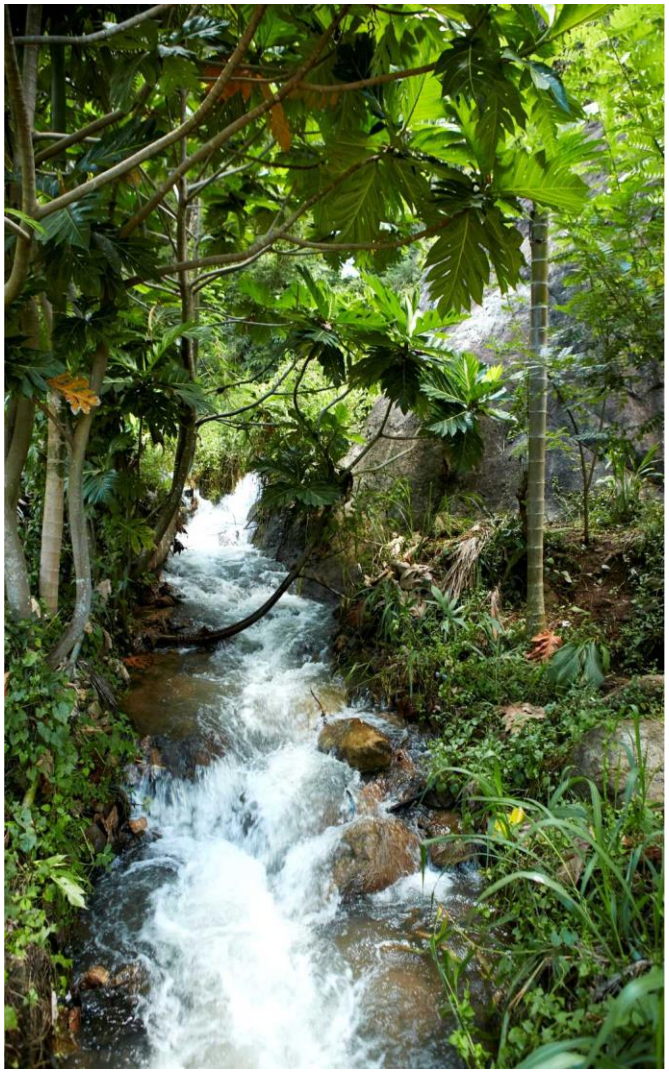

Land cover classification and validation

Barbara Pollini

25 April | Tubmanburg

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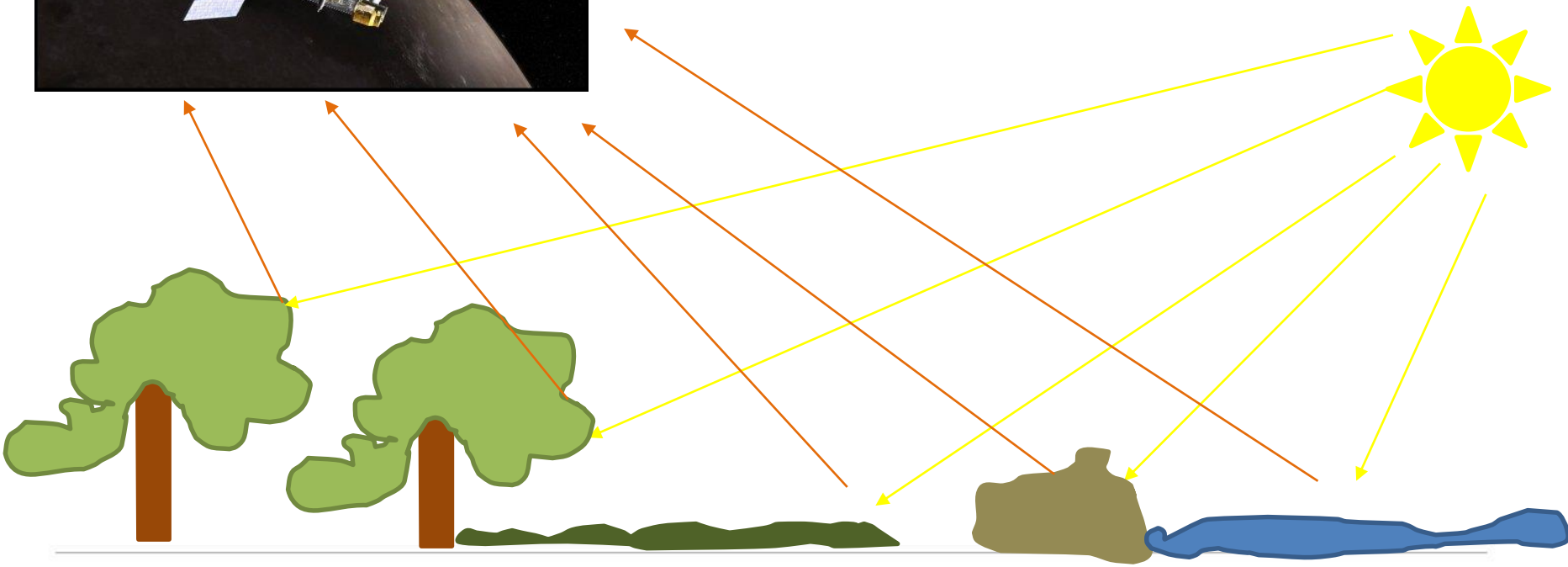
Outline

- Remote sensing and Satellite images
- Landsat 8
- Pre-processing and Processing
- Tools to process satellite images
- Supervised and Unsupervised classification
- QGis Dzetsaka plugin for land cover classification
- Validation of derived datasets
- Limitations

Remote sensing

"The process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance from the targeted area. Special cameras collect remotely sensed images of the Earth, which help researchers "sense" things about the Earth."



