Reflectivity Fingerprints!

Material	R(UV)	R(Vis)	R(NIR)
Snow	90%	80%	70%
White Concrete	22%	80%	73%
Aluminum Roof	75%	74%	68%
Vegetation	15%	50%	40%
Bare Soil	15%	30%	50%
Wood Shingle	7%	17%	28%
Water	2%	5%	1%
Black Asphalt	4%	3%	3%

The amount of light a body reflects isn't the same for all of the different light wavelengths that fall on its surface. Because of this, each substance can have a unique fingerprint of reflectivity at different wavelengths that lets you identify it. The table above shows the reflectivity of various common materials. For example, snow reflects 80% of the light that falls on it at visible light wavelengths (Vis= 400 to 600 nm), but reflects quite a bit more at ultraviolet wavelengths (UV= 200 to 300 nm), and quite a bit less at near-infrared wavelengths (NIR= 700 to 1500 nm).

Problem 1 - If 1000 watts falls on a body in the ultraviolet band, and you measure 150 watts reflected, what is the reflectivity of the body, and from the Table, A) what might be its composition? B) What other reflectivity measurements can you make to tell the difference between your choices?

Problem 2 - You are given the reflectivity maps in each of the three wavelength bands, UV, VIS and NIR at the bottom of this page. What are the likely compositions of the areas in the map?

UV				VIS				NIR		
15	15	15		50	50	30		40	40	50
15	15	22		50	30	80		40	50	73
22	90	75		80	80	74		73	70	68

Problem 1 - If 1000 watts falls on a body in the ultraviolet band, and you measure 150 watts reflected, what is the reflectivity of the body, and from the Table, A) what might be its composition? B) What other reflectivity measurements can you make to tell the difference between your choices?

Answer; A) The reflectivity is 100% x (150 watts/1000 watts) = 15% in the ultraviolet band. There are two candidates from the table: a surface covered with vegetation, and a surface covered with bare soil. B) By measuring the reflected power in the visible band (Vis) the difference in reflectivity is 50% for the vegetation and 30% for the bare soil, which is enough for you to be able to tell the difference.

Problem 2 - What are the likely compositions of the areas in the map? Answer: See map below. V = Vegetation; bS = Bare Soil; C = Concrete; S = Snow and A = Aluminum Roof.

Note: The problem can be made more challenging by only giving students two out of the three band measurements for a given map 'pixel', and have the student fill -in the missing reflectivity percent and then identify the material.

UV

15 V	15 V	15 bS
15 V	15 bS	22 C
22 C	90 S	75 A

VIS

50	50	30
50	30	80
80	80	74

NIR

40	40	50
40	50	73
73	70	68