PRINCIPLES OF IMAGE INTERPRETATION

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Trained Specialist apart form his/her field of specialization need to possess the following aspects to become a professional analyst :

- Keen power of observation
- Imagination
- Great deal of Patience

Amount of Information derived from Imagery is Proportional to the :

Knowledge

Skill

Experience of the analyst.

Detection

The process of examining the data which show that some thing is present or absent.

Identification

The process where enough information is provided to clearly identify the object or feature perceived or detected.

Analysis

Process of perceiving the information beyond detection and identification of the features for further details.

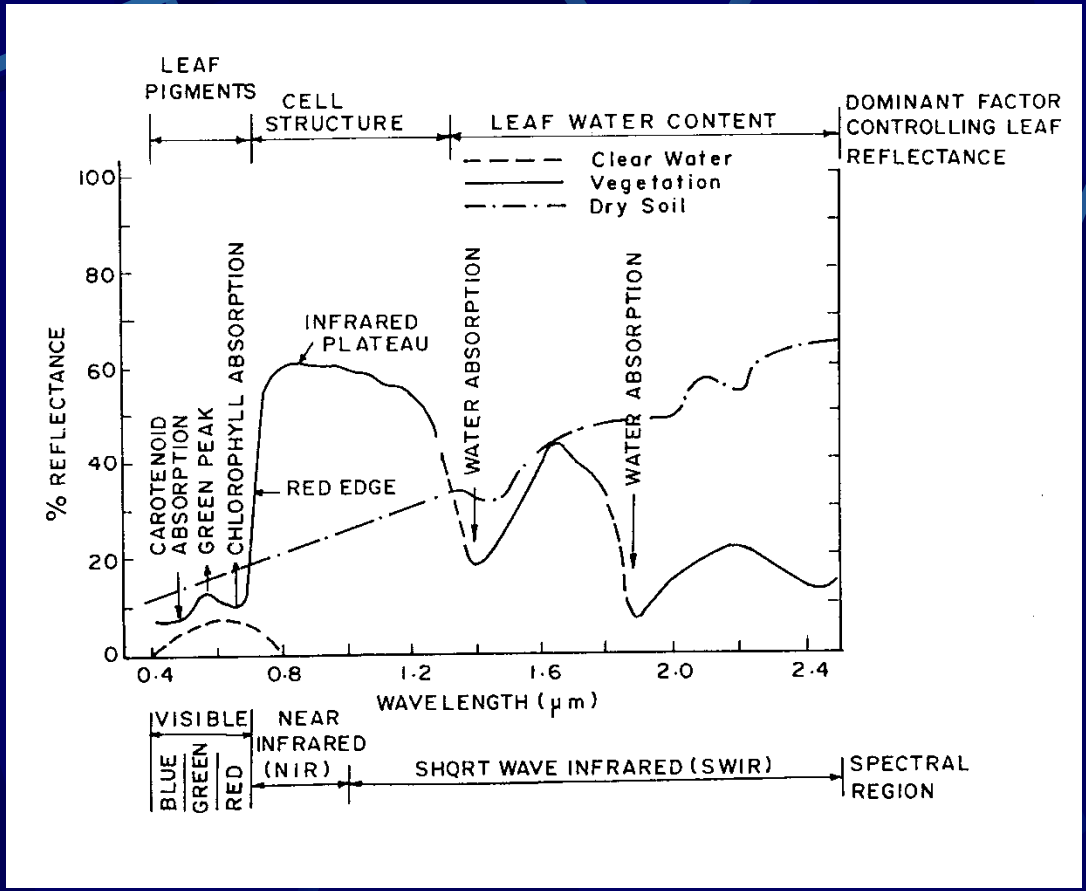
Normally, to proceed further from detection to identification 3 times the spatial resolution is required.

Similarly, 1 – 2 times of magnitude increase in spatial resolution is necessary to clearly analyse the identified image.

Resolution (in meters) required for interpretation tasks

Target	Dectection	General Identification	Precise Identification	Description	Analysis
Bridges	6	4.6	1.5	0.9	0.3
Communications Radar	3	0.9	0.3	0.15	0.04
Airfield facilities	6	4.6	3	0.3	0.15
Aircraft	4.6	1.5	0.9	0.15	0.03
Surface ships	7.6	4.6	0.6	0.3	0.08
Nuclear weapon components	2.4	1.5	0.3	0.03	0.01
Vehicles	1.5	0.6	0.3	0.05	0.03
Ports and Harbours	30.5	15	6	3	0.3
Railway yards and shops	30.5	15	6	1.5	0.6
Roads	9	6	1.8	0.6	0.15

SPECTRAL SIGNATURES



Reflectance curves of common earth surface features in the visible , near-infrared and mid-infrared region (after Goetz et al, 1983)

Visual interpretation of remote sensing data?

To extract meaningful information from the imagery.

Interpretation and analysis of remote sensing imagery involves the identification and/or measurement of various targets in an image in order to extract useful information about them. Targets in images may be any feature or object which can be observed in an image.

Analog or Digital?

Both manual and digital techniques for interpretation of remote sensing data have their respective advantages and disadvantages. Generally, manual interpretation requires little, if any, specialized equipment, while digital analysis requires specialized, and often expensive, equipment.

Manual interpretation is often limited to analyzing only a single channel of data or a single image at a time due to the difficulty in performing visual interpretation with multiple images.

Manual interpretation is a subjective process, meaning that the results will vary with different interpreters. Digital analysis is based on the manipulation of digital numbers in a computer and is thus more objective, generally resulting in more consistent results. However, determining the validity and accuracy of the results from digital processing can be difficult.

However, rarely is digital processing and analysis carried out as a complete replacement for manual interpretation. Often, it is done to supplement and assist the human analyst.

The computer environment is more amenable to handling complex images of several or many channels or from several dates. In this sense, digital analysis is useful for simultaneous analysis of many spectral bands and can process large data sets much faster than a human interpreter.

