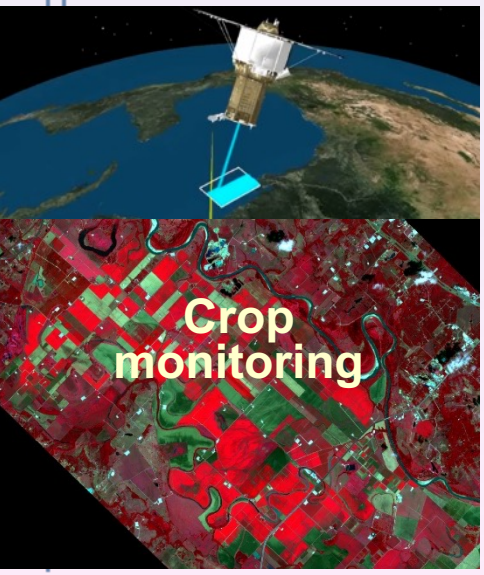
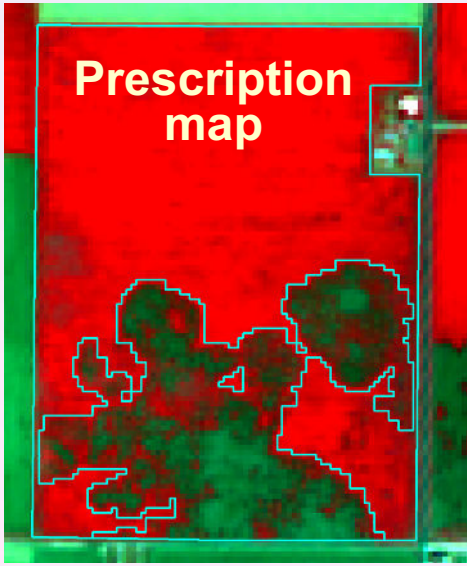
Using Freely Available Satellite Imagery and Software for Creating Prescription Maps

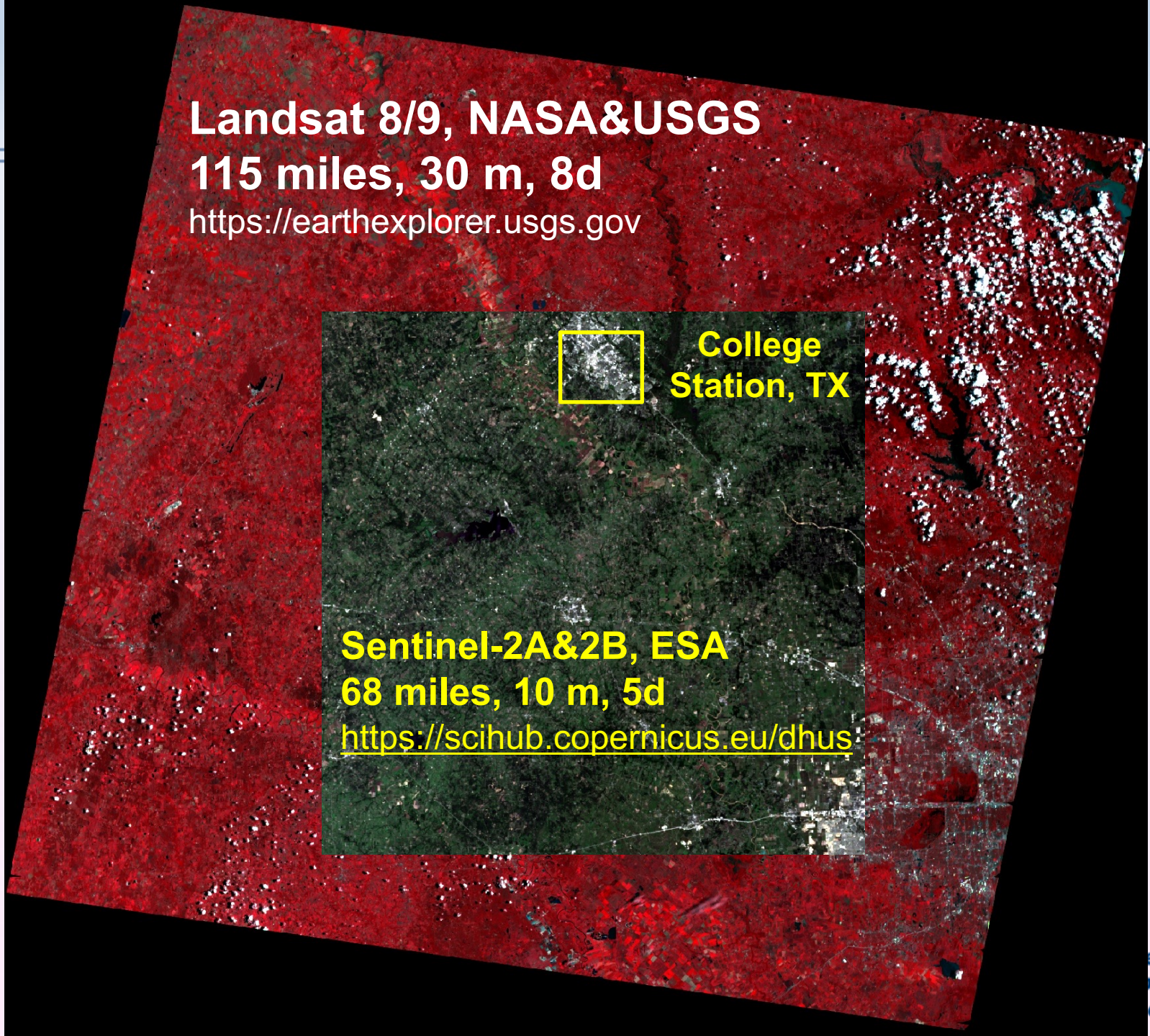
Chenghai Yang
Research Agricultural Engineer



