REFLECTANCE

40% NIR 30% RED

NDVI = 0.14

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

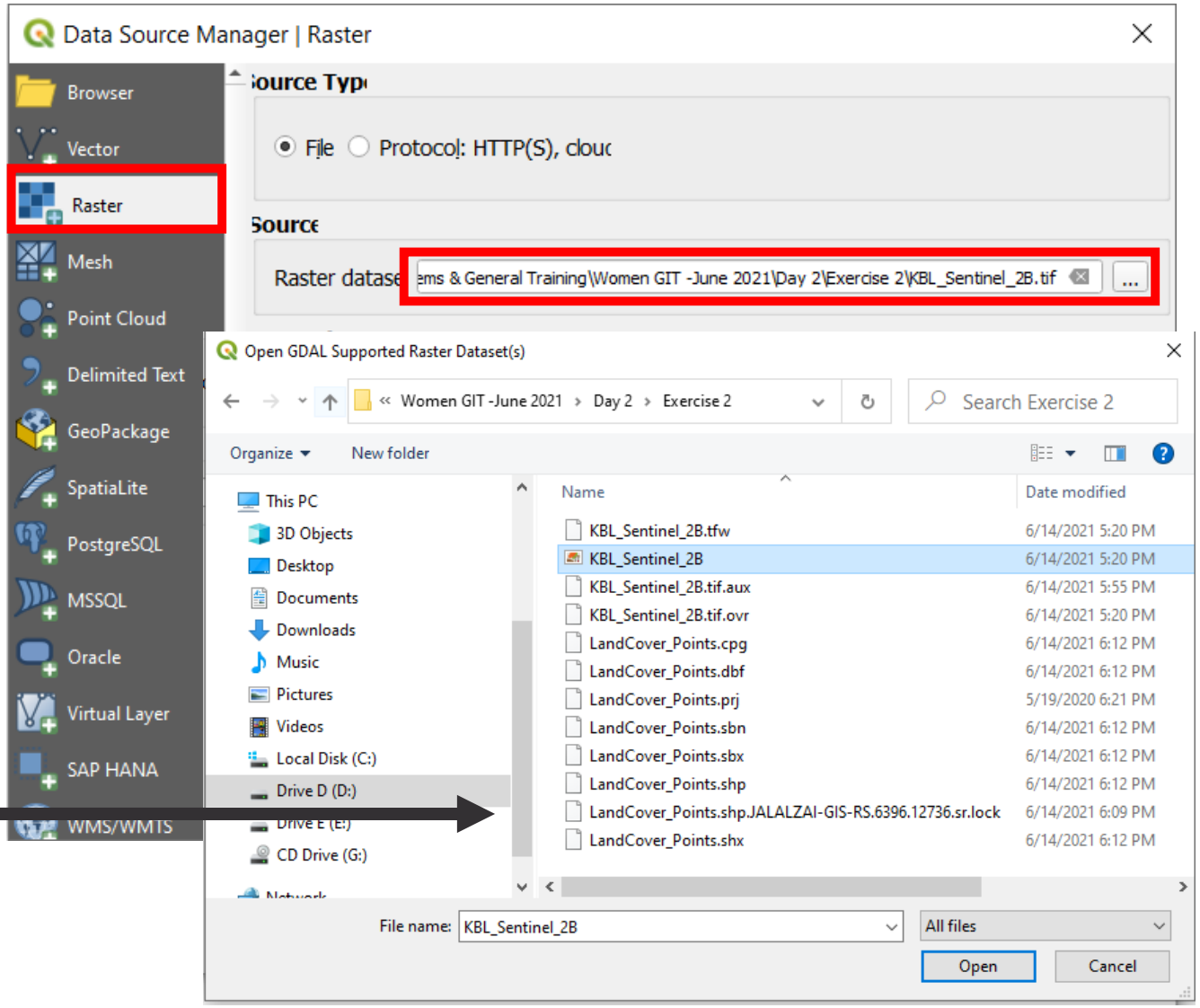
Band	Resolution	Central Wavelength	Description
B1	60 m	443 nm	Ultra blue (Coastal and Aerosol)
B2	10 m	490 nm	Blue
B3	10 m	560 nm	Green
B4	10 m	665 nm	Red
B5	20 m	705 nm	Visible and Near Infrared (VNIR)
B6	20 m	740 nm	Visible and Near Infrared (VNIR)
B7	20 m	783 nm	Visible and Near Infrared (VNIR)
B8	10 m	842 nm	Visible and Near Infrared (VNIR)
B8a	20 m	865 nm	Visible and Near Infrared (VNIR)
B9	60 m	940 nm	Short Wave Infrared (SWIR)
B10	60 m	1375 nm	Short Wave Infrared (SWIR)
B11	20 m	1610 nm	Short Wave Infrared (SWIR)
B12	20 m	2190 nm	Short Wave Infrared (SWIR)

