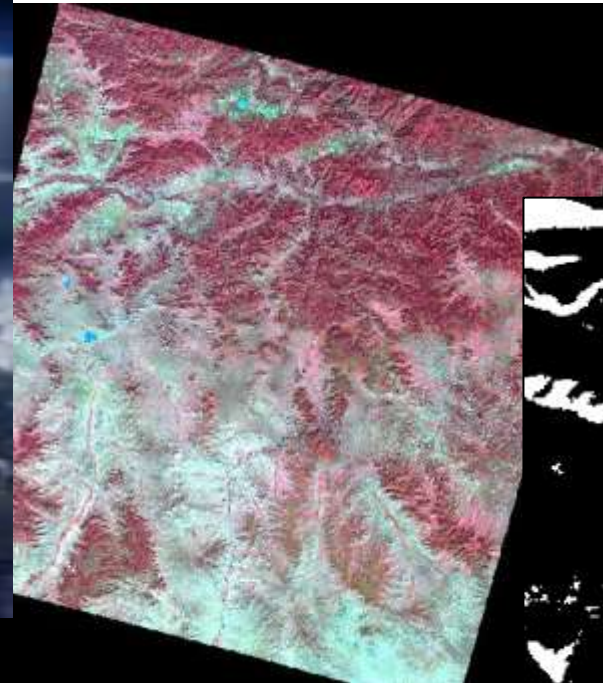




Forest classification using Landsat 8 satellite images and open source-software





Data and programs we are using for the classification

Landsat 8 satellite images (maybe Landsat 7)

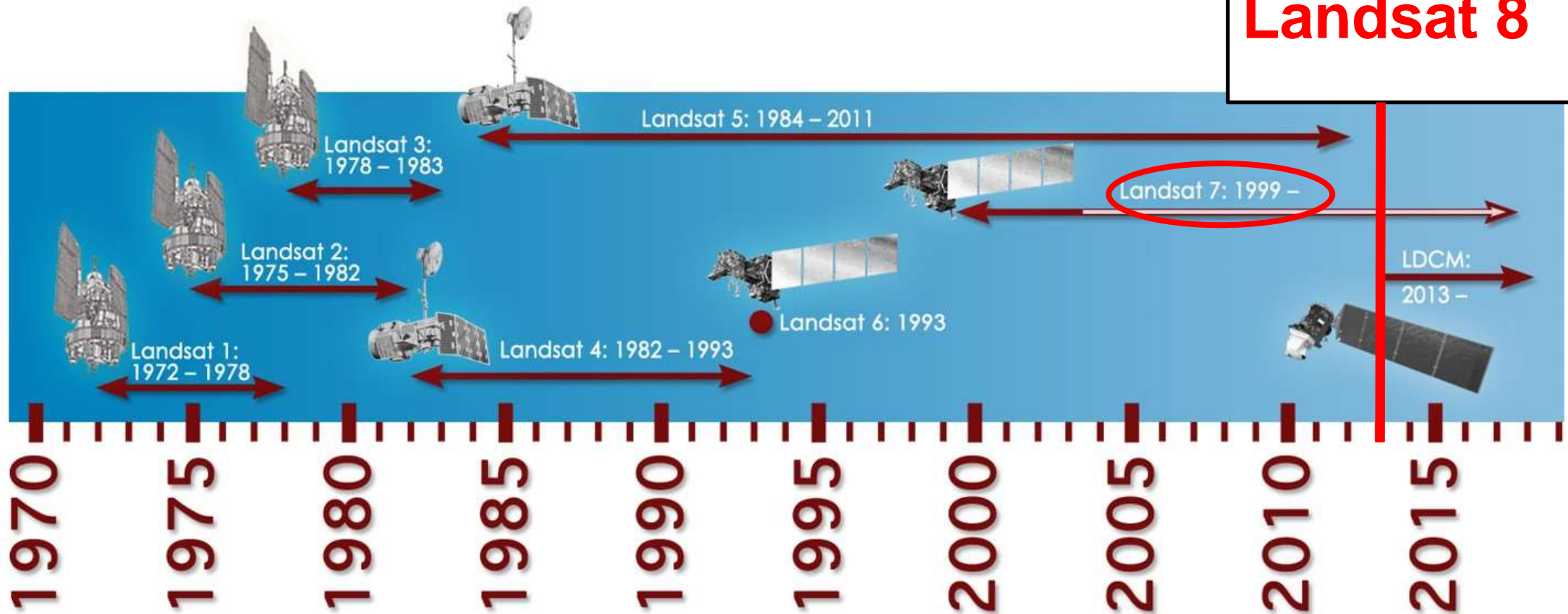
QGIS (Geographic Information System)

Semi automatic classification plugin



Landsat history

February 2013
Landsat 8





Important developments and facts

- **Landsat 5**
 - Introduced the TM (thematic mapper) sensor
 - Very useful for land cover classification at 30m resolution
- **Landsat 7**
 - Introduced the ETM+ (enhanced thematic mapper plus) sensor
 - Includes a panchromatic band with 15m resolution
 - Data available from 1999 till present
 - Data available for download free of charge since December 2005
 - In 2003 an error occurred (Scan Line Corrector failed)



Scan line corrector error

Gaps (stripes) in the images





Scan line corrector error



Tools for gap filling



PANCROMA
ENVI/IDL
ERDAS Imagine



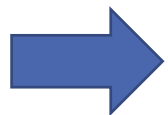


Why use Landsat 7 instead of Landsat 8 ?

- Landsat 8 is on duty only within the past few months (since February 2013)



Only few images are available (the satellite returns to the **same place only every 16 days**)



