

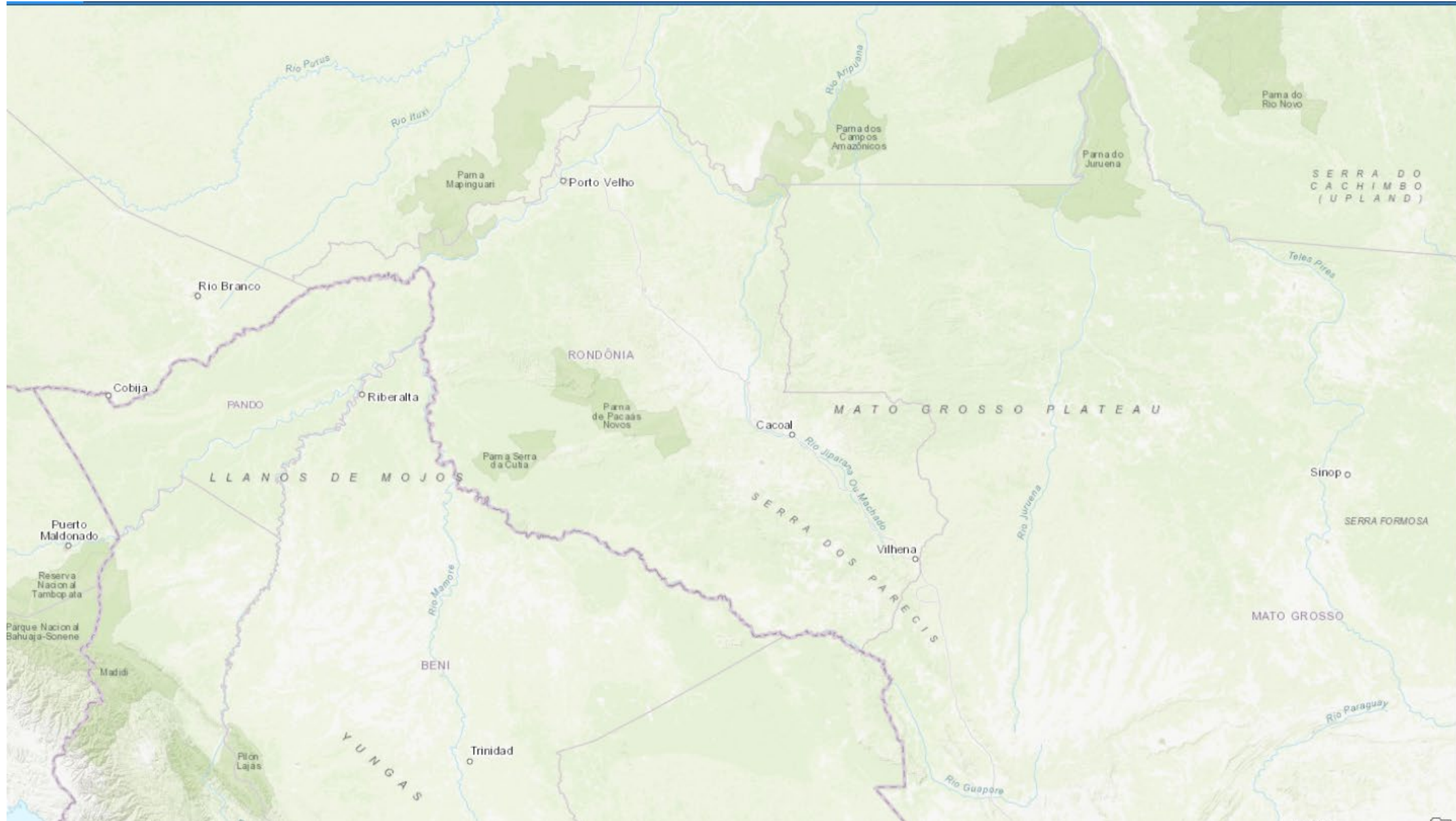
Image Classification of Agriculture, Rainforest and Urbanization of Rondolandia, Brazil

Geography 342

Wynshum Luke

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Study Site: Rondolandia, Brazil



Goals

- Create a classification output identifying urban, agriculture and forest using a supervised classification method.
- Data Source: Landsat 8 / USGS Earth Explorer Portal.



Creating Training Sites and Emerging Issues

- Training Site Guideline Followed:
 - $TS > 100$ Pixels
 - Homogeneous Spectral Signature
- Potential issues
 - Spectral similarities between areas of agriculture and forests.
 - Forest or Orchard?
 - Features like water/roads/canals are only one pixel wide.
 - User unfamiliar with the Brazilian landscape.







l@hal2000: ~

```
l@hal2000:~$ sudo apt install qgis
```

Exploring Image Classification of Agriculture, Rainforest and Urbanization of Rondolandia, Brazil using QGIS and SACP

Geography 342

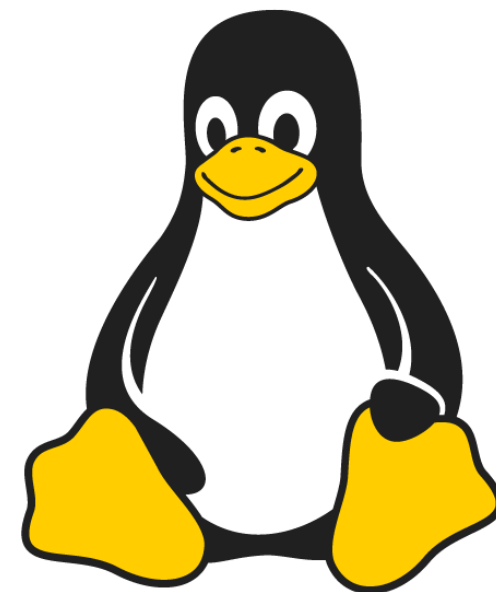
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Tools Used

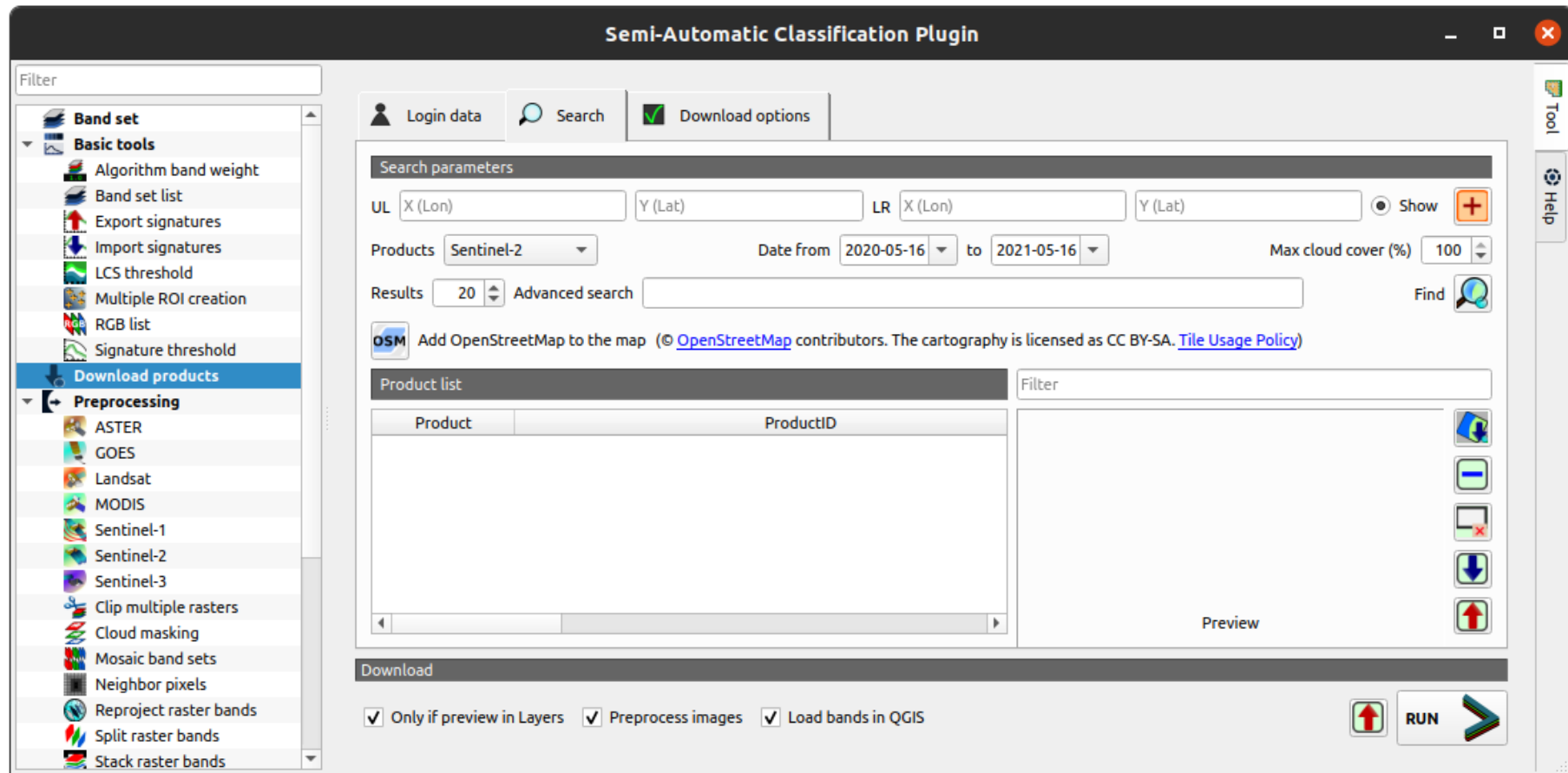
- Operating System
 - Ubuntu Linux 20.04
- QGIS
 - Semi-Automatic Classification Plugin
- Dependencies
 - Python
 - NumPy
 - SciPy
 - GDAL



