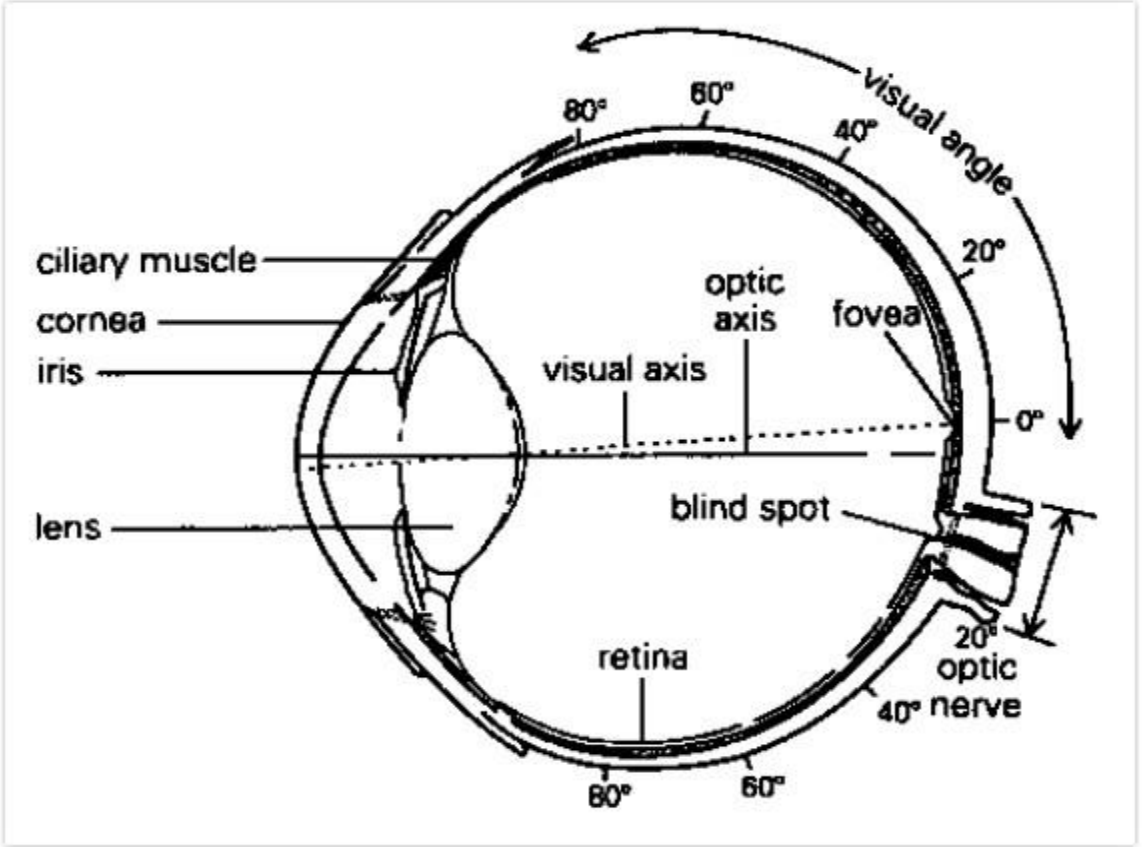
Chapter 4
Basics of Remote Sensing

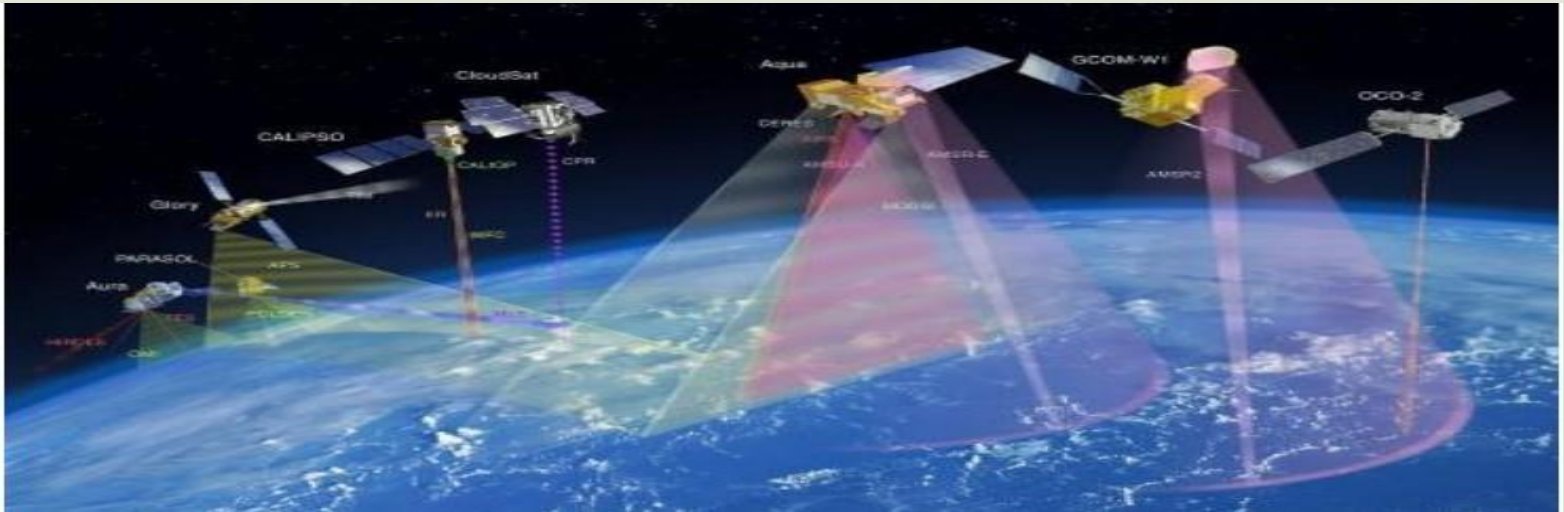
What is Remote Sensing

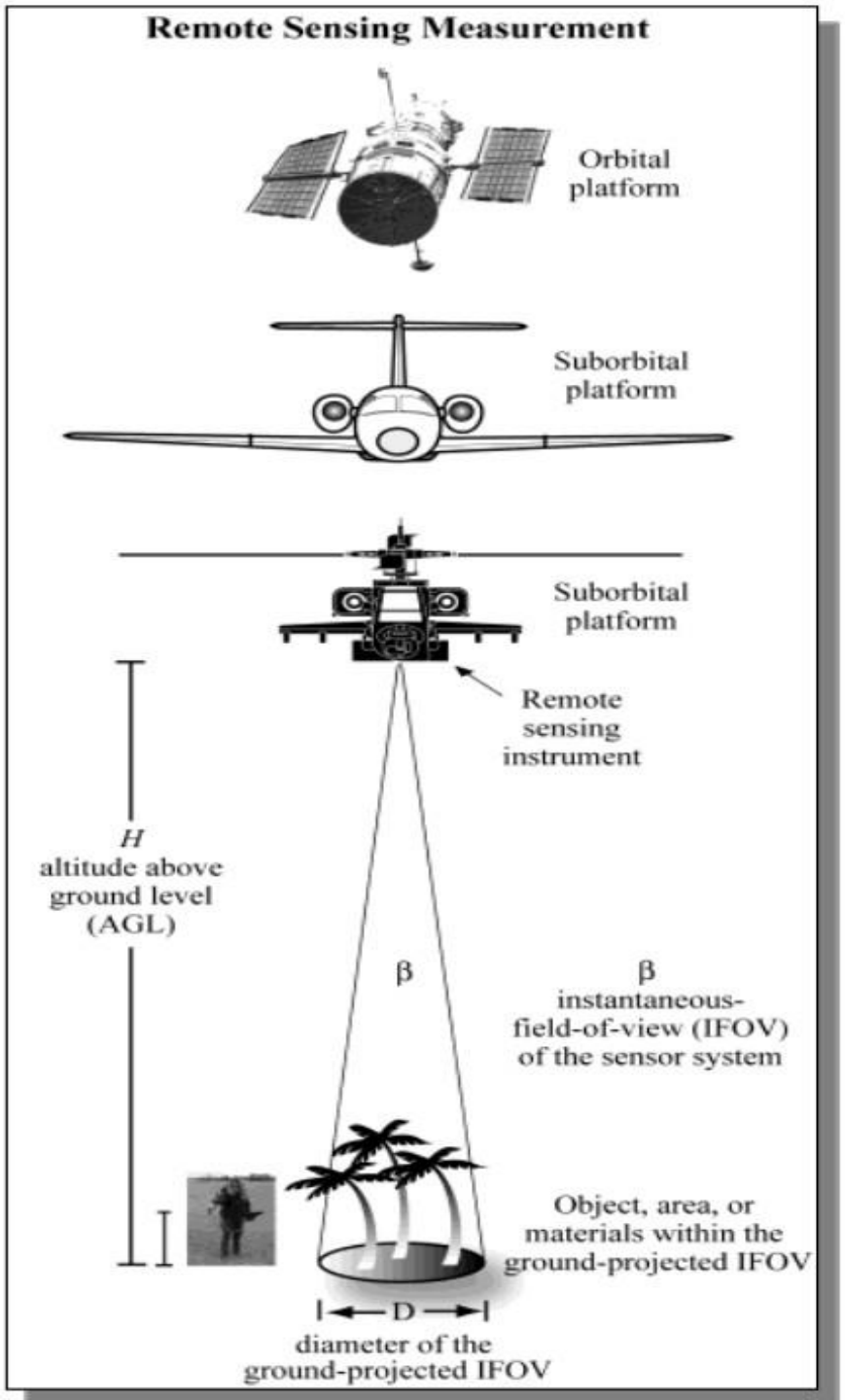
- Remote- Away from or at a distance
- Sensing – detecting a property of characteristic



What is Remote Sensing Used For.????

- Remote sensing is a method for getting information about of different objects on the planet, without any physical contacts with it.
- This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information."