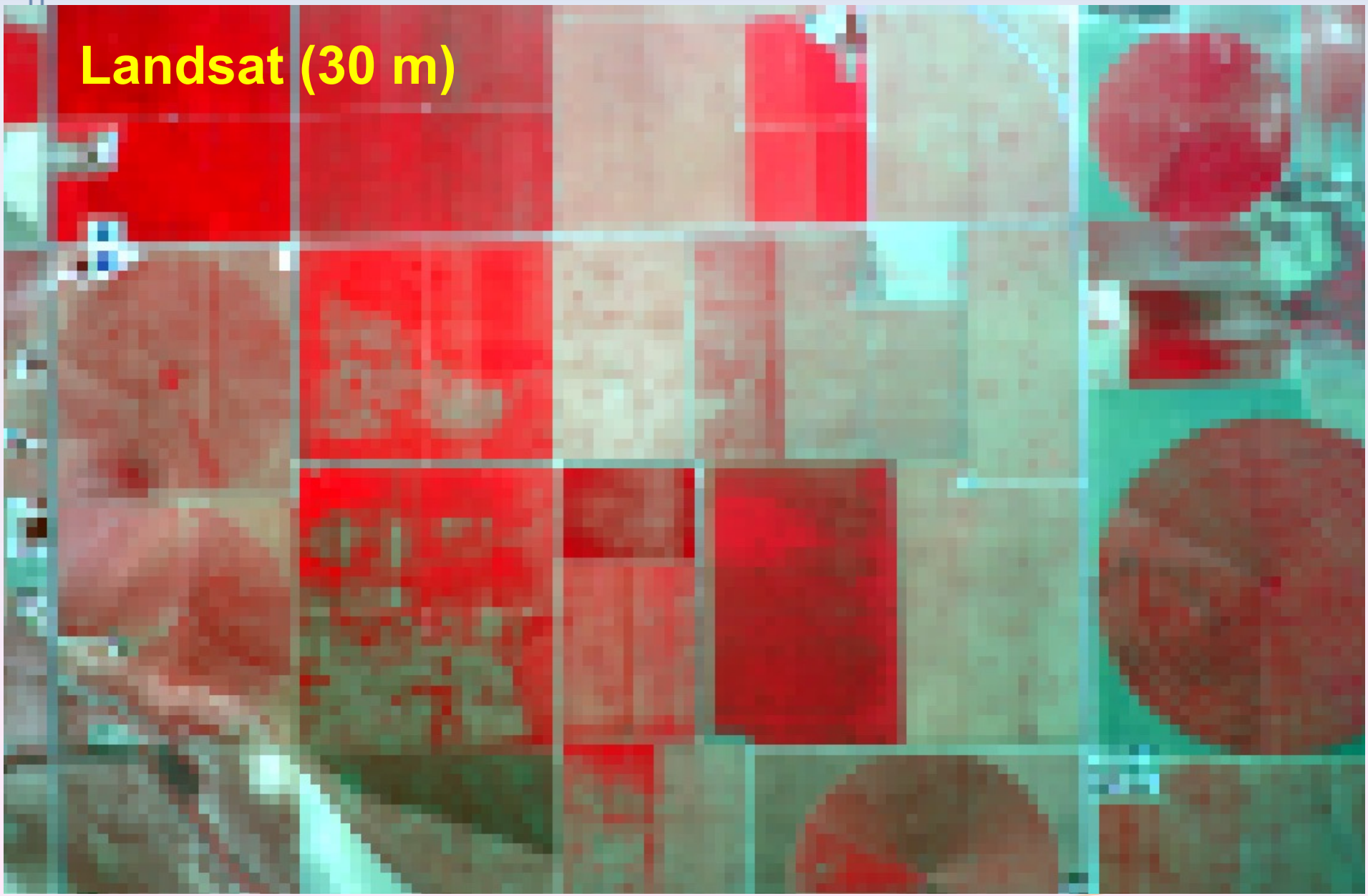
USDA-ARS
Aerial Application Technology
Research Unit
College Station, TX



2022 Ag Aviation Expo, Knoxville, TN, Dec. 5-8, 2022


Landsat 8/9, NASA&USGS
115 miles, 30 m, 8d
https://earthexplorer.usgs.gov
College Station, TX
Sentinel-2A&2B, ESA
68 miles, 10 m, 5d
https://scihub.copernicus.eu/dhus

Airborne, Sentinel-2 and Landsat Images



Sentinel-2 Specifications

Sentinel-2 band	Wavelength (nm)	Spatial resolution (m)
Band 1 - Coastal aerosol	443±10	60
Band 2 - Blue	**490±32.5**	**10**
Band 3 - Green	**560±17.5**	**10**
Band 4 - Red	**665±15**	**10**
Band 5 - Vegetation red edge	705±7.5	20
Band 6 - Vegetation red edge	740±7.5	20
Band 7 - Vegetation red edge	783±10	20
Band 8 - Near-infrared (NIR)	**842±57.5**	**10**
Band 8A - Vegetation red edge	865±10	20
Band 9 - Water vapor	945±10	60
Band 10 – SWIR2-Cirrus	1375±15	60
Band 11 - SWIR	1610±15	20
Band 12 – SWIR	2190±90	20

https://scihub.copernicus.eu/dhus

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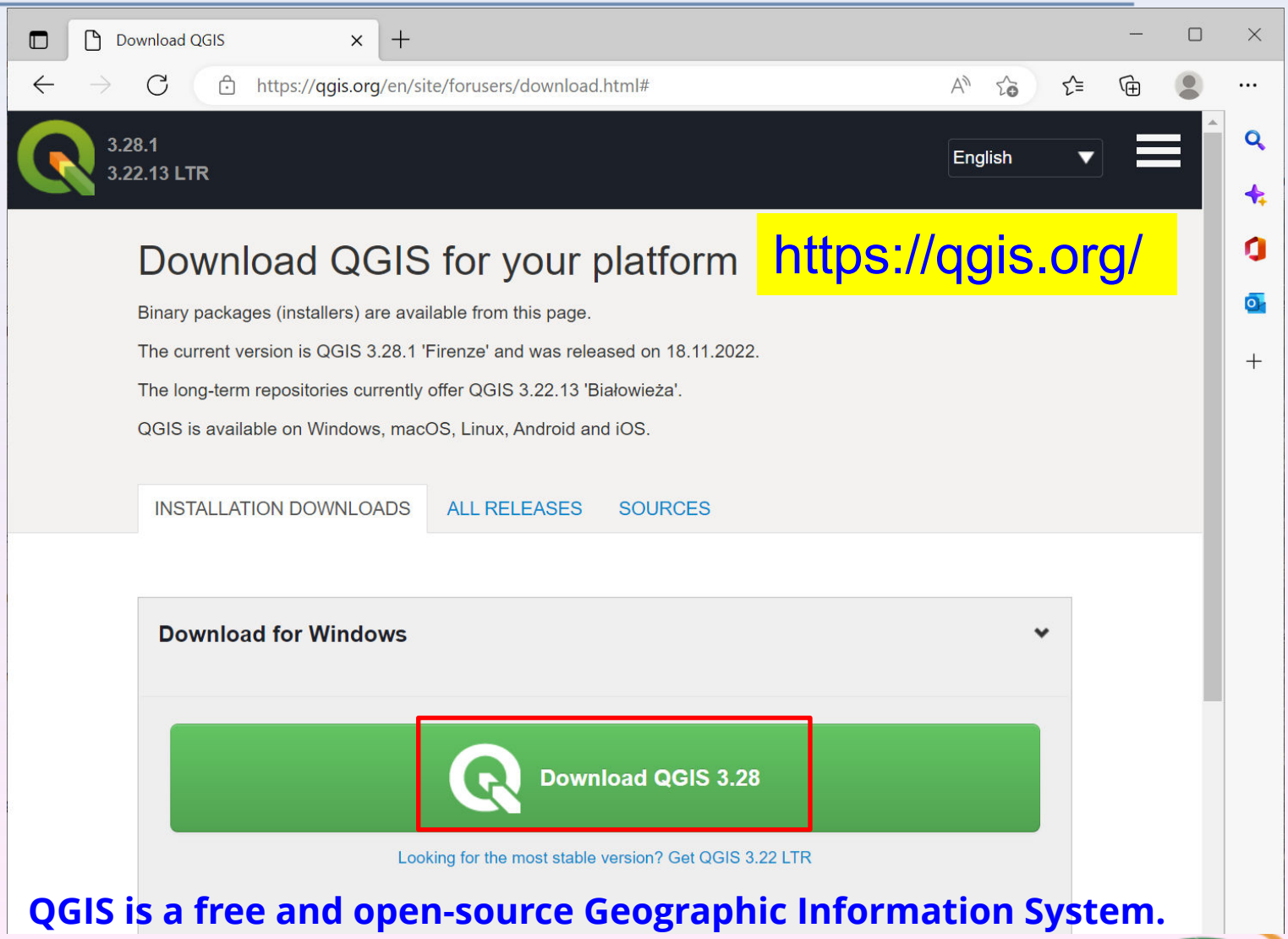
Download QGIS at QGIS.org



QGIS is a free and open-source Geographic Information System.

QGIS is maintained by volunteer developers with support by users.

