I forgot to record this lecture (again), so I've added some notes including main points notably for the exam pointers and review comments

Midterm, Wednesday 14 October, 9.30-10.20am (15%)

Content: lecture topics covered so far
(see syllabus or webpage lecture list) – up to today's class

This week's lectures will be uploaded after this class, along with some supplementary webpages for further reading if needed

I will email the exam as word doc ~ 9.25am; you return it by ~10.25am

[I could also load it onto the webpage for downloading]

The exam is intended to be 'closed book' in principle, but is not enforced !

Feel free to email me during the exam if a question needs clarification

I wll also start a Teams session for people with queries – but no answers !

Midterm sample

Mix of multiple choice and short answers (5/10 or 10/5)
Multiple choice = less typing – just **bold** the correct answer

A.Multiple Choice

1. Of these parts of the electromagnetic spectrum, which is the median in wavelength:
a. Mid-IR b. Red c. Thermal IR d. Green **e. Near IR**

Pre-exam Tip: put them in wavelength sequence and which is in the middle ?

2. Which of these 3-band combinations form the **best** colour composite in terms of total information content and contrast ?
a. 1,2,3 b. 3,5,7 **c. 2,4,7** d. 2,3,4 e. 1,2,7

Pre-exam tip: most information/contrast is one band each from visible, near-IR and mid-IR

B. Explanation of terms and processes

In spaces between questions; use note (bullet) form to reduce typing …

1. Explain the difference between a Colour composite versus a pseudo-colour display

A: Colour composite displays 3 bands (channels) in RGB colour guns; Pseudocolour displays (only) one channel in a colour palette sequence (e.g. for classifications)

2. Linear stretch (enhancement)

A: (linearly) expanding the range of digital numbers with a limited range of values, to fill the full 8-bit display options for a band/channel/composite

Env. Change assignment 10%

Fri Oct 9 lecture: more details plus midterm tips ←--

Wed Oct 14 class: midterm, done at 10.30am

Thurs Oct 15 lab: download and clip/format the two images

Mon Oct 19: send slides and text to wheate@unbc.ca

Wed Oct 21: class: 3 minutes each – demo your example

Env. Change assignment 10% (Oct 19)