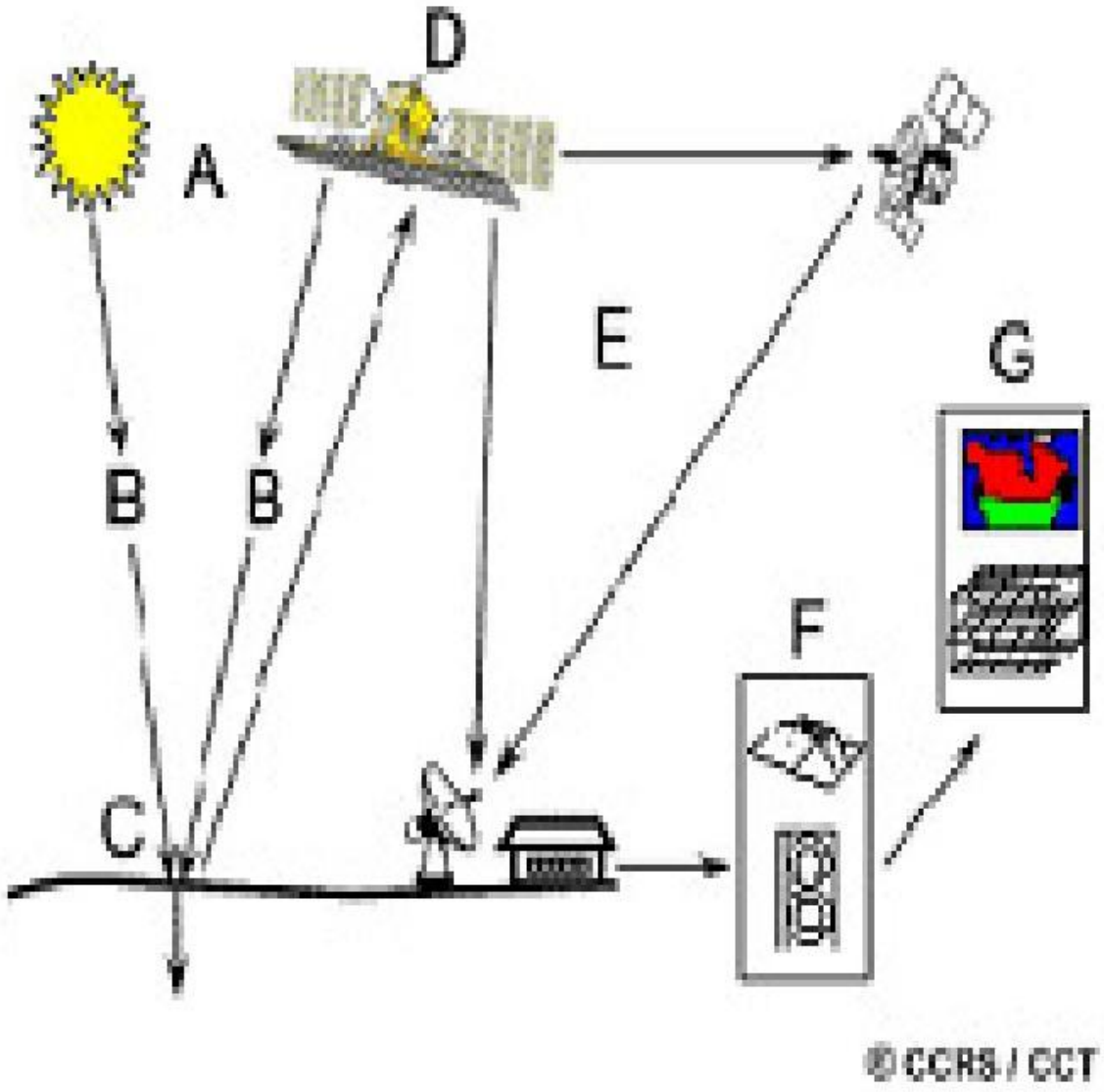




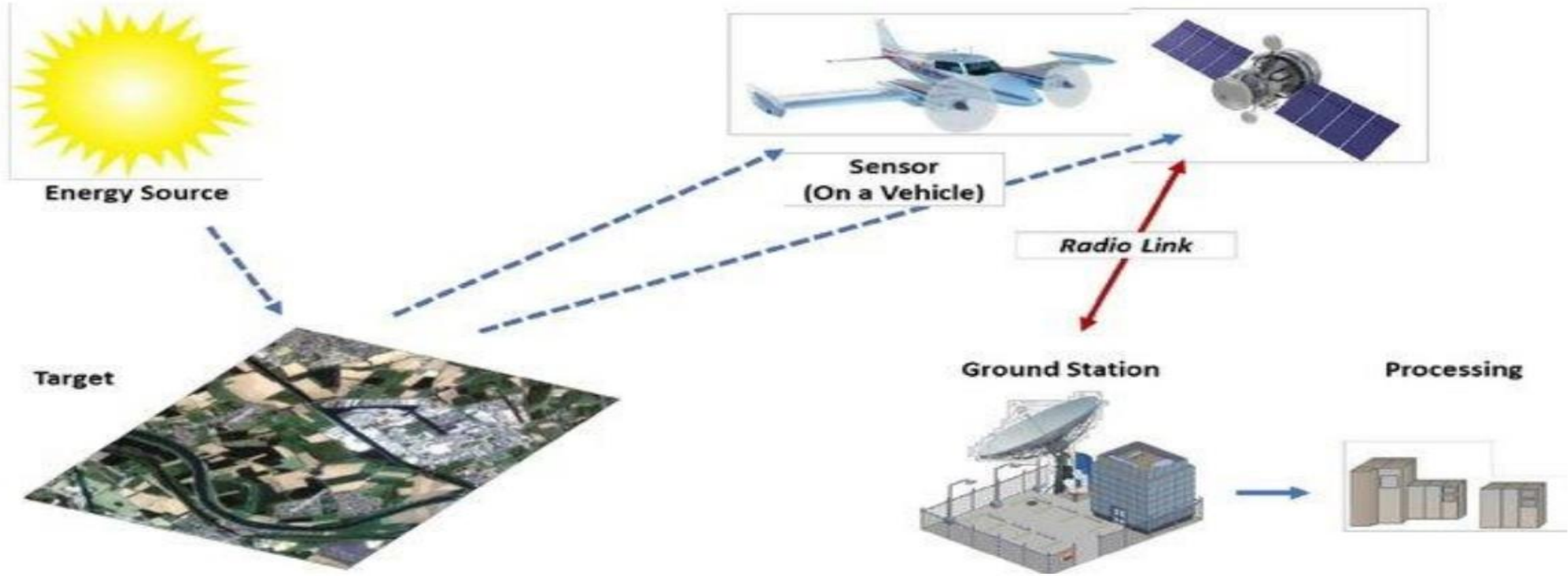
Remote Sensing Process

The process involves an interaction between incident radiation and the targets of interest.

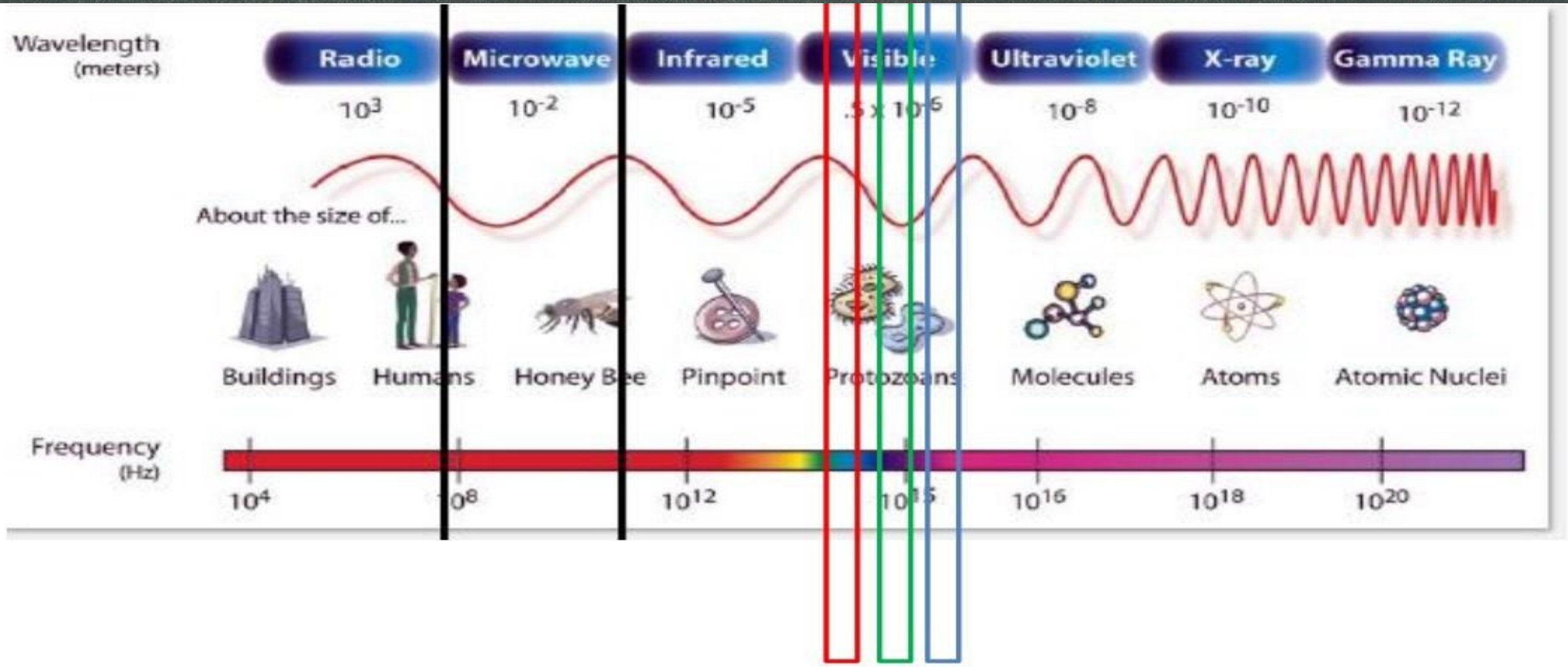
-Energy Source or Illumination (A)
-Radiation and the Atmosphere(B)
-Interaction with the Target (C)
-Recording of Energy by the Sensor(D)
-Transmission, Reception, and Processing (E)
-Interpretation and Analysis(F)
-Application(G)



