

Remote Sensing software

... Not just one that 'rules them all' like GIS

- **The big three**
- **Less expensive options**
- **Free download options**

The Big Three

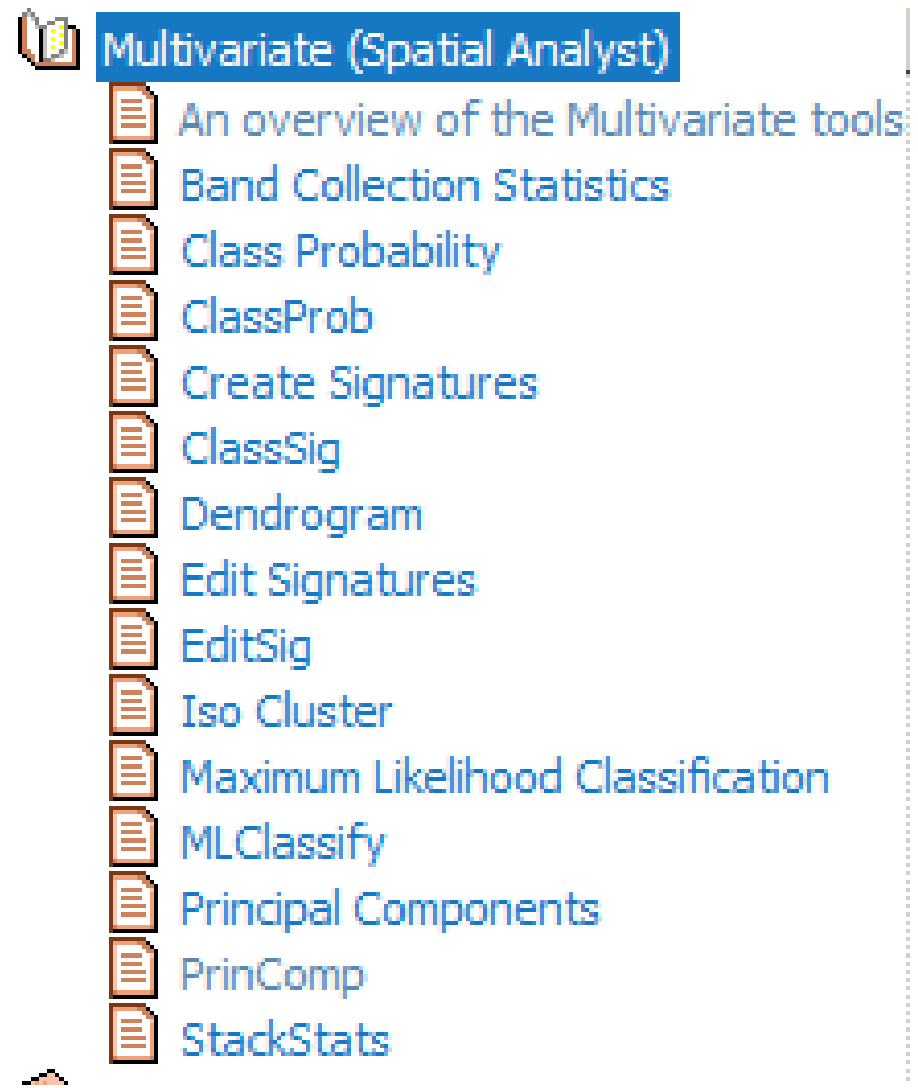
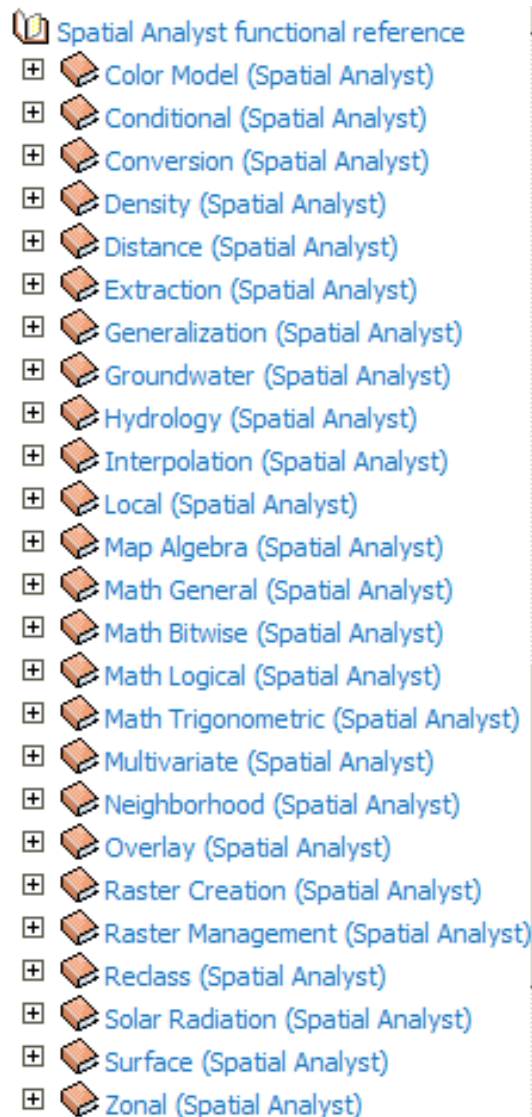
Initially for UNIX, then Windows