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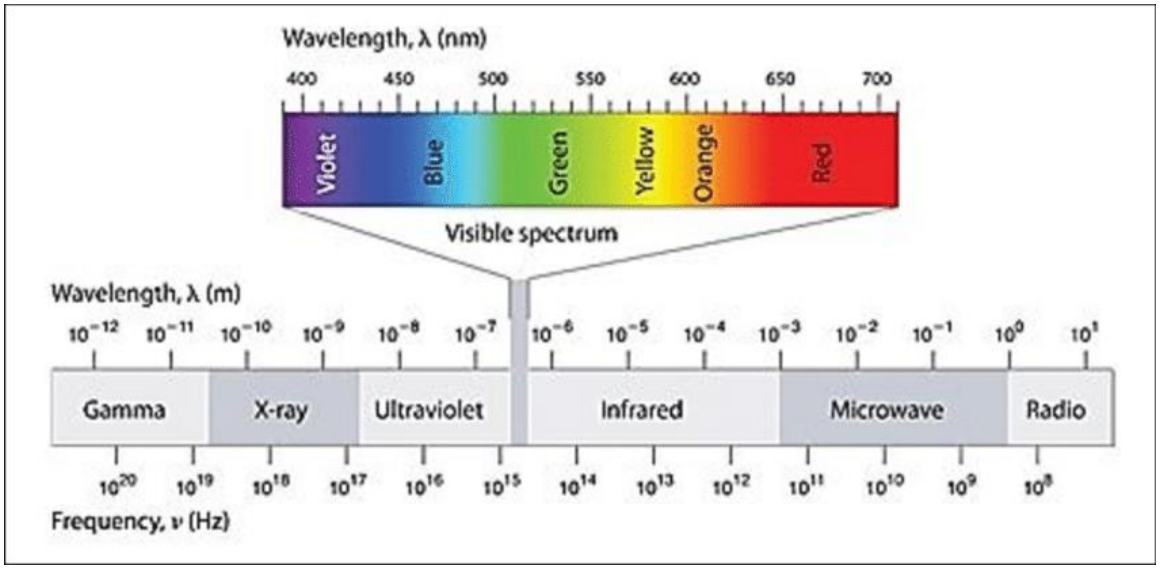
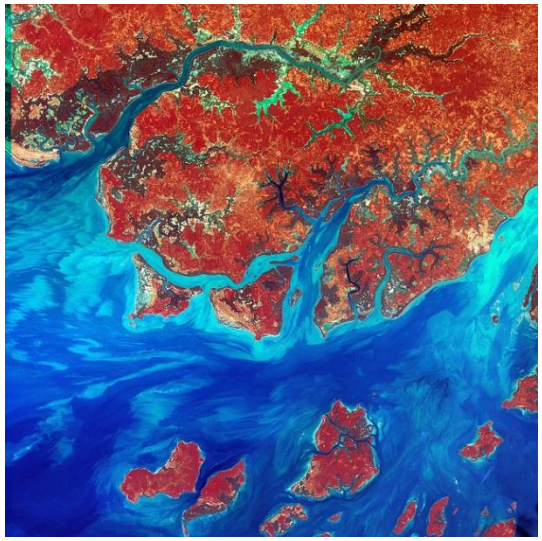
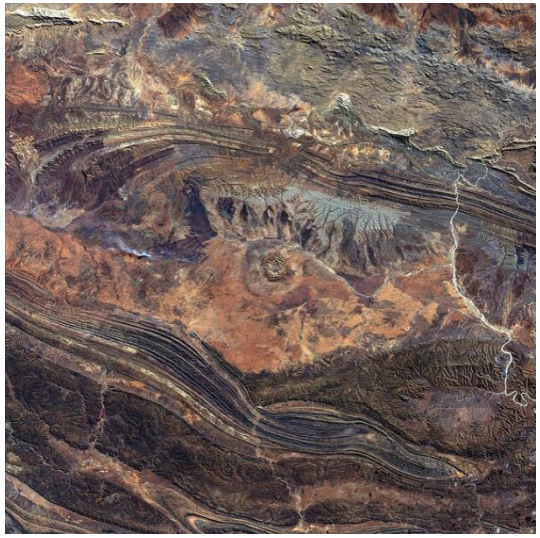
Wave bands

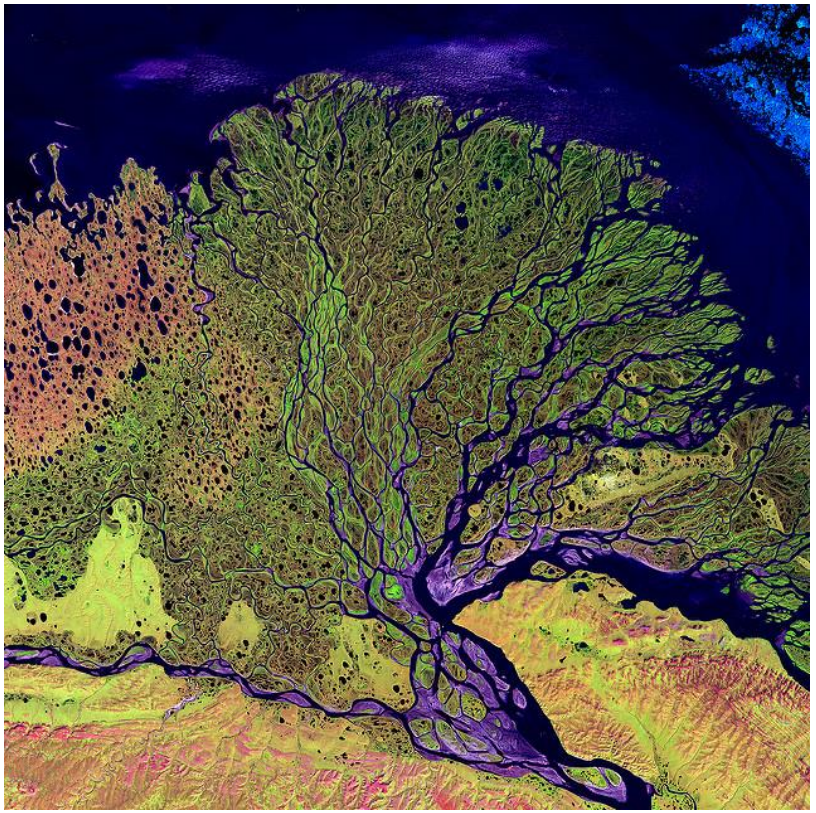
"Observations of earth from space use small number of wave-bands where atmosphere is relatively transparent and radiation can travel unimpeded - visible, infrared and microwave"



Water Quality Assessment for Dukan Lake Using LANDSAT 8 OLI Satellite Images - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/Fig-3-2-The-diagram-shows-the-wavelength-and-frequency-ranges-of-EM-radiation_fig2_315717521 [accessed 18 Apr, 2018]







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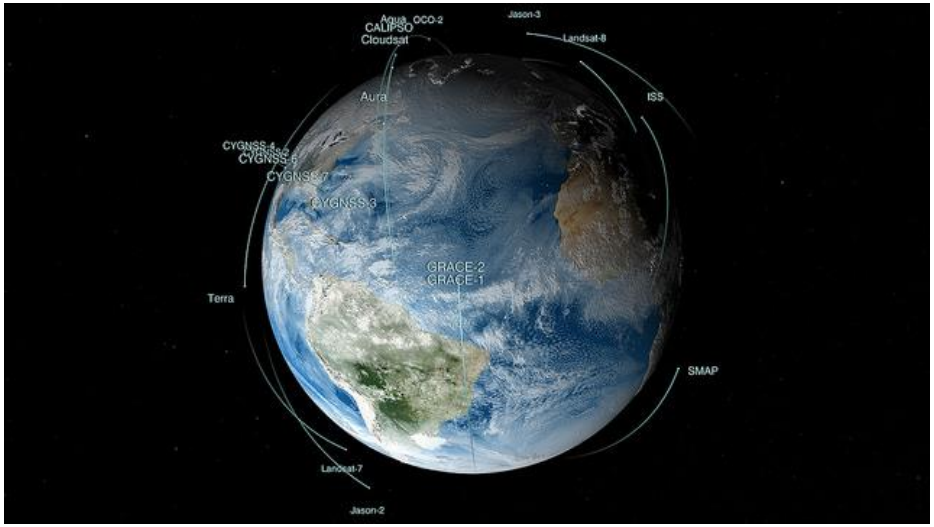
Imaging satellites