There are less cloud-free images to choose



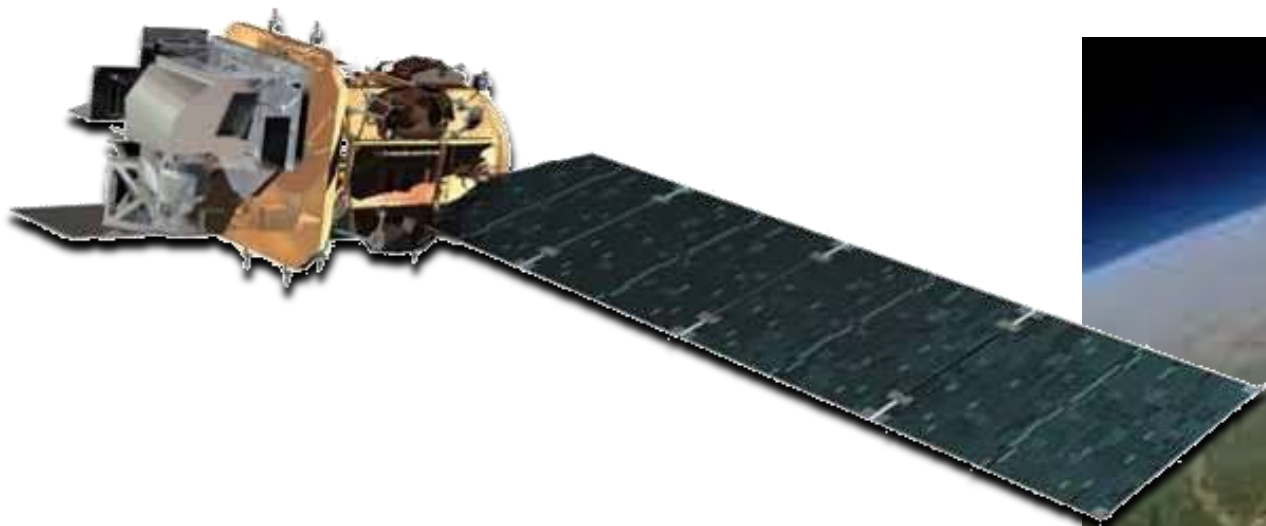
If you find cloud-free images from Landsat 8



Take Landsat 8

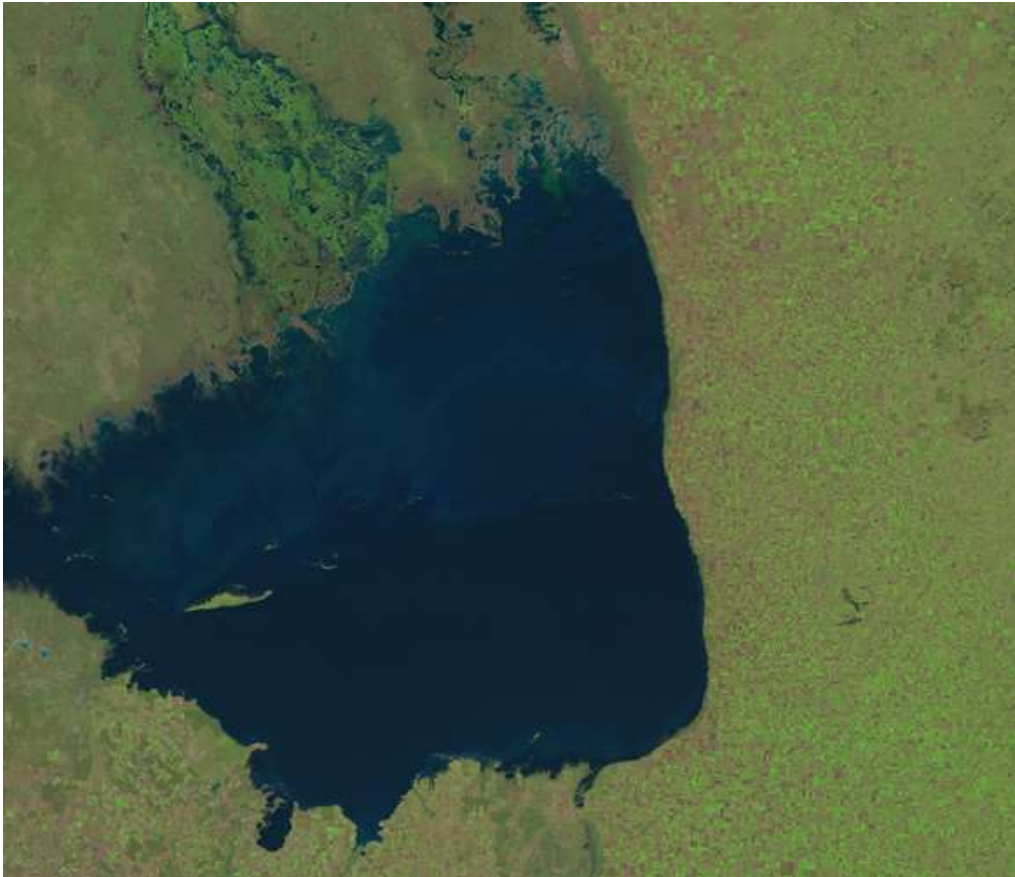


Landsat 8





Landsat 5 (1984)



Landsat 8 (2013)





Landsat 8 – Technical facts

- Two new spectral bands
 - A deep-blue band for coastal water (band 1)
 - A band for cirrus cloud detection (band 9)
- Pixel size: 15 meters/30 meters/100 meters (panchromatic/multispectral/thermal)
- Captures approximately 400 scenes a day (Landsat 7: 250)
- Landsat 8 data are sufficiently consistent with data from the earlier Landsat missions
- Main instrument: Operational Land Imager (OLI)
 - Improved land surface information