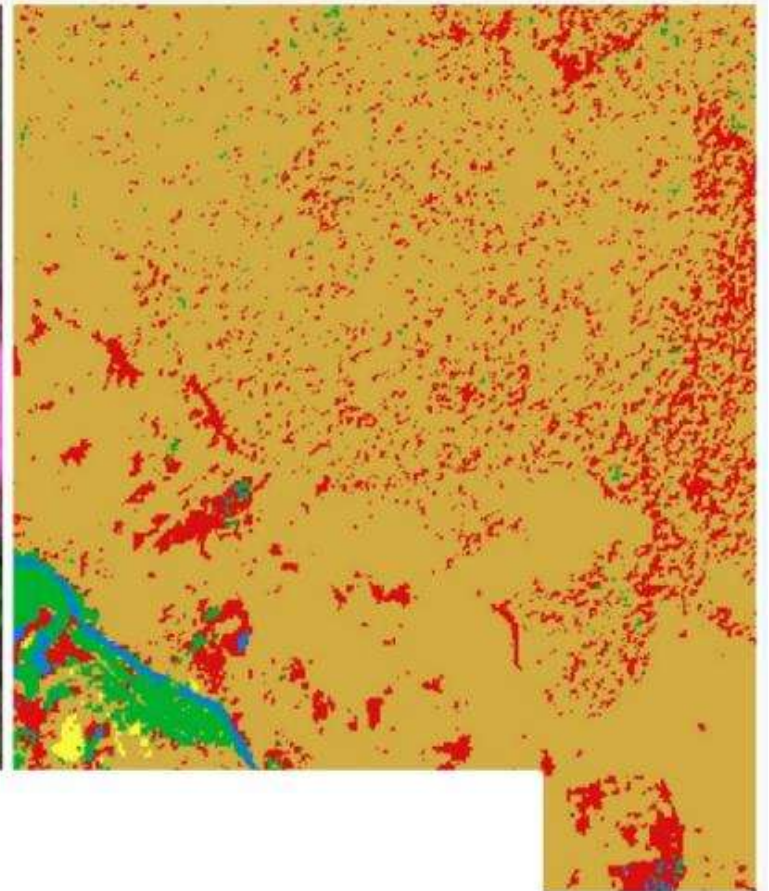
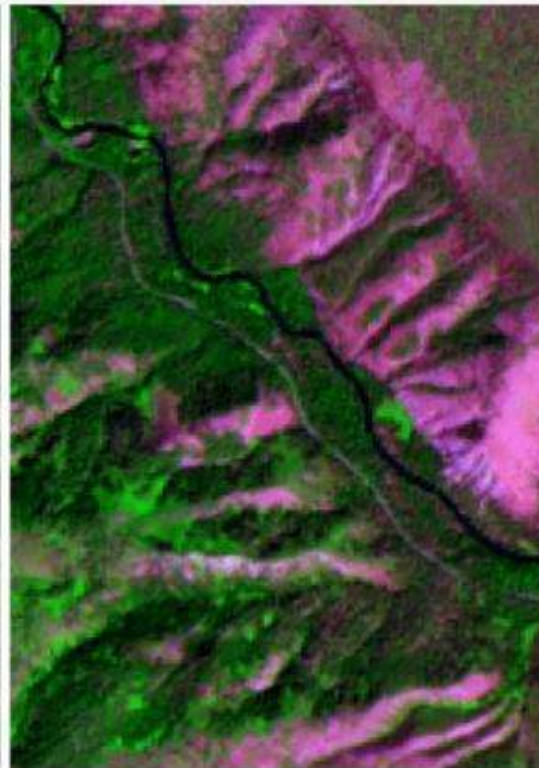
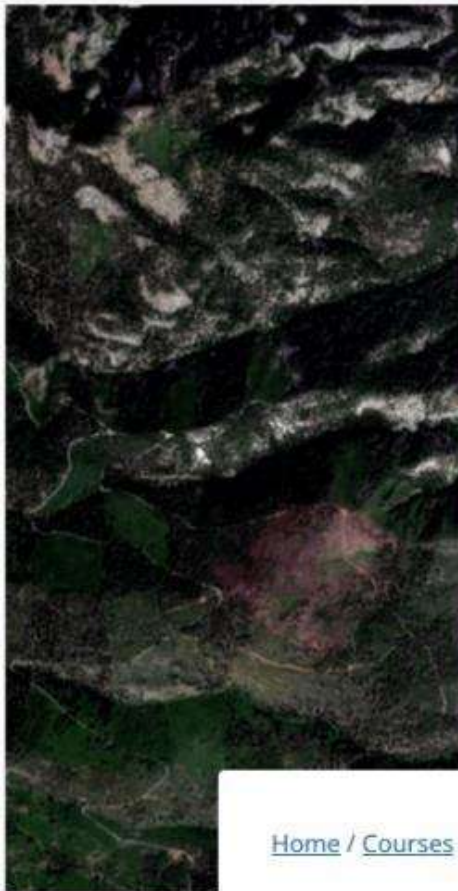
Software	special strength	
ERDAS (Atlanta, USA: 1978)	– vector integration	.img
PCI (Toronto, Canada : 1982)	– orthoimages / breadth	.pix *
ENVI (Boulder, USA: 1991)	– hyperspectral	

