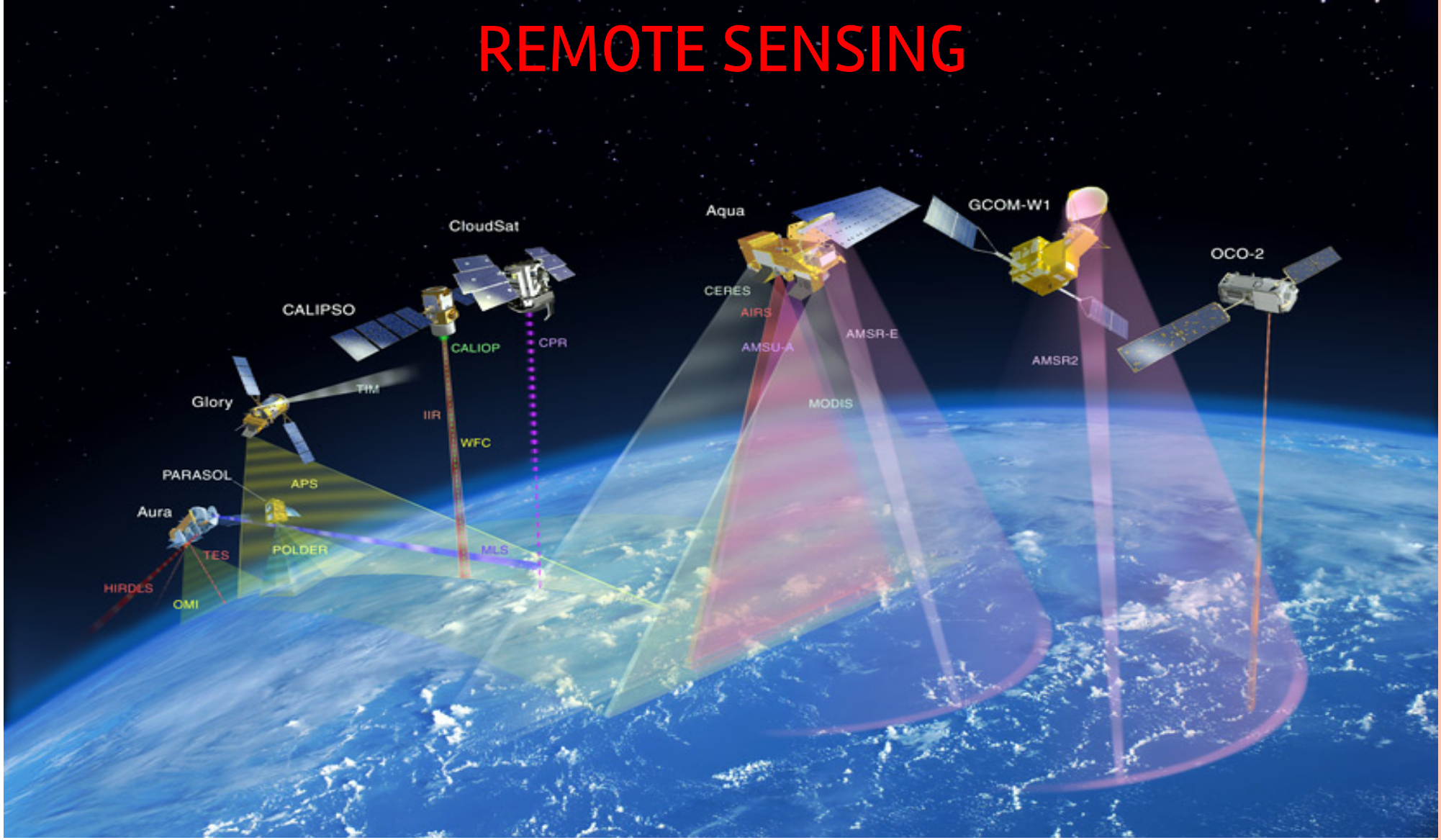
REMOTE SENSING



Md. Ashraful Imran

Lecturer

Department of Civil Engineering

Rajshahi University of Engineering & Technology (RUET)