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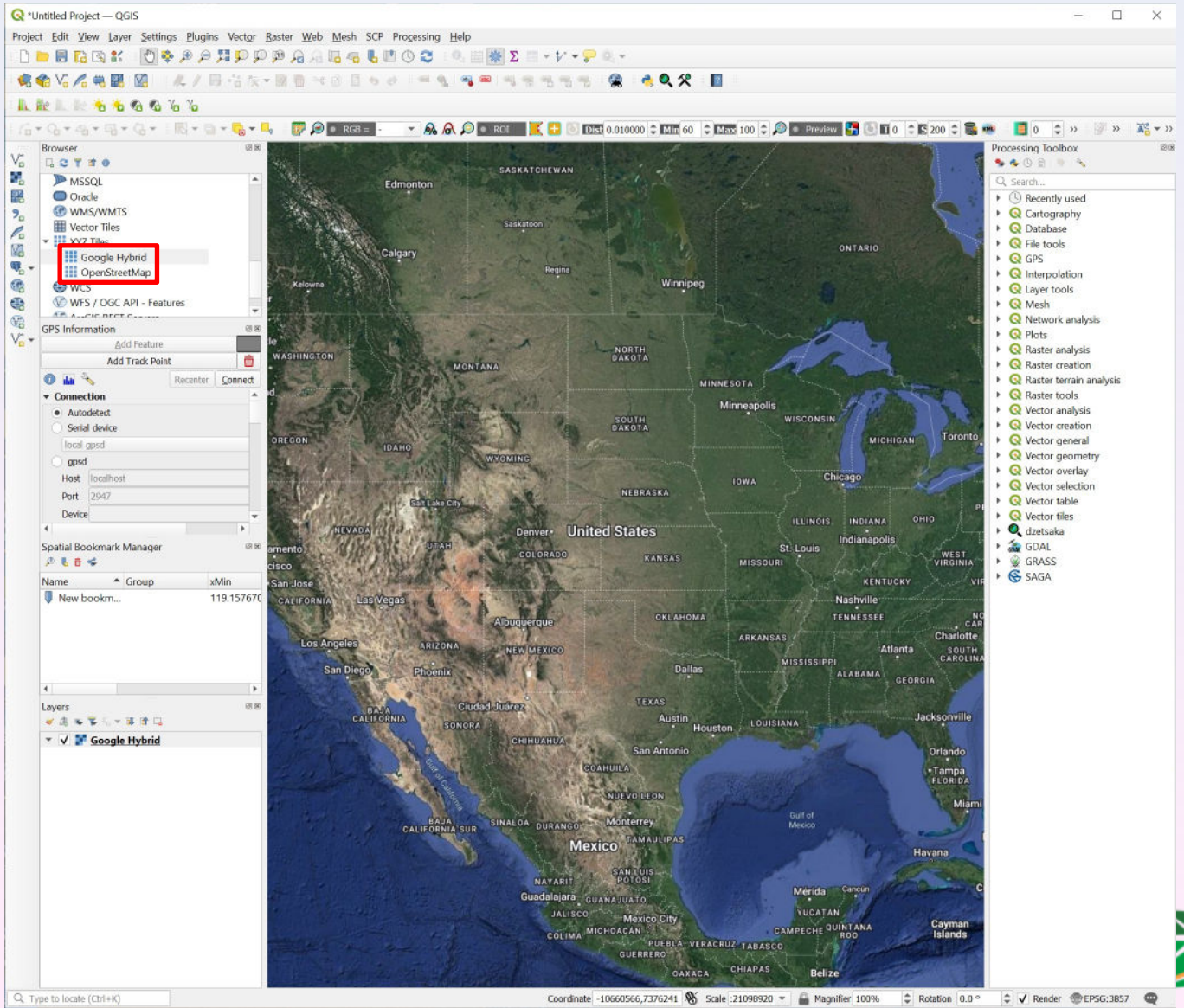
Open QGIS and Google Maps



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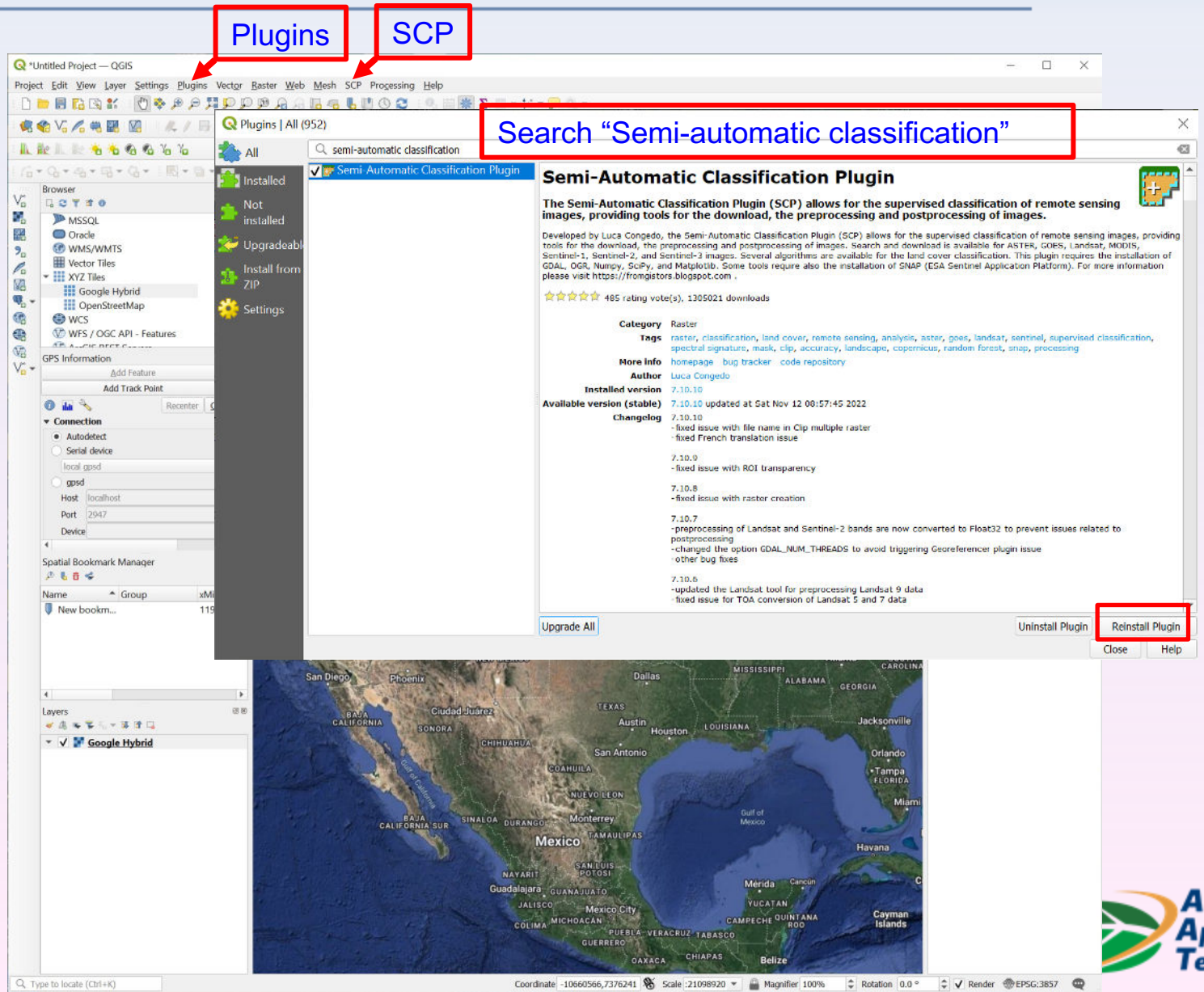
Install Semi-Automatic Classification Plugin