- ***GeoEye:*** 0.41-1.65 meters ground resolution
- ***Digital Globe:*** 0.46-0.31 meters ground resolution
- ***Spot Image:*** from 2.5 m to 1 km ground resolution
- ***ASTER:*** 15m
- ***BlackBridge (previously RapidEye):*** 5 meters ***EROS:*** 70cm resolution panchromatic
- ***Landsat 8:*** 30m (15m panchromatic)
- ***Sentinel:*** 10m
- …



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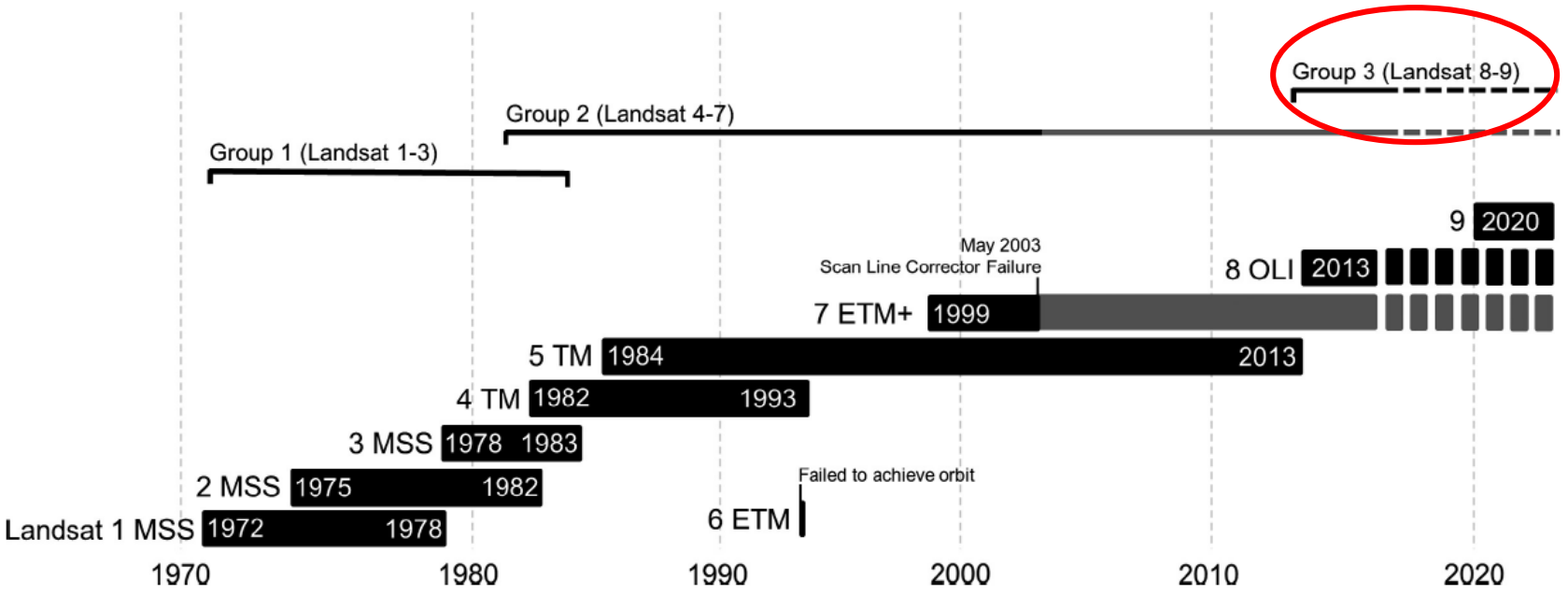
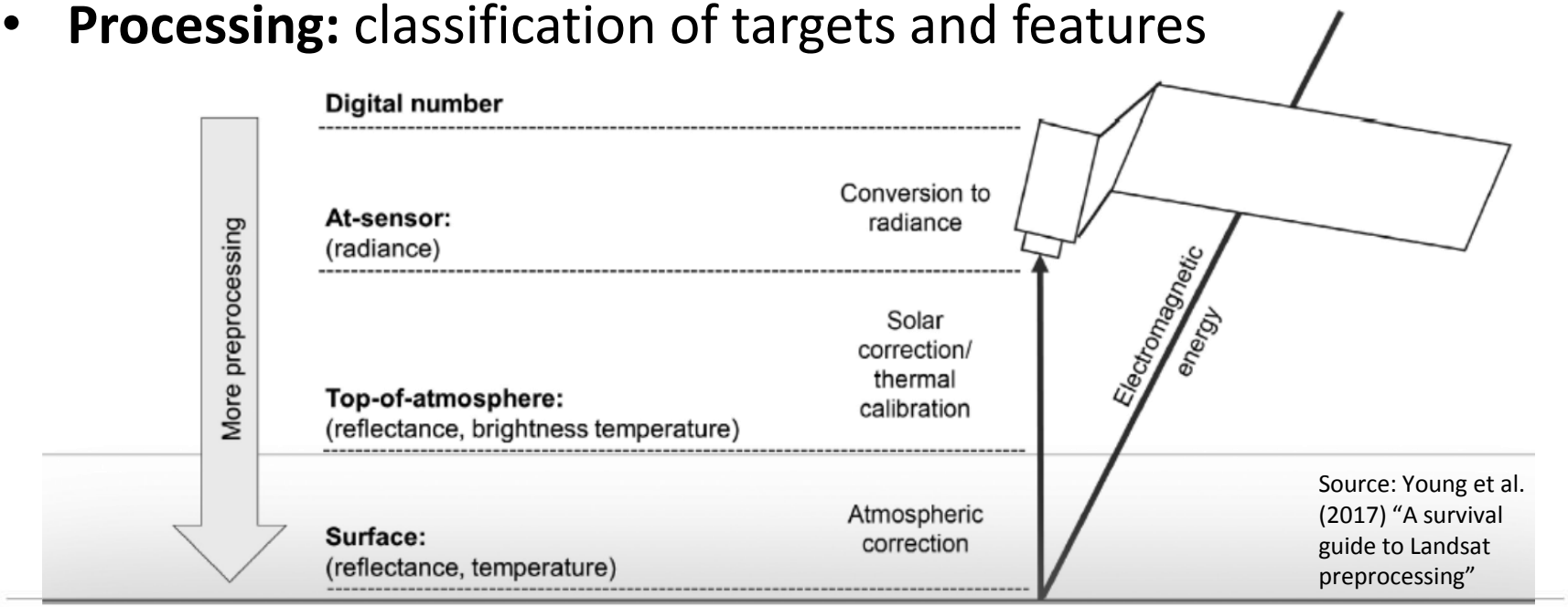
Landsat a timeline