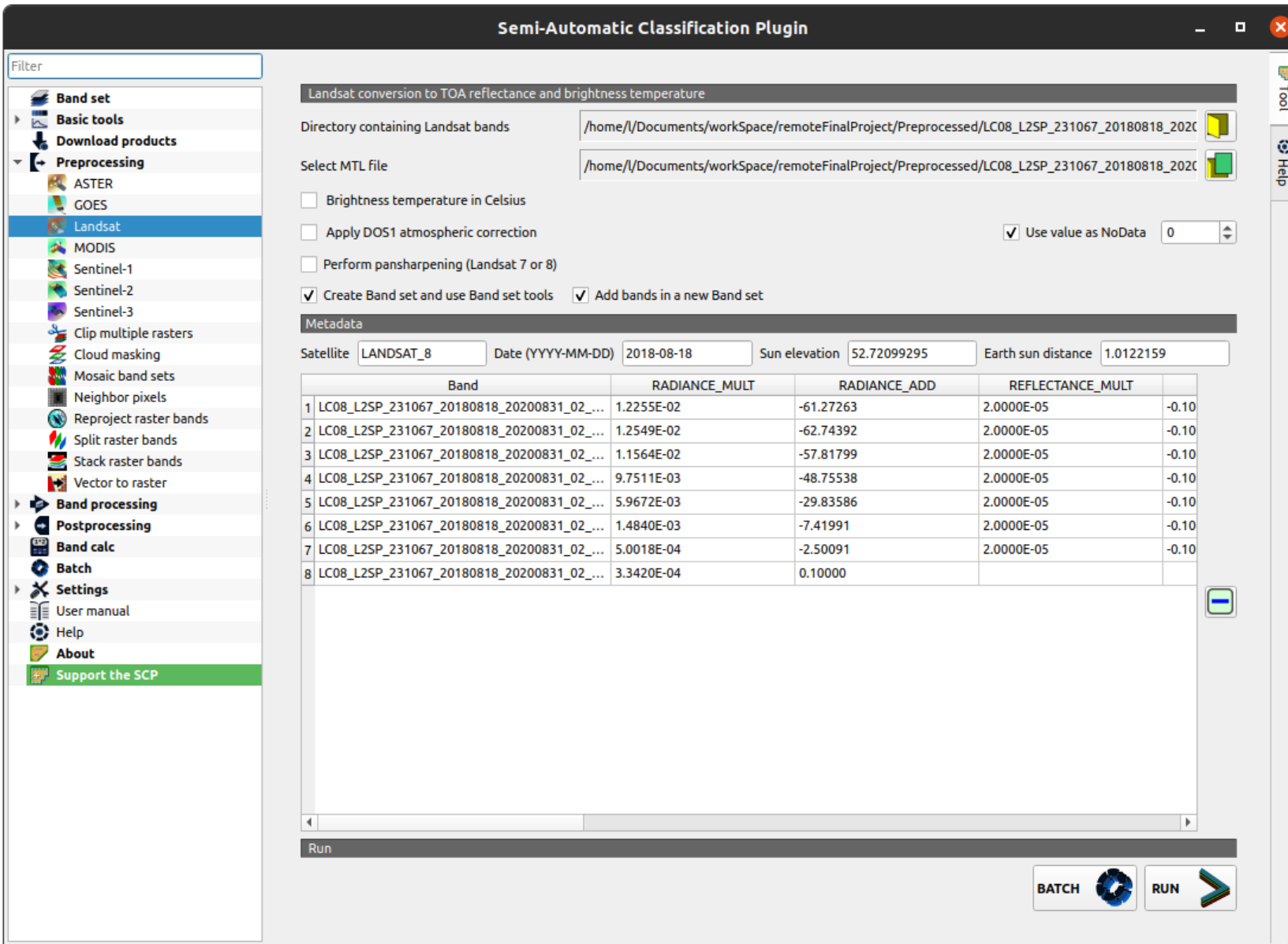
Using Semi-Automatic Classification Plugin

It's pretty user friendly and intuitive.....

SACP has a data downloader interface

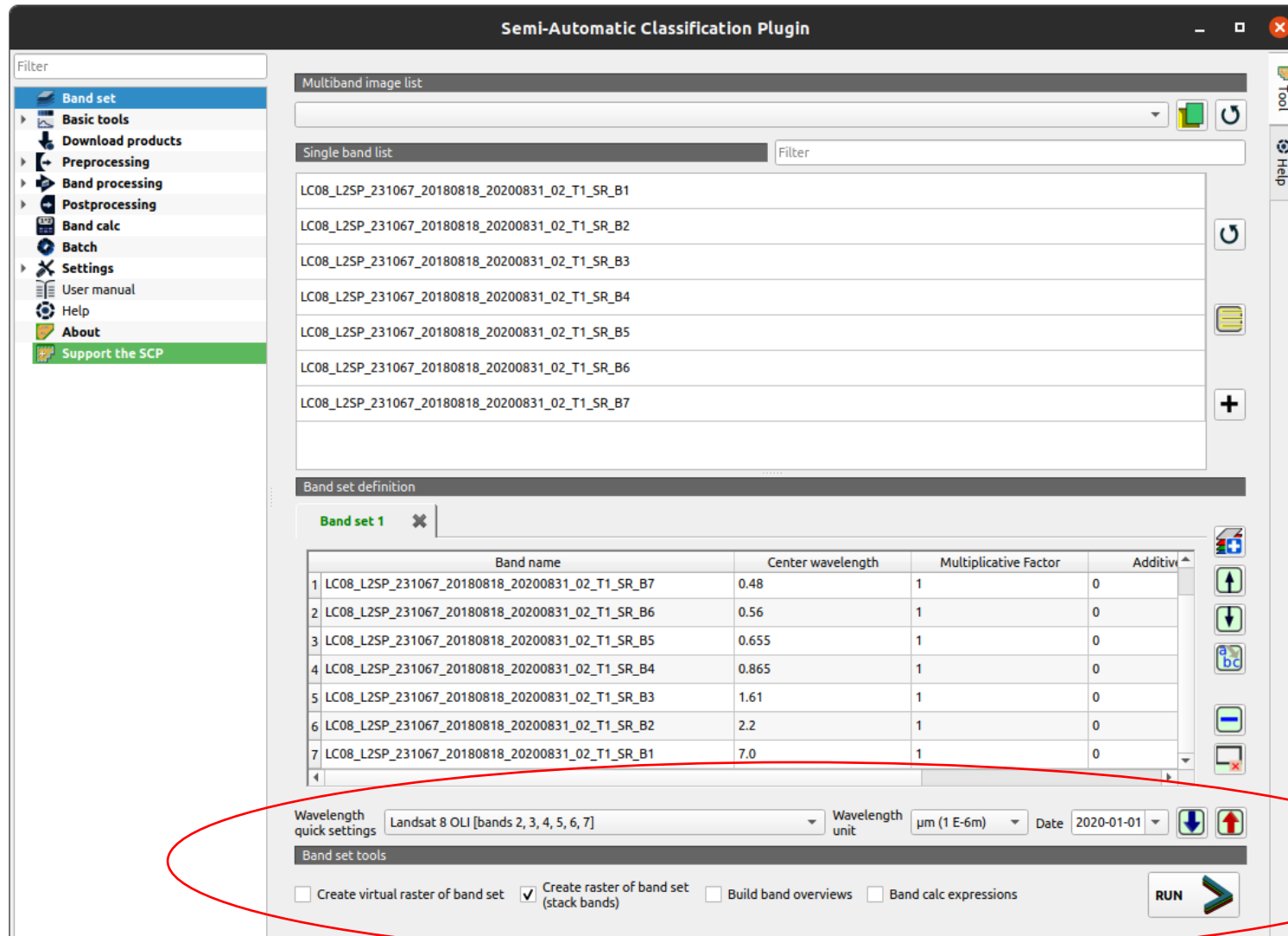


Preprocessing



- Converts to surface reflectance
- Has various settings specific to types of satellite imagery
- Has a clipping option for clipping without the creation of a vector /polygon feature
 - Visual selection
 - Coordinates

