

REMOTE SENSING

Maps & Geospatial Concepts | Fall 2015



Remote Sensing

What is it?

- Generally
 - ▣ 'Sensing' through the lens of a camera
 - ▣ 'Remotely' from some distance
- Geospatial Technologies
 - ▣ Information about the light energy being reflected off of a target

Aerial Photography

- Taking pictures of the ground from above the Earth
 - Balloons
 - Kites
 - Aircraft
 - Satellites
- Why?
 - Base source for creating & updating geospatial data
 - Military, Surveillance, studying Landscapes, Planning



Figure 9.1
Introduction to Geospatial Technologies
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Figure 9.2
Introduction to Geospatial Technologies
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Aerial Photography

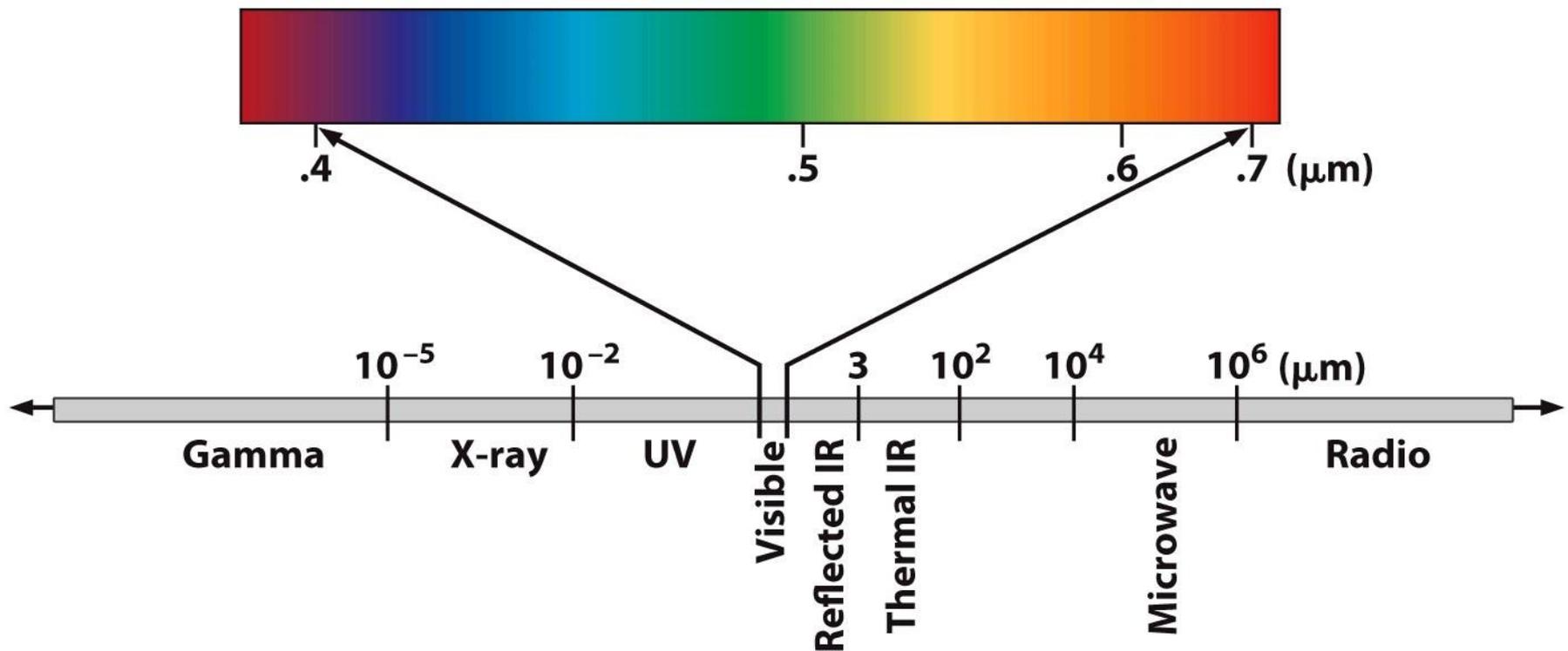
- 1908: First time a aerial photograph was captured aboard an aircraft in France
- End of WWI: aerial photographs from aircraft was common for mapmaking and military planning
- Continues to be important for military through to the present day



Types of Aerial Photographs

Light Energy

- **Electromagnetic Spectrum.** Properties of light energy in relation to wavelength



Aerial Photographs

- **Panchromatic.** capturing only one visible portion of light in its entirety making it grayscale
- **Color.** capturing **three** main bands of visible light – red, green, blue – and the colors are composited together as a true color composite

Color Infrared Photo

- Captured using special film sensitive to infrared light, which is invisible to human eye
- Color Representation
 - ▣ Near infrared (NIR) displayed in Red
 - ▣ Red reflection displayed in Green
 - ▣ Green reflection displayed in Blue
- Applications
 - ▣ Vegetation health