Download Landsat 8 satellite images

Glovis

<http://glovis.usgs.gov>

Earthexplorer

<http://earthexplorer.usgs.gov>





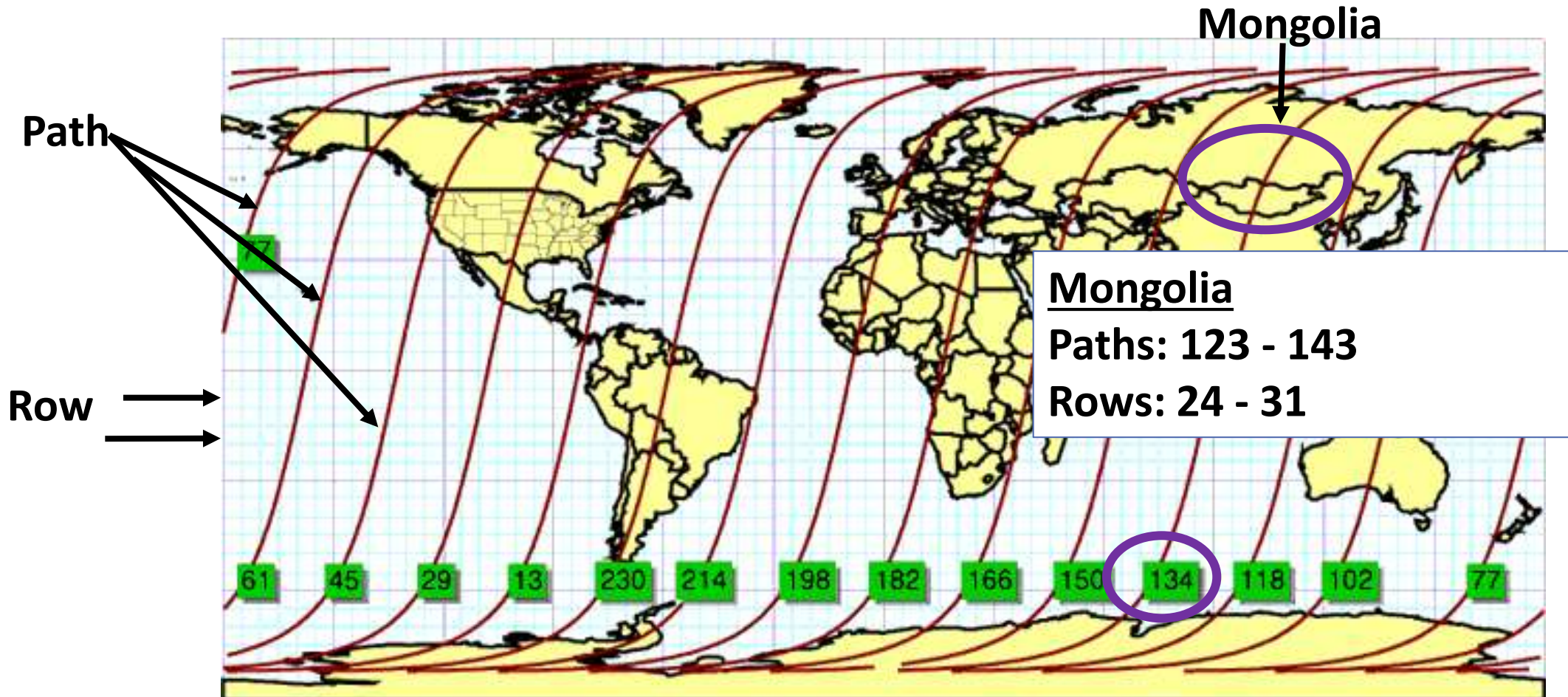
Select satellite image type

The screenshot shows the USGS Global Visualization Viewer web application. The browser address bar displays 'glovis.usgs.gov'. The main menu includes 'Collection', 'Resolution', 'Map Layers', 'Tools', 'File', and 'Help'. The 'Collection' menu is open, showing a list of satellite data sources. The 'Landsat 8 OLI' option is selected and circled in red. Other options include Aerial, ASTER, EO-1, Landsat Archive, Global Land Survey, Landsat MRLC Collections, Landsat Legacy Collections, MODIS Aqua, MODIS Terra, MODIS Combined, and TerraLook. The 'Data Descriptions' sub-menu is also visible, listing various data products like 'Landsat 8 OLI Pre-WRS-2', 'L7 SLC-off (2003->)', 'L7 SLC-on (1999-2003)', 'Landsat 4-5 TM', 'Landsat 4-5 MSS', 'Landsat 1-3 MSS', and 'Landsat 4 - Present'. A yellow box highlights a satellite image on the map, and a red circle highlights the 'Collection' menu.

Collection	Resolution	Map Layers	Tools	File	Help
Aerial				Downloadable	
ASTER					
EO-1					
Landsat Archive					Data Descriptions
Global Land Survey					<input checked="" type="checkbox"/> Landsat 8 OLI
Landsat MRLC Collections					<input type="checkbox"/> Landsat 8 OLI Pre-WRS-2
Landsat Legacy Collections					<input type="checkbox"/> L7 SLC-off (2003->)
					<input type="checkbox"/> L7 SLC-on (1999-2003)
MODIS Aqua					<input type="checkbox"/> Landsat 4-5 TM
MODIS Terra					<input type="checkbox"/> Landsat 4-5 MSS
MODIS Combined					<input type="checkbox"/> Landsat 1-3 MSS
TerraLook					<input type="checkbox"/> Landsat 4 - Present