Remote Sensing Process and Components



Electromagnetic Spectrum



Bands Used in Remote Sensing

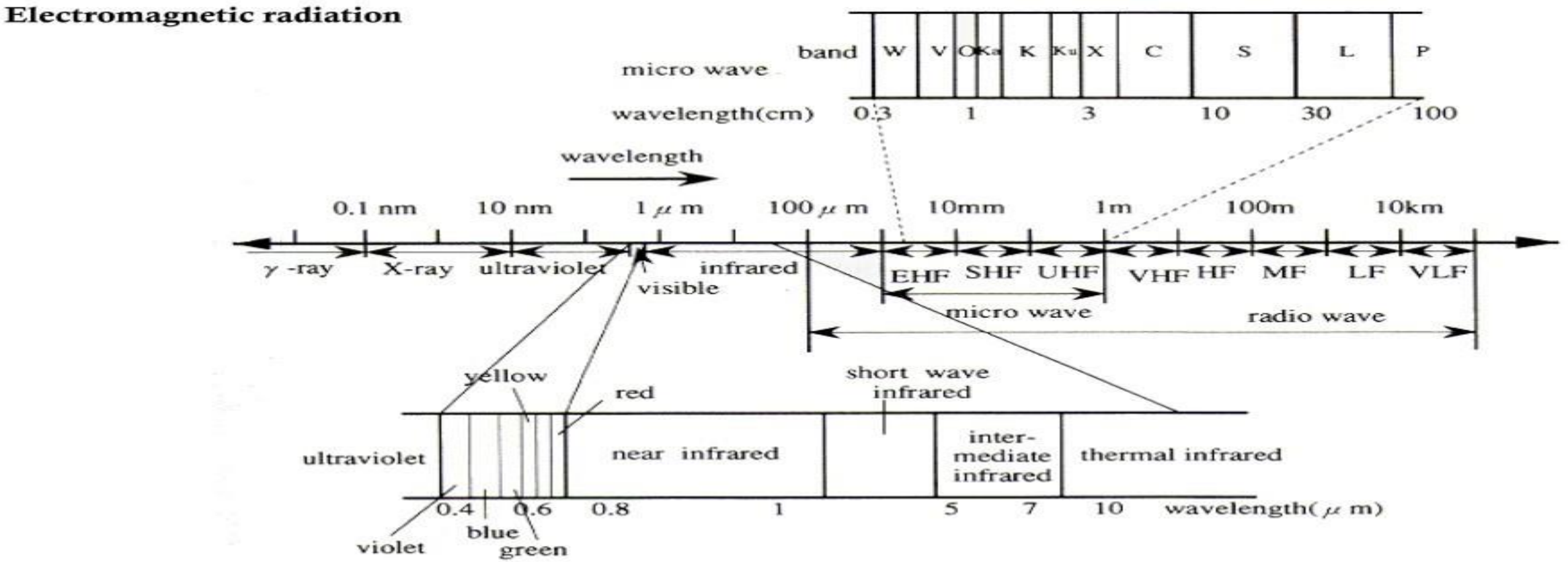
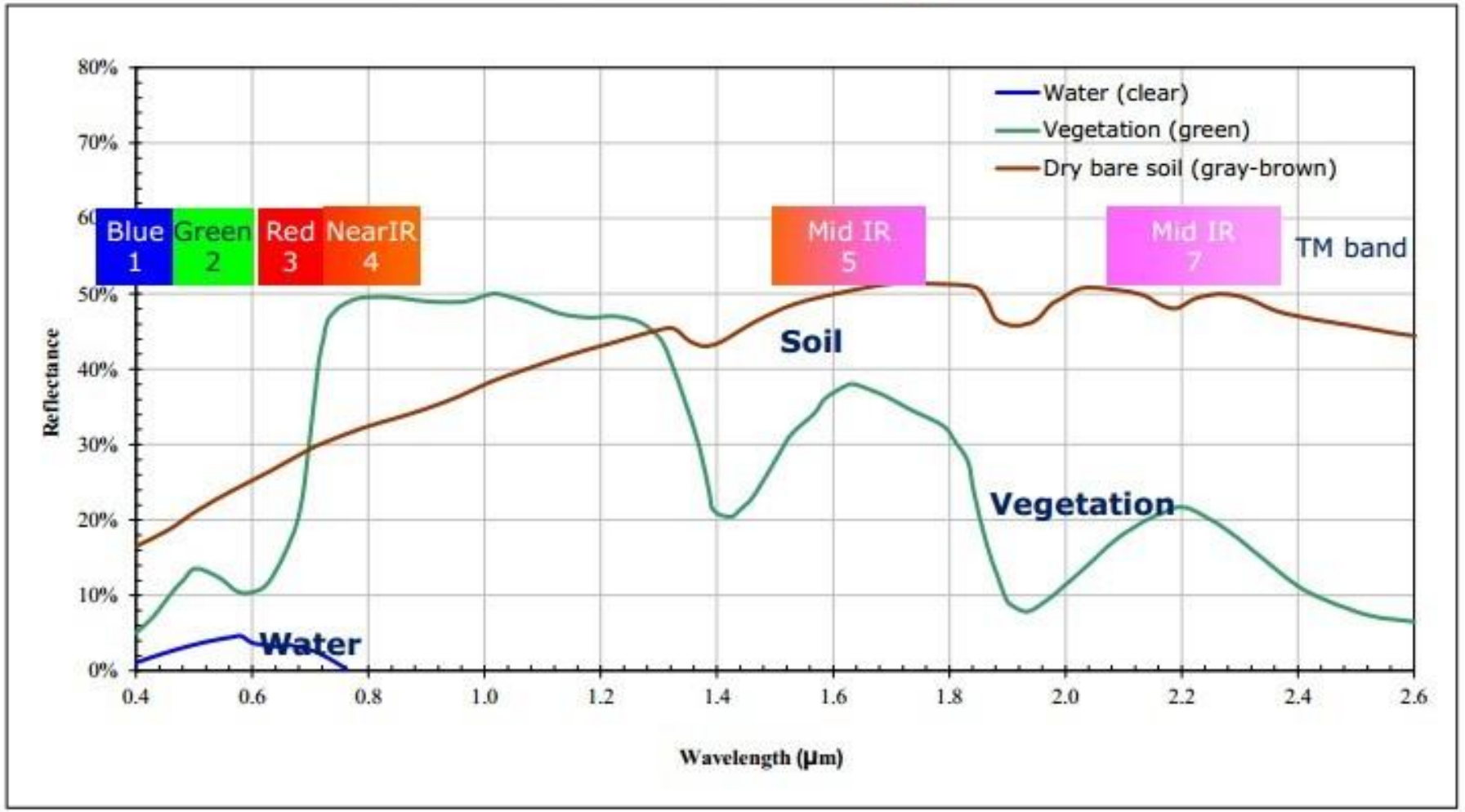


Figure 1.4.1 The bands used in remote sensing

Spectral Reflectance of Earth Surface Satellite Data Acquisition



Resolutions of Remote Sensing

- - Defined as the ability of the system to provide the information at the smallest discretely separable quantity in terms of distance (spatial),wavelength band of EMR (spectral), time (temporal) and/or radiation quantity (radiometric)

A. Spatial Resolution

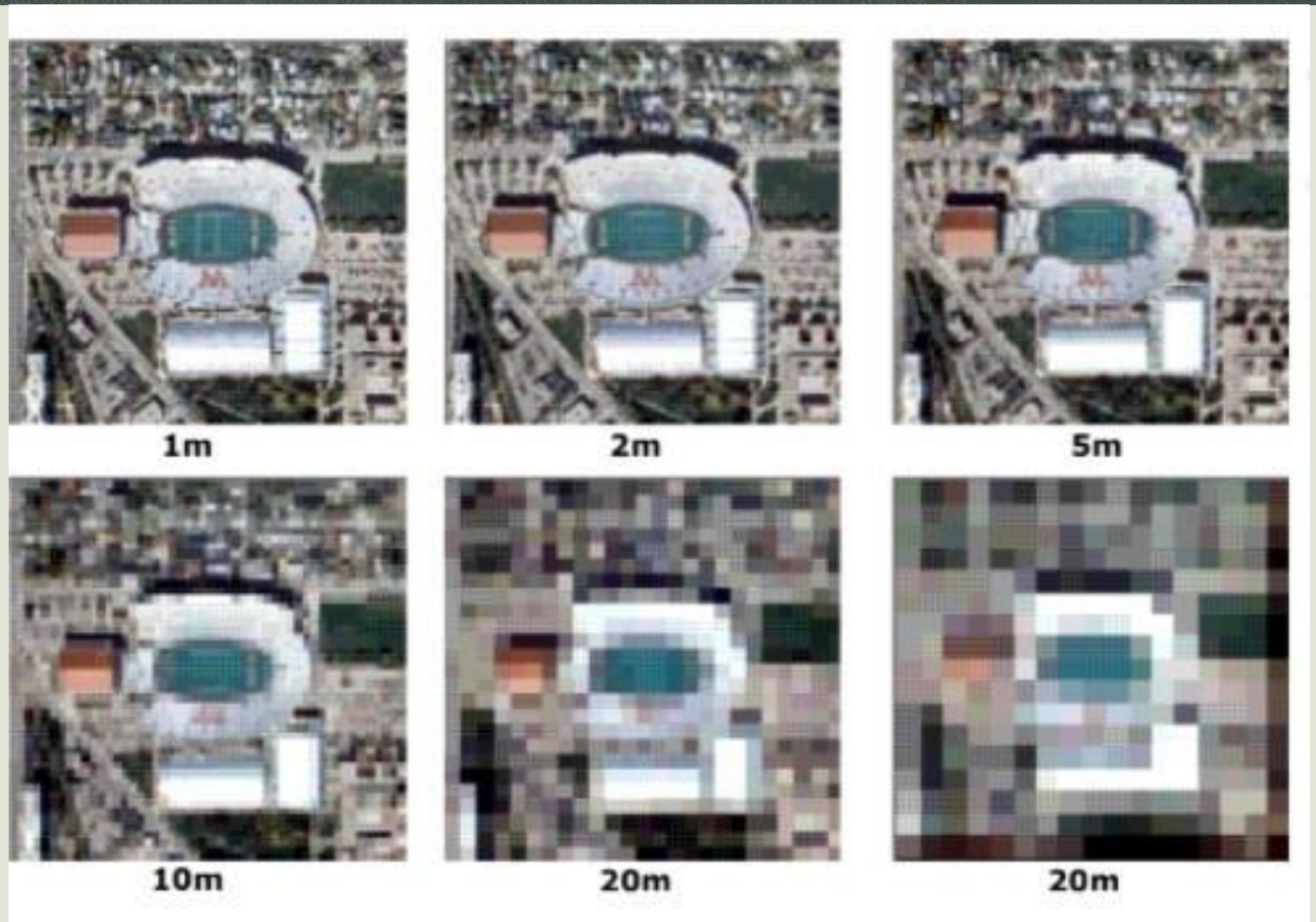
B. Temporal Resolution

C. Spectral Resolution

D. Radiometric Resolution

Spatial Resolution

The area in the ground represented by each pixel, refers to the fineness of the details visible in the image.

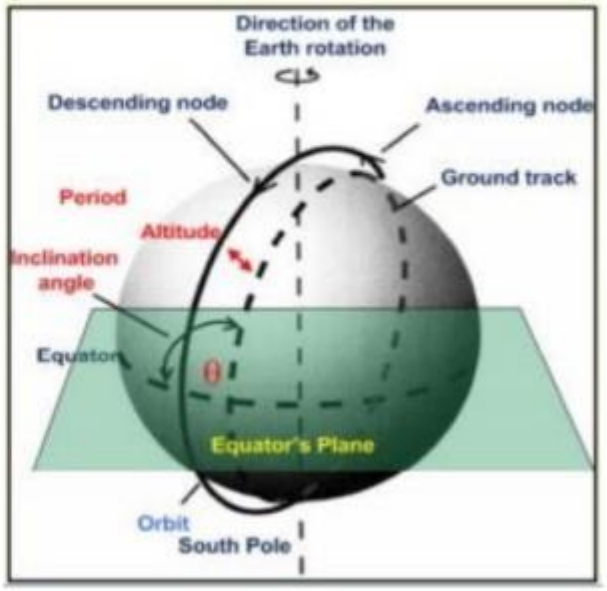


Temporal Resolution

- The revisit period of the satellite sensor to the same area

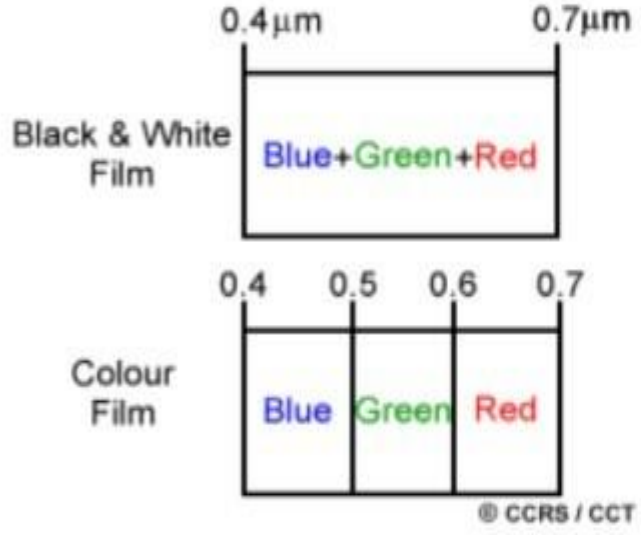
How often a sensor obtains imagery of a particular area (Time between Observations)

Satellite/Sensor	Temporal Resolution
SPOT	26 Days
Landsat	16 Days
NOAA	Daily
MODIS (Terra/AQUA)	Daily



Spectral resolution

Spectral resolution refers to how many spectral “bands” an instrument records.



