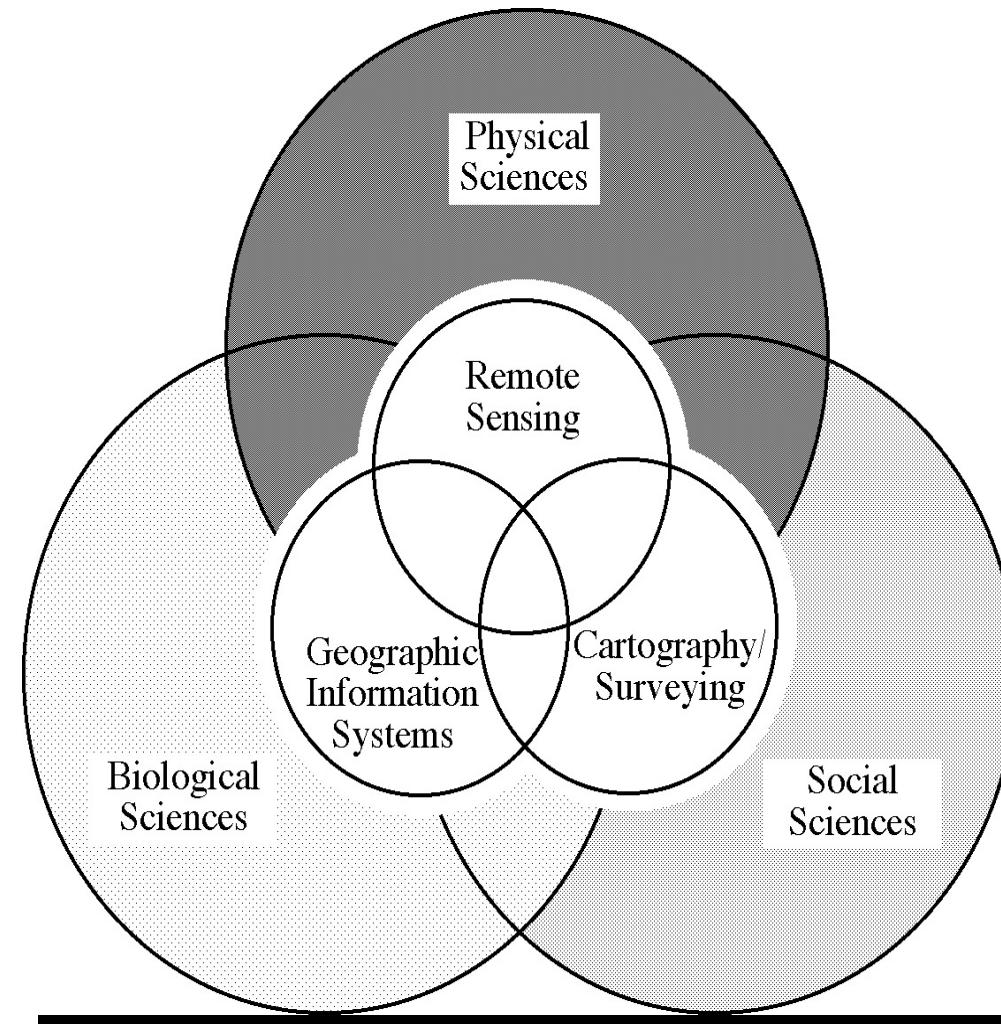


# Satellite Penginderaan Jauh dan Aplikasinya

By  
Fiolenta Marpaung

Rladies, 30 Juli 2022



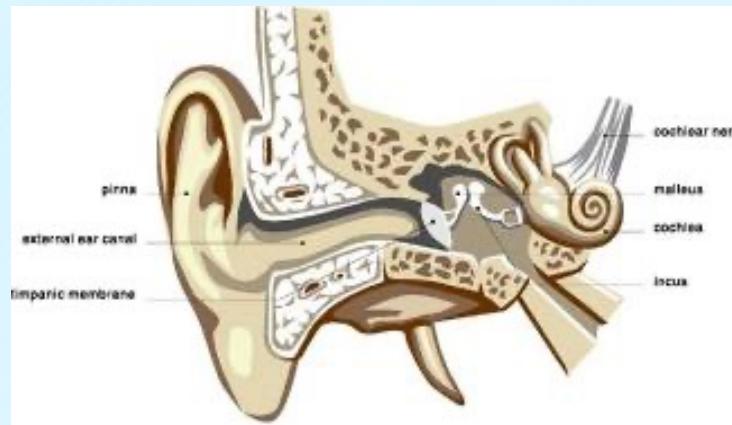
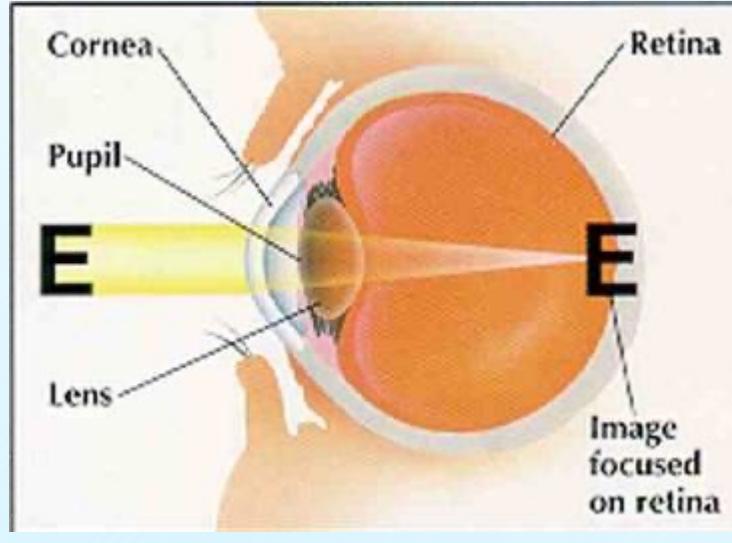


Source: Jensen (2000)

# Outline

- Remote Sensing (Penginderaan Jauh)
- Resolusi
- Tipe
- Aplikasi

# Contoh Sensor

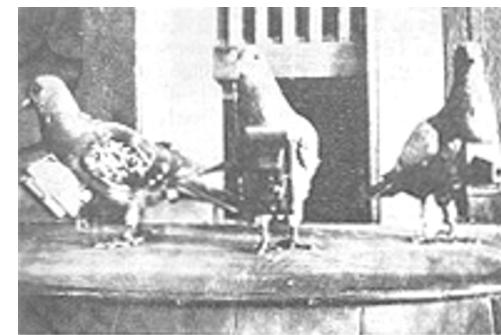


# Remote Sensing (Penginderaan Jauh)

- Penginderaan jauh adalah ilmu atau seni untuk **memperoleh informasi** tentang objek, daerah atau gejala, dengan jalan menganalisis data yang diperoleh **dengan menggunakan alat, tanpa kontak langsung** dengan objek, daerah atau gejala yang akan dikaji (Lillesand dan Kiefer, 1990).
- Penginderaan jauh merupakan upaya untuk memperoleh, menemunjukkan (mengidentifikasi) dan menganalisis objek dengan sensor pada posisi pengamatan daerah kajian (Avery, 1985).
- Penginderaan jauh merupakan teknik yang dikembangkan untuk memperoleh dan menganalisis informasi tentang bumi. Informasi itu berbentuk radiasi elektromagnetik yang dipantulkan atau dipancarkan dari permukaan bumi (Lindgren, 1985).

# Sejarah Penginderaan Jauh

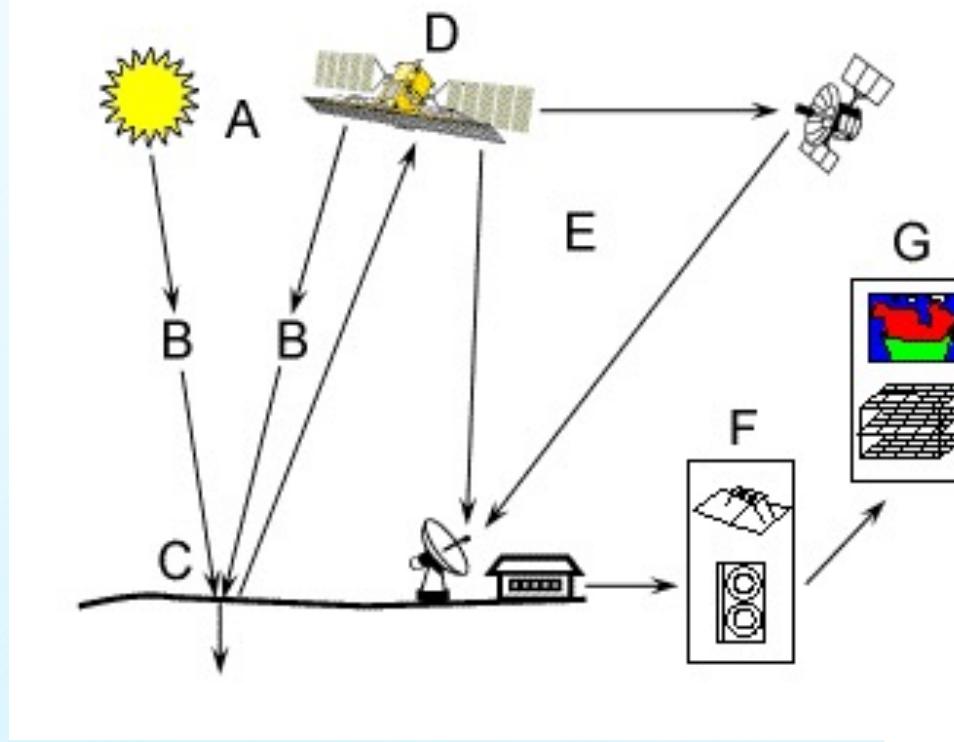
- Balloon photography (1858)
- Pigeon cameras (1903)
- Kite photography (1890)
- Aircraft (WWI and WWII)
- Space (1947)



Images: Jensen (2000)

Fig. 2-3. Pigeon photo.