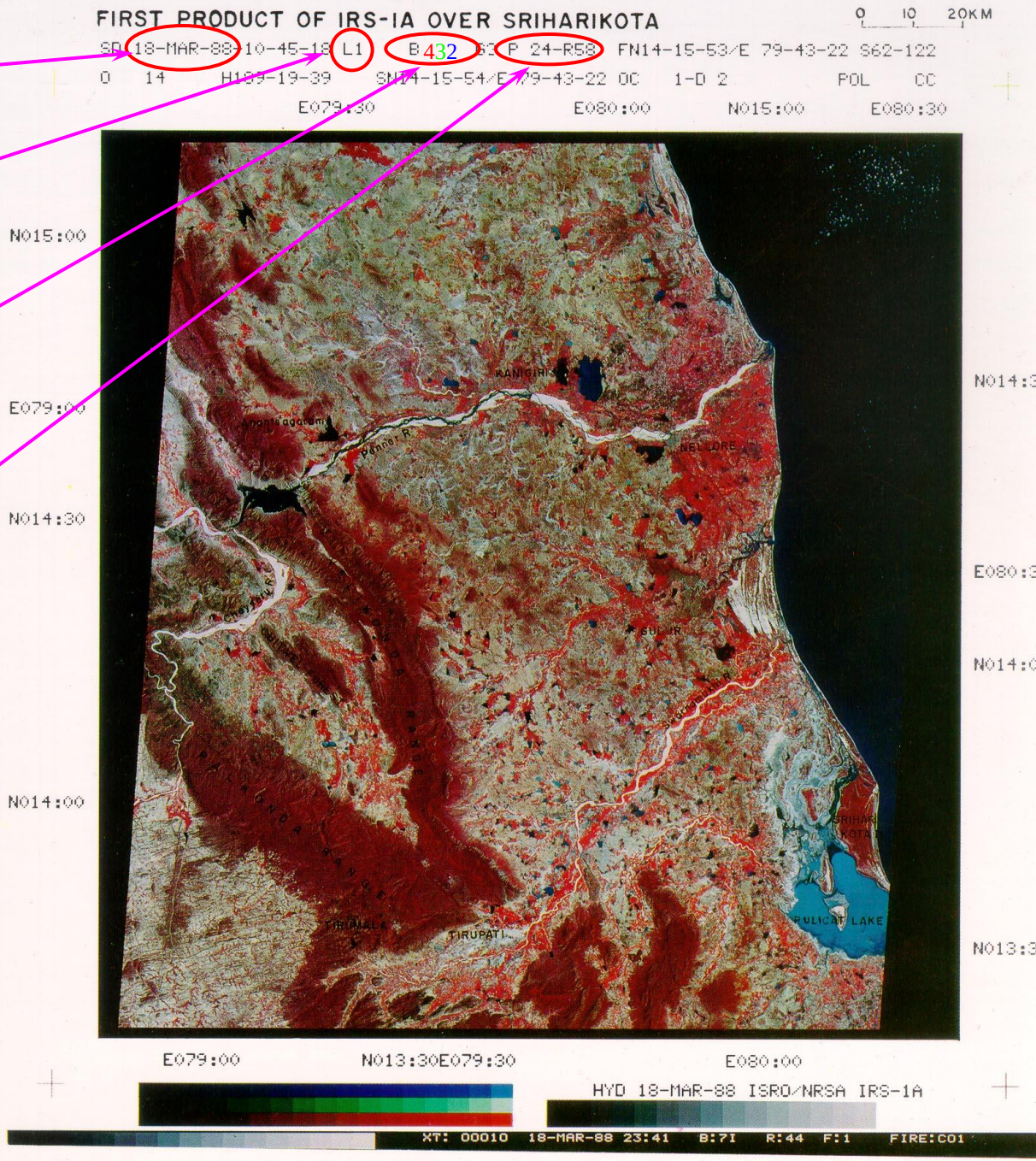
It is important to reiterate that visual and digital analyses of remote sensing imagery are not mutually exclusive.

Date of acquisition

Sensor

Band combination

Path and Row

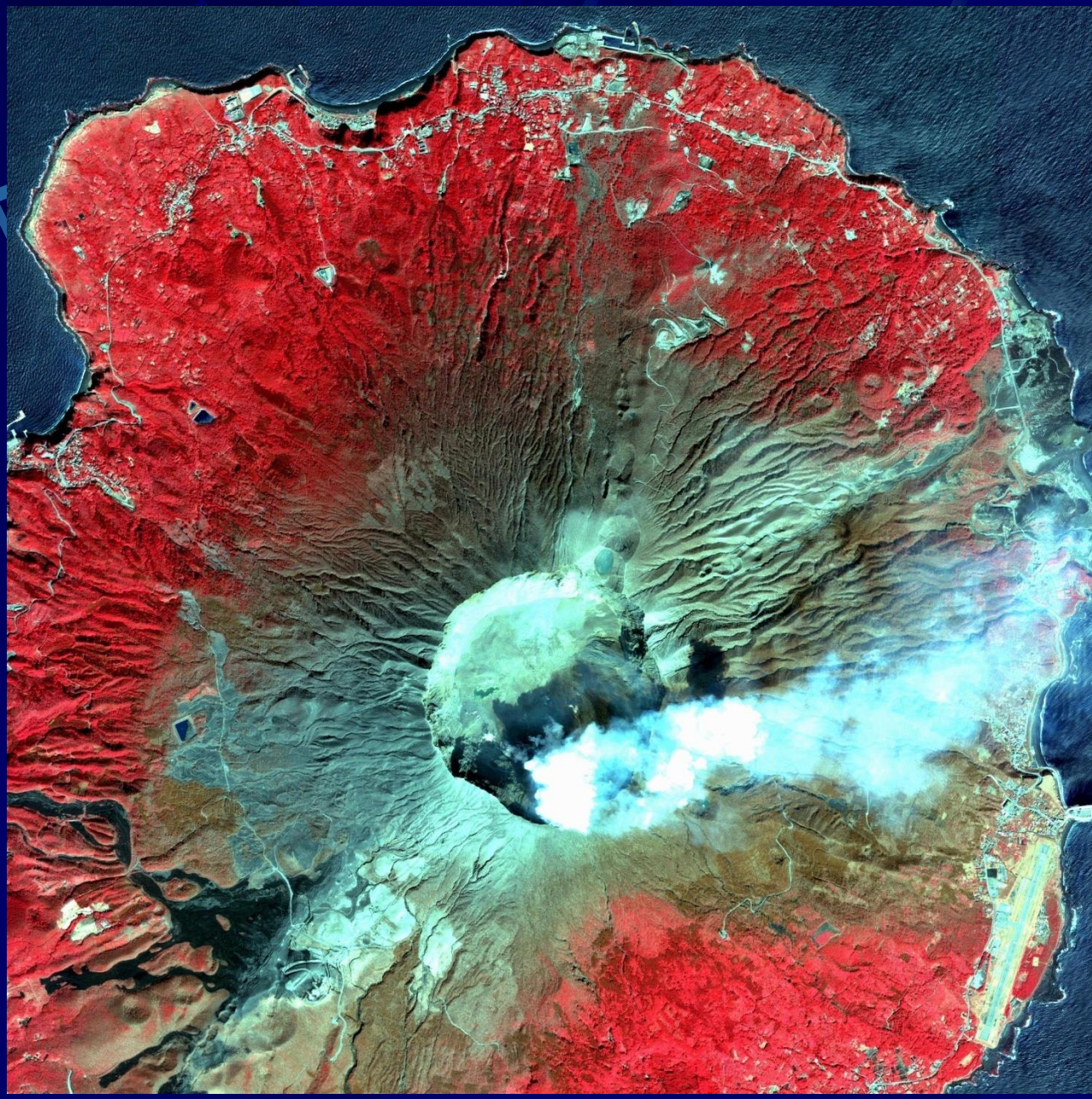


Elements required for visual interpretation of remote sensing data are

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

TONE

Tone refers to colour (color composite) or grey shade (single band) of objects in an image. Generally, tone is the fundamental element for distinguishing between different features. Variations in tone also allows the elements of shape, texture, and pattern of objects to be distinguished.