** Other software will open .pix files, but best to convert to .img*

ArcGIS spatial analyst (formerly GRID) – increased raster options

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Remote Sensing with QGIS

QGIS Python Plugins Repository

Semi-Automatic Classification Plugin

SAGA

System for Automated Geoscientific Analyses

Raster GIS, Germany, 2004

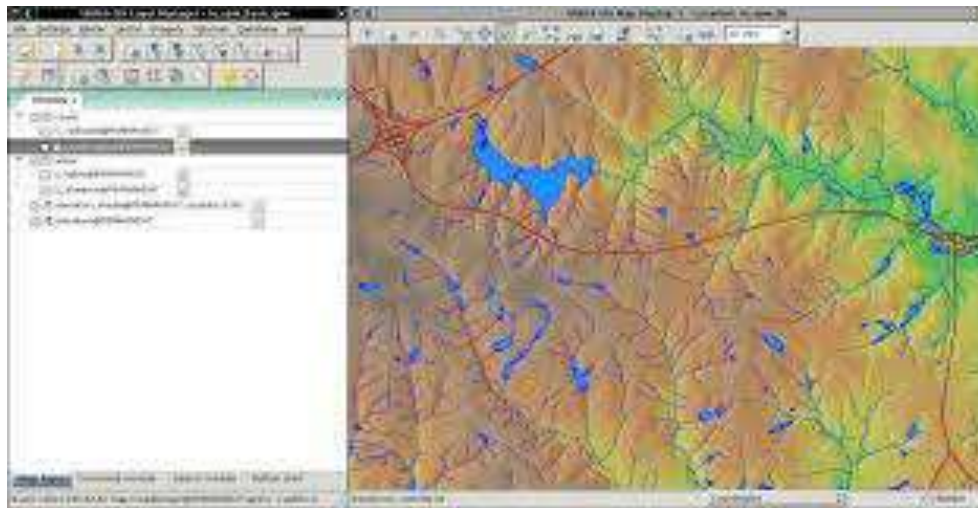
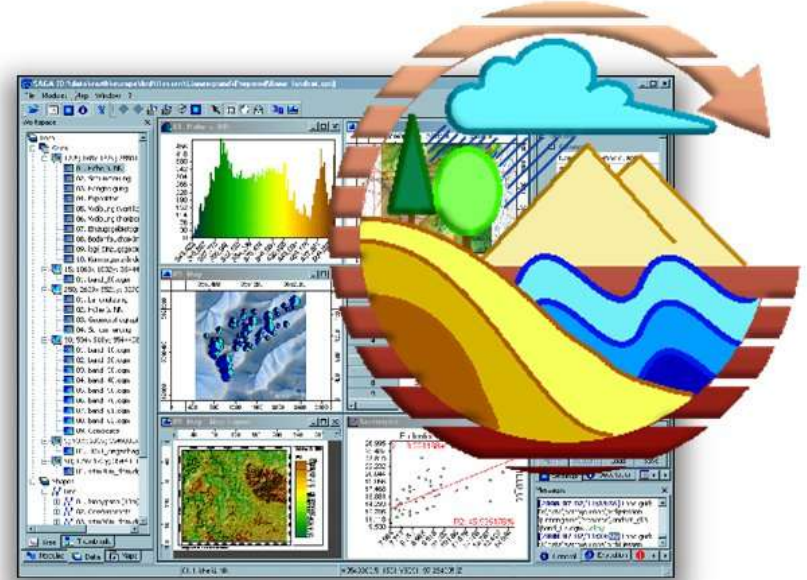
FREE

<http://www.saga-gis.org/en/index.html>

integrated into QGIS

GRASS raster GIS (1982)

<https://grass.osgeo.org/>



Started in 1982 by U.S. Army - Construction Engineering Research Laboratory (USA-CERL) in Champaign, Illinois. USA-CERL completed its last release of GRASS in 1992. GRASS development was assumed by academia in 1997, and became an OS project – international team manages the source code.

FREE – ESA (Sentinel)

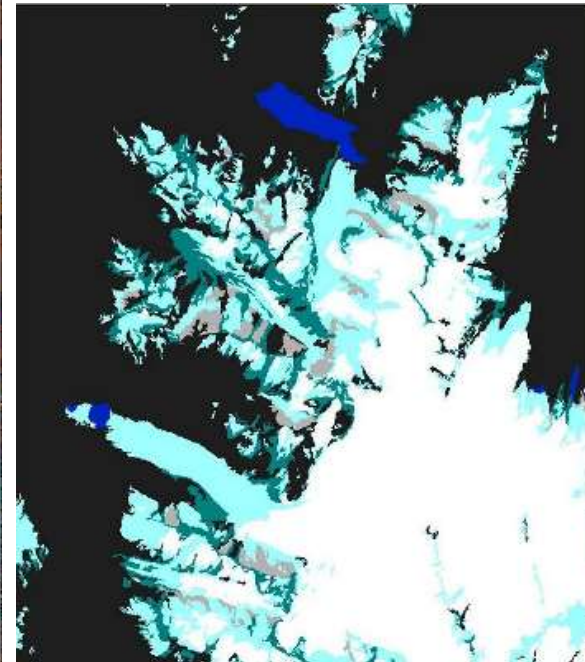
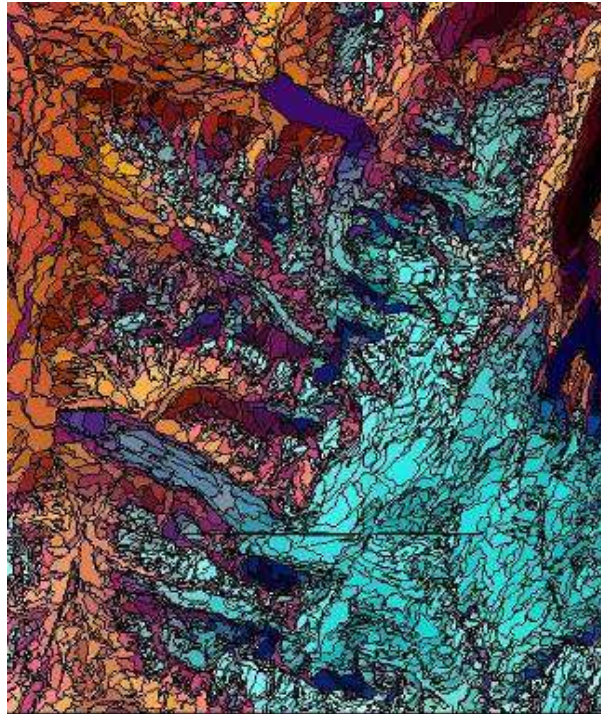
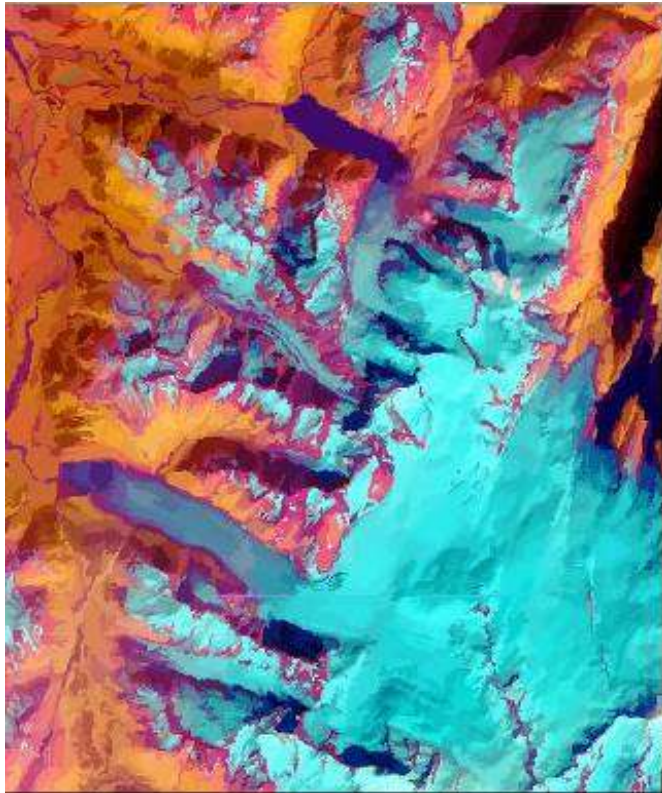