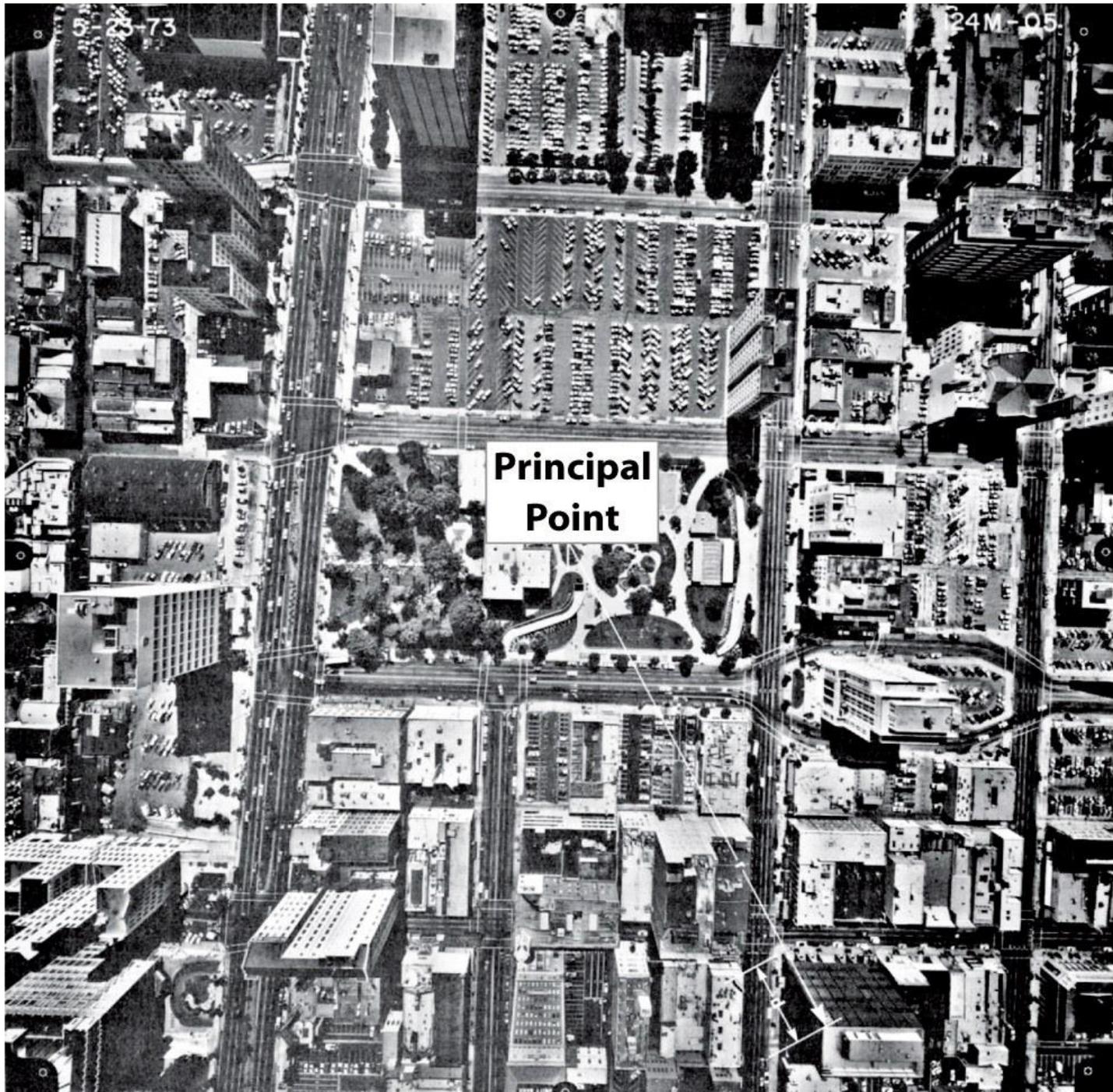


Aerial Photographs

- Cannot be used as a map b/c it does not have the same scale at every spot on the image
 - ▣ As planes fly over the area, some features will be further away than others

Aerial Photographs

- **Principal Point.** the center of the photo
- **Relief Displacement.** when tall objects, such as buildings or mountains, tend to 'lean' away from the center point towards the edges of the photo



**Principal
Point**

Aerial Photography

- **Orthophotos.** aerial photographs *with* a uniform scale
- **Orthorectification.** the process that removes the effects of terrain and relief displacement to enforce the same scale

Digital Orthophoto Quads (DOQ)

- Covers 3.75 minutes of latitude & longitude
- Orthorectified and Georeferenced



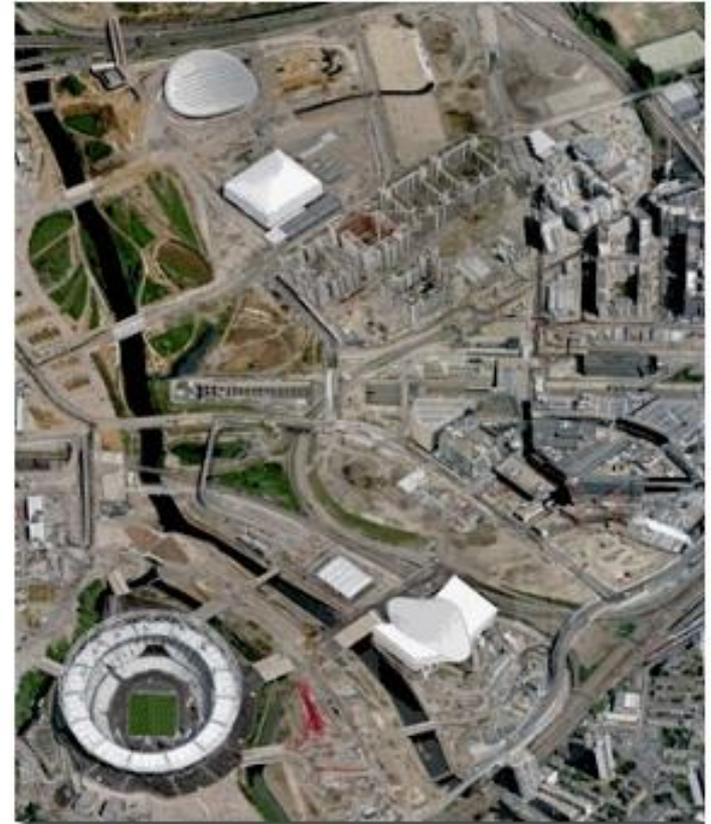
Oblique Photo

- Camera is tilted so it is positioned at an angle

BEFORE



AFTER





Interpretation

Aerial Photograph Interpretation

- Learning what things look like 'from above'
- Search out for clues in the image to understand what is in the image