# Remote Sensing Process Components



**Energy Source or Illumination (A)**

**Radiation and the Atmosphere (B)**

**Interaction with the Target (C)**

**Recording of Energy by the Sensor (D)**

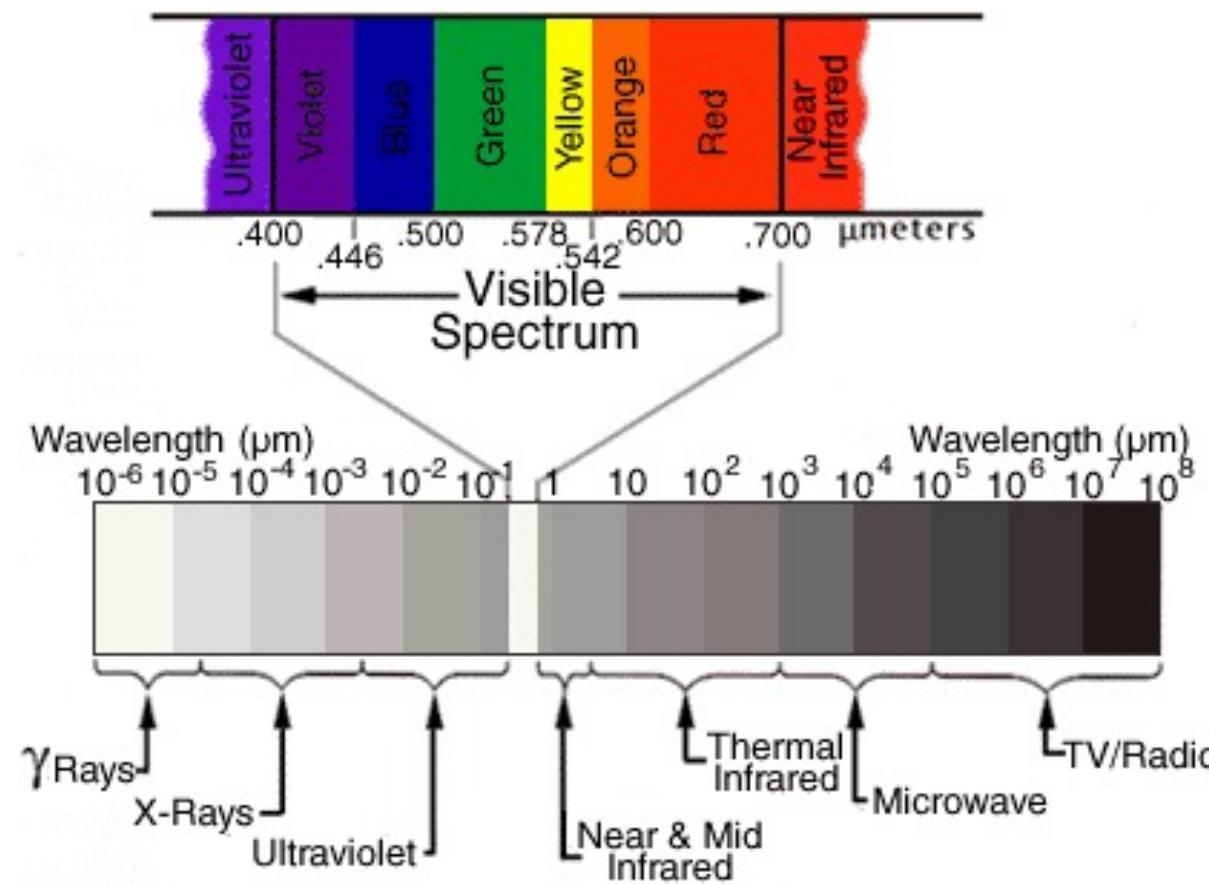
**Transmission, Reception, and Processing (E)**

