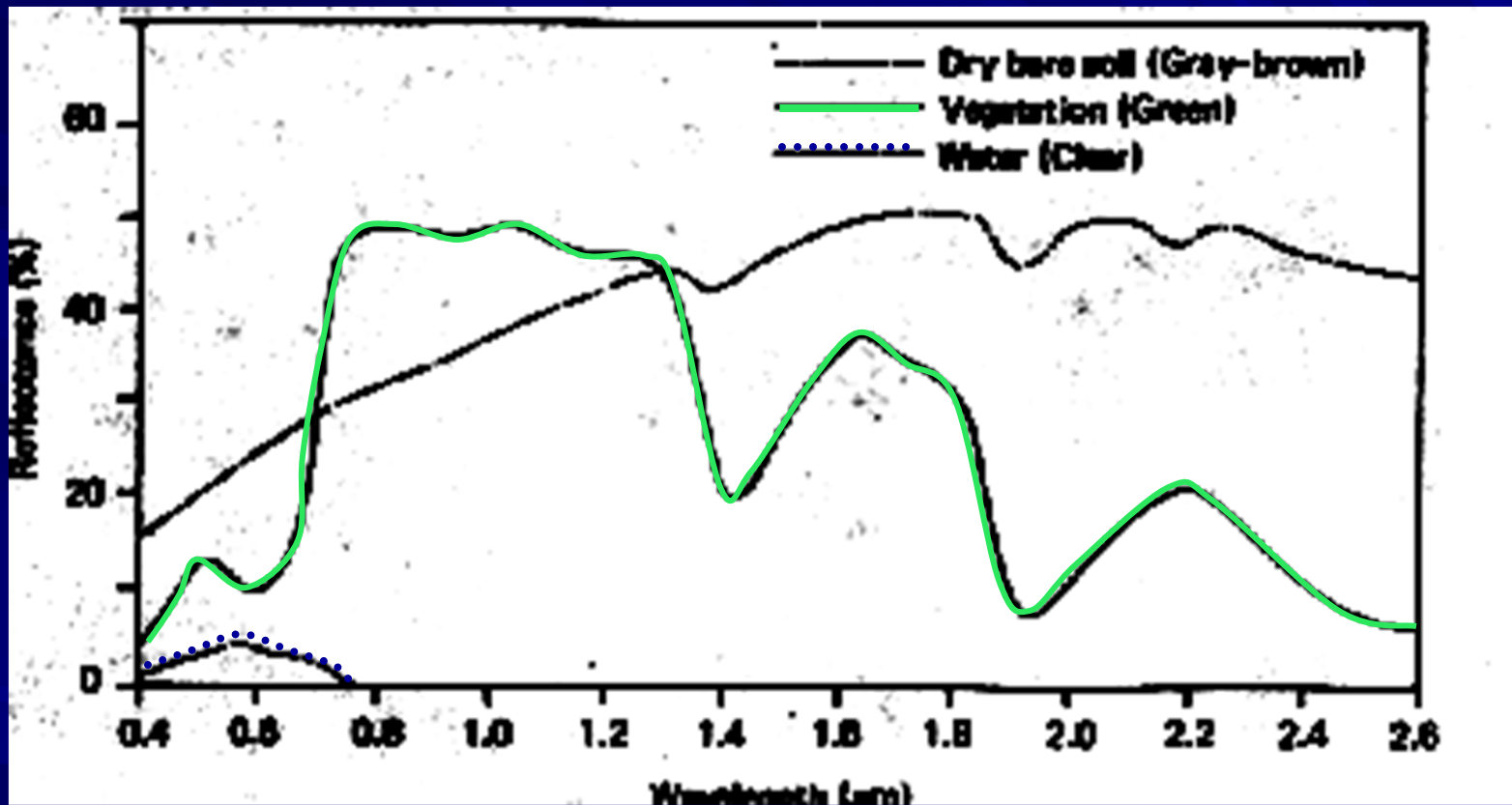


# Spectral Response Pattern / Signature

## Reflectance



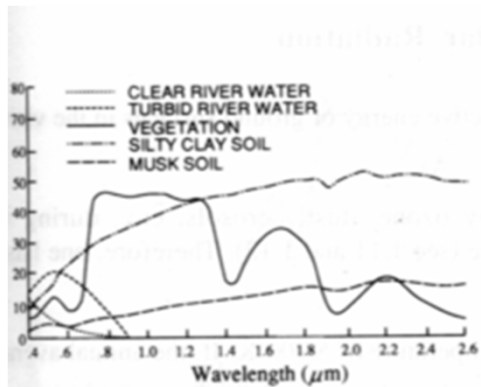
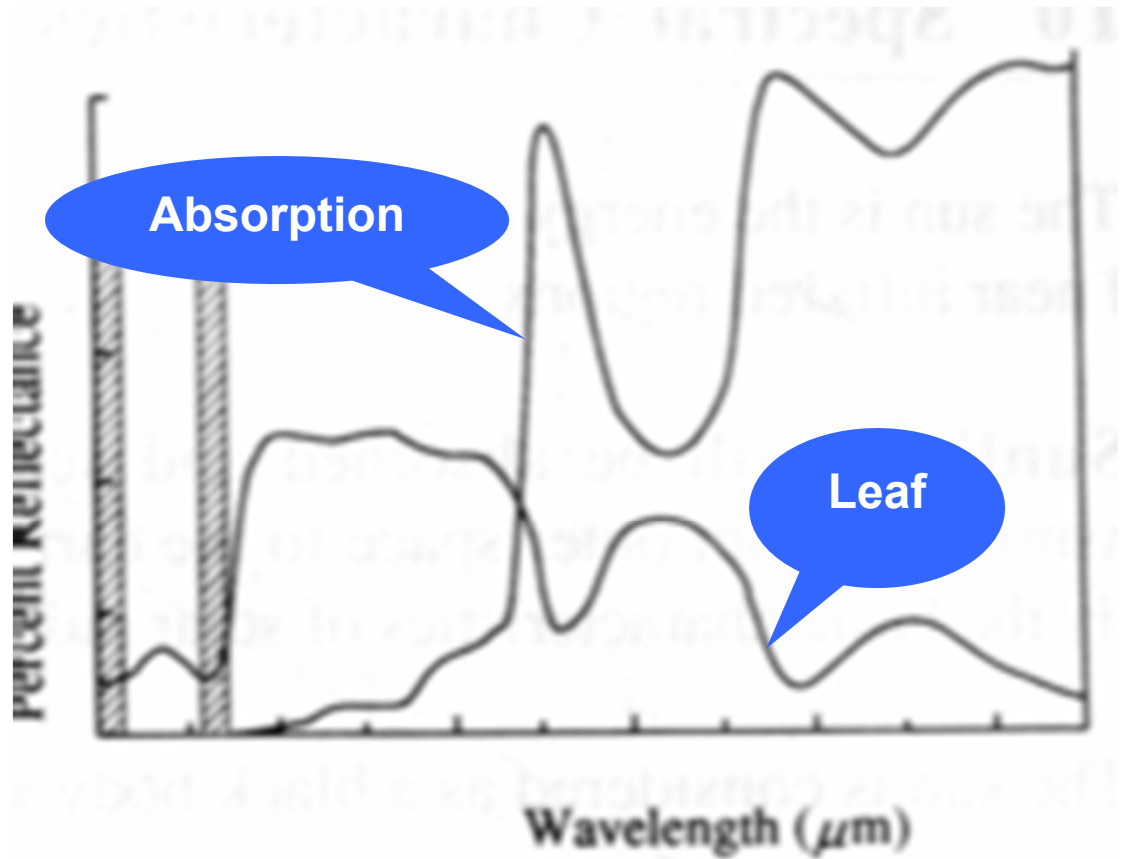
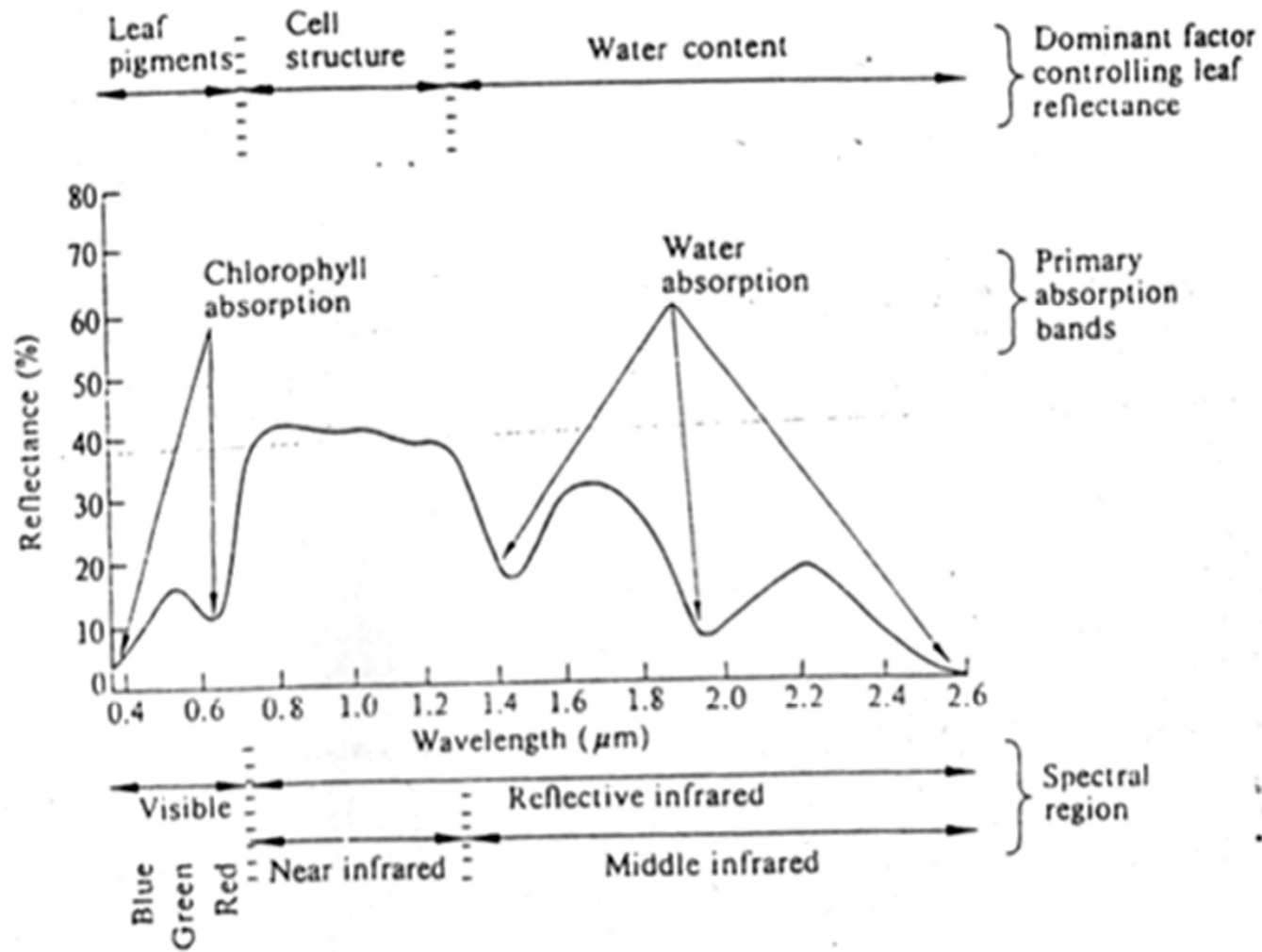