The (free) Landsat image archive covers 1984 – 2020

Select before/after images to show some selected change

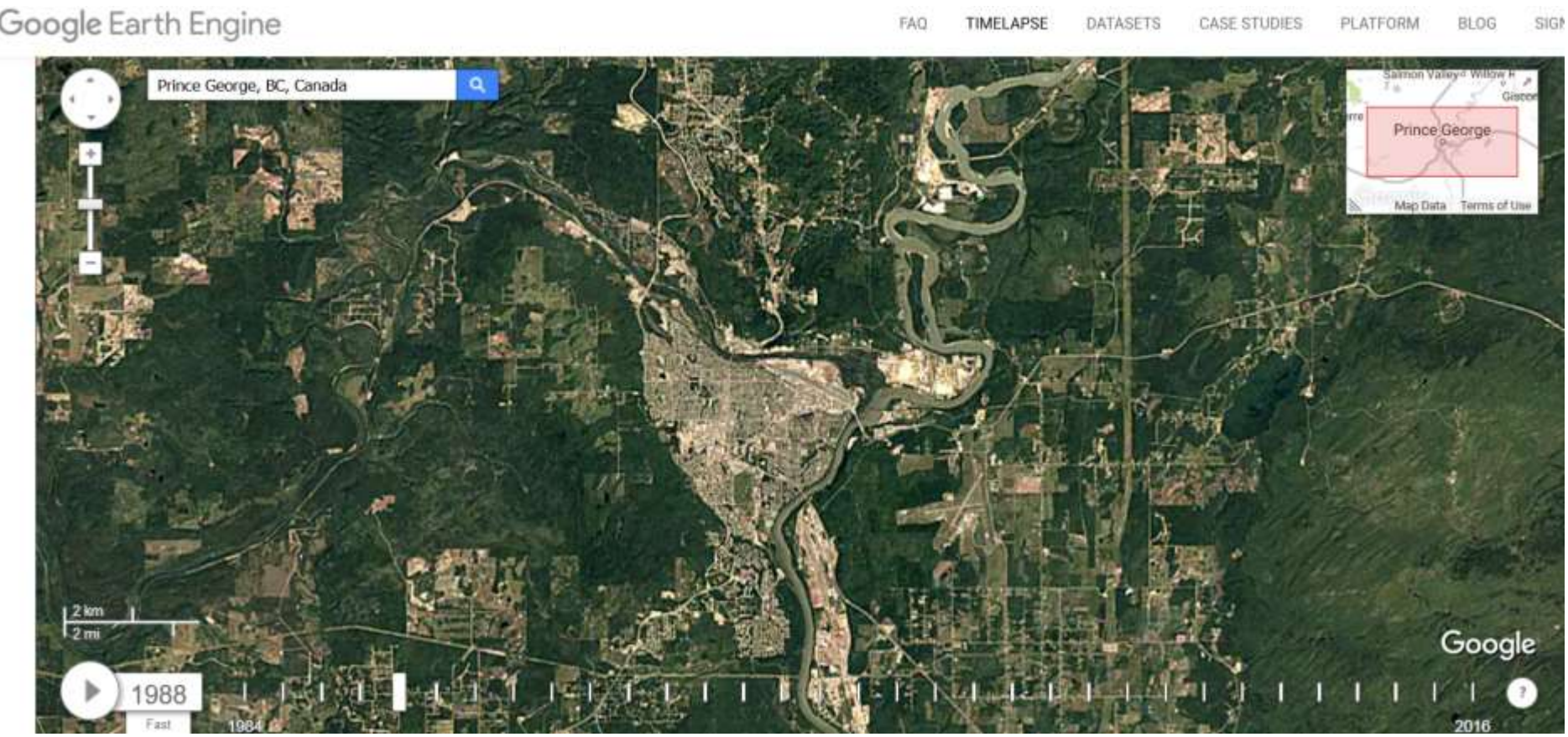
- This should be in an **area of interest** to you, both the location and topic / feature - e.g. deforestation, urban expansion, glacier retreat, fire, volcanic eruption etc..
- Hence it could show a **gradual** or **catastrophic** change – it might just be one event - just before and after
- Think about it once the midterm is done – start the lab next week with thoughts on where/what you will download … you can use ‘google earth time lapse’ to confirm ideas – places where you know or suspect major changes have occurred.

You can use the Google Earth Time Lapse site to review some locations/changes

Landsat images 1984 - 2019 (30m res.) – Google Earth Timelapse

Use this first website listed to view changes around the world, with some case studies linked
https://earthengine.google.com/timelapse/