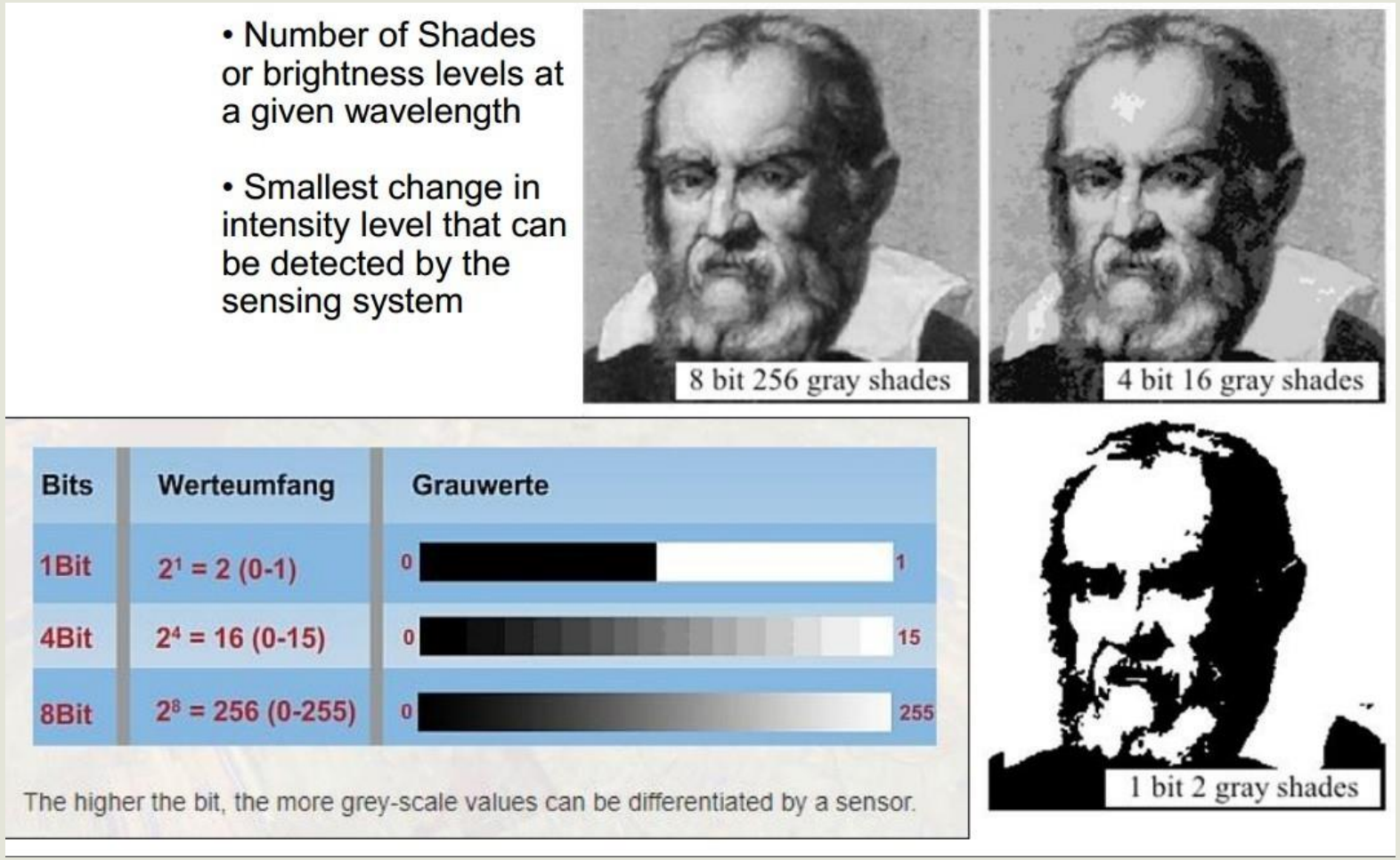
Black-White image → Wide Interval in electromagetic Spectrum → Coarse Spectral Resolution

Color Image → Narrow Interval in electromagnetic spectrum → Fine Spectral Resolution

A sensor with **higher spectral resolution** is required for detailed distinction.

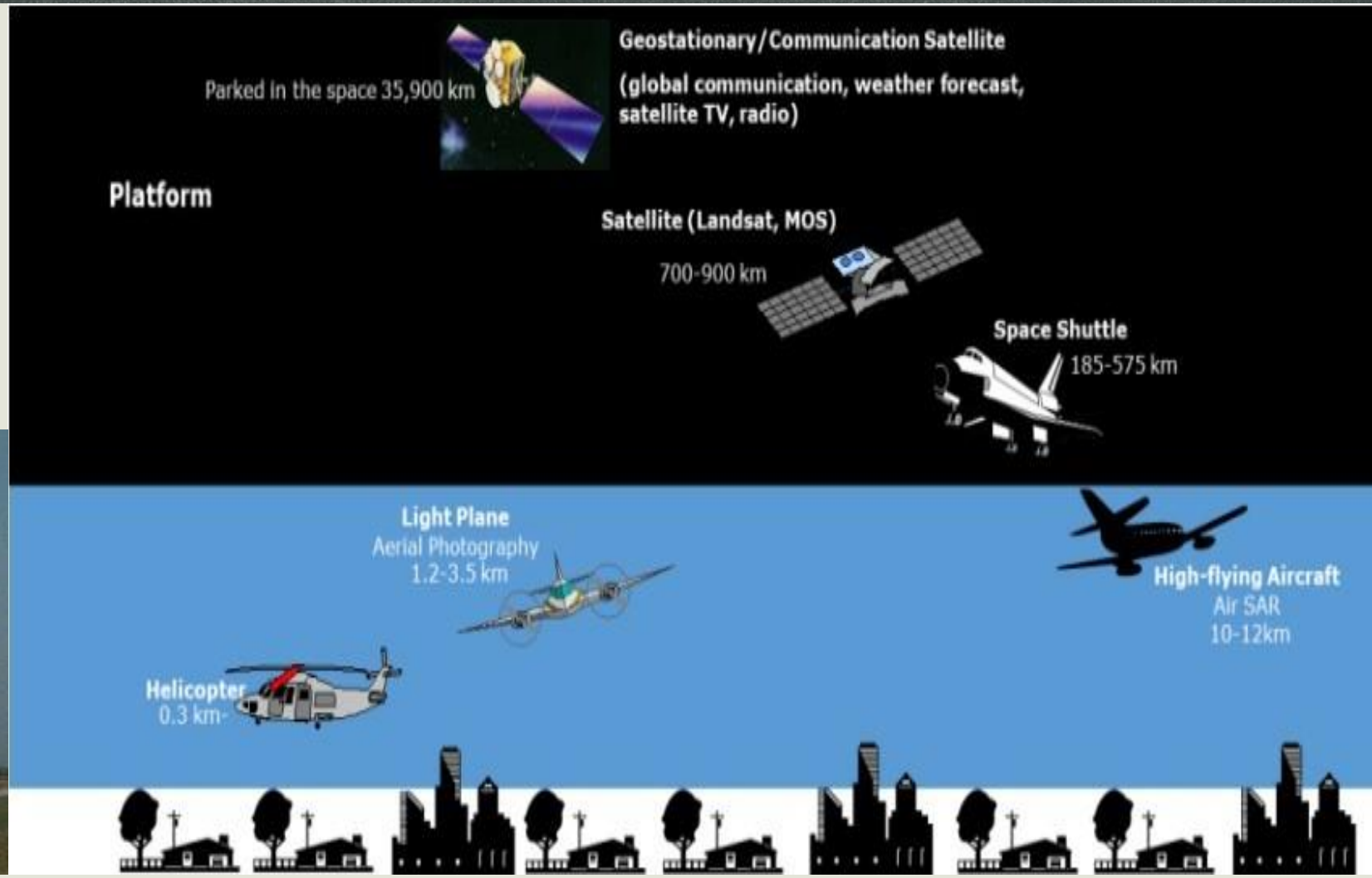
Radiometric Resolution

Determines how fine the sensor can distinguish between objects of similar reflection



Remote Sensing Platforms

- Ground based
- Aircraft/ drone/ UAV
- Space shuttle
- Satellite



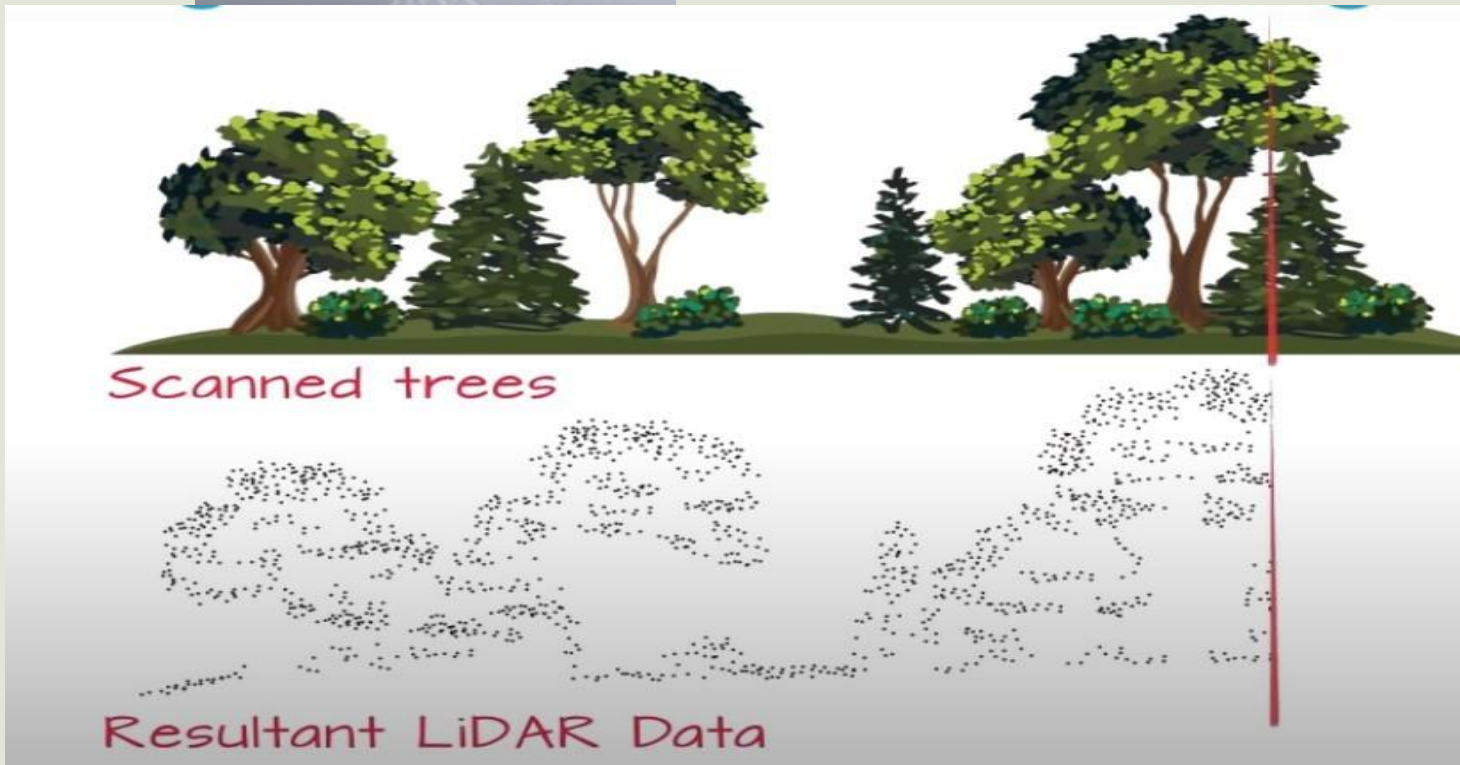
Lidar Remote Sensing

- Light Detection And Ranging (LiDAR): Active form of remote sensing: information is obtained from a signal which is sent from a transmitter, reflected by a target, and detected by a receiver back at the source.