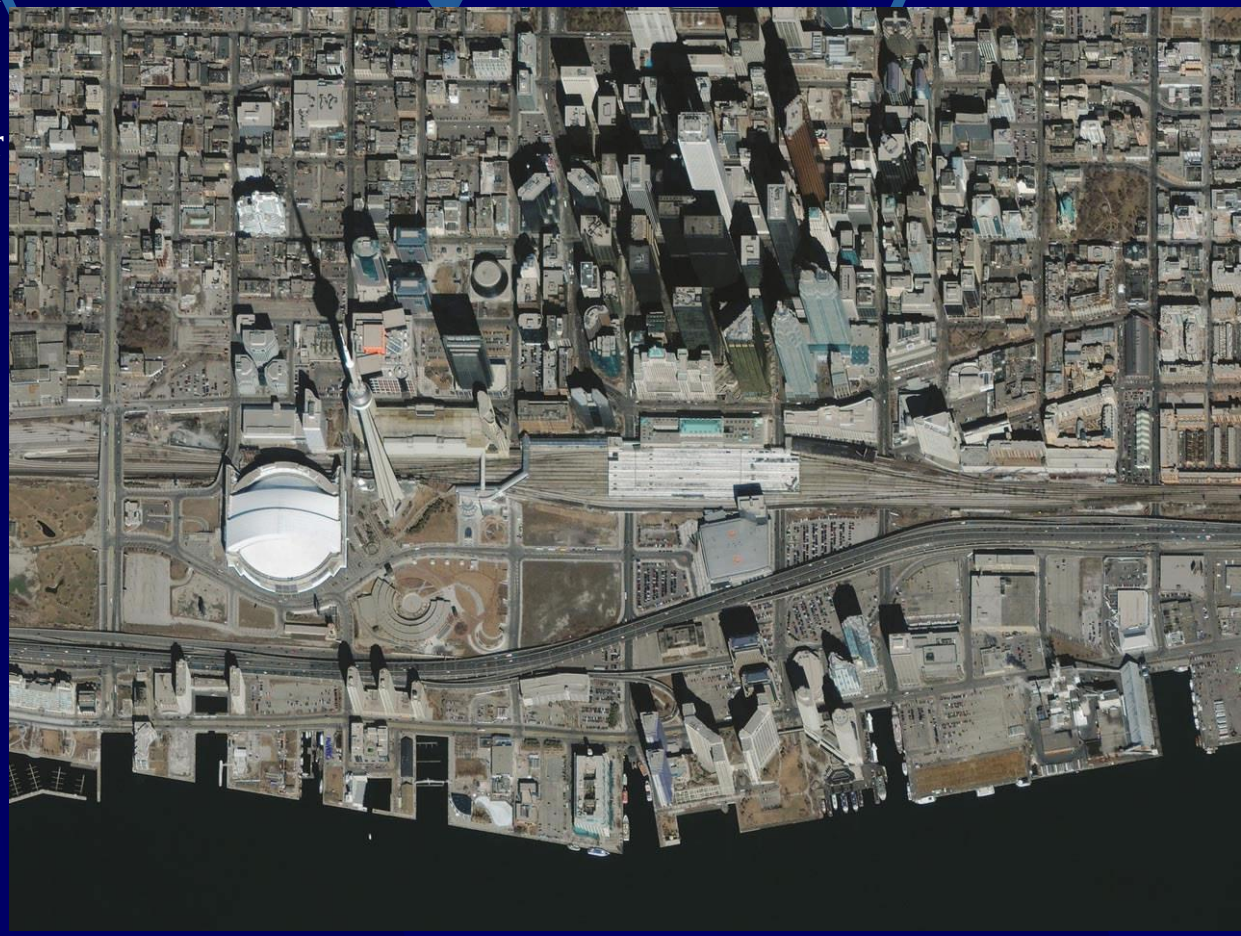
SHAPE

Shape refers to the general form, structure, or outline of individual objects. Shape can be a very distinctive clue for interpretation. Straight edge shapes typically represent urban or agricultural (field) targets, while natural features, such as forest edges, are generally more irregular in shape, except where man has created a road or clear cuts. Farm or crop land irrigated by rotating sprinkler systems would appear as circular shapes.

61-centimeter pan-sharpened image of the Great Pyramid in Giza, Egypt, collected by QuickBird (February 2, 2002)

SIZE

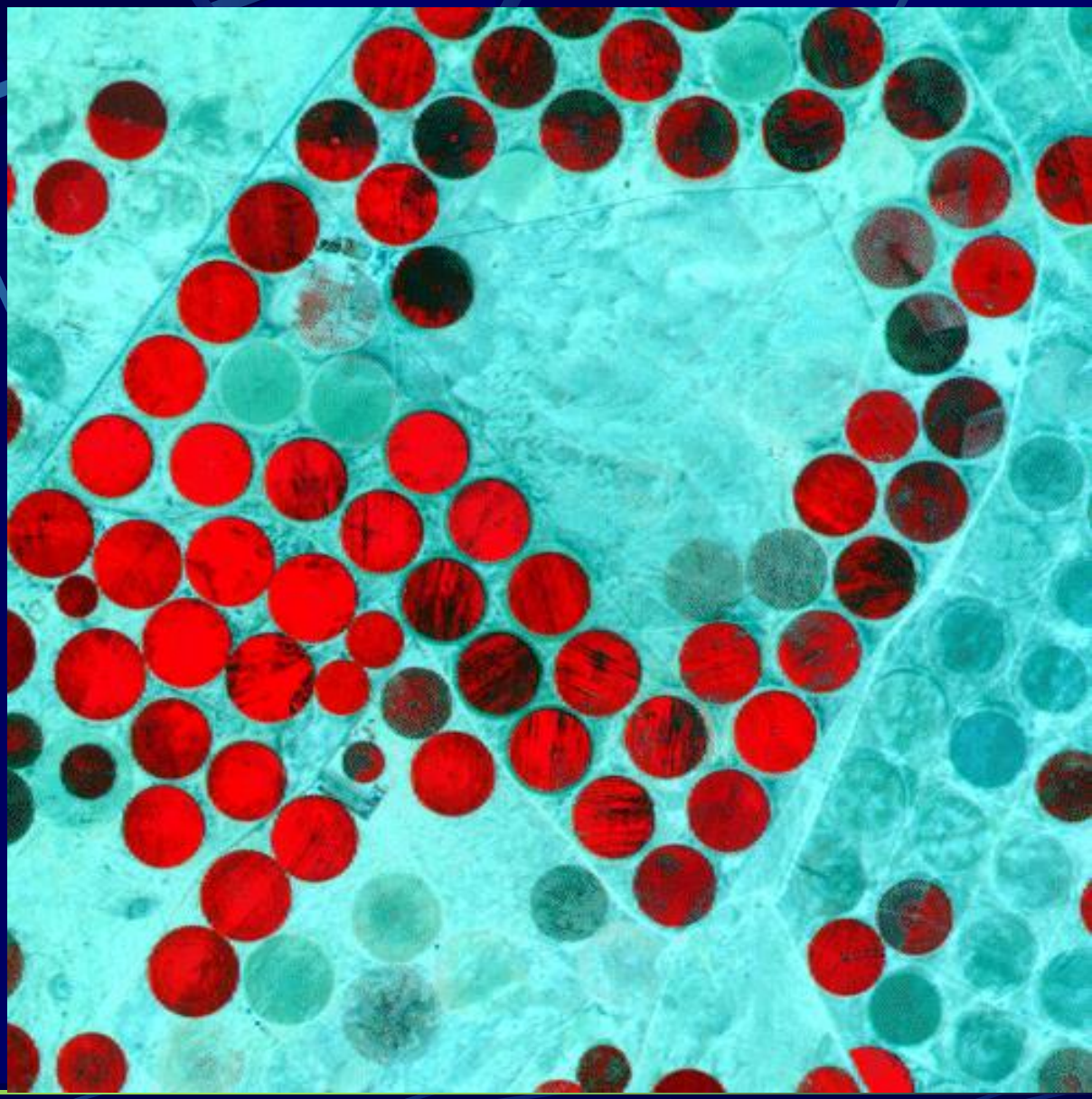
Size of object in an image is a function of scale. It is important to assess the size of a target relative to other objects in a scene, as well as the absolute size, to aid in the interpretation of that target. A quick approximation of target size can direct interpretation to an appropriate result more quickly. For example, if an interpreter had to distinguish zones of land use, and had identified an area with a number of buildings in it, large buildings such as factories or warehouses would suggest commercial property, whereas small buildings would indicate residential use.