Source: Young et al. (2017) "A survival guide to Landsat preprocessing"

Pre-processing and processing

- **Pre-processing**: procedures to format, correct the data for the distortion caused by sensor, solar, atmospheric and topographic effects, and enhance the data to facilitate the interpretation
- **Processing:** classification of targets and features



Source: Young et al. (2017) "A survival guide to Landsat preprocessing"

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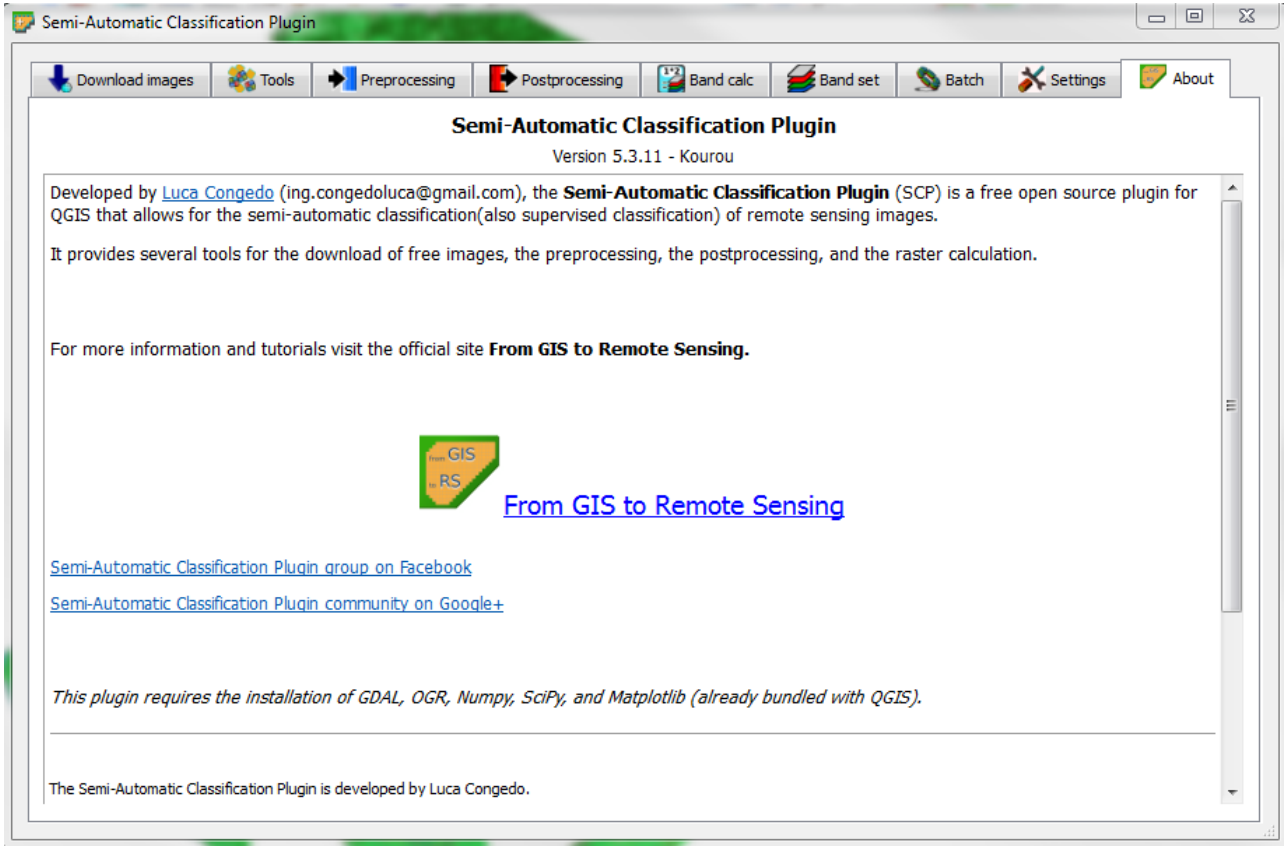
Tools to process satellite images

- Google Earth Engine
- ERDAS Imagine
- ENVI

- FAO Collect Earth and OPENFORIS tools

- QGis toolboxes: Orfeo toolbox, Semi-automatic Classification Plugin, Dzetsaka plugin

Pre-processing in QGis: the Semi-automatic Classification Plugin



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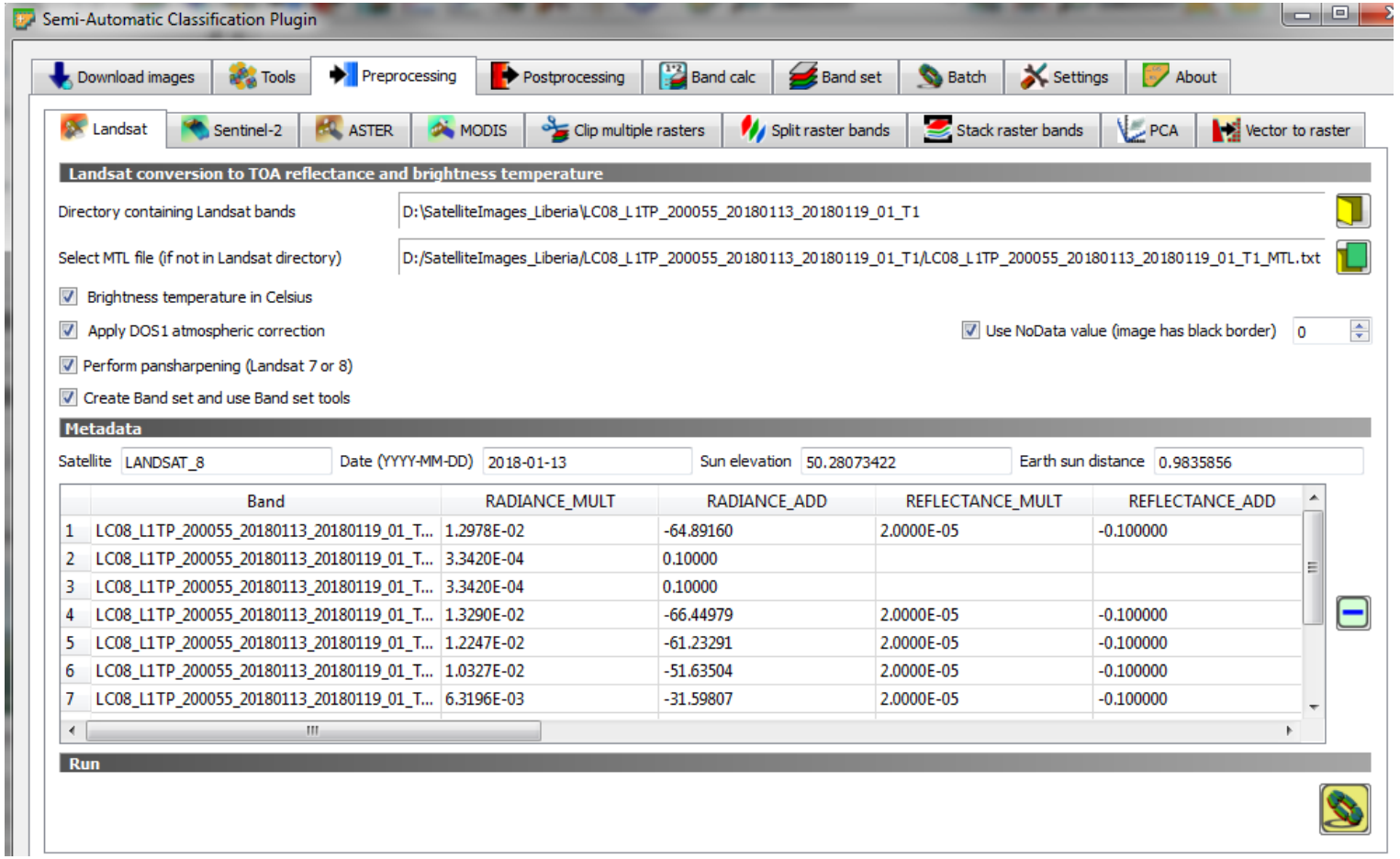
The Pre-processing toolbox