**Interpretation and Analysis (F)**

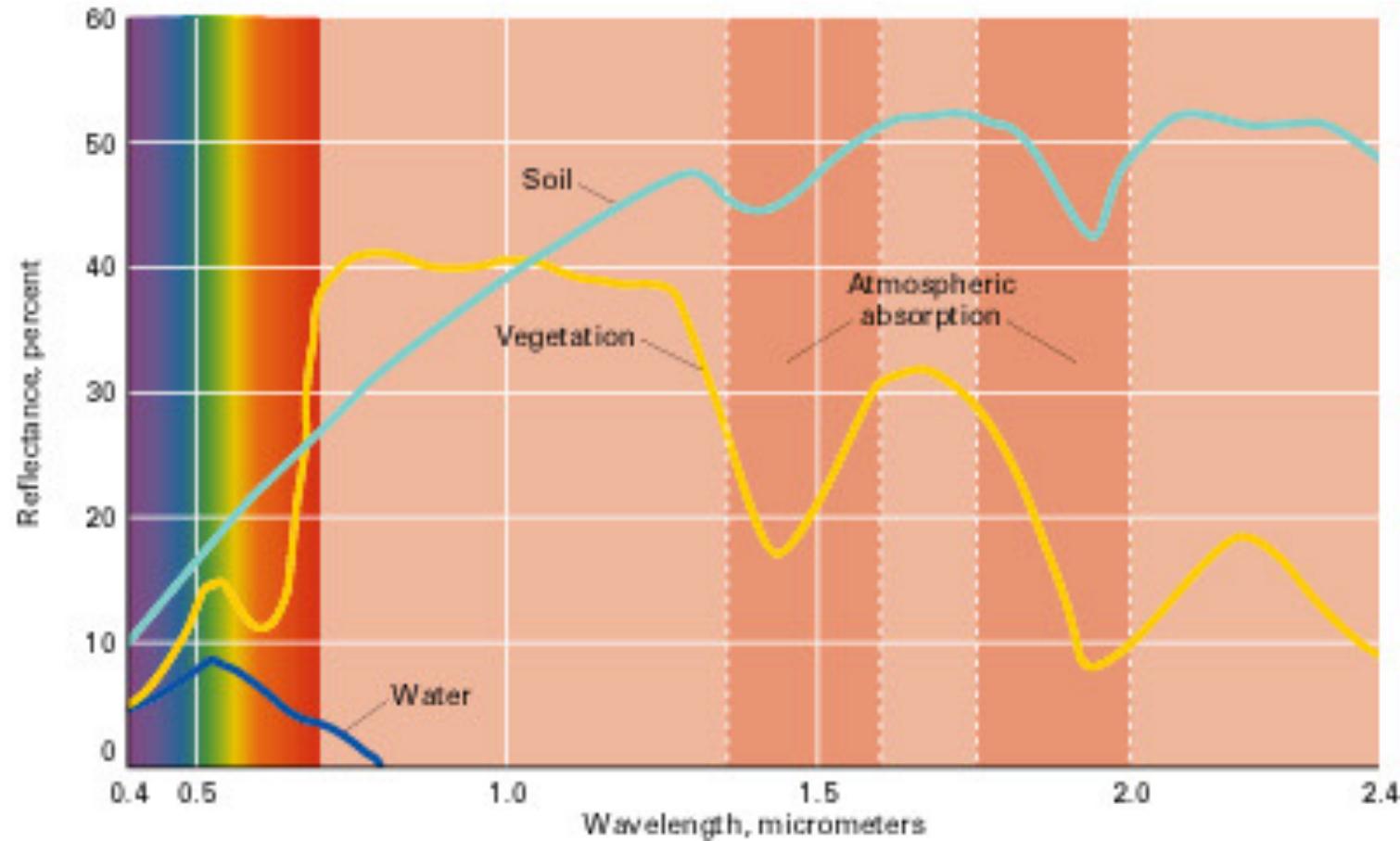
**Application (G)**

Source: Canadian Centre for Remote Sensing

# Electromagnetic Spectrum



# Signature Spectra

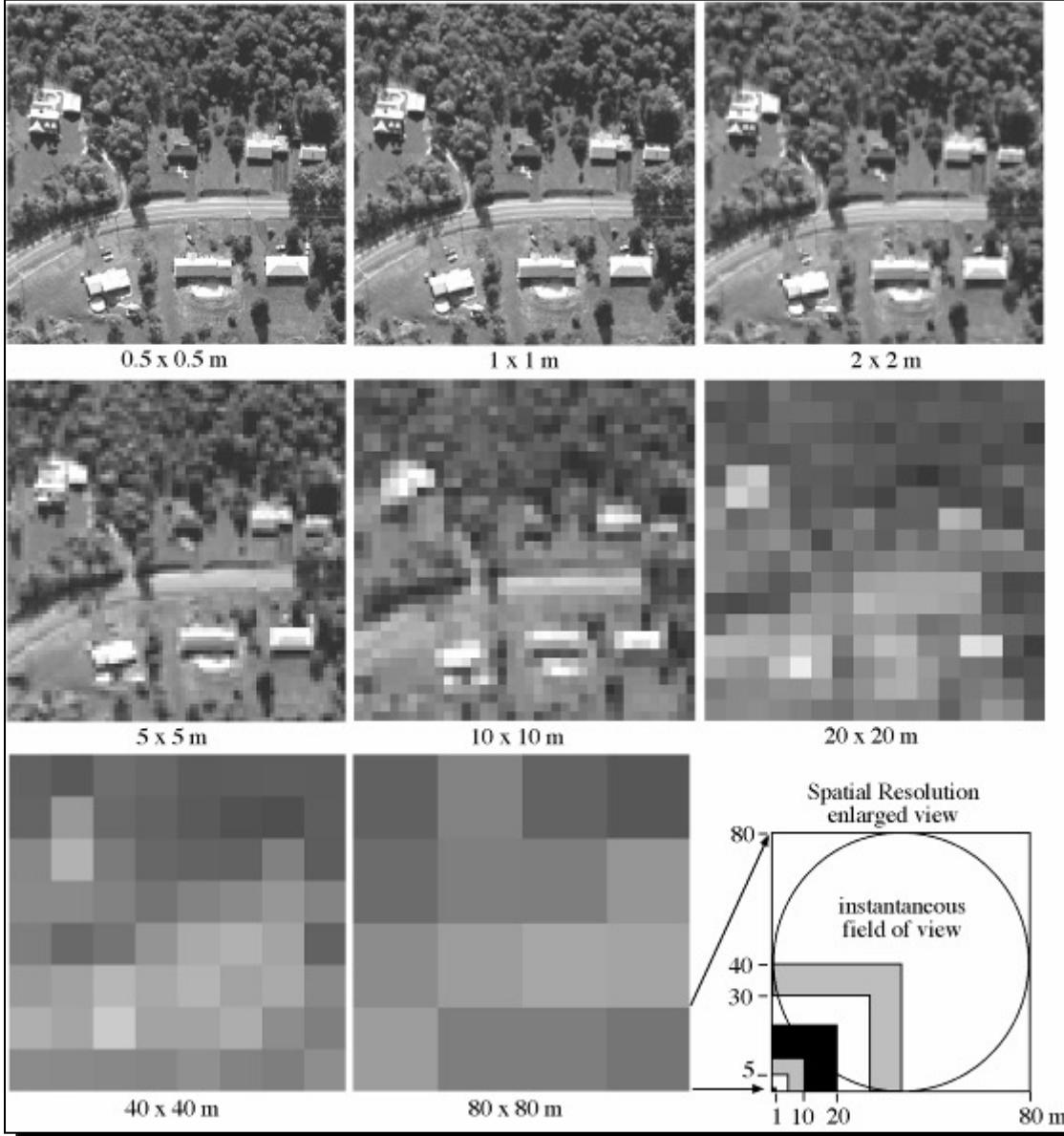


# Dasar Umum Penginderaan Jauh

- Semua sistem penginderaan jauh memiliki 4 tipe resolusi:
  - Spatial
  - Spectral
  - Temporal
  - Radiometric

# Spatial Resolution (Resolusi Spasial)

- Luas permukaan bumi yang ditutupi oleh piksel gambar dikenal sebagai resolusi spasial
- Area luas yang dicakup oleh satu piksel berarti resolusi spasial yang rendah, dan sebaliknya



## Spatial Resolution

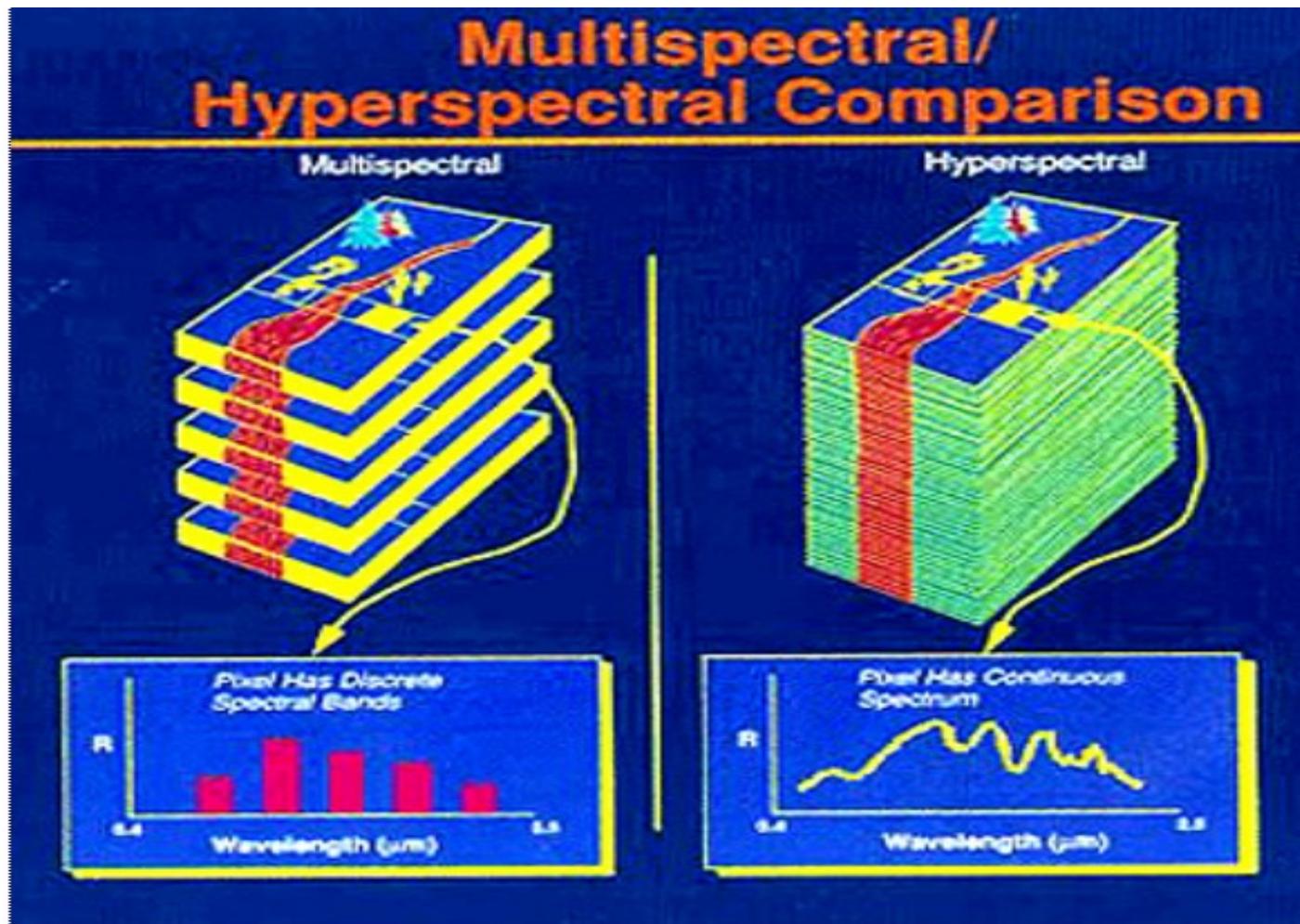
Tinggi vs. Rendah?

Source: Jensen (2000)

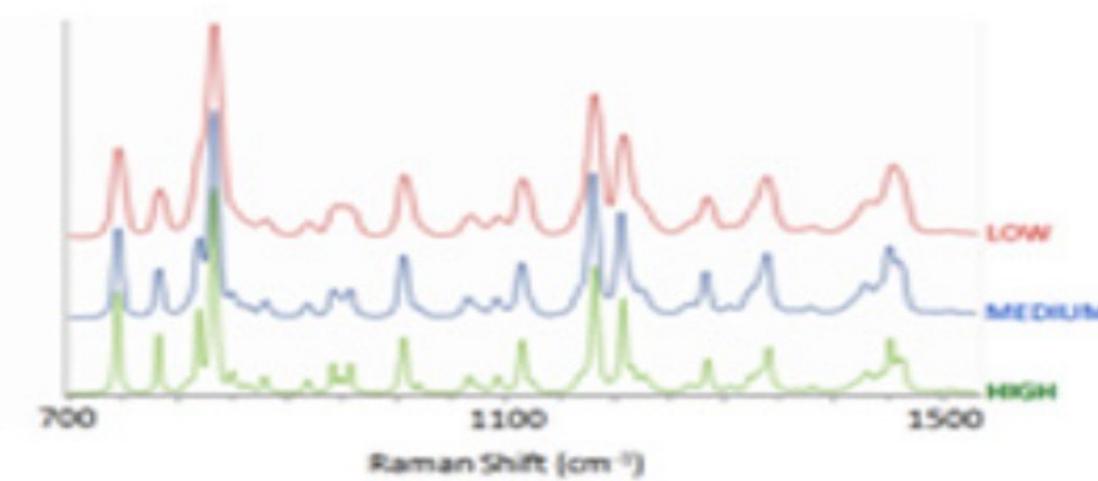
# Spectral Resolution (Resolusi Spektral)