Figure 1.9.1 Spectral reflectance of vegetation, soil and water



Spectral reflectance of a green leaf

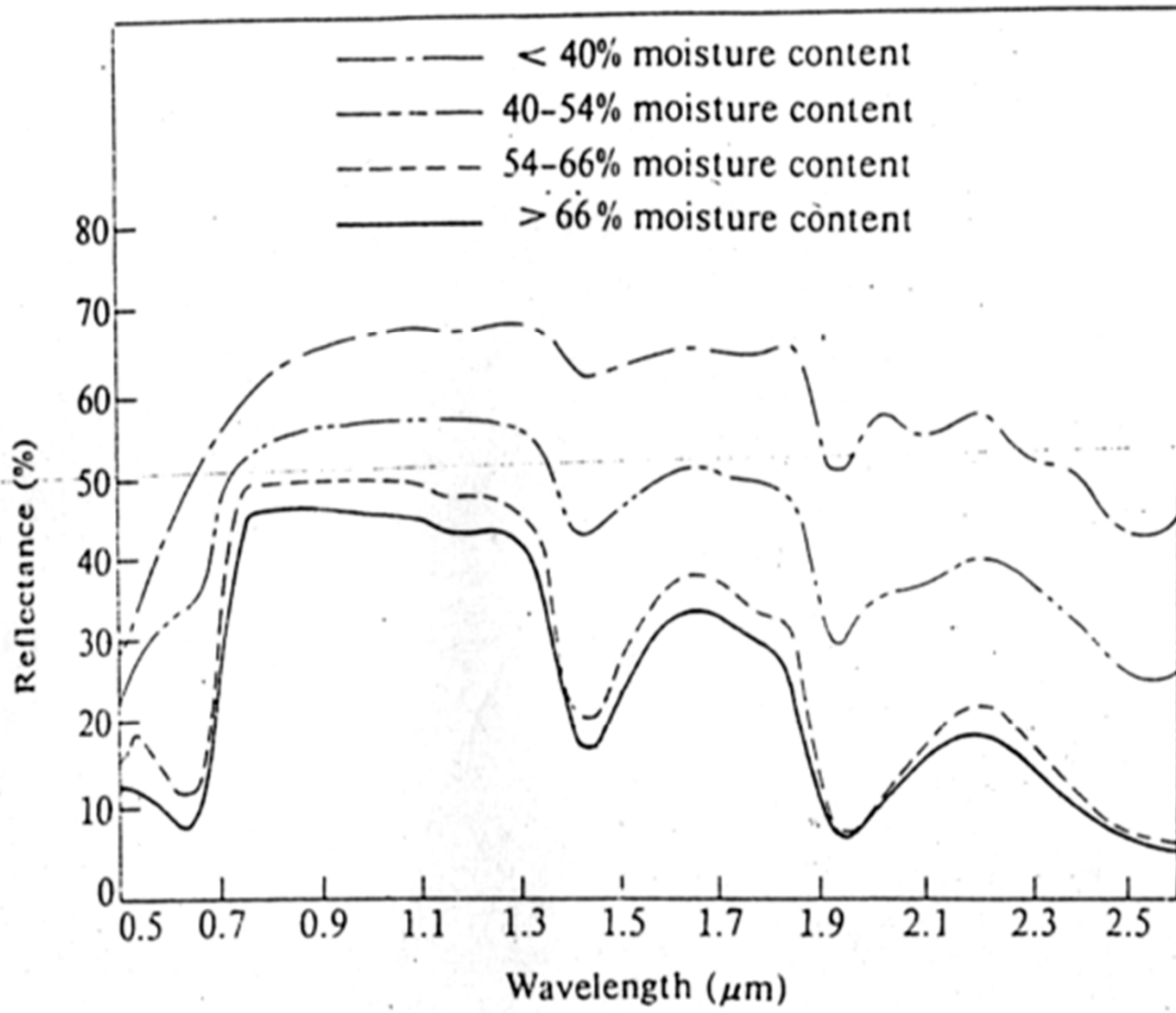


*Significant spectral response characteristics of green vegetation*

# Feature of Leaf & Relative Bands

- Pigmentation or Chlorophyll
  - Visible band
- Internal Structure of Leaf
  - NIR
- Water Contents
  - MIR