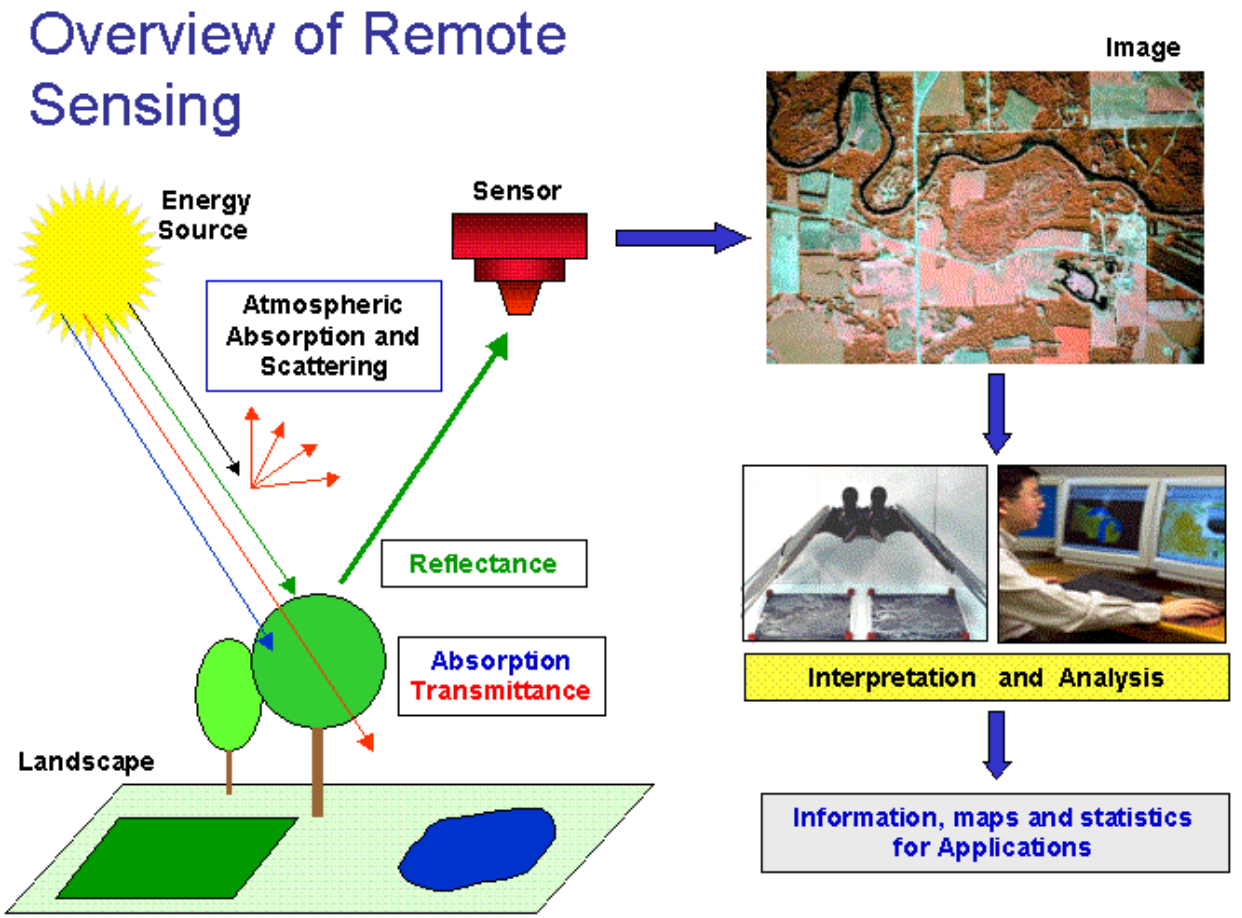
Rajshahi-6204, Bangladesh

❑ Contents

- Introduction and Definition
- Principles of Remote Sensing
- Classification of Remote Sensing
- Remote Sensing Observation Platform
- Electromagnetic energy
- Applications of Remote Sensing
- Advantages of Remote Sensing

Definition

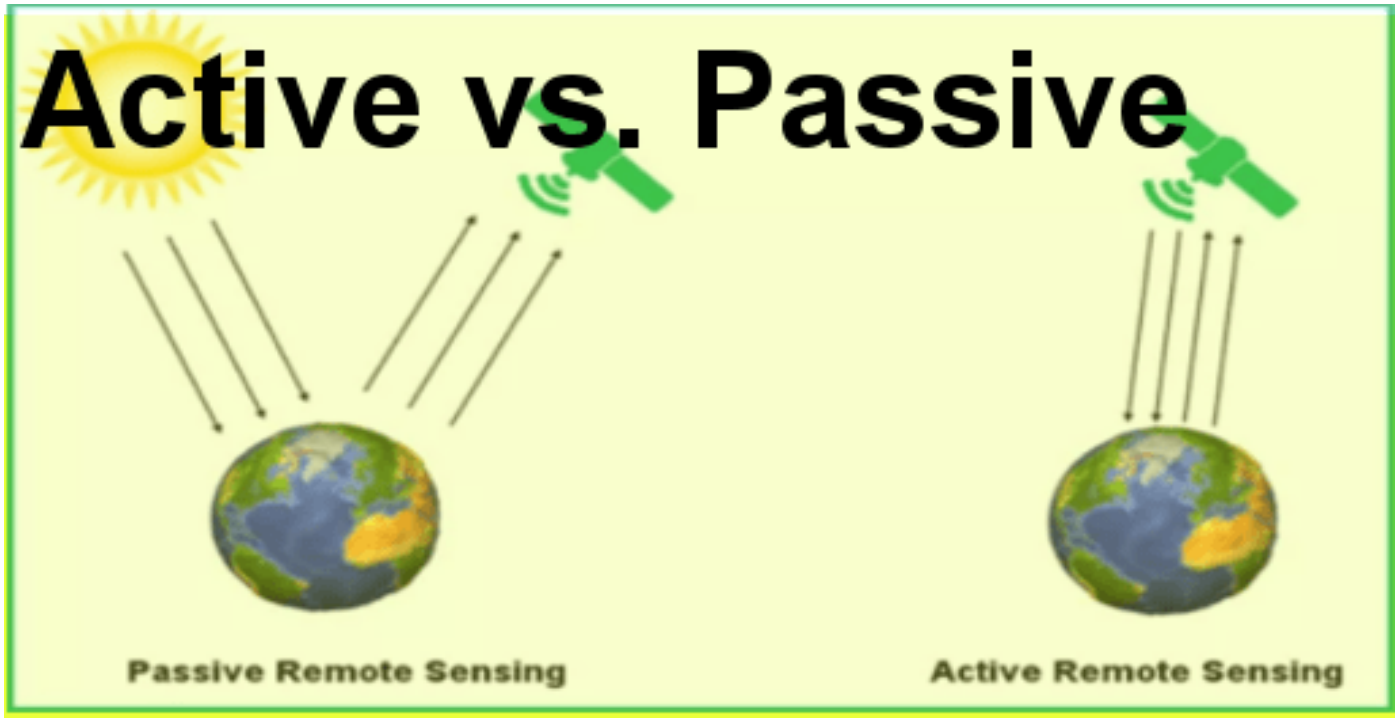
Remote sensing is the art or science of obtaining information about an object, an area or a phenomena, through analyzing of data collected by a given device or sensor that has no direct physical contact with the object, area or phenomena being investigated. In simple terms, remote sensing is the process of acquiring data or information about an object without any physical contact.