PATTERN

Pattern refers to the spatial arrangement of visibly discernible objects. Typically an orderly repetition of similar tones and textures will produce a distinctive and ultimately recognizable pattern. Eg., Orchards with evenly spaced trees, urban streets with regularly spaced houses and drainage pattern.

Saudi Arabia by IRS 1C LISS III

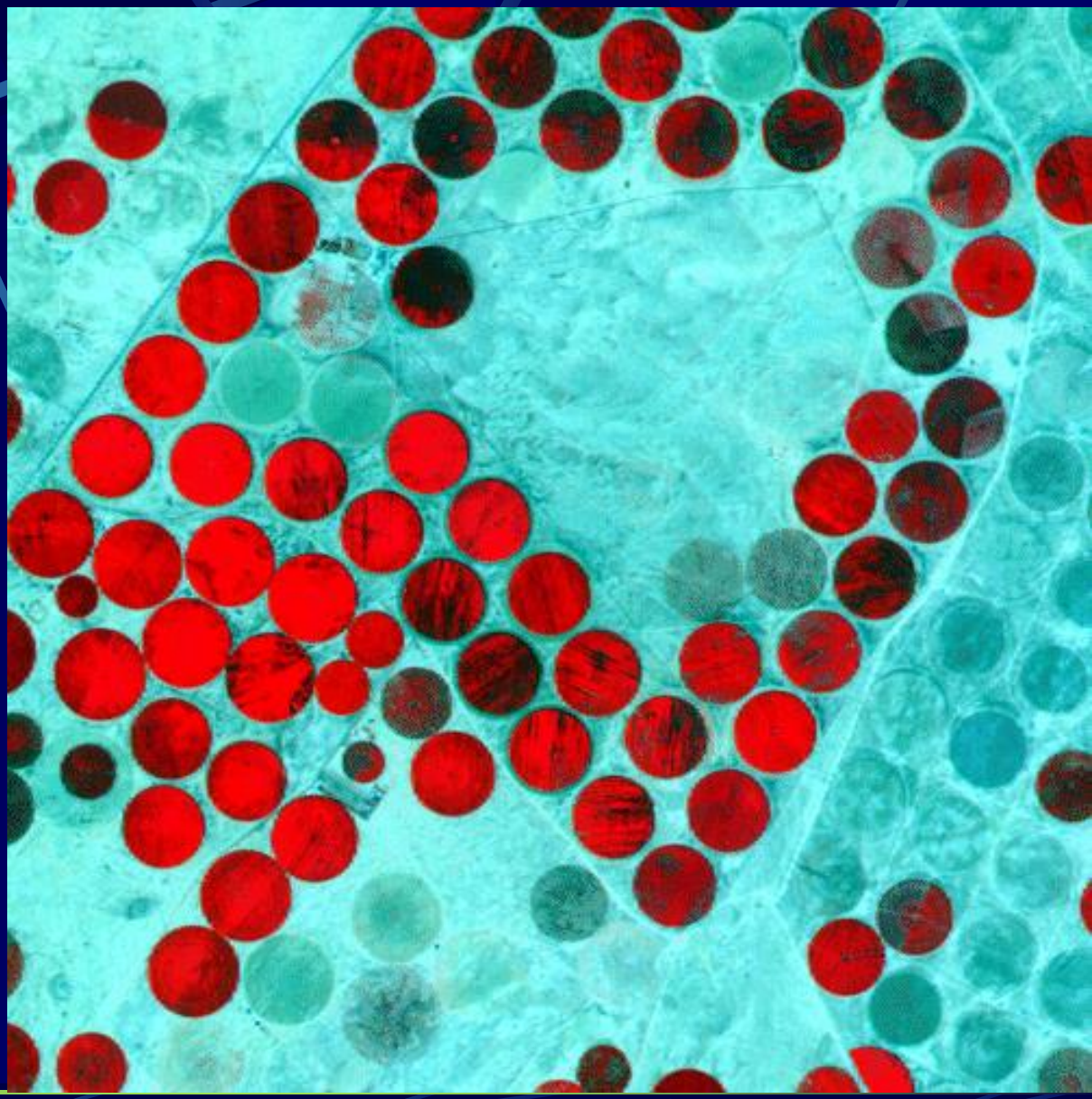


The circular features indicate sprinkler irrigation systems. Dark color indicates fallow land.