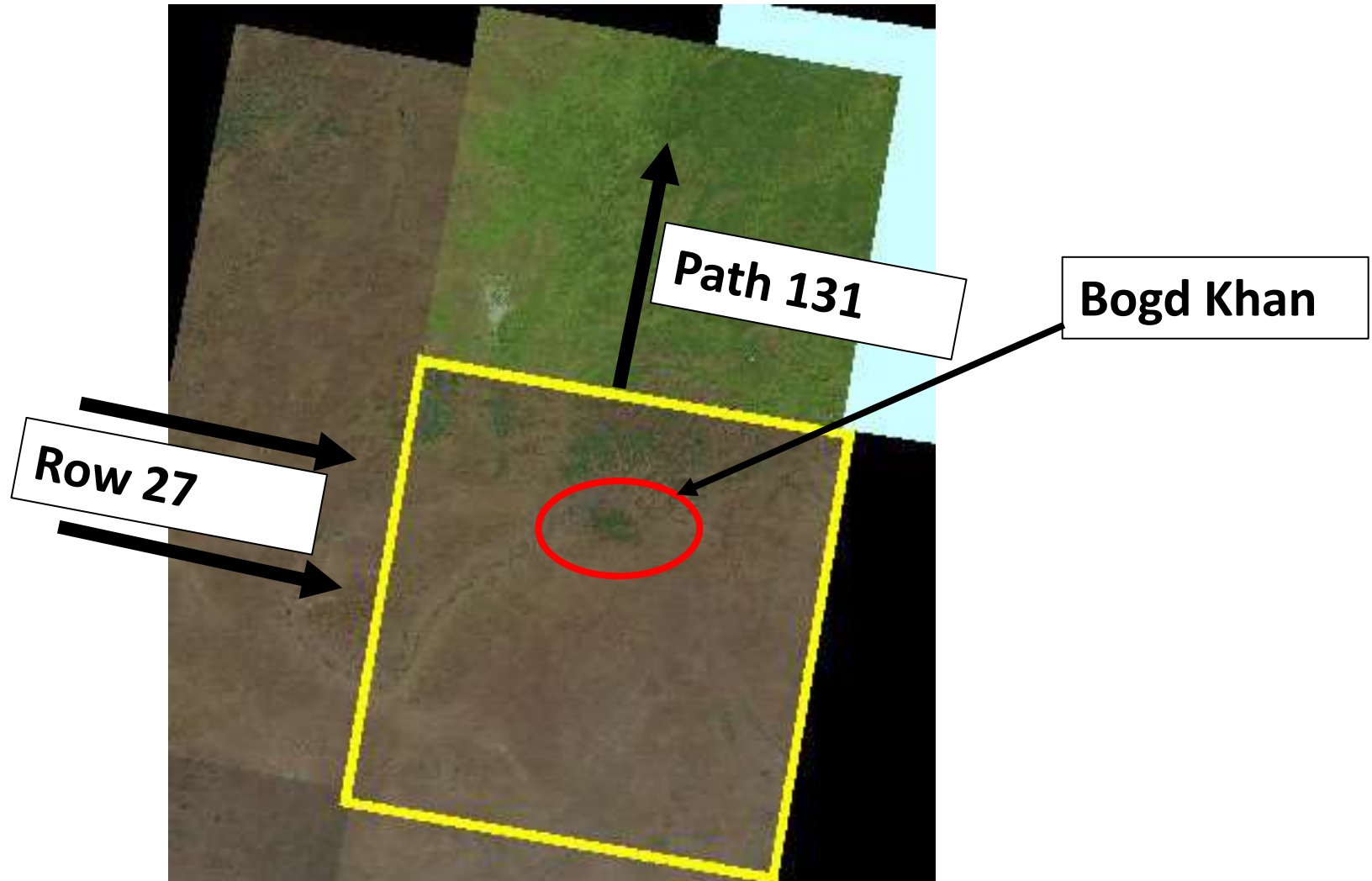
Landsat Path/Row-System





Select Landsat 8 satellite images

WRS-2
Path / Row: 131 27 Go
Lat: 47.4 Long: 106.8 Go
Max Cloud: 100%
Scene Information:
ID: LC81310272013268LGN00
CC: 0% Date: 2013/9/25
Qlty: 9 Product: OLI_TIRS_L1T
Sep 2013 Go
Prev Scene Next Scene
Landsat 8 OLI Scene List
Add Delete Send to Cart



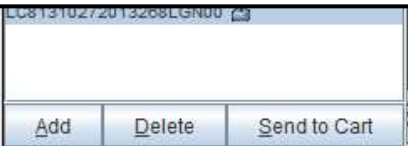


Select Landsat 8 satellite images



Cloud cover

- The less the better
- Depending on clouds nature and where the clouds are located
- Clouds above non forest area is not a problem
- Clouds above forest area **is** a problem





Select Landsat 8 satellite images

Scene Information:

ID: LC81310272013268LGN00
CC: 0% Date: 2013/9/25
Qlty: 9 Product: OLI_TIRS_L1T



OK

Max Cloud: 100%

Scene Information:
ID: LC81310272013268LGN00
CC: 0% Date: 2013/9/25
Qlty: 9 Product: OLI_TIRS_L1T

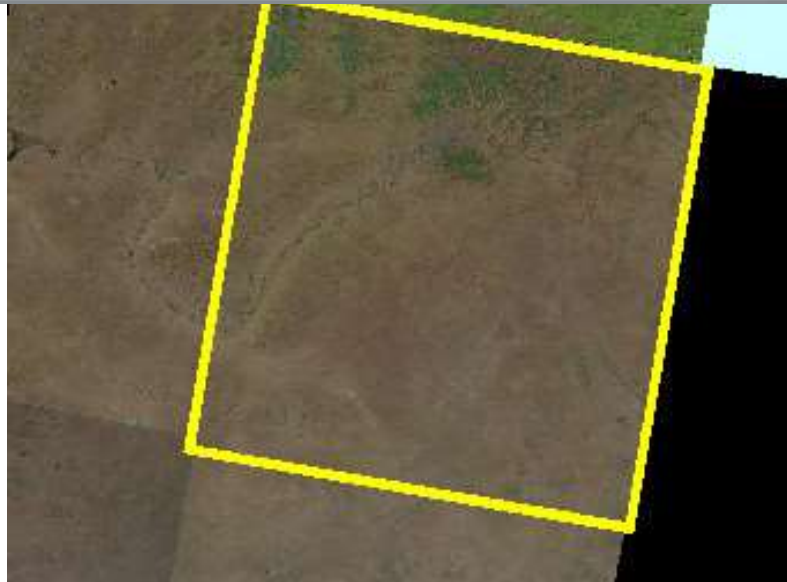
2013 Go

Prev Scene Next Scene

Landsat 8 OLI Scene List

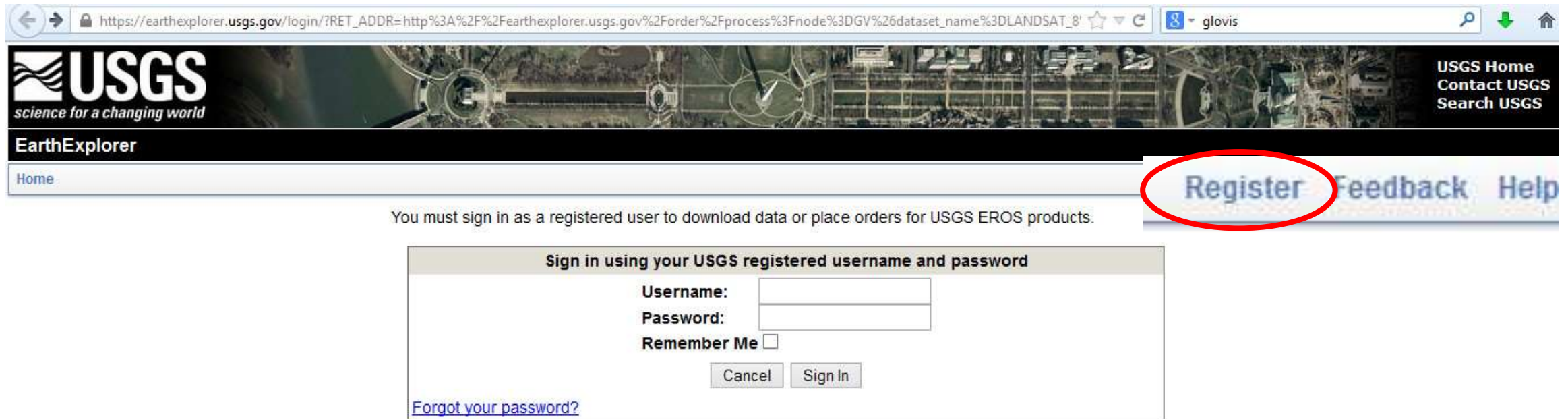
LC81310272013268LGN00

Add Delete Send to Cart





Register for download



The screenshot shows the USGS EarthExplorer login page. The browser address bar displays the URL: https://earthexplorer.usgs.gov/login/?RET_ADDR=http%3A%2F%2Fearthexplorer.usgs.gov%2Forder%2Fprocess%3Fnode%3DGV%26dataset_name%3DLANDSAT_8. The page header includes the USGS logo with the tagline "science for a changing world" and navigation links for "USGS Home", "Contact USGS", and "Search USGS". Below the header, there are links for "Home", "Register", "Feedback", and "Help", with "Register" circled in red. A message states: "You must sign in as a registered user to download data or place orders for USGS EROS products." Below this message is a sign-in form titled "Sign in using your USGS registered username and password". The form contains fields for "Username:" and "Password:", a "Remember Me" checkbox, and "Cancel" and "Sign In" buttons. A link for "Forgot your password?" is located below the form.