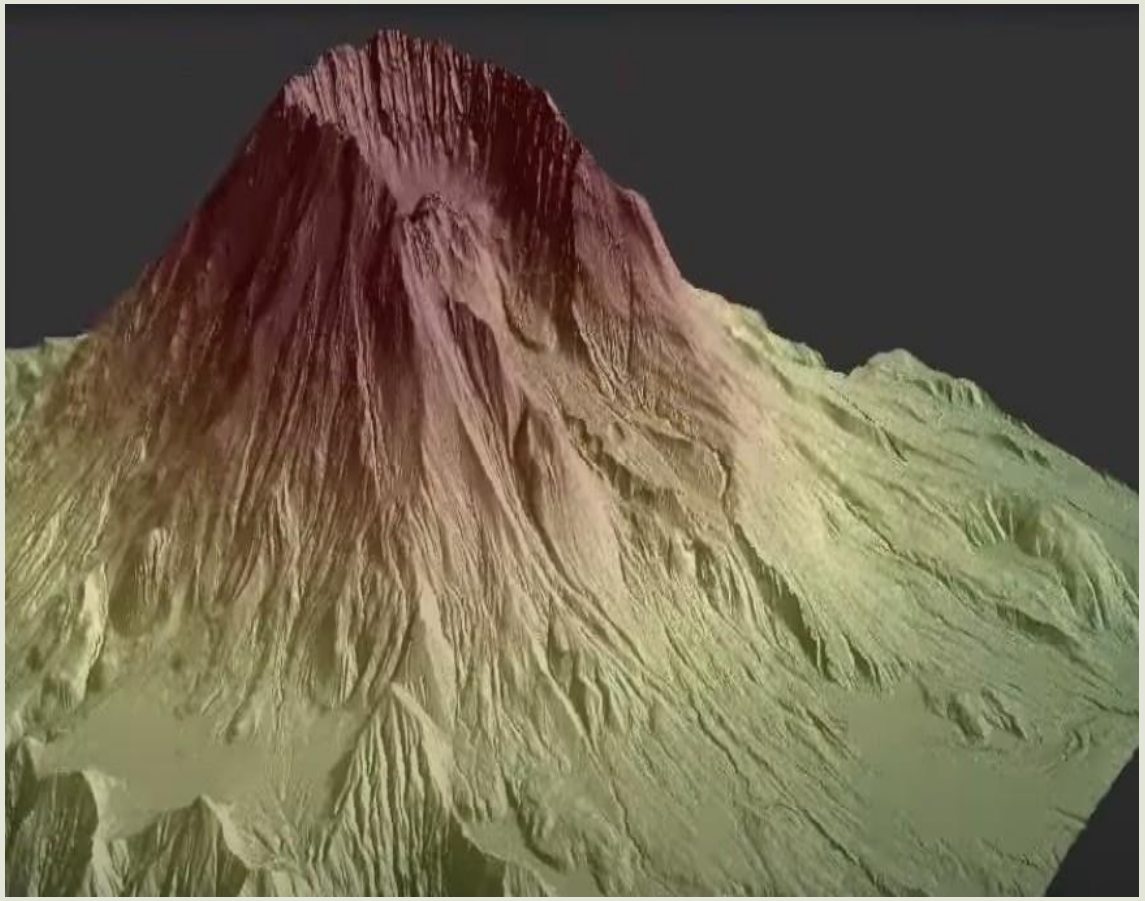
It uses laser light to determine the height of an object which may be ground, trees, building, etc

Lidar generates digital elevation models and contours which can be used for various purposes like

- Engineering design and design review
- Floodplain mapping
- Hydrological modelling
- Soil Survey(slope, aspect)
- Surface Feature Extraction(trees, road, building)
- Vegetation Mapping(Height, Density)



Elevation Models



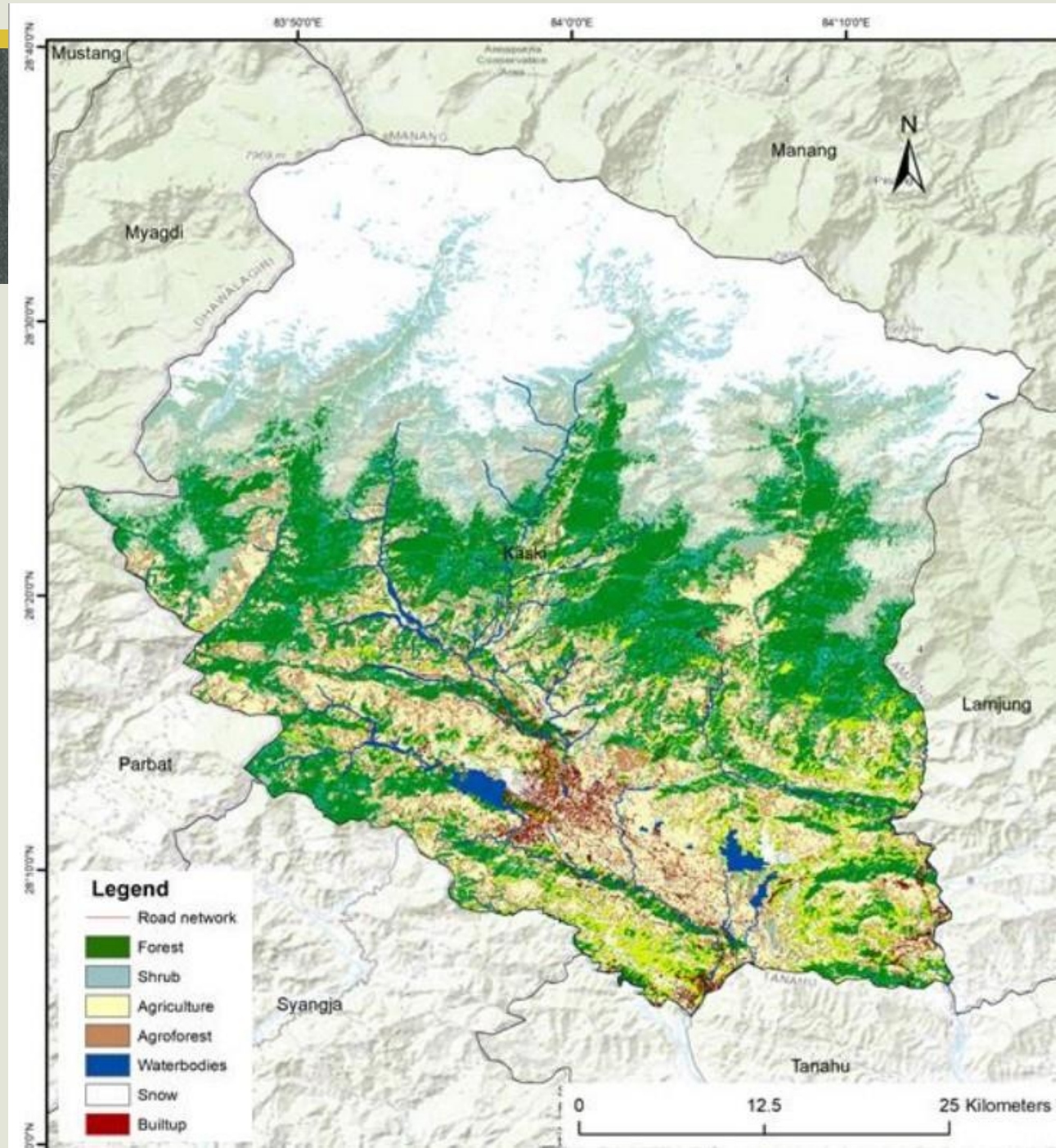
Do you know, in Nepal also lidar survey is being conducted..??

Interconnection between GIS and RS

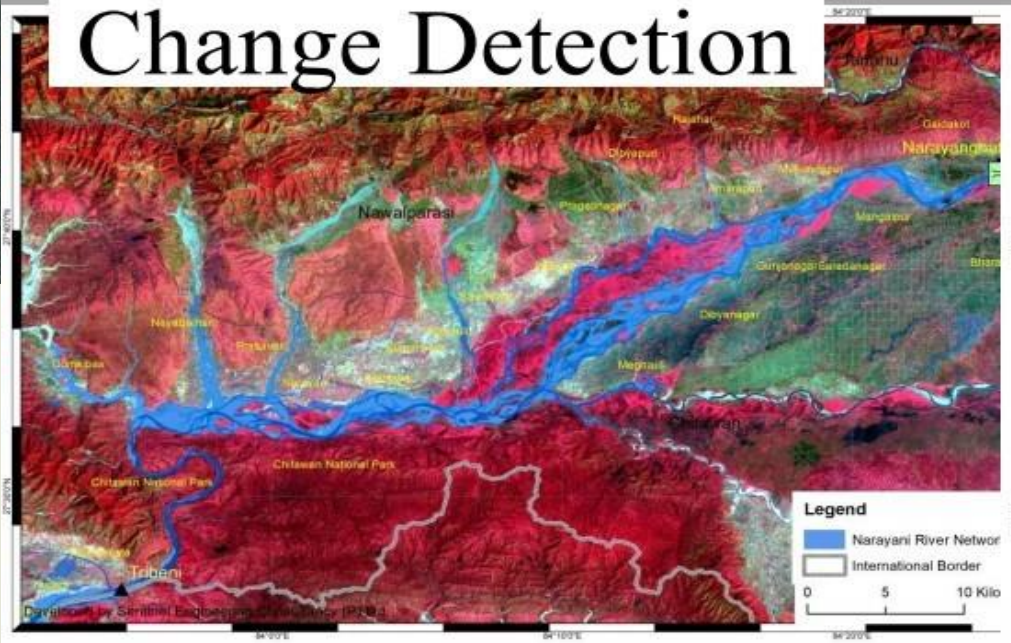
- GIS manages location-based information and provides tools for display and analysis of various statistics, including population characteristics, economic development opportunities, and vegetation types. GIS allows you to link databases and maps to create dynamic displays.
- Remote sensing provide data input to GIS
- Remote sensing is most commonly a data input into GIS as base layers or for analysis, especially temporal analytics. Crop health, landcover changes, habitat suitability, flood or other disaster impacts can be easily measured at broad scales with the combination of GIS and RS