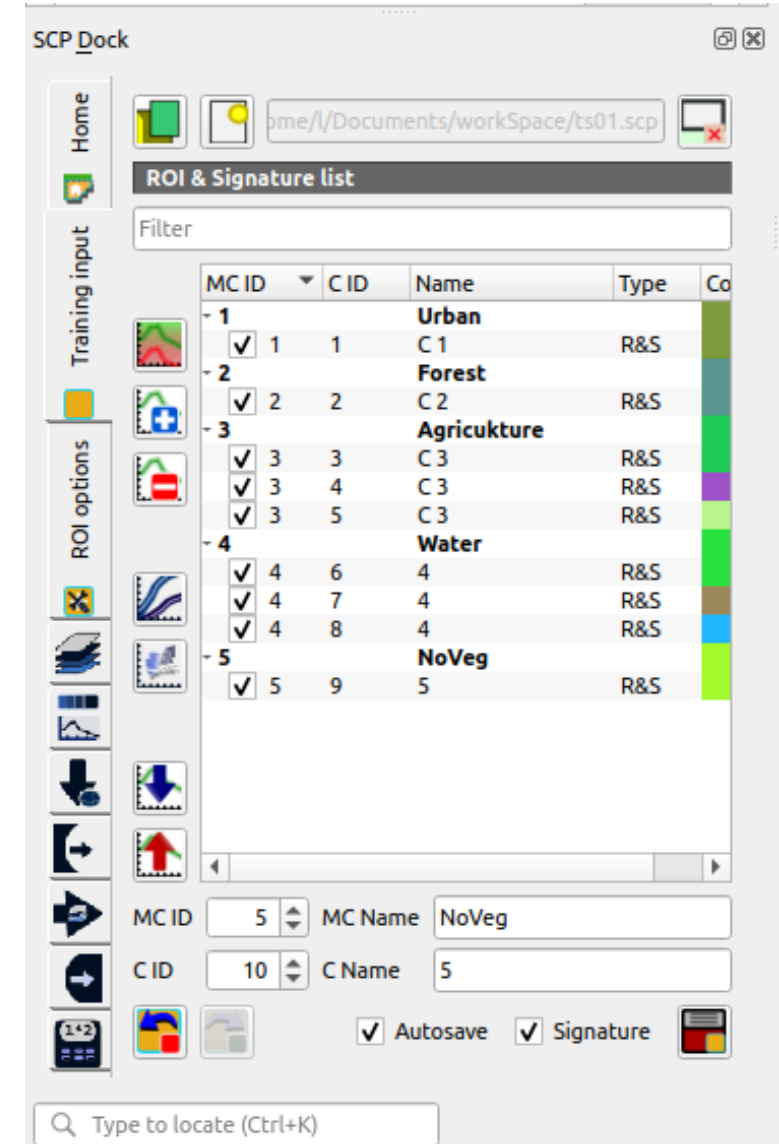
Compositing Bandset

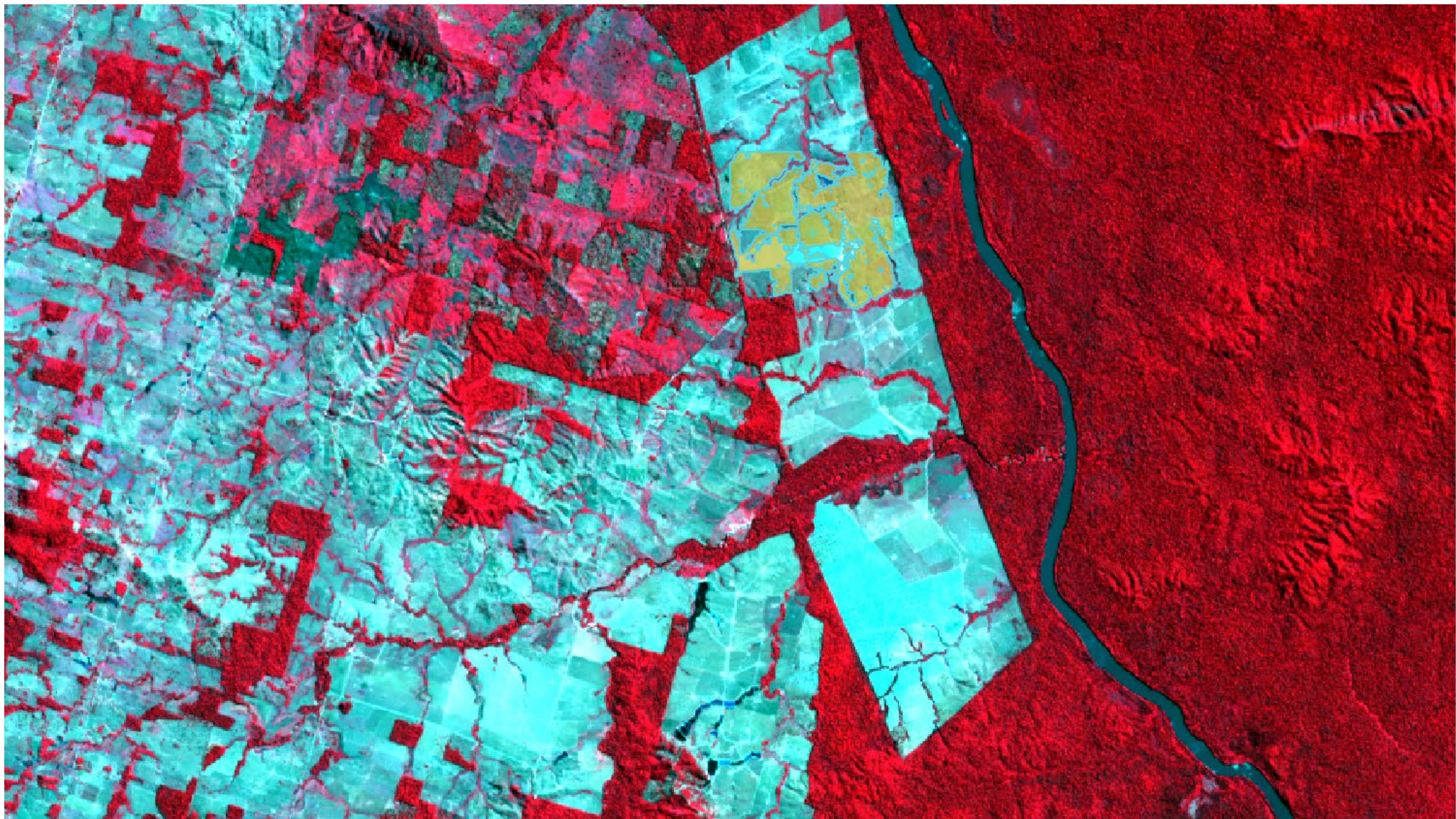


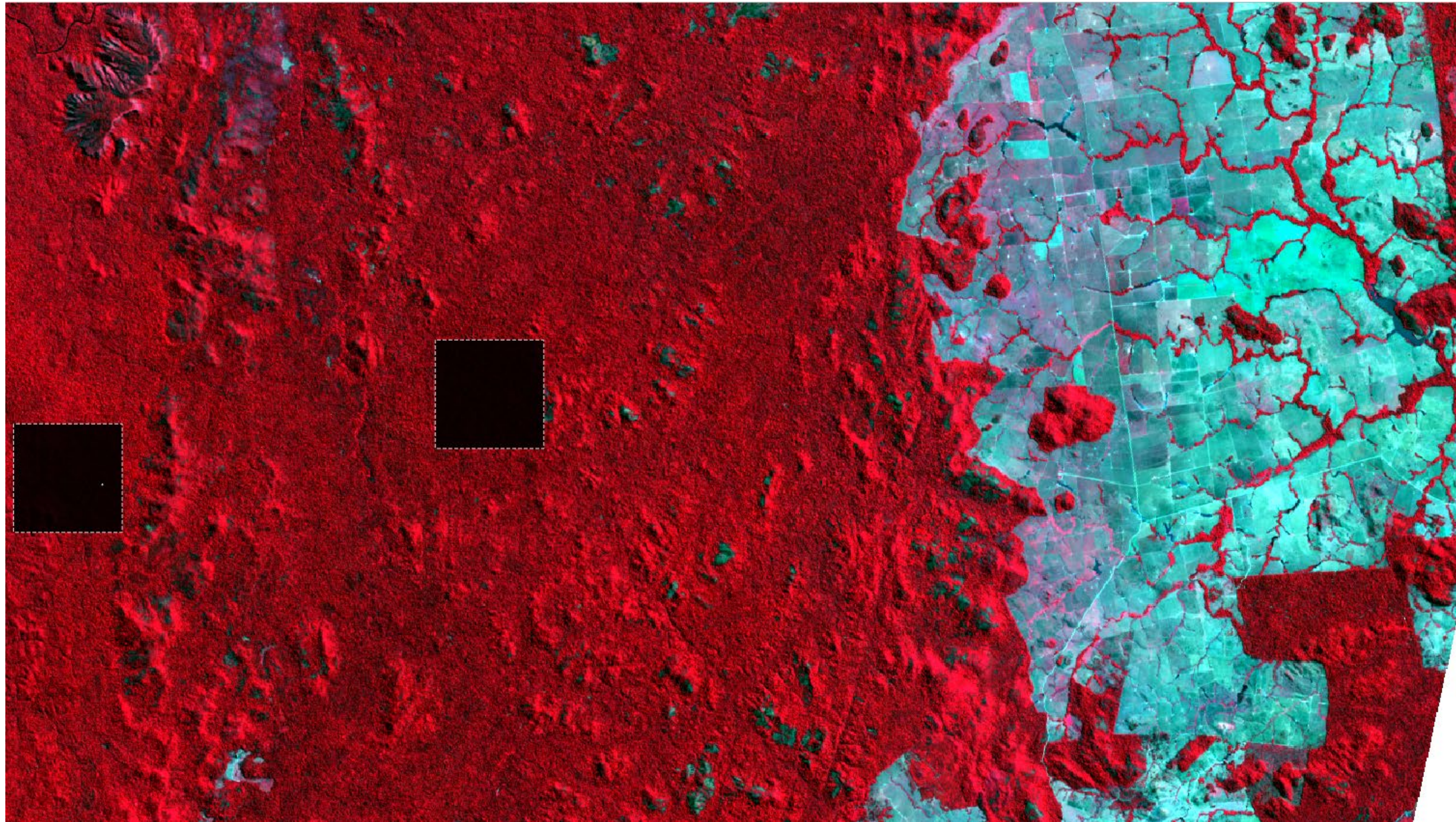
- Using the “bandset” section to combine bands into a composite geotiff.
- Various outputs available
 - Raster export
 - Temp/dynamic raster
 - Band overview
 - Band expression

Training Site (ROI) Creation and Selection

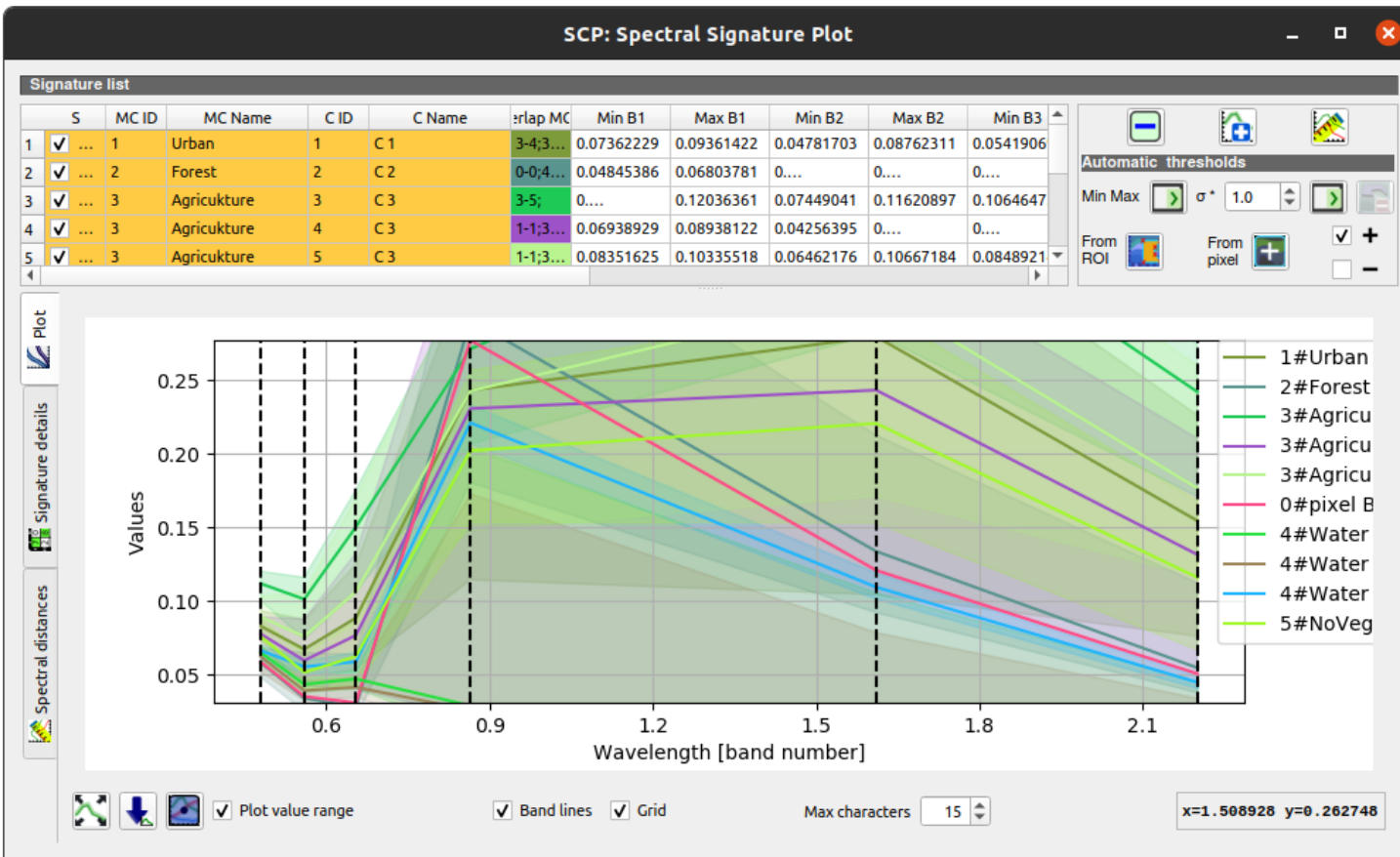
- SCP calls training sites “region of interests”
- Similar to ArcPro
 - Can select by shape
 - Does not create a segmented image
 - Can select by object or spectrally similar nearby pixels
- Different keys can be assigned to unique training sites and can be referenced in the classification process.
 - Macro Class and Class, ID





