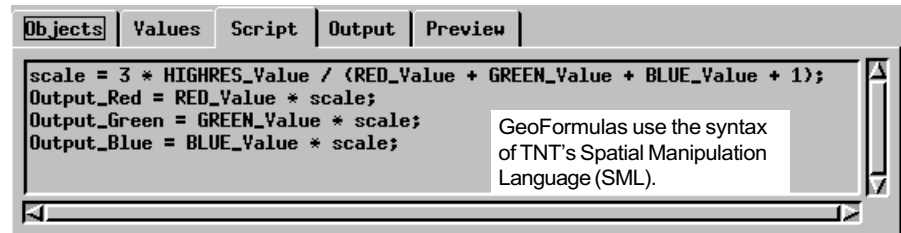# GeoFormula™ Layers for "Data Fusion"

A GeoFormula is a computed display layer that fuses data from one or more input objects and displays the result. In the display process, a GeoFormula gives you a way to combine objects "on the fly." A GeoFormula display layer contains a "virtual object" that is created dynamically, and then exists only as a simple script when you are finished with it. You can also run a separate Geo-Formula process to prepare output objects to keep with your other project materials.

The Script tab in the GeoFormula Controls window lets you type in a complex series of statements and expressions that define manipulations to apply to objects for display.

| Objects | Values | Script | Output | Preview |

```
scale = 3 * HIGHRES_Value / (RED_Value + GREEN_Value + BLUE_Value + 1);
Output_Red = RED_Value * scale;
Output_Green = GREEN_Value * scale;
Output_Blue = BLUE_Value * scale;
```

GeoFormulas use the syntax of TNT's Spatial Manipulation Language (SML).

The Script illustrated here is treated at more length in the Getting Started booklet, _Using Geospatial Formulas_. Essentially, the Brovey transform normalizes the low resolution RGB component images and then multiplies the result by the high resolution grayscale image. A scale factor in this implementation increases the display intensity.
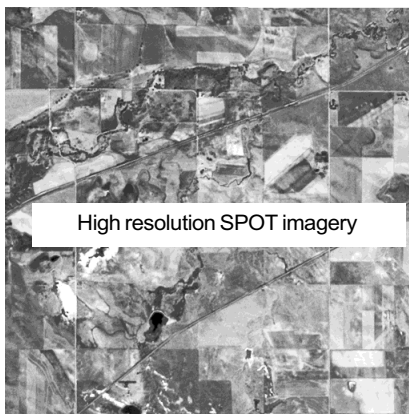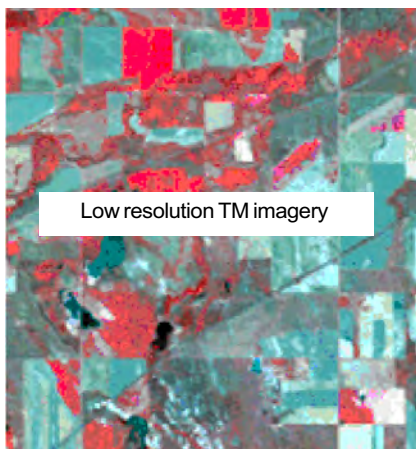
The GeoFormula illustrated on this page implements the Brovey transform, which enhances low resolution color imagery with high resolution grayscale imagery. Three bands of 30-meter TM imagery have been selected with a 10-meter SPOT image to display a synthetic 10-meter resolution for the color TM data.

Low resolution TM imagery

High resolution SPOT imagery

A simple GeoFormula applies a Brovey Transform, combining low resolution color imagery with high resolution grayscale imagery to display a color image with enhanced resolution. Sample data for this illustration is the 30-meter Color-IR image from bands 4, 3, and 2 of Crow Butte TM, and the 10-meter SPOT panchromatic. When objects have different spatial extents, you can have the process display the overlap region (as in this example), or the combined region.
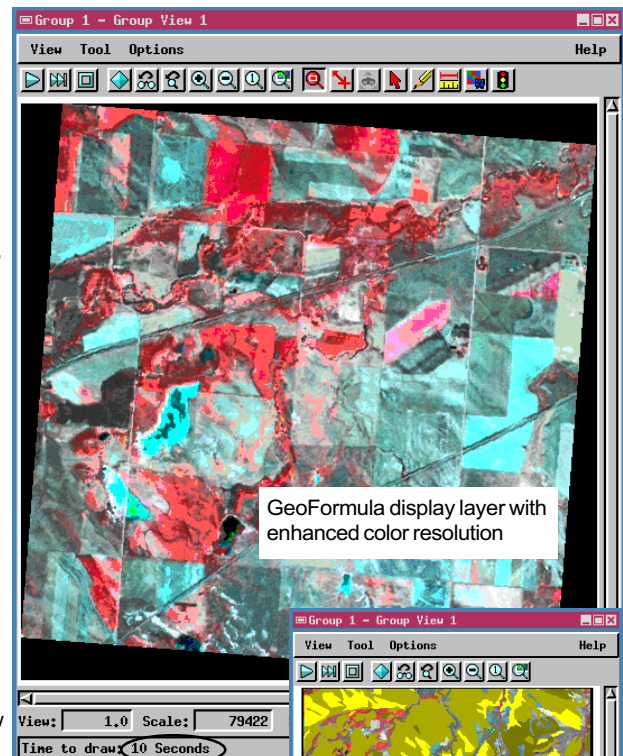
GeoFormula layers can be used in all standard display contexts in TNTmips, TNTedit, and TNTview. You can also use a GeoFormula script in a separate process to create output objects.

Click the GeoFormula button in the Group Controls window to add a GeoFormula layer.

GeoFormula display layer with enhanced color resolution
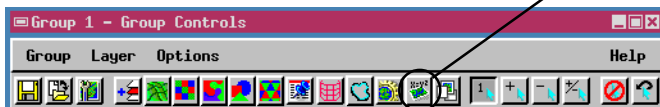
On a Pentium 180, execution and display took only 10 seconds.

GeoFormulas can use all kinds of geo-data objects from TNT Project Files. The script illustrated at right uses 3 bands of TM imagery and the CBSOILS vector object. The polygon attribute YIELD.OATS is displayed where its value is larger than zero. Elsewhere the composite TM image is displayed.

```
if (CBSOILS.poly.YIELD.OATS > 0)
{Output_Red = CBSOILS.poly.YIELD.OATS * 5
Output_Green = CBSOILS.poly.YIELD.OATS * 5
#Output_Blue = CBSOILS.poly.YIELD.OATS * 5
}
else {
Output_Green = TM_3_Value
Output_Blue = TM_1_Value
Output_Red = TM_4_Value
}
```