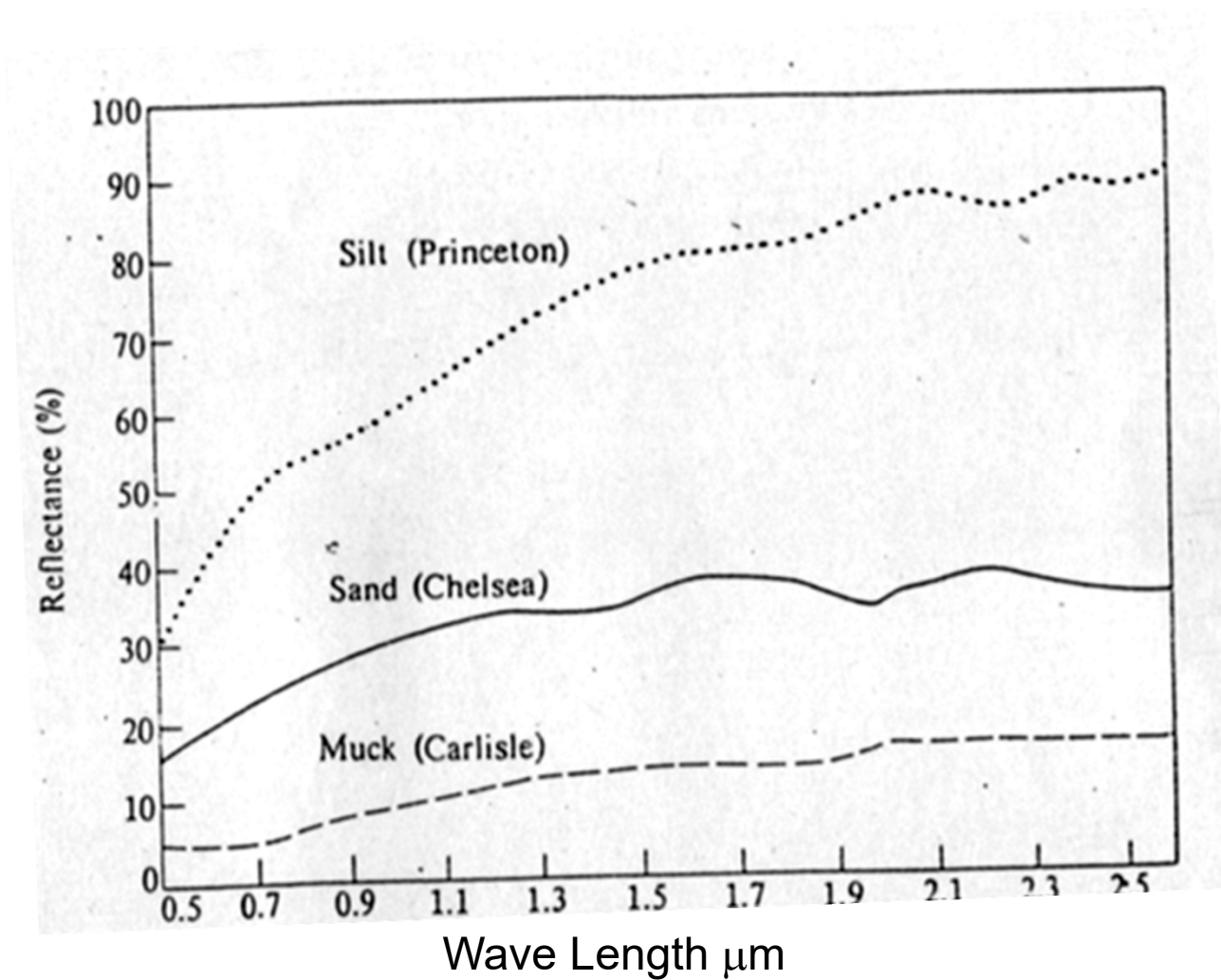


*Effect of moisture content on reflectance of corn leaves*

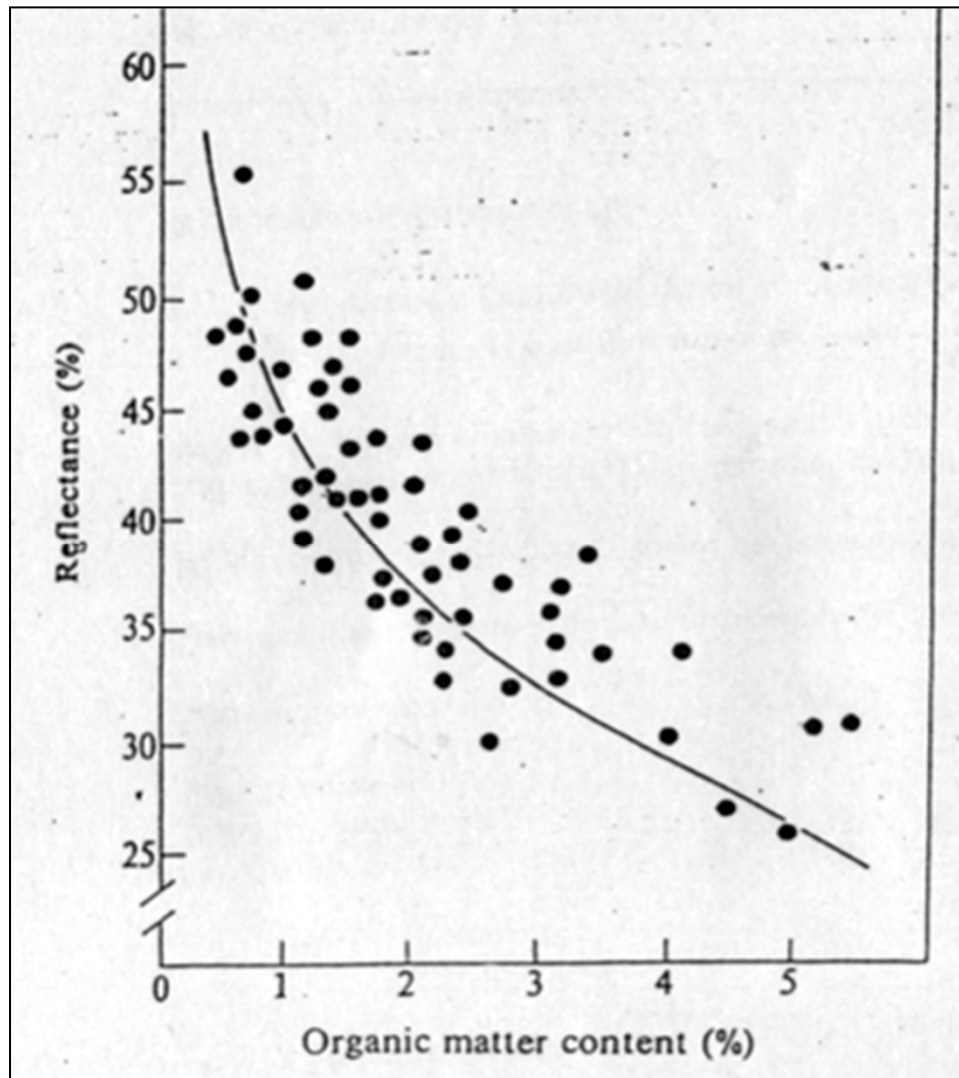
# Reflectance of Soil

- No Peaks and Valleys as compared to Vegetation
- Increasing Reflectance with Increasing  $\lambda$
- As Soil is Opac, so no Transmission, only Absorption or Reflectance
- Effect of Size of Soil
- Effect of Moisture Content
- Effect of Organic Matter
- Effect of Iron Oxides

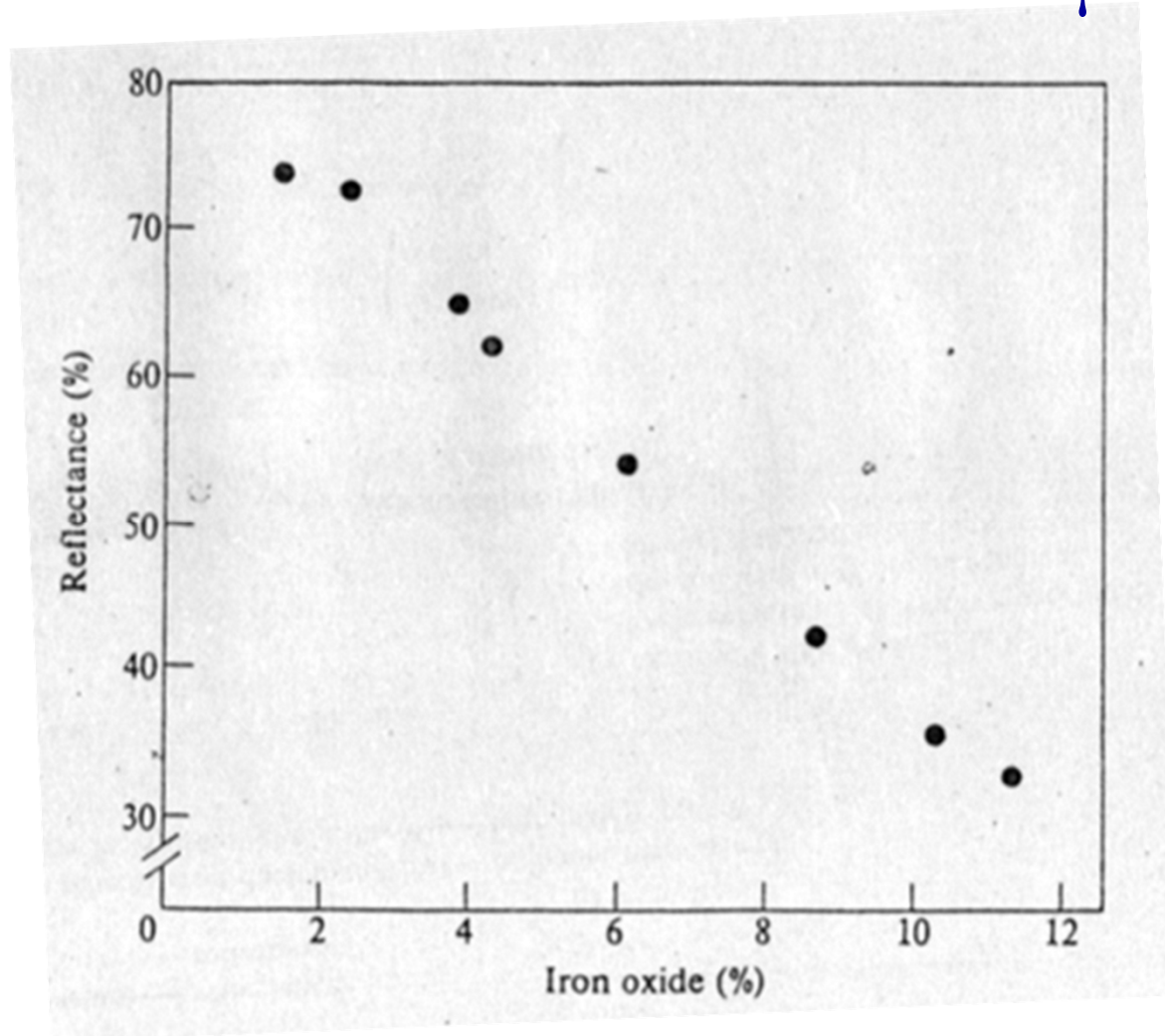
# Spectral Reflectance of Different Soil Types



# Effect of Organic Components



# Effect of Iron Oxide Contents on Reflection Characteristics of Soil in 0.50-0.64 $\mu\text{m}$ Band



# Ability of Characterize Soil

<u>Reflectance</u>		<u>Thermal</u>	<u>Type of Soil</u>
■ D	+	■ D	Moist, high org. comp.
■ L	+	■ L	Dry, Low Org. Comp.
■ D	+	■ L	Dry, High Org. Comp.
■ L	+	■ D	Moist, Low Org. Comp.

