

Approximating the Area of Wheat Fields Using Drone Data

1. Start a blank project, name it something descriptive (e.g. Unsup_Classification), and save it in a safe location.
2. Click New Map to start a new map.
3. We will add in an orthomosaic collected using a multispectral scanner (MicaSense RedEdge) mounted on a sUAS/drone.

Go to Add Data, and add in the RedEdge_Wheat_GeoTIFF.tif

4. The layer that you just added is a composite image created by four different sensors within the multispectral scanner. The approximate wavelength detectable by each sensor is as follows:

Band 1: 480 nm
Band 2: 560 nm
Band 3: 670 nm
Band 4: 720 nm
Band 5: 840 nm

Review this page about the visible spectrum (https://en.wikipedia.org/wiki/Visible_spectrum) and answer the following questions:

Q1. Which band contains information on red reflectance? (Band 3, Band 4 is acceptable)

Q2. Which band contains information on green reflectance? (Band 2)

Q3. Which band contains information on blue reflectance? (Band 1)

5. Go to the Appearance tab, click on Band Combination, select Custom. Assign Band 3 to be shown in red, Band 2 to be shown in green, and Band 1 to be shown in blue. Type in Natural as the name and click Add. You should now see a natural color composite, or an image that our eyes are accustomed to seeing.
6. We will now create a near infrared composite image to highlight vegetation in the study area. Go to the Appearance tab, click on Band Combination, select Custom. Assign Band 5 to be shown in red, Band 3 to be shown in green, and Band 2 to be shown in blue. Type in Near Infrared as the name and click Add. You should now see a near infrared composite, where the higher the level of infrared reflectance the brighter the red color is.
7. We will now perform a simple ISO (iterative self-organizing) unsupervised classification to group/cluster the pixels in the study area into the number of classes specified by the user. In particular, the pixels in each class are more similar to each other than pixels in other classes.

Click on the Analysis tab, select Tools, and search for Iso Cluster Unsupervised Classification. Within the Iso Cluster Unsupervised Classification tool, enter the following:

- Input raster bands: RedEdge_Wheat_GeoTiff.tif
- Number of classes: 5
- Output classified raster: unsup_out (be sure to save this output in a safe location)
- (Leave other parameters as is)
- Hit Run

8. In order to make sense of the 5 different colors that were shown in our output (since we requested 5 classes in the previous step), select the name of the output (unsup_out) in the table of contents, and select the Appearance tab in the main menu. Make sure that the unsup_out layer and the original image are both turned on, use the Swipe tool from the Effects group to answer the following questions:

Q4. Which color represents shadows? What is its value in the table of contents? (Depends)

Q5. Which color represents vegetation? What is its value in the table of contents? (Depends)

Q6. What do the remaining color represents? (Bare earth with different level of moisture or disturbance, manmade features/structures such as pipes and towers)

9. We will now estimate the area within the study region that is covered by vegetation using tools in ArcGIS Pro.

Go to the Analysis tab, click on Tools, and search for Raster to Polygon. Enter the following:

-Input raster: unsup_out

-Field: Value

-Output polygon features: unsup_out_polygons (be sure to save this output in a safe location)

-Uncheck simplify polygons

-Hit Run

10. The current spatial reference system of our dataset is in geographic coordinates (i.e. decimal degrees), which is not conducive to areal calculations. So we will reproject the unsup_out_polygons layer.


Go to the Analysis tab, click on Tools, and search for Project. Enter the following:


-Input Dataset or feature Class: unsup_out_polygons

-Output Dataset or Feature Class: proj_output (be sure to save this output in a safe location)

-Output Coordinate System: click on the select coordinate system button, and enter 3857 for in the search field (This is the ID for the WGS 1984 Web Mercator system). Hit OK.

-Hit Run

11. Change the symbology of the proj_output layer by clicking on the name of the layer in the table of contents, selecting the Appearance tab in the main menu, and click on Symbology.
12. On the symbology pane, make sure that unique values is selected, and gridcode is selected as the Field 1 under the Value Field section. Click on the Add all values icon .
13. Still within the symbology pane, find the class that represents shadows in the polygon layer by looking for the class with the value that you answered as representing shadows in the previous question. Change the label for that class to Shadows. Repeat this process, and change the label for the class representing vegetation. Change the labels for the three other classes to others.
14. Since there is only one class value which represents vegetation in our map, we will implement a definition query to filter it out.

To help organize ourselves, first turn off all other layers except the proj_output layer. Then select the proj_output layer in the table of contents. Select the Data tab in the main menu, click on the tiny arrow () to the right of the words Definition Query.

In the Definition Query window, click Add Clause, and enter the following statement:

- Field: gridcode
- is Equal to
- Value: (select value that you previously answered as representing vegetation)
- Click OK

15. We will now complete our calculation of the areas that are vegetated in our study area.

Open the attribute table of the proj_output layer, you may see a Shape_Area field already created in the table for you if you have been saving your output in a geodatabase, but we will disregard this calculation in favor of a more accurate geodesic area calculation (ignore the last sentence if you do not have a Shape_Area field).

Go to the Analysis tab, click on Tools, and search for Add Geometry Attributes, enter the following:

- Input Features: proj_output
- Geometry Properties: Geodesic_area
- Area Unit: Acres
- Coordinate System: (select proj_output, and WGS_1984_Web_Mercator_Auxiliary_Sphere should be populated)
- Click Run

16. Open the attribute table of the proj_output layer if necessary, you should see an attribute called AREA_GEO that was automatically created for you as a result of running the Add Geometry Attribute tool. We will now run the Summarize tool to sum up the area occupied by vegetation.

Right click on the AREA_GEO field name, and select Summarize. In the Summary Statistics pane, enter the following:

- Input Table: proj_output
- Output Table: area_output
- Field: AREA_GEO
- Statistic Type: SUM
- Case Field: gridcode
- Click Run

17. A new table should be generated in the table of contents, open the area_output table.

Q7. What is the approximate size of the vegetated area (in acres)? (3.55)

18. Compare the proj_output to the original sUAS/drone image (you will need to turn the drone image back on in the table of contents first). You will notice that there are some tree in the southern edge and eastern edge of the study area that are not part of the field. We will need to exclude these areas as we only want to approximate the area of the fields.

Q8. What tool can you use to delete or exclude these non-field areas from our analysis? (Clip)

19. Delete the non-field areas from the proj_output layer, and rerun the Summarize tool (you do not need to rerun the Add Geometry Attributes tool since the area of the remaining polygons did not change, you merely deleted some of the polygons representing non-field areas).

Q9. What is the approximate size of the vegetated area that are fields (in acres)? (3.53)



Attribution-NonCommercial-ShareAlike

CC BY-NC-SA

This activity was created with support from the National Science Foundation under Grant ATE #1700552. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