Classification of Remote Sensing

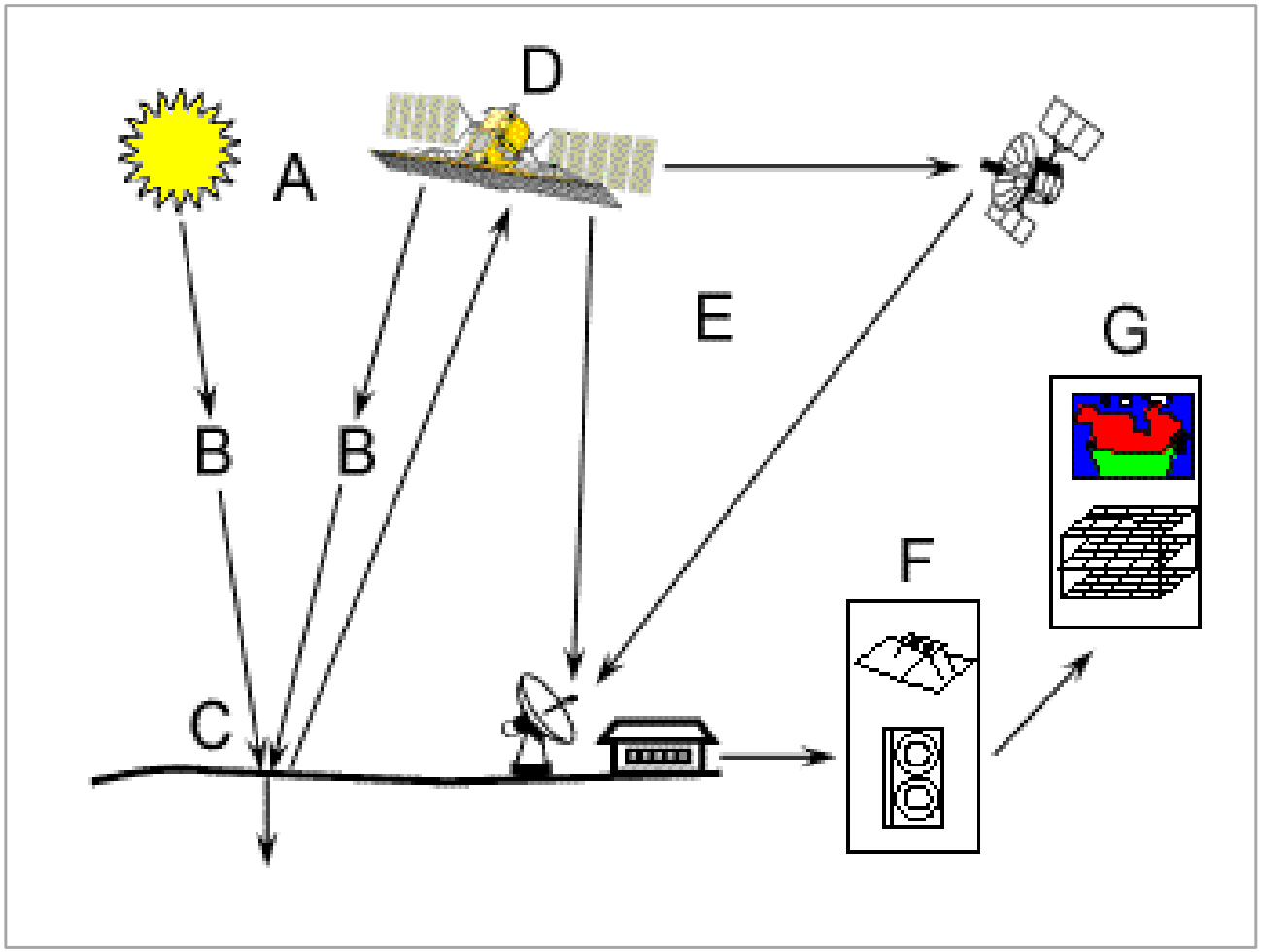
- **Remote sensing is broadly classified into two categories:**

1. Passive remote sensing: It uses sun as a source of EM energy and records the energy that is naturally radiated and/or reflected from the objects.
2. Active remote sensing: It uses its own source of EM energy, which is directed towards the object and return energy is measured.



Principles of Remote Sensing

Remote sensing involves the detection and measurement of the radiations of different wavelengths reflected or emitted from distant objects or materials, which helps in their identification and categorization. It offers the following basic components to measure:



Principles of Remote Sensing

1. **Energy Source or Illumination (A)** – the first requirement for remote sensing is to have an energy source which illuminates or provides electromagnetic energy to the target of interest.

2. **Radiation and the Atmosphere (B) –** as the energy travels from its source to the target, it will come in contact with and interact with the atmosphere it passes through. This interaction may take place a second time as the energy travels from the target to the sensor.

3. **Interaction with the Target (C)** – once the energy makes its way to the target through the atmosphere, it interacts with the target depending on the properties of both the target and the radiation.

4. **Recording of Energy by the Sensor (D)** – after the energy has been scattered by, or emitted from the target, we require a sensor (remote – not in contact with the target) to collect and record the electromagnetic radiation.