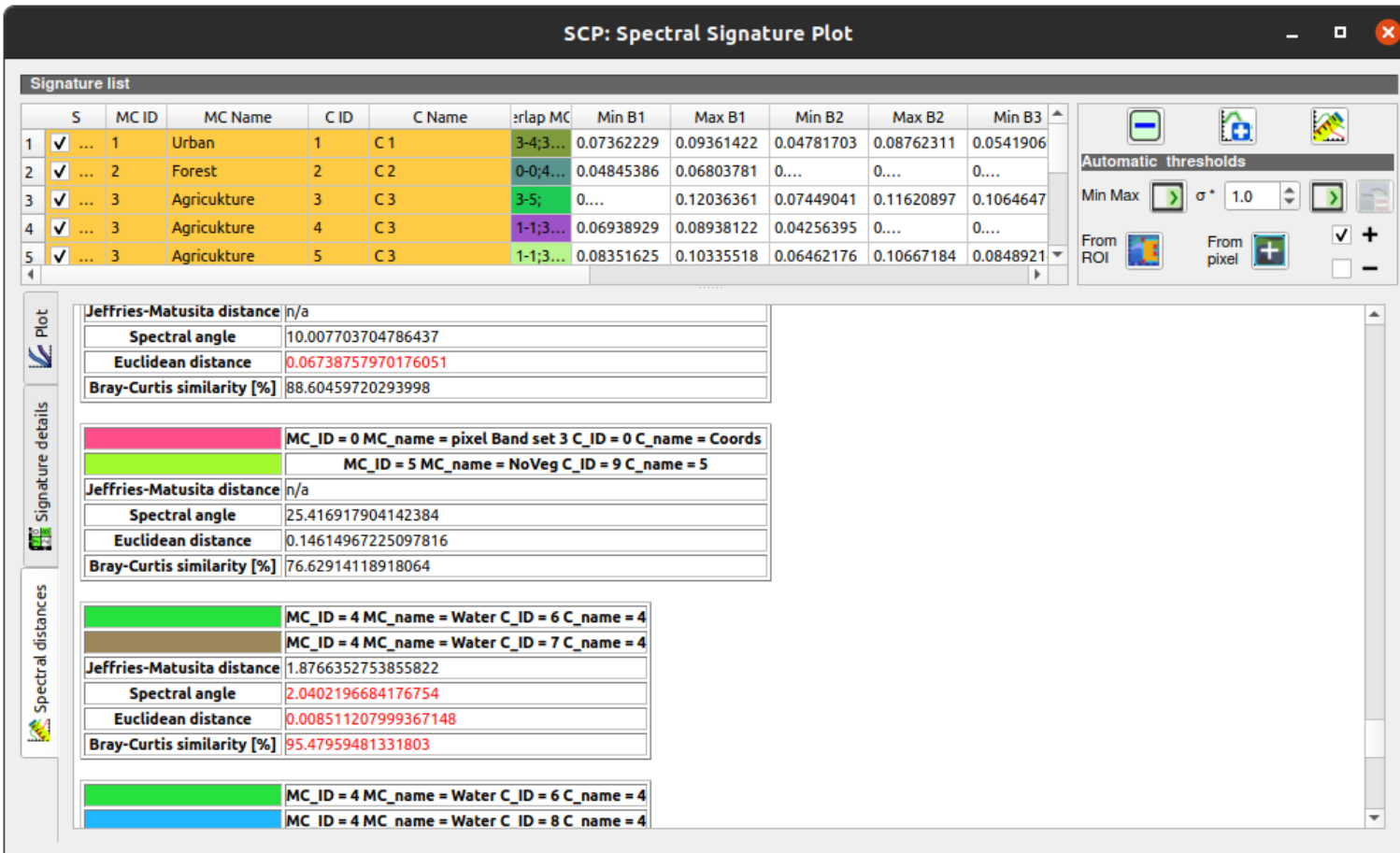


Examining ROI Spectral Data



- The Spectral Signature Plot allows users view spectra signature of collected ROI data.
- Allows users to find classes with similar signatures before classification.

Spectral Distance Data



- Allows users a quantitative view to compare spectral data or collected ROI.
- Similar or near values are highlighted in red.

Running the classification algorithm.

Save now!

SACP Classification

- Spectral Angle Mapping
- Minimum Distance
- Maximum Likelihood

- DO NOT CREATE VECTOR!!!!!!

The screenshot displays the 'SACP Classification' tool interface. The 'Classification' section has 'Select input band set' set to 1 and 'Use' checked for 'MC ID'. The 'Algorithm' section has 'Maximum Likelihood' selected with a 'Threshold' of 0.0000. The 'Land Cover Signature Classification' section has 'Use' checked for 'LCS', 'Algorithm', and 'only overlap'. The 'Classification output' section has 'Load qml style' set to an empty field, 'Apply mask' checked, 'Create vector' checked, 'Classification report' checked, and 'Save algorithm files' checked. The interface includes a 'Tool' button and a 'Help' button on the right side.

Classification

Select input band set 1

Use ☒ MC ID ☐ C ID

Algorithm

Maximum Likelihood Threshold 0.0000

Land Cover Signature Classification

Use ☒ LCS ☒ Algorithm ☒ only overlap

Classification output

Load qml style

☒ Apply mask

☒ Create vector

☒ Classification report

☒ Save algorithm files

The screenshot displays the 'SACP Classification' tool interface. The 'Classification' section has 'Select input band set' set to 1 and 'Use' checked for 'MC ID'. The 'Algorithm' section has 'Spectral Angle Mapping' selected with a 'Threshold' of 0.0000. The 'Land Cover Signature Classification' section has 'Use' checked for 'LCS', 'Algorithm', and 'only overlap'. The 'Classification output' section has 'Load qml style' set to an empty field, 'Apply mask' checked, 'Create vector' checked, 'Classification report' checked, and 'Save algorithm files' checked. The interface includes a 'Tool' button and a 'Help' button on the right side.

Classification

Select input band set 1

Use ☒ MC ID ☐ C ID

Algorithm

Spectral Angle Mapping Threshold 0.0000

Land Cover Signature Classification

Use ☒ LCS ☒ Algorithm ☒ only overlap

Classification output

Load qml style

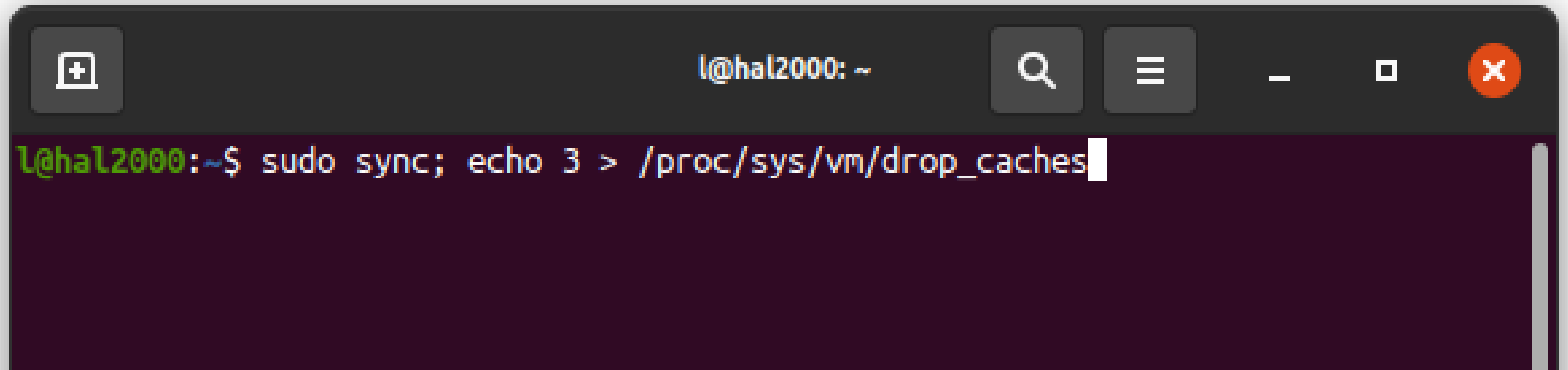
☒ Apply mask

☒ Create vector

☒ Classification report

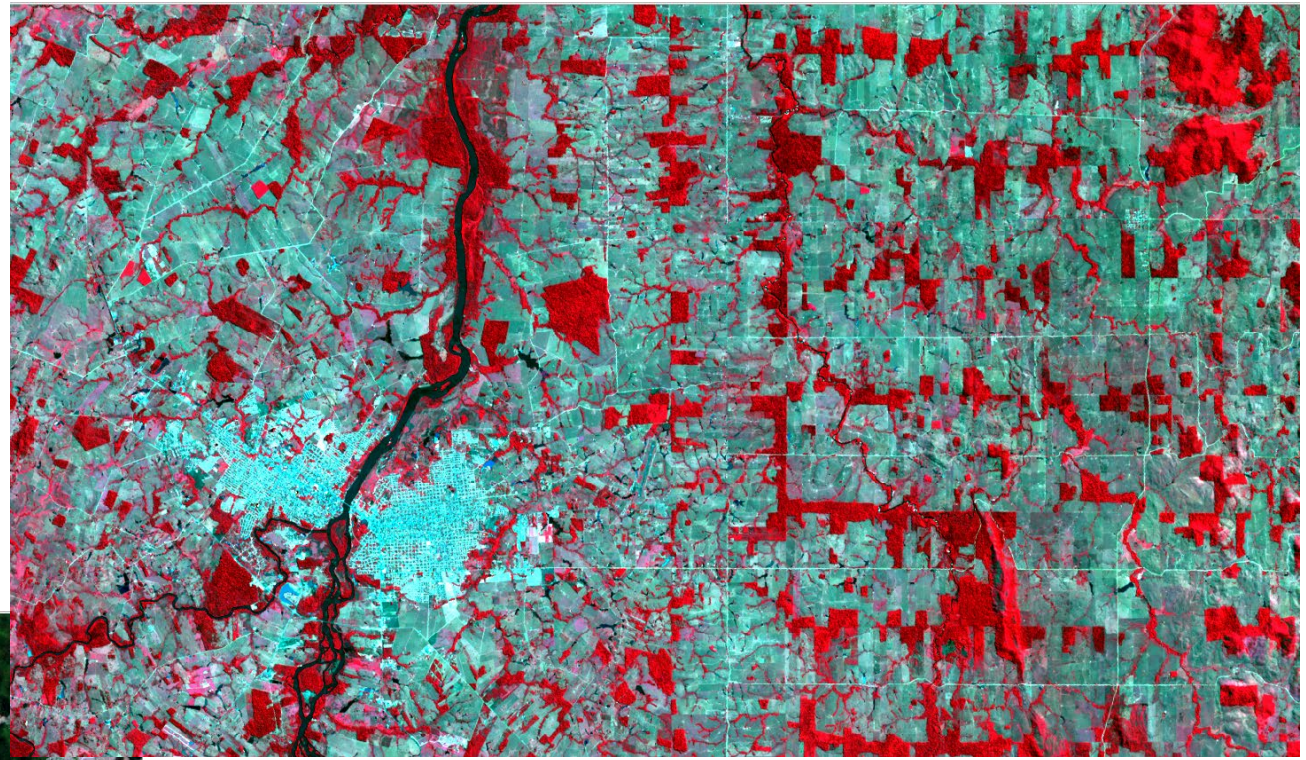
☒ Save algorithm files

RAM Cache Dump Helps

A terminal window with a dark background and a title bar. The title bar contains a window icon on the left, the text 'l@hal2000: ~' in the center, and search, menu, and window control icons on the right. The terminal shows a command being entered: 'l@hal2000:~\$ sudo sync; echo 3 > /proc/sys/vm/drop_caches'.