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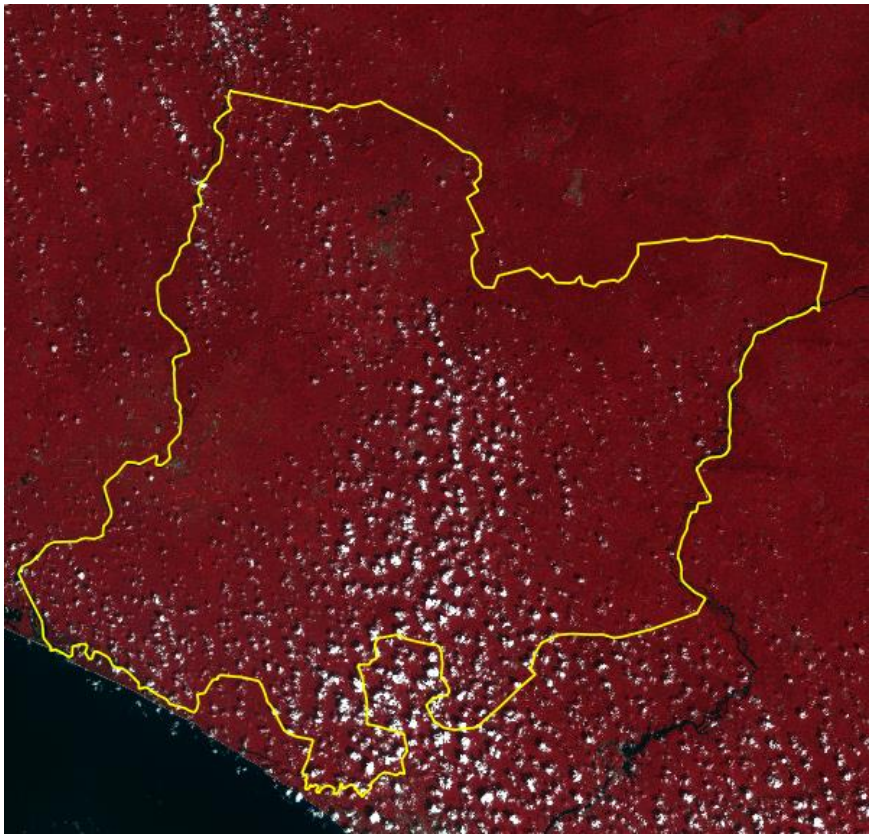
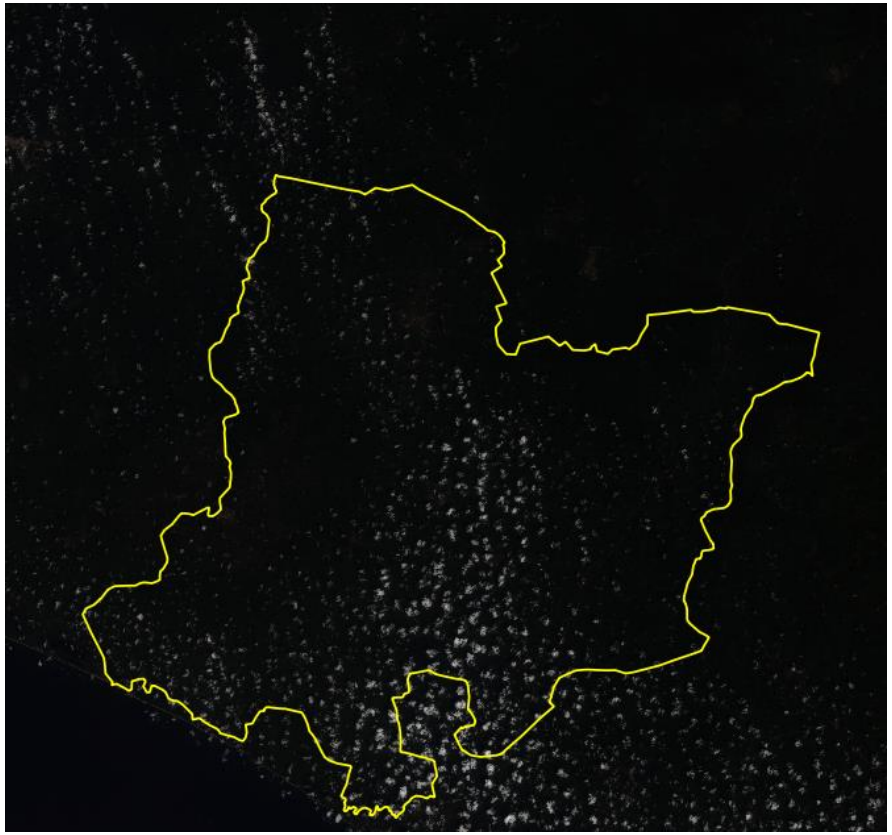
Corresponding Bands in Landsat 8