1-meter resolution color image of the Gold Coast of Australia by IKONOS
(May 8, 2000)

TEXTURE

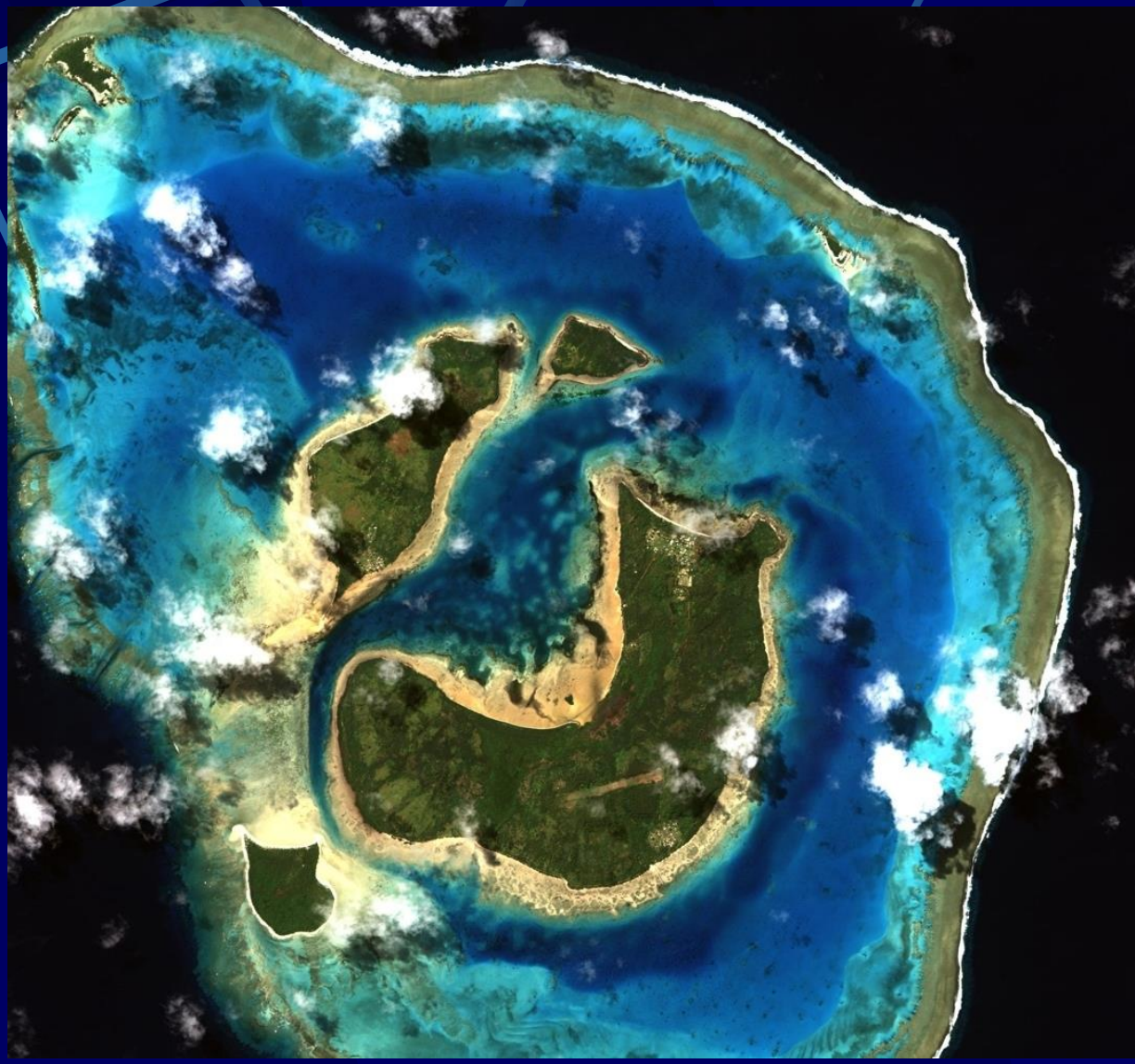
Texture refers to the arrangement and frequency of tonal variation in particular areas of an image. Rough textures would consist of a mottled tone where the grey levels change abruptly in a small area, whereas smooth textures would have very little tonal variation. Smooth textures are most often the result of uniform, even surfaces, such as fields, asphalt, or grasslands. Eg., Forest canopy (rough texture). Texture is one of the most important elements for distinguishing features in radar imagery.