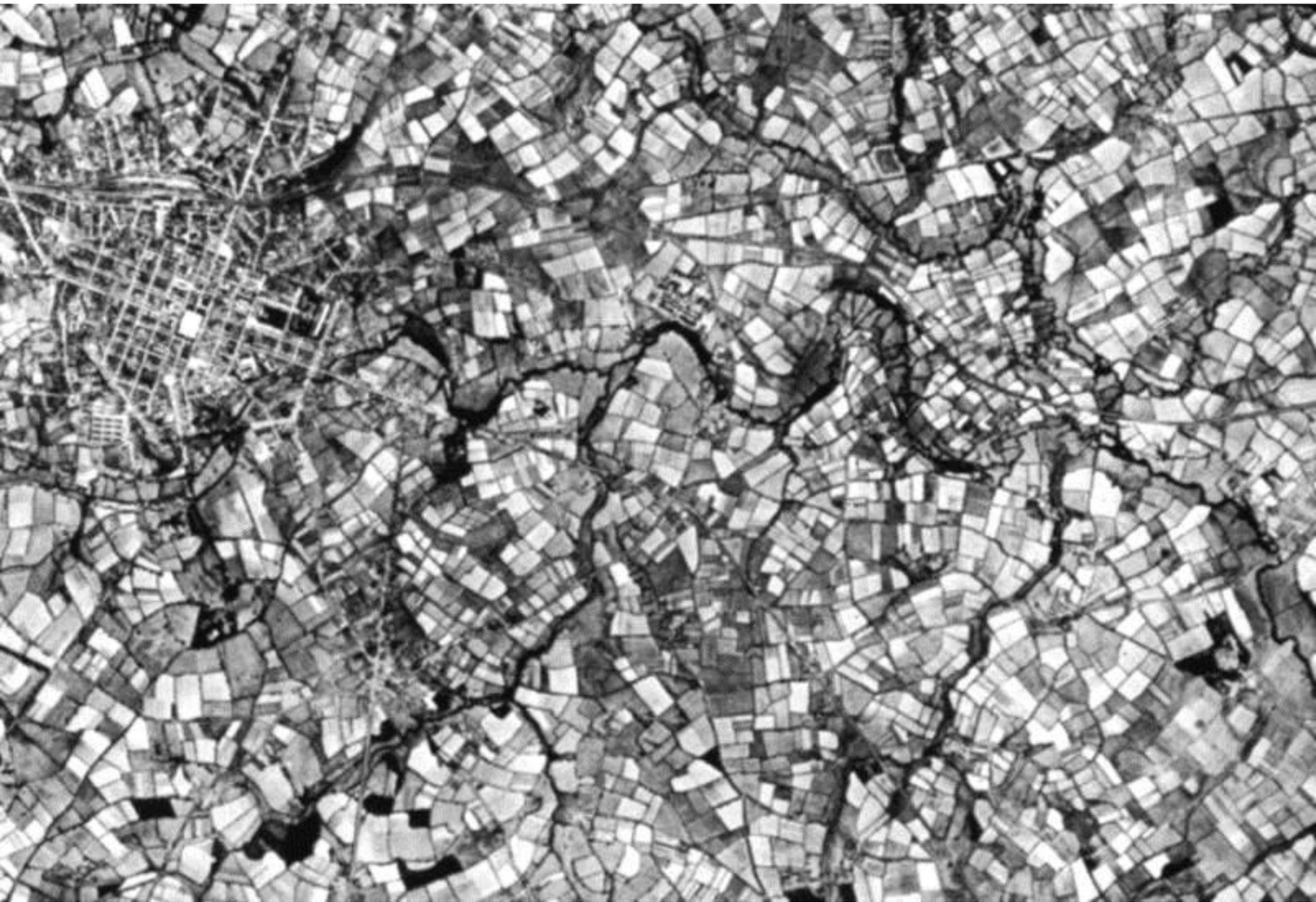
Visual Image Interpretation

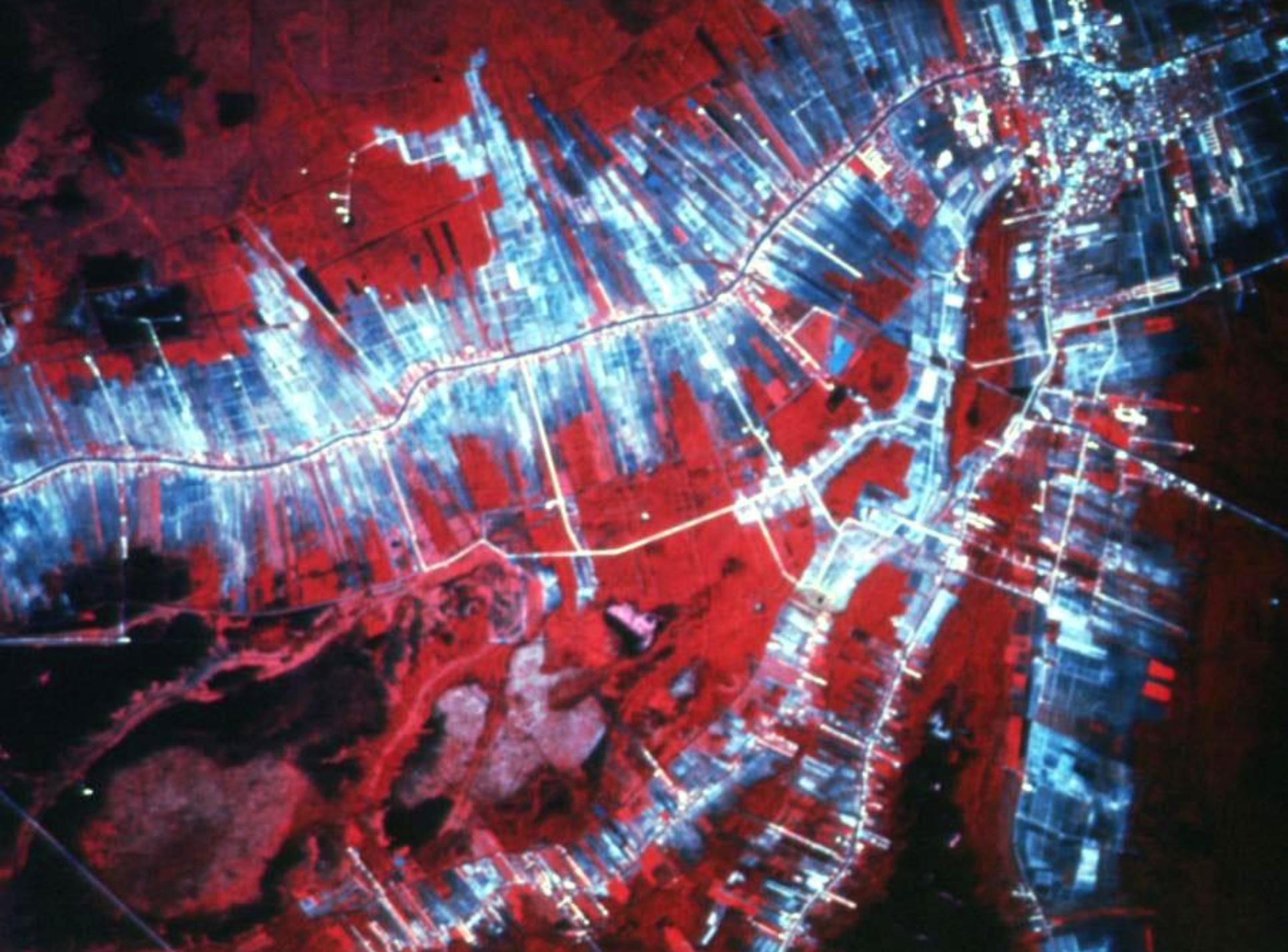
- The activity of identifying features in an remotely sensed image based on several elements
 - Pattern
 - Site & Association
 - Size
 - Shadow
 - Shape
 - Texture
 - Tone

