## Lesson 3.4: Developing a Yield Goal and N fertilizer prescription maps

## Data Source: dataset3.zip

**Part 1:** Creating a Yield Goal for corn based on a 5-year yield record.

- 1. Open the previously saved project.
- 2. Add a subgroup named "Nitrate" under the group "Soil Prescription".
- 3. Add a group named "Yield Interpolation" under your map.
- 4. The maps you create in this lesson are **based on the following formulas**. If you find yourself confused by the instructions, you can return to these formulas to better understand the instructions.

Yield normalization:

$$y_{relative_{year}} = \frac{Y_{actual_{year}}}{\overline{Y}_{year}}$$

Temporal statistics of historical yields:

Average

$$_{avg} y_{relative} = \frac{y_{relative_{year1}} + y_{relative_{year2}} + \dots + y_{relative_{yearN}}}{N}$$

Standard Deviation

$$StDev \mathcal{Y}_{relative} = \sqrt{\frac{(\mathcal{Y}_{relative_{year1}} - avg \mathcal{Y}_{relative})^2 + \dots + (\mathcal{Y}_{relative_{yearN}} - avg \mathcal{Y}_{relative})^2}{N-1}}$$

• Coefficient of Variation (%)

$$CV = \frac{StDev \mathcal{Y}_{relative}}{ave \mathcal{Y}_{relative}} \cdot 100$$

Yield Goal:

$$YG = 1.1 \cdot_{avg} y_{relative} \cdot Y_{average_{crop}}$$

- 5. Add the following layers to your map.
  - $Y_{corn06} = \text{corn06}$  $Y_{soybean07} = \text{soybean07}$  $Y_{wheat08} = \text{wheat08}$  $Y_{corn09} = \text{corn09}$
  - $Y_{soybean10} = soybean10$

6. Right click on each of the added layer and select **Properties.** Find the **statistics** for the layer and write down the mean value for each layer.

| Layer Properties: soybea | n07  |              |               |                | C              | ) X   |
|--------------------------|--|--------------|---------------|----------------|----------------|-------|
| General<br>Metadata      | Location   | C:\Users\ava | co\Documents' | \ArcGIS\Projec | ts\MyProject1\ | ^     |
| Source                   | Name   | soybean07    |               |                |                |       |
| Elevation                | Vertical Units   | Meter        |               |                |                |       |
| Display                  | Raster Inform  | nation       |               |                |                |       |
| Cache                    |  |              |               |                |                |       |
| Time                     | Band Metada  | ta           |               |                |                |       |
| Processing Templates     | ✓ Statistics   |              |               |                |                |       |
| Joins                    | Build Parameters: skipped columns: 1, rows: 1, ignored value(s): |              |               |                |                |       |
| Relates                  | Band Name  | Minimum      | Maximum       | Mean           | Std. Deviatior | A     |
|                          | Soybean07  | 0.005066758  | 8.220833778   | 4.281550089    | 1.241615378    |       |
|                          | > Extent   |              |               |                |                | - II  |
|                          | > Spatial Refere   | ence         |               |                |                | ~     |
|                          |  |              |               | ОК             | Cancel         | Apply |

Take note of these values for further use:

 $\overline{Y}_{corn06} = 9.51$ ;  $\overline{Y}_{corn09} = 10.51$ ;  $\overline{Y}_{soybean07} = 4.28$ ;  $\overline{Y}_{soybean10} = 6.29$ ;  $\overline{Y}_{wheat08} = 2.44$ 

- 7. Search Raster Calculator (Spatial Analyst).
- 8. Input the following formula, as shown below, into the box. In the environments tab, select the extent to be *Field20\_boundary*. Then hit **Run**.



Part 3: Creating a nitrate prescription variability map

1. The nitrate prescription map will be based off the following formula. YG is the yield goal calculated in Part 1 of this lesson and OM is the field interpolated organic matter (%) map obtained from Lesson 2 – Exercise 1.

 $N = 21.4YG - 2.5YG \cdot OM$ 

2. Search **Raster Calculator** and **Input the following formula**, as shown below, into the box. In the **environments** tab, select the extent to be *Field20\_boundary*.Then hit **Run**.



- 3. Search Focal Statistics.
- 4. In the window, select raster to be *Nitrate\_1* and change the rectangle width and height to **5**. Hit **Run.**

| Raster Functions                | ? ∨ ¤ × |       | him    | min         |
|---------------------------------|---------|-------|--------|-------------|
| Focal Statistics Properties     |         | 1465  | AA 82  | 101 1.54    |
| General Parameters              |         |       |        | HE          |
| Raster                          |         |       | 1980   | C 485 M     |
| Nitrate_1                       | ~ 🦳     |       | 1000   | 1.11.1      |
| ✓ Neighborhood Settings         |         | 163   | 13. 13 | 1000        |
| Neighborhood                    |         | 1.000 |        |             |
| Rectangle                       | ~       |       |        |             |
| Width                           |         | Line  |        | C. 0. 1. 1. |
| 5                               |         |       |        |             |
| Height                          |         |       |        |             |
| 5                               |         |       |        |             |
| > Statistics                    |         |       |        |             |
| ✓ Ignore Nodata in Calculations |         |       |        | ]           |

- 5. Right-click on the new Nitrate layer and select **Symbology.**
- 6. Change the symbology to **classify** and change the **classes to 15.**

## 7. Search Reclassify.

8. In the window, select your *focal statistics layer*. Then change the new values. **Starting at 80** increase each new value by 10 until you reach 220. Hit Run.

| Geoprocessing               |            | ~             | άX       |
|-----------------------------|------------|---------------|----------|
| $\odot$                     | Reclassify |               | $\oplus$ |
| Parameters Environment      | S          |               | ?        |
| Input raster                |            |               | 1        |
| FOCAL STATISTICS_INITIATE_1 |            | · ·           | _        |
| Reclass field               |            |               |          |
| VALUE                       |            |               | \$\$F    |
| Reclassification            |            |               |          |
| Reclassification            | 5          |               |          |
|                             | Reve       | rse New Value | es       |
| Start                       | End        | New           |          |
| 33.388271                   | 56.755715  | 80            | ^        |
| 56.755715                   | 68.793489  | 90            |          |
| 68.793489                   | 78.70695   | 100           |          |
| 78.70695                    | 88.62041   | 110           |          |
| 88.62041                    | 99.241976  | 120           |          |
| 99.241976                   | 111.279749 | 130           |          |
| 111.279749                  | 124.025628 | 140           |          |
| 124.025628                  | 136.771506 | 150           |          |
| 136.771506                  | 147.393071 | 160           |          |
| 147.393071                  | 157.306532 | 170           |          |
| 157.306532                  | 167.928097 | 180           |          |
| 167.928097                  | 178.549662 | 190           | ~        |
| Classify Unique             |            | 🧀 🔒           |          |
| Output raster               |            |               |          |
| Nirate 1 raster             |            |               |          |
|                             |            |               |          |
| Change missing values       | to NoData  |               |          |

## 9. Search Raster to Polygon.

| (                                     | Raster to Polygon |   | $\oplus$ |
|---------------------------------------|-------------------|---|----------|
| Parameters Environm                   | ients             |   | ?        |
| Input raster Nirate_1_raster Field    | ]                 | ~ | <b></b>  |
| Value                                 |                   | ~ | ÷        |
| Output polygon featur<br>Nitrate poly | 25                |   |          |



10. This is your final map. Save your project.