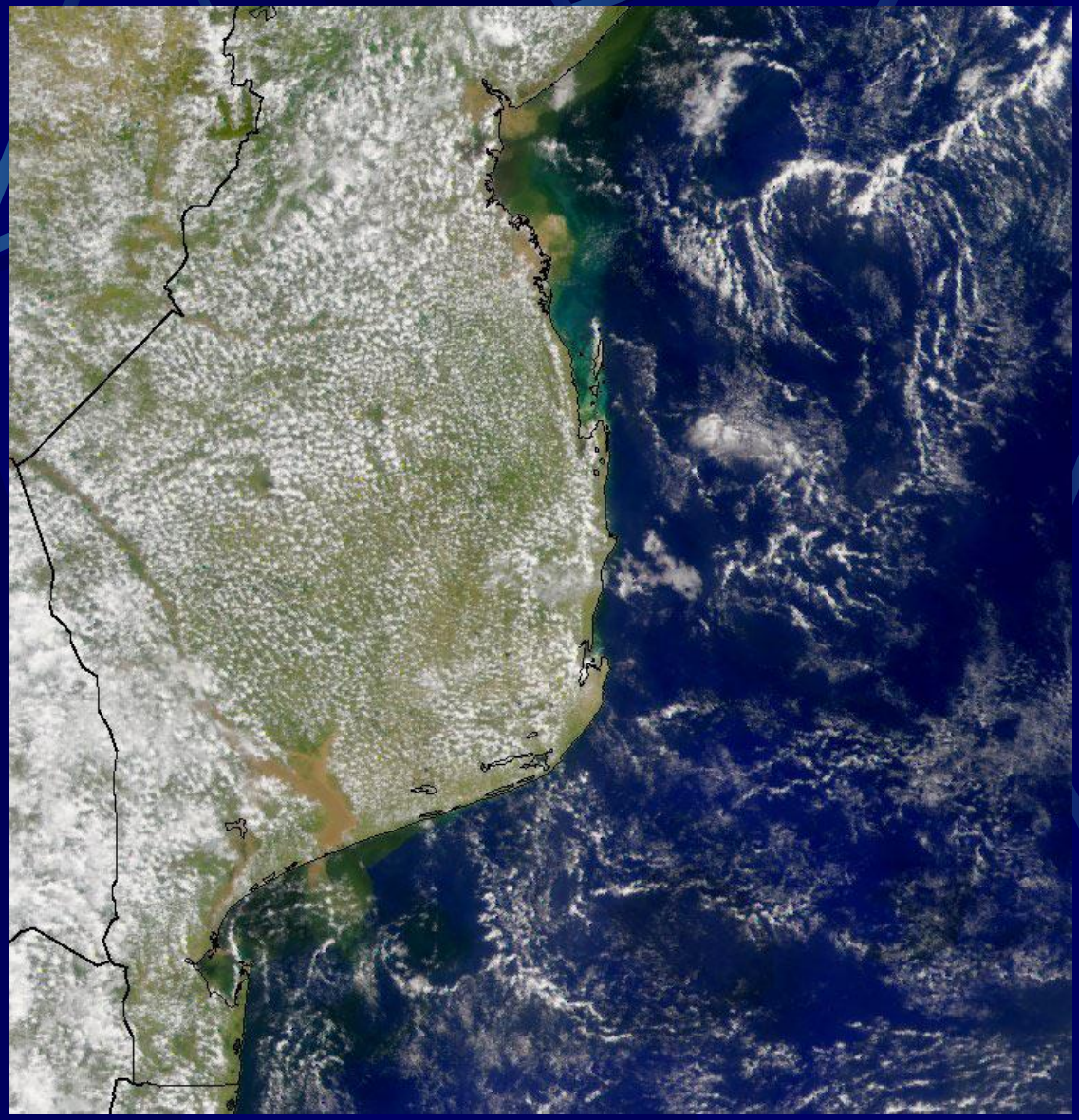
SHADOW

Ono-i-Lau, Fiji

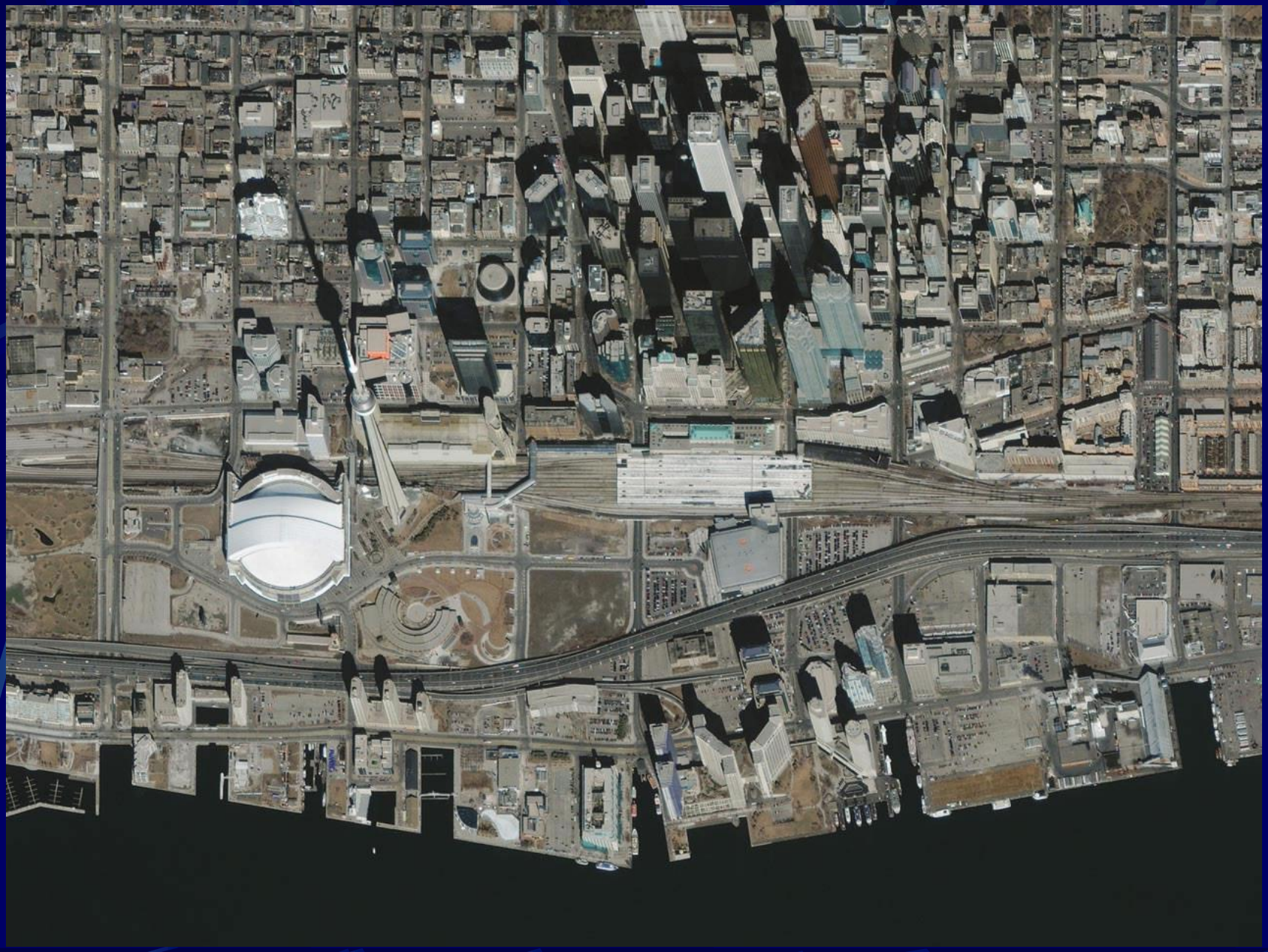
Shadow is also helpful in interpreting as it may provide an idea of the profile and relative height of a feature. However, shadows can also reduce or eliminate interpretation in their area of influence, since targets within shadows are much less (or not at all) discernible from their surroundings. Shadow is also useful for enhancing or identifying topography and landforms, particularly in radar imagery.



One of the 322 islands of the Fiji archipelago, was collected by ORBIMAGE's OrbView-3 satellite on Thursday, May 13, 2004. This tiny tropical island is acutally an atoll composed of six main islands - eroded remnants of an old volcanic crater. Ono-i-lau is approximately 7.9 sq. km in size, with a shoreline that is 99 percent coral reef.



Mozambique Flooding (2Mar2000)