- Kemampuan untuk menyelesaikan fitur spektral dan *band* spektral ke dalam komponen terpisah.
- Lebih banyak *band* dalam *bandwidth* yang ditentukan berarti resolusi spektral yang lebih tinggi, dan sebaliknya

# Spectral Resolution



# Spectral Resolution

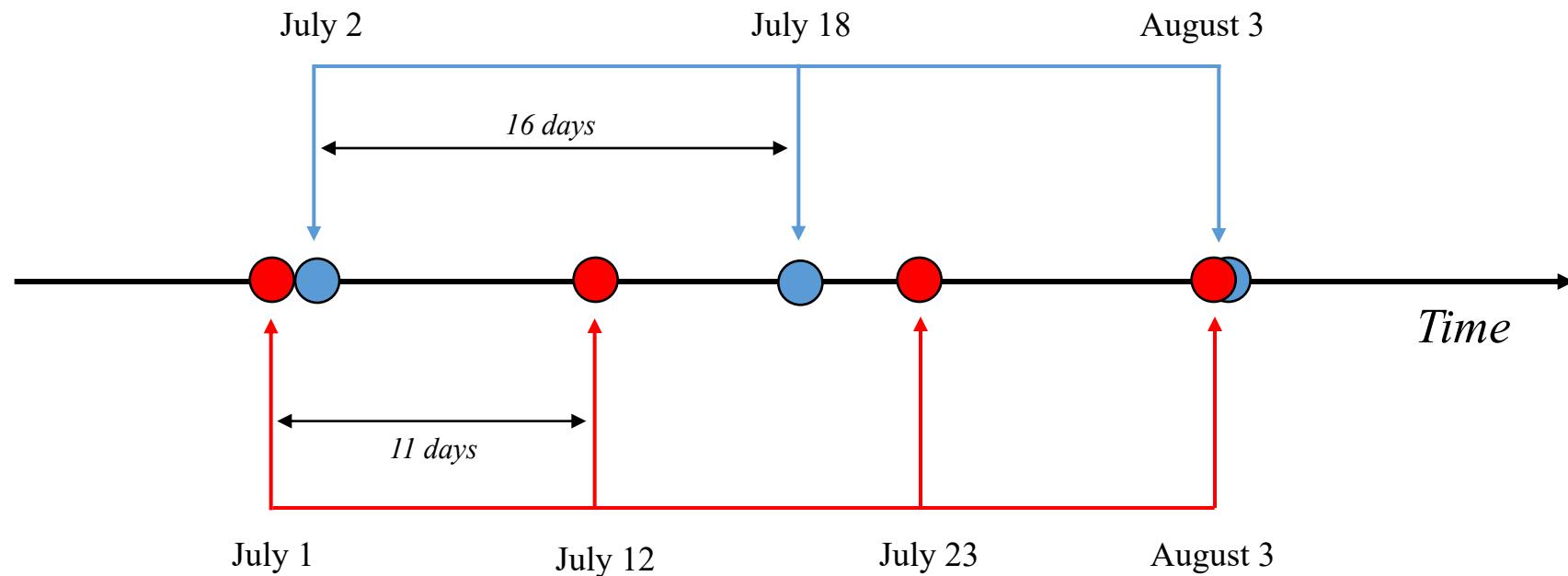


Tiga spektral yang direkam pada resolusi spektral rendah, sedang, dan tinggi, menggambarkan bagaimana mode resolusi tinggi menghasilkan puncak yang lebih tajam, dan memisahkan puncak berbaring yang dekat, yang digabungkan bersama pada resolusi rendah

# Temporal Resolution (Resolusi Waktu)

- Frekuensi di mana gambar direkam / ditangkap di tempat tertentu di bumi.
- Semakin sering ditangkap, semakin baik atau lebih halus resolusi temporal dikatakan
- Misalnya, sensor yang menangkap gambar lahan pertanian dua kali sehari memiliki resolusi temporal yang lebih baik daripada sensor yang hanya menangkap gambar yang sama seminggu sekali.

# Temporal Resolution (Resolusi Waktu)



# Radiometric Resolution

- Sensitivitas sensor terhadap besarnya energi elektromagnetik yang diterima menentukan resolusi radiometrik
- Semakin halus resolusi radiometrik sensor, jika lebih sensitif dalam mendekripsi perbedaan kecil dalam energi yang dipantulkan atau dipancarkan