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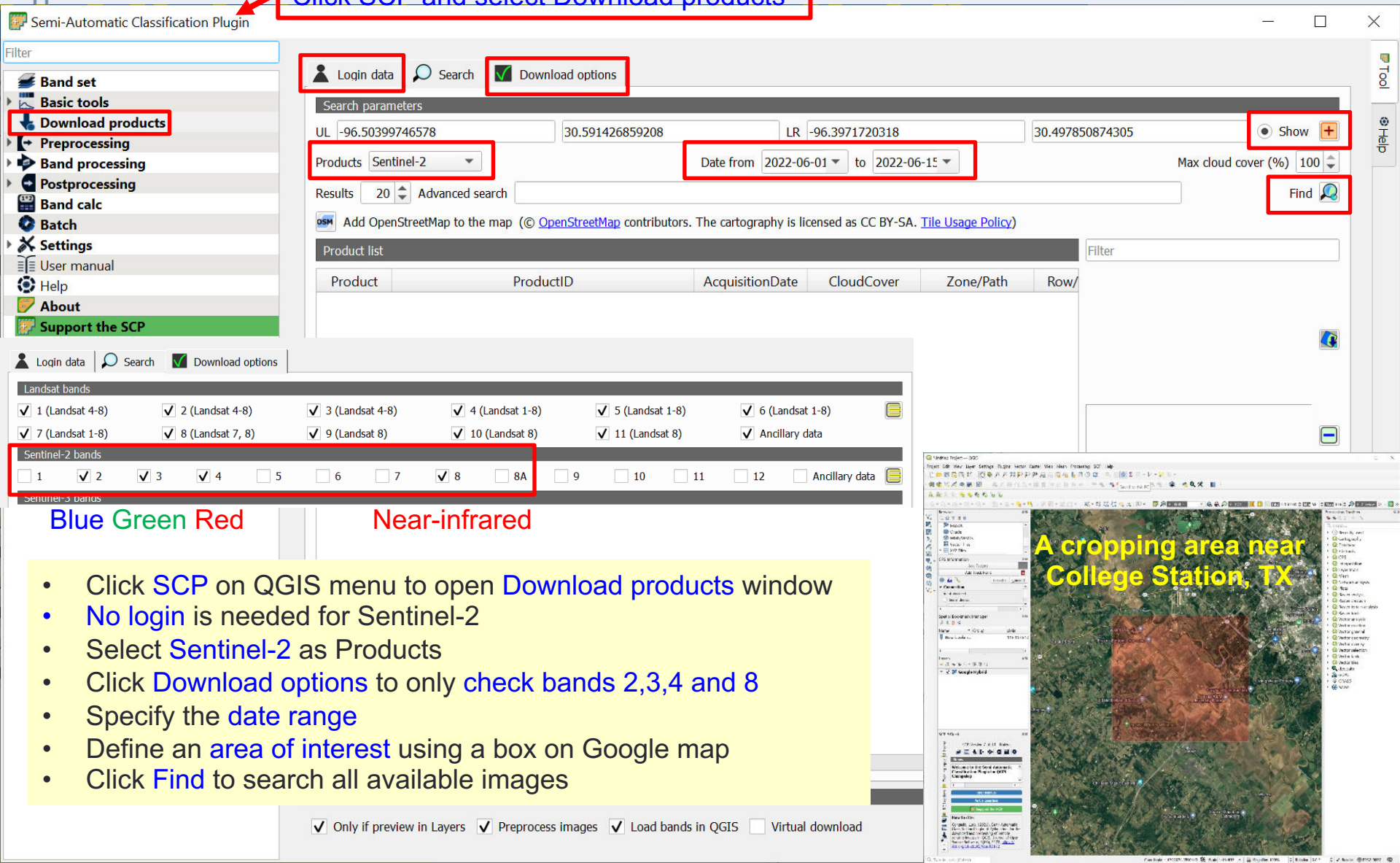
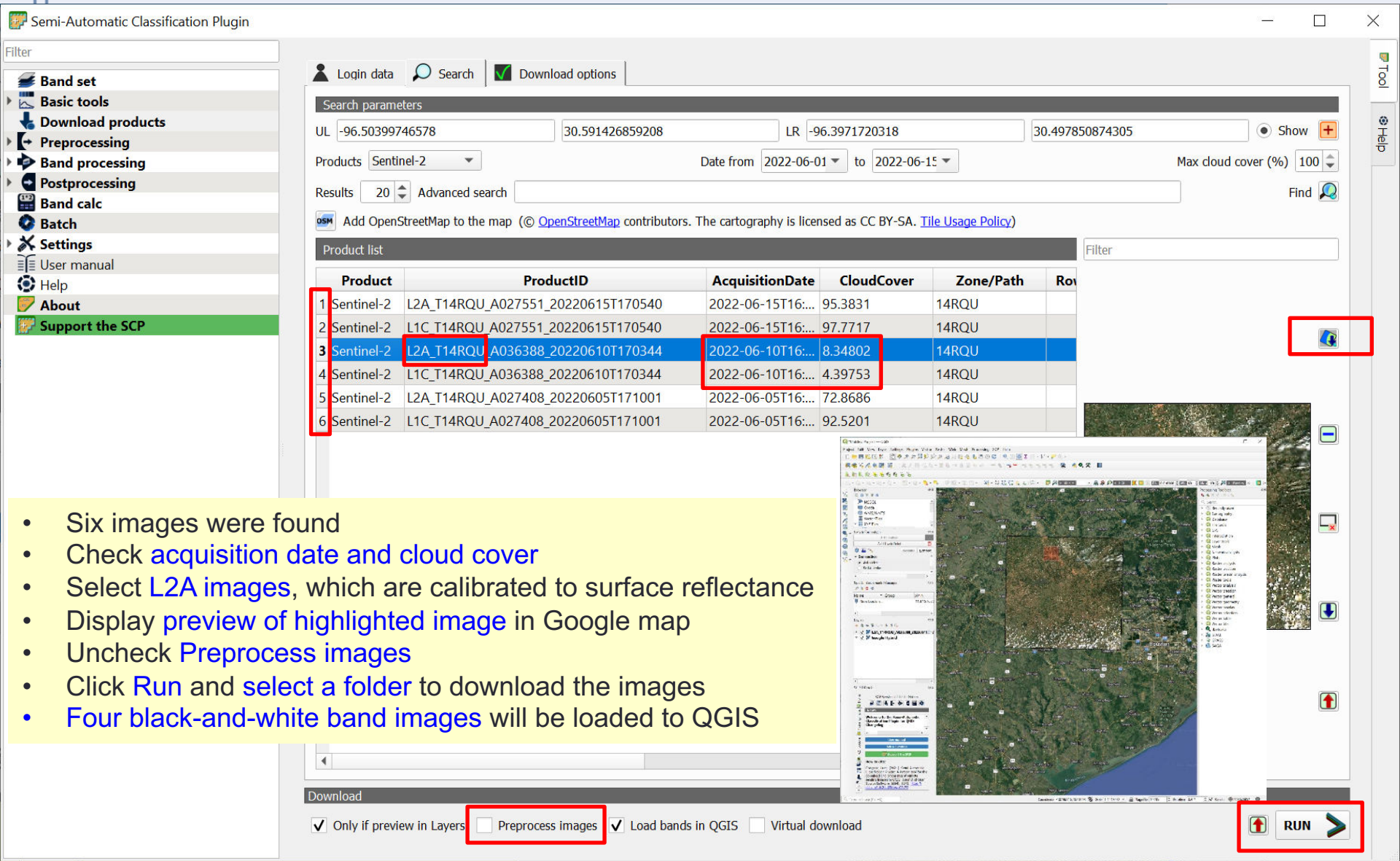
Download Sentinel-2 Imagery