Visual Elements



- **Pattern.** the arrangement of objects in an image



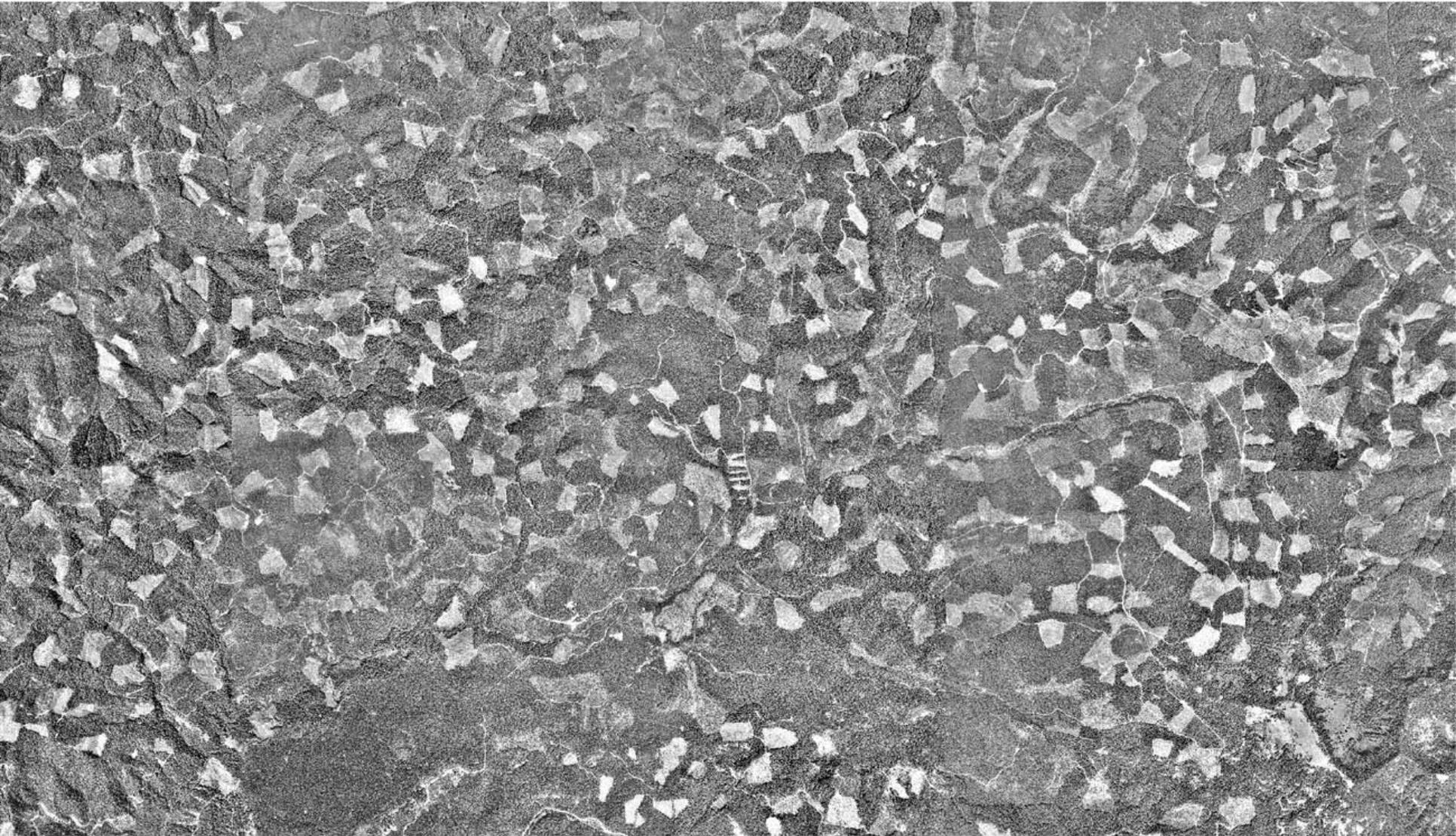




Visual Elements



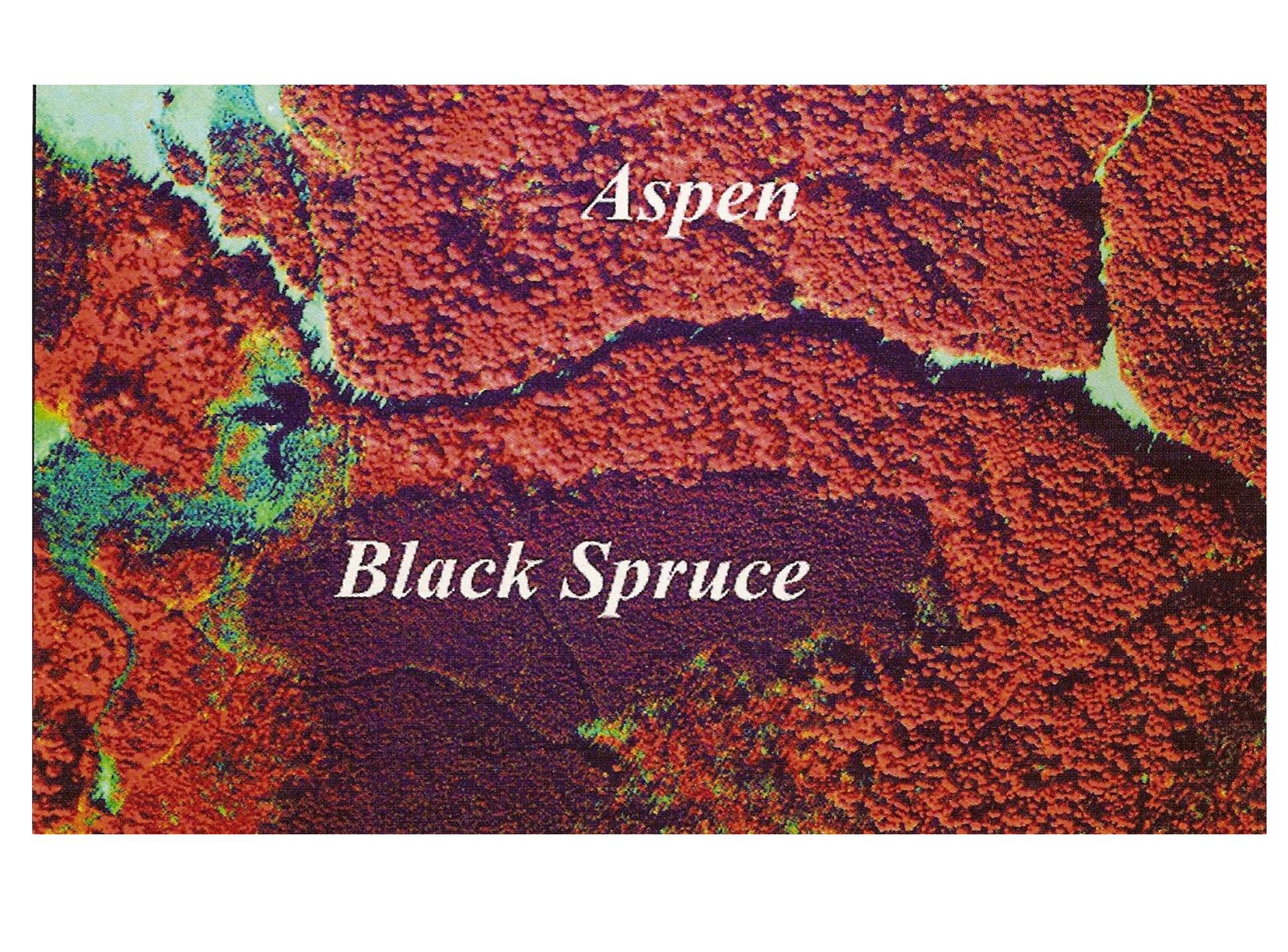
- **Pattern**
- **Site & Association.** Information referring to the location of objects and the things surrounding them



0

3

6 Miles

An aerial photograph of a forest landscape. The image shows a dense forest with two distinct tree types. The upper portion of the image is dominated by a dense canopy of reddish-brown trees, which are identified by the text as Aspen. The lower portion of the image shows a darker, more textured canopy of dark green trees, identified by the text as Black Spruce. The two forest types are separated by a winding, light-colored path or stream that meanders through the landscape. The overall scene is a high-angle view of a natural forest environment.