Lokaler Datenträger (C:) > tmp > 131_27 131_27 durchsuchen

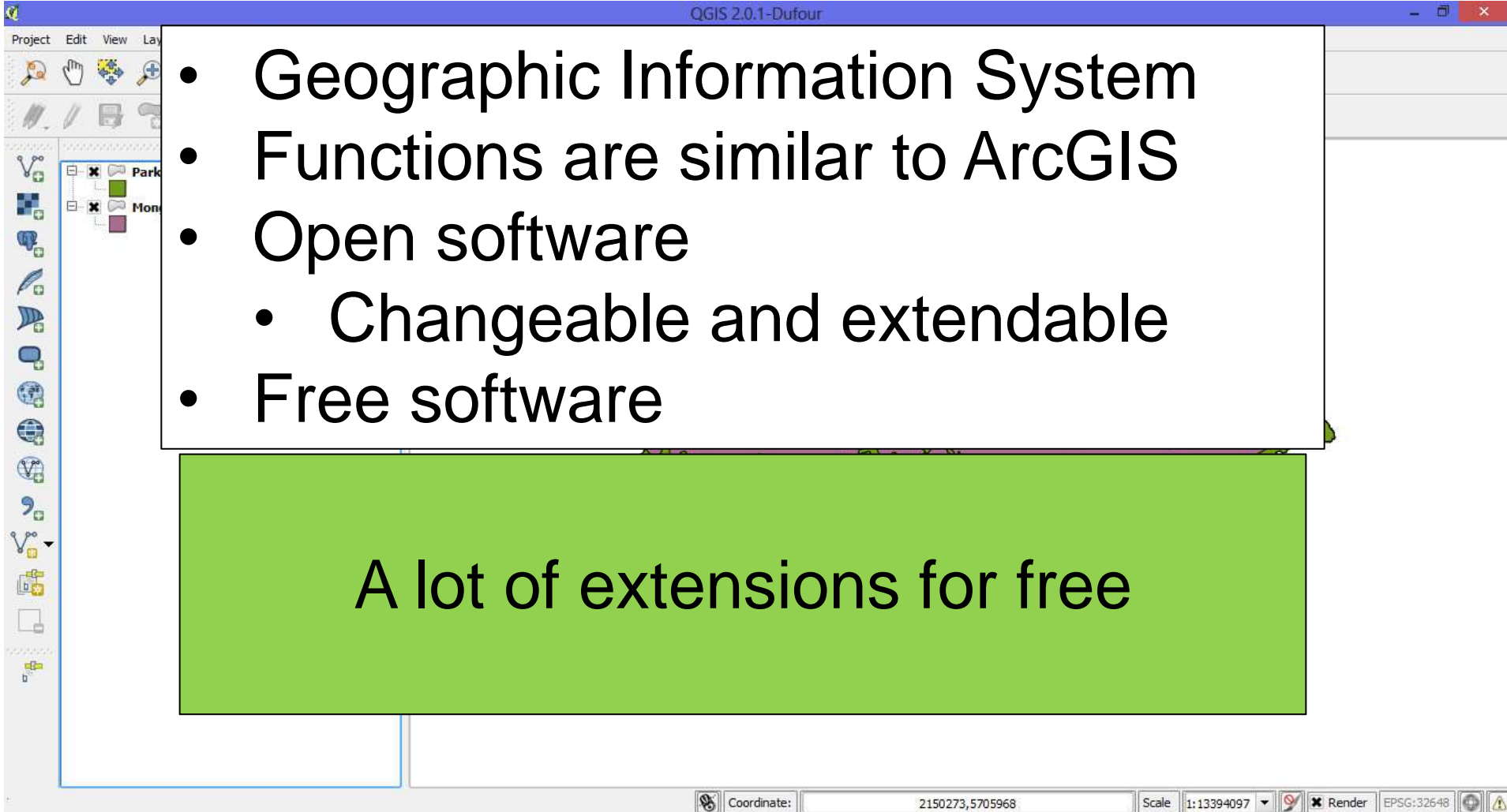
Name	Änderungsdatum	Typ	Größe
LC81310272013124LGN01.tar	01.06.2013 07:23	TAR-Datei	1.659.800 KB
LC81310272013124LGN01_B1	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B2	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B3	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B4	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B5	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B6	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B7	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B8	01.06.2013 07:22	TIF-Datei	442.477 KB
LC81310272013124LGN01_B9	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B10	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_B11	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_BOA	01.06.2013 07:22	TIF-Datei	110.664 KB
LC81310272013124LGN01_MTL	01.06.2013 07:22	TXT-Datei	8 KB

ion
e(s)

Landsat 8 images
Consisting of 12 single bands



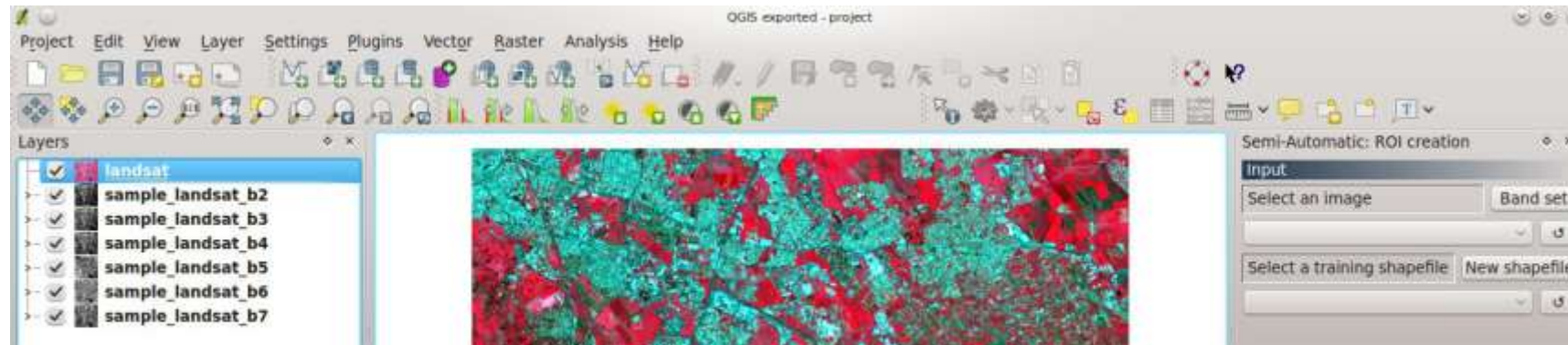
QGIS

- 
- Geographic Information System
 - Functions are similar to ArcGIS
 - Open software
 - Changeable and extendable
 - Free software