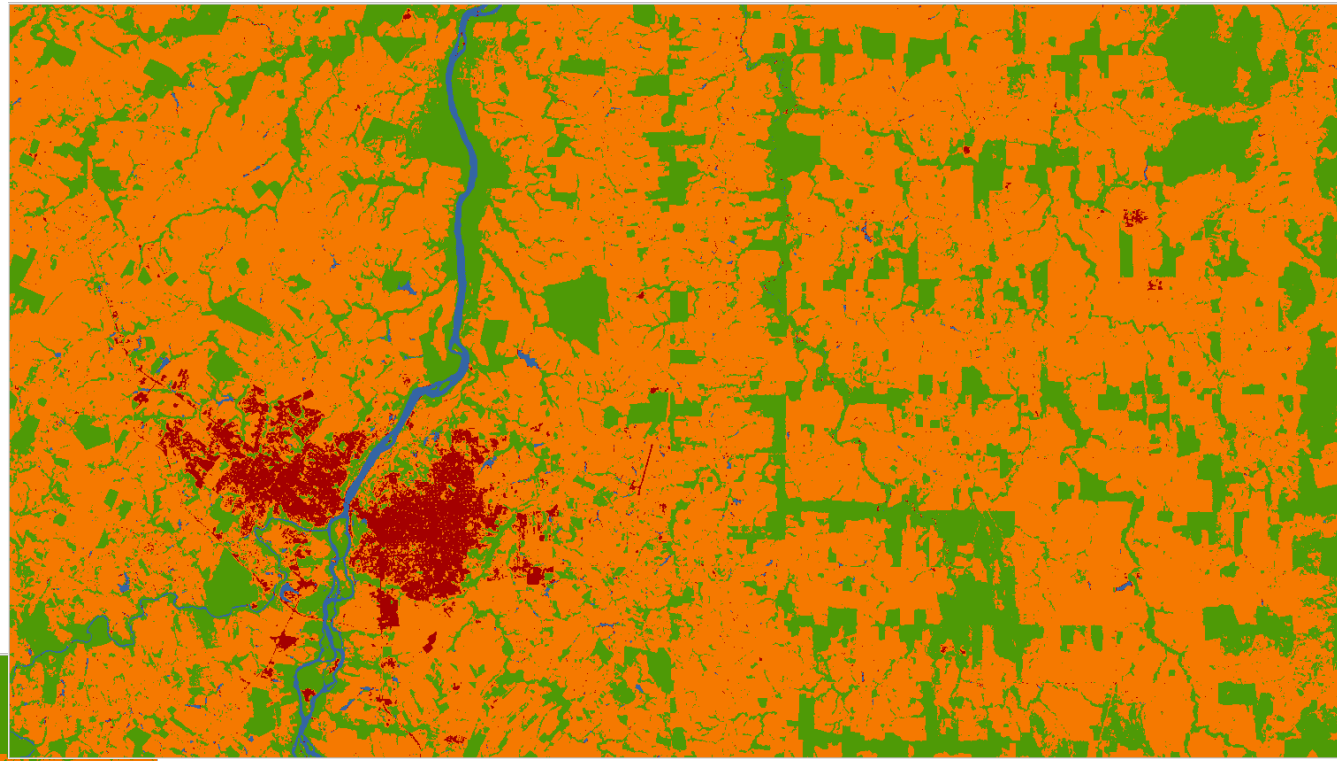
```
l@hal2000:~$ sudo sync; echo 3 > /proc/sys/vm/drop_caches
```

