

Lesson 3.5: Development of yield productivity management zones

Data Source: *dataset3.zip*

Part 1: Creating a map of Average-Relative Yield, a map of Standard-Deviation-Relative Yield, and a map of Coefficient of Variability.

- The following formulas will be used to create your maps. These equations are used for temporal statistics of historical yields.

Average Yield

$$\text{avg } Y_{\text{relative}} = \frac{y_{\text{relative}_{\text{year}1}} + y_{\text{relative}_{\text{year}2}} + \dots + y_{\text{relative}_{\text{year}N}}}{N}$$

Standard Deviation

$$\text{StDev } Y_{\text{relative}} = \sqrt{\frac{(y_{\text{relative}_{\text{year}1}} - \text{avg } Y_{\text{relative}})^2 + \dots + (y_{\text{relative}_{\text{year}N}} - \text{avg } Y_{\text{relative}})^2}{N - 1}}$$

Coefficient of Variation (%)

$$CV = \frac{\text{StDev } Y_{\text{relative}}}{\text{avg } Y_{\text{relative}}} \cdot 100$$

Class of Yield

$$CY = \begin{cases} \text{Yield Always High (Nitrogen} = -1) & \text{if } \text{avg } Y_{\text{relative}} - \text{StDev } Y_{\text{relative}} > 1 \\ \text{Yield Always Low (Nitrogen} = 1) & \text{if } \text{avg } Y_{\text{relative}} + \text{StDev } Y_{\text{relative}} < 1 \\ \text{Yield Variable Average (Nitrogen} = 0) & \text{if } \text{Otherwise} \end{cases}$$

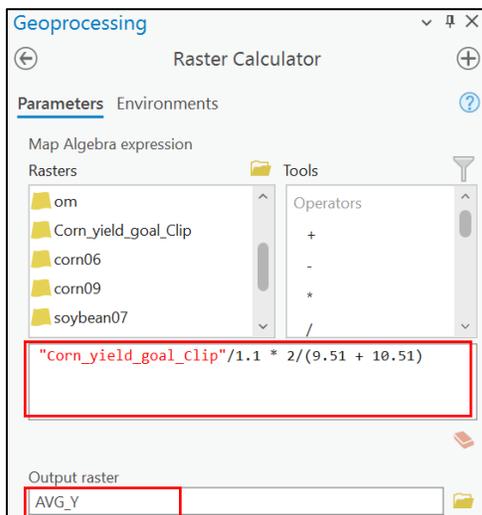
$$\text{avg } Y_{\text{relative}} = YG \cdot \frac{1}{1.1} \cdot \frac{2}{(\bar{Y}_{\text{corn}06} + \bar{Y}_{\text{corn}09})}$$

- We will use the mean values noted down from the last lesson.

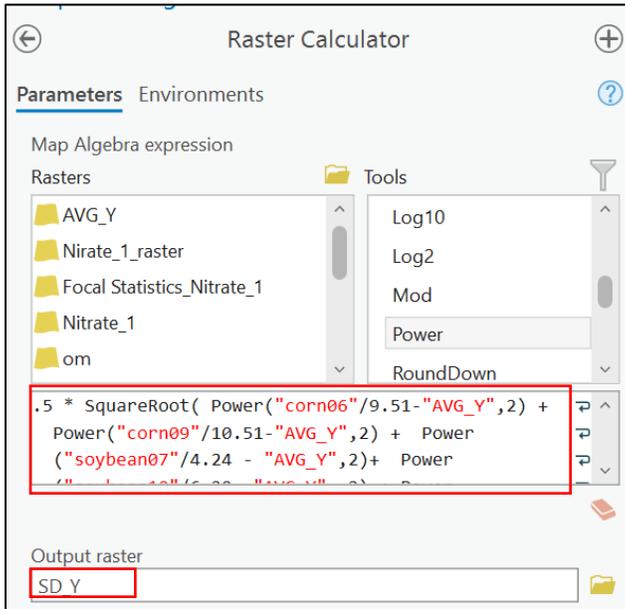
Take note of these values for further use:

$$\bar{Y}_{\text{corn}06} = 9.51; \bar{Y}_{\text{corn}09} = 10.51; \bar{Y}_{\text{soybean}07} = 4.28; \bar{Y}_{\text{soybean}10} = 6.29; \bar{Y}_{\text{wheat}08} = 2.44$$

- Search **Raster Calculator**. Input the following formula and raster name. This will create the **Average Yield Map**.



4. Search **Raster Calculator**. Input the following formula and raster name. This will create the **Standard Deviation of Relative Yield Map**.



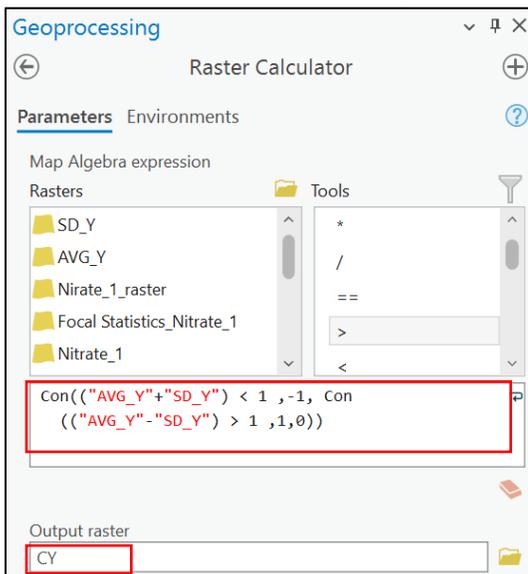
The formula:

