

ICIMOD

Empowering Women in Geospatial Information Technology

Mohammad Sharif Jalalzai

Poonam Tripathi

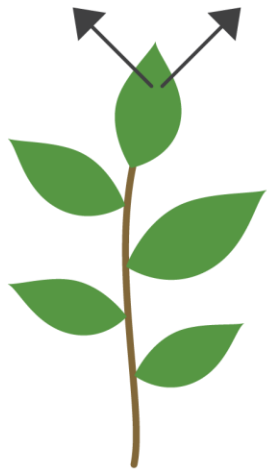
22nd June 2021

Remote Sensing based Indices

NDVI calculation

HEALTHY
VEGETATION REFLECTANCE

50% NIR 8% RED



NDVI = 0.72

STRESSED
VEGETATION REFLECTANCE

40% NIR 30% RED




NDVI = 0.14

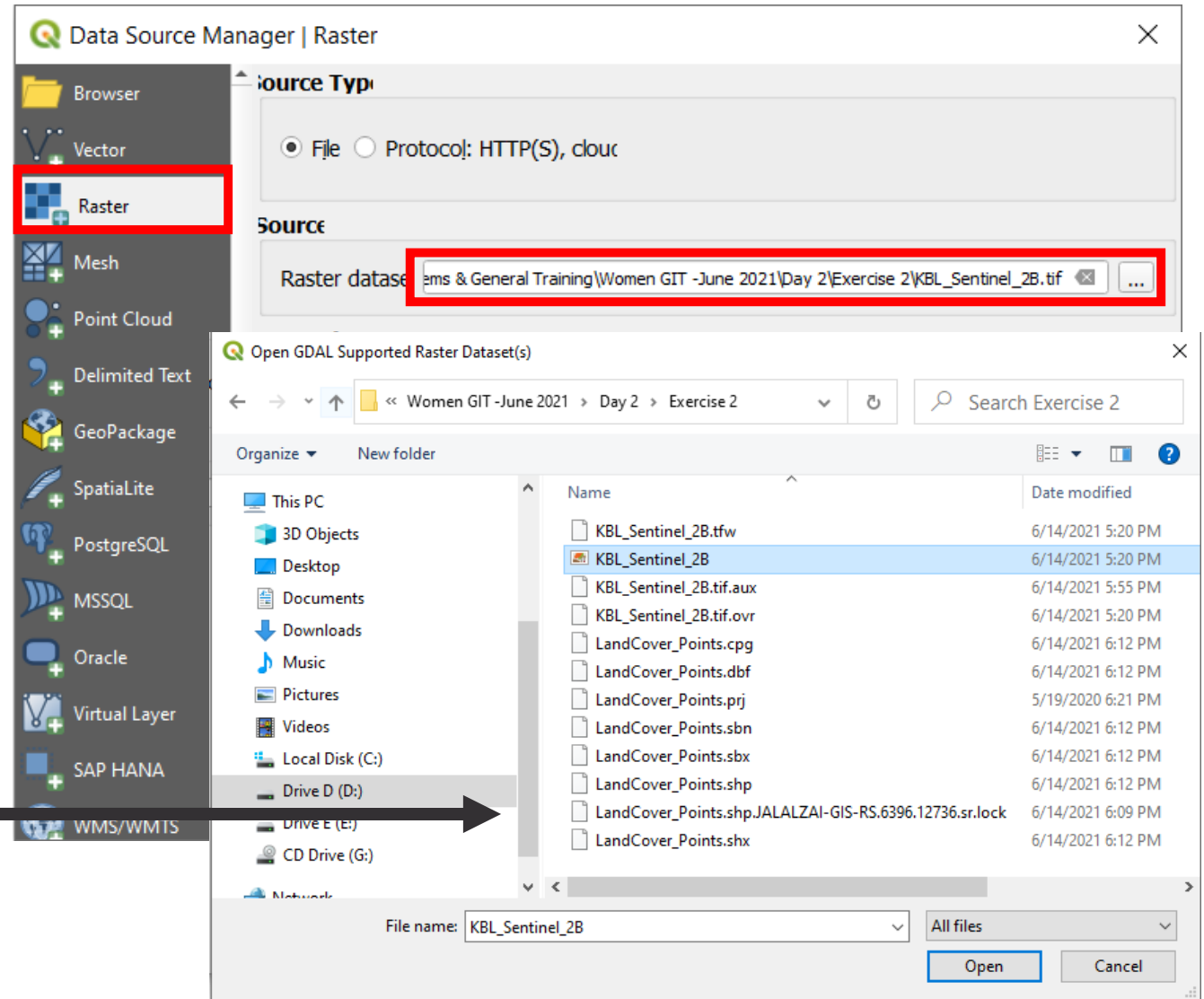
$$\text{NDVI} = \frac{\text{NIR} - \text{RED}}{\text{NIR} + \text{RED}}$$