# Radiometric Resolution

2-bit range  
0 → 4

6-bit range  
0 → 63

8-bit range  
0 → 255

10-bit range  
0 → 1023



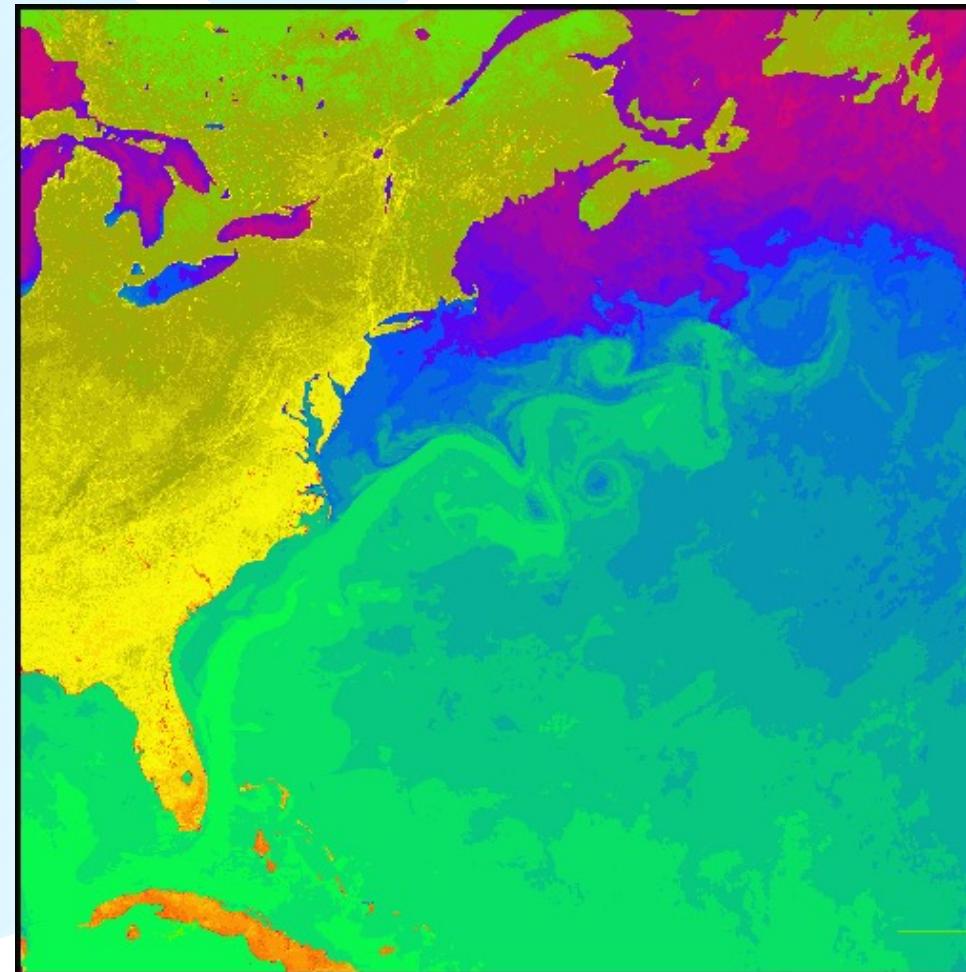
# Tipe Penginderaan Jauh

- Aerial Photography
- Multispectral
- Active and Passive Microwave and LIDAR

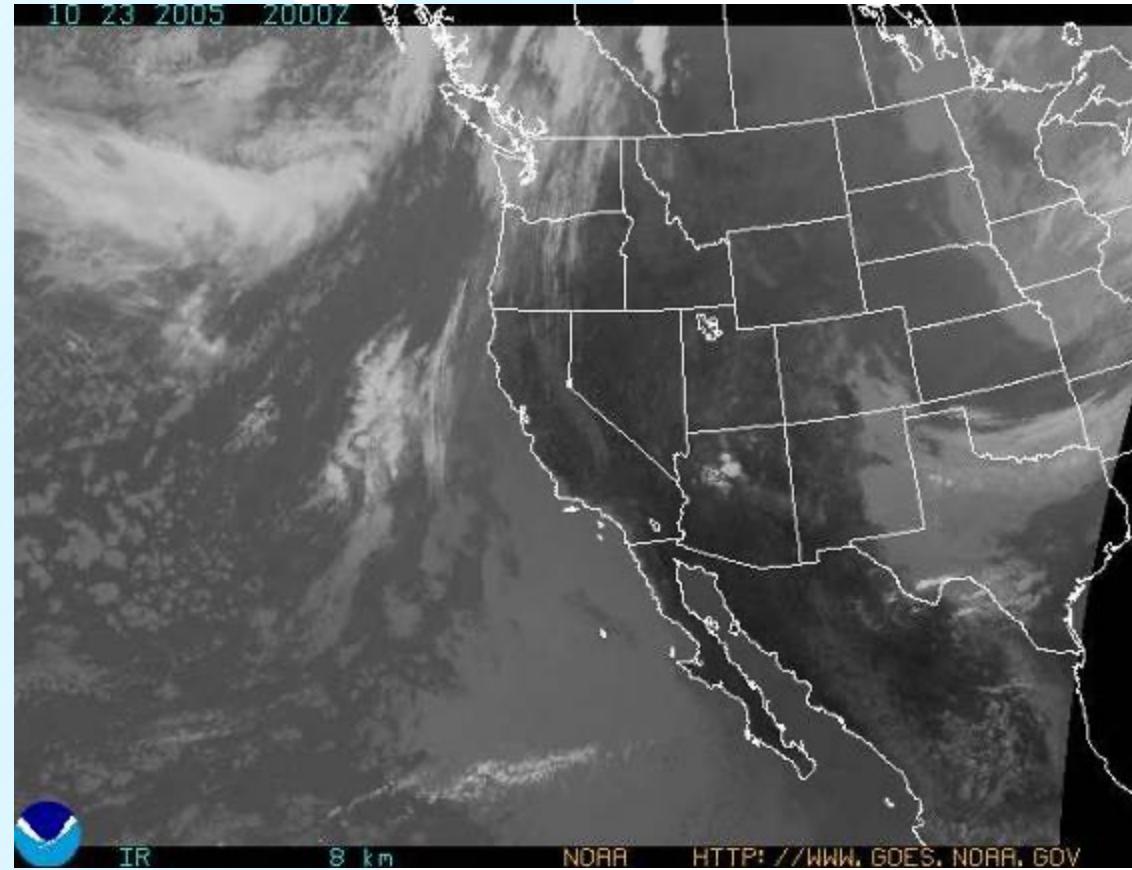
# Contoh satellites

- NOAA-AVHRR (1100 m)
- GOES (700 m)
- MODIS (250, 500, 1000 m)
- Landsat TM and ETM (30 – 60 m)
- SPOT (10 – 20 m)
- IKONOS (4, 1 m)
- Quickbird (0.6 m)

# AVHRR (Advanced Very High Resolution Radiometer) NASA



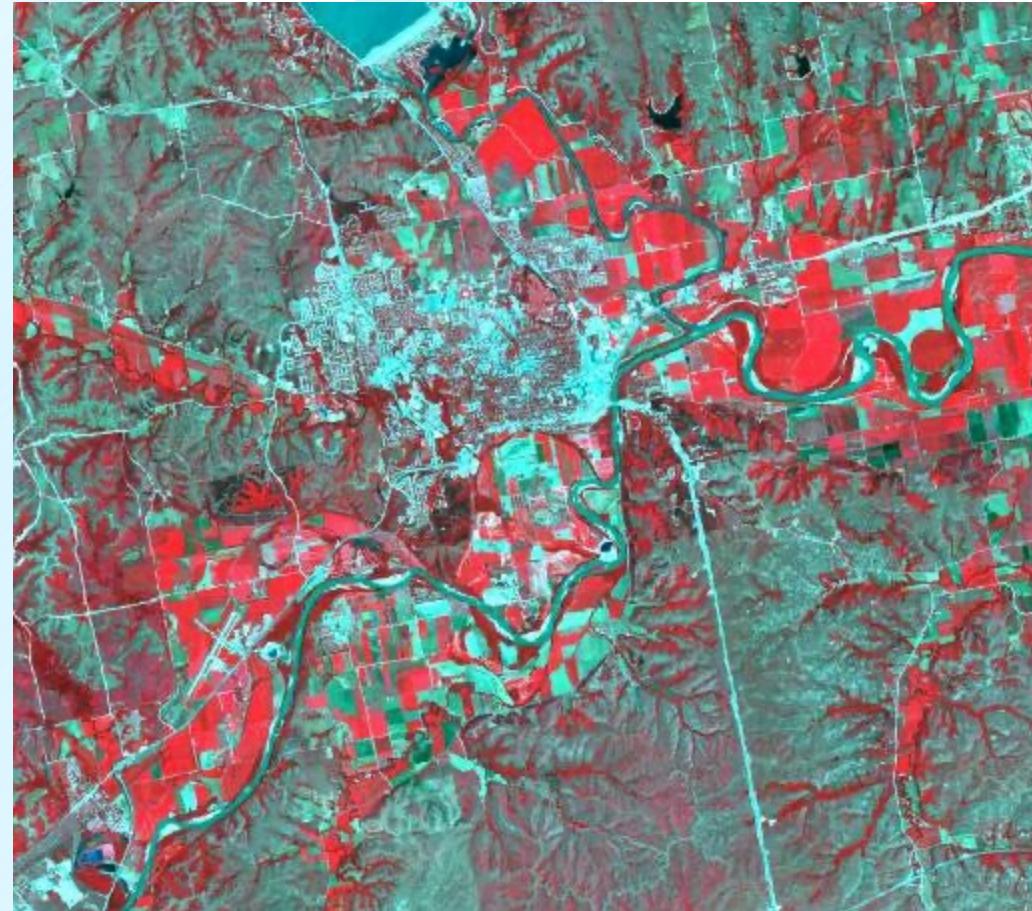
# GOES (Geostationary Operational Environmental Satellites) IR 4



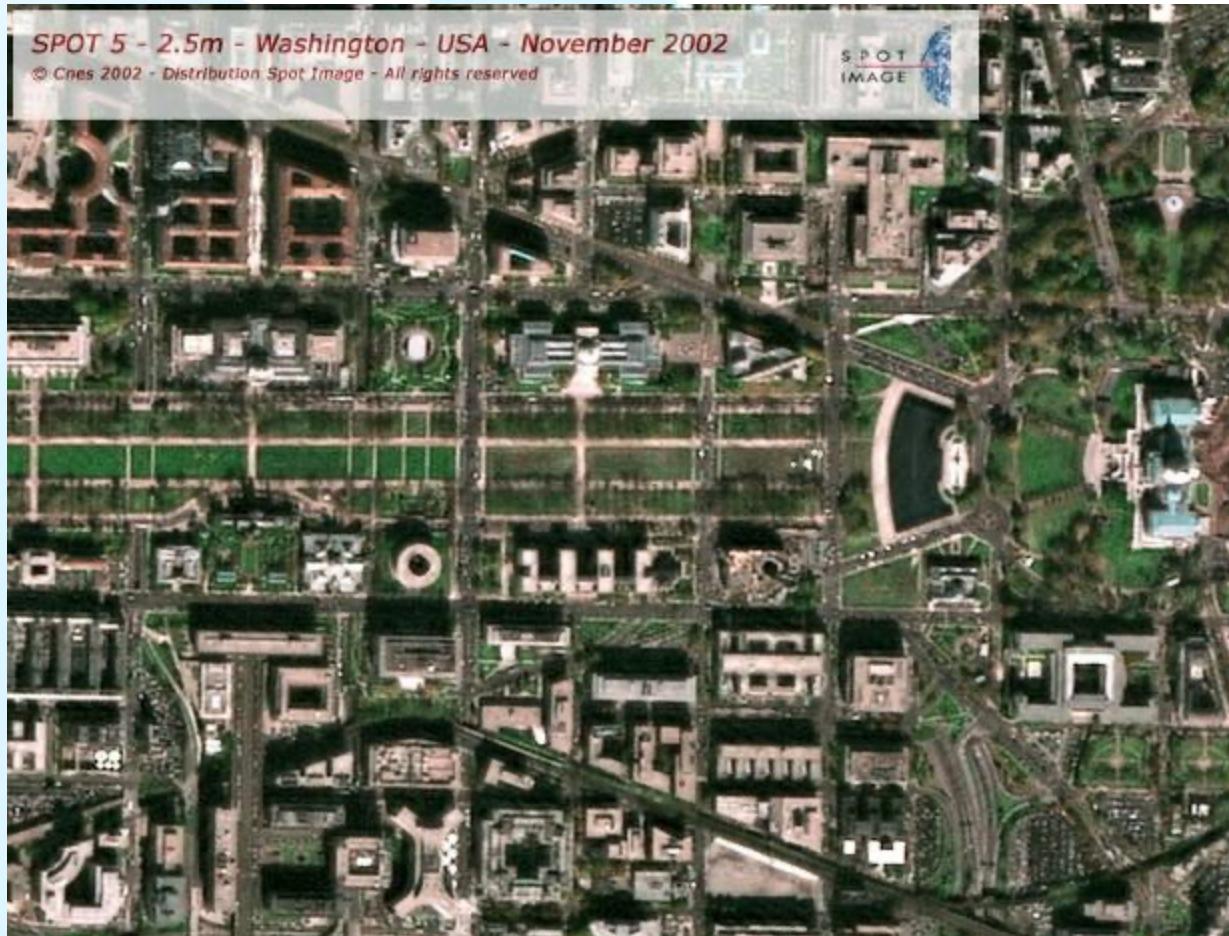
# MODIS (250 m)