5. **Transmission, Reception, and Processing (E)** – the energy recorded by the sensor has to be transmitted, often in electronic form, to a receiving and processing station where the data are processed into an image (hardcopy and/or digital).

Principles of Remote Sensing

6. **Interpretation and Analysis (F)** – the processed image is interpreted, visually and/or digitally or electronically, to extract information about the target which was illuminated.

7. **Application (G)** – the final element of the remote sensing process is achieved when we apply the information we have been able to extract from the imagery about the target in order to better understand it, reveal some new information, or assist in solving a particular problem.

Remote Sensing Observation Platform

Remote sensing platforms

- There are three main categories of remote sensing platforms

Commonest platforms

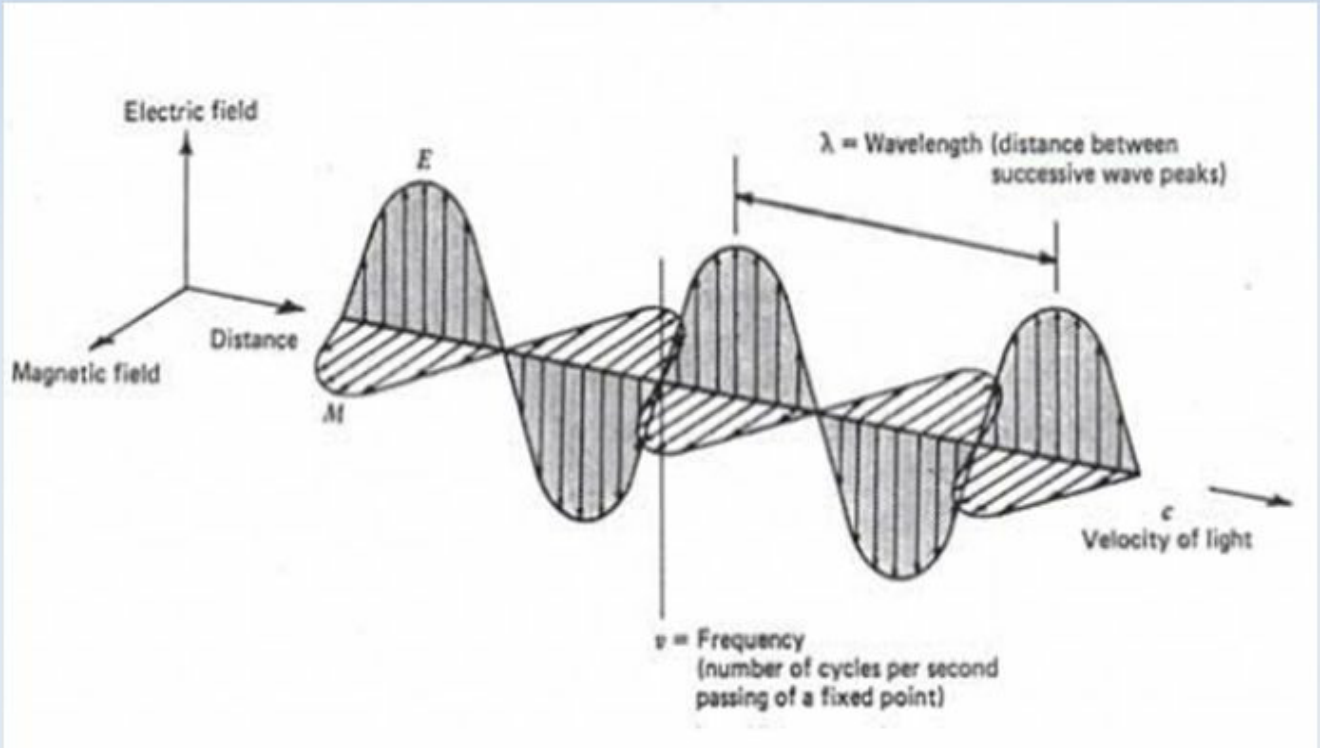
Spaceborne
- Satellite
- Shuttle

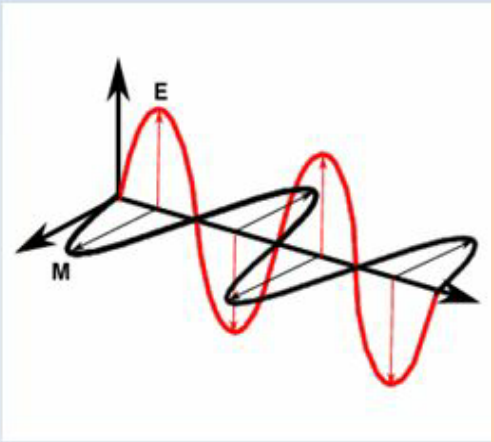
Airborne
- Aeroplane
- Helicopter
- Hot air balloon
- Air ship
- Tethered balloon