Starting Raster

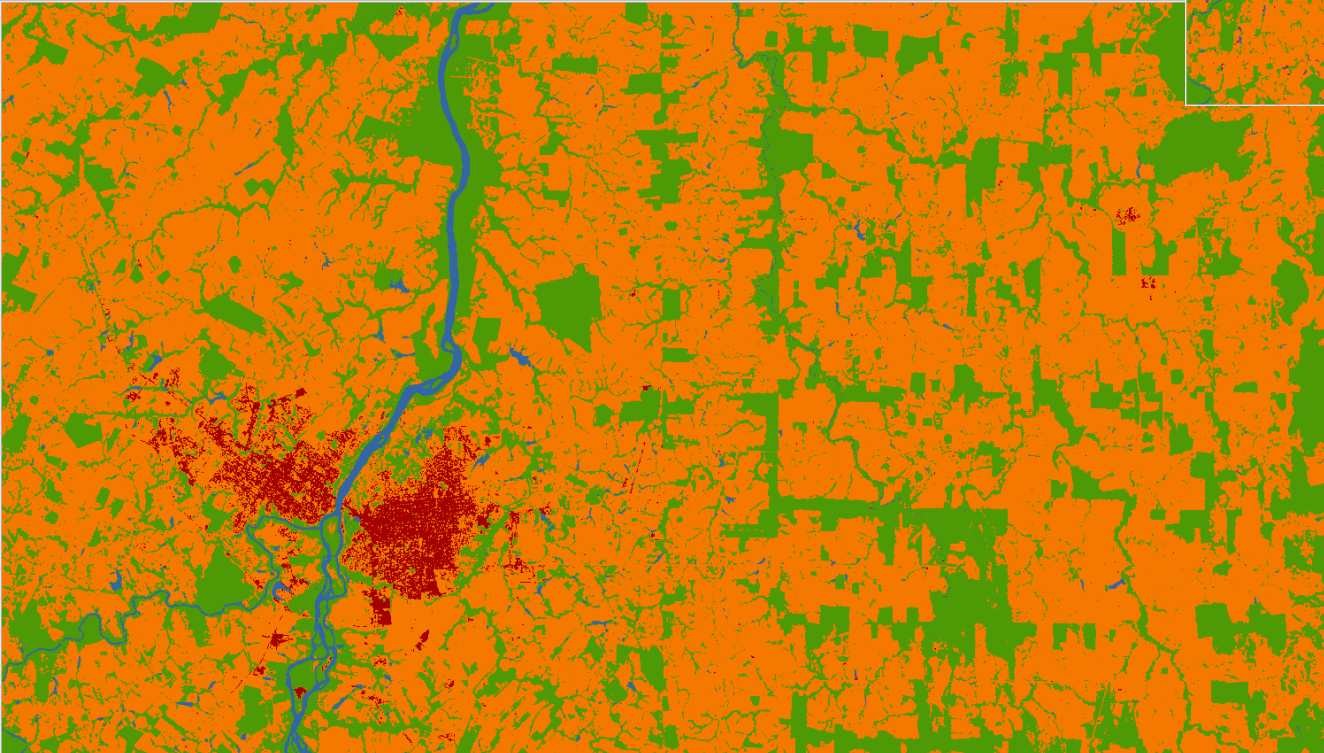


Minimum Distance

Gen 1

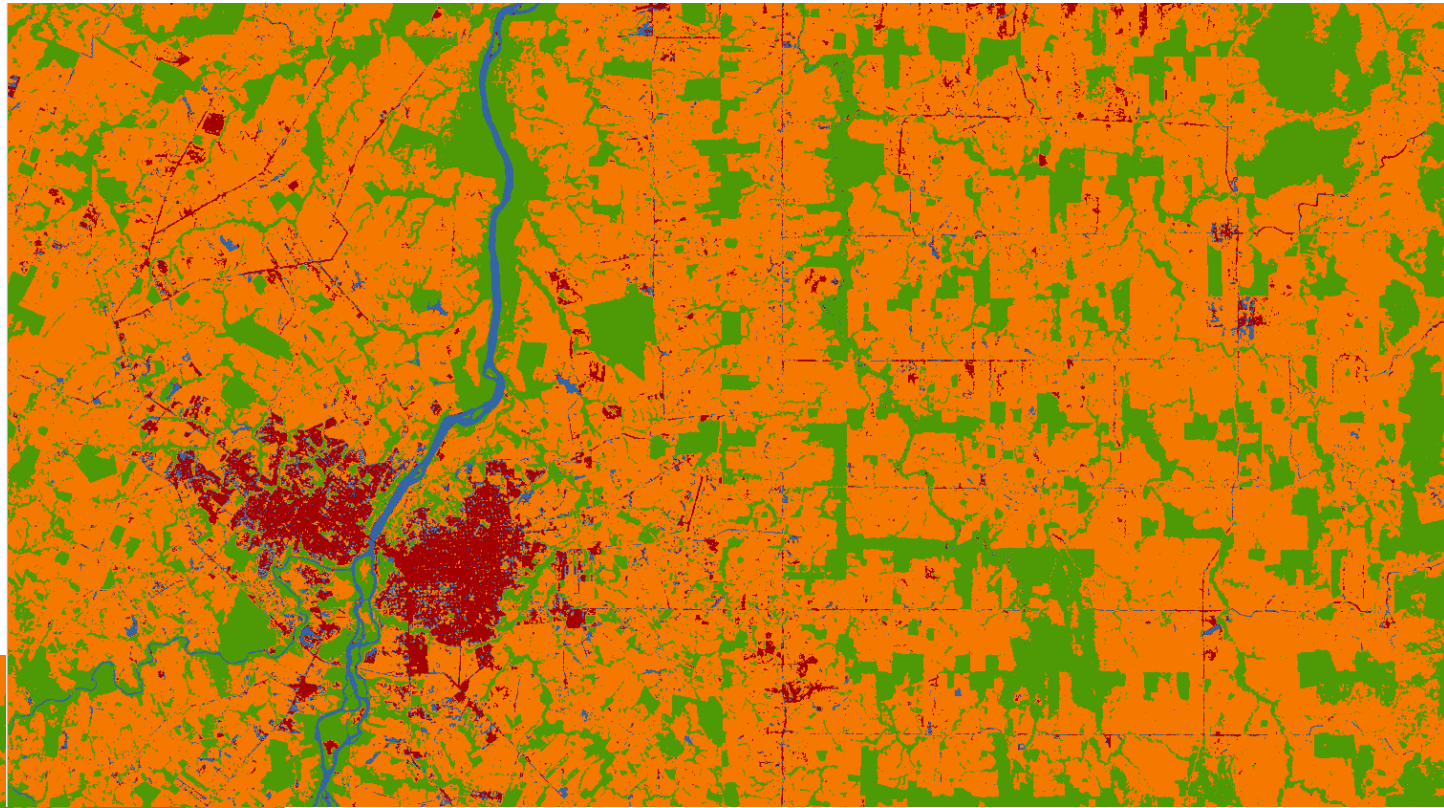


Gen Final

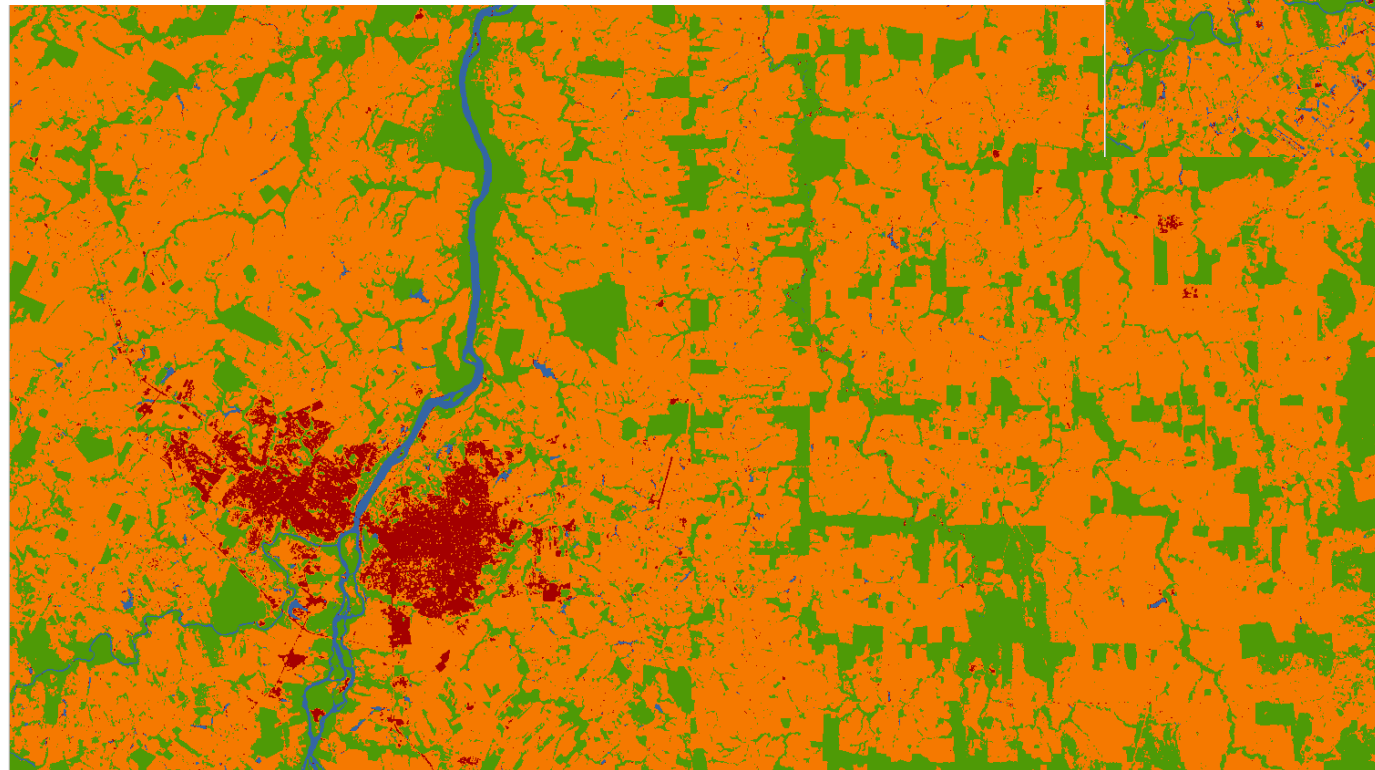


Spectral Angle Mapping

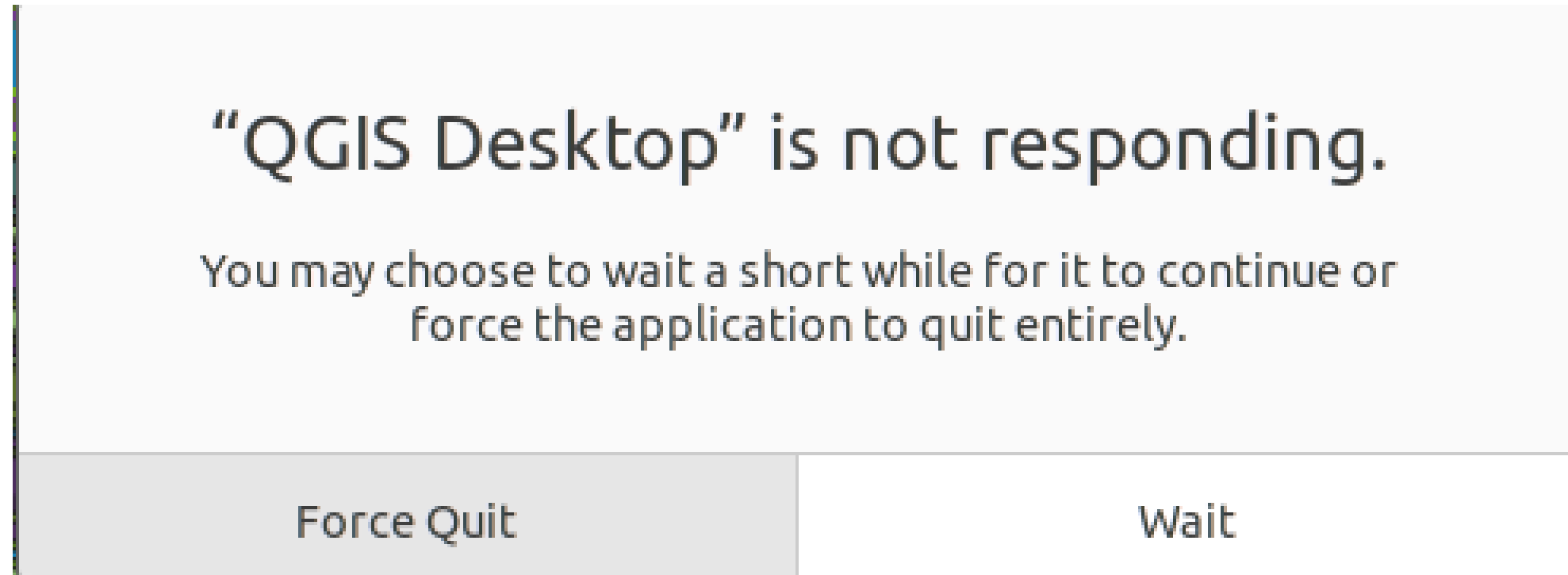
Gen 1



Gen Final

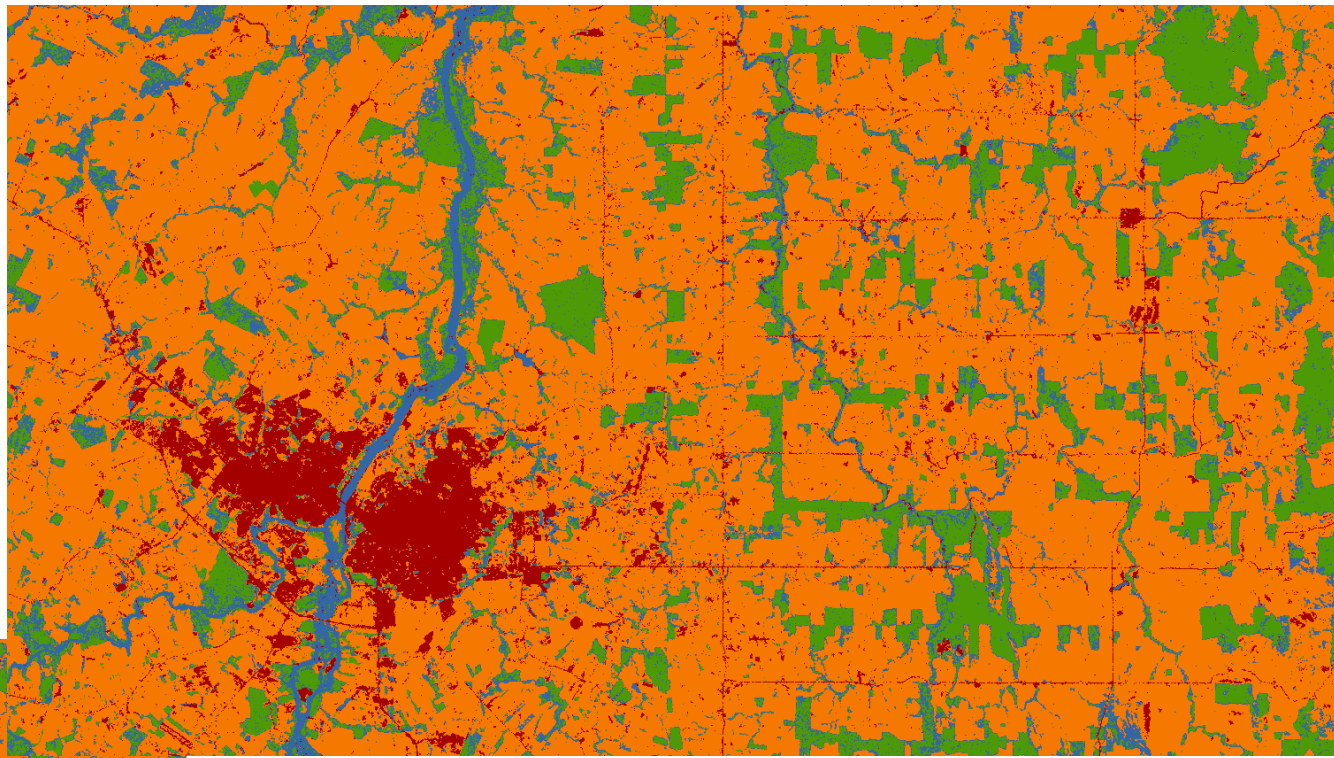


Maximum..... Likelihood.....