Click SCP and select Download products



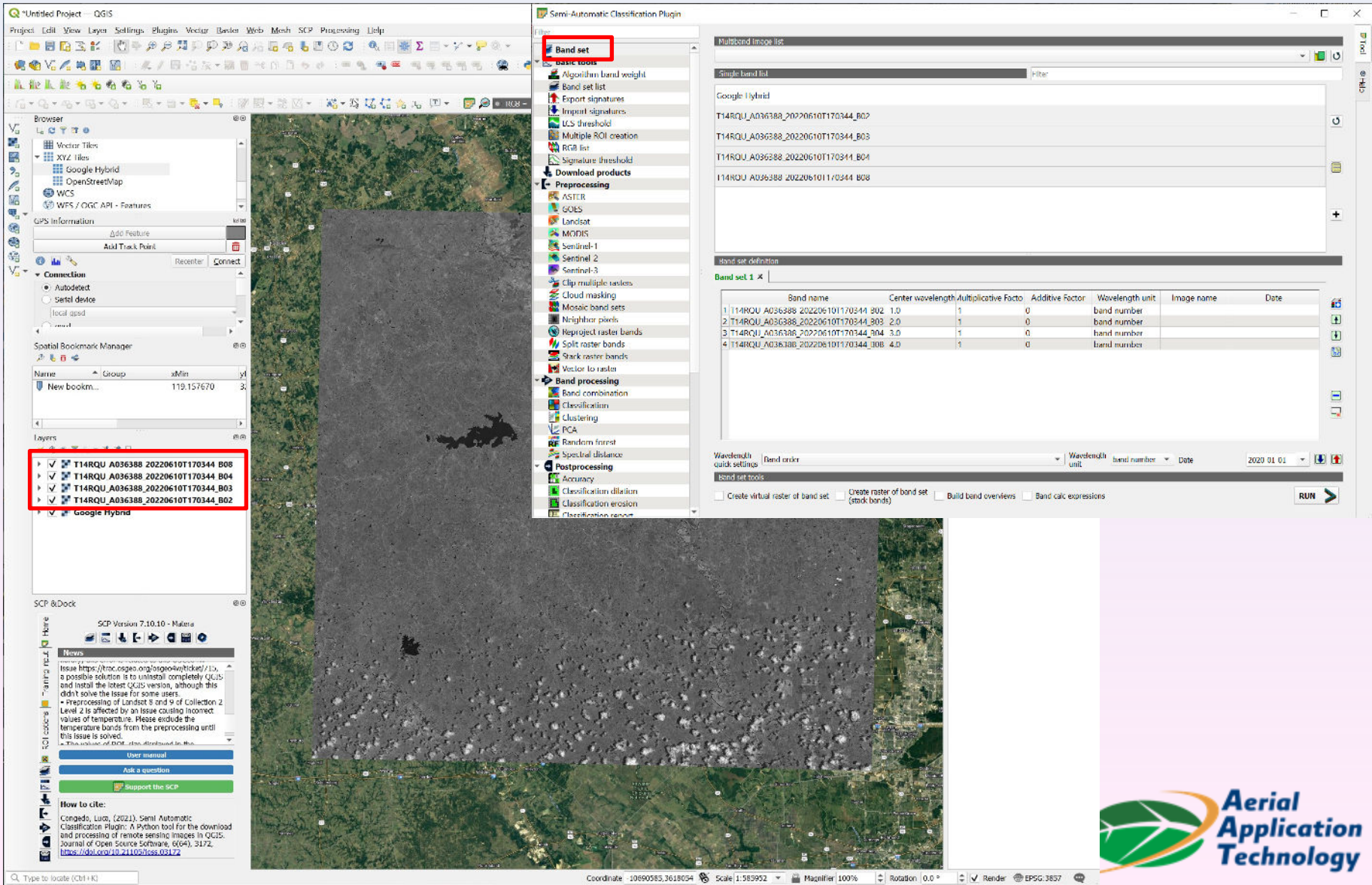
- Click SCP on QGIS menu to open Download products window
- No login is needed for Sentinel-2
- Select Sentinel-2 as Products
- Click Download options to only check bands 2,3,4 and 8
- Specify the date range
- Define an area of interest using a box on Google map
- Click Find to search all available images

Download Sentinel-2 Imagery



- Six images were found
- Check acquisition date and cloud cover
- Select L2A images, which are calibrated to surface reflectance
- Display preview of highlighted image in Google map
- Uncheck Preprocess images
- Click Run and select a folder to download the images
- Four black-and-white band images will be loaded to QGIS

Merge Band images as Composites



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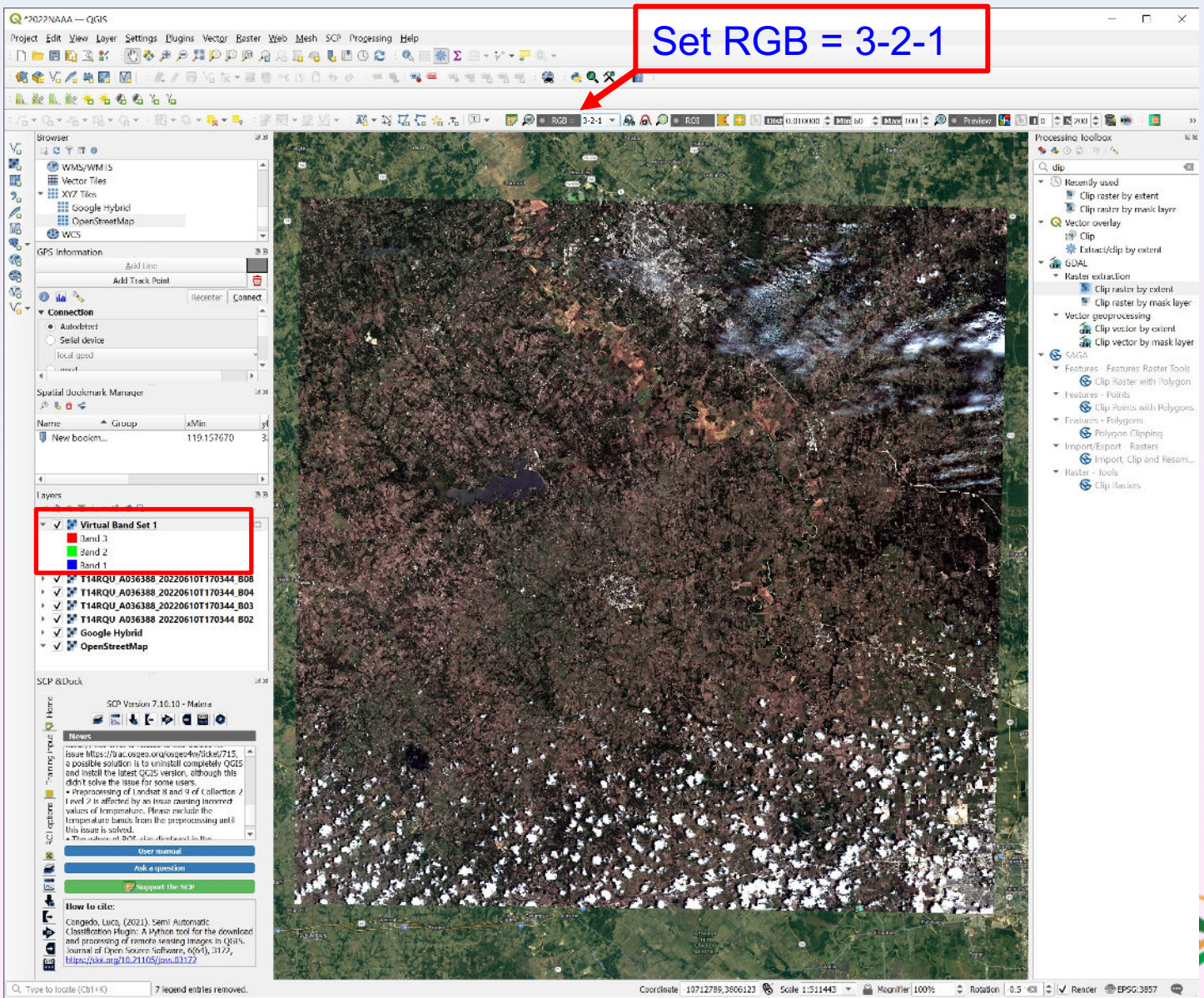
Visualize Normal Color Images