Ground-based
- Hand-held
- Raised platform

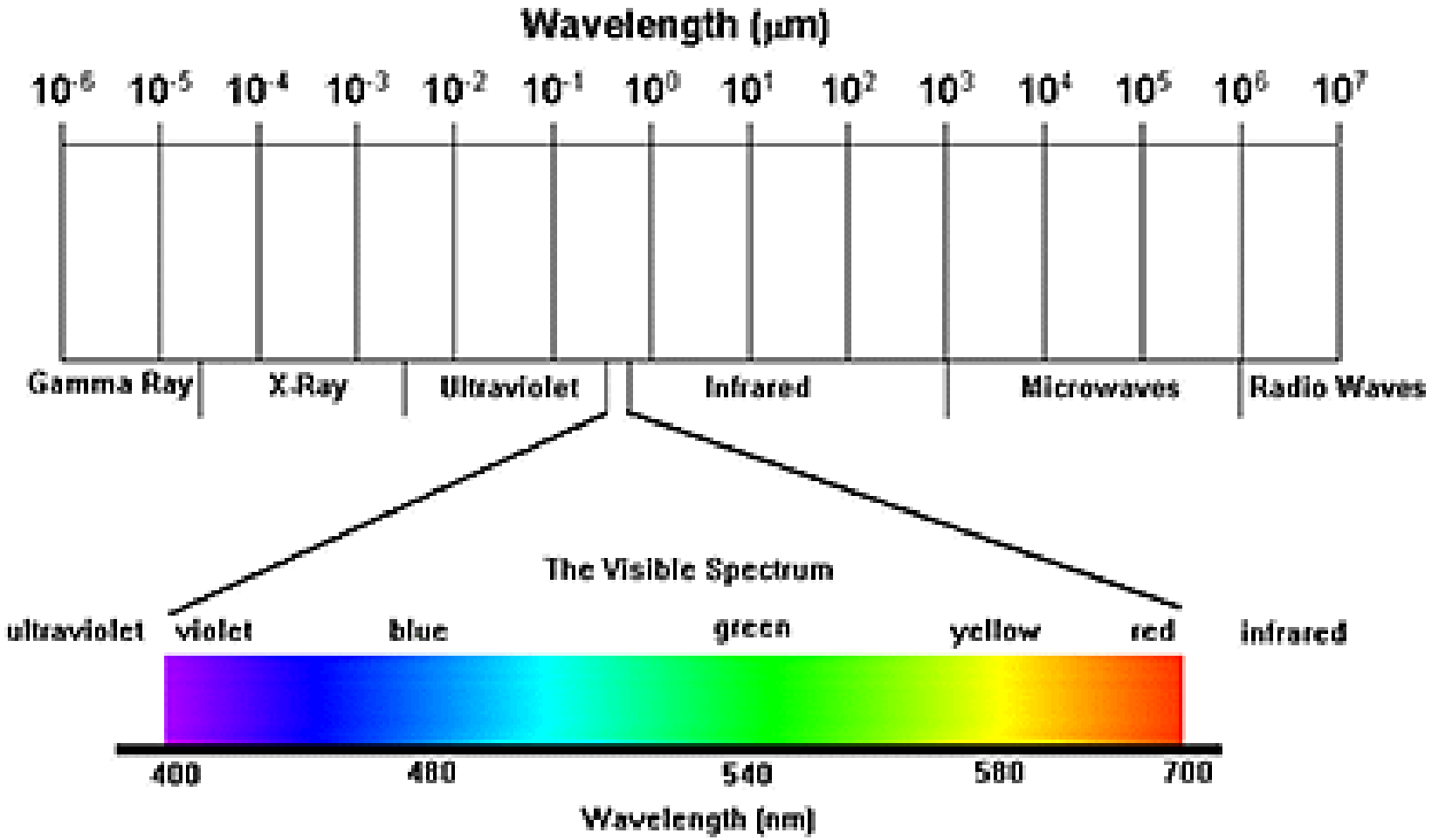
Electromagnetic radiation

- Electromagnetic radiation (EMR) describes the way in which high-frequency energy (visible light, radio waves, heat, ultraviolet rays and X-rays) is transferred from one object to another through space.
- The sun is the main source of electromagnetic radiation (EMR)
- The electromagnetic radiation is normally used as an information carrier in remote sensing.





Wavelength region and their application in remote sensing



Wavelength region and their application in remote sensing

Band	Wavelength	Nominal Spectral Location	Principal Applications
1	0.45-0.52	Blue	Useful for coastal water mapping as it is designed for water body penetration. Also useful for forest type mapping, soil/ vegetation discrimination, and cultural feature identification.
2	0.52-0.60	Green	Useful for vegetation discrimination and vigor assessment as designed to measure green reflectance peak of vegetation. Also useful for identification of cultural feature.
3	0.63-0.69	Red	Aiding in plant species differentiation, as it is designed to sense in a chlorophyll absorption region. Also useful for identification of cultural feature.
4	0.76-0.90	Near infrared	Useful for determination of vegetation types, vigor, and biomass content, for soil moisture discrimination and for delineating water bodies.
5	15.5-1.75	Mid-infrared	Useful for determination of vegetation moisture content, soil moisture discriminations, and thermal mapping applications.
6	10.4-12.5	Thermal infrared	Useful in vegetation stress analysis, soil moisture discrimination, and thermal mapping applications.
7	2.08-2.35	Mid-infrared	Useful for discrimination of types of mineral and rock and determination of vegetation moisture content.