NDVI calculation

- Open QGIS in your Laptop
- Click on the sign in the **manage layers toolbar** panel

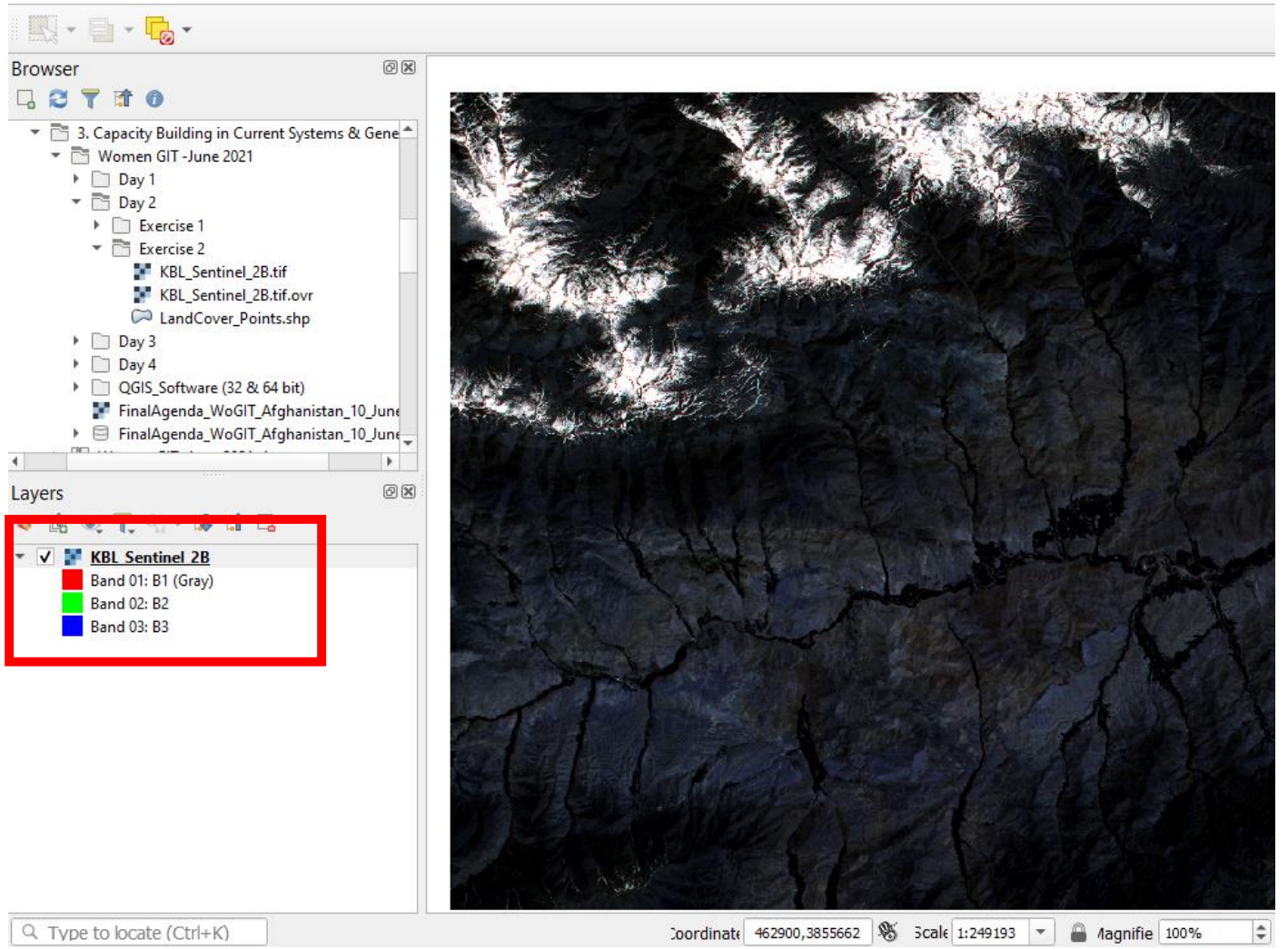
- A window opens
- Navigate to your image data folder **(Day 2\Exercise 2)**