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

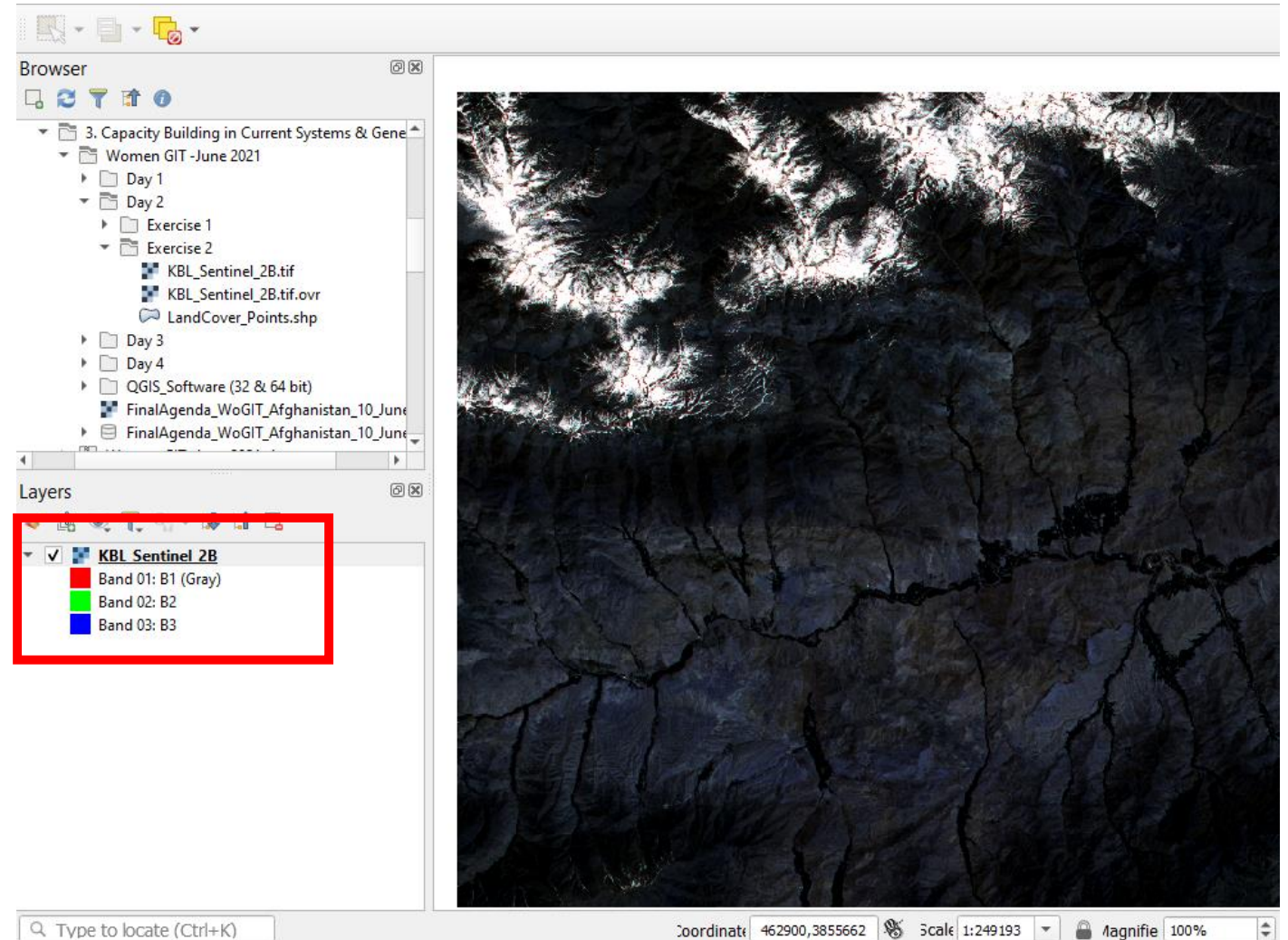


NDVI calculation

➤ 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

The screenshot displays the QGIS interface with the **Panels** list on the left and the **Processing Toolbox** on the right. In the **Panels** list, the **Processing Toolbox Panel** is checked and highlighted in blue. In the **Processing Toolbox**, the search bar contains the text "raster calculator" and is highlighted with a red rectangle. Below the search bar, the **Raster calculator** tool is listed and highlighted in blue. A tooltip for the **Raster calculator** tool is visible, showing the **Algorithm ID: 'qgis:rastercalculator'**. At the bottom of the **Processing Toolbox**, there is a search bar labeled "Search QMS" and "Search string..." and a button labeled "Filter by extent".



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**



Raster Calculator

Parameters Log

KBL_Sentinel_2B@5
KBL_Sentinel_2B@6
KBL_Sentinel_2B@7
KBL_Sentinel_2B@8

^ sqrt tan atan ()
< > = != <= >=
abs min max

Expression

("KBL_Sentinel_2B@8" - "KBL_Sentinel_2B@4") / ("KBL_Sentinel_2B@8" + "KBL_Sentinel_2B@4")

Expression is valid

Select reference layer

Predefined expressions

NDVI Add... Save...

Reference layer(s) (used for automated extent, cellsize, and CRS) [optional]

1 inputs selected

Cell size (use 0 or empty to set it automatically) [optional]

0.000000

Output extent [optional]

Not set

Output CRS [optional]