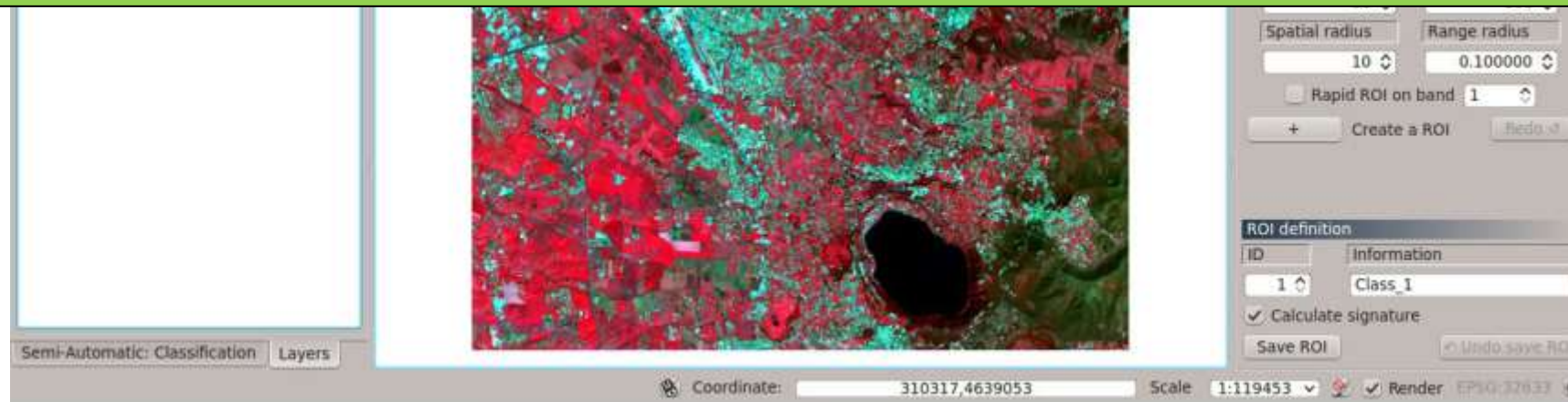
A lot of extensions for free



Semi automatic classification plugin



Tool for supervised classification of remote sensing images





Semi automatic classification plugin

QGIS

The screenshot displays the QGIS 2.0.1-Dufour interface with the 'Semi-Automatic Classification' plugin active. The main window shows a satellite image of a landscape. The 'Semi-Automatic: Classification' dialog is open on the left, and the 'Semi-Automatic: ROI creation' dialog is open on the right. A green box with the text 'Semi automatic classification plugin' is overlaid on the top center. A red circle highlights the 'Semi-Automatic: Classification' dialog, and another red circle highlights the 'Semi-Automatic: ROI creation' dialog. Red arrows point from the central text to these two dialog boxes.

Semi-Automatic: Classification

ROI list (ID - Info)

- 1 - Class_1
- 2 - Class_2

Select All Delete selected ROIs

Classification algorithm

Select classification algorithm: Maximum Likelihood Threshold: 0,0000

Classification preview

+ Size: 100 Redo

Classification style

Select qml Reset

Classification output

Create vector Calculate accuracy

Apply mask: Shapefile mask [optional]

Perform classification

Semi-Automatic: ROI creation

Input

Select an image: Band set

<< band set >>

Select a training shapefile: New shapefile

131_27_training.shp

ROI parameters

Min ROI size: 60 Max ROI width: 100

Spatial radius: 10 Range radius: 0,100000

Rapid ROI on band: 1

+ Create a ROI Redo

ROI definition

ID: 1 Information: Class_1

Calculate signature

Save ROI Undo save ROI

Coordinate: 11927593,6187154 Scale: 1:2458021 Render EPSG:3857



Load Landsat 8 images into QGIS

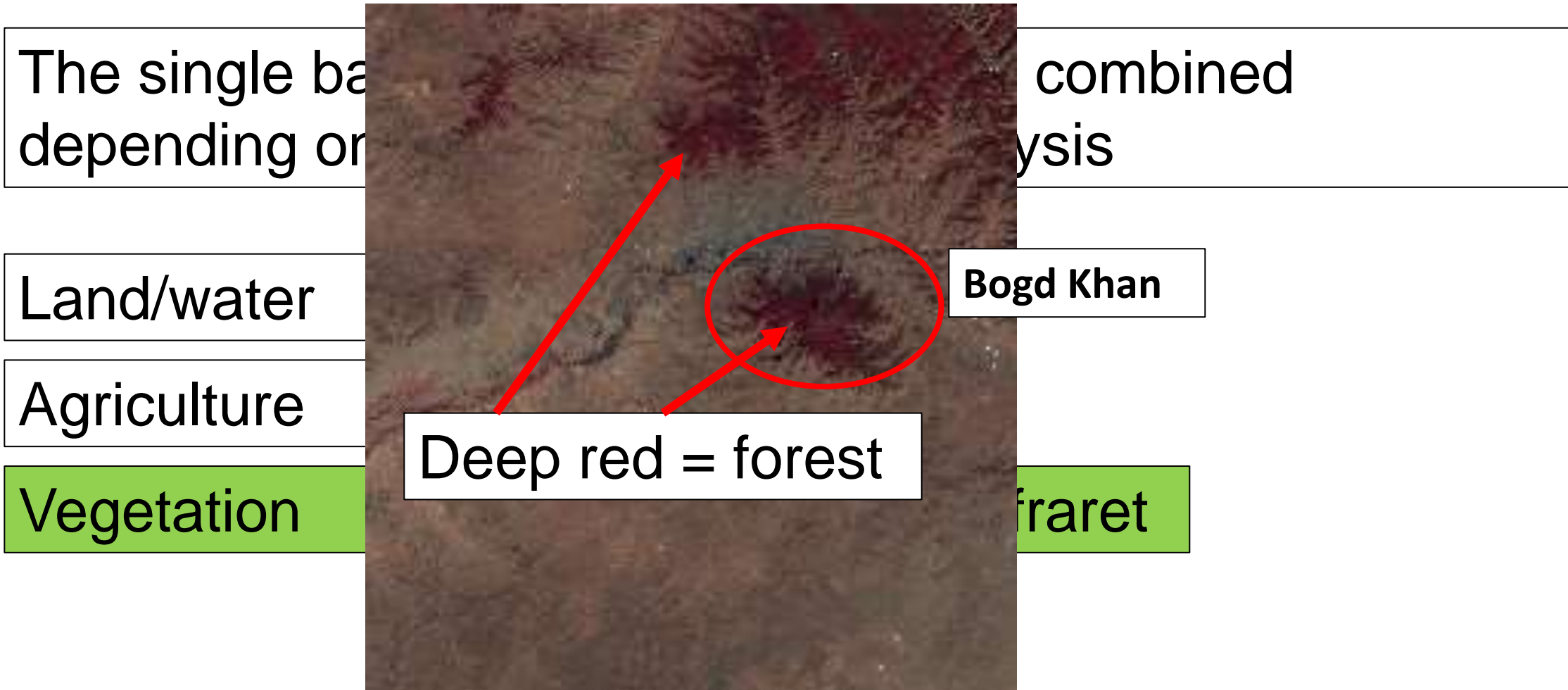
The screenshot shows the QGIS 2.0.1-Dufour interface. The Layers panel on the left contains the following list of loaded Landsat 8 image files:

Layer Name
LC81310272013124LGN01_B2
LC81310272013124LGN01_B3
LC81310272013124LGN01_B4
LC81310272013124LGN01_B5
LC81310272013124LGN01_B6
LC81310272013124LGN01_B7
LC81310272013124LGN01_B8

To the right of the screenshot, a grayscale satellite image of a landscape is shown, representing the data loaded from the Landsat 8 images.

