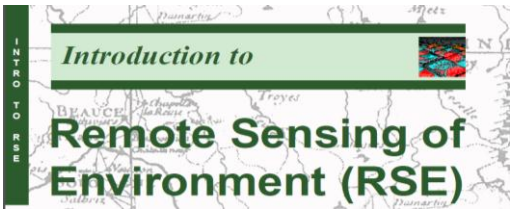
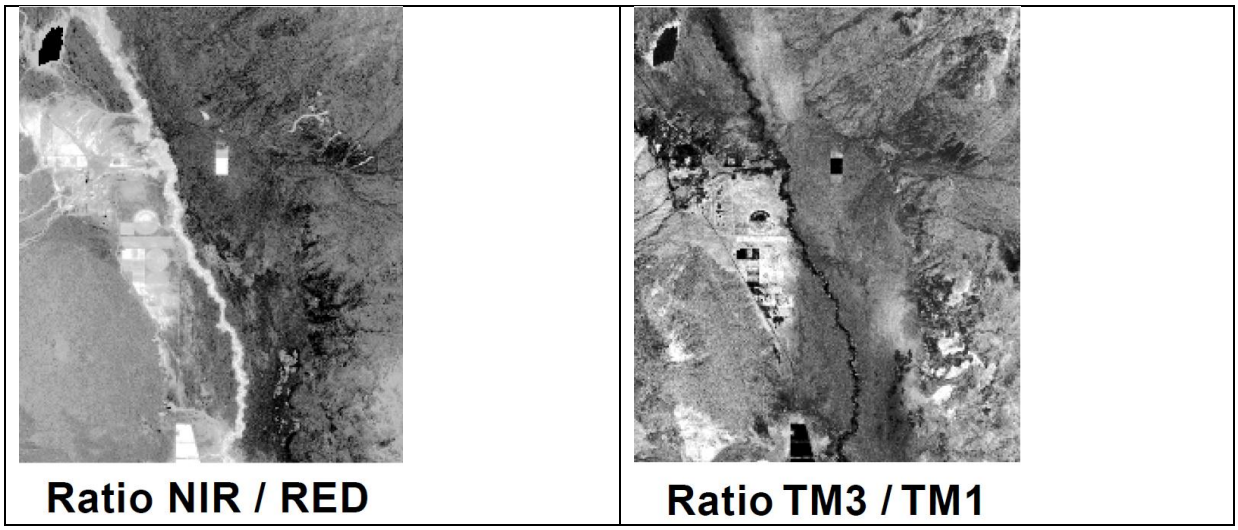


http://www.microimages.com/getstart/pdf/introrse.pdf

Band Ratios

Aerial images commonly exhibit illumination differences produced by shadows and by differing surface slope angles and slope directions. Because of these effects, the brightness of each surface material can vary from place to place in the image. Although these variations help us to visualize the three-dimensional shape of the landscape, they hamper our ability to recognize materials with similar spectral properties. We can remove these effects, and accentuate the spectral differences between materials, by computing a *ratio image* using two spectral bands. For each cell in the scene, the ratio value is computed by dividing the brightness value in one band by the value in the second band. Because the contribution of shading and shadowing is approximately constant for all image bands, dividing the two band values effectively cancels them out. Band ratios can be computed in TNTmips using the Predefined Raster Combination process, which is discussed in the tutorial booklet entitled *Combining Rasters*.

Band ratios have been used extensively in mineral exploration and to map vegetation condition. Bands are chosen to accentuate the occurrence of a particular material. The analyst chooses one wavelength band in which the material is highly reflective (appears bright), and another in which the material is strongly absorbing (appears dark). Usually the more reflective band is used as the numerator of the ratio, so that occurrences of the target material yield higher ratio values (greater than 1.0) and appear bright in the ratio image.



A ratio of near infrared (NIR) and red bands (TM4 / TM3) is useful in mapping vegetation and vegetation condition. The ratio is high for healthy vegetation, but lower for stressed or yellowed vegetation (lower near infrared and higher red values) and for nonvegetated areas. Exploration geologists use several ratios of Landsat Thematic Mapper bands to help map alteration zones that commonly host ore deposits. A band ratio of red (TM3) to blue (TM1) highlights reddish-colored iron oxide minerals found in many alteration zones. Nearly all minerals are highly reflective in the shorter-wavelength middle infrared band (TM5), but the clay minerals such as kaolinite that are abundant in alteration zones have an absorption feature within the longer-wavelength middle infrared band (TM7).

A ratio of TM5 to TM7 thus highlights these clay minerals, along with the carbonate minerals that make up limestone and dolomite. Compare the ratio images shown at left to the color composites of the third image set on the preceding page.