Output

D:/ICIMOD/TO do/2021/CB Trainings/WOGIT/Afghanistan/Rough/NDVI.tif

Open output file after running algorithm

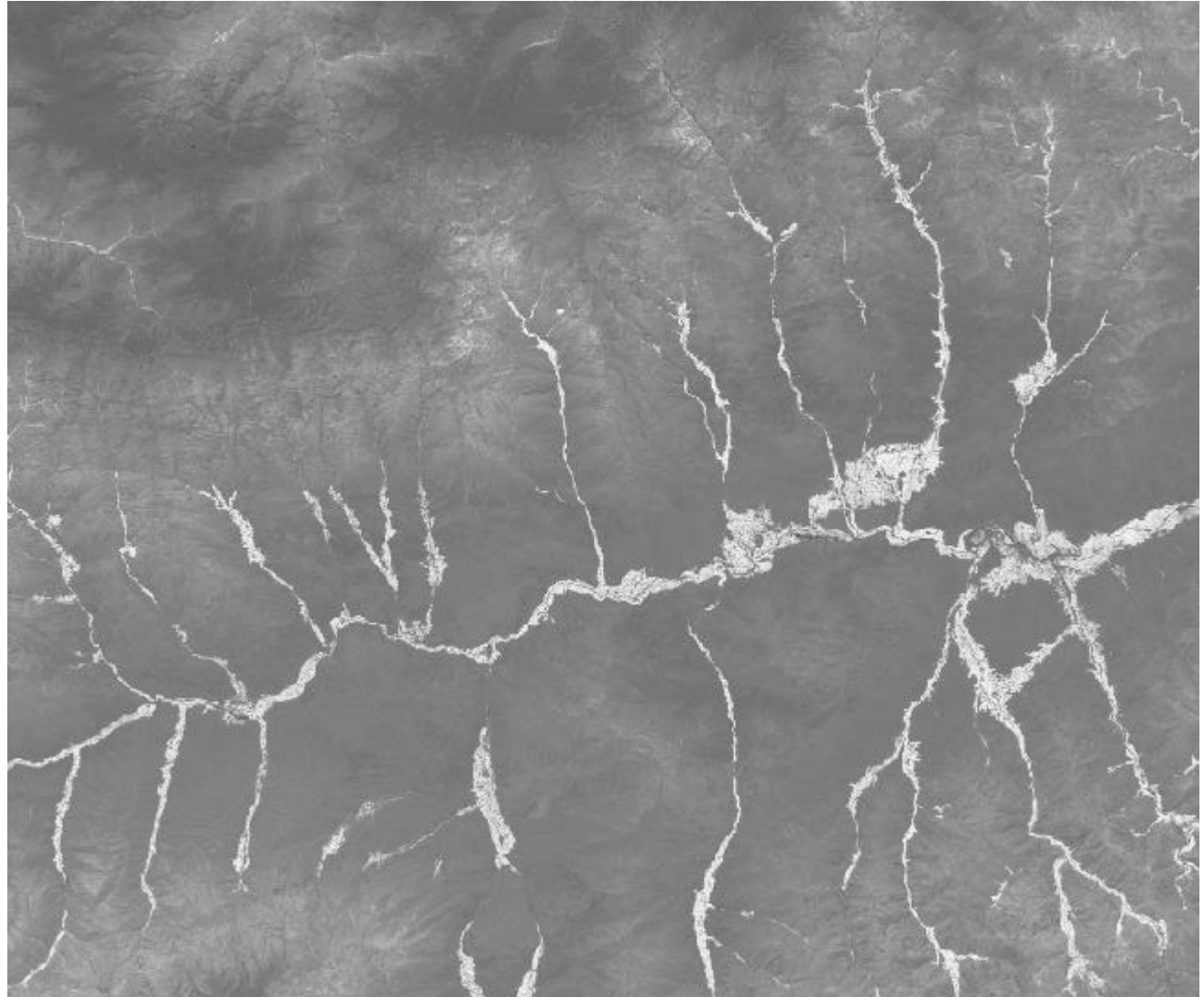
0%

Run as Batch Process... Run Close Help



NDVI calculation

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



NDVI calculation

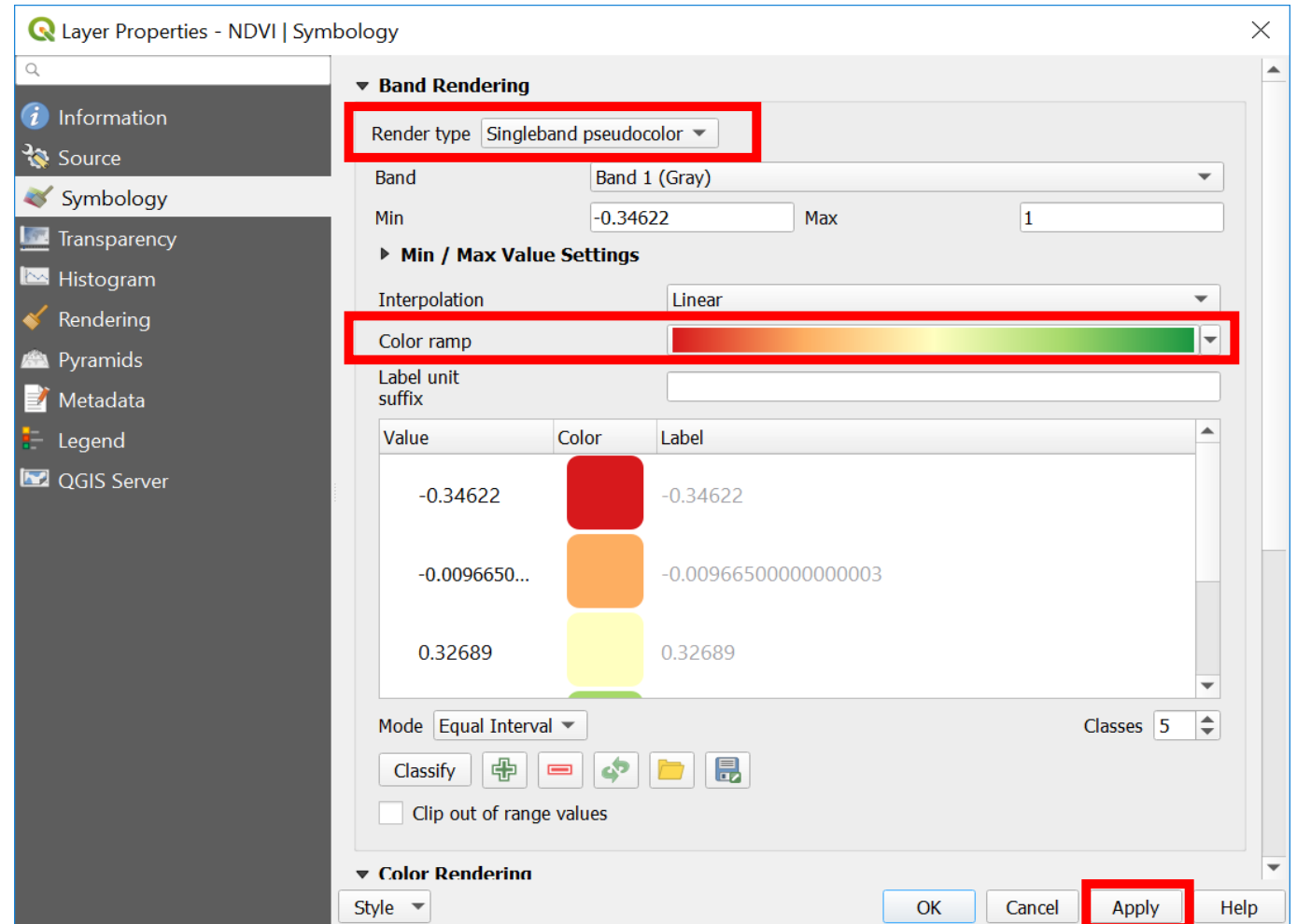
- Right click on the NDVI layer-> Properties
- Click on **Symbology** and select **Singleband pseudocolor** from the **Render type**
- Choose a suitable color ramp

The screenshot displays the QGIS interface with the 'Layers' panel on the left showing the 'NDVI' layer. A right-click context menu is open over the layer, with 'Properties...' selected. The 'Layer Properties - NDVI | Symbology' dialog box is open, showing the 'Symbology' tab. The 'Render type' is set to 'Singleband pseudocolor'. The 'Gray band' is set to 'Black to white'. The 'Min / Max Value Settings' are set to 'Stretch to MinMax' with a minimum value of -0.34622 and a maximum value of 1. The 'Color Rendering' section shows 'Blending mode' set to 'Normal', 'Brightness' and 'Saturation' sliders at 0, and 'Grayscale' set to 'Off'. The 'Resampling' section shows 'Zoomed: in' and 'out' both set to 'Nearest neighbour' and 'Oversampling' set to 2.00. A thumbnail of the NDVI map is visible at the bottom left of the dialog.