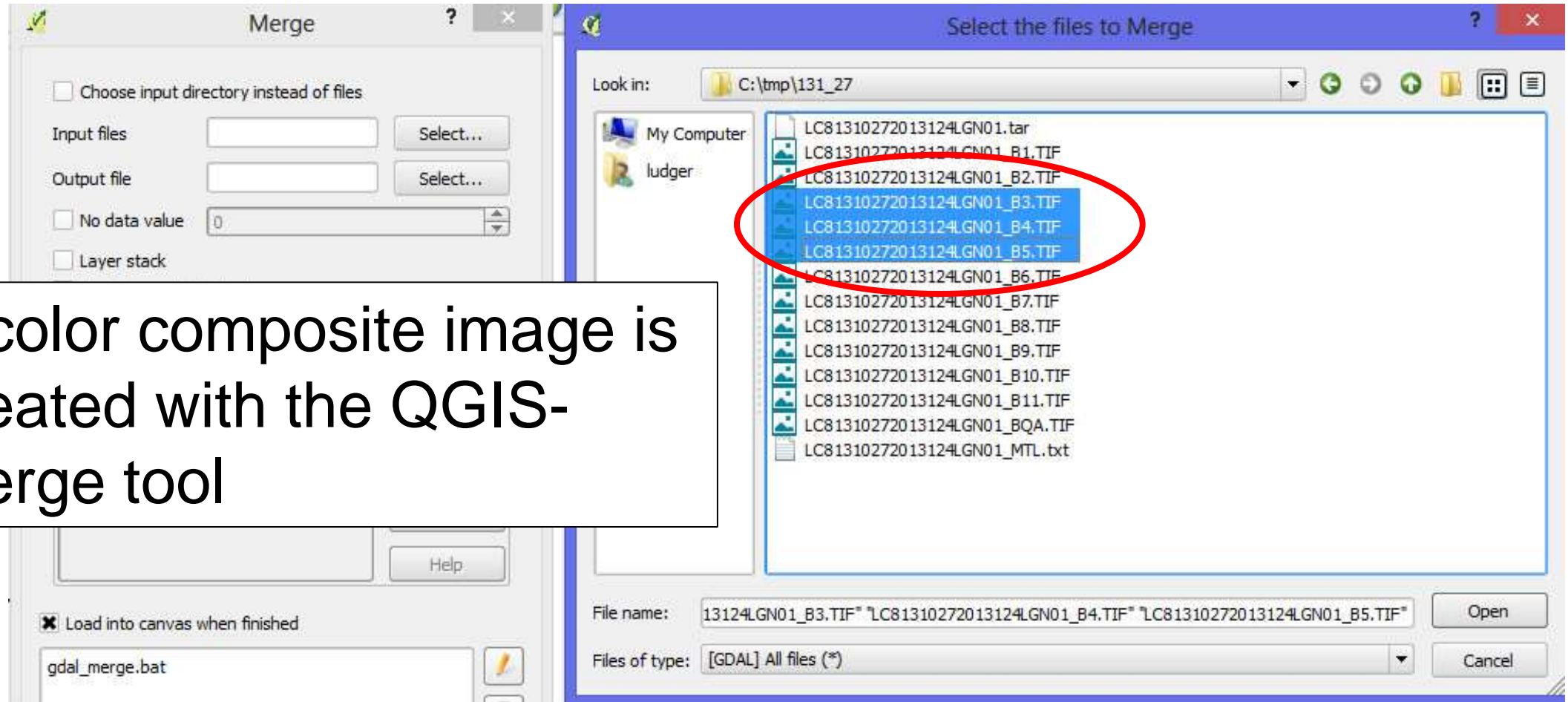


Combination of Landsat 8 bands





Create color composite image

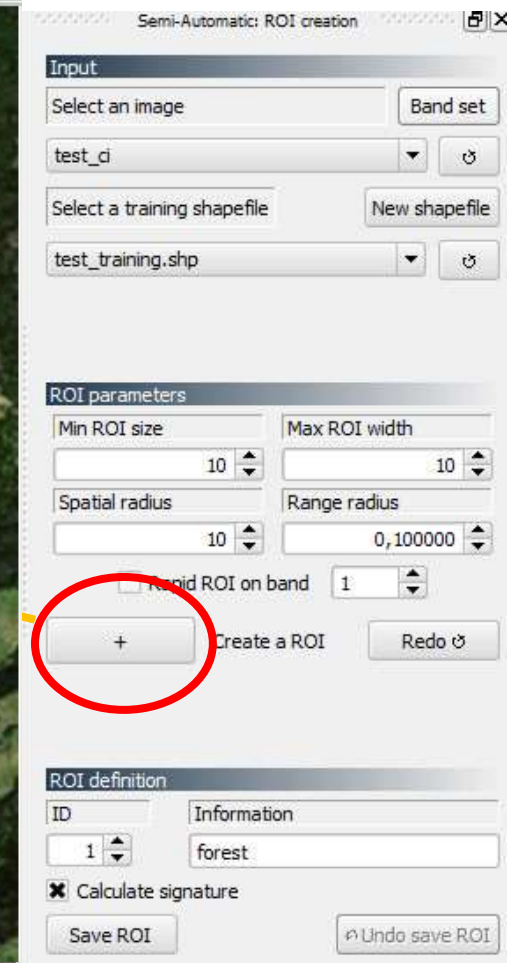
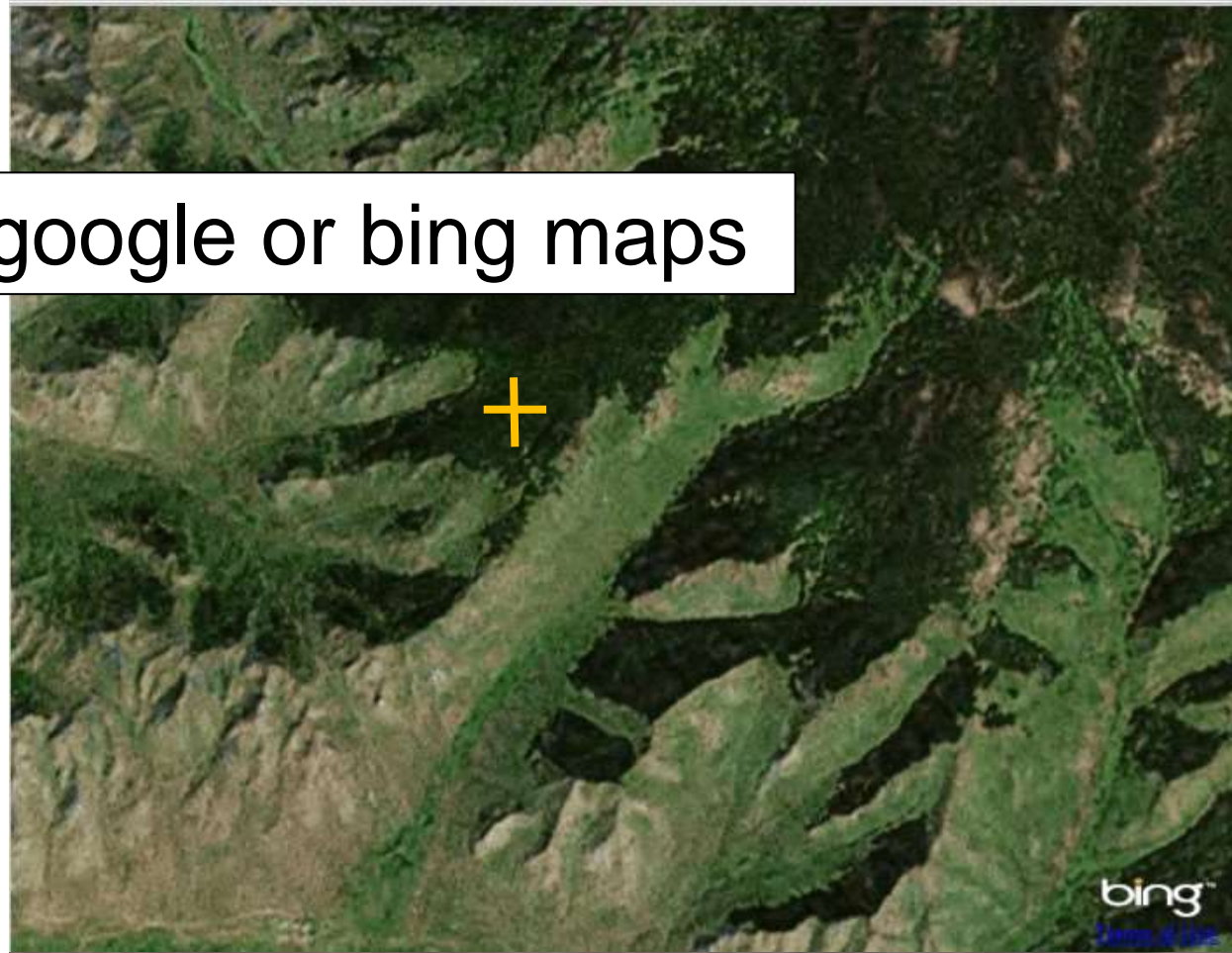


A color composite image is created with the QGIS-merge tool




Select forest pixels

Check with google or bing maps





Select forest pixels



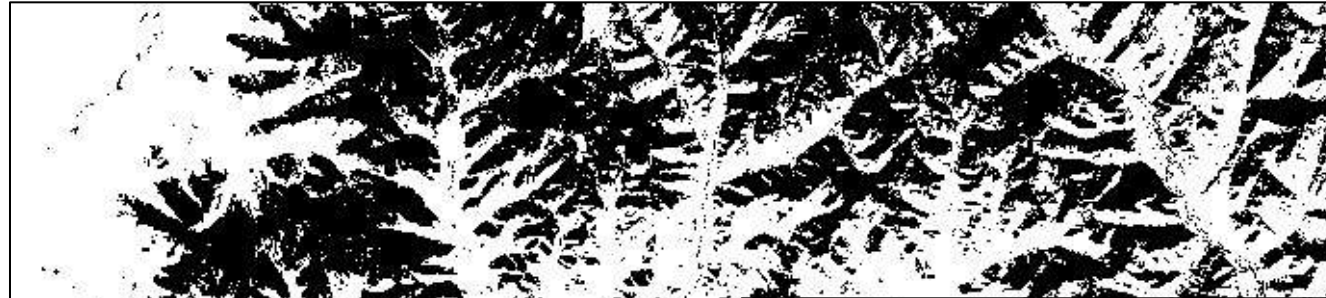
Pixels around the selected pixel having a similar spectral value are selected