D = Dark Tone = Less Reflectance or Emission

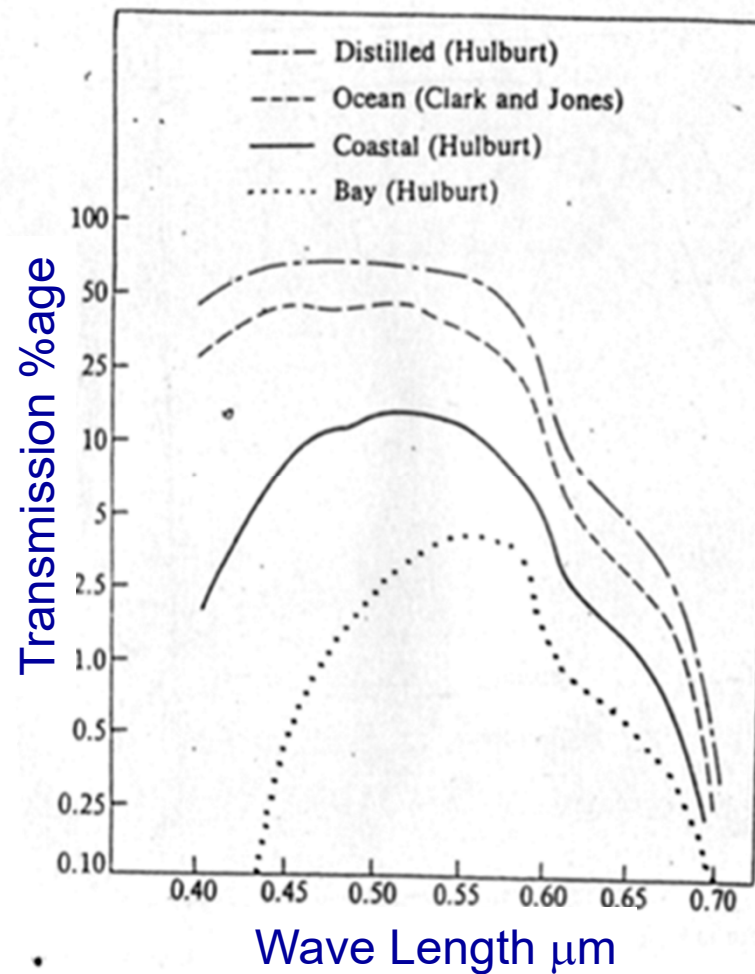
L = Light Tone = High / Bright Reflectance or Emission

# Spectral Characteristics of Water & Snow

## ■ Water:

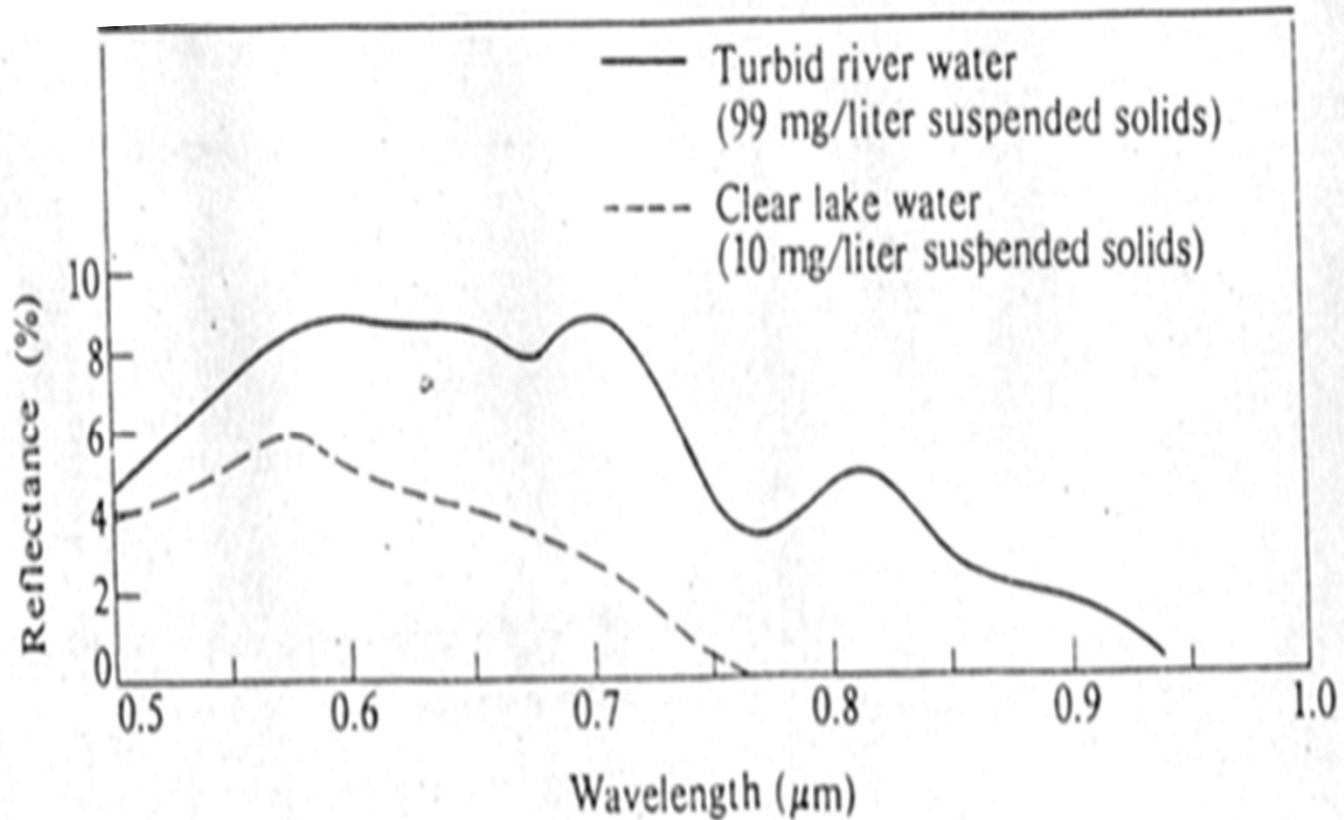
- Reflectance is Effected by
  - Nature of Water itself
  - Various Conditions of Water
- Conditions of Water can be Best Assessed in Visible Band
- Water Body Delineation, best in NIR
- Mapping extent of Snow Cover, Best in MIR
- Nearly All energy in NIR and MIR is absorbed, Nothing to Reflect