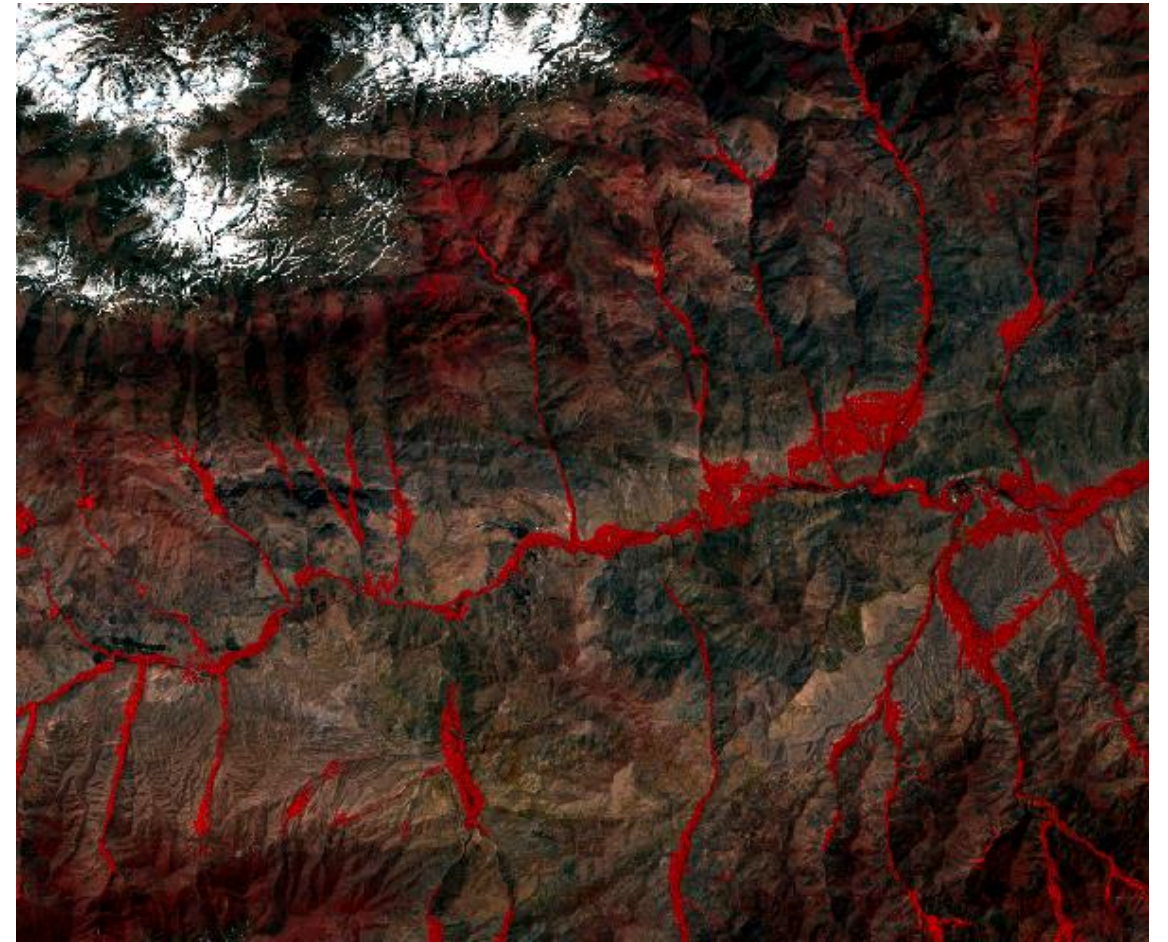
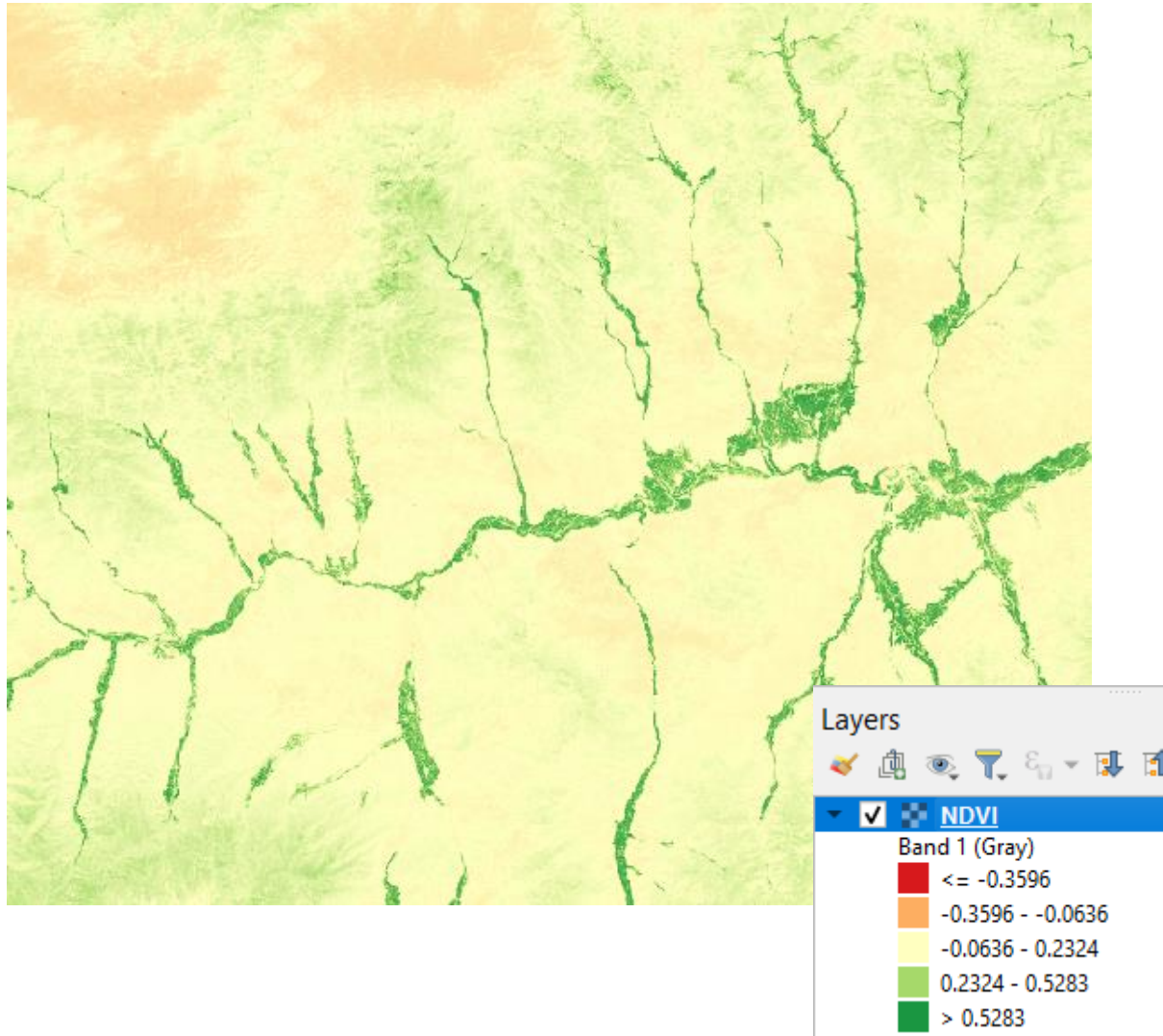


NDVI calculation

- 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):** $2.5 * ((\text{NIR} - \text{RED}) / (\text{NIR} + 2.4 * \text{RED} + 1))$

2. **Soil Adjusted Vegetation Index (SAVI):** $(\text{NIR} - \text{RED}) * (1.0 + L) / (\text{NIR} + \text{RED} + L)$

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):** $(\text{NIR} - \text{SWIR}) / (\text{NIR} + \text{SWIR})$

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):** $(\text{Green} - \text{NIR}) / (\text{Green} + \text{NIR})$
2. **Water Ratio Index (WRI):** $(\text{Green} + \text{Red}) / (\text{NIR} + \text{SWIR})$

SNOW

1. **Normalized Difference Snow Index (NDSII):** $(\text{Green} - \text{SWIR}) / (\text{Green} + \text{SWIR})$
2. **Snow Water Index (SWI):** $\text{Green}(\text{NIR} - \text{SWIR}) / (\text{Green} + \text{NIR})(\text{NIR} + \text{SWIR})$

Others

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

