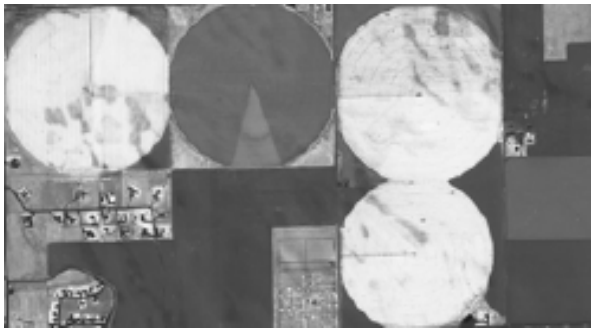
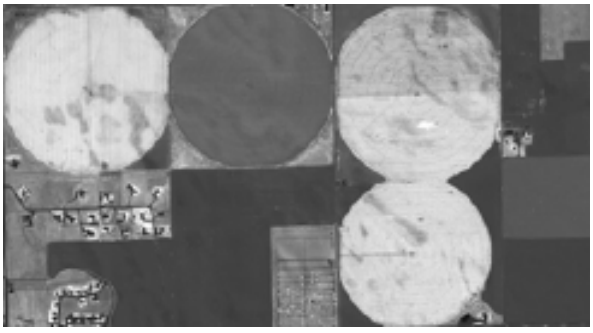
Scripts by Jack™

Mapping Vegetation/Soil Biophysical Properties

Color-infrared combination of QuickBird MS image bands for an agricultural area in Colorado. The three circular center-pivot irrigated fields that are dominated by red colors are corn fields near maximum biomass density. Color variations in these fields are due to both biomass density differences and background soil surface color and wetness variations. The top center circular field is newly-planted, with very low biomass density; the darker wedge-shaped portion of this field was wet from ongoing irrigation.



Traditional Normalized Difference Vegetation Index (NDVI) image of the fields computed using optional settings in the GRUVI script. Higher NDVI (brighter tones) are meant to indicate higher vegetation biomass, but NDVI is also unduly influenced by background soil surface wetness; note the wedge of wet soil in the top center circular field is obvious and appears brighter than the adjacent dry soil background.



GRand Unified Vegetation Index (GRUVI) image of the fields computed by the GRUVI script using an optional background soil adjustment parameter optimized for this image. Soil surface wetness variations are not visible and do not contaminate the biomass signal in this image.

The GRand Unified Vegetation Index (GRUVI) geospatial script in the *Scripts by Jack™* series incorporates concepts derived from Dr. Jack F. Paris's several decades of research and practical experience in applications of remote sensing to agriculture and natural resources. The GRUVI script produces a pair of calibrated indicator rasters for green vegetation biomass and soil surface brightness. These indicators are computed from near-infrared and red spectral bands of a multispectral image that has been calibrated to scaled surface reflectance values using the SRFI geospatial script (see the *Scripts by Jack* color plates entitled *Calibrating Multispectral Satellite Images* and *Calibrate Satellite Images to Surface Reflectance*) and corrected for terrain effects if needed using the TERCOR script (see the color plate *Scripts by Jack*: *Correct for Terrain Induced Radiance Effects*). You can provide additional scene-specific processing parameters (band values characteristic of dense vegetation and soil) to allow the script to compensate for local soil surface characteristics and conditions and produce a vegetation index that directly indicates the true variability of vegetation.

All vegetation indices depend upon the differing responses of healthy green vegetation and soil in the near-infrared and red spectral bands. Near-infrared light penetrates the leaf canopy, interacting with multiple canopy levels before reflecting upward to be measured by a satellite sensor. Near-infrared light is therefore sensitive to vegetative biomass, not just leaf area, and interacts with the soil surface between and below the plants as well. The near-infrared response of "vegetation" is thus a complex non-linear mixture of the foreground vegetation and the background soil surface that can have a range of brightness due to variations in soil surface color, texture, organic content, and wetness. Most standard vegetation indices, such as the Normalized Difference Vegetation Index (NDVI), do not adequately account for the influence of background soil surface variations on the result. With the proper input parameters, the GRUVI script can solve this nonlinear mixing problem to provide vegetation and soil brightness indices that are independent of variable soil surface conditions.

GRUVI processing parameters can also be adjusted, if you choose, to compute a range of standard vegetation indices, such as NDVI, the Soil Adjusted Vegetation Index (SAVI), and others. By selecting different pairs of spectral image bands as input raster objects in place of near-infrared and red, you can use the script to compute indicator rasters of other foreground-background biophysical conditions, such as green trees and shrubs against a background of yellowed (senescent) grass, or flooded vegetation. The GRUVI script is documented by Part E of *FAQs by Jack™*, which provides not only instructions for use of the script, but also a full conceptual background, including discussions of all standard vegetation indices.

Dr. Jack F. Paris, a private remote-sensing and geospatial consultant/coach, has developed a collection of advanced, model, geospatial ***Scripts by Jack™*** and associated documentation called ***FAQs by Jack™***. These scripts are in the public domain and can be used and modified as desired. For access to the scripts and FAQs, more information, and contact with Jack, go to: **www.microimages.com/freestuf/ScriptsByJack.htm**