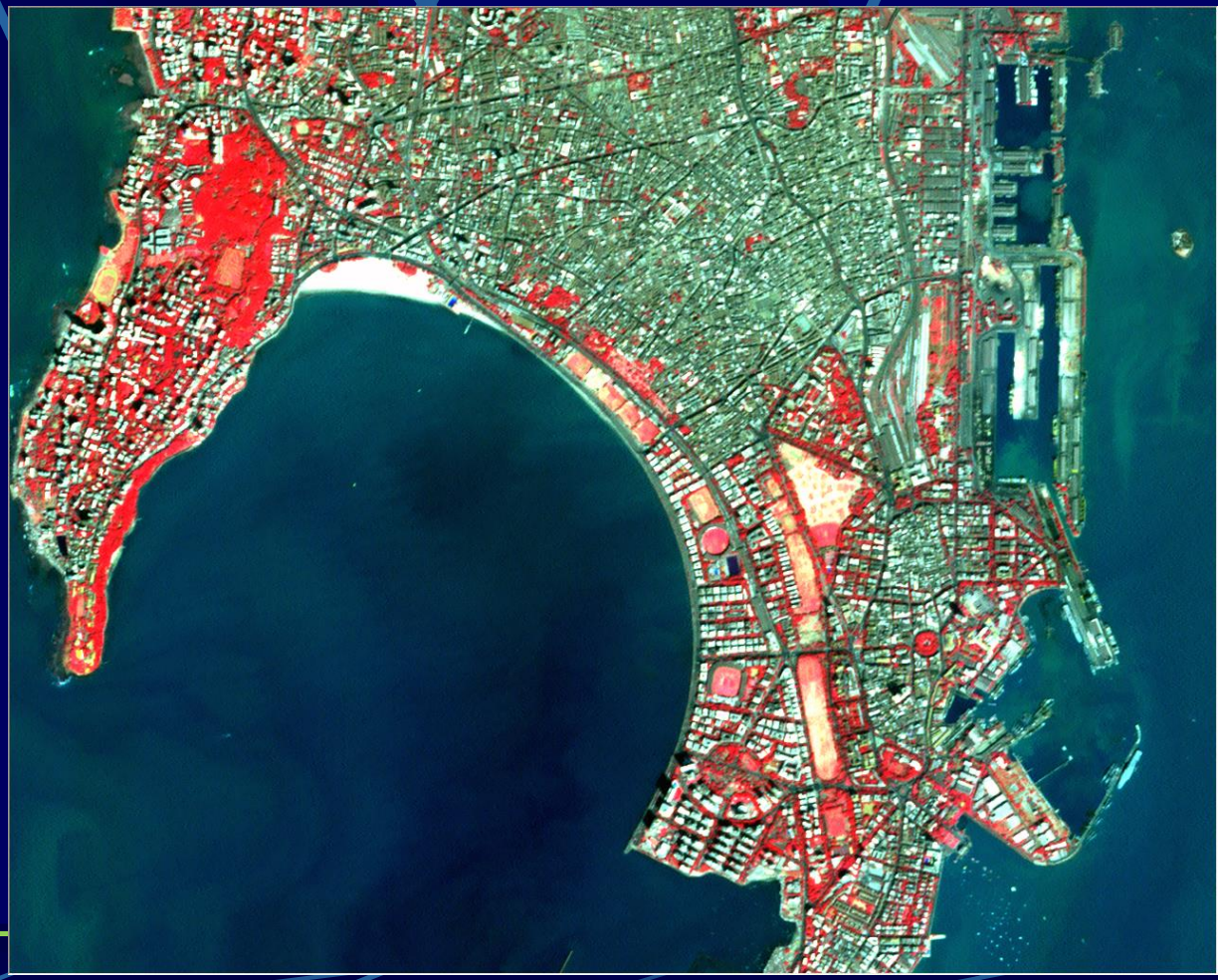


1-meter resolution image shows downtown Toronto, Ontario, Canada (March 18, 2000)

Shimla by IRS 1D LISS III

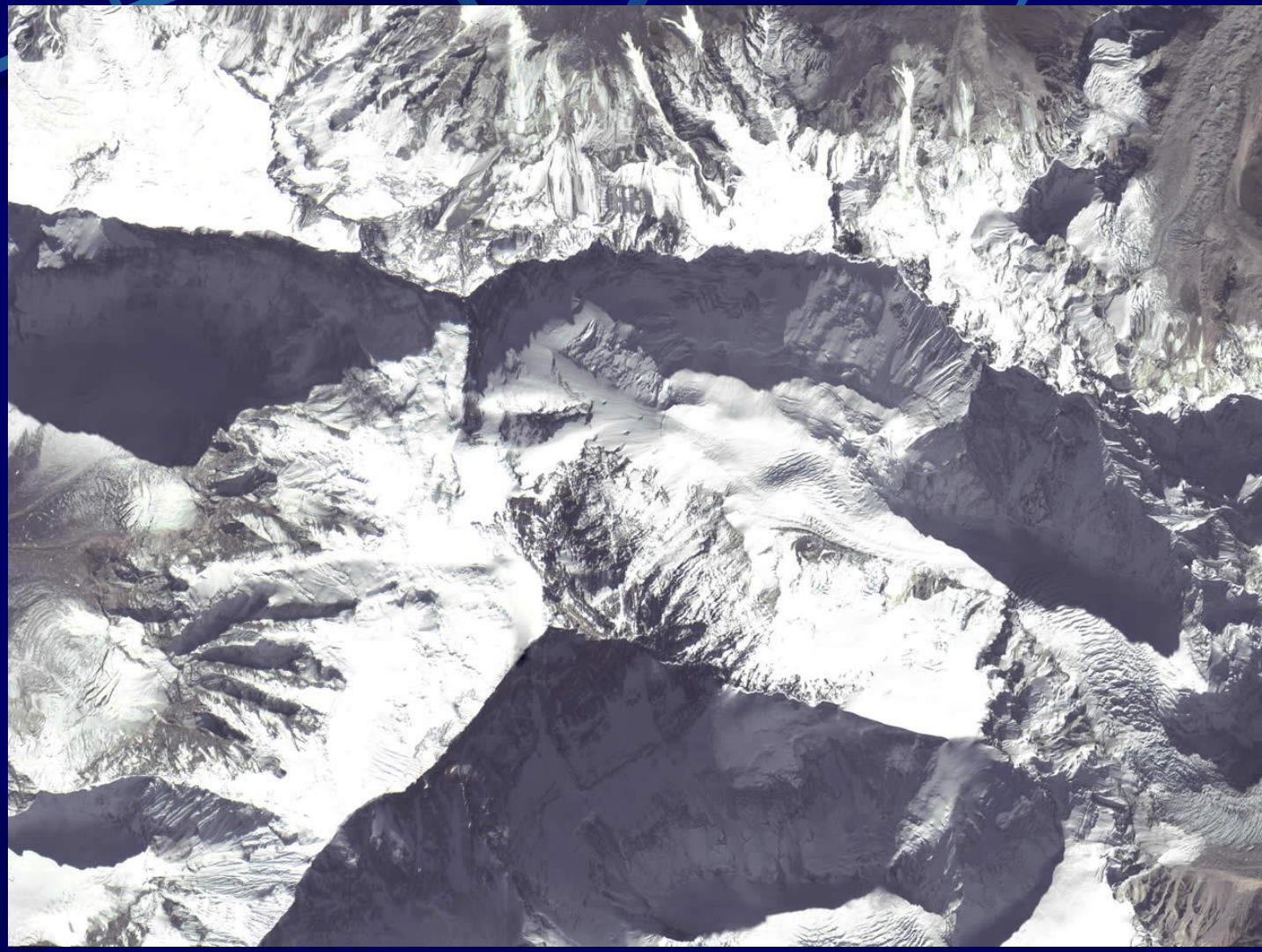
ASSOCIATION

Association takes into account the relationship between other recognizable objects or features in proximity to the target of interest. The identification of features that one would expect to associate with other features may provide information to facilitate identification. Eg., commercial properties may be associated with proximity to major transportation routes, whereas residential areas would be associated with schools, playgrounds, and sports fields.



Site/location also helps in identifying objects as some features exits in certain geographic locations. Eg., Snow cover can be expected on Himalayan region but not in southern India.