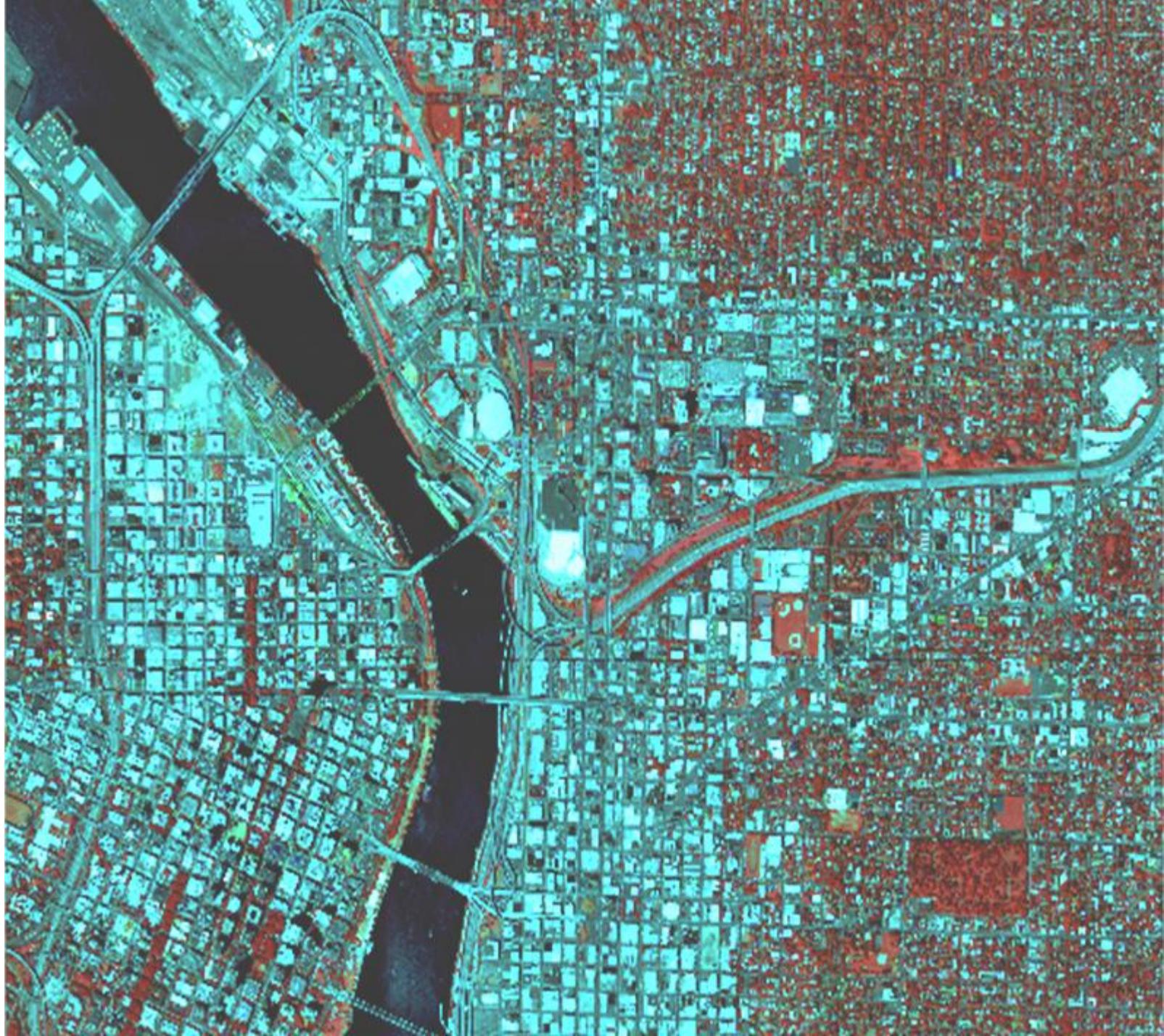
Aspen

Black Spruce

Visual Elements



- **Pattern.**
- **Site & Association.**
- **Size.** Physical dimensions of an object (length, width)



Visual Elements

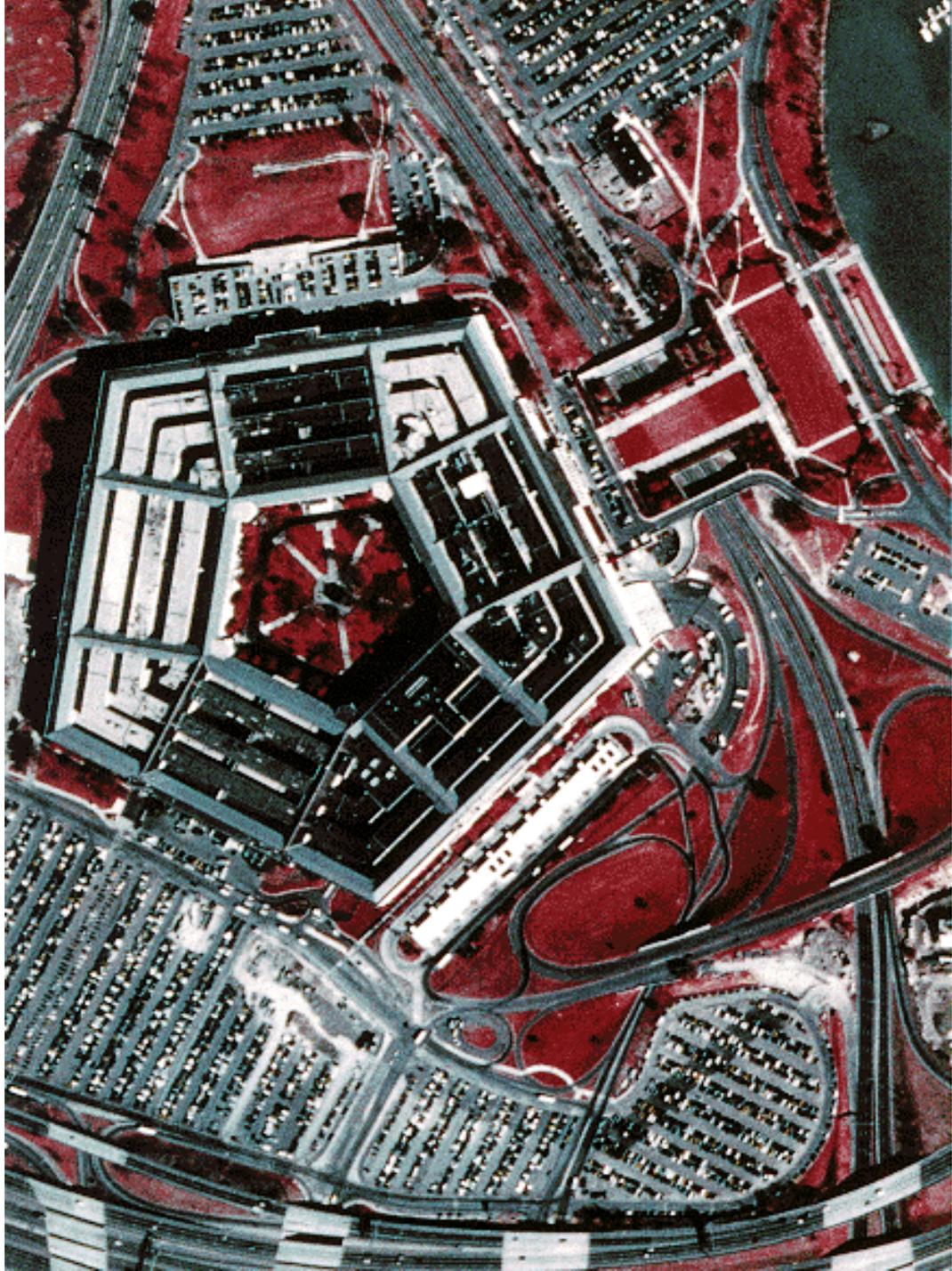
- **Pattern.**
- **Site & Association.**
- **Size.**
- **Shadow.** The shadings in an image caused by a light source. Can help understand the true height or shape of an object