eCognition, Germany 2000

-> Object-oriented classifier; Feature based not per-pixel

-> the most significant change in RS for 25 years ?

Object-oriented classification starts by segmenting the image into meaning objects. The segmentation algorithm is a bottom-up region-merging technique. It begins by considering each pixel as a separate object. Subsequently, adjacent pairs of image objects are merged to form bigger segments.



PCI: Object Analyst : Object Based Image Analysis (OBIA)

ArcGIS: Feature Analyst

QGIS: OBIA plug-in

IDRISI Worcester (Boston) \$

<http://www.clarklabs.org> Idrisi Canada: <http://www.idrisi.ca>

Raster based GIS and remote sensing since 1986

What's New

**IDRISI Taiga Now Shipping! Includes Innovative Earth Trends Modeler Application
Segment-based Classification!**

[Learn More](#) >

Focus Paper on Segmentation & Segment-Based Classification Now Available!

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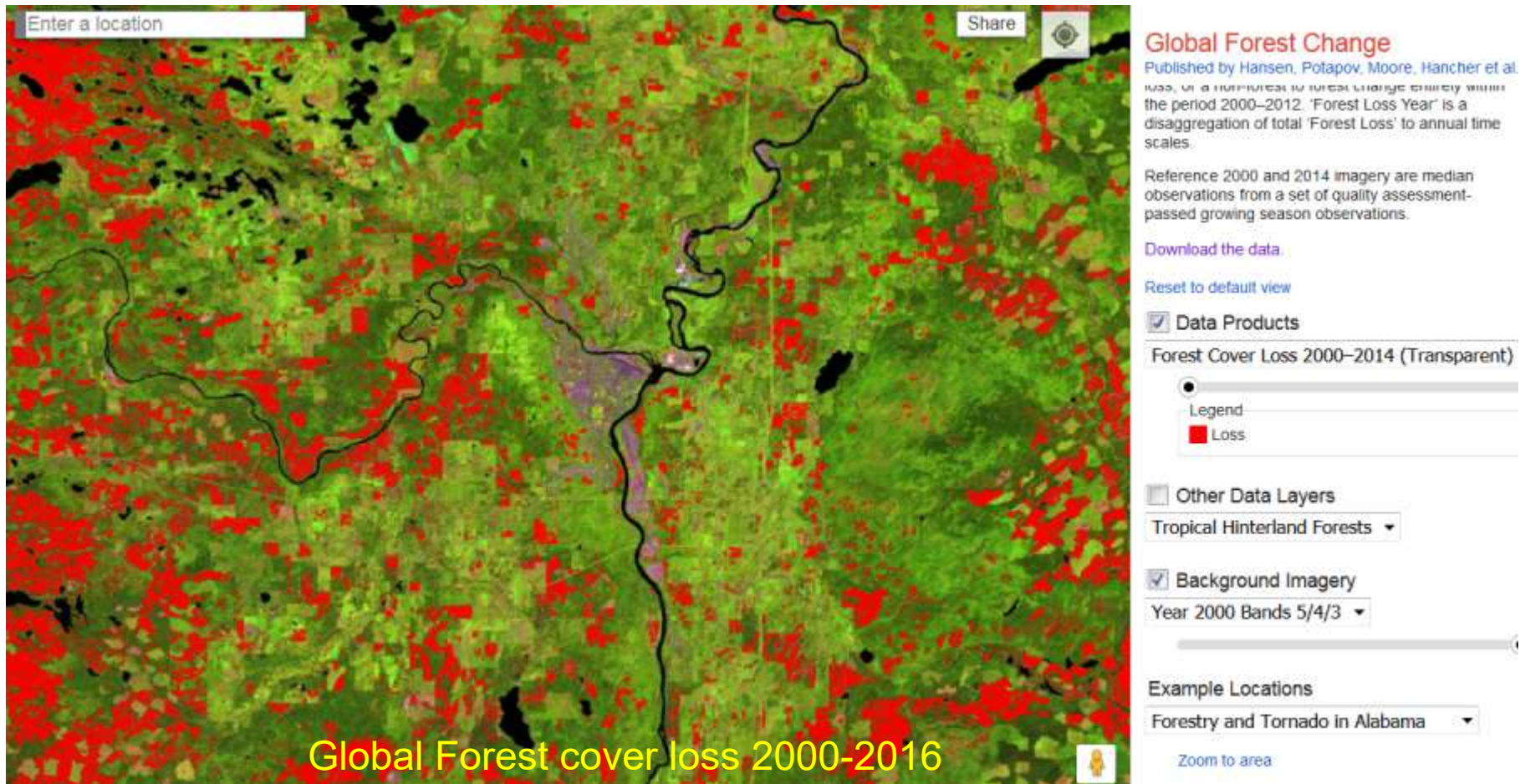


Feature / segment classification (instead of per pixel) is now part of GIS/RS software:

Google Earth Engine is a cloud computing platform for processing satellite imagery and other Earth observation data. It provides access to a large warehouse of satellite imagery and the computational power to analyze those images.