SITE / LOCATION

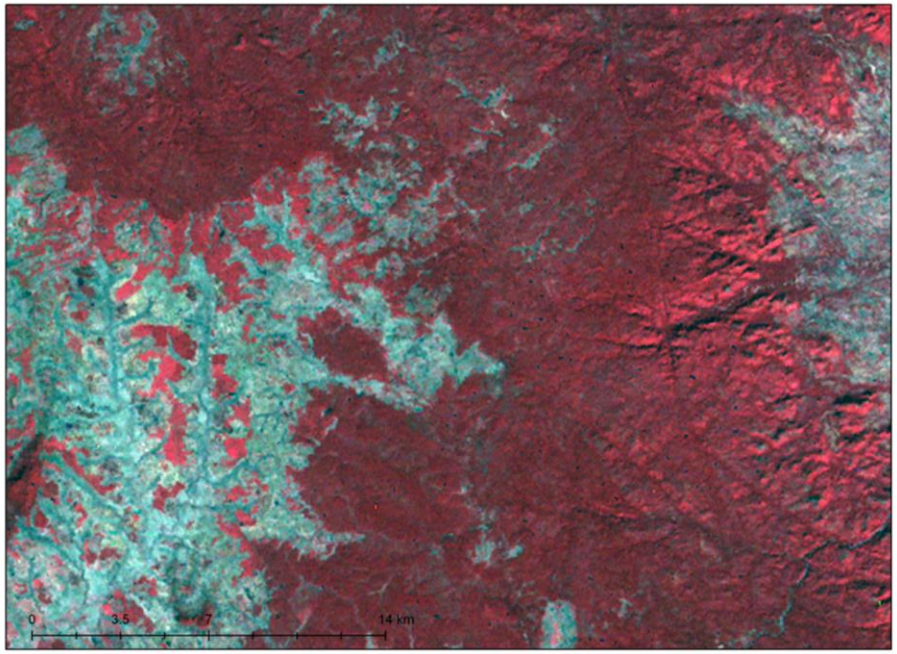


Mt. Everest at 4 m by Ikonos

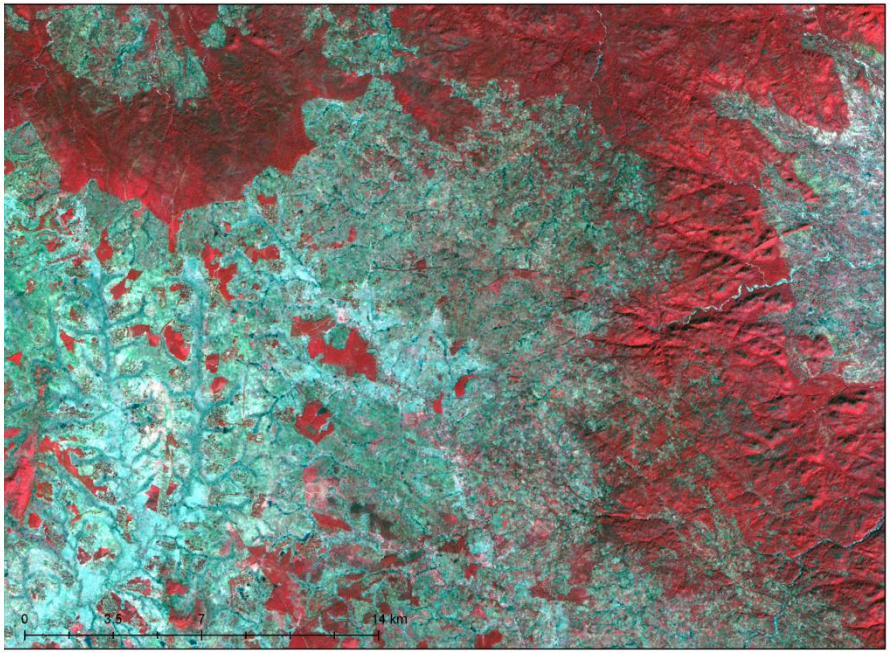
Change Detection (Forest Cover Change)

False Colour Composite Images of part of Nawarangpur district, Odisha

1975

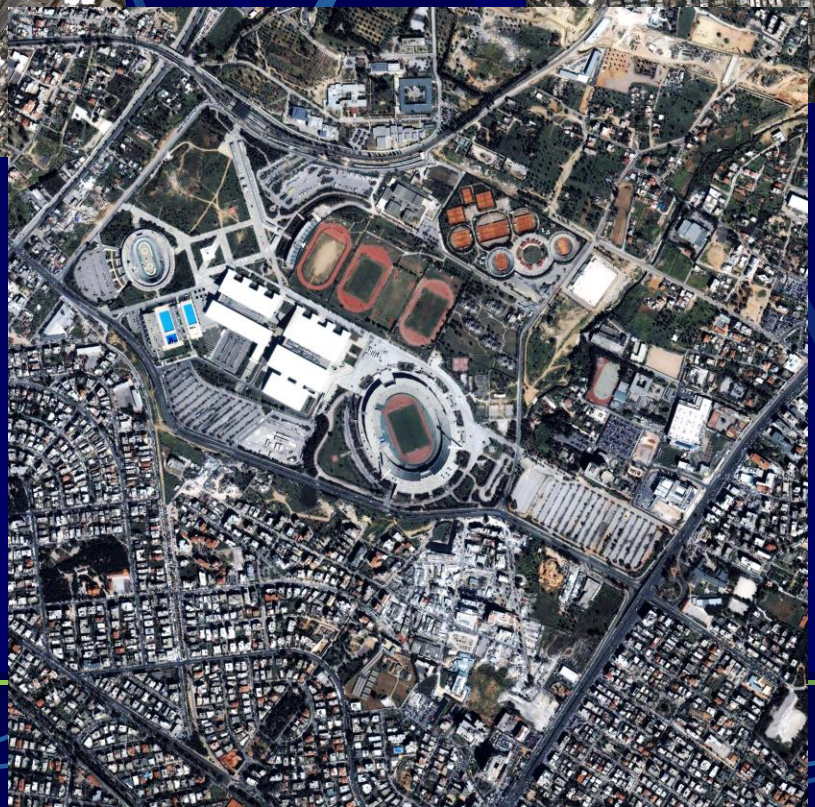


2014



14 Jun 2003

24 July 2004



15 March 2001

Athens Olympic Sports Complex
by IKONOS satellite

Suitability of TM single bands to different themes

Themes	B1 (0.45-0.52)	B2 (0.52-0.60)	B3 (0.63-0.69)	B4 (0.76-0.90)	B5 (1.55-1.75)	B7 (2.08-2.35)
Water bodies	P	P	M	G	G	G
Water characteristics	G	G	P	N	N	N
Drainage patterns	P	P	M	G	G	M
Soil boundaries	P	M	G	M	G	M
Forest areas	M	M	M	G	G	M
Agricultural areas	P	M	M	G	G	M / G
Urban / Residential areas	M / G	G	G	P	P	P / M
Quaries	P	P	P	G	M	M

Good, Medium, Poor, Not Usable

(Wavelength in micro meters)

Various TM FCCs and their use

Category	432	321	532	543	453	345
Urban features	1-2	6	5	2	1	1-2
Water sediment pattern	2	1	3	5-6	5-6	4
Drainage	1	6	2	3	2	4
Field boundaries	2	6	4	3	3	5
Water Vegetation boundaries	2	6	5	3	1	4
Soil patterns	1	5	6	2-3	2	2-3
Forest Vegetation type	2	6	5	1	1	4
Small ponds	4	6	5	3	3	2

1 = Most easily interpreted 6 = Least easily interpreted

Thank you