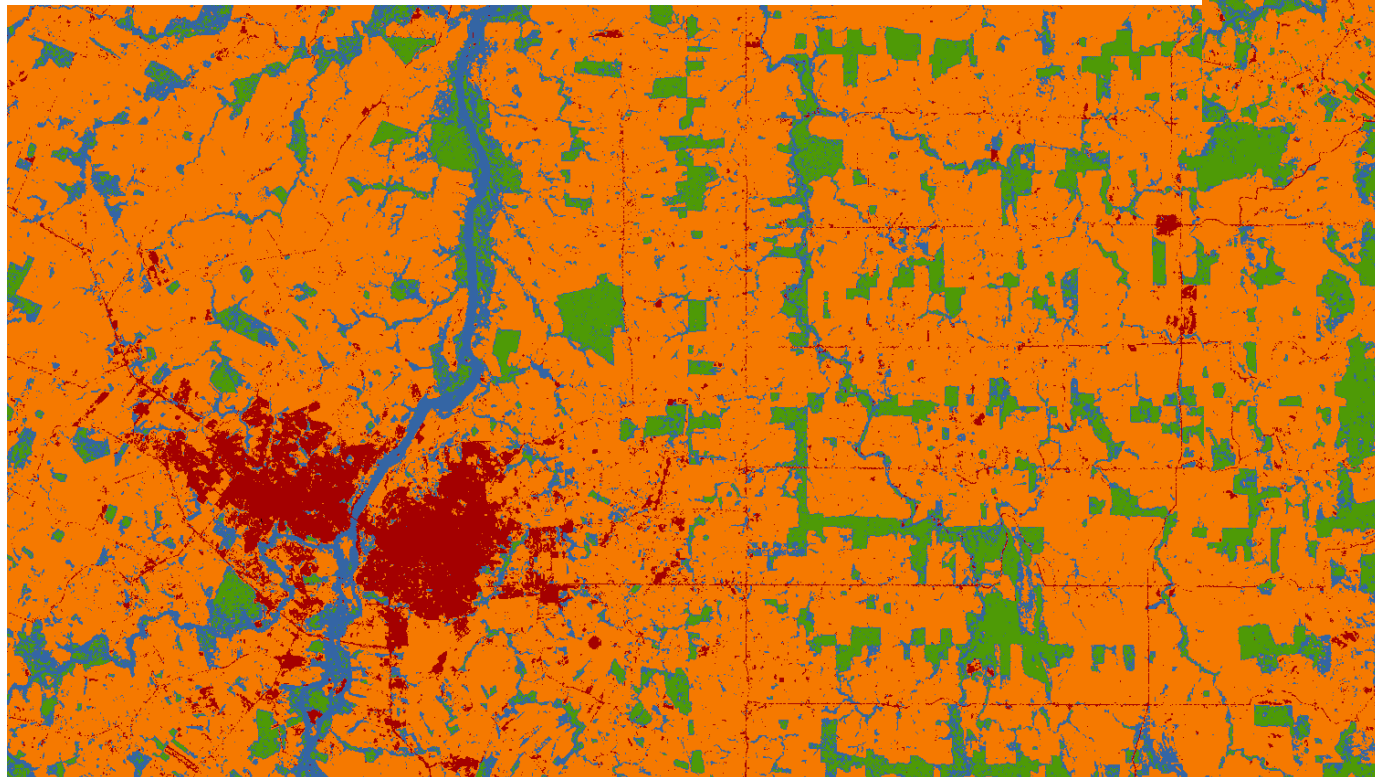


Maximum Likelihood

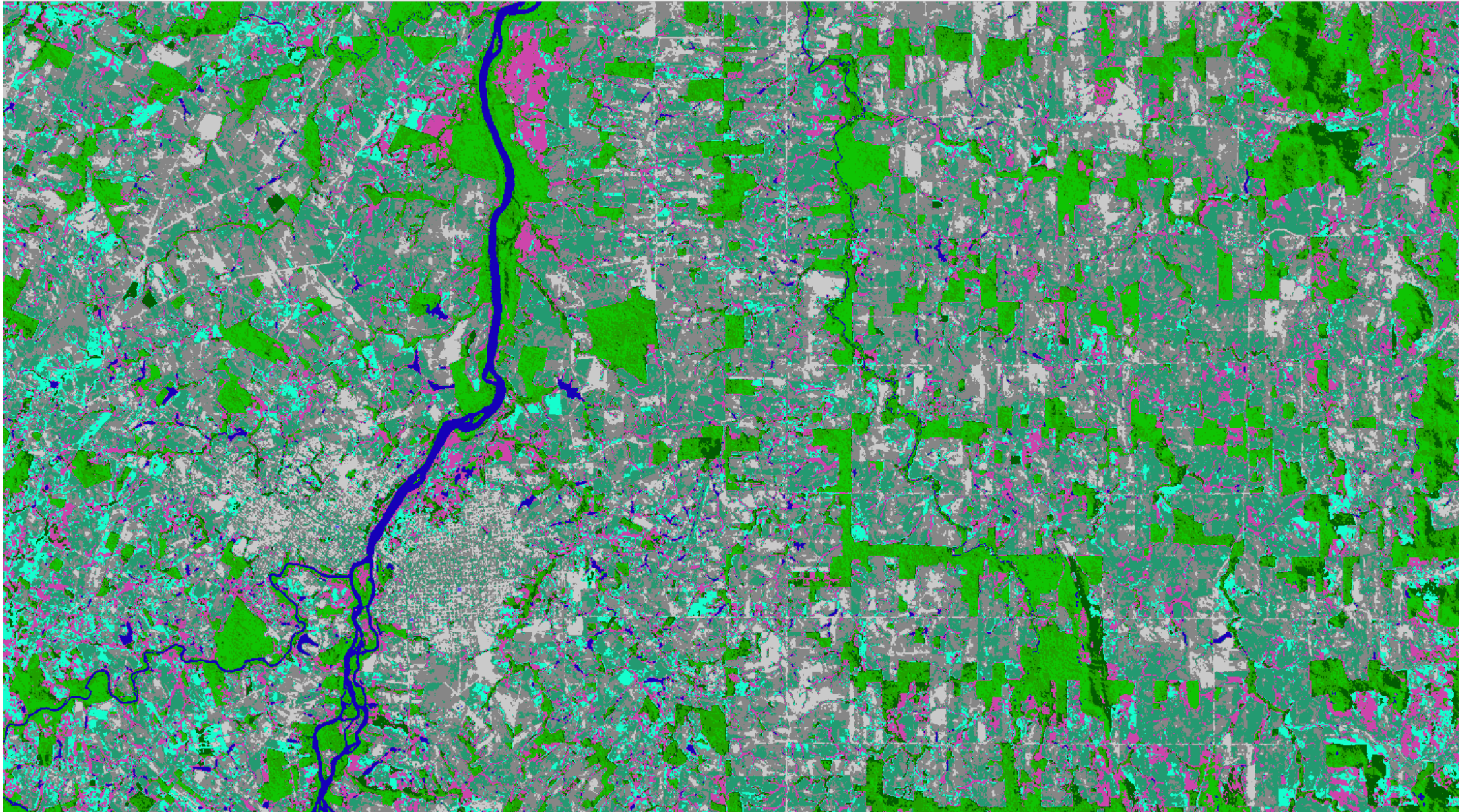
Gen 1



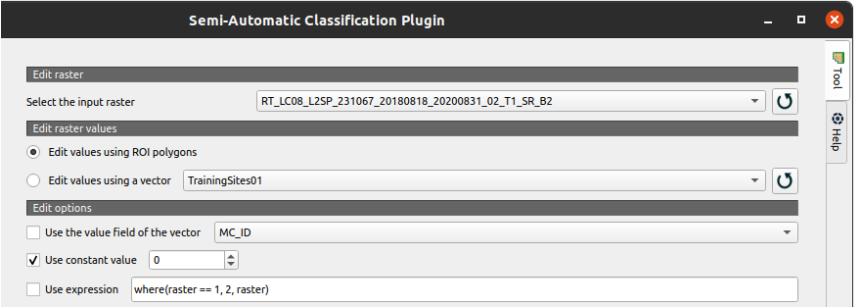
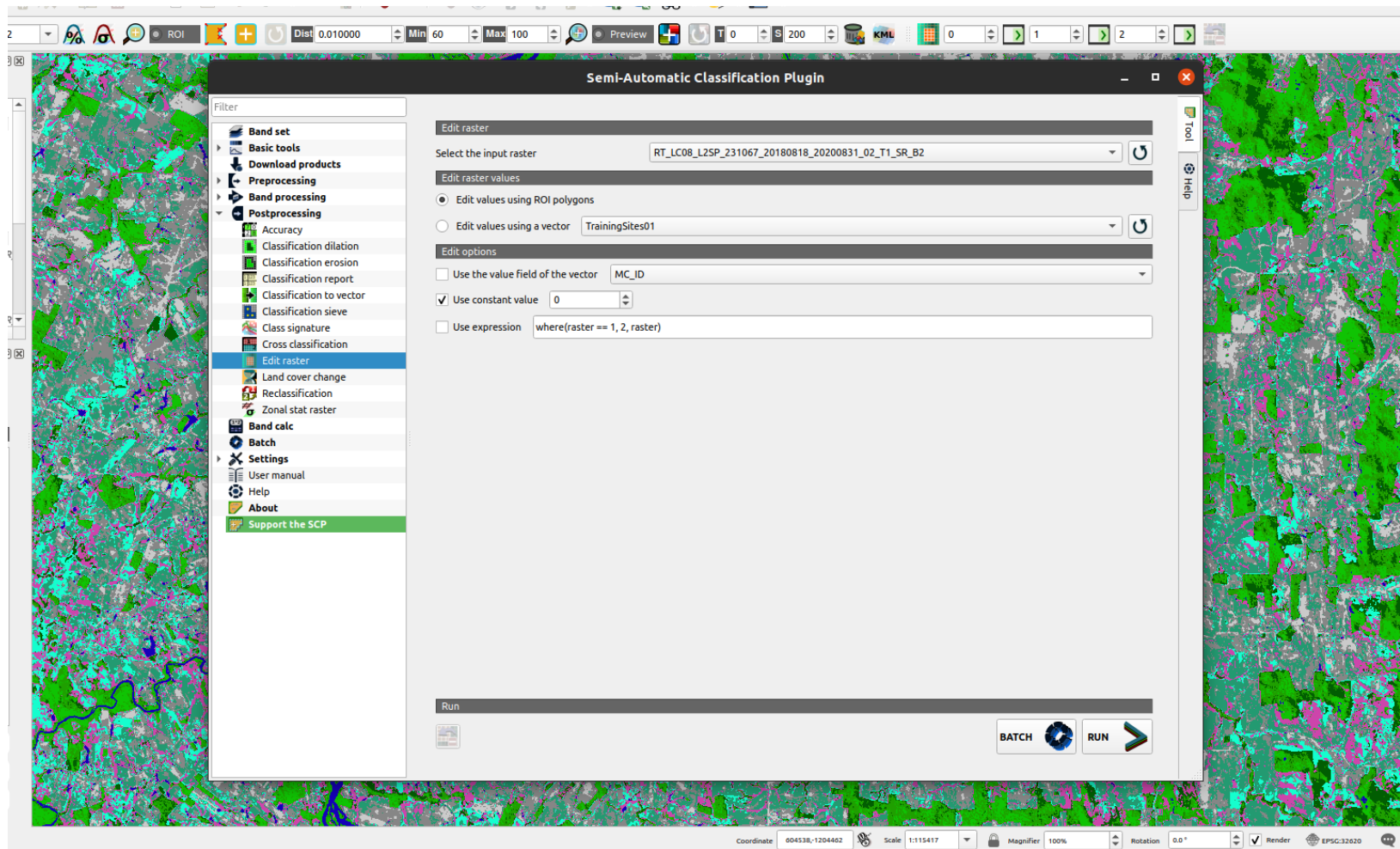
Gen Final



Ten Class Unsupervised



Post Processing: Reclassify and Edit



Accuracy Assessment: Generate Samples

*accuracyMinDist — QGIS

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh SCP Processing Help

Layers

- AccuracyAssessment
- minDistance14Accuracy
- minDistance14
- Band 1 (Gray)
- 0 - Unclassified

SCP Dock

ROI & Signature list

Filter

MC ID	CID	Name	Type	Co
1	27	Agriculture	R&S	
1	32	C1	R&S	
1	33	C1	R&S	
1	34	C1	R&S	
1	35	C1	R&S	
2	25	water	R&S	
2	28	C1	R&S	
2	29	C1	R&S	
2	30	C1	R&S	
2	31	C1	R&S	
3	26	Urban	R&S	
3	36	C1	R&S	
3	37	C1	R&S	
3	38	C1	R&S	
3	39	C1	R&S	
4	24	forest	R&S	
4	40	C1	R&S	
4	41	C1	R&S	
4	42	C1	R&S	
4	43	C1	R&S	

MC ID: 4 MC Name: Forest

CID: 44 C Name: C1

Autosave Signature

Warning [12]: The following signature will be excluded if using Maximum Likelihood (singular covariance matrix). Macro: 4 ID: 42

4 more

Semi-Automatic Classification Plugin

Filter

Band set

- Basic tools
- Algorithm band weight
- Band set list
- Export signatures
- Import signatures
- LCS threshold
- Multiple ROI creation
- RGB list
- Signature threshold
- Download products
- Preprocessing
- ASTER
- GOES
- Landsat
- MODIS
- Sentinel-1
- Sentinel-2
- Sentinel-3
- Clip multiple rasters