Band	Wavelength	Useful for mapping
Band 1 – Coastal Aerosol	0.435 - 0.451	Coastal and aerosol studies
Band 2 – Blue	0.452 - 0.512	Bathymetric mapping, distinguishing soil from vegetation, and deciduous from coniferous vegetation
Band 3 - Green	0.533 - 0.590	Emphasizes peak vegetation, which is useful for assessing plant vigor
Band 4 - Red	0.636 - 0.673	Discriminates vegetation slopes
Band 5 - Near Infrared (NIR)	0.851 - 0.879	Emphasizes biomass content and shorelines
Band 6 - Short-wave Infrared (SWIR) 1	1.566 - 1.651	Discriminates moisture content of soil and vegetation; penetrates thin clouds
Band 7 - Short-wave Infrared (SWIR) 2	2.107 - 2.294	Improved moisture content of soil and vegetation and thin cloud penetration
Band 8 - Panchromatic	0.503 - 0.676	15 meter resolution, sharper image definition
Band 9 – Cirrus	1.363 - 1.384	Improved detection of cirrus cloud contamination
Band 10 – TIRS 1	10.60 – 11.19	100 meter resolution, thermal mapping and estimated soil moisture
Band 11 – TIRS 2	11.50 - 12.51	100 meter resolution, Improved thermal mapping and estimated soil moisture

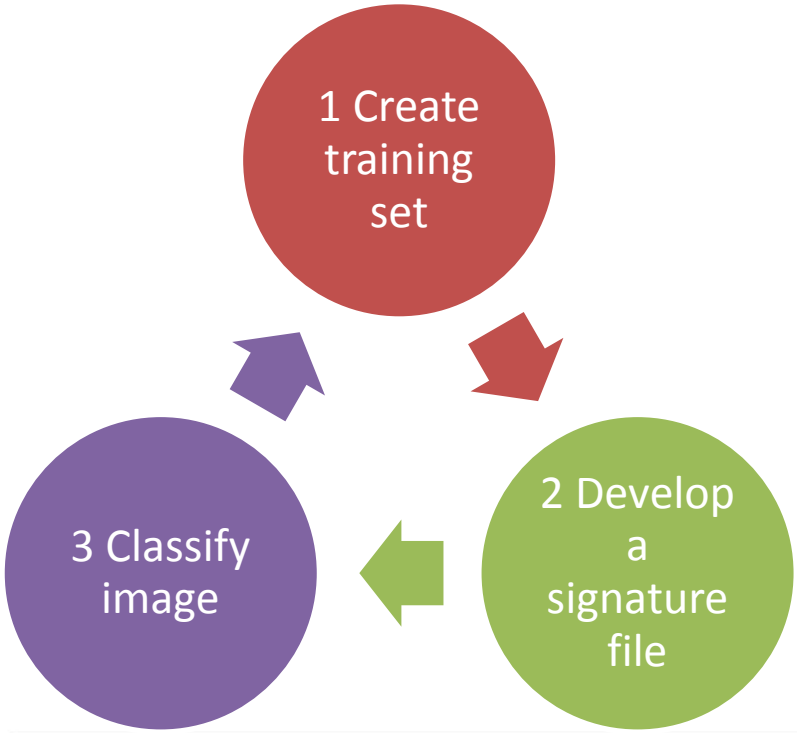
Results for Bomi county



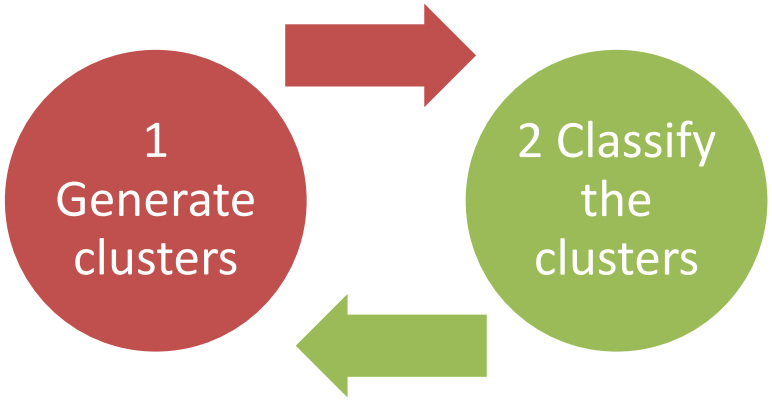


Supervised and Unsupervised classification

Supervised classification



Unsupervised classification

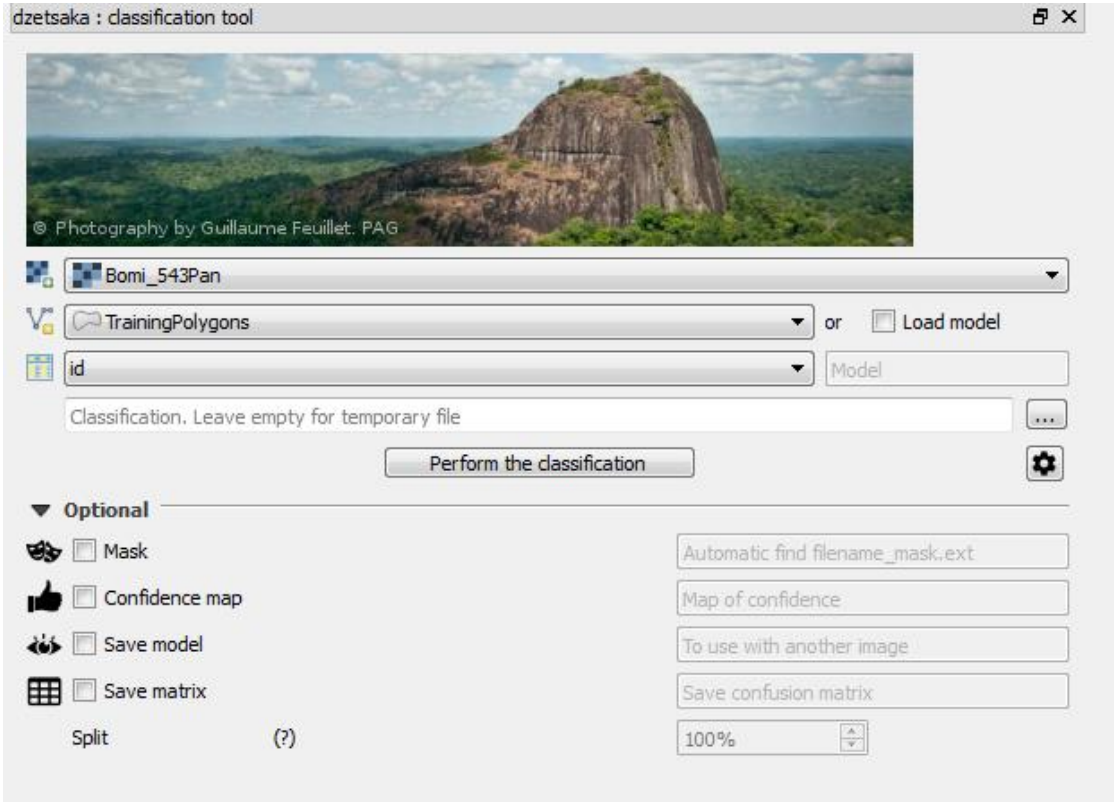


Dzetsaka plugin

It's a fast and easy to use, but also powerful classification plugin for QGis.