- Select the **KBL_Sentinel_2B.tif** and add in the QGIS



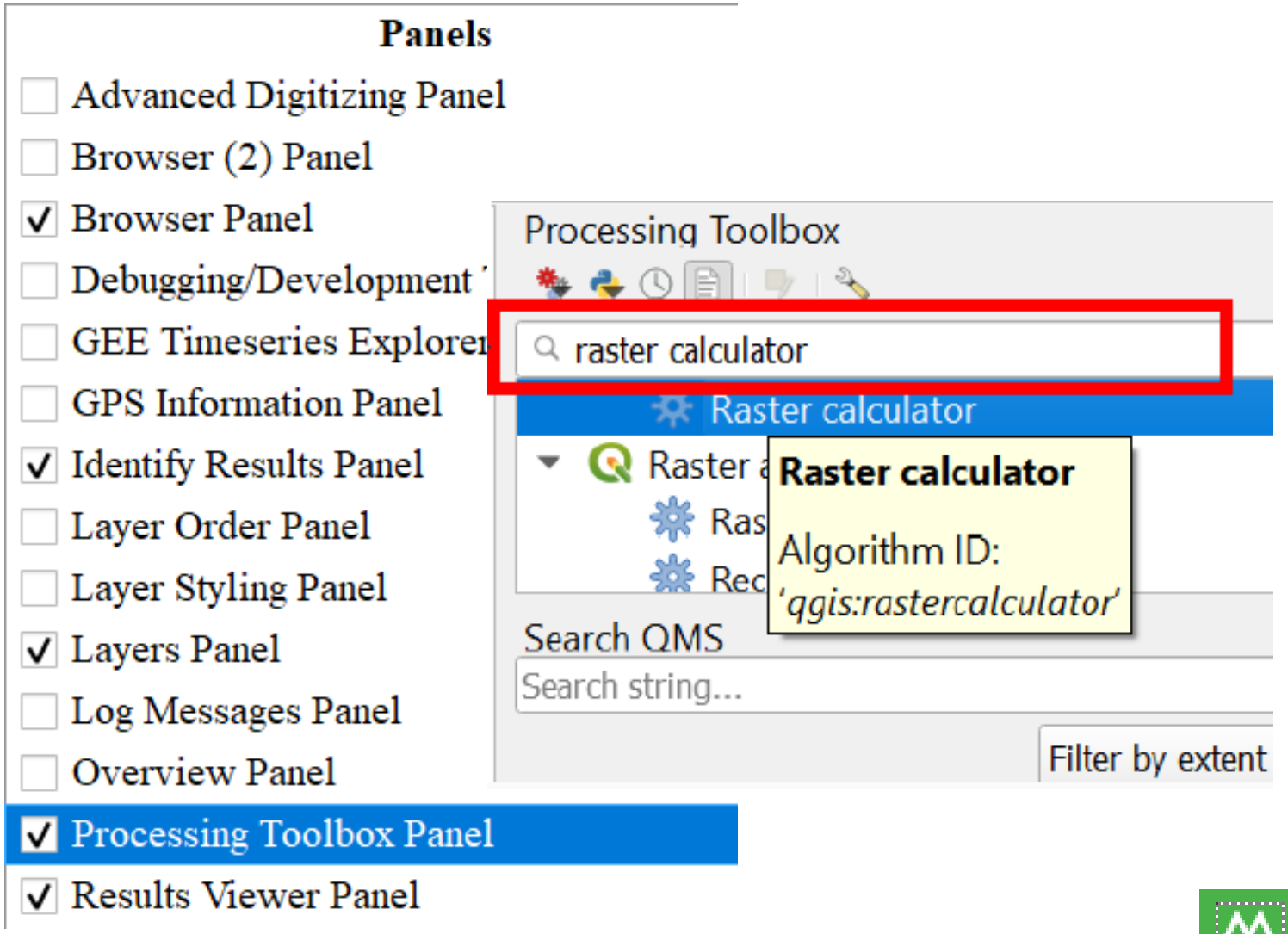
NDVI calculation

- Select the **KBL_Sentinel_2B.tif** and add in the QGIS
- Click **ADD**
- The layer is added in the layer panel