# Landsat TM (False Color Composite)



# SPOT (2.5 m)



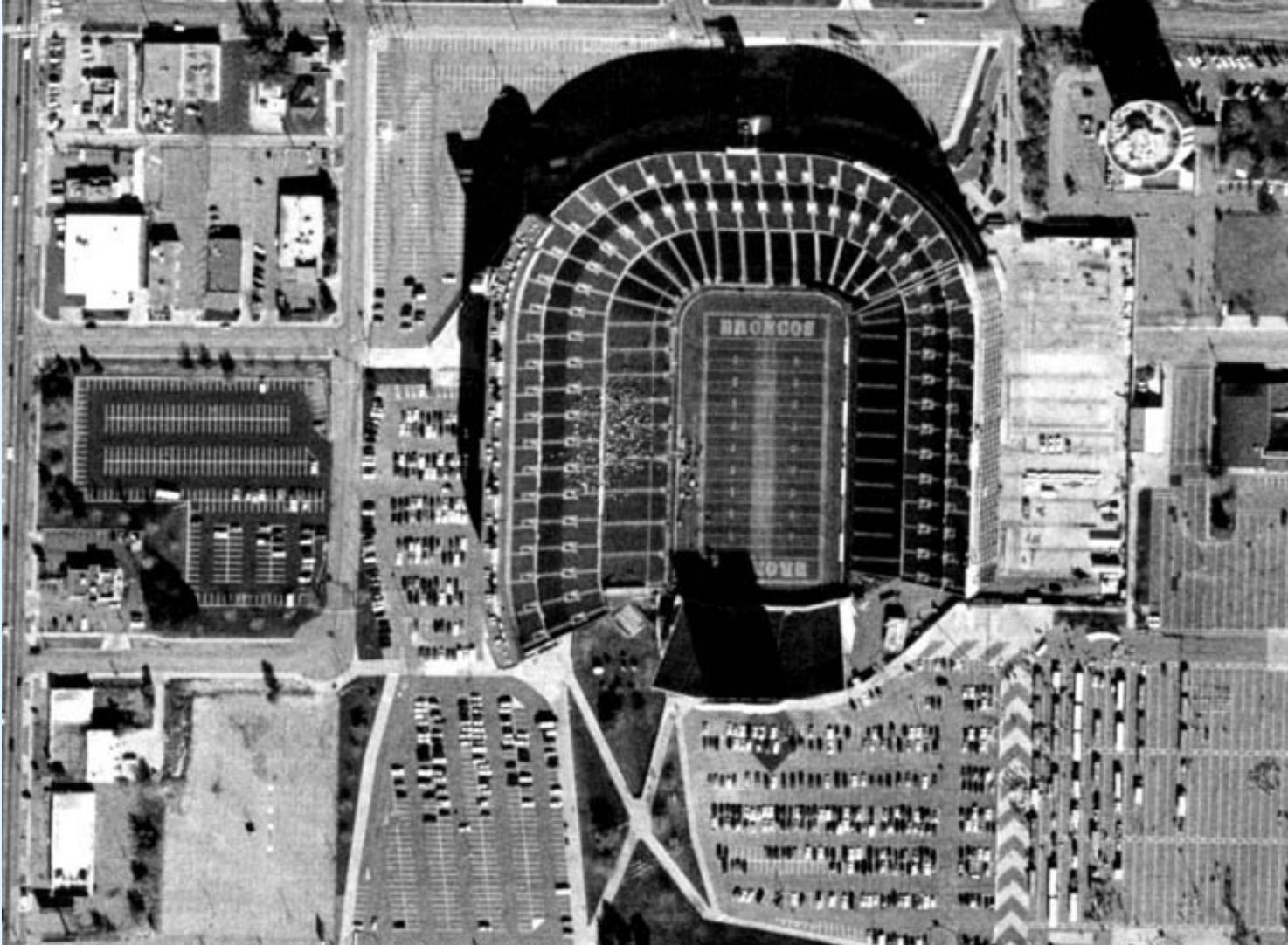
# QUICKBIRD (0.6 m)



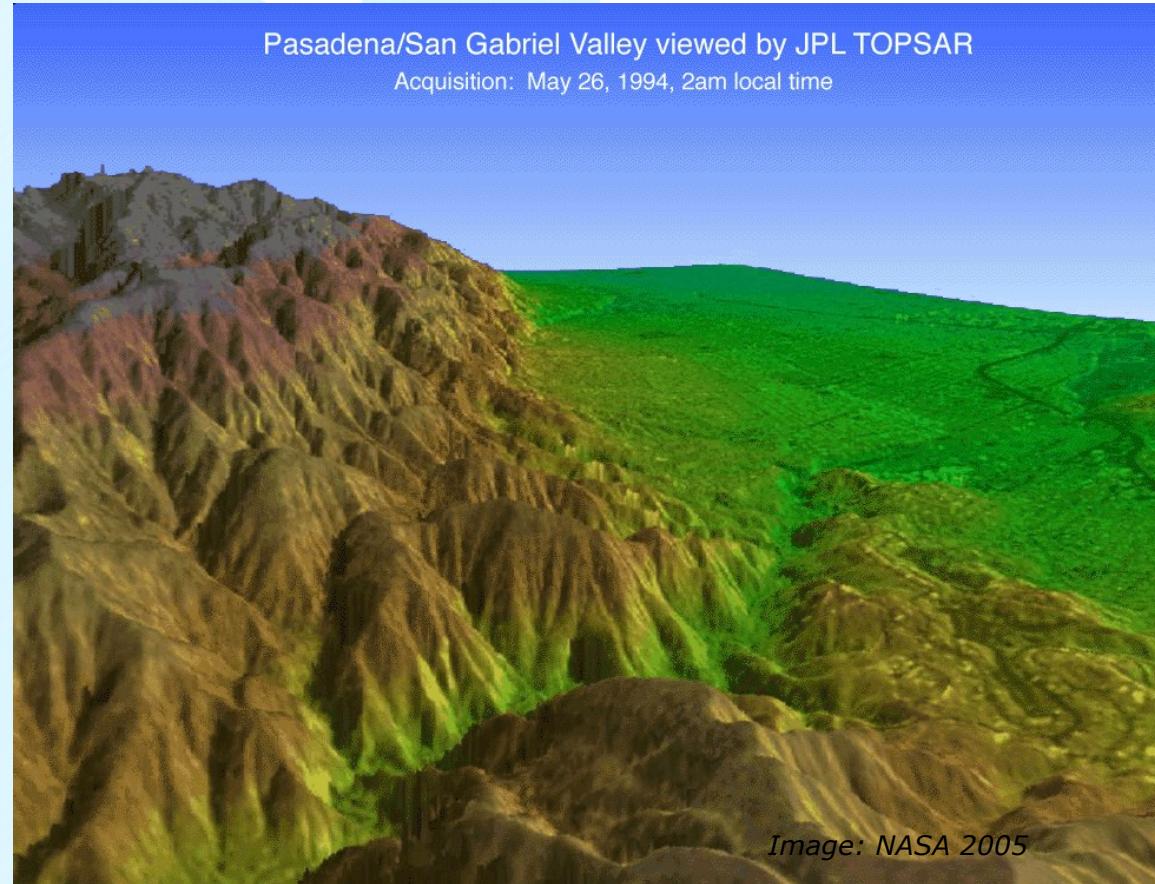
# IKONOS (4 m Multispectral)



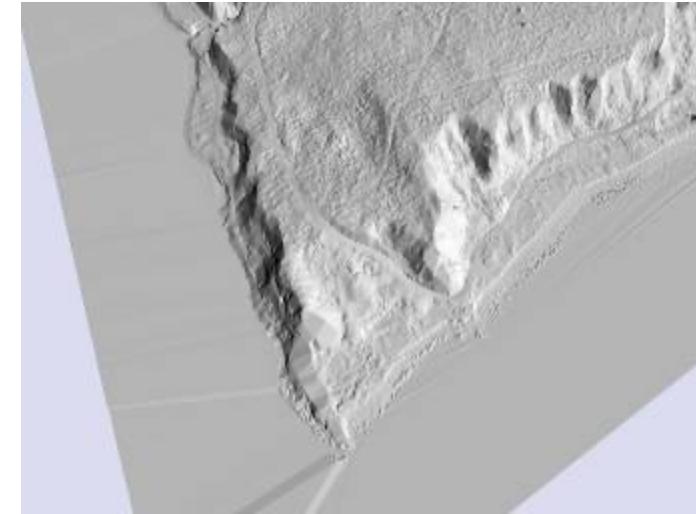
# IKONOS (1 m Panchromatic)