# Transmission Characteristics of 10m depth of Different Waters

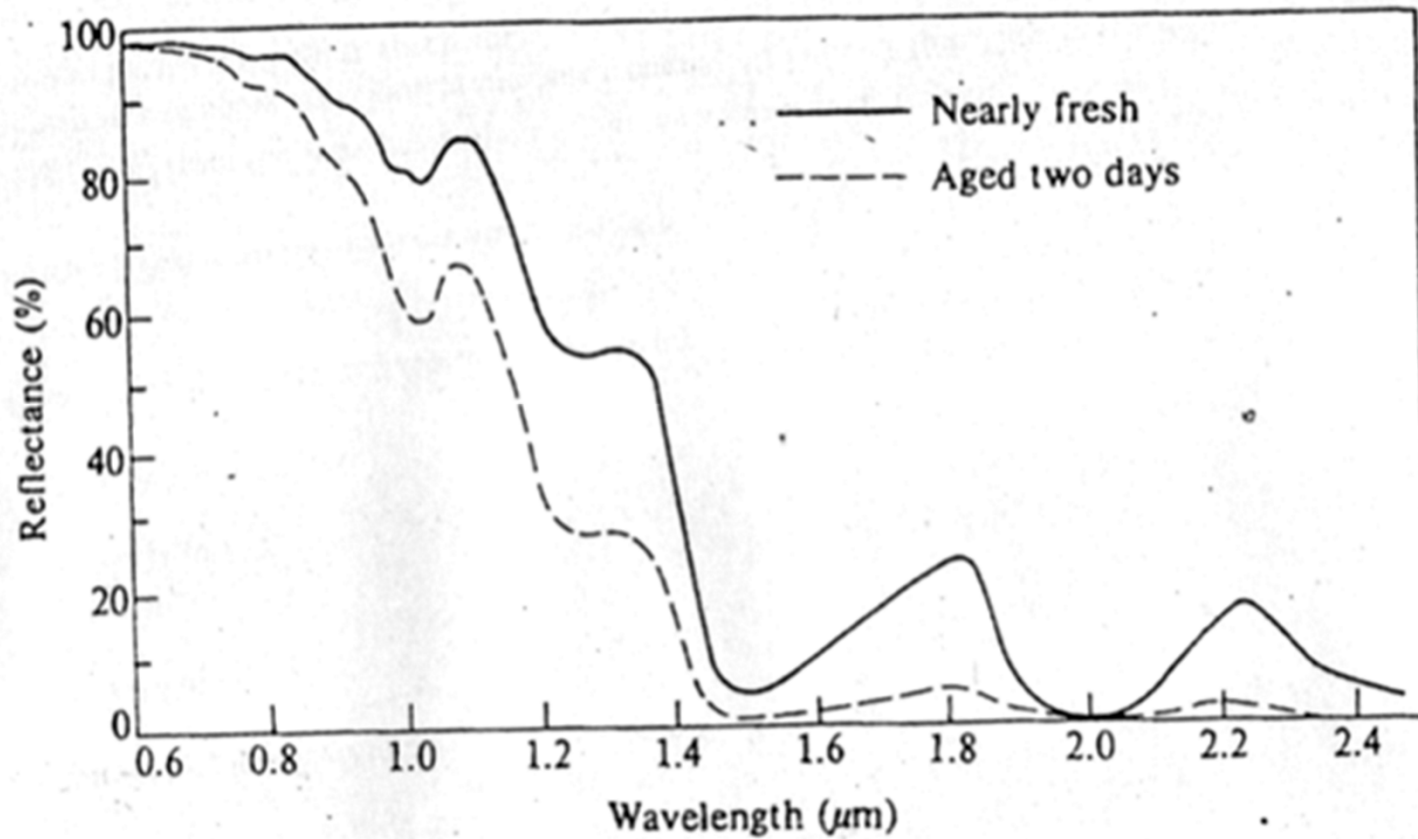




# Effects of Sediments / Turbidity on Reflectance Characteristics of Water

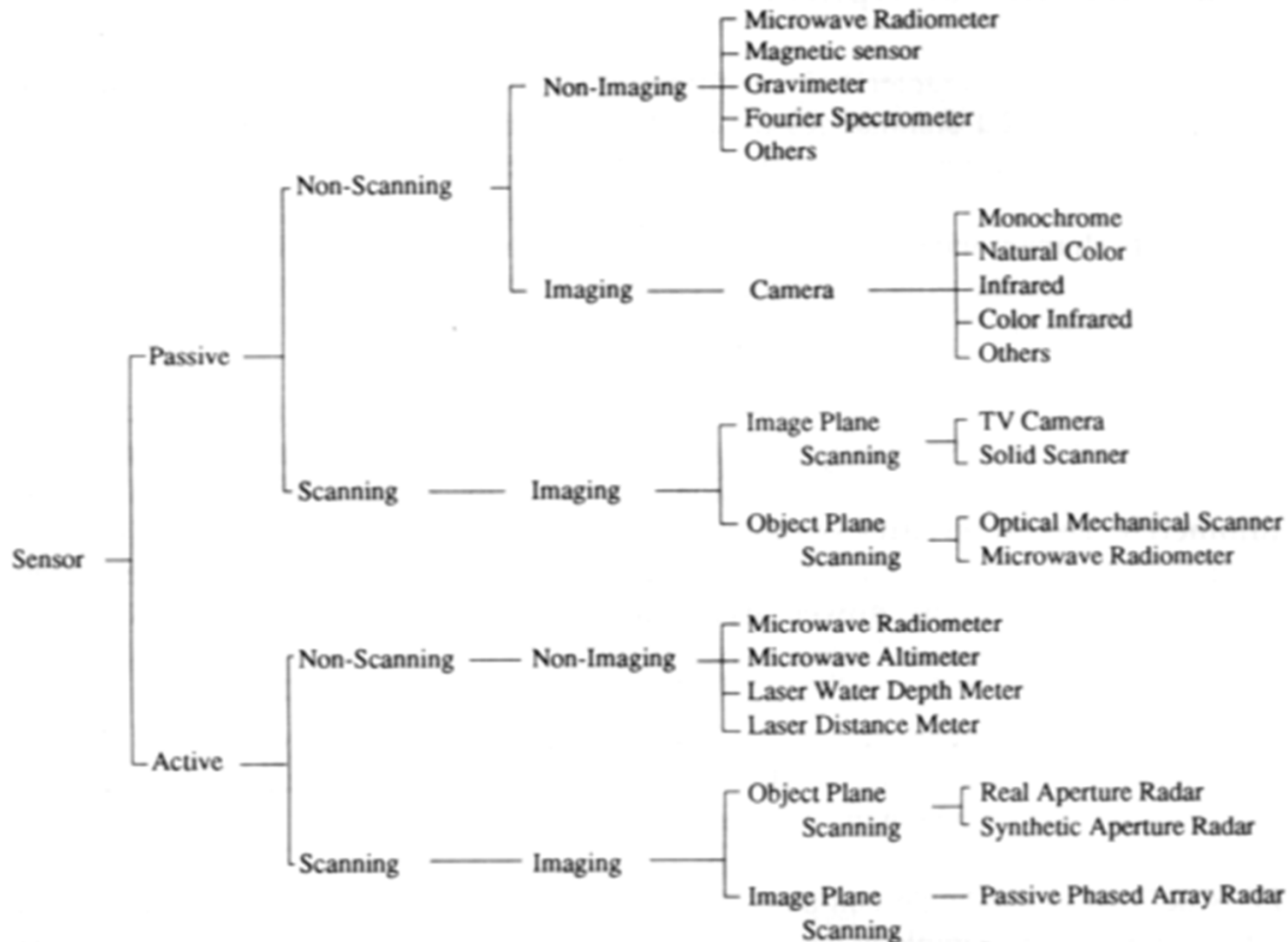


# Reflectance Characteristics of Snow



# SENSORS & PLATEFORMS

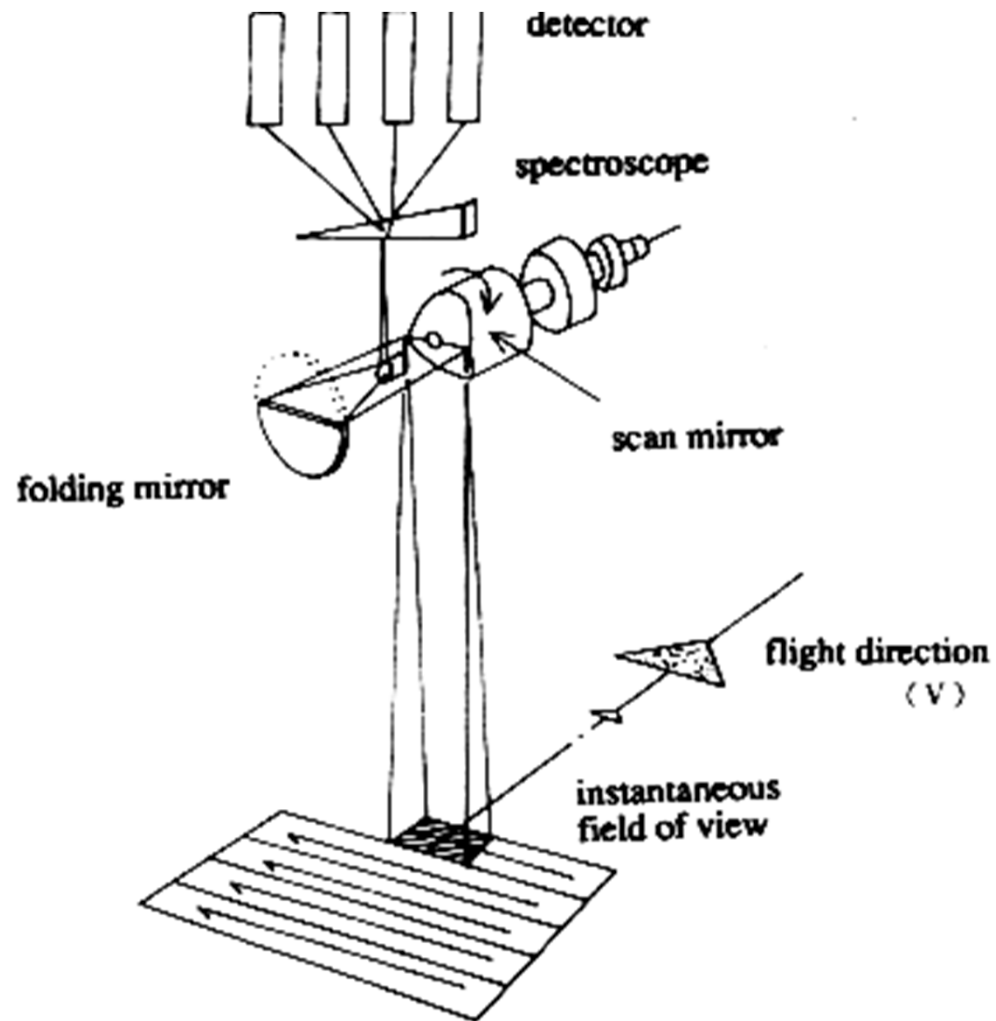
# Classification of Sensor



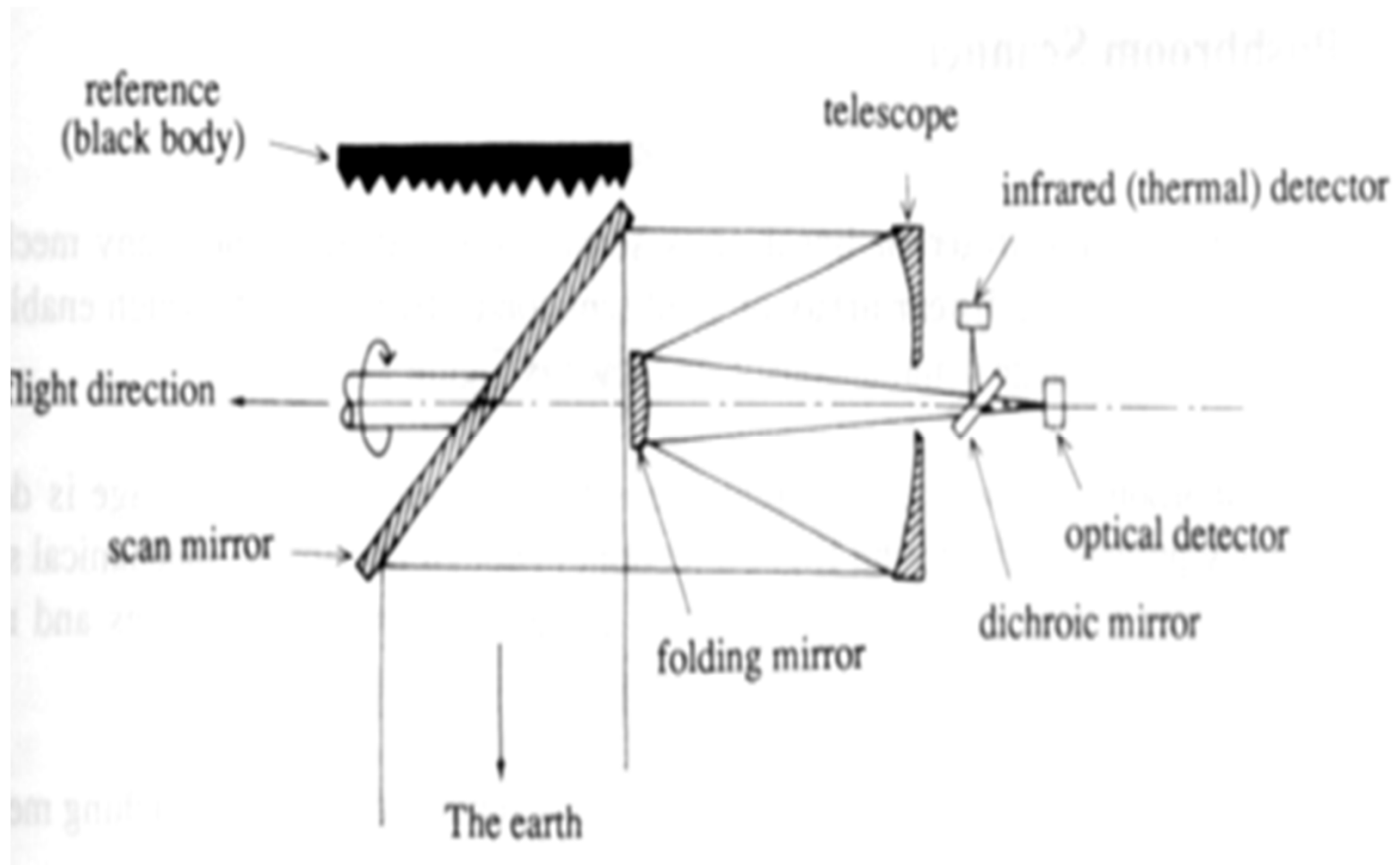
# Sensor & Their Wave Lengths

Sensor	Wave Length ( $\mu\text{m}$ )													
	U.V.	Visible					Infrared				Radio			
		0.4	0.5	0.6	0.7	0.9	1.5	5.5	8.0	14.0	S.M.wave	1000	10000	100000
Camera (Monochrome film)	—————													
(Color Film)	—————													
(Infrared film)				—————										
(Color Infrared Film)		—————												
Solid Scanner (SPOT HRV)		—————		—										
(Thermal Video)								—		—————				
TV Camera	—————													
Optical Mechanical Scanner														
(Airbone MSS)	—————									—————				
(Landsat MSS)		—————												
(Landsat TM)		—————							—		—			
Rader												—————		
Microwave Radiometer												—————		

