Supervised Classification of UAS Multispectral Images and Landcover Analysis

1. Start a blank project, name it something descriptive (e.g. Sup_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_Field_1_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

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. Go to the Appearance tab, click on Band Combination, select Natural to see the natural color composite in your map again.
8. Compare the natural color composite with the Topographic basemap (it should already be in your map by default, or add the basemap if necessary) to distinguish the different types of features (i.e. water, cultivated areas, developed/building, barren/dirt roads) we are looking at in the drone multispectral (natural color composite) image.

Q1. In which country was the drone/UAS photo taken? (The Netherlands)

9. In a typical supervised classification workflow, we would go into the field and collect several training samples (i.e. data points) for each of the different types of feature we are interested in. Since our travel budget is limited, we will identify these training sample points by looking at the basemap and the natural color composite.
10. With the RedEdge_Field_1_GeoTIFF.tif image selected in the table of content, click on the Imagery tab.
11. Within the Imagery tab, click on Classification Tools, and select Training Samples Manager. You should now see a NLCD 2011 template on the right pane with commonly used classes (see below). Click on water, click on the polygon shape ( ) near the top of the pane, and sketch a polygon in an area occupied by water in the map. Repeat the process to draw at least 4 or 5

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