<https://earthenginepartners.appspot.com/science-2013-global-forest>

Updated site: <https://glad.earthengine.app/view/global-forest-change>



Application of Machine Learning, Deep Learning, AI, Neural networks

built-in contextual rules to identify and define objects and assess probabilities of features to replicate human interpretation methods

Examples often use recognizing cats v dogs

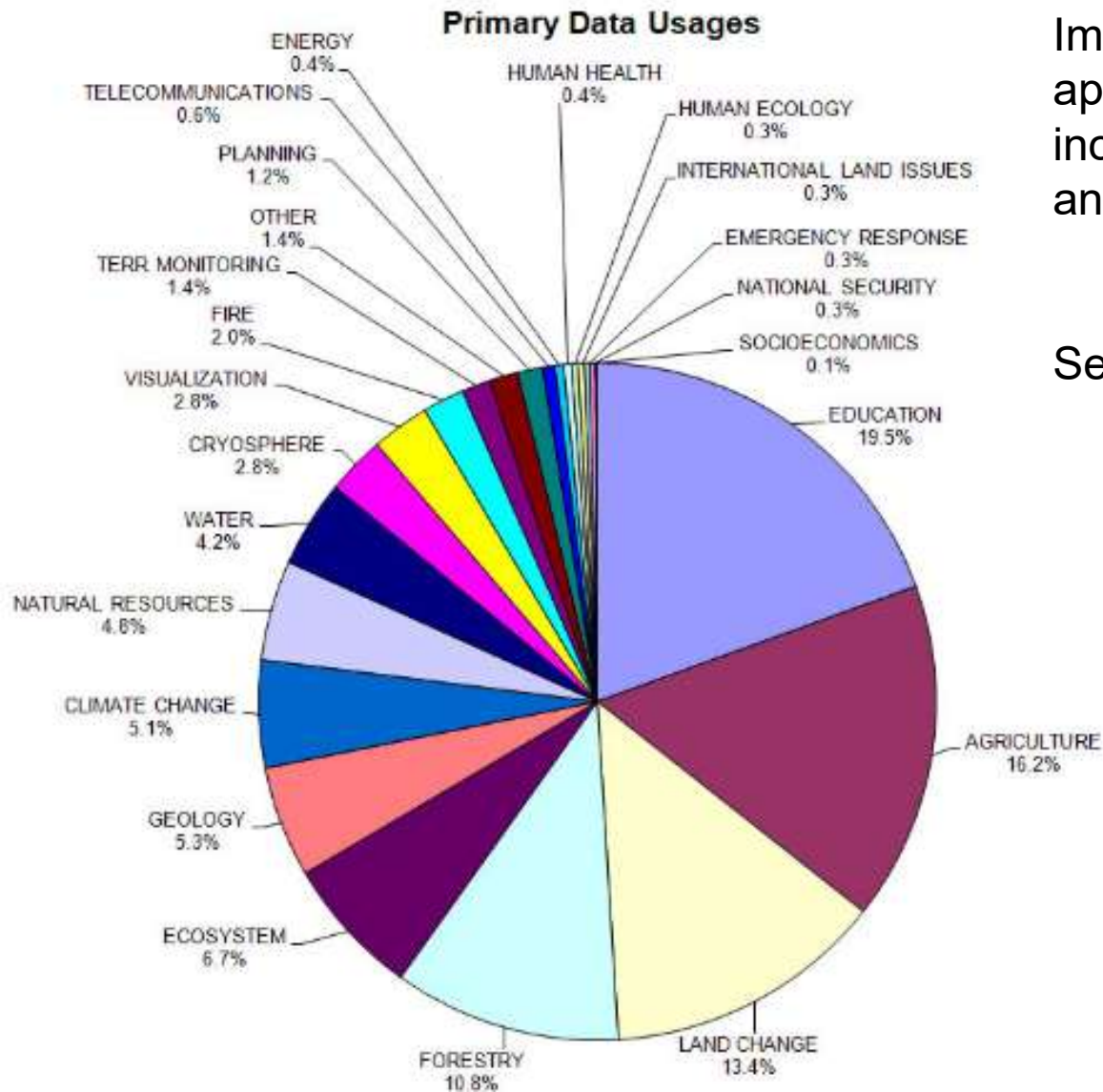


Chihuahuas or muffin?



Landsat Free Archive – How Landsat Data are Being Used

Statistics as of August 31, 2009



Landsat free since 2008

Impact of free data on applications and use including open source analysis.

Sentinel free since 2015

Major trends in remote sensing 2025 -> (see next class)

More and more satellites especially (small) nano and cubesat

More airborne platforms – planes and drones

Data clouds – online processing and more and more data

Scripting data options: GDAL, Google Earth Engine, Python

Object Based Image Analysis

PCI Catalyst: Object Analyst [option below Analysis-> Supervised Classification]

ArcGIS: Feature Analyst

QGIS: OBIA (with plug-Ins)

GEOG 457 runs in January 2026

Course summary / review

In this course, you should have gained a sense of:

- Understanding of imagery and wavelengths
- Potential of digital imaging to extract features
- The potential power of multispectral sensing
- Contribution of remote sensing to Geomatics / GIS
- Data availability – purchase and online
- Many applications - agriculture, forestry, land cover, glaciers etc..