It uses the following classifier:

- ***Gaussian Mixture Model***
- ***Random forest***
- ***Support Vector Machines***
- ***K-Nearest Neighbours***



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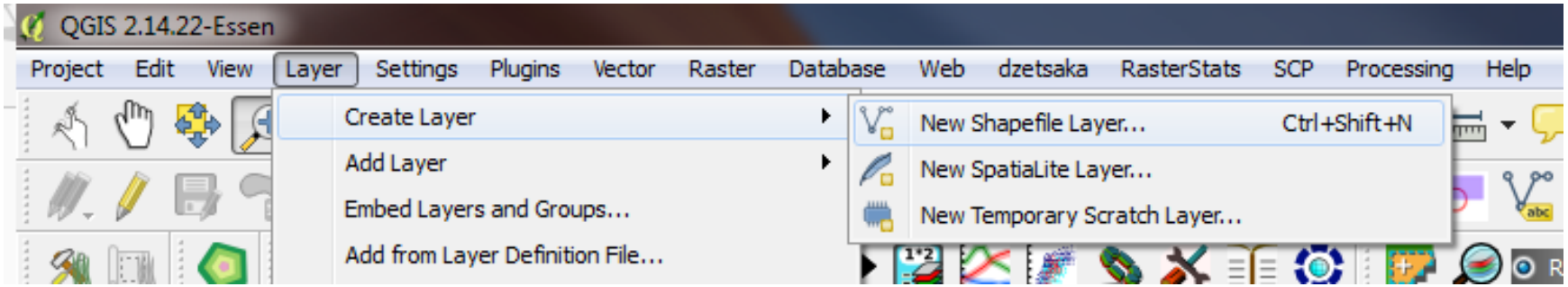
Dzetsaka step 1

- Define the land cover classes and create a table

- Create the training polygons using the field data

Id	Class name
1	
2	
3	
4	
5	
…	



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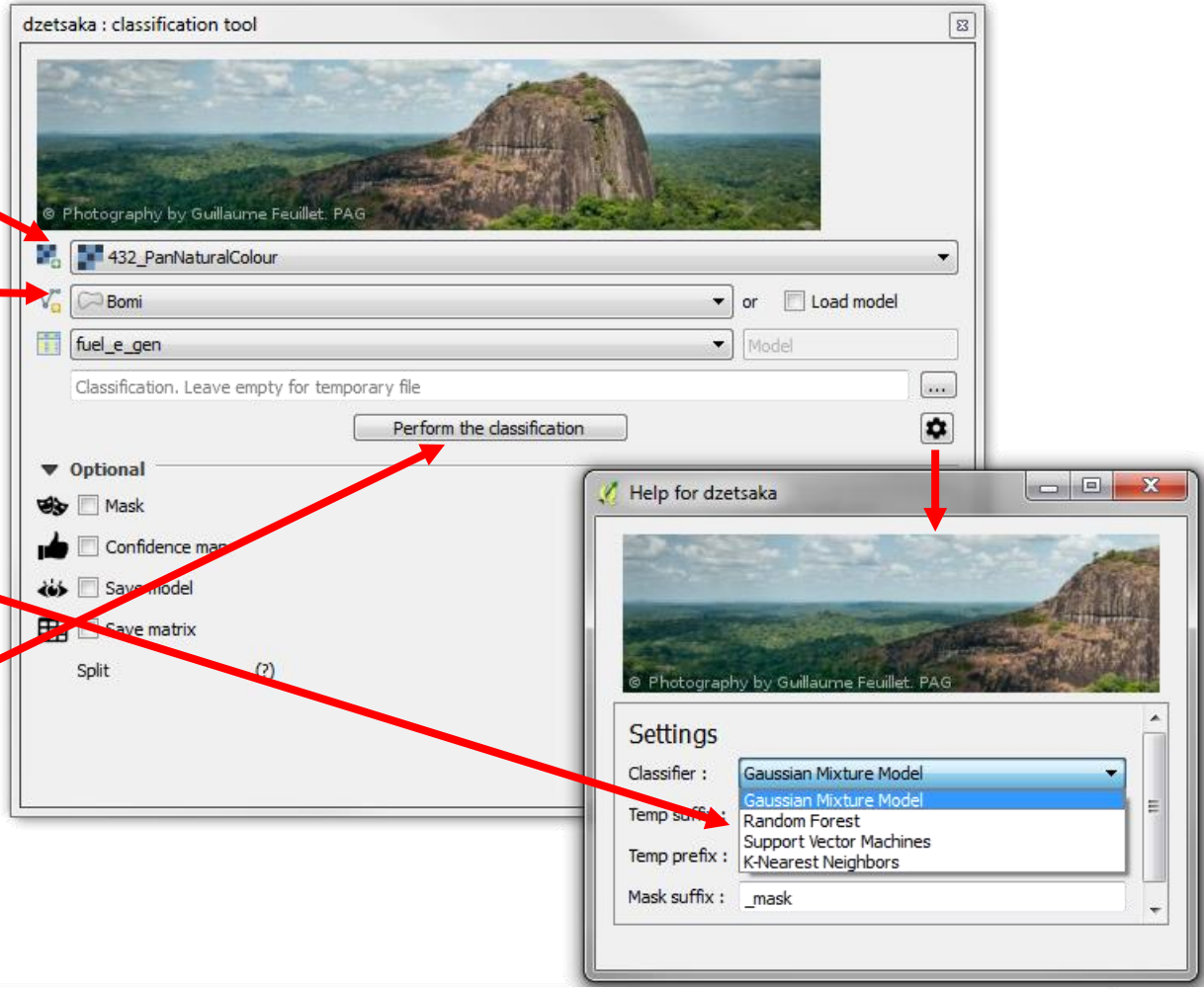
Dzetsaka step 2

- Add the satellite image and the training polygons in the tool
- Select a classifier
- Perform the classification