# RADAR (Radio Detection and Ranging)

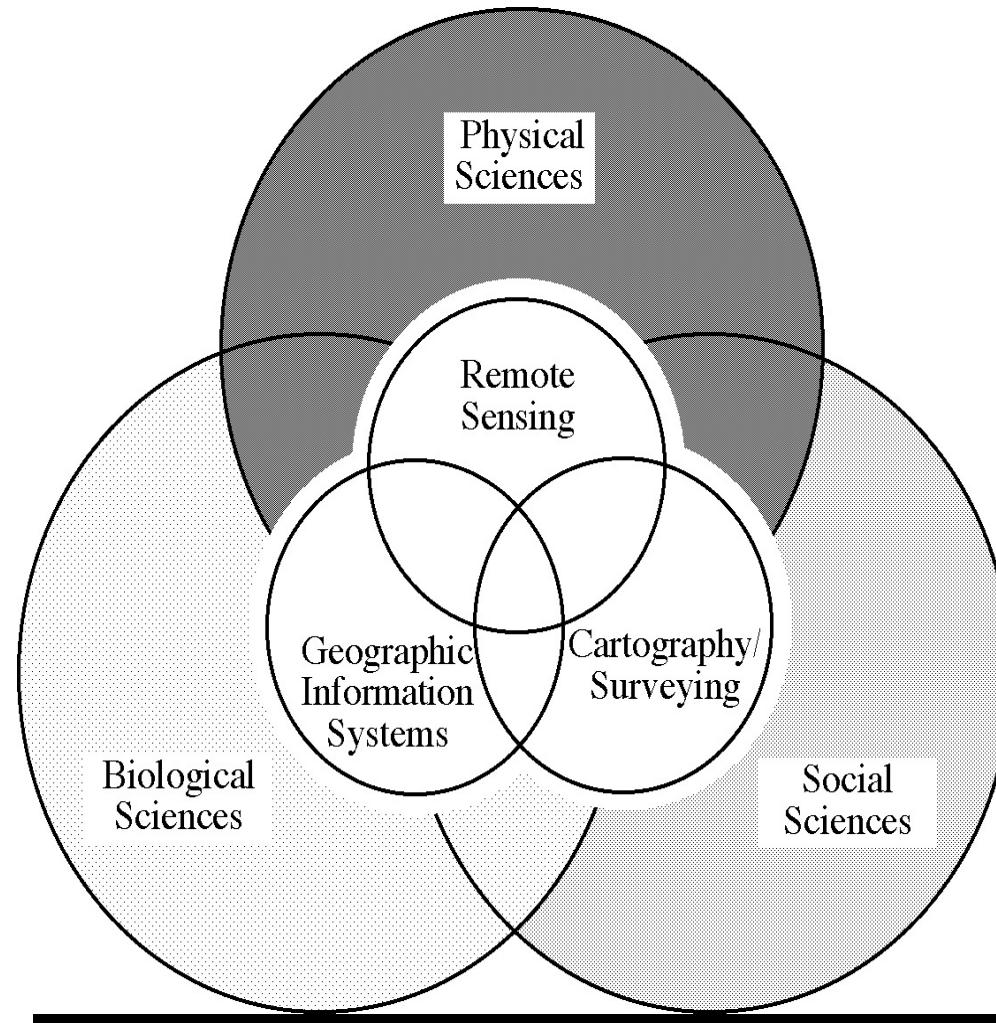


# LIDAR (Light Detection and Ranging)



*Image: Bainbridge Island,  
WA courtesy Puget Sound  
LIDAR Consortium, 2005*

# Domain



Source: Jensen (2000)

# Aplikasi

# Urban & Regional Planning

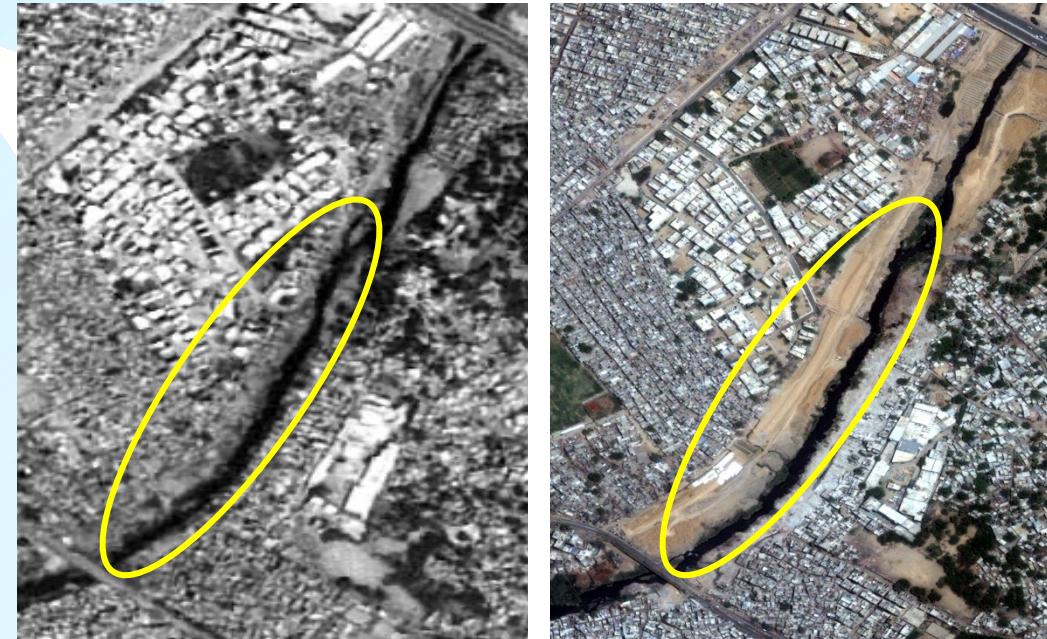
## Scope

- Mapping & updation of city/town maps
- Urban sprawl monitoring
- Town planning
- Facility management
- GIS database development

## Benefits

- Better decision support, planning & management
- Rapid information updation
- Infrastructure development monitoring
- Spatial information analysis

Lyari Express Way – Section (Essa Nagri)



# Agriculture

## Scope

- Crop acreage estimation
- Crop modeling for yield & production forecast / estimation
- Crop & Orchard monitoring

## Benefits

- Timely availability of crop statistics for decision making & planning
- Crop growth monitoring
- Soil status monitoring
- Regular reports regarding total area under cultivation



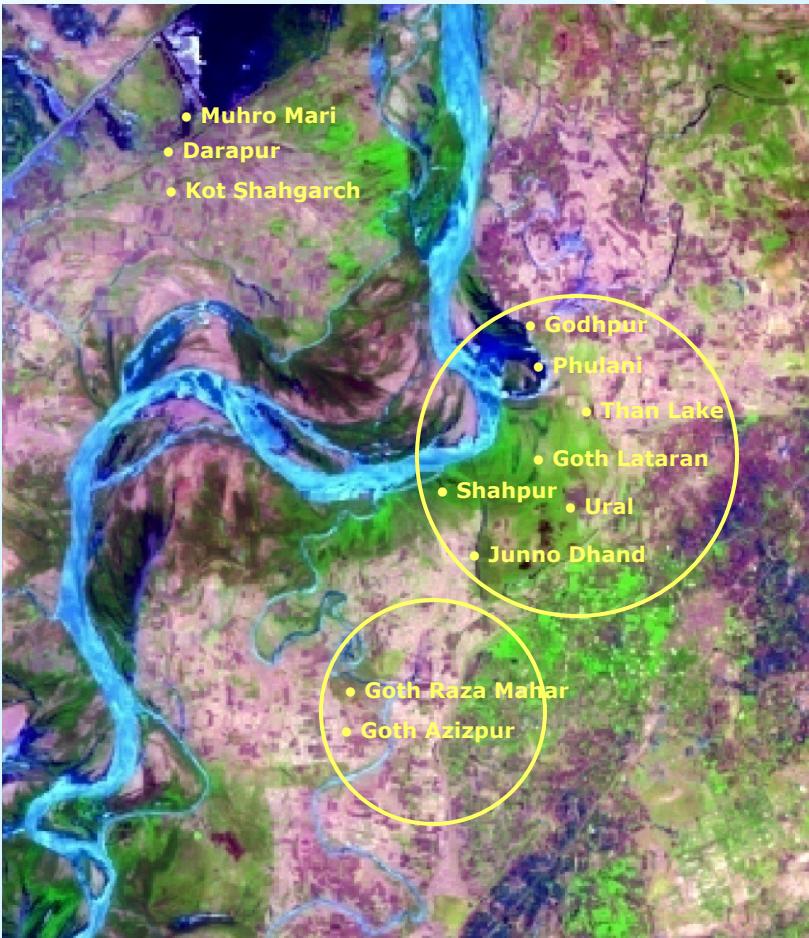
FFC Goth Macchi



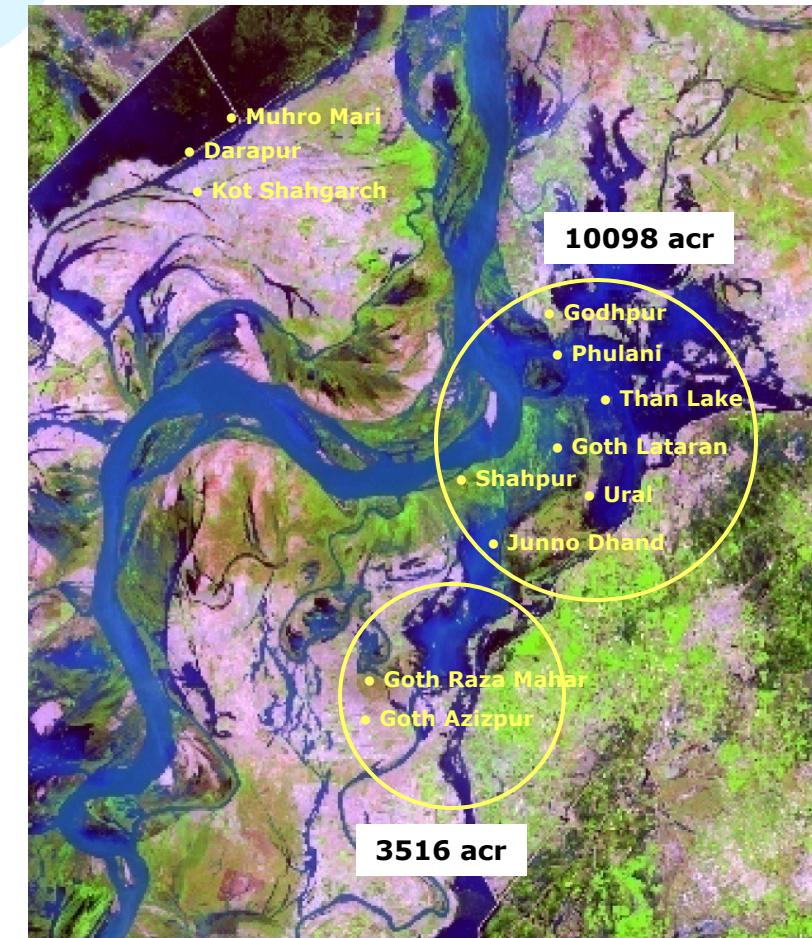
Banana Plantation – Muhammad Pur (Ghotki)