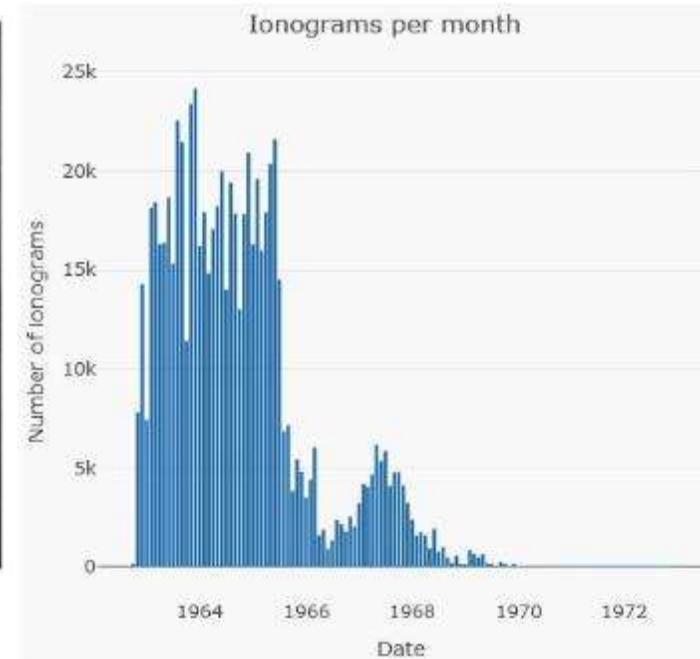
Alouette 1 and 2 (1962 / 1965) Canadian Space Agency

- first Earth satellites after USA / USSR

The primary purpose of the Alouette mission was to investigate the geographic and diurnal properties of the ionosphere at altitudes up to 1000 km



Dr. John Chapman (L) and Dr. LeRoy Nelms (R) toast the success of the Alouette satellite. August 24, 1970. Credit: Canadian Space Agency.



Ionosphere images from Alouette 1 / 2 download:

<https://open.canada.ca/data/en/dataset/221c1c75-4c42-4286-a4ce-ca6c3027b7fe>

<https://www.asc-csa.gc.ca/eng/blog/2023/09/27/alouette-i-saving-its-data-60-years-later.asp>

Canada's first Lunar Rover: launch 2028 ?

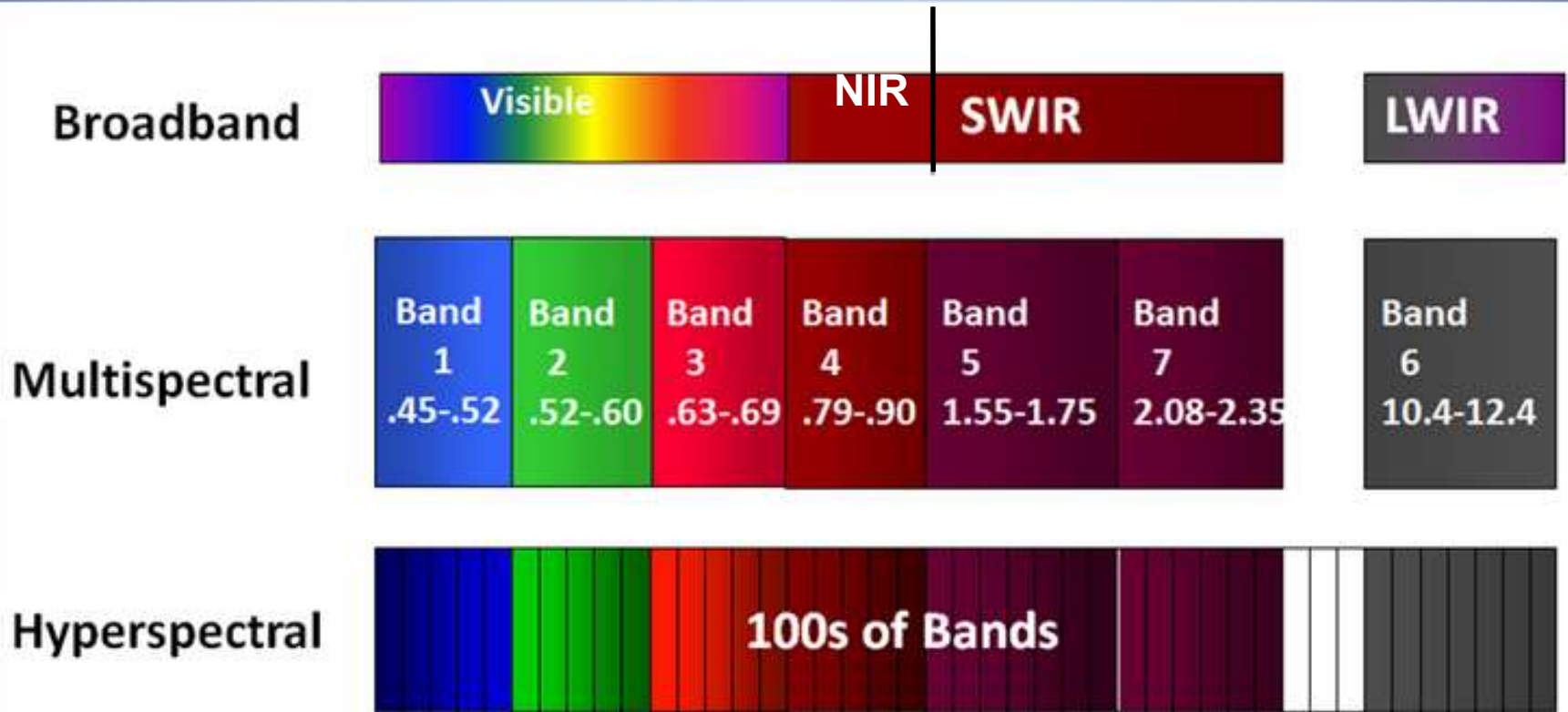
<https://news.westernu.ca/2024/11/gordon-osinski-lunar-rover>



Hyperspectral remote sensing ('Image spectroscopy')

- **Multispectral** systems contain ~4-15 bands, 70-400 nm wide
- **Superspectral**: 16-60 (e.g. MODIS)
- **Hyperspectral**: 100- 200+ bands 0.38 - 2.5 μ m, 5-10nm each
Bands are contiguous and high spectral resolution