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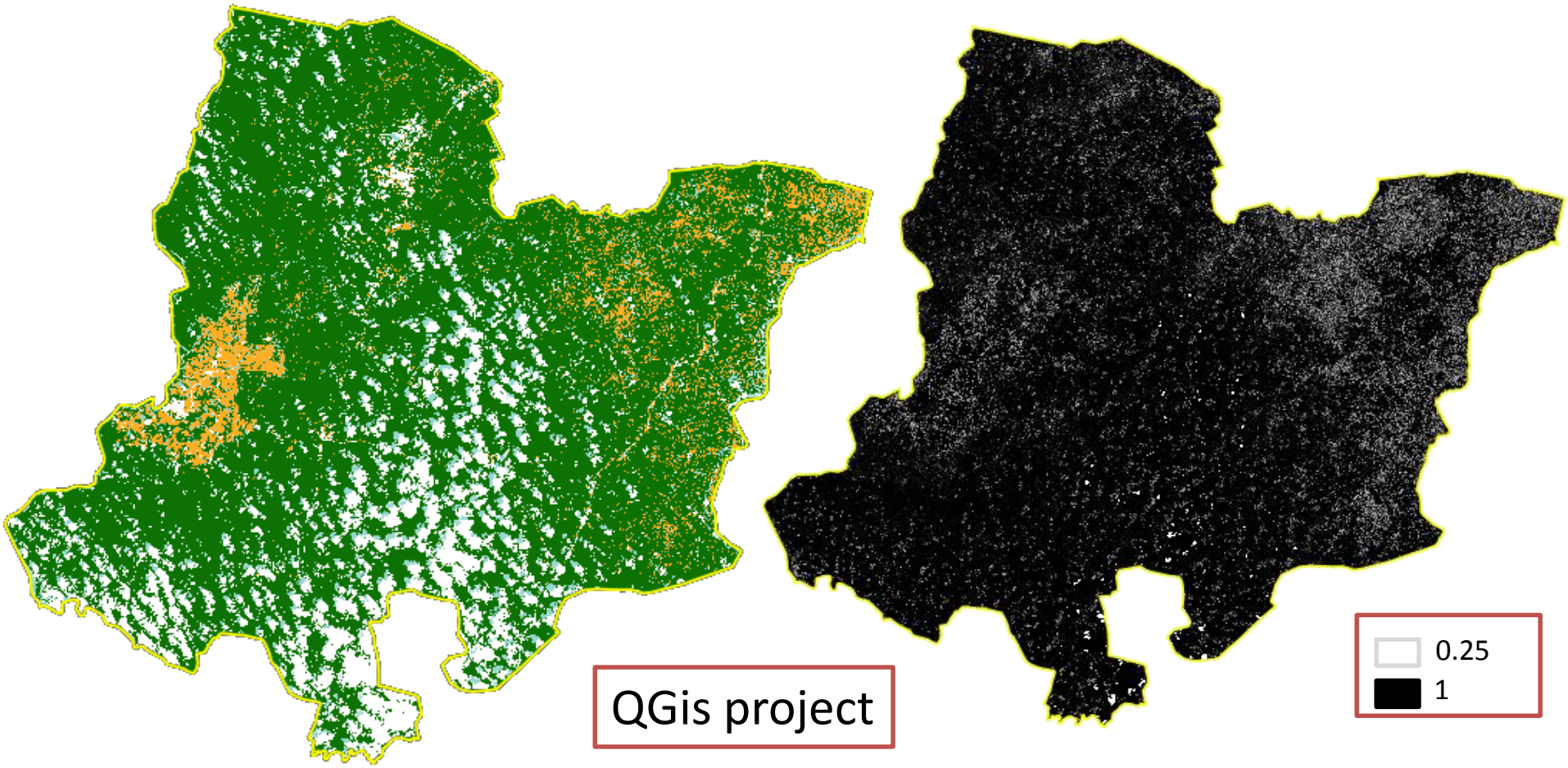
Final maps

Land cover map

Confidence map



QGis project

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Validation of land cover datasets

Step 1 Harmonize the classes in the datasets to be validated and the field data classes

Step 2 Compile the data collected in the field in a spreadsheet and import the file in QGis . Compare the data

Step 3 Create a confusion matrix

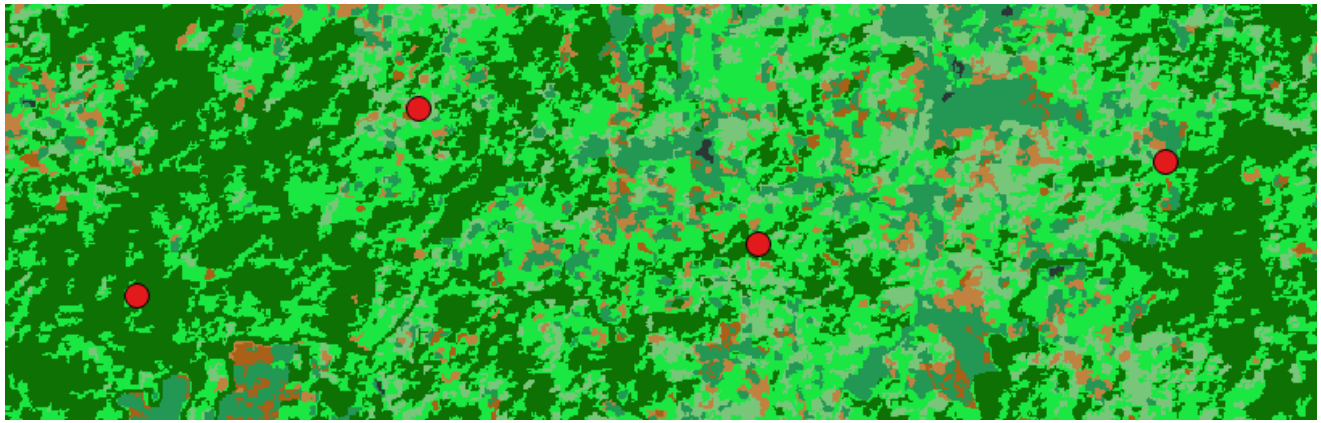
Step 4 Calculate accuracy parameters

Validation step 1: Harmonize data

Map land cover class	Field data
Tree cover > 80%	
Tree cover 30-80%	
Tree cover <30%	
Settlements	
Surface water bodies	
Grassland	
Shrub	
Bare soil	

Validation step 2: compile and compare the data

GPS point	X	Y	Forest type	CC1	CC2	CC3	CC4	CC percentage class	Geoville Classification



Validation step 3: confusion matrix

	Ground truth data									
Map classification	Tree cover > 80%	Tree cover 30-80%	Tree cover <30%	Settlements	Surface water bodies	Grassland	Shrub	Bare soil	Classification total	Correct samples
Tree cover > 80%										
Tree cover 30-80%										
Tree cover <30%										
Settlements										
Surface water bodies										
Grassland										
Shrub										
Bare soil										
Reference total										

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Validation step 4: calculate accuracy parameters

- Overall accuracy parameter: *N. correct points/total number of points*
- User's accuracy: *Diagonal total for class a/Row total for class a*
- Producer's accuracy: *Diagonal total for class a/Column total for class a*
- Commission error: *1-User accuracy for class a*
- Omission error: *1-Producer accuracy for class a*
- Kappa coefficient: $\frac{OA - \sum(Row\ i\ total * Column\ i\ total/N)/N}{1 - \sum(Row\ i\ total * Column\ i\ total/N)/N}$

Kappa statistic strength of agreement

Kappa statistic	Strength of agreement
< 0.00	Poor
0.00 – 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.8-	Substantial
0.81 – 1.00	Almost perfect

Thank you!

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