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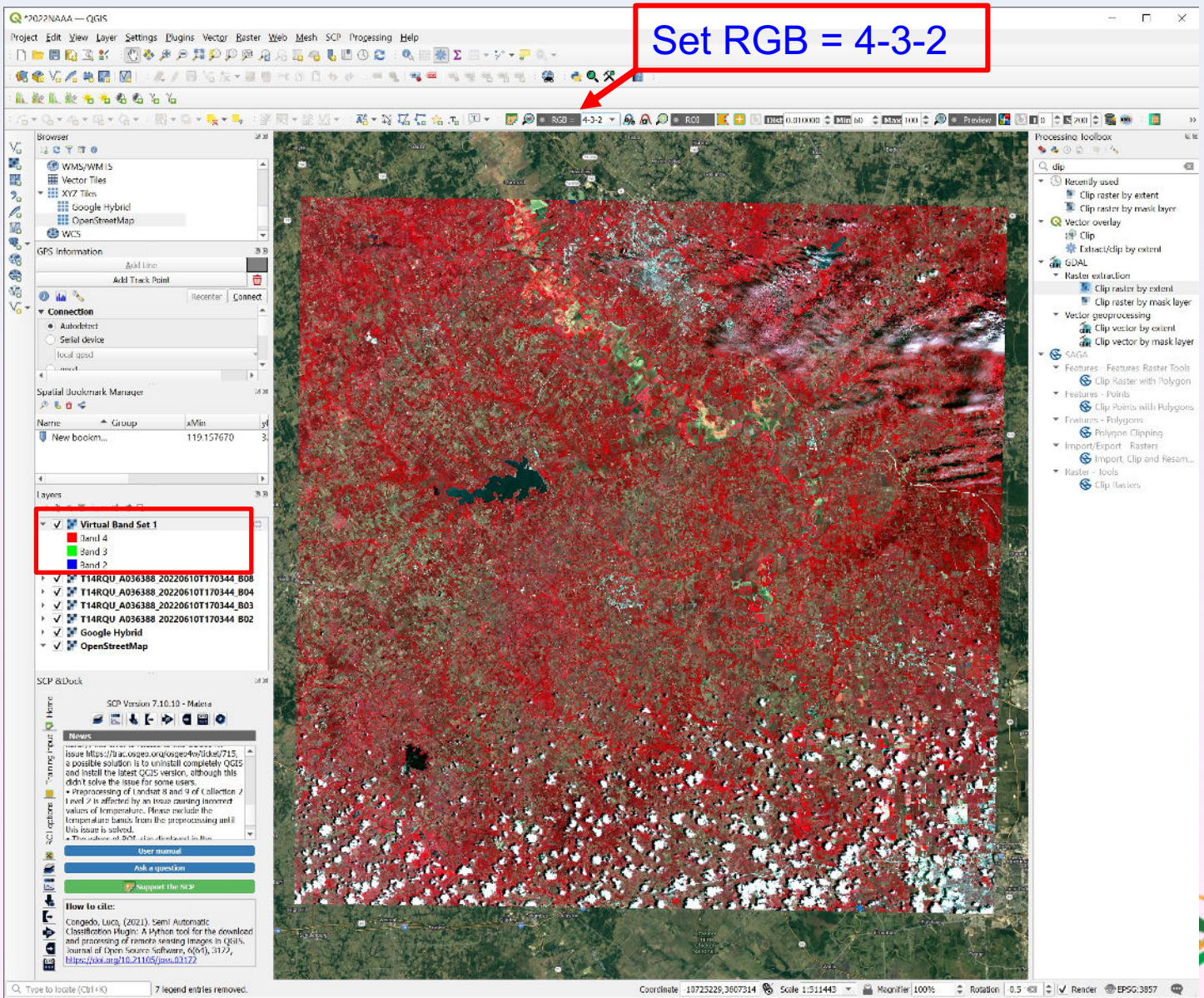
Visualize Color-infrared Image



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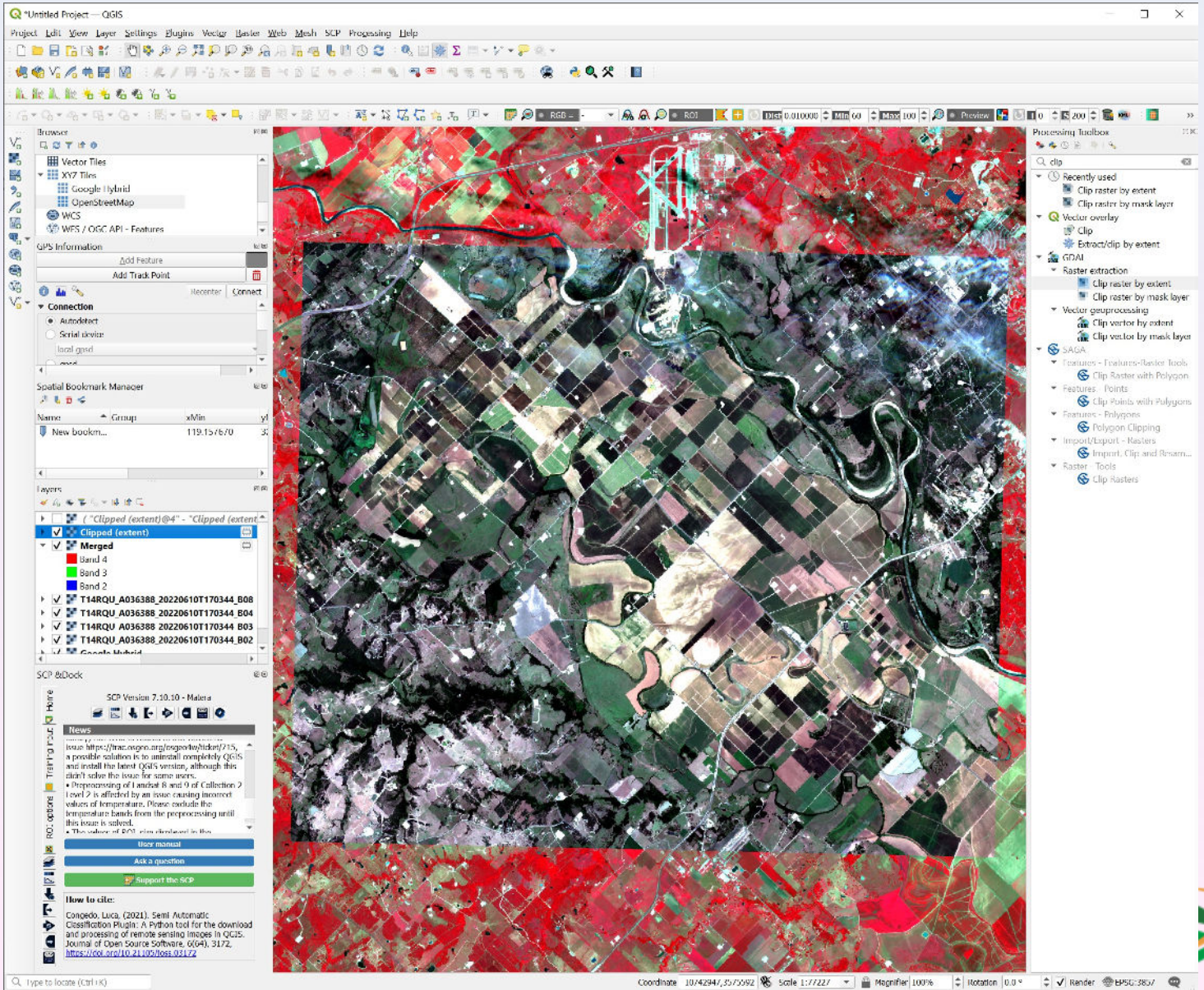
Clip Image to Your Area of Interest