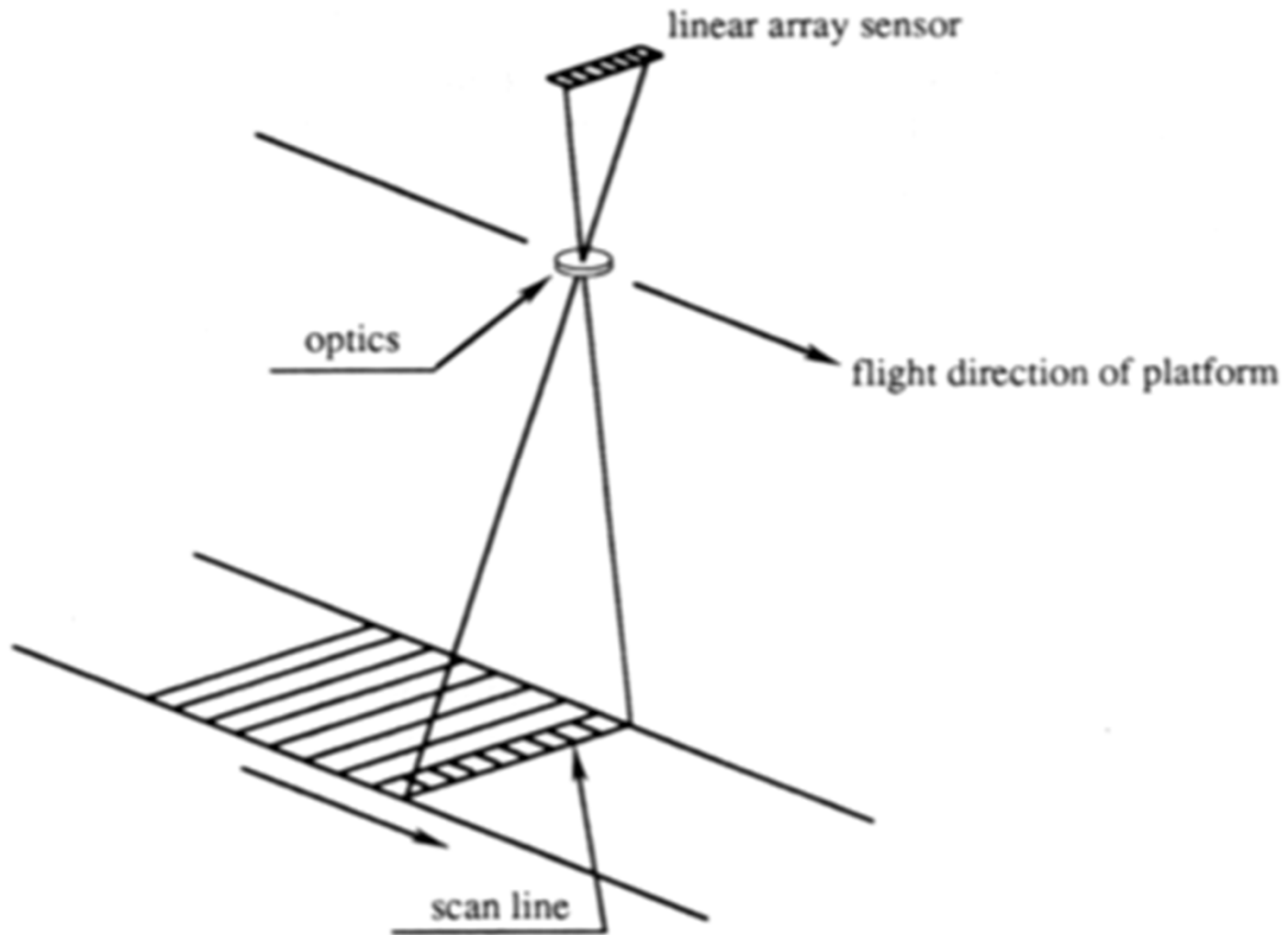
# Optical Mechanical Scanner



# Structure of Optical Mechanical Scanner

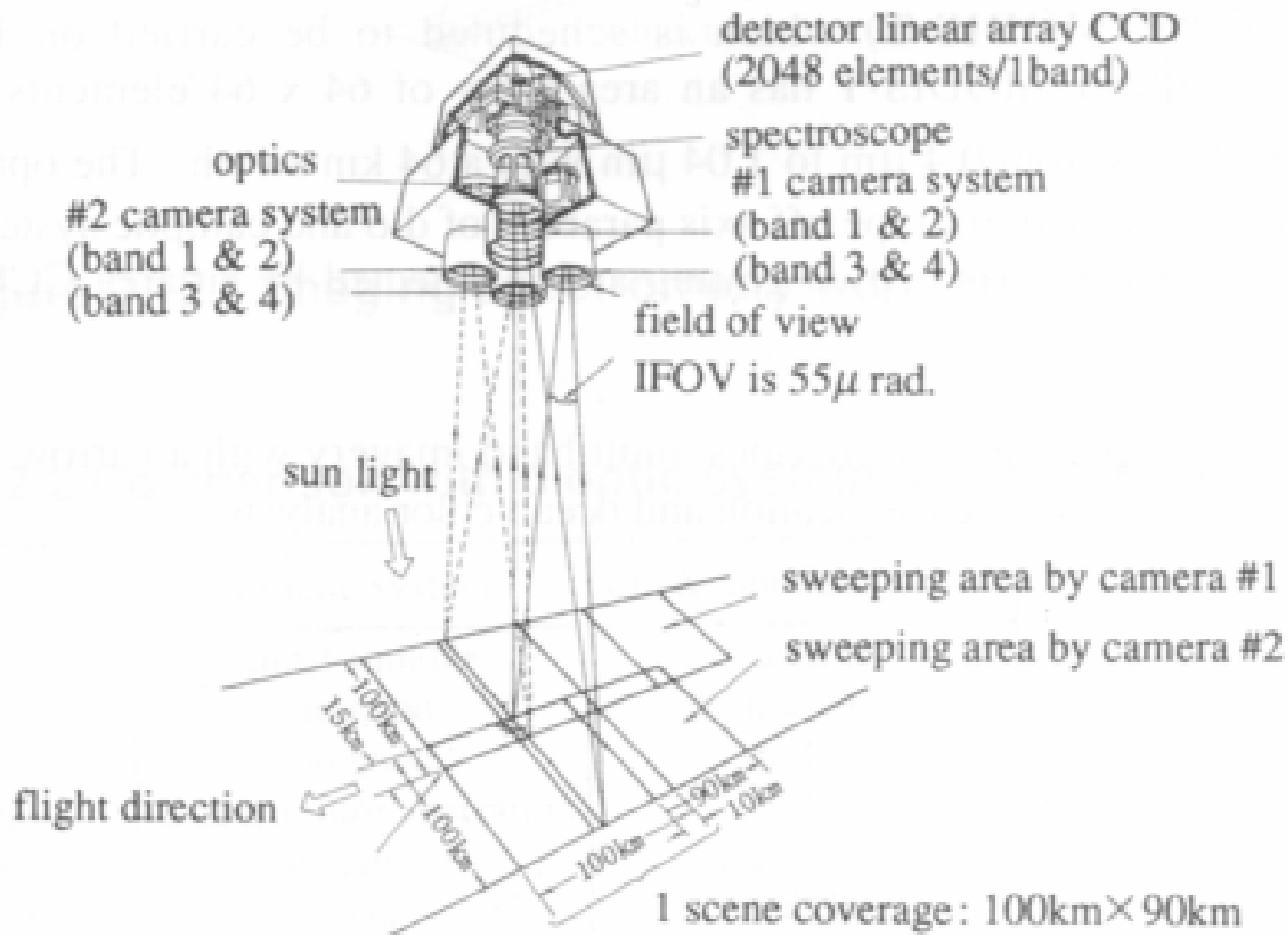


# Push Broom Scanner





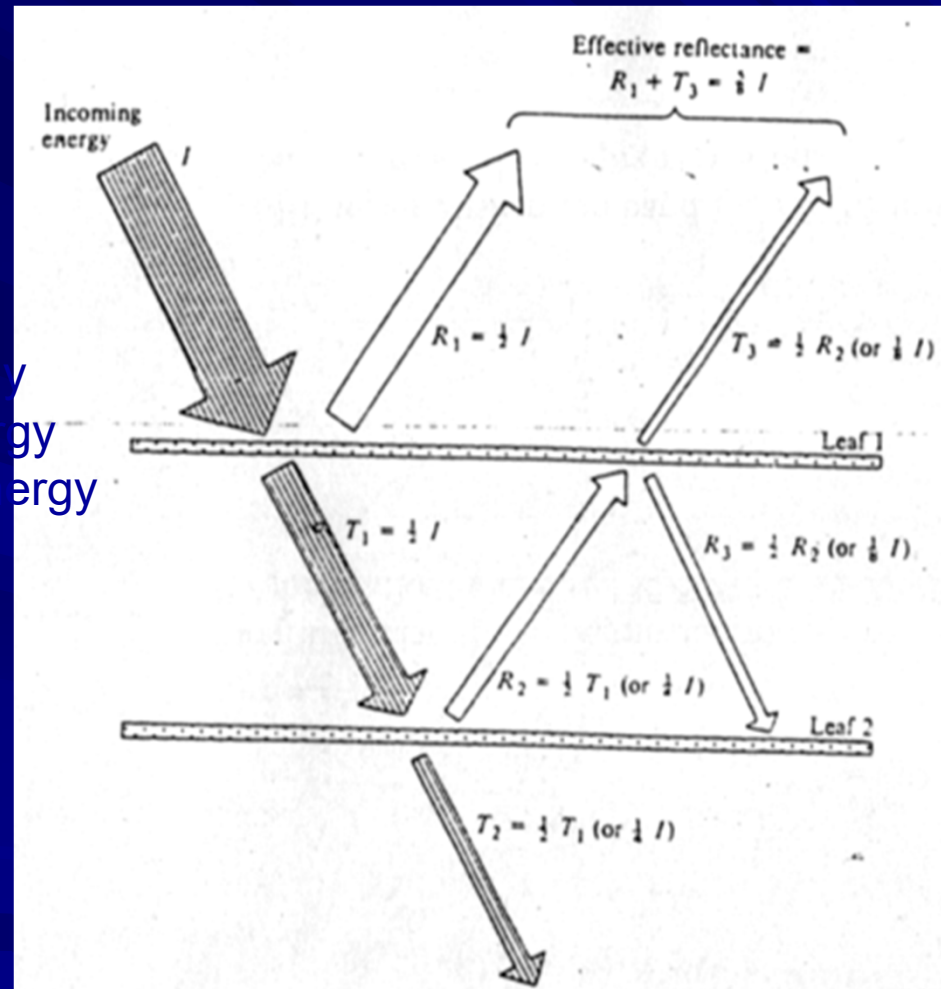
# Sensor on MOS-1



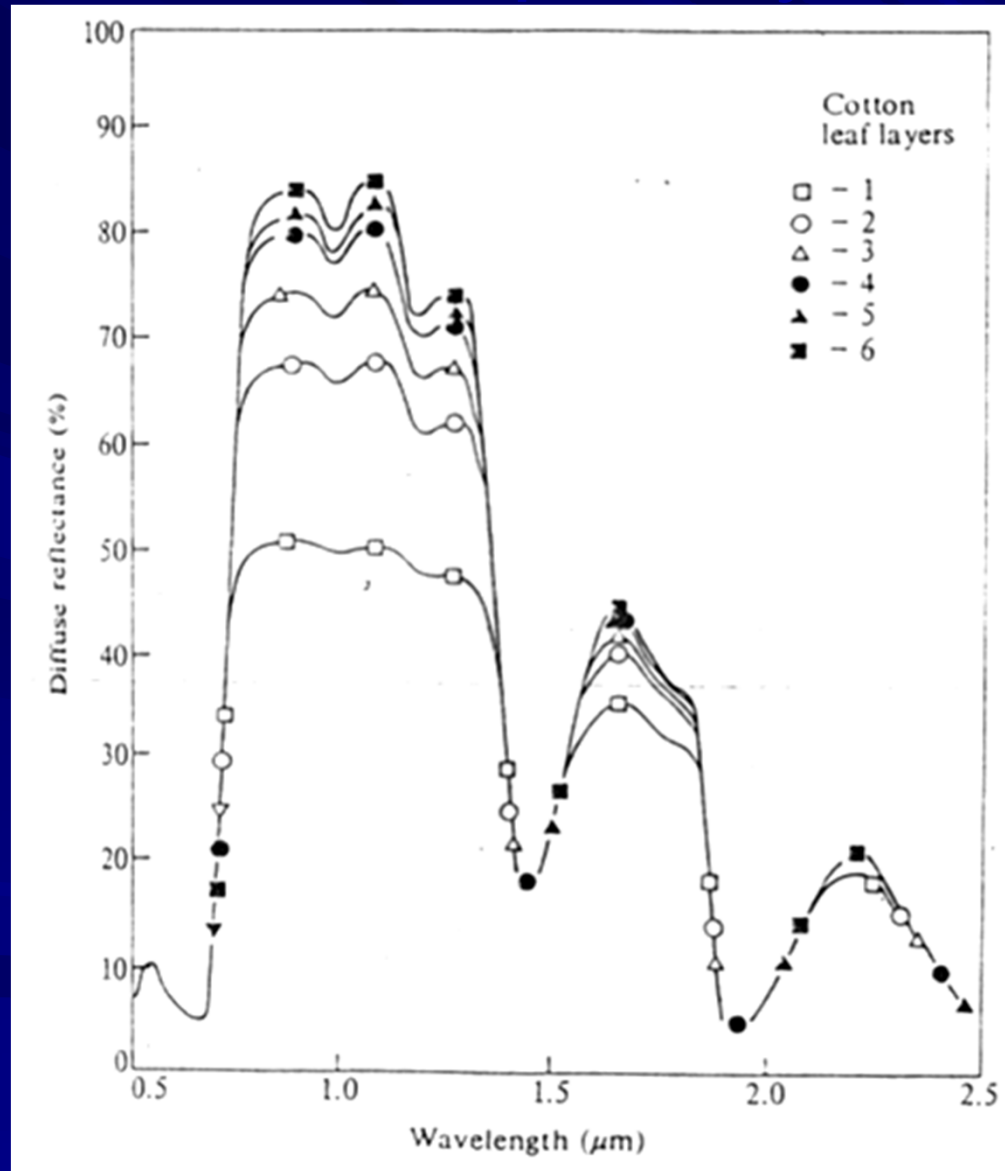
# Extra

# Effect of Multiple Leaf Layers

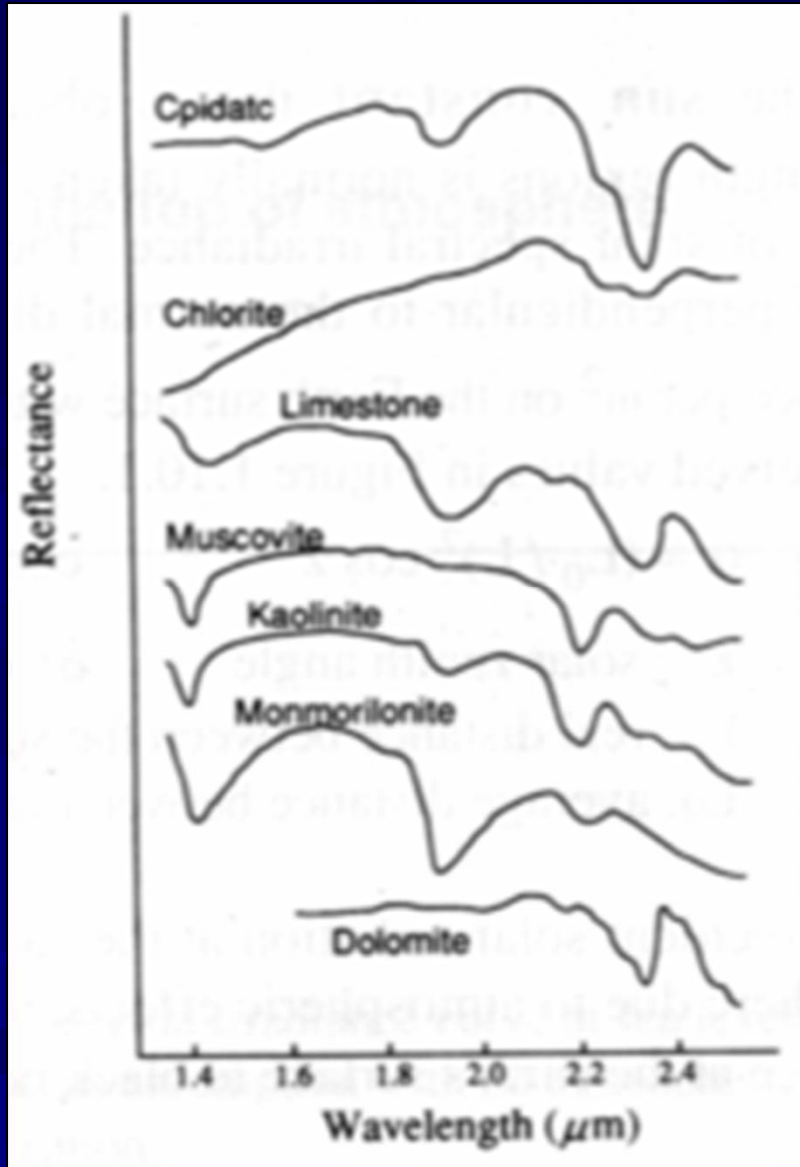
I = Incoming Energy  
R = Reflected Energy  
T = Transmitted Energy



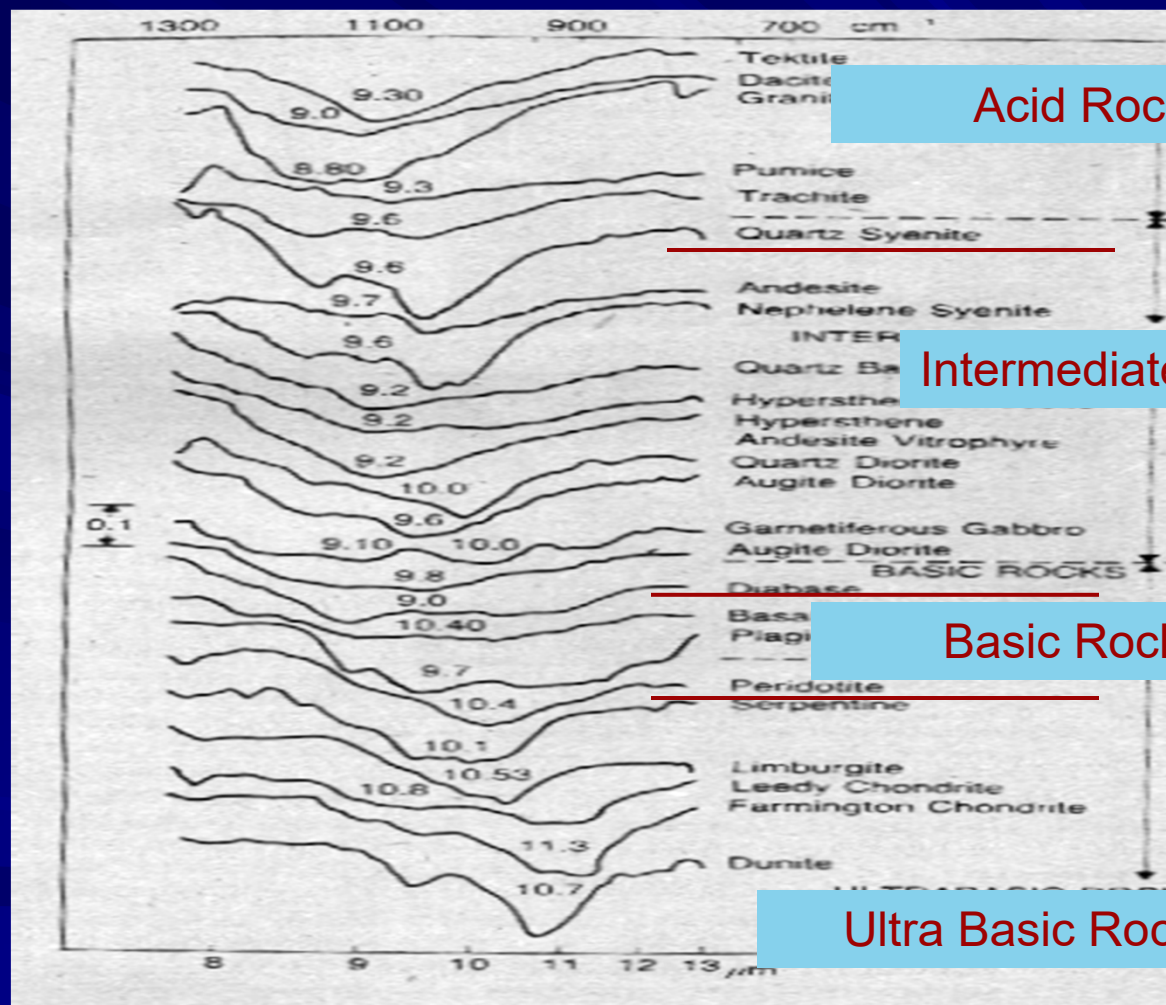
# Effect of Multiple Layers of Leaf



# Spectral reflectance of rocks and minerals



# Spectral Response Pattern / Signature IR Emission



Acid Rocks

Intermediate Rocks

Basic Rocks

Ultra Basic Rocks

# Typical Albedo/Reflectance Values

Type of surface	Surface	Albedo % of incident shortwave radiation
Soils	Fine sand	37
	Dry black soil	14
	Moist ploughed field	14
	Moist black soil	8
Water surfaces	Dense, clean and dry snow	86–95
	Woody farm, snow-covered	33–40
	Sea ice	36
	Ice sheet with water covering	26
Vegetation	Desert shrubland	20–29
	Winter wheat	16–23
	Oaks	18
	Deciduous forest	17
	Pine forest	14