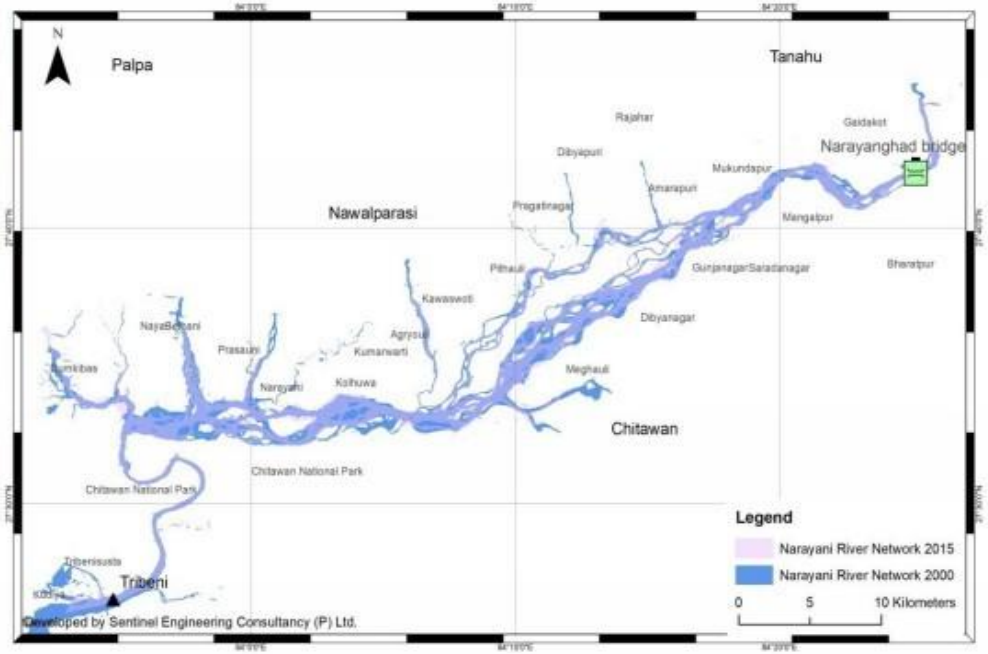
Application of Remote Sensing

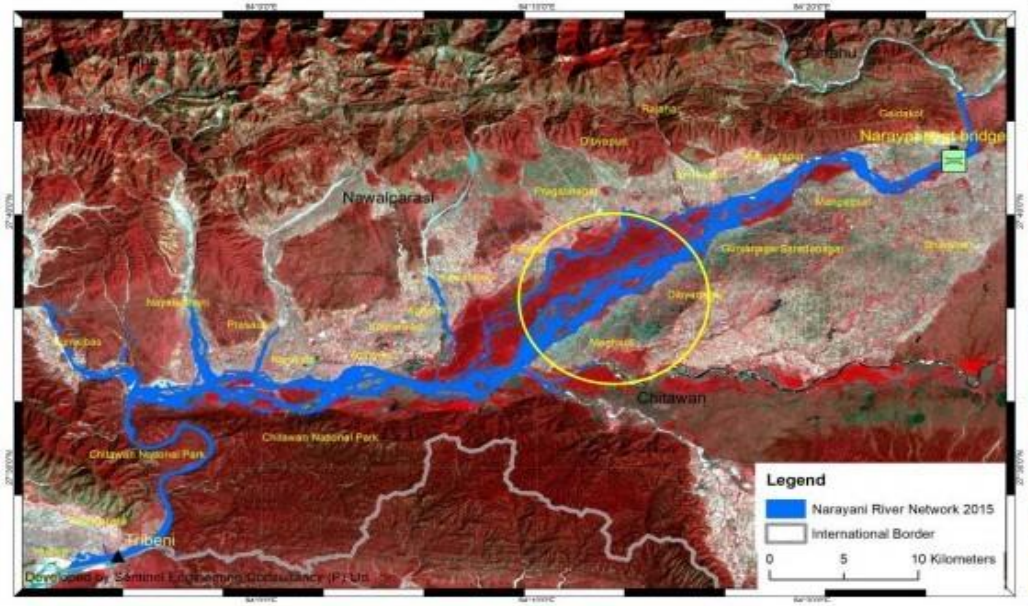
- Land use and Land use change detection.

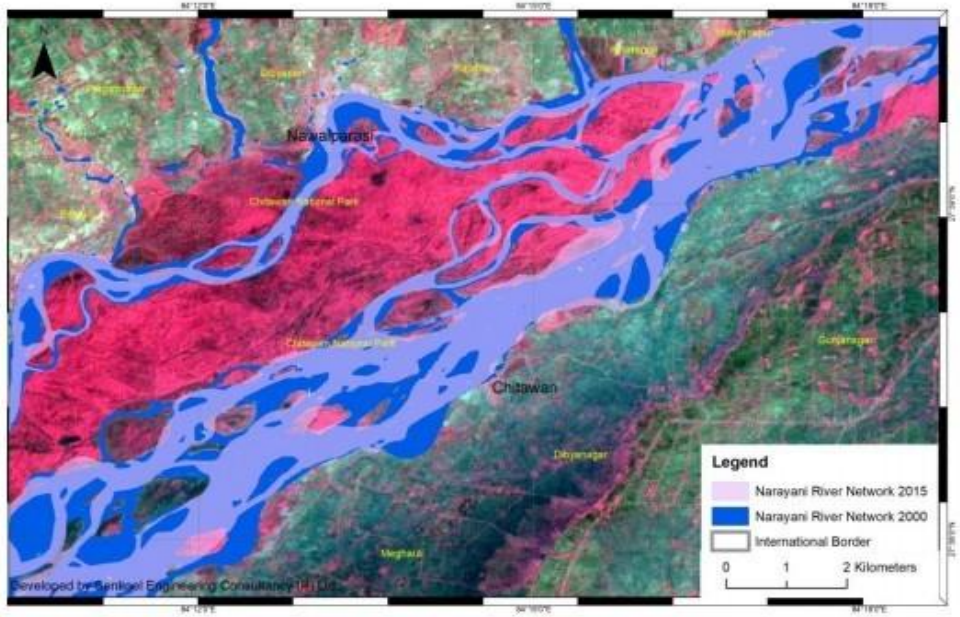


Change Detection

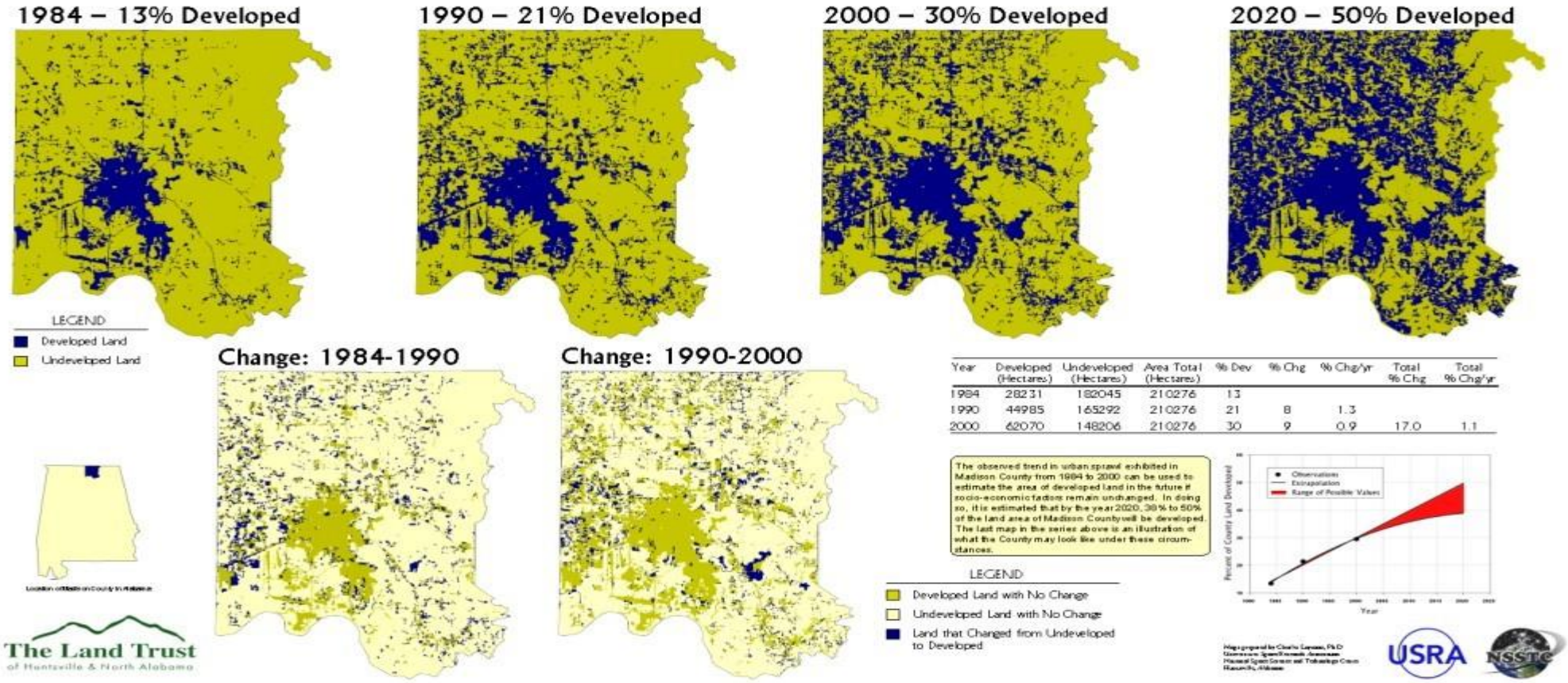








Change Detection [Growth of Urban Areas]

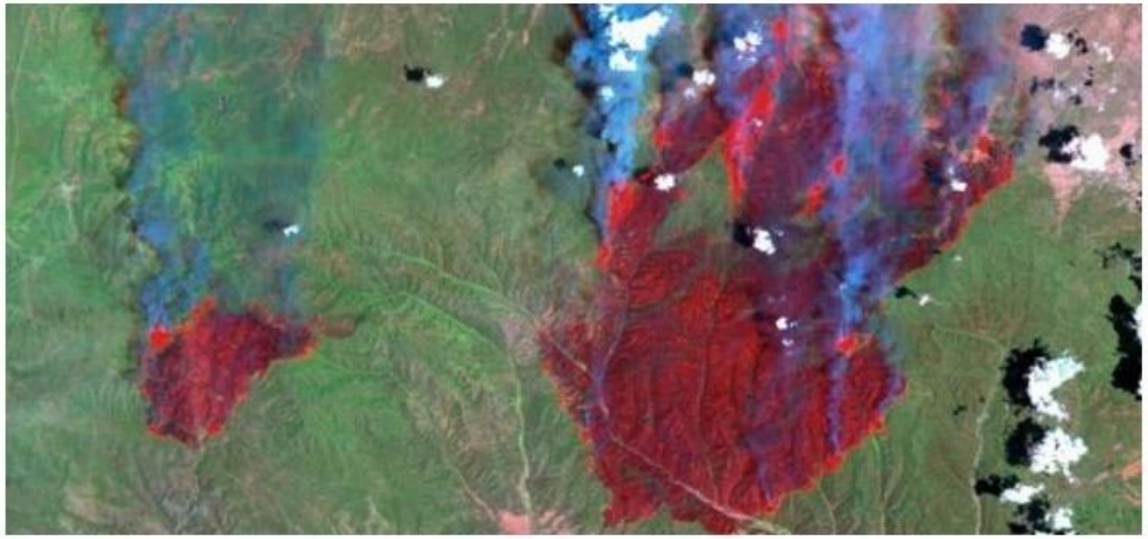


Year	Developed (Hectares)	Undeveloped (Hectares)	Area Total (Hectares)	% Dev	% Chg	% Chg/yr	Total % Chg	Total % Chg/yr
1984	28231	182045	210276	13				
1990	44985	165292	210276	21	8	1.3		
2000	62070	148206	210276	30	9	0.9	17.0	1.1