# Flood Damage to Standing Crops

Pre Flood – 17 July 2006



Post Flood – 09 Aug 2006



Sukkur

# Forestry

## Scope

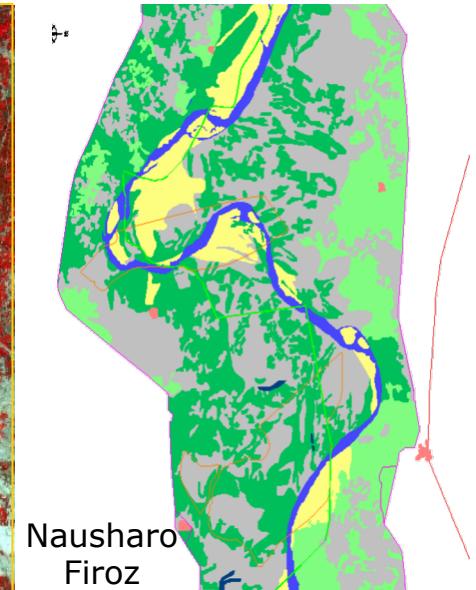
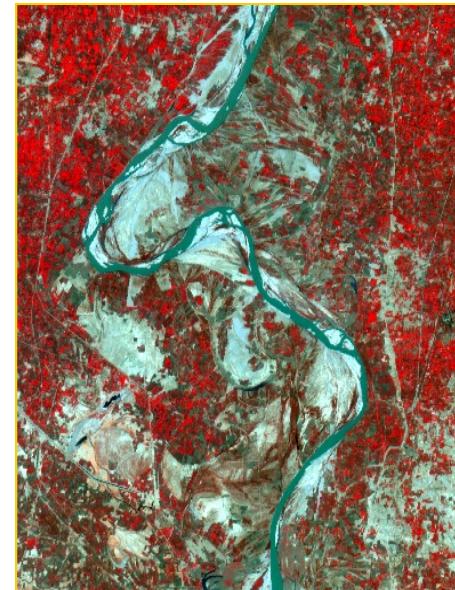
- Satellite image based forest resource mapping and updation
- Forest change detection
- Forest resource inventory
- GIS database development

## Benefits

- Availability of baseline information
- Planning for aforestation strategies
- Futuristic resource planning
- Sustainability of environment
- Wild life conservation & development for recreation purpose



Sarhad Reserve Forest (Ghotki)



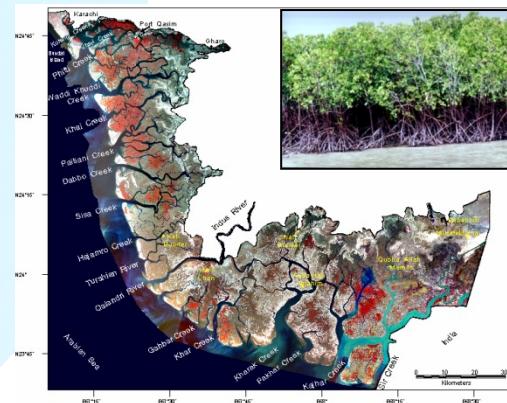
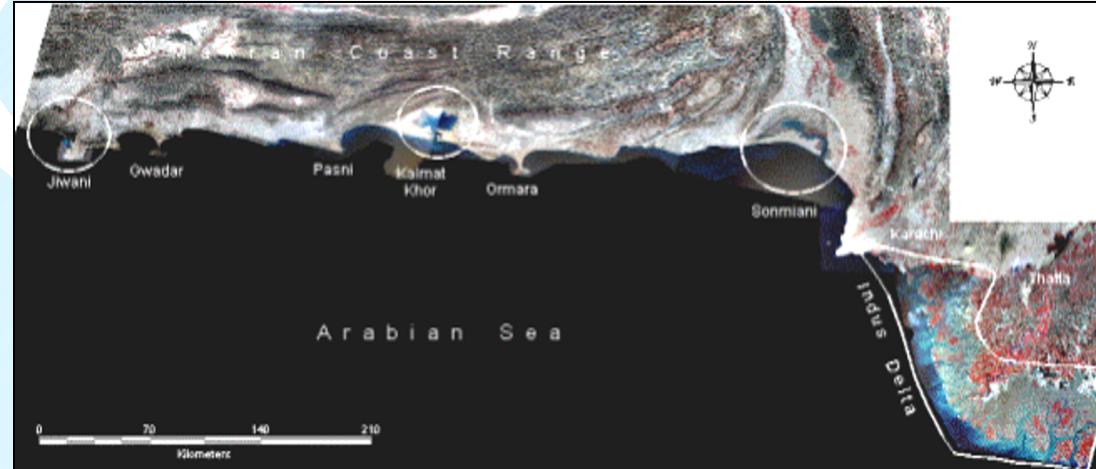
# Coast Resource Mapping

## Scope

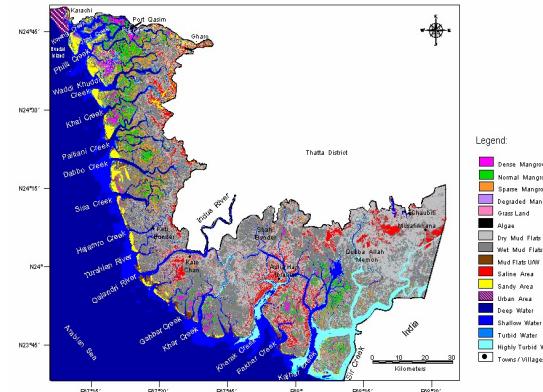
- Mangrove forest monitoring
- Change detection
- Hazard impacts
- Aqua-culture zones

## Benefits

- Availability of updated information on mangroves forest
- Planning strategies for aforestation and deforestation trend
- Timely Intervention in specific areas as and when needed



Satellite image



Mangroves forest map

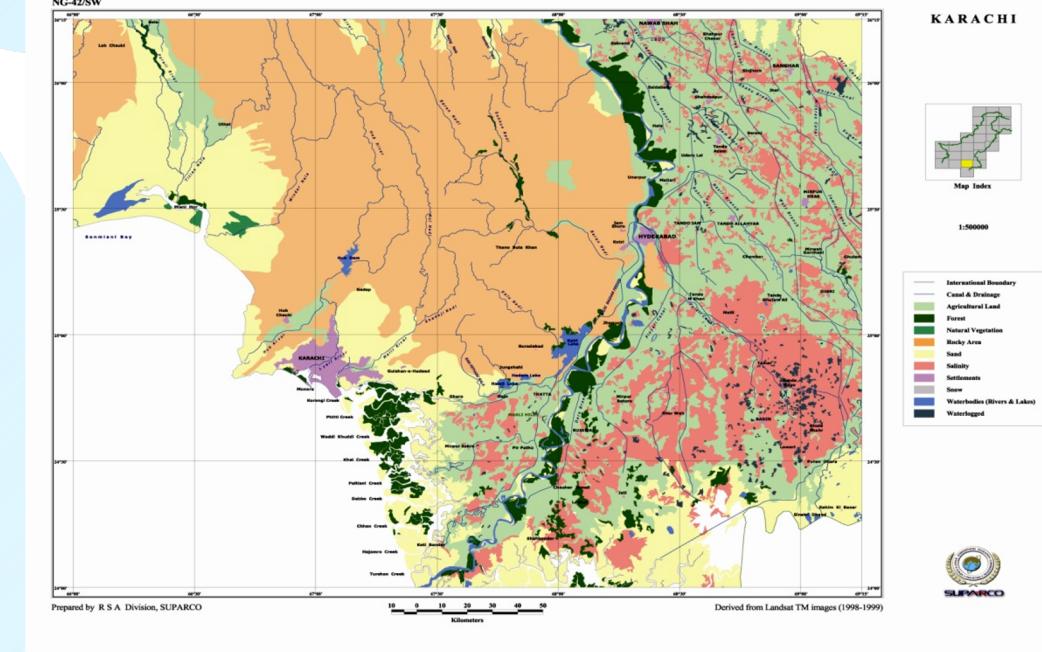
# Landuse / Landcover Mapping

## Scope

- Monitoring dynamic changes
- Urban/Rural infrastructure
- Waterlogging & salinity

## Benefits

- Assessment of spatial distribution of land resources
- Infrastructure monitoring
- Availability of usable land
- Future planning for better land management for socio-economic development



# Infrastructure Development



**Bridge**

# TERIMA KASIH

TRANSPORTASI



HANKAM



INFORMASI &  
ELEKTRONIKA



KESEHATAN &  
PANGAN



ENERGI



KEMARITIMAN



REKAYASA &  
KETEKNIKAN

MITIGASI  
BENCANA