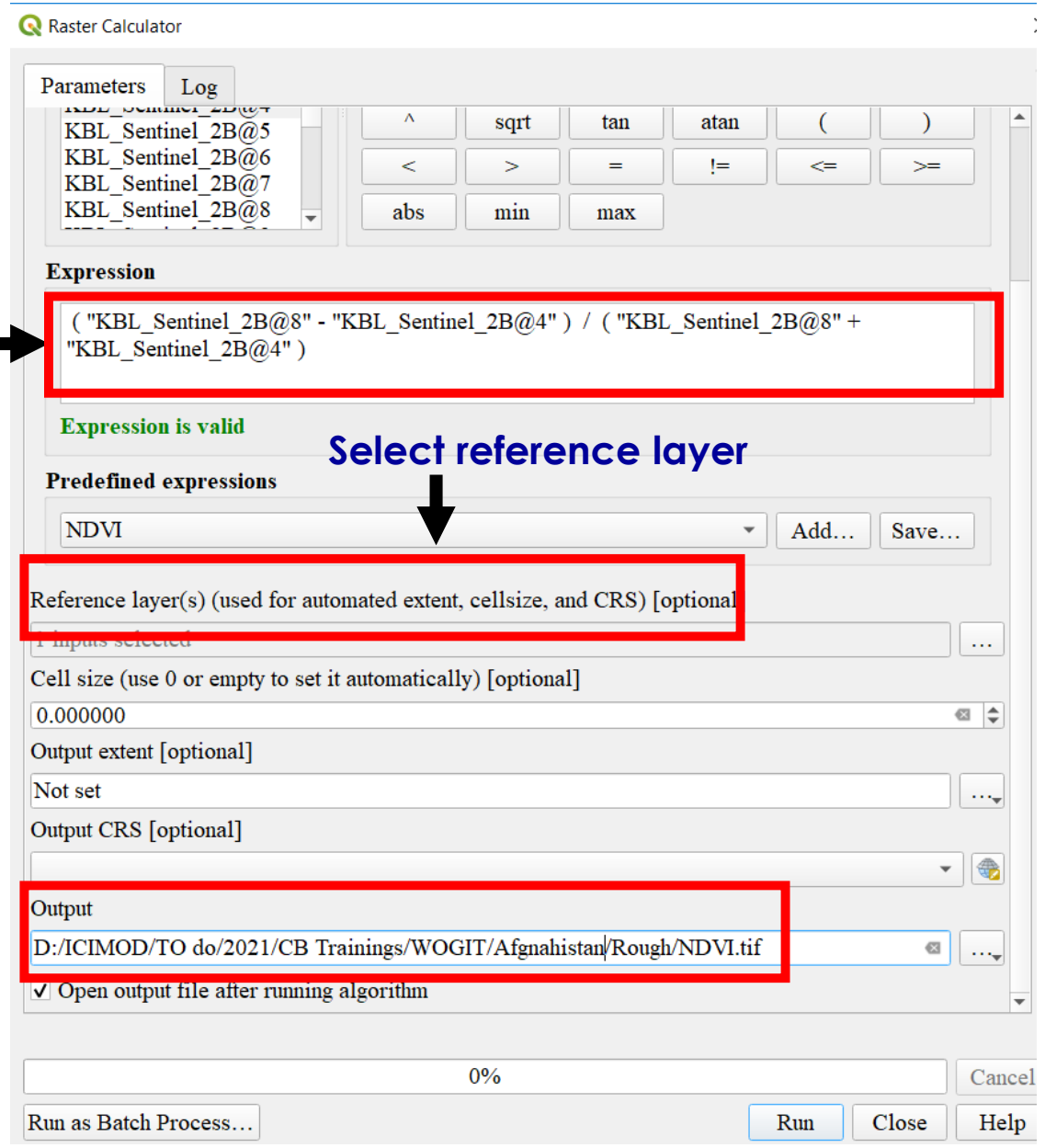
NDVI calculation

- Add **Processing Toolbox Panel** in your QGIS interface
- Type **Raster calculator** in the search bar of Processing Toolbox
- Double click and open the **Raster calculator**
- A window opens

