

# GEOG432/632: Fall 2018 Lab 1

## Geomatica: Display and Digital numbers

This lab explores the Geomatica interface, display options and examining the DNs that make up satellite image bands, for Landsat Thematic Mapper, and Landsat 8 OLI data

**All data for the course are stored in this folder: L:\labs\geog432\data2018**

Software: Geomatica by PCI Geomatics, Toronto

The native format for PCI images is **.pix** (though you can load other formats)

**0. Login using your UNBC login and password** - this will get you onto the Linux desktop; if this is your first time, you may need to logout and back in again in order to see the shortcut icons displayed. Ignore/cancel the pop-up that says 'enter password to unlock your login key ring'

Unlike Esri software which runs only under Windows, PCI Geomatica runs under Linux or Windows (Osmotar) – we prefer to use the Linux version to avoid Windows / Osmotar bottlenecks and oddities, but the Osmotar option can be handy from other labs and environments. The software should be identical in Linux or Windows once the application is launched.

Reminder of Landsat 5 bands:

Landsat TM: Visible: 1,2,3 (Blue, Green, Red) Near IR: 4 Mid-IR: 5,7 Thermal IR: 6

Thematic Mapper (TM)	Landsat 4-5	Wavelength (micrometers)	Resolution (meters)
	Band 1	0.45-0.52	30
	Band 2	0.52-0.60	30
	Band 3	0.63-0.69	30
	Band 4	0.76-0.90	30
	Band 5	1.55-1.75	30
	Band 6	10.40-12.50	120* (30)
	Band 7	2.08-2.35	30

Remember the difference between RGB – the display guns and the image bands (1-7)

**Image Bands:** Refer to the individual Landsat TM bands ranging from 1 -7.

**Display guns (RGB):** up to three planes can be displayed simultaneously in red-green-blue (RGB). Displaying the same channel three times in RGB produces a gray tone image.

**00. Start Geomatica 2017 software (Linux: double-click local launch Geomatica 2017)**

in the 'Focus' window which opens (this may be the only button in the panel we use this course):

All files for this lab (and future labs) are in the folder: */home/labs/geog432/data2018*

# 1. Color Image Display and Set-up

## Loading Satellite Imagery in Focus

- file -> Open** and select from the course lab folder: **pg14sept2011.pix**
- The filename is self-explanatory – it's the last year Landsat 5 was able to transmit data  
The scene has been clipped to reduce size and need to pan
- Resize to get best display .. you should be able to see the whole dataset without panning; resize by extending the corners, but I recommend you do NOT maximise the window.

## Display and Enhancement

The initial display usually has poor contrast; default bands 1-2-3 are in R-G-B ('reversed': blue band is shown in red, red in blue) -> 'flip' bands 1 and 3 by right-clicking filename and then **RGB mapper** - click 3 in red and 1 in blue

**Enhance:** right-click -> enhance - root- usually works best (or linear)

You can also enhance using the icon in the 2<sup>nd</sup> row at the top, left of the sun and shade icons

a. Zoom and Pan – + and - zoom in and out, but more useful, use the box symbol to the left of + to outline an area of interest (same as in ArcMap); check out the campus and your house areas; zoom enough to see the pixels. Use the 'zoom to overview' box to return to the whole area.

b. Note the UTM coordinates (displayed at the bottom) as you move – scenes are downloaded in the local UTM zone; see Lat/long as well for a point by clicking the +x,y button

c. Measure the approximate E-W and N-S extents .. use the measuring tool, or basic math from the UTM coordinates; how big is it across in kilometres ?

d. Enhance – try linear and root – see which gives best contrast (enhancements is on the 2nd row of symbols, to the left of the sun); you can also adjust contrast and brightness

e. You can also find many tools using right-click on filename e.g. enhancements, layer overview

Note below also the DN values (0-255) at the cursor position for the bands displayed (in R-G-B)

Change the display to 'false colour'

- This 2011 image has haze especially in the NW, we can reduce this with a composite:
- Right-click on filename and select RGB Mapper again
- Move the check boxes to 4-3-2 and enhance - root again [you always need to as the display is based on the previous data display]
- Now change to 5-4-3 maximum contrast in the same way (and enhance again)
- We can compare the 5-4-3 and 3-2-1 displays by adding the normal colour RGB
- Layer-add-> RGB and in the 'wizard pop-up box' click on 3 then 2 then 1, finish -> enhance
- Now click the normal colour display on and off to compare with the 543 - note the contrast in the 543 and advantages of using IR: veg contrast, land v water, no haze.

## 2. View the individual bands in grayscale:

Layer-add-grayscale; select band 1 and finish

Right-click on the grayscale layer in the Files list and select RGB mapper – note that all 3 colour guns are ticked for Band 1; change this to band 2, close and enhance as needed.

Do the same to view bands 3-7 (always enhance if needed)

Note that bands 1-3 are similar, bands 5 and 7 are similar, band 6 is ‘fuzzy’ – larger pixels.