	Prairie	12–13
	Swamp	10–14
	Heather	10
Geographic locations	Yuma, Arizona	20
	Winnipeg (July)	13–16
	Washington, DC (September)	12–13
	Great Salt Lake, Utah	3



# %age Reflectance as Recorded by MSS of Landsat

	Reflectance (%)			
	Band 1 (0.5–0.6 $\mu\text{m}$ )	Band 2 (0.6–0.7 $\mu\text{m}$ )	Band 3 (0.7–0.8 $\mu\text{m}$ )	Band 4 (0.8–1.1 $\mu\text{m}$ )
<i>Rock and soil materials and covers</i>				
Sand	5.19	4.32	3.46	6.71
Loam 1% H <sub>2</sub> O	6.70	6.79	6.10	14.01
Loam 20% H <sub>2</sub> O	4.21	4.02	3.38	7.57
Ice	18.30	16.10	12.20	11.00
Snow	19.10	15.00	10.90	9.20
Cultivated land	3.27	2.39	1.58	(not given)
Clay	14.34	14.40	11.99	(not given)
Gneiss	7.02	6.54	5.37	10.70
Loose soil	7.40	6.91	5.68	(not given)
<i>Vegetation</i>				
Wheat (low fertilizers)	3.44	2.27	3.56	8.95
Wheat (high fertilizers)	3.69	2.58	3.67	9.29
Water	3.75	2.24	1.20	1.89
Barley (healthy)	3.96	4.07	4.47	9.29
Barley (mildewed)	4.42	4.07	5.16	11.60
Oats	4.02	2.25	3.50	9.64
Oats	3.21	2.20	3.27	9.46
Soybean (high H <sub>2</sub> O)	3.29	2.78	4.11	8.67
Soybean (low H <sub>2</sub> O)	3.35	2.60	3.92	11.01