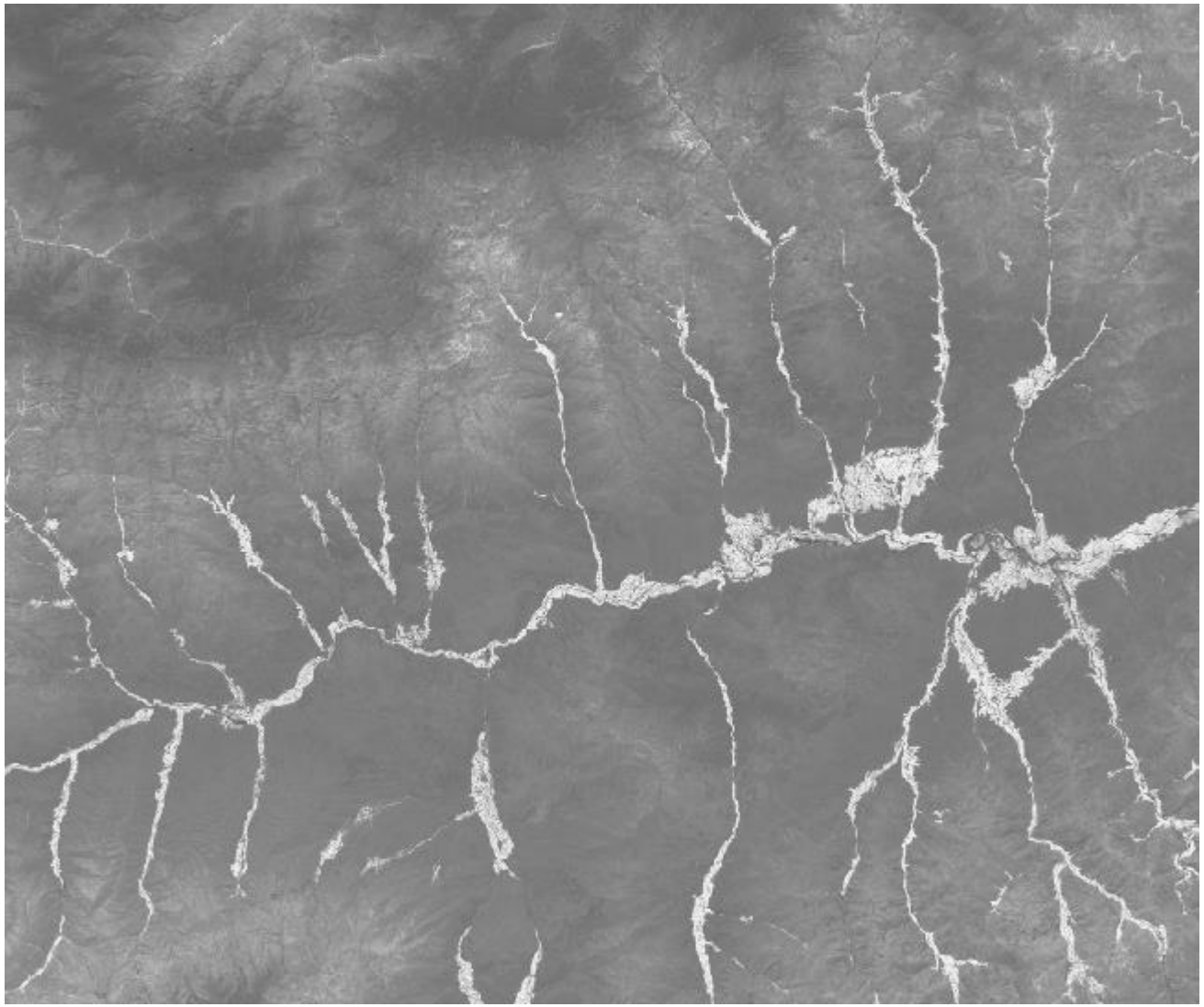


NDVI calculation

- In the Expression tab type the expression for NDVI as given below:
- **Example** ("T43SBU_20191202T055211_B08@1" - "T43SBU_20191202T055211_B04@1")/ ("T43SBU_20191202T055211_B08@1" + "T43SBU_20191202T055211_B04@1")
- Click on the **Output** and select the output folder and name the output file as **NDVI.tif**
- Make sure the **expression is valid**
- Click **OK**