Application of Remote Sensing

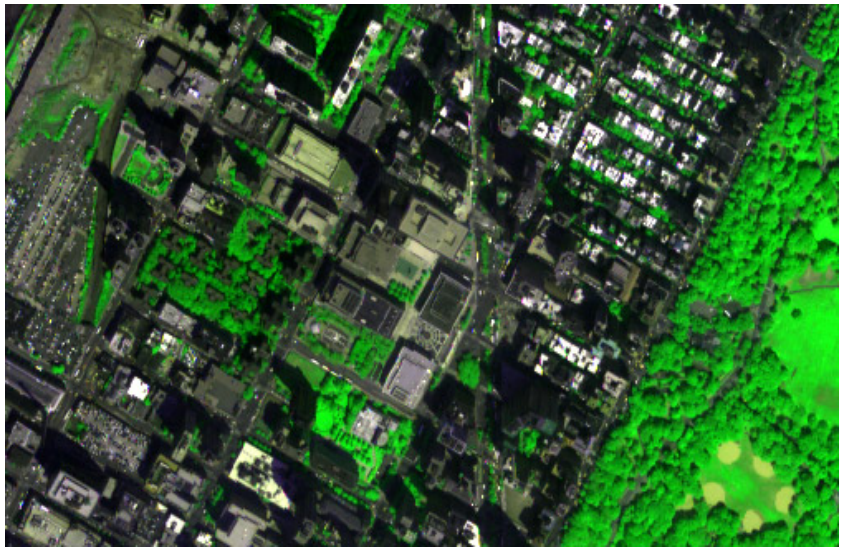
- Application in Agriculture

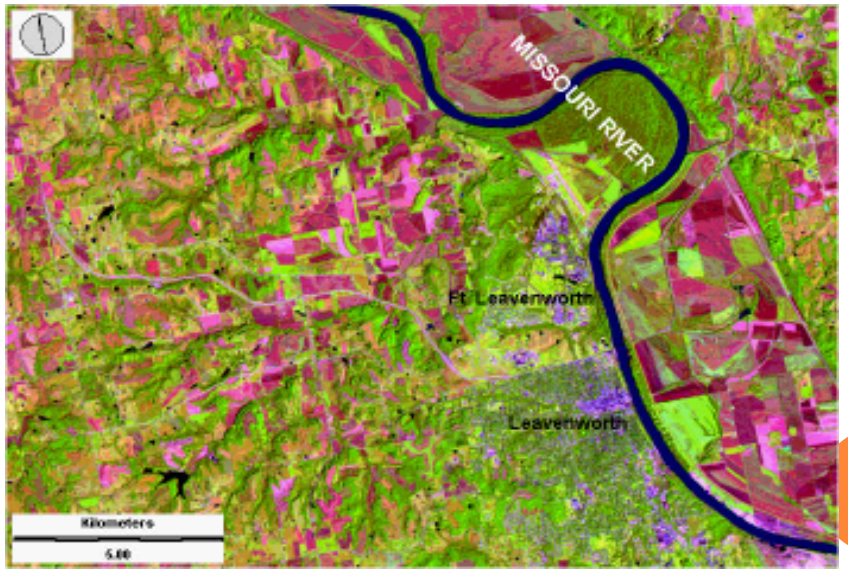
1. Crop identification
2. Crop acreage estimation
3. Crop condition assessment and stress detection
4. Identification of planting and harvesting dates
5. Crop yield modeling and estimation
6. Identification of pest and disease infestation
7. Soil moisture estimation
8. Irrigation monitoring and management
9. Soil mapping
10. Monitoring of droughts
11. Land cover and land degradation mapping
12. Identification of problematic soils

Application of Remote Sensing

- Urbanization & Transportation

  - Urban planning
  - Roads network and transportation planning
  - City expansion
  - City boundaries by time