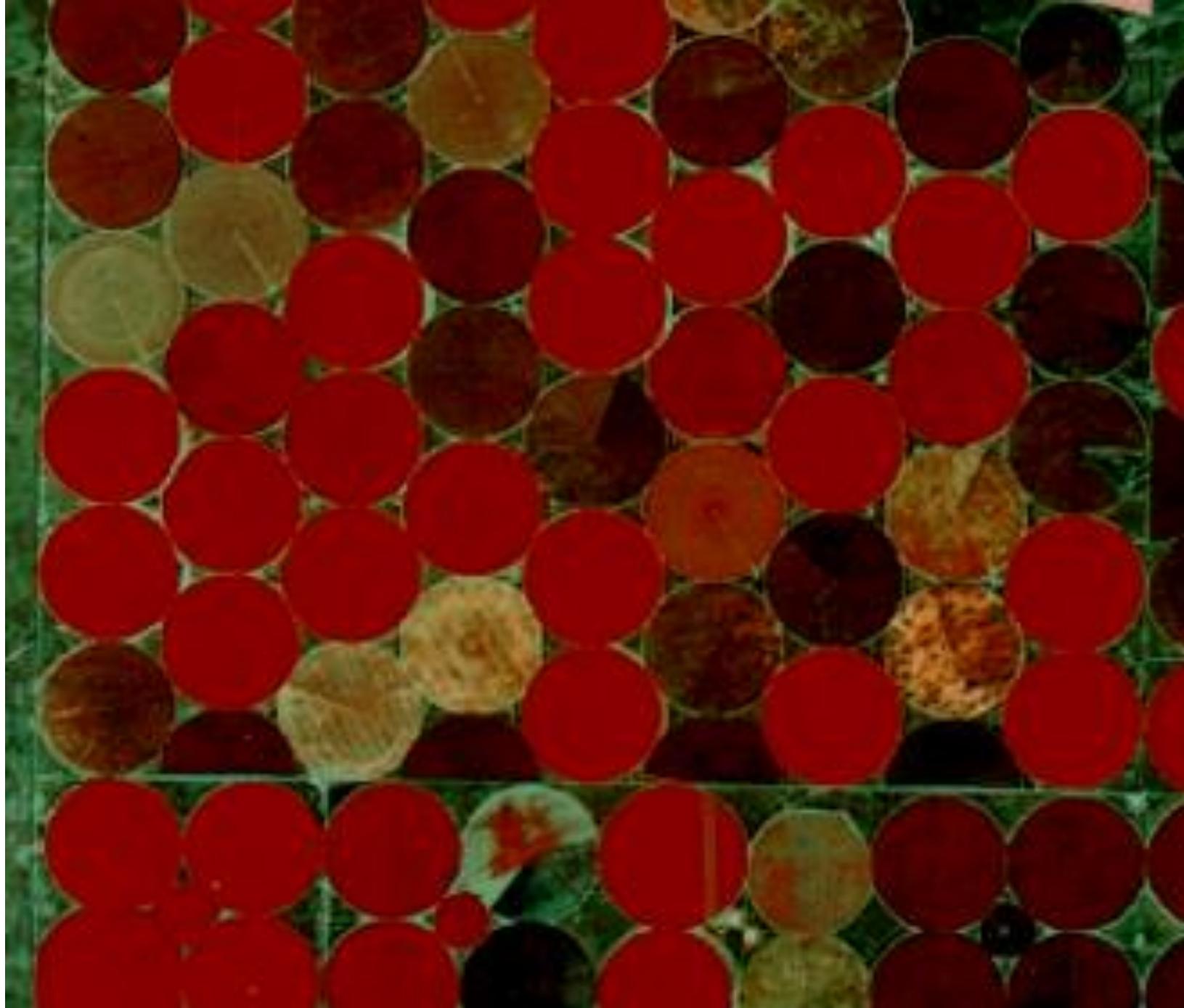


Visual Elements

- **Pattern.**
- **Site & Association.**
- **Size.**
- **Shadow.**
- **Shape.** Form of an object (baseball field, crop circle)







Visual Elements

- **Pattern.**
- **Site & Association.**
- **Size.**
- **Shadow.**
- **Shape.**
- **Texture.** Repeating tones in an image - can determine types of vegetation for example: smooth (grass) v. coarse (forest)