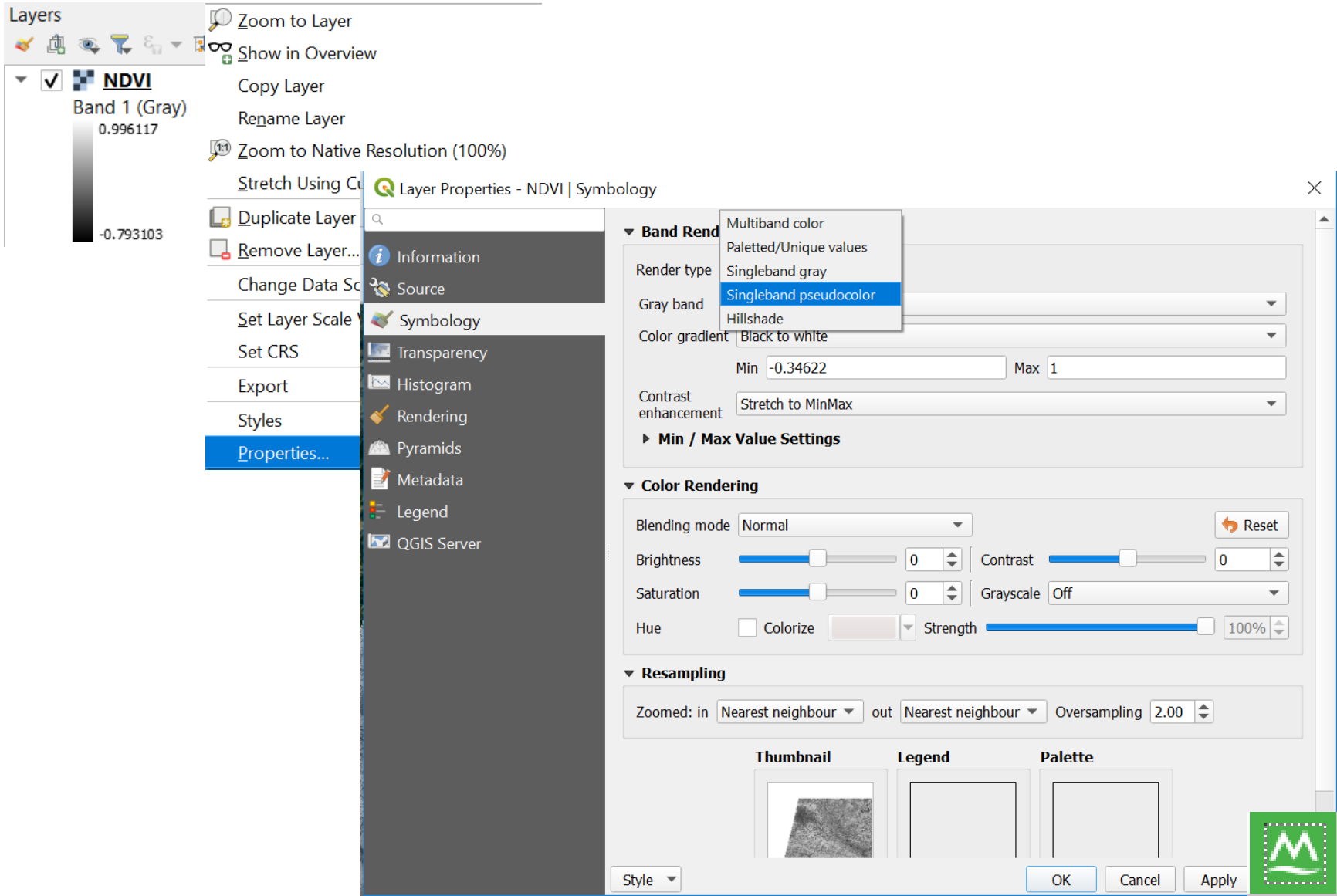
NDVI calculation



- Calculated NDVI image appears in the **layers panel**
- The range varies from -0.65 to 0.66

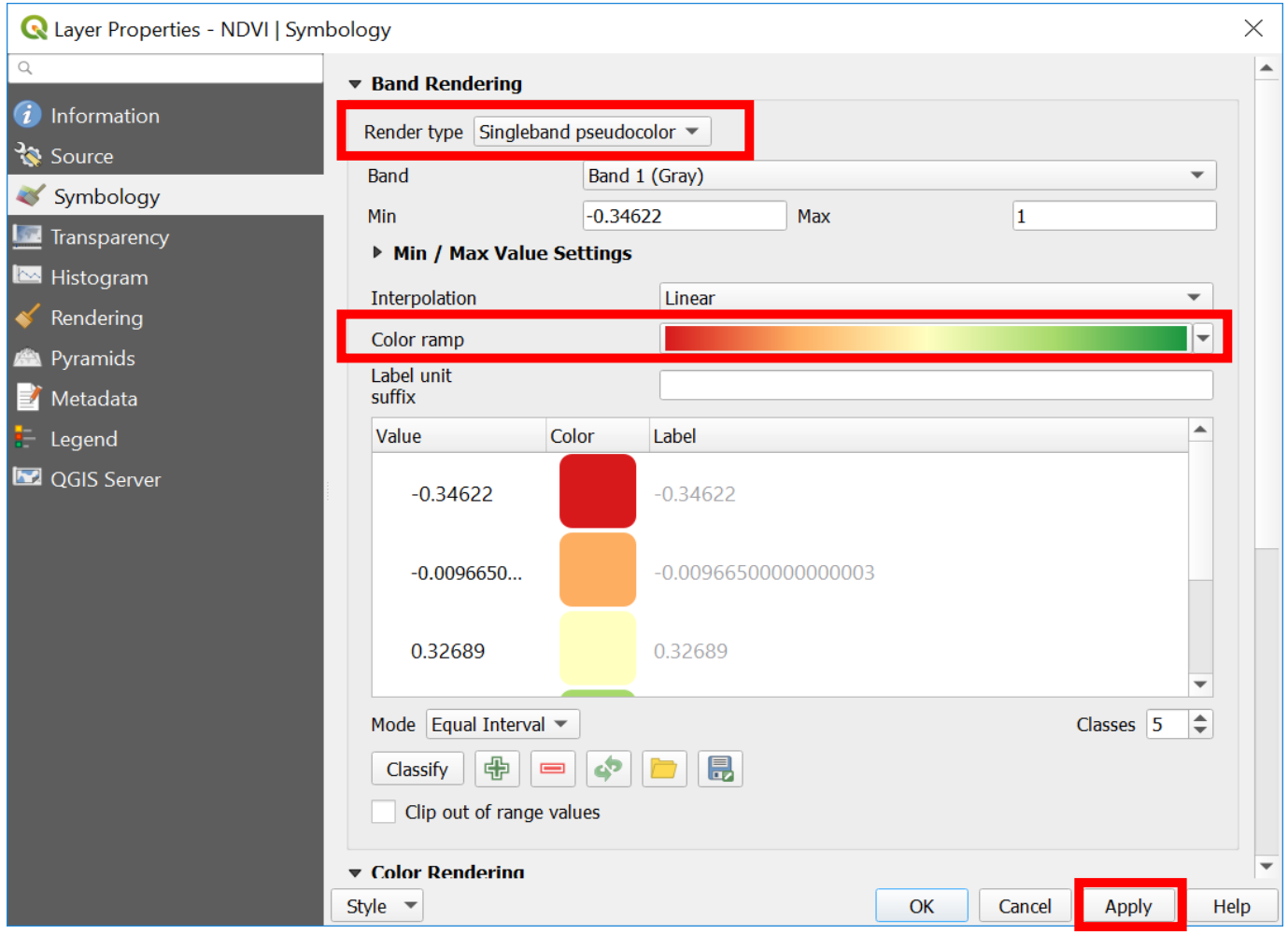
NDVI calculation

- **Right click** on the NDVI layer**-> Properties**
- Click on **Symbology** and select **Singleband pseudocolor** from the **Render type**
- Choose a suitable color ramp