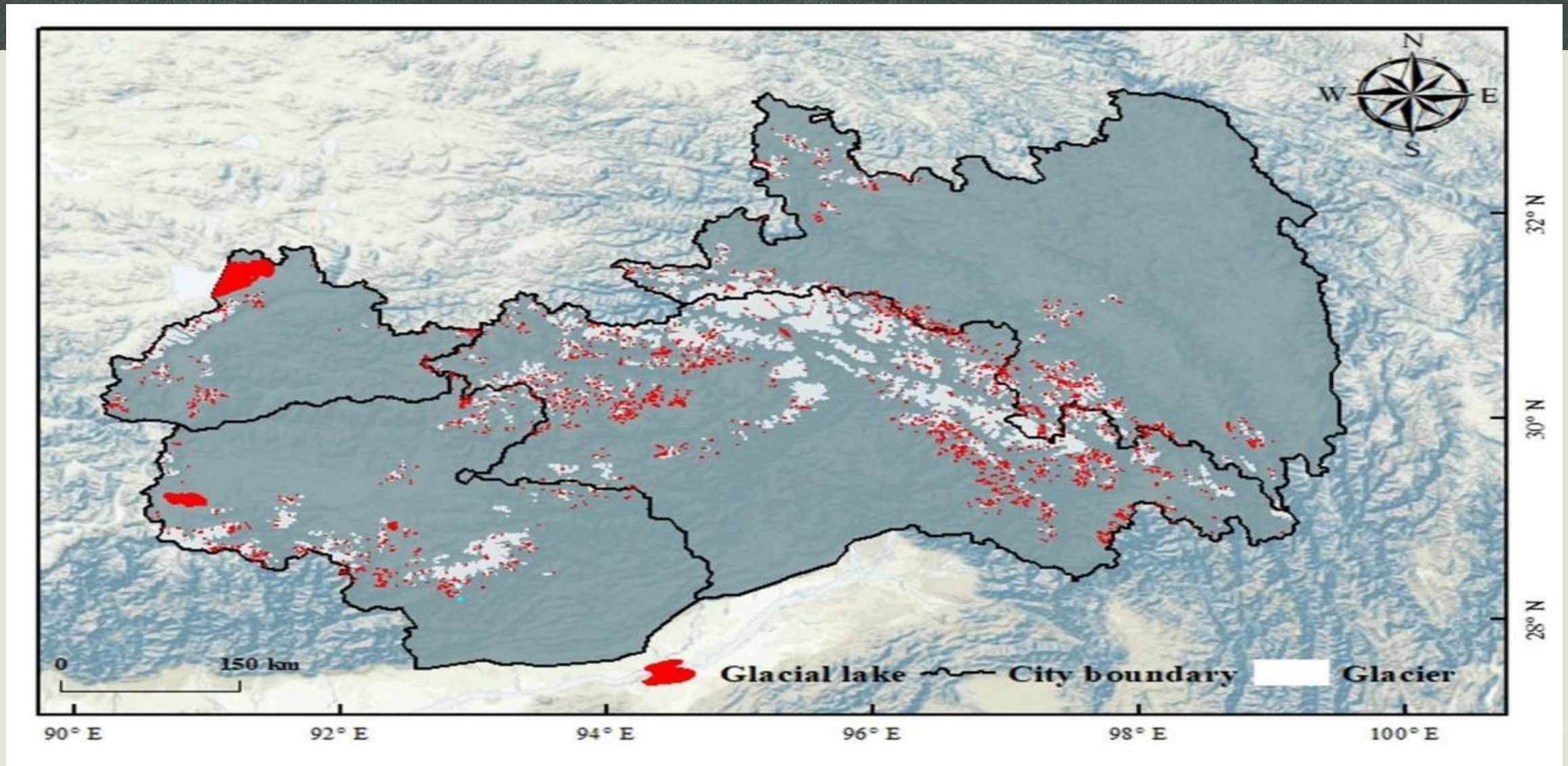
Detecting and Monitoring Wildland Fires

Borneo

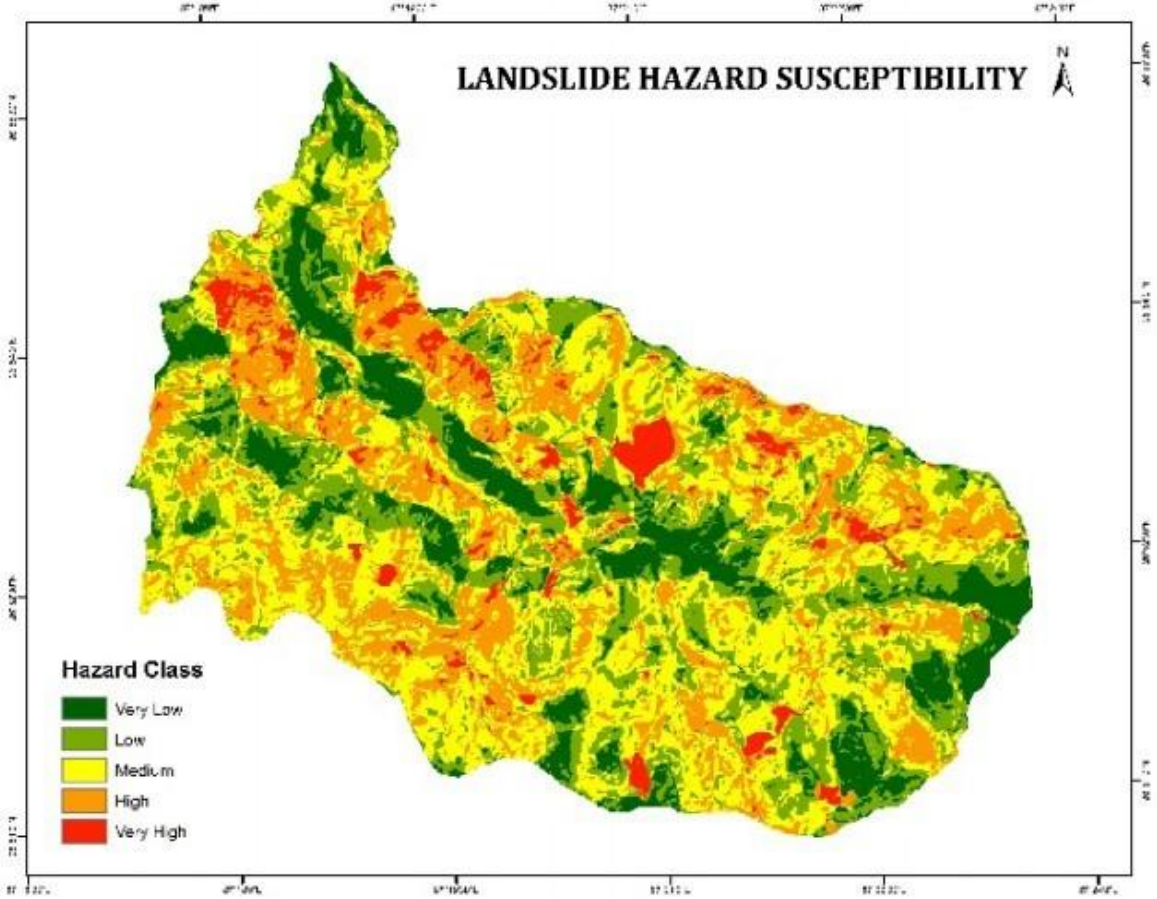
Arizona, June 2002

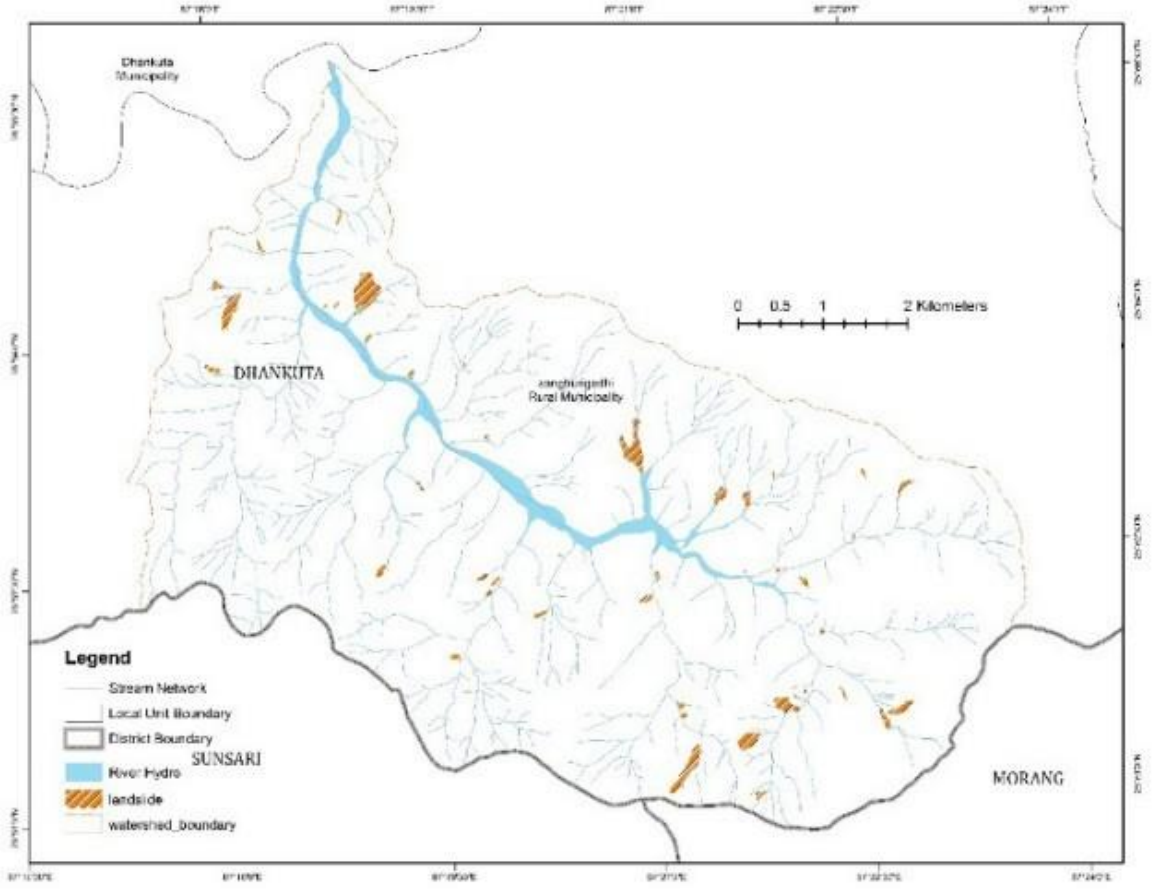


- Glacier monitoring, ice extent mapping, snow cover monitoring



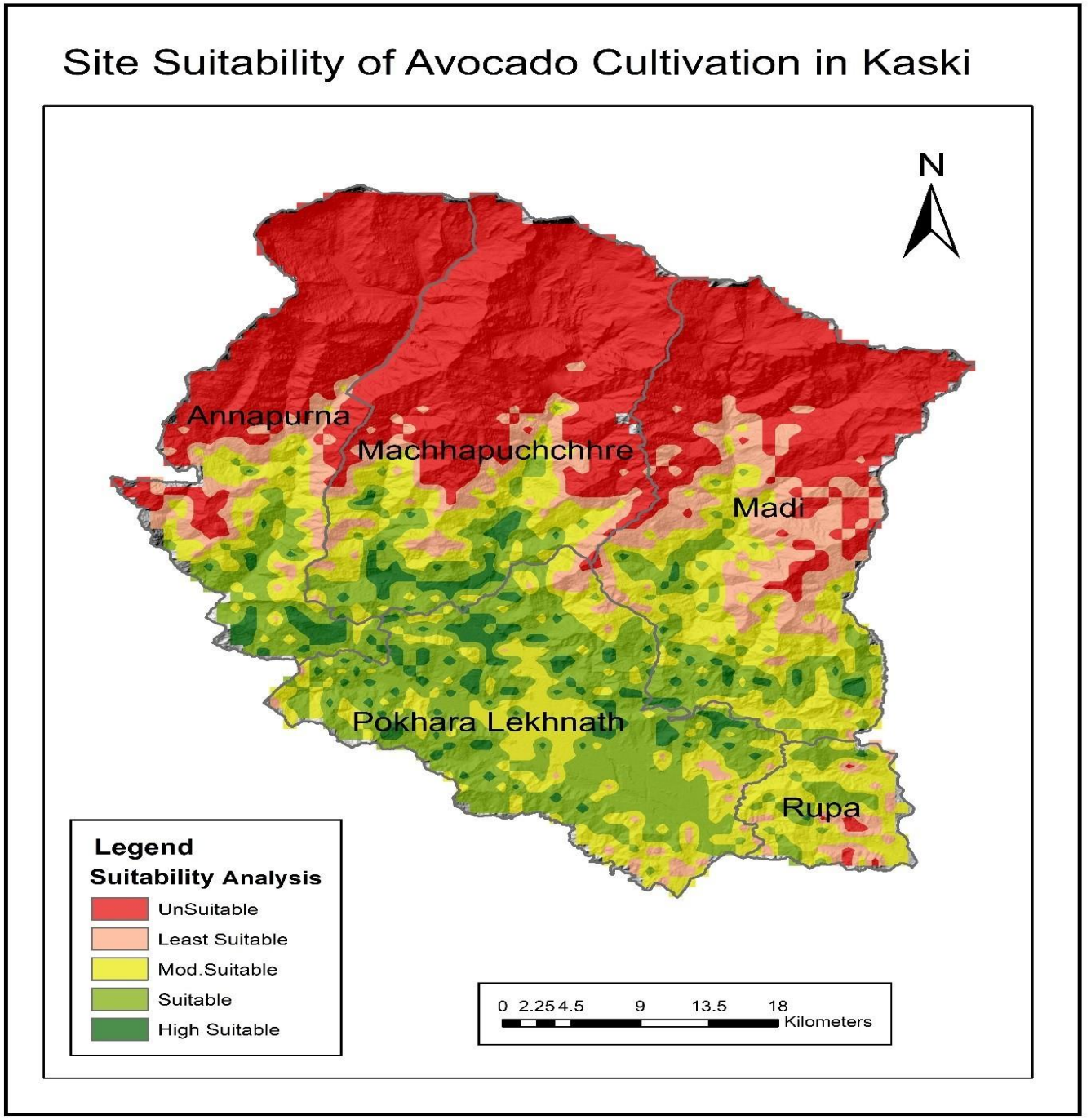
Risk analysis, carefully monitoring and mapping of crisis situations



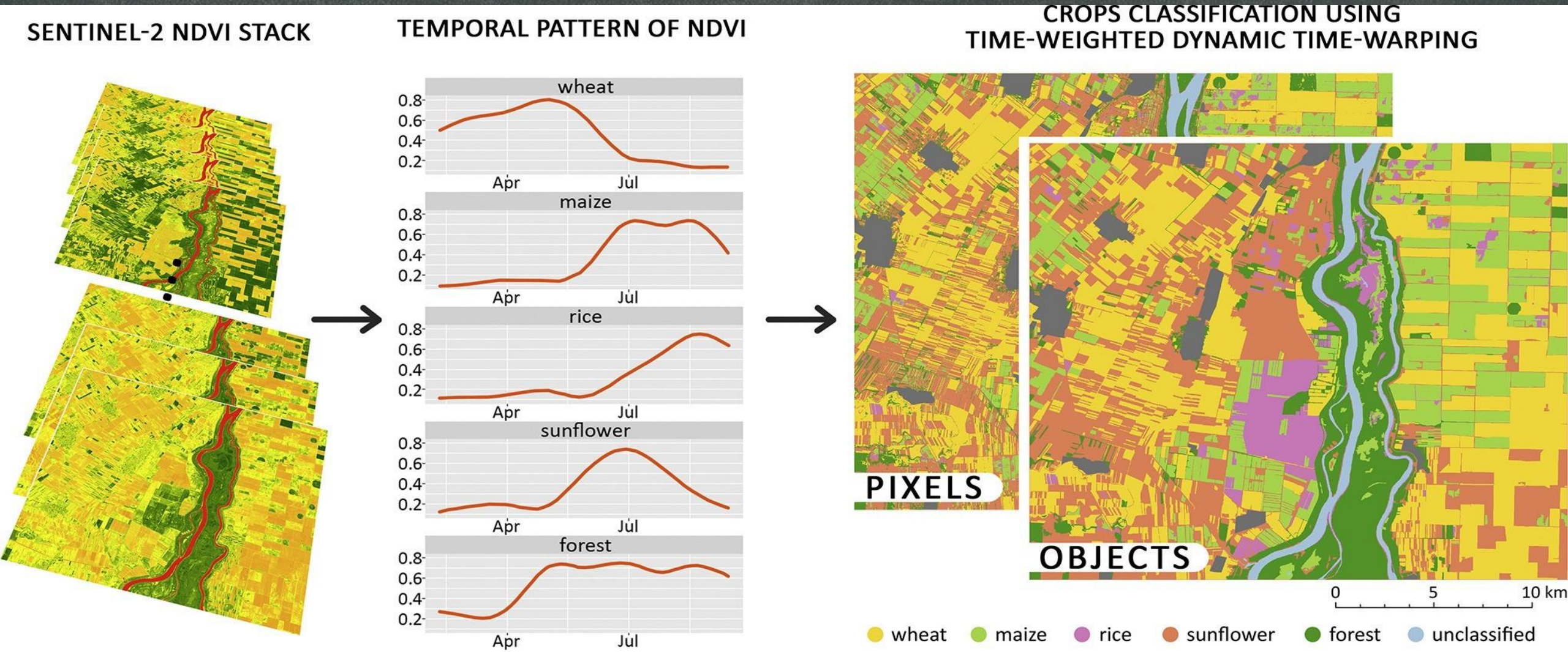


Landslide susceptibility hazard maps

Suitability Analysis

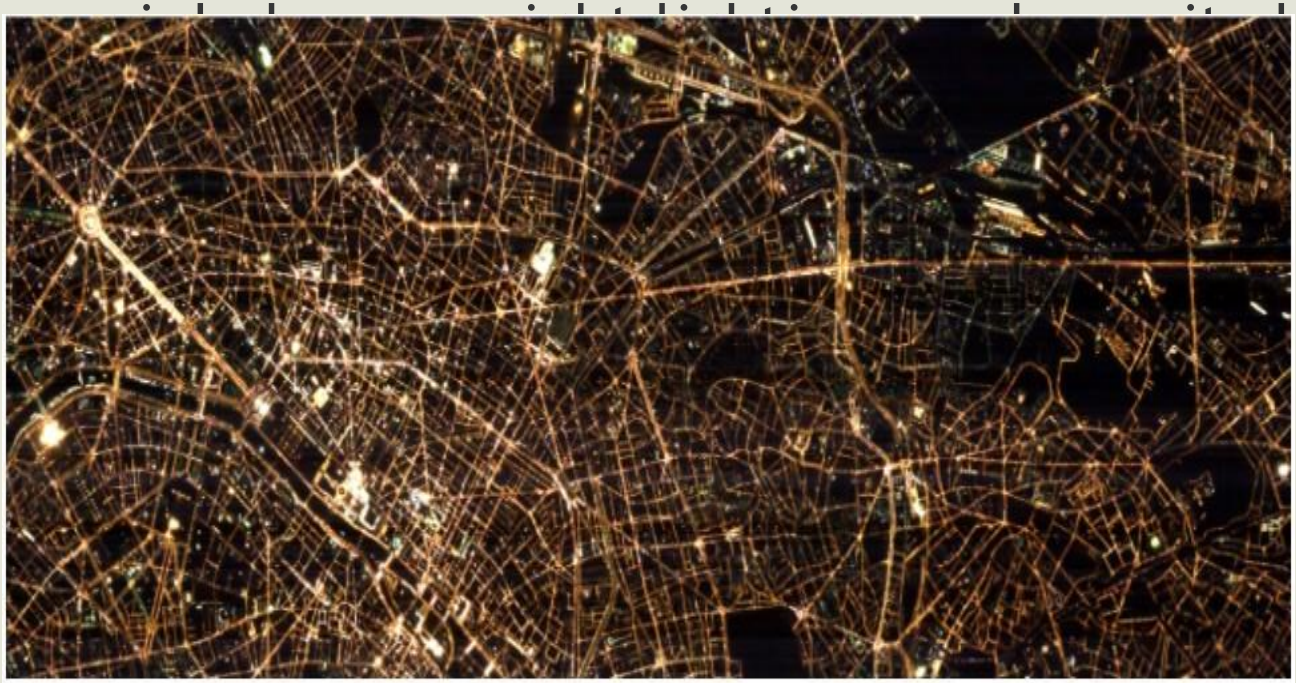


Agriculture applications such as crop monitoring



Nightlight time Remote Sensing

- Nighttime light remote sensing means the process of remote sensing satellites recording visible radiance source information from land/water at cloud-free nights. Most of this kind of light information emitted by human activities on the earth, ight



Paris, France

Rome, Italy

Images taken by Changguang Satellite “Jilin

Application of Nightlight time Remote Sensing

- Compared to daytime remote sensing, nighttime light remote sensing provides a unique perspective on human social activities.
- By mining data on night-time remote sensing images, we can discover the following knowledge:
- Estimation of socioeconomic parameters (population, GDP, electricity consumption, etc.), urbanization monitoring and evaluation, major event assessment (crisis, natural disasters, war, humanitarian disasters, etc.), eco-environmental assessment and health effects research, including light pollution analysis and its medical and ecological effects analysis and so on