With these pixels an average value for the forest classification is calculated

All pixels in the satellite image being similar to the average value are classified as forest.



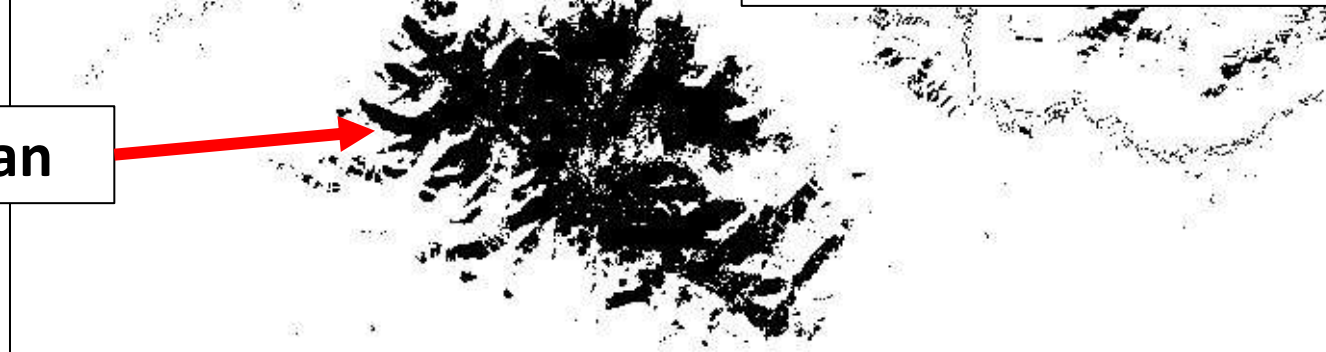
Result: Forest mask



Black = Forest
White = Non-forest


The forest mask can be compared with older forest masks to determine changes

Bogd Khan





Forest mask 2013



The forest mask 2013 using Landsat 8 images is currently in process



Results are expected by the end of November 2013