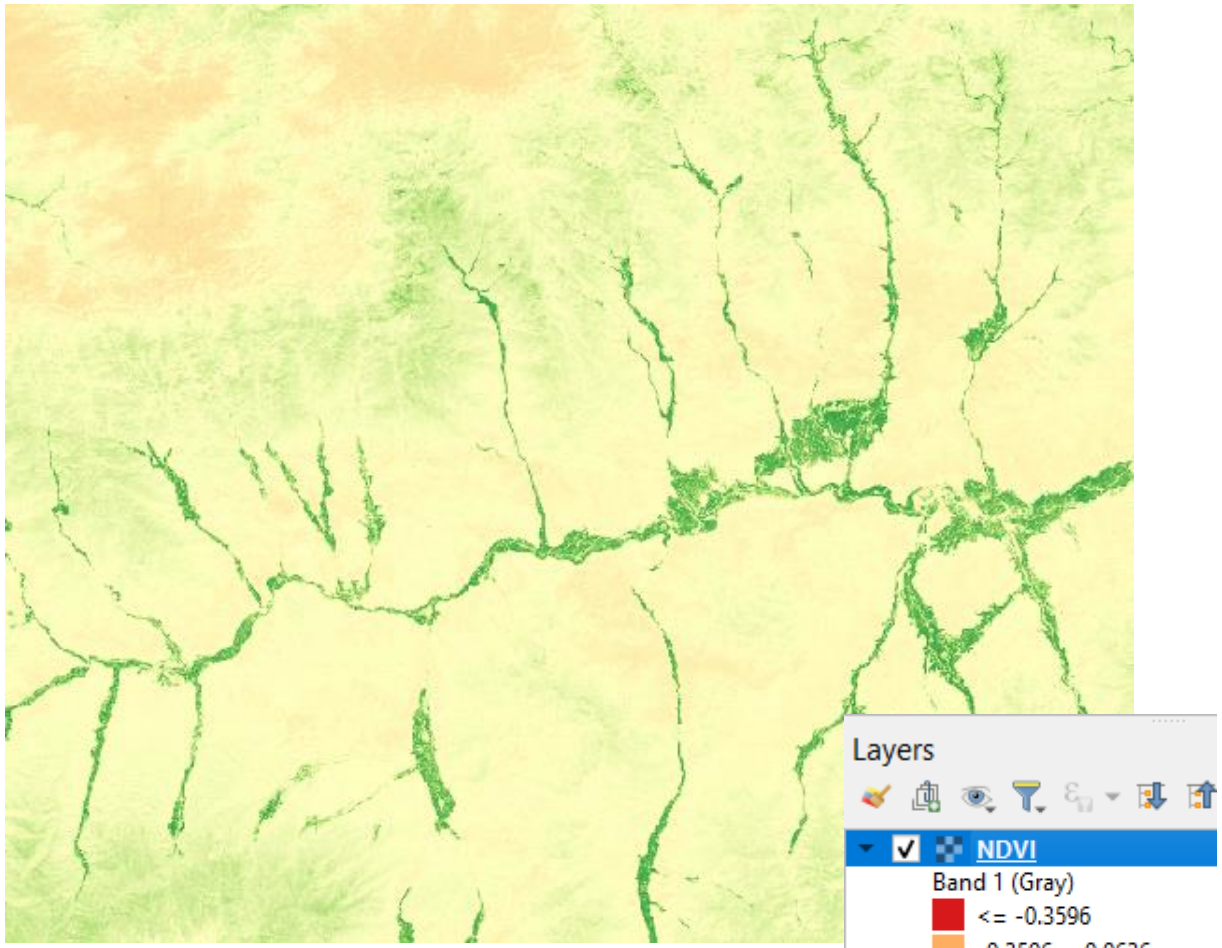


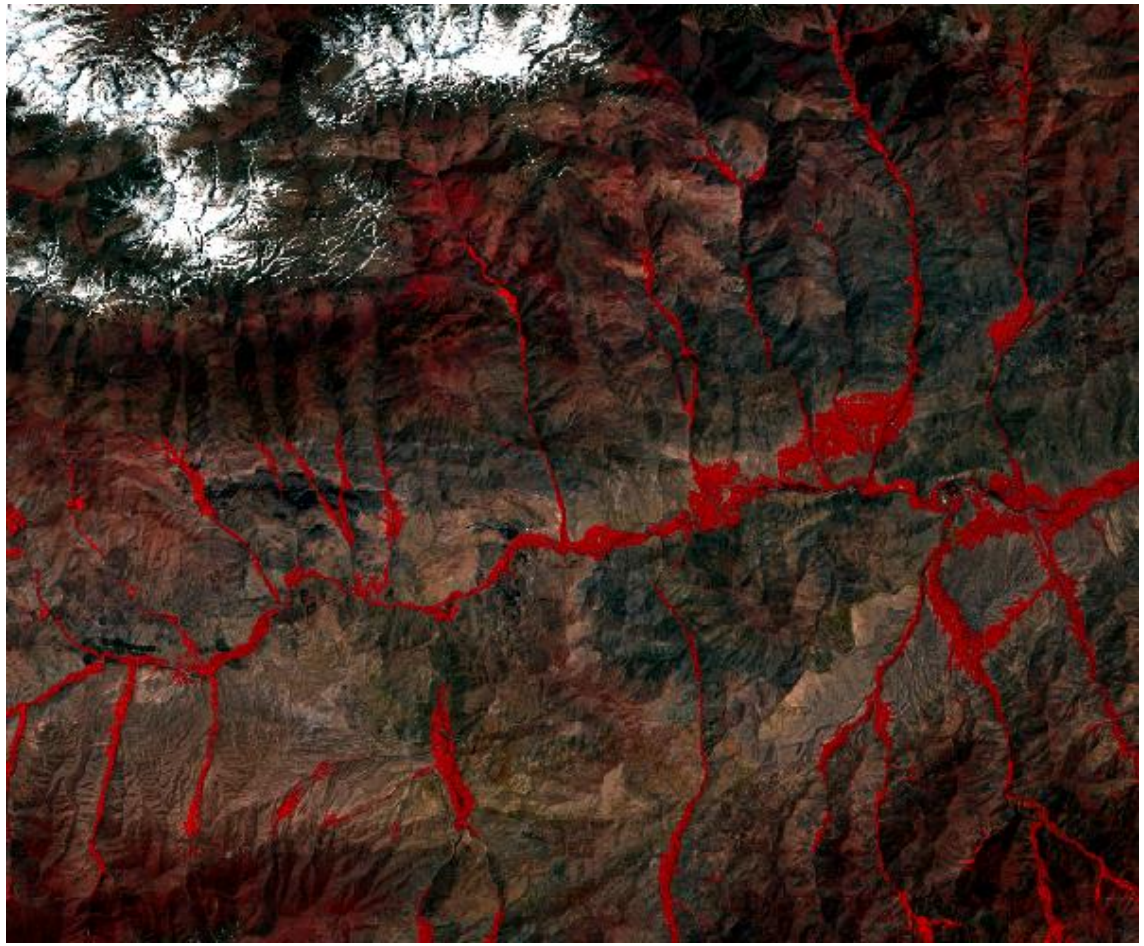
NDVI calculation

- Choose a suitable **color ramp**
- Click **Apply and** analyze the image



NDVI calculation





Can you do the similar exercises for water extraction?

Indices and Formula

Vegetation

1. **Enhanced Vegetation Index (EVI 2):** 2.5 * ((NIR - RED) / (NIR + 2.4* RED + 1))

2. Soil Adjusted Vegetation Index (SAVI): (NIR - RED) * (1.0 + L)/ (NIR + RED + L)

Here L is a constant and varies by the amount or cover of green vegetation: in very high vegetation regions, L=0; and in areas with no green vegetation, L=1; default: 0.5

Vegetation/Crop Water index

3. Normalized Difference water index (NDWI): (NIR - SWIR) / (NIR + SWIR)

Absorption by vegetation liquid water in the NIR channel is negligible, while in the SWIR channel it is very high. If Vegetation Water Content (VWC) decreases, then reflectance in the SWIR channel increases significantly. Thus, the Normalized Difference Water Index (*NDWI*) value – that combines information from the NIR and the SWIR bands – decreases, reflecting dry vegetation that is experiencing drought stress

Indices and Formula

WATER

1. **Normalized Difference Water Index (NDWI):** (Green −NIR)/(Green + NIR)
2. **Water Ratio Index (WRI):** (Green +Red/ NIR+SWIR)

SNOW

1. **Normalized Difference Snow Index (NDSII):** (Green – SWIR) / (Green + SWIR)
2. **Snow Water Index (SWI):** Green(NIR-SWIR)/ (Green + NIR)(NIR + SWIR)

Others

1. **Normalized difference built-up index (NDBI) :** SWIR − NIR/SWIR + NIR
2. **Bare Soil Index (BSI):** (SWIR+RED)-(NIR+BLUE)/(SWIR+RED)+(NIR+BLUE)