Difference Between Multispectral and Hyper-spectral Data

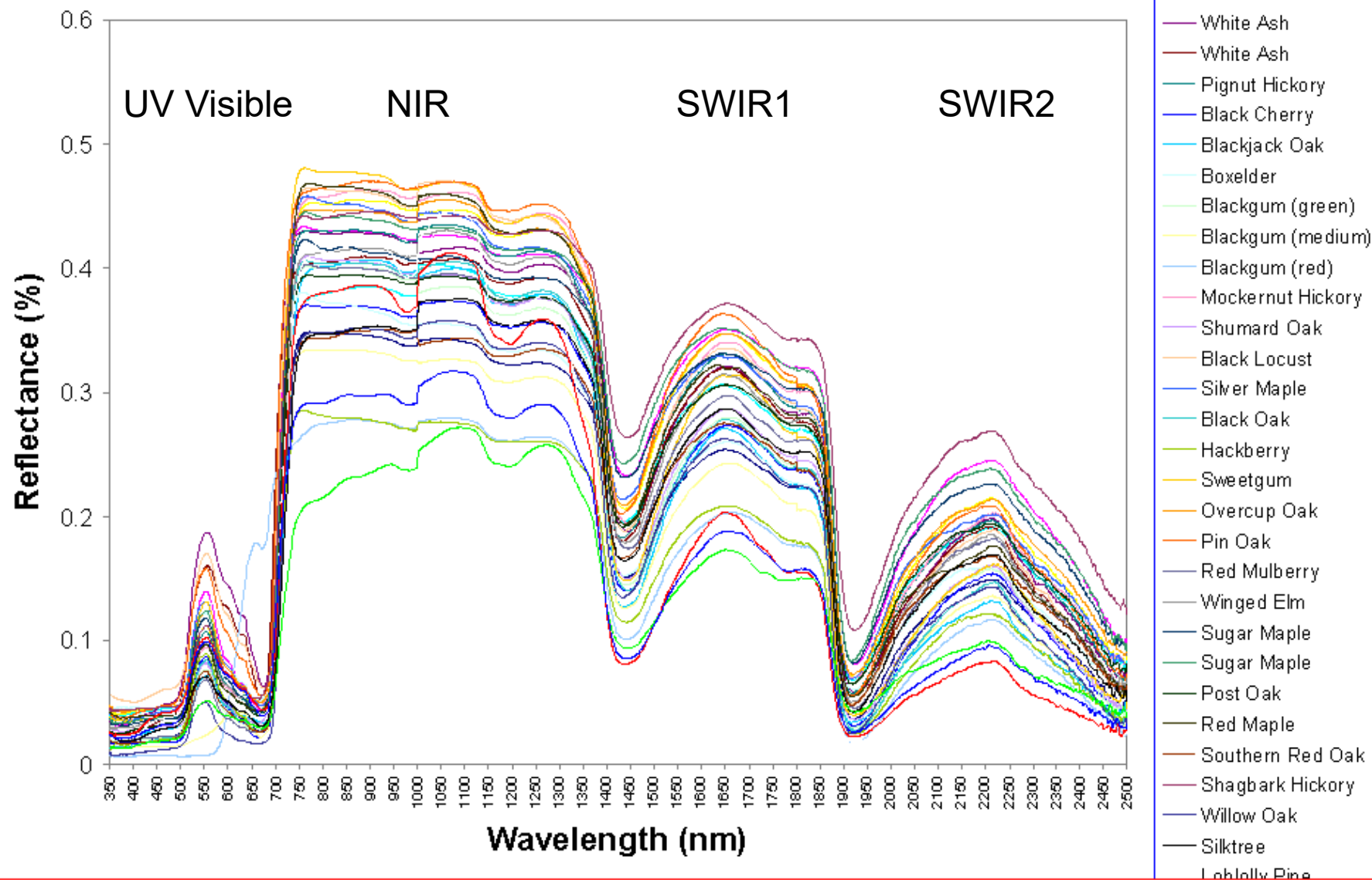


Some ‘earlier’ airborne hyperspectral systems from the 1970s/80s
- now available on satellites and drones (UAV)

Sensor	Wavelength (nm)	Band width (nm)	# bands
AVIRIS	400-2500	10	224
TRWIS III	367-2328	6	335
HYDICE	400-2400	10	210
CASI (ITRES)	400- 900	1.8	288 (Calgary, now with NASA)
OKSI AVS	400-1000	10	61
ESSI Probe-1	400-2450	15	128