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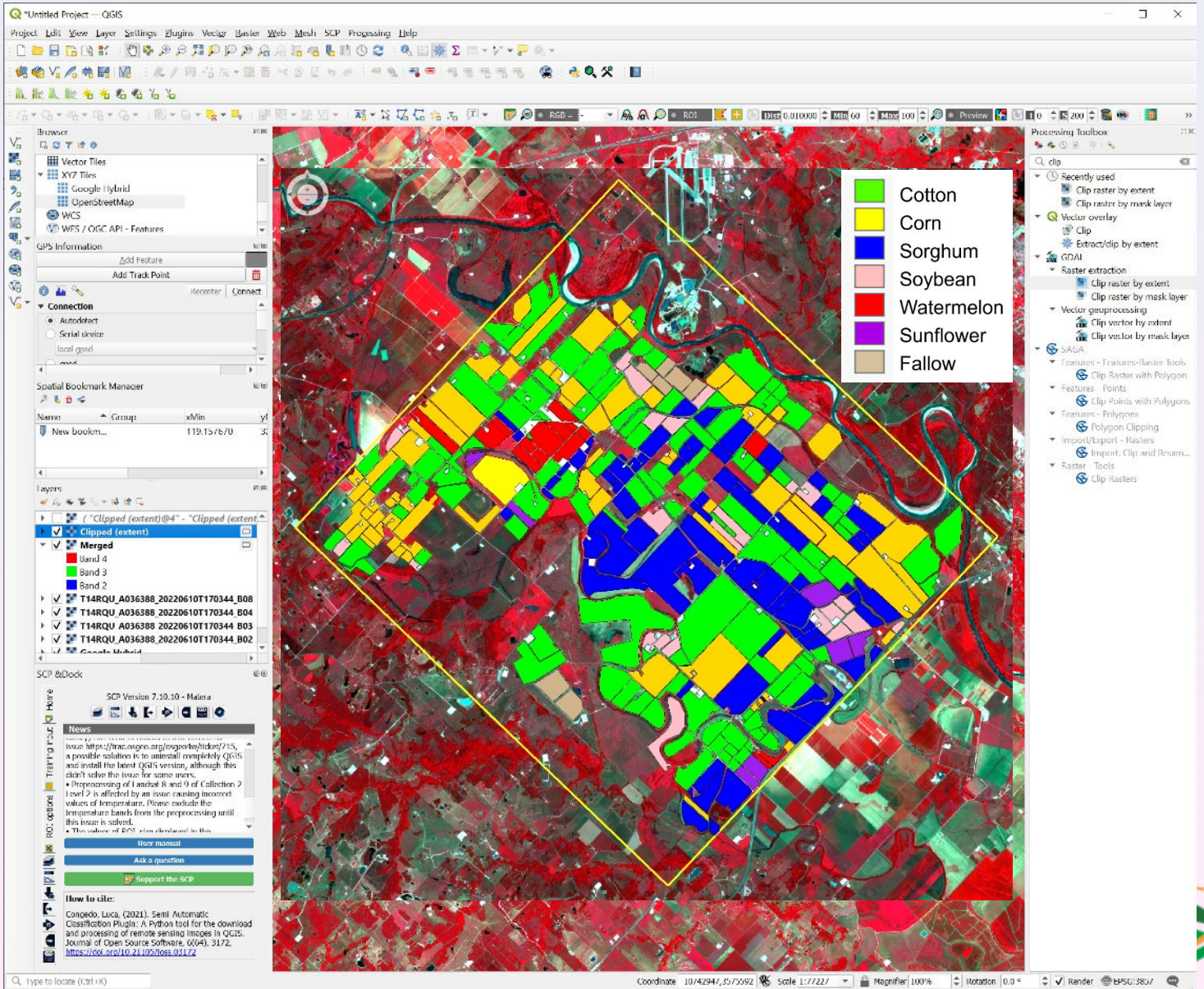
Classify the image to Crop Types



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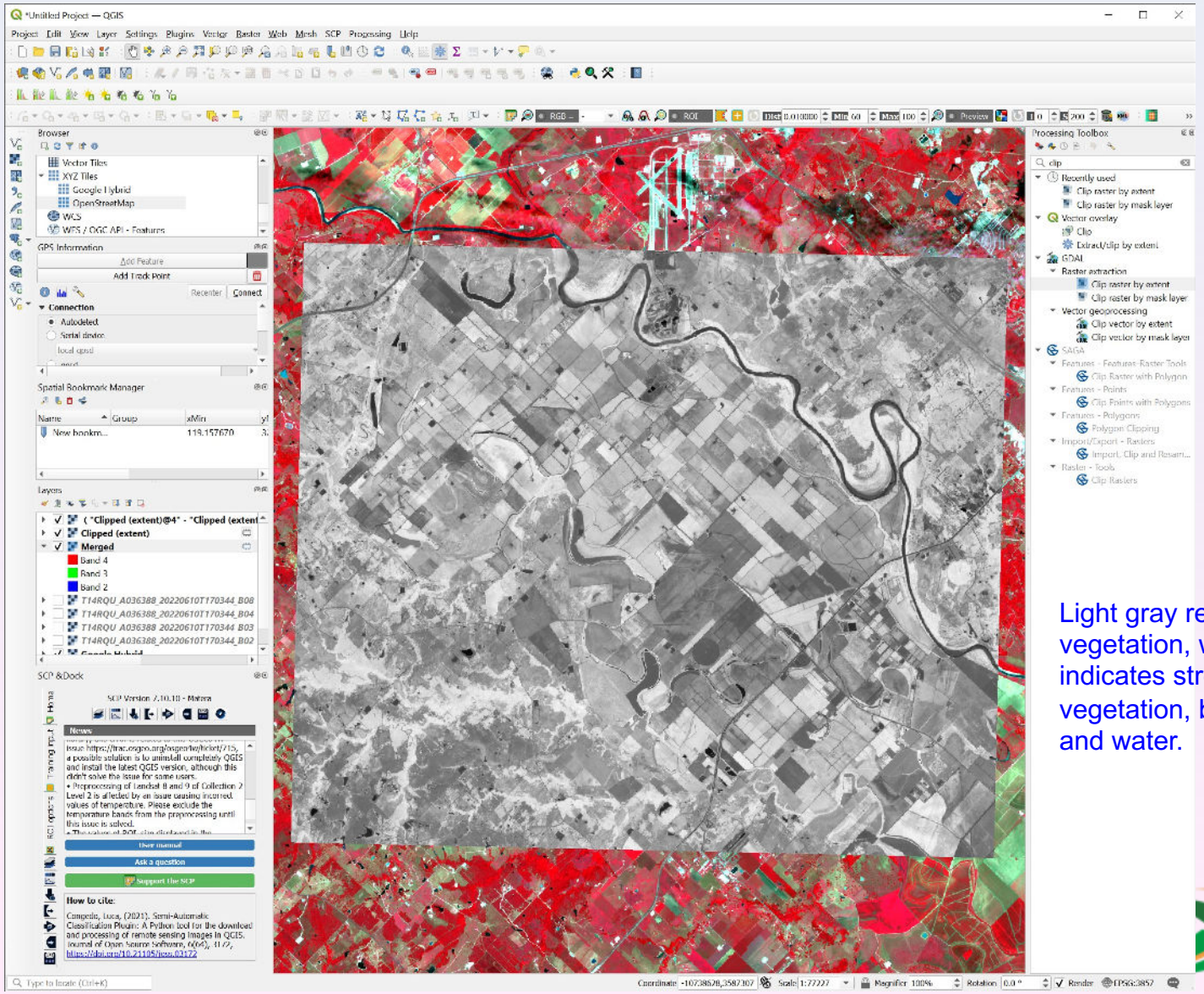
Calculate Normalized Difference Vegetation Index (NDVI)



Light gray represents healthy vegetation, while dark gray indicates stressed/sparse vegetation, bare soil, roads and water.