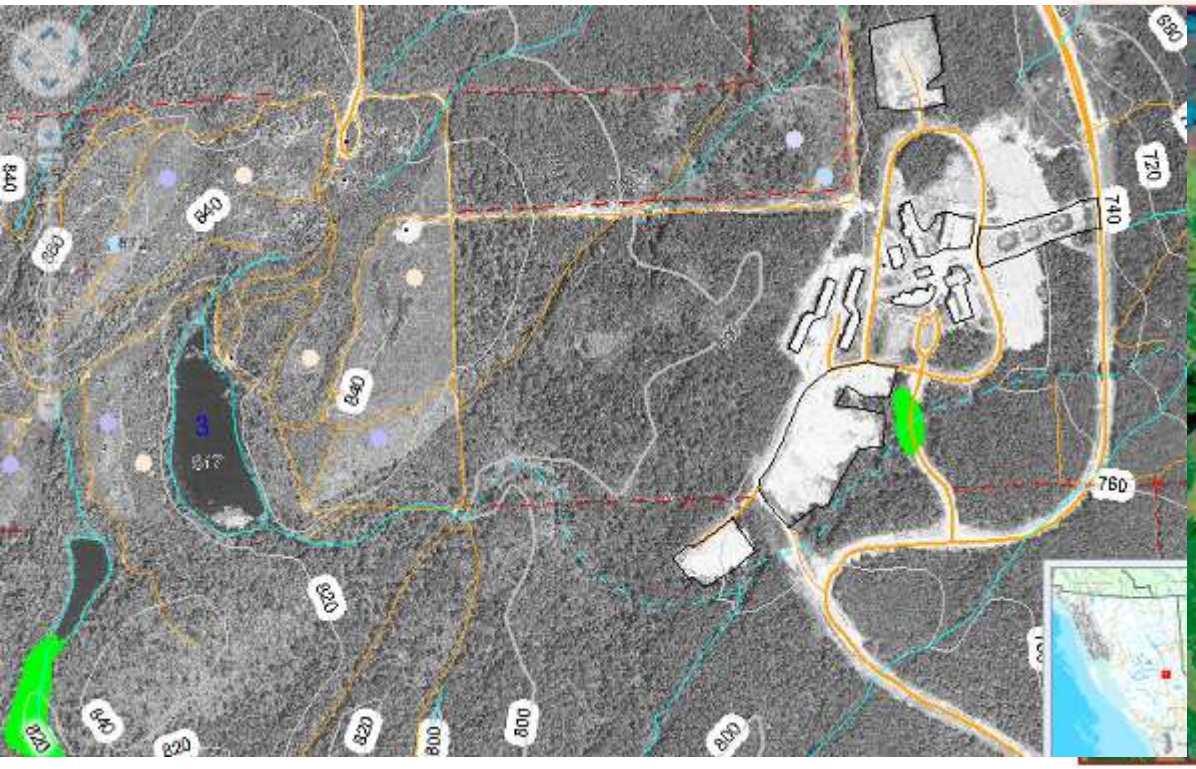
(2012 version) https://earthengine.google.org/timelapse/timelapseplayer_v2.html

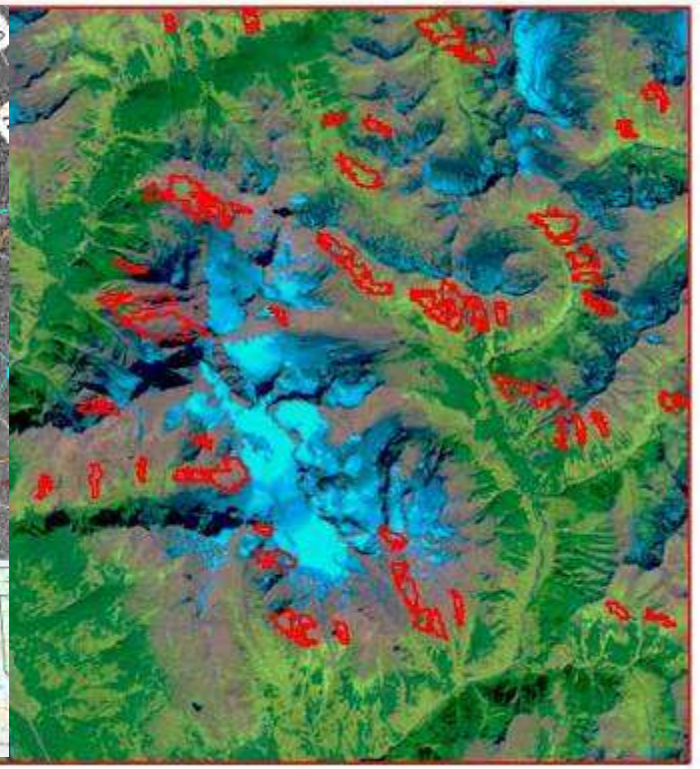


The google earth engine now shows 35 years of change around the world, though the images chosen are not always the best – they will be in your work !.. You can use the link above to review where they might be interesting changes (subtle in Prince George)