### Maps and Files tabs

The coordinates are given below the image frame – they should be familiar numbers ...  
On the left in the ‘TOC’ you see two tabs: maps and files. The default is maps, which enables display options, while files shows database information.  
[For GIS geeks, you could think of them as parallel to ArcMap and Catalog].

Switch the tab to files and right-click on the filename.

General – file size etc..      History and metadata – none given  
Projection –                      UTM and 30m (pixel size)

Check rasters .. it will list the bands / channels available (7)

Switch tab back to Files

## 3. Examining histograms

Highlight the 321 display layer name and

View the histogram by selecting:

**Right-click filename -> histograms** OR select (in menu bar at top) **Layers -> Histograms**

This displays the histograms for the selected RGB (note that all operations relate to the layer highlighted in the TOC, not the one displayed, unless they are the same.

Get more detail and information for each one by clicking on its histogram (yes, try it!)  
Would higher or lower standard deviation give you more variation in an image band ?

Note (as in lectures): the 3 histograms are similar in shape (all are visible bands);

All have a low range of values compared to the 0-255 possible range

Also. the minimum DN decreases as wavelength increases as bands are less affected by haze - haze adds fake 'brightness' so there are no pixels with lowest values

Now highlight the 5-4-3 composite display

View the histograms for this composite

Note the differences in shape, and how the IR histograms are bimodal (why?)

Set the grayscale layer to band 6 and note that band 6 has a lower DN range as the amount of emitted energy is much lower than the reflected bands (what is the min and max DN value ?)

#### **4. Add a second image (1996)**

File->open and select pg11sept1996.pix

Switch the bands to 5-4-3 and enhance

Compare with 2011 - they should line up perfectly

You can easily see some changes - changes to the UNBC camps e.g. appearance of the Northern Sports Centre and other buildings/roads; also the expansion of the runway at the airport - now the 3rd largest in Canada ! There are many forest changes with cutblocks and regrowth etc..

As well as a visual change, check the DNs and compare - do this by clicking on a point, and then simply highlight the other scene data in the TOC ... watch the DN display at bottom change - which band is changing most for a feature/area that has changed ?

Do this for other locations e.g. another cleared area, and an area with little change - is one band changing more than the others ? We may use this info later in the change detection lab.

#### **5. Image interpretation**

The best overall combo is one band each from the visible, near-IR and mid-IR e.g. 543 or 742  
543 is generally the most commonly used

In the 5,4,3 colour composite for 2011 - note the following general colours for surface types:

- Dark-green: coniferous.
- Light-green: deciduous.
- Pink: arable / agricultural.
- Dark-purple: industrial.
- Light-purple: residential.
- Black: deep or sediment-free water.
- Blue: shallow or sediment-laden water.

Click with your mouse on a sample location of each of these to see why the colours appear as they do

Remember that Near IR indicates vegetation vigour / health, high DN = healthy vegetation

Mid-IR indicates moisture – or rather lack of it; high DN indicates low moisture

First select the chip piles at Canfor (brightest place on the image) ... they are bright (white) as they reflect high in all 3 bands

Note we are seeing the original band DNs – the enhancement might disguise their true values



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## 7. Adding vectors to the display

Layer-> Add -> Vector (click next)

Click on browse button and navigate to our data folder and in the shapefiles subfolder, select pgcity.shp (open), and click on pgcity in the window below, finish. (ignore projection warning box). This displays the shapefile for the city boundary.

Do the same to load and display the rivers (rivers.shp). Note that these vectors might differ from the image due to either changes in the river banks, or the image resolution. Zoom in on selected areas to find such differences.

## 8. Viewing satellite imagery in ArcMap (or QGIS)

Note that arcmap can display a PCI .pix file, though if you plan to do major analysis, its more stable to convert it to .img or .tif

In Osmotar, start arcmap and a blank new map

You may need to map a network drive to access ninkasi and L:\labs\geog432\data2017

OR if you are a QGIS'er, start QGIS (its also on Linux) and do what is needed to display an image, switch to bands 543 and enhance

### ArcMap

**Add data** – and select the pg14sept2011.pix file (you may need to ‘connect’ to this folder).

- It will ask about building pyramids – whatever, say No to display quicker
- The display may be all gray – this is the ‘no stretch’ in arcmap;
- Right-click on the filename -> properties -> symbology
- Change stretch from none to standard deviations (apply)

It will display as it does in PCI with 123 in RGB

- Right-click select properties and the symbology tab Switch the bands to 543
- You should also need to enhance one of the stretch types
- This takes some experimenting -
- You may need to change 'current display extent' to 'each raster set'

Query DN values using the ‘I’ (info) button to get the 3 DNs

Some users do all their image processing in arcmap – especially if they don’t do enough to warrant buying more software. Generally PCI Geomatica will have more options – and operations like enhancements are much easier

**That’s it for now. Next week, we’ll use these DNs to classify an image into land cover types. Exit Geomatica and log out – nothing to save, we only viewed; don’t turn off workstations !**