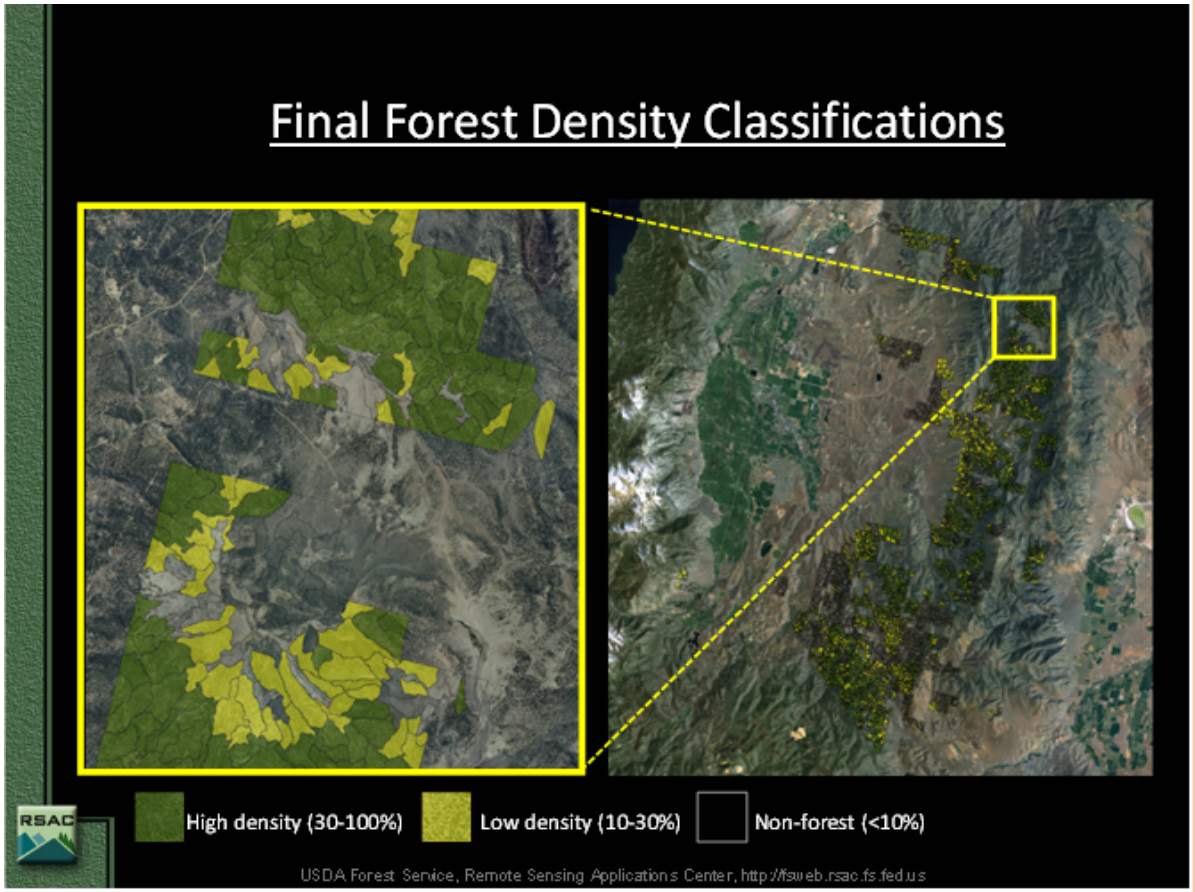




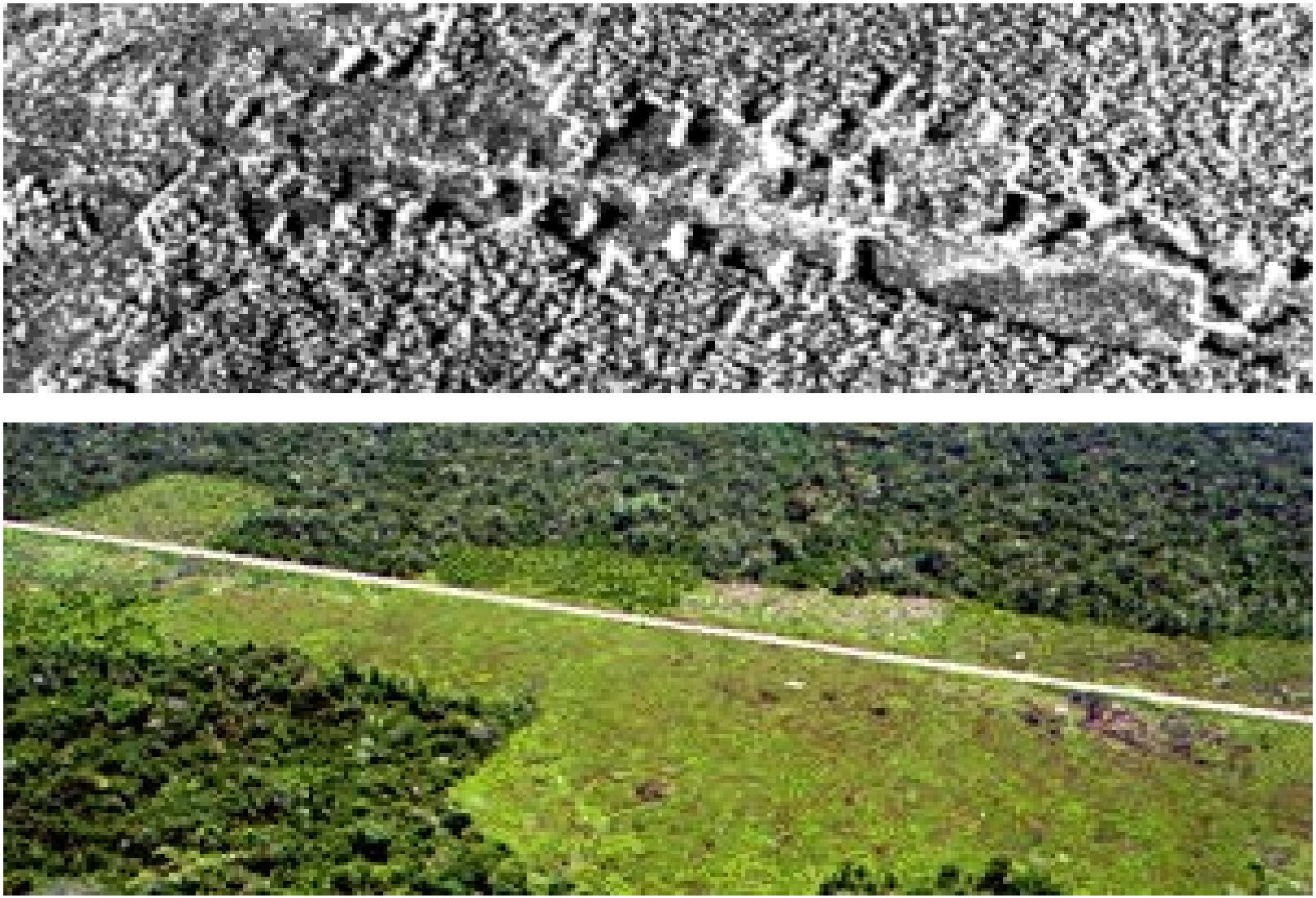
Application of Remote Sensing

❑ Natural resource Management

- Forestry: Monitoring urban forestry, forest deforestation
- Water source management
- Habitat analysis
- Environmental assessment
- Impervious surface mapping
- Hydrology
- Mineral province
- Geomorphology