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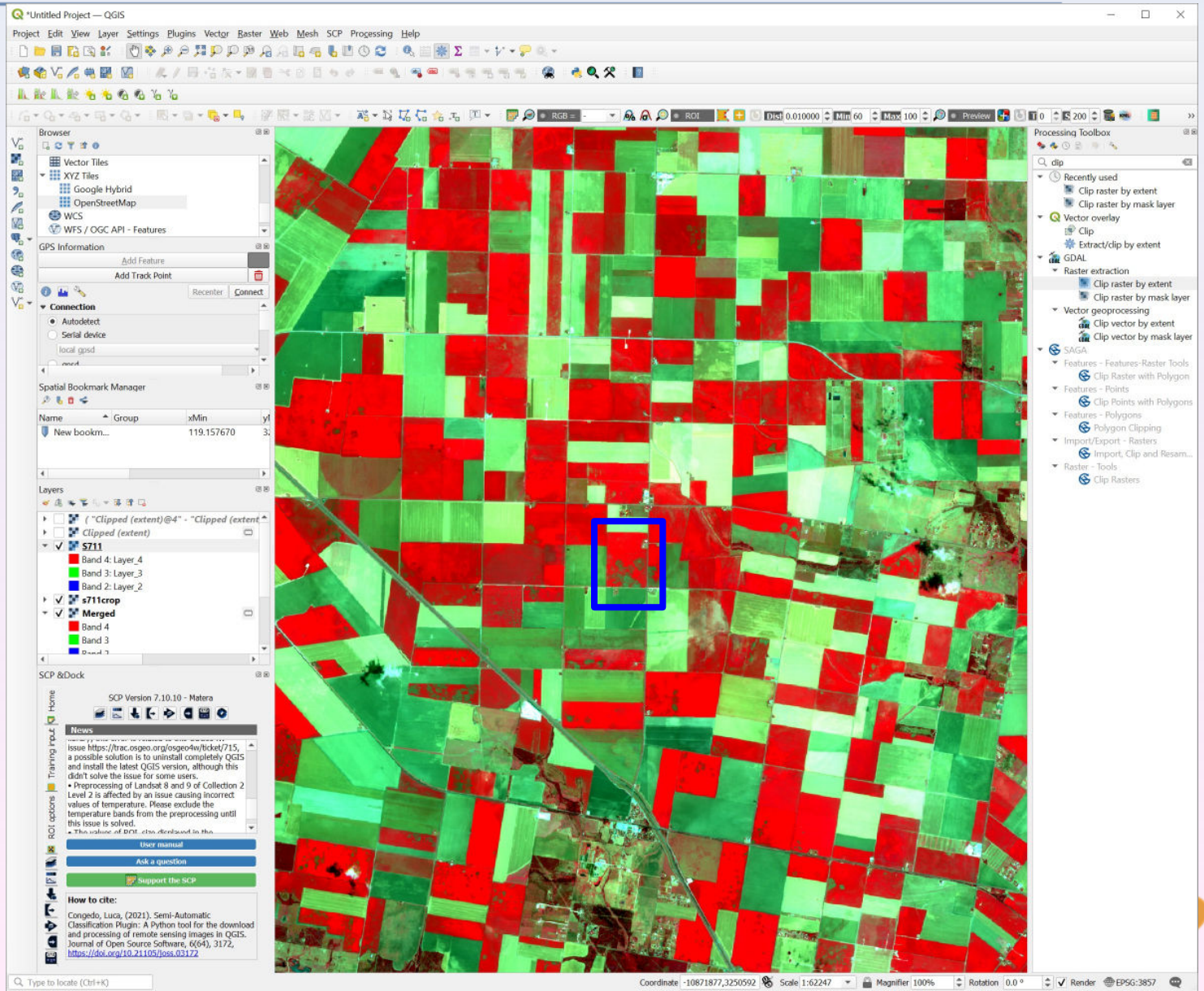
A Root Rot-infested Cotton Growing Area



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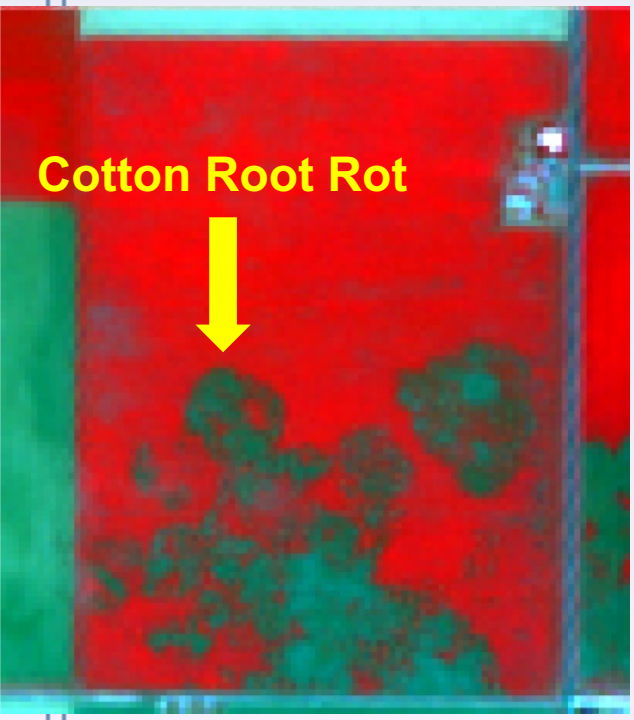
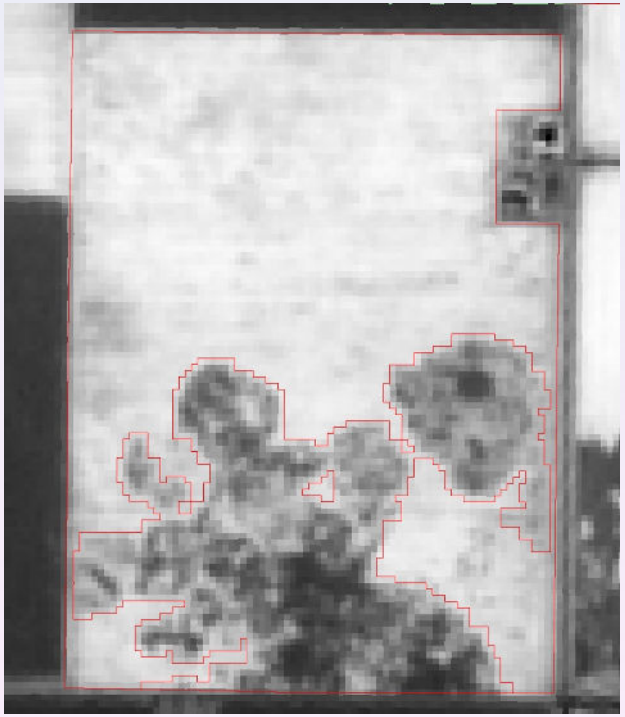
Create Prescription Map from NDVI Image for Site-specific Fungicide Application



Color-infrared image



NDVI map

Prescription map

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Summary

- The free QGIS software can be used for downloading and processing free Sentinel-2 satellite imagery.
- Sentinel-2 imagery can be used to create prescription maps for site-specific management of crop problems and many other agricultural applications.
- This presentation serves as a first step to get you started. It will take some hands-on experience for you to feel comfortable to complete the process.

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Questions?

Thank You!

chenghai.yang@usda.gov