LBL Overstory Vegetation Spectra

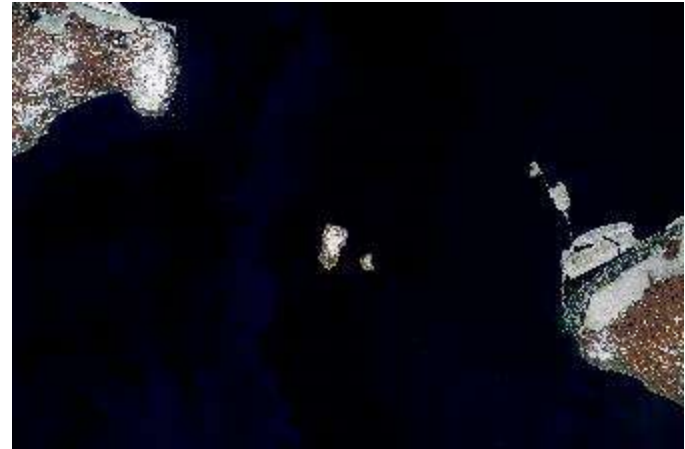
<http://www.murraystate.edu>



Neat images

Closest distance
Russia-USA 3.8km

Landsat 8 OLI

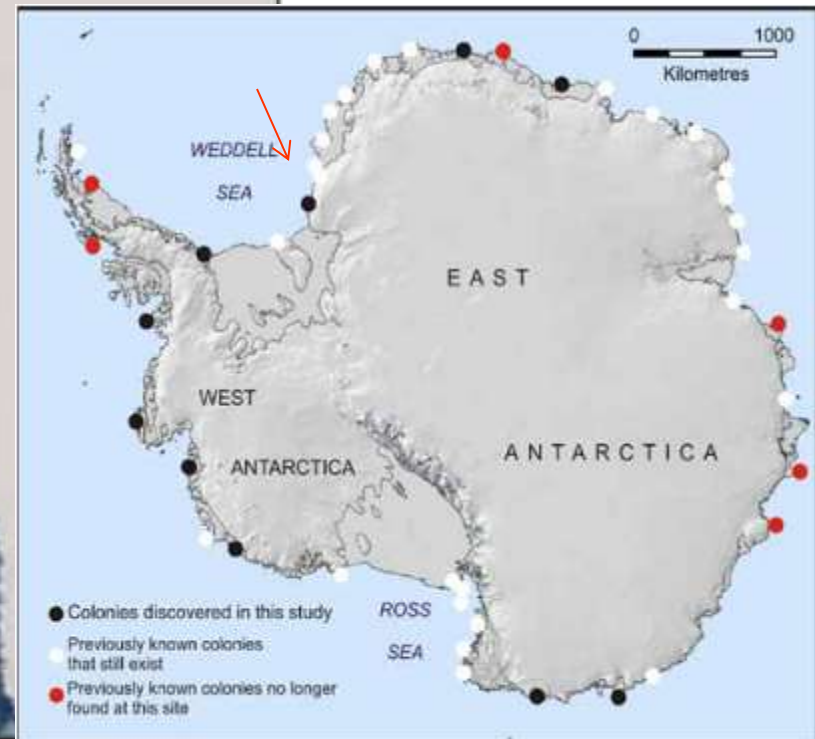
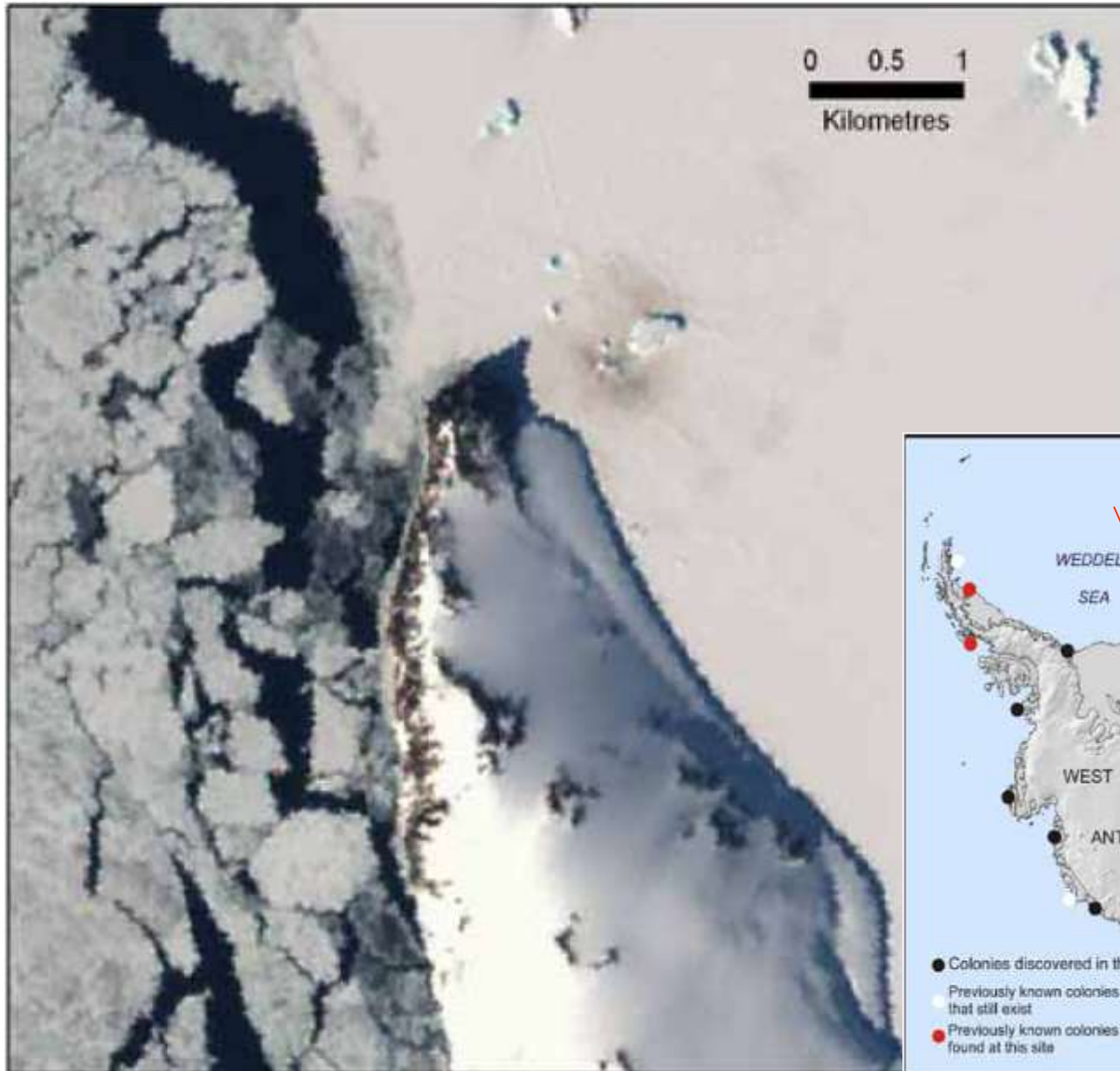


My favourite satellite image

Mapping Penguins from space – using penguin poop



Landsat TM image showing guano stains of an emperor penguin colony in Halley Bay, Antarctica



2nd Exam: Monday 1 Dec, 8.30-9.10 (40 minutes)

- Glaciers
- Change detection
- RADAR
- LiDAR
- DEMs
- Env. Change demos
- High resolution sensors
- RS Software
- Future trends

Sample exam question: *which wavelengths are able to penetrate cloud cover*

a. Visible b. Near-IR c. SWIR d. Thermal IR e. Microwave