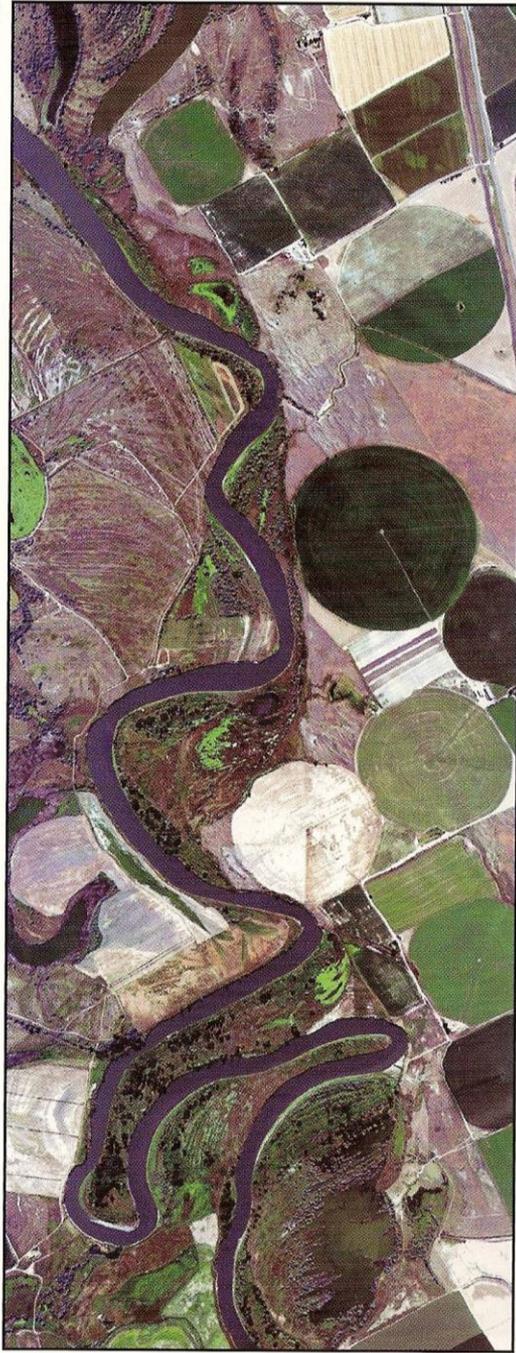




Visual Elements

- **Pattern.**
- **Site & Association.**
- **Size.**
- **Shadow.**
- **Shape.**
- **Texture.**
- **Tone/Color.** Grayscale levels or ranges of a color in an object – boardwalk extending into the water

(a)



(b)







Case Study



www.satimagingcorp.com

QuickBird Satellite Sensor, February 2002
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Measurements

Photogrammetry

- The process of making measurements from aerial photographs
 - ▣ Use **photo scale** to determine real-world sizes
 - ▣ Measuring height & depth of objects

Photo Scale

- Photo scale depends on the focal length of the camera's lens and altitude of the plane
- Determining an unknown photo scale can be done with the known scale from a secondary source
 - ▣ Photo scale = Photo Distance (PD) / Ground Distance (GD or real-world distance)

Height

- Examine the shadow
 - ▣ Know the photo scale
 - ▣ Clearly see the full shadow on level ground
 - ▣ Know the height of one object with a shadow you can measure

Height

- Use height of a known object to calculate angle of the sun
 - ▣ $\tan a = \text{height}/\text{length}$
 - ▣ sun (a), real-world height & length
- To determine length use the height of a shadow in the image of the same known object
 - ▣ $\text{Length} = \text{height of shadow (in image)} \times \text{photo scale}$
- Use the same formula to figure out the heights of unknown objects, using same sun angle
 - ▣ $\tan a = \text{height}/\text{length}$

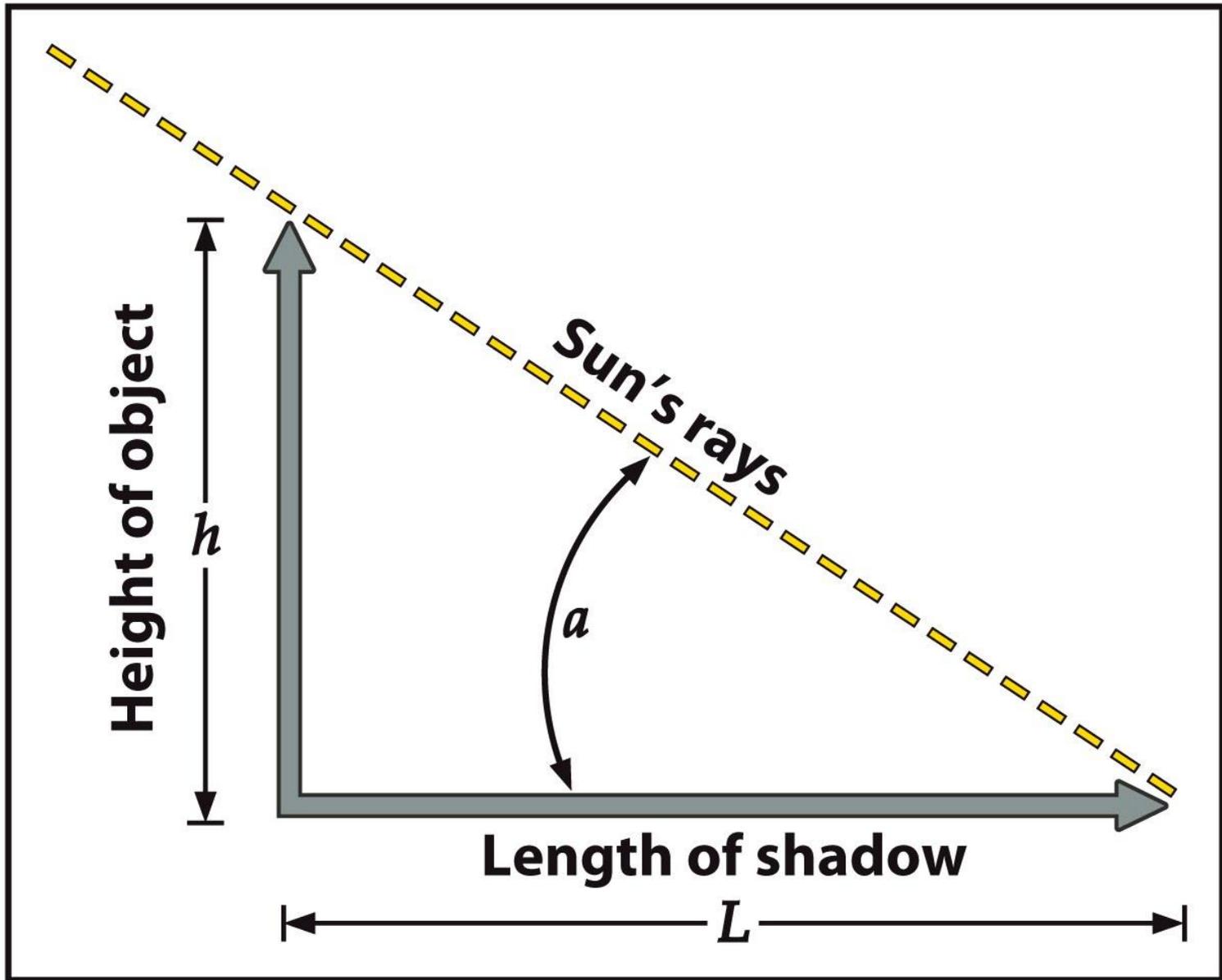


Figure 9.13
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