.5 * SquareRoot(Power("corn06"/9.51-"AVG_Y",2) + Power("corn09"/10.51-"AVG_Y",2) + Power("soybean07"/4.24 - "AVG_Y",2)+ Power("soybean10"/6.29 - "AVG_Y",2) + Power("wheat08"/2.44 - "AVG_Y",2))

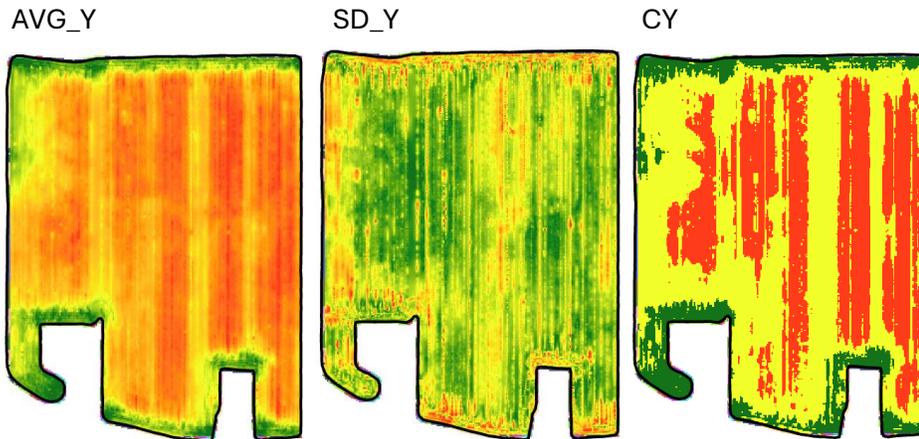
Copy and pasting the formula can cause issues if your file pathnames are different. To avoid mistakes, type the formula yourself.

5. Search **Raster Calculator**. Input the following formula and raster name. This will create the **Class of Yield Map**.

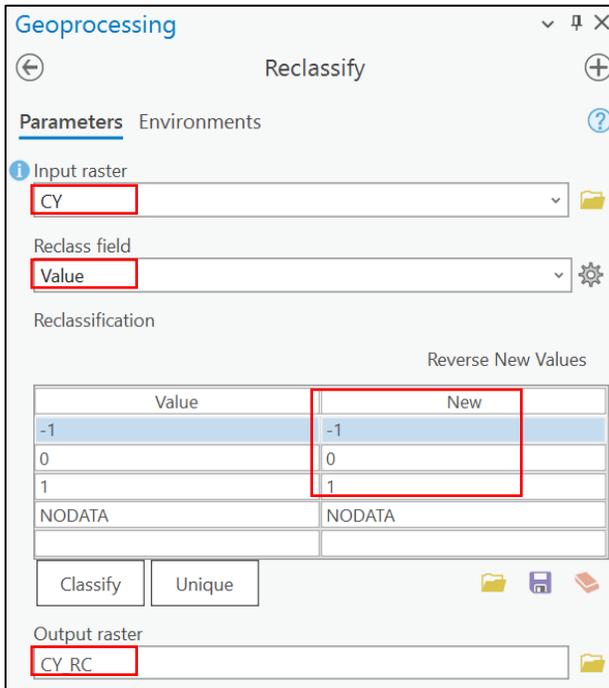
Careful of the commas and parentheses!



6. The resultant maps:



7. Search **Reclassify**. For the **CY** raster layer, change the **New** values to match the **Values**.



8. Search **Focal Statistics**.

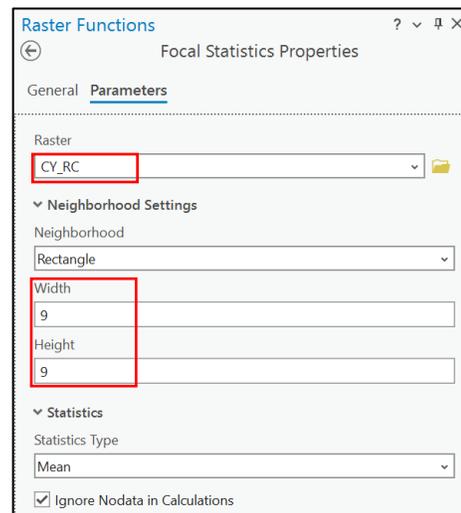
9. In the window, select raster to be **CY_RC** and change the rectangle width and height to **9**. Hit **Run**.

10. Right-click on the focal layer and select **Symbology**.

11. Change the symbology to **classify** and change the **classes to 3**.

12. Search **Reclassify**.

13. In the window, select your *focal statistics* layer. Then change the new values. **Change the new values to -1,0,1**. Hit **Run**.



Input raster
Focal Statistics_CY_RC

Reclass field
VALUE

Reclassification

Start	End	New
-1	-0.333333	-1
-0.333333	0.333333	0
0.333333	1	1
NODATA	NODATA	NODATA

Classify Unique

Output raster
CY_Raster

14. Search **Raster to Polygon**.

Raster to Polygon

Parameters Environments

Input raster
CY_Raster

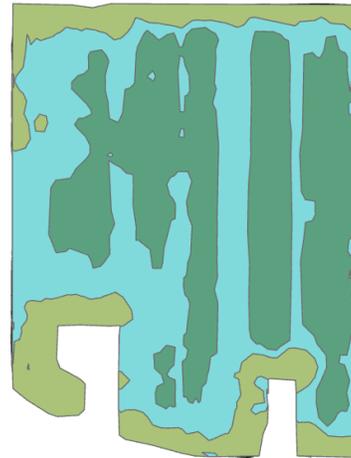
Field
Value

Output polygon features
CY_poly

Simplify polygons

Create multipart features

Maximum vertices per polygon feature



15. Save your project.