Review and Image interpretation

- The **analogue** data unit is the photograph from a camera;
- the **digital** unit is the scene, composed of pixels, created by using a scanner.
- Analogue remote sensing involves interpretation, location & feature updating;
- digital applications include classification & feature extraction – based on DN's





Manual interpreting/digitization from photos | digital extraction of caribou habitats by Digital Numbers

Midterm review of Landsat bands

The bands vary between sensors Landsat 4/5 TM, 7 ETM+ and 8 (OLI)
But have many similarities for continuity

Landsat-7 ETM+ Bands (μm)			Landsat-8 OLI and *TIRS* Bands (μm)		
			30 m Coastal/Aerosol	0.435 - 0.451	Band 1
Band 1	30 m Blue	0.441 - 0.514	30 m Blue	0.452 - 0.512	Band 2
Band 2	30 m Green	0.519 - 0.601	30 m Green	0.533 - 0.590	Band 3
Band 3	30 m Red	0.631 - 0.692	30 m Red	0.636 - 0.673	Band 4
Band 4	30 m NIR	0.772 - 0.898	30 m NIR	0.851 - 0.879	Band 5
Band 5	30 m SWIR-1	1.547 - 1.749	30 m SWIR-1	1.566 - 1.651	Band 6
Band 6	60 m TIR	10.31 - 12.36	*100 m TIR-1*	*10.60 – 11.19*	Band 10
			100 m TIR-2	*11.50 – 12.51*	Band 11
Band 7	30 m SWIR-2	2.064 - 2.345	30 m SWIR-2	2.107 - 2.294	Band 7
Band 8	15 m Pan	0.515 - 0.896	15 m Pan	0.503 - 0.676	Band 8
			30 m Cirrus	1.363 - 1.384	Band 9