Create random points

Number of points: 5 inside grid 10000 min distance 100 Create points

stratified for the values raster == 1 of first band of band set 1

Point coordinates and ROI definition

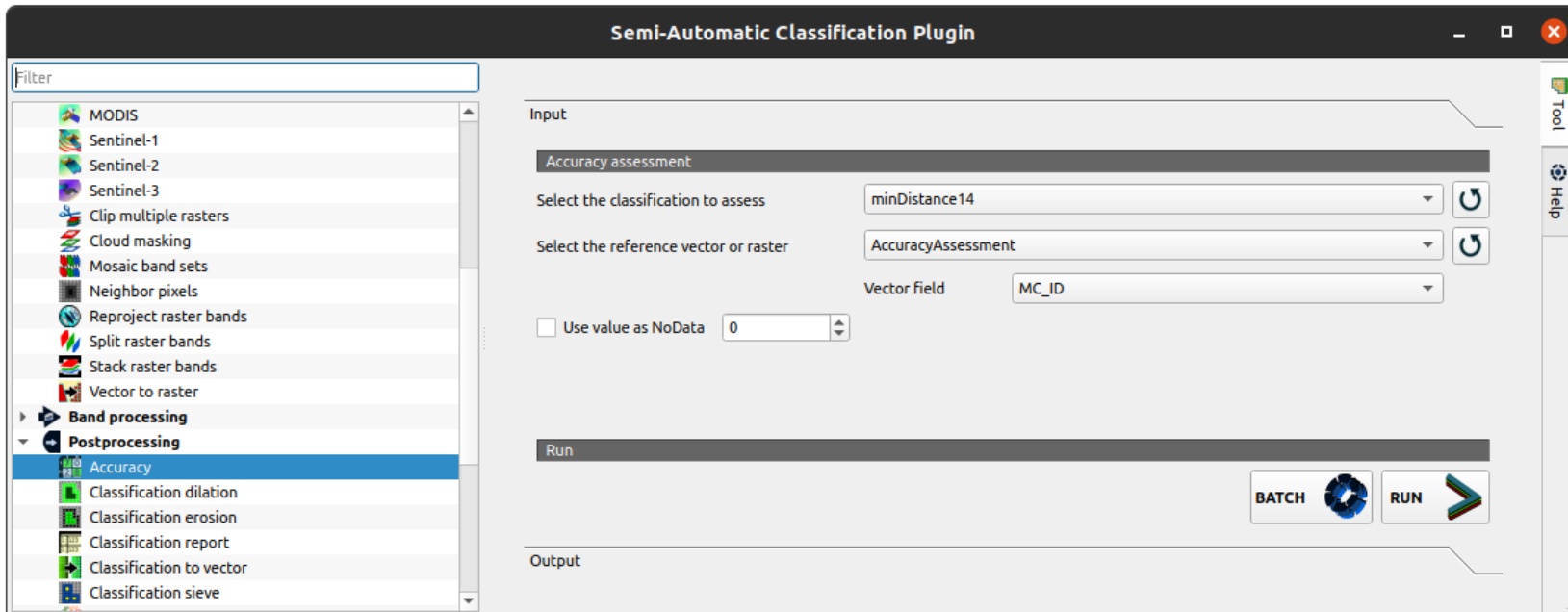
X	Y	MC ID	MC Name	CID	C Name	Min
1 549834.3315675444	-1036913.250...	4	forest	24	C1	1
2 611026.5551989259	-1157702.148...	4	forest	24	C1	1
3 535220.4212694343	-1062058.224...	4	forest	24	C1	1
4 523584.41666589596	-1219253.847...	4	forest	24	C1	1
5 557597.8867159702	-1170831.812...	4	forest	24	C1	1

Run

Calculate sig. RUN

Coordinate: 578354/-1063794 Scale: 1:1130914 Magnifier: 100% Rotation: 0.0° Render EPSC:32620

Accuracy Assessment

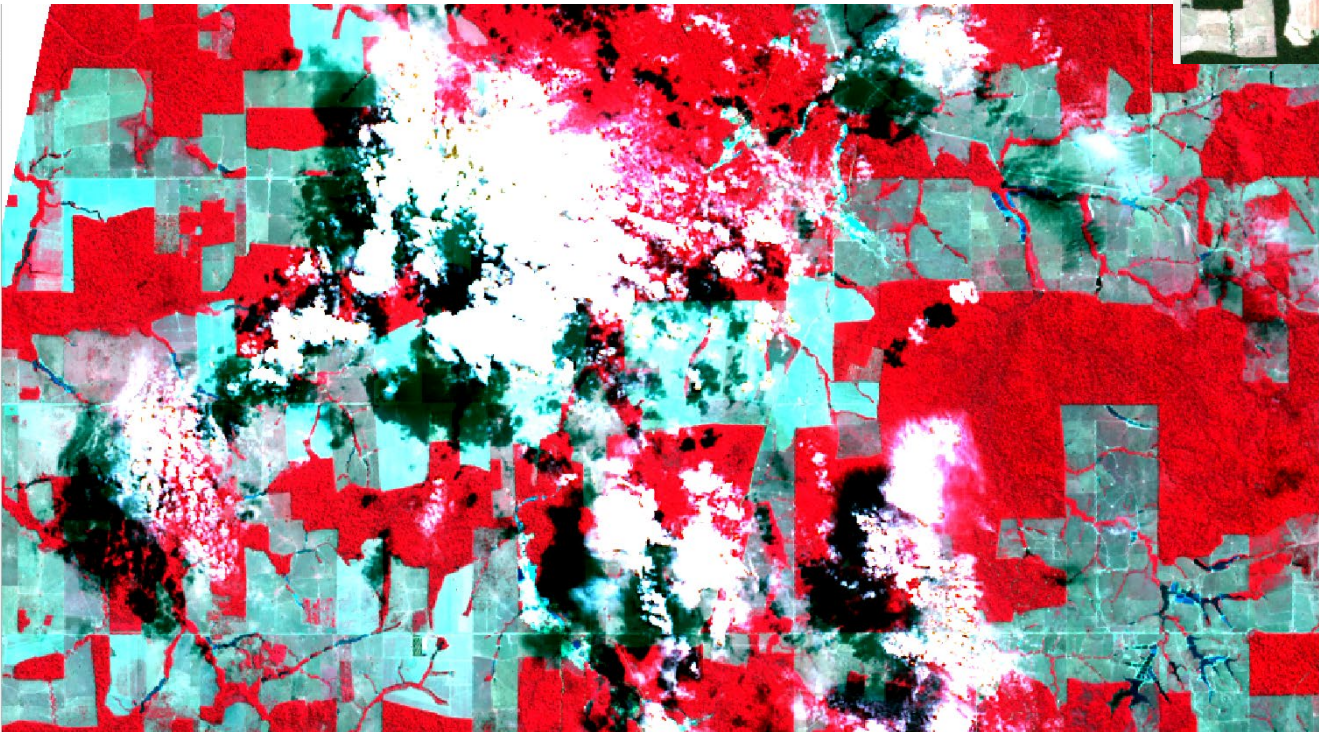
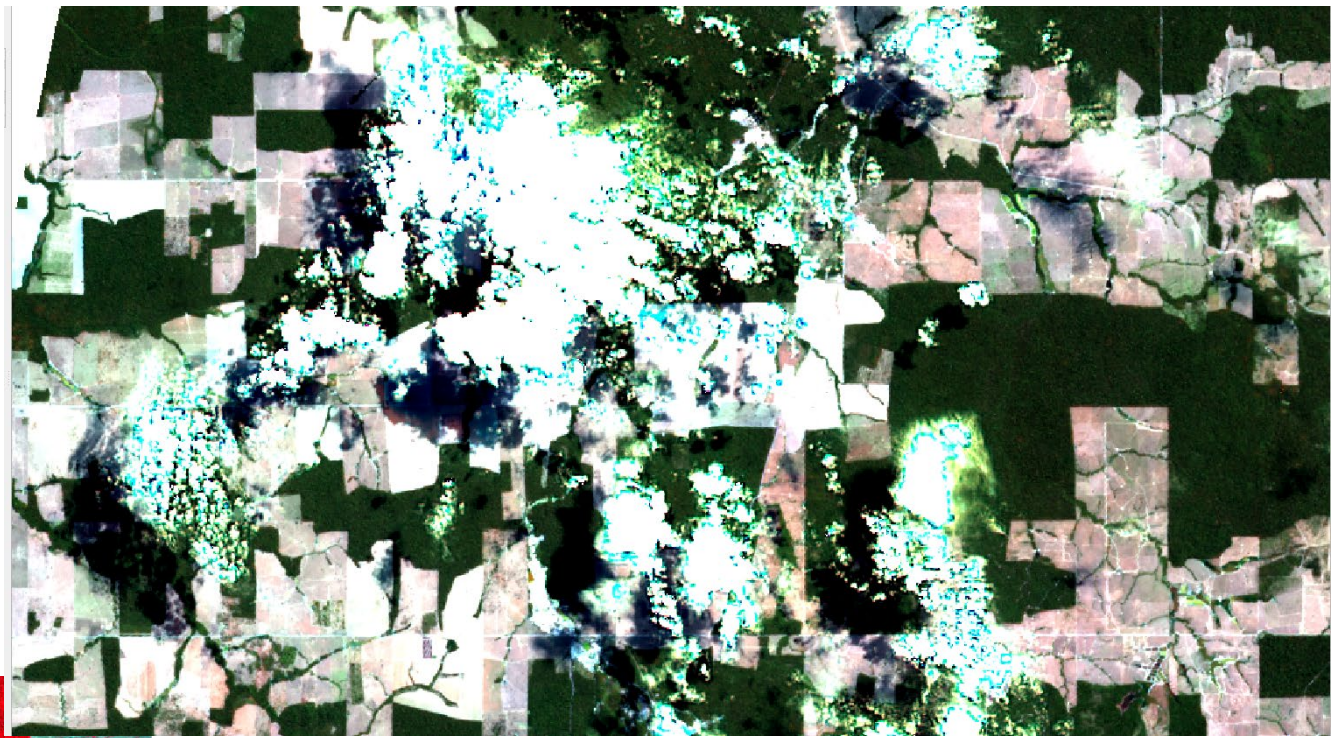


Output Algorithm	Overall Accuracy
Spectral Angle Mapping	37.6%
Minimum Distance	45.8%
Maximum Likelihood	41.9%
Unsupervised	29.3%

Issues and Problems

- Over exposure or dead pixels
- Narrow lines of pixels
- Groves, trees, orchards among agriculture and urban environments
- Software
 - Missing dependencies
 - Lack of community support

Over exposure or
dead pixels



Narrow lines of pixels: Roads, Canals, Paths..?



Groves, trees, orchards
among agriculture and
urban environments



I really hate Software As A Service.

ArcGIS Image Analyst

Requires ArcGIS Pro

Qty

-	1	+
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\$600/yr

- Analysis software for image data interpretation and exploitation
- Tools for stereo and image space visualization
- Apply machine learning to imagery pixels and objects for rapid answers

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- <https://postgis.net/>
- <https://geonode.org/>
- <https://www.qcad.org/en/>
- <https://www.osgeo.org/>
- <https://www.linux.org/>
- <https://opensource.org/>



- Feel free to contact me if you have questions about open source. Linux user as my only OS for 10+ years.

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