Satellite image of deforestation

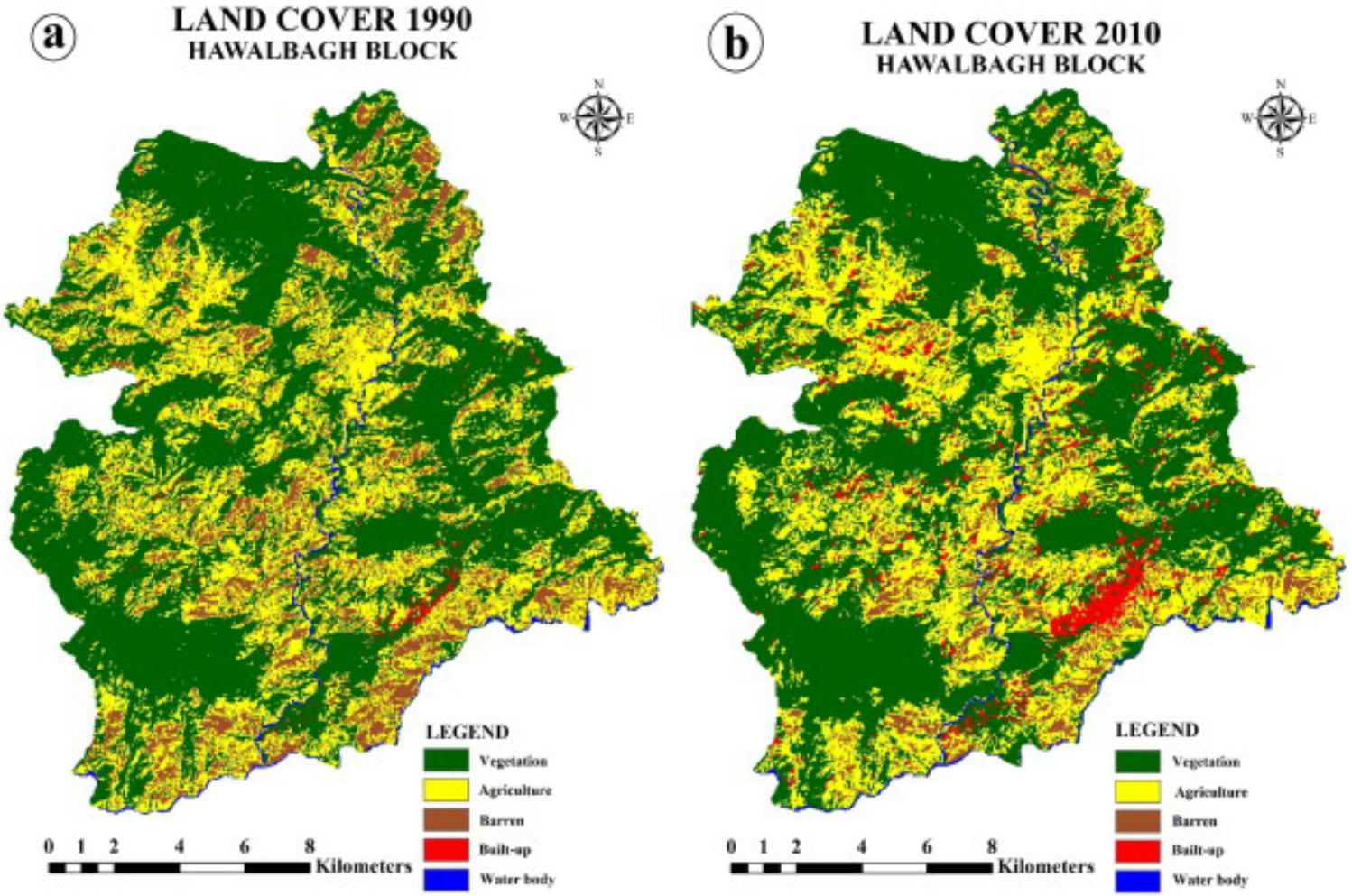


Comparison of an aerial photograph (bottom) with a radar image (top) of deforestation along a road

Application of Remote Sensing

❑ Land use

Land cover means any surface cover on the ground which can include vegetation, urban infrastructure, water, lake, mountain, transportation networks, buildings or any other. The attributes measured by remote sensing techniques relate to land cover, from which land use can be inferred, particularly with ancillary data or a priori cognition.



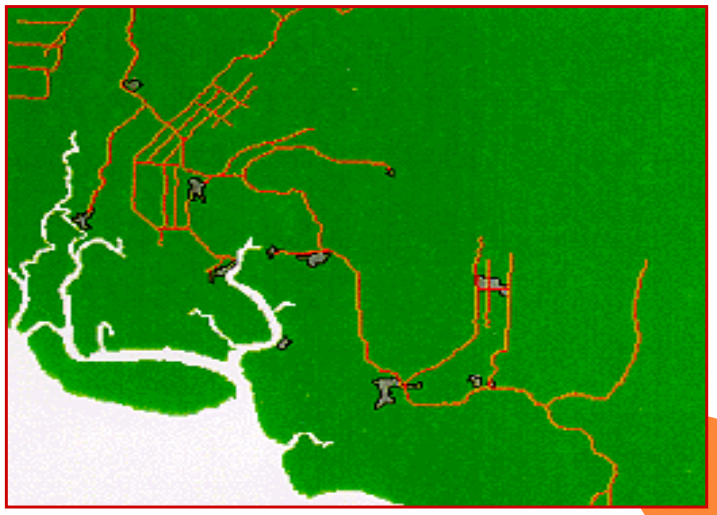
Application of Remote Sensing

- Mapping

Generating different maps from remotely sensed data can be so effective and valuable. A classification of sensing elements and methodologies to generate theses remotely sensed models are essential for mapping. Two primary methods of generating elevation data are:

1. Stereogrammetry techniques by air photos
2. Radar interferometry

Radar image of a continuously clouded area



Map with the road network

Advantages of Remote Sensing

- Provides a view for the large region
- Offers Geo-referenced information and digital information
- Most of the remote sensors operate in every season, every day, every time and even in real tough weather


THANK YOU ALL