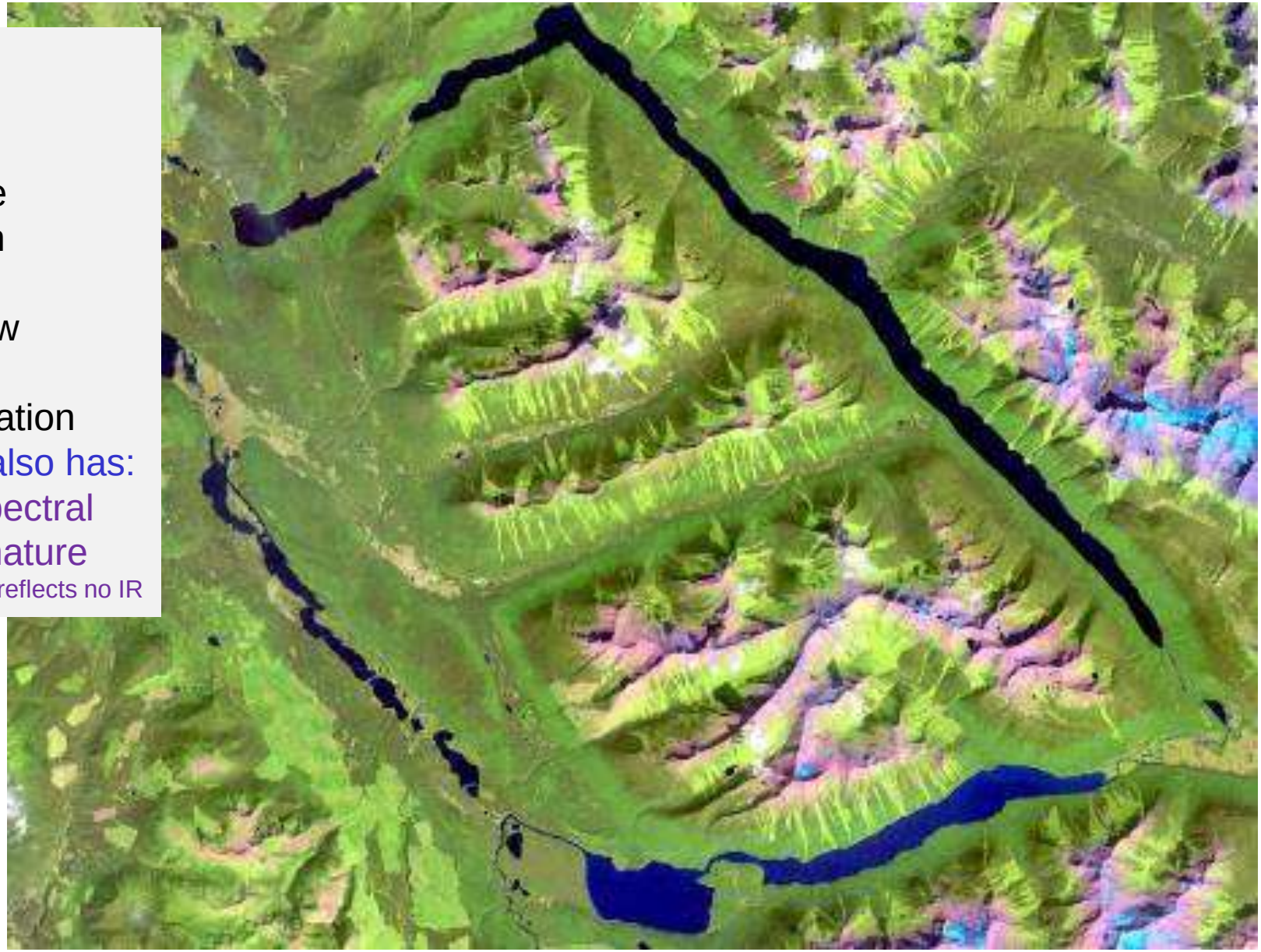
Landsat 7 has the Pan band added vs Landsat 5; Landsat 8 has Pan, plus Coastal / Cirrus bands

Satellite Image interpretation – manually uses the same factors as Air photos

-Colour
-Tone

-Texture
-Pattern
-Shape
-Shadow
-Size
-Association

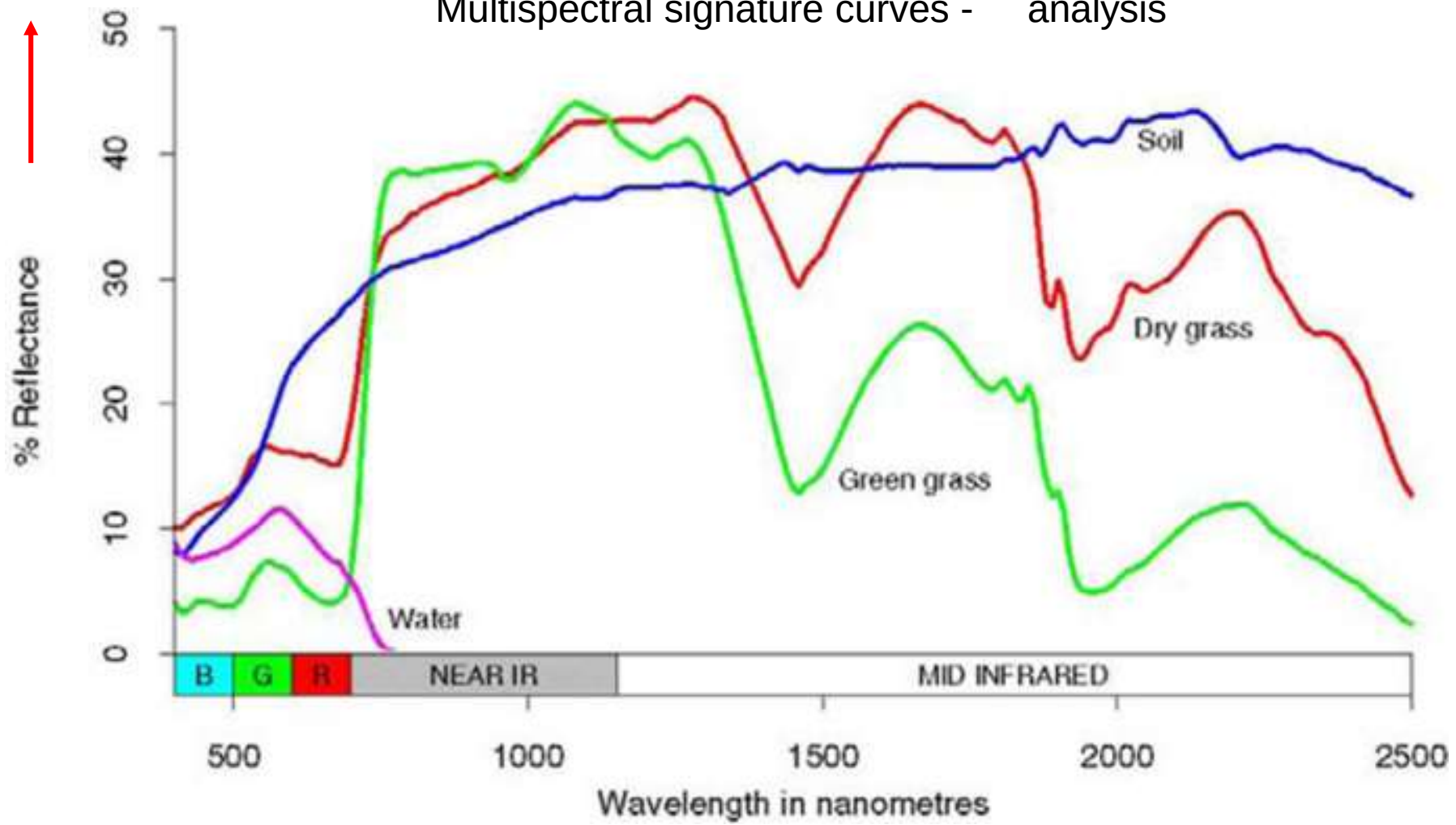
Digital also has:
-Multispectral signature
-e.g. water reflects no IR



Digital Number (DN) enable identification of feature types across the spectrum

DN

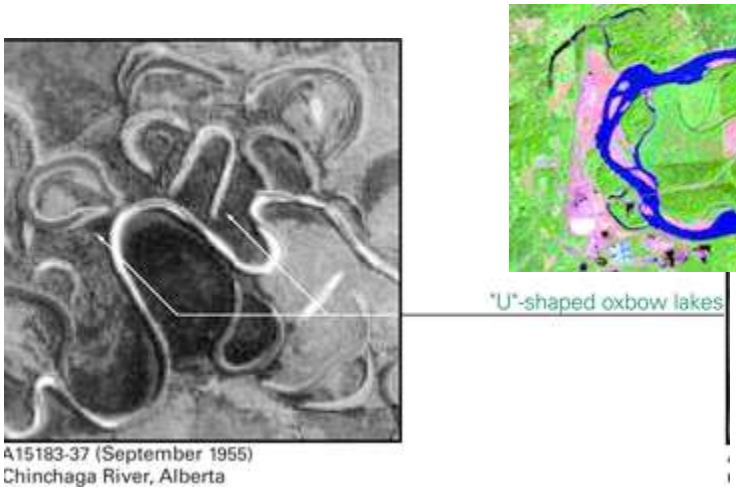
Multispectral signature curves - analysis



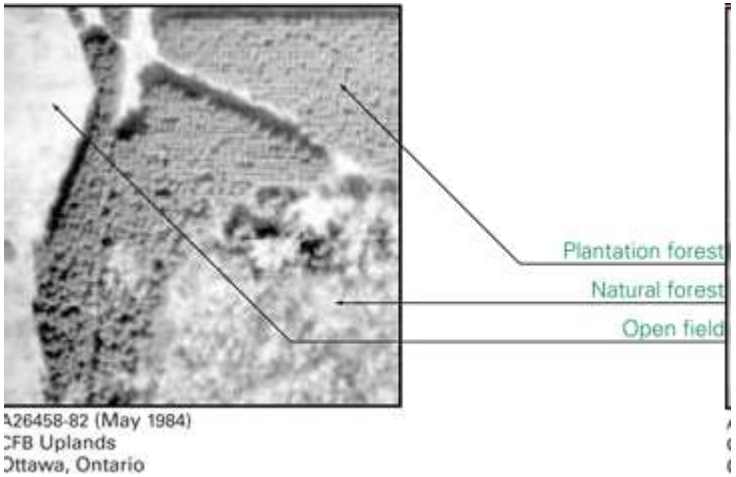
Visible brightness	vegetation vigour	dryness (lack of moisture)
TM band 1- 3	4	5 / 7
Colour guns B	G	R

Some examples of interpretation of photos and satellite images

Shape: the form of an object on an air photo helps to identify the object. Regular uniform shapes often indicate a human involvement;



Pattern: similar to shape, the spatial arrangement of objects (e.g. row crops vs. pasture) is also useful to identify an object and its usage;

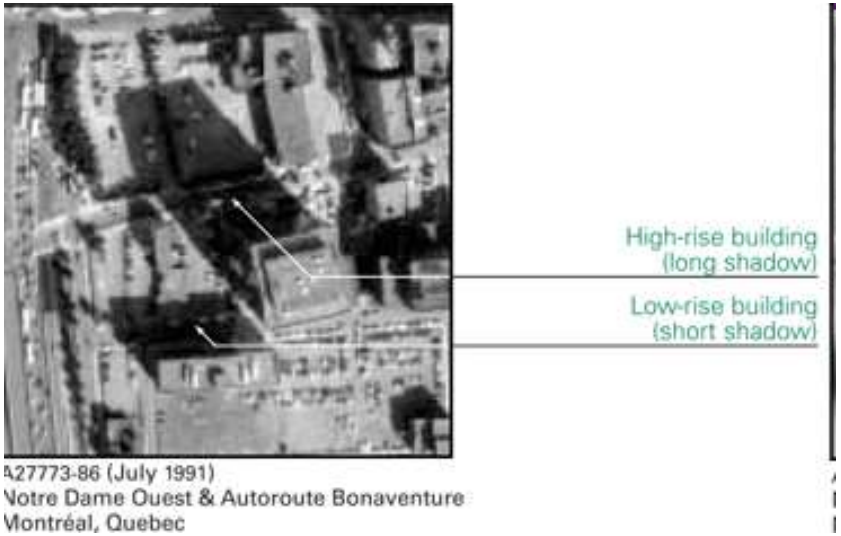


Texture: the physical characteristics of an object affects how they appear

e.g. calm water has a smooth texture; a forest canopy has a rough texture

PCI: ‘TEX’

Shadow: a shadow provides information about height, shape, and orientation



Shadows: usually from the SE (~10am)

Northern hemisphere example – Mt. Robson

Image interpretation

Did Aliens create Indian Head with an iPod ?

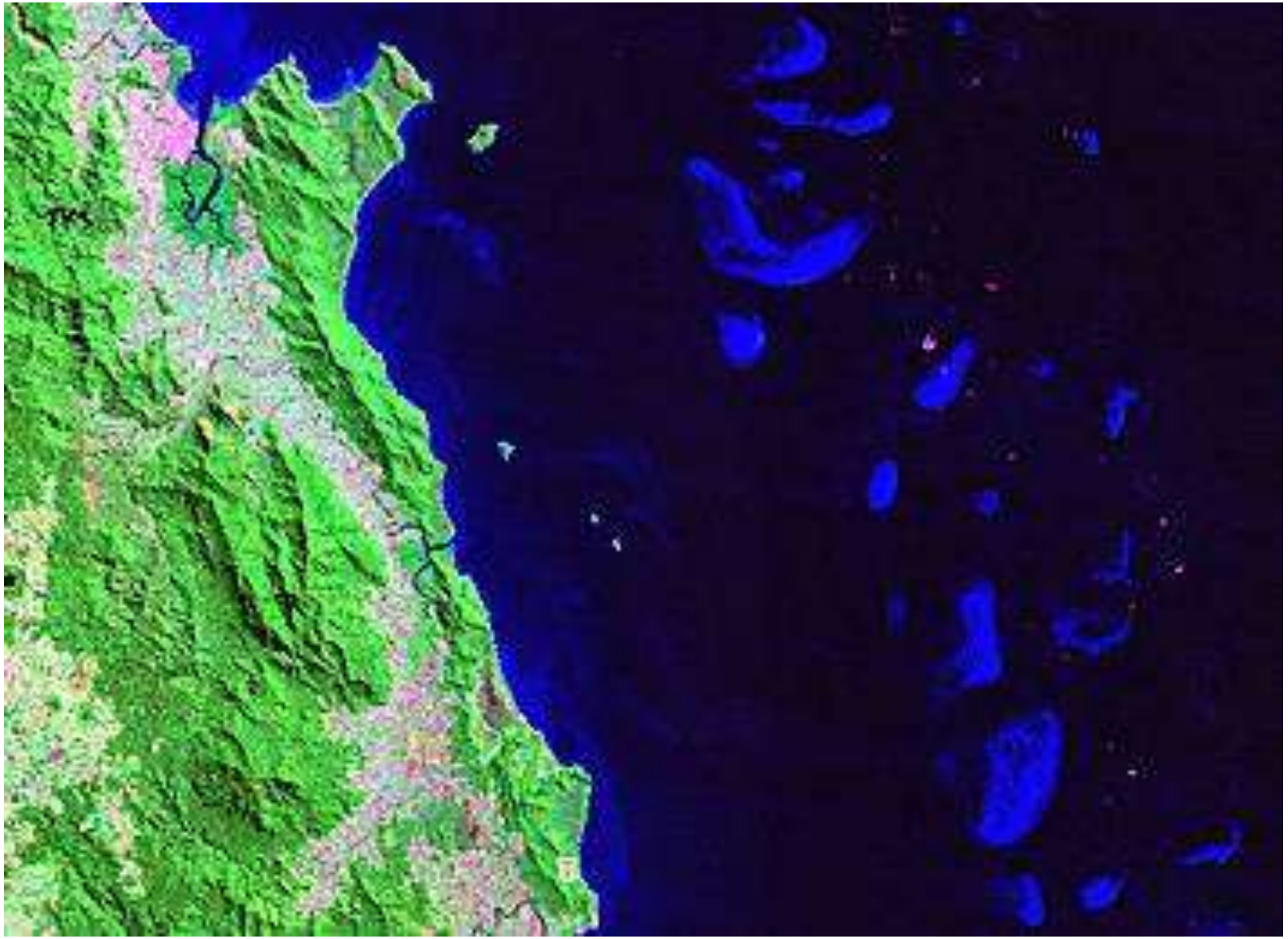
Badlands Guardian (CBC)

This feature can be found 300 KMs SE of Calgary.
50° 1' N 110° 7' W

Identified from Google Maps/Earth by morning light / sun angle

Deriba Caldera, Sudan (13°S): from the Space Station – sun in NE in southern hemisphere

Great Barrier Reef, Australia (20°S)



Tasmania – sunlight from NE and note cloud shadows SW of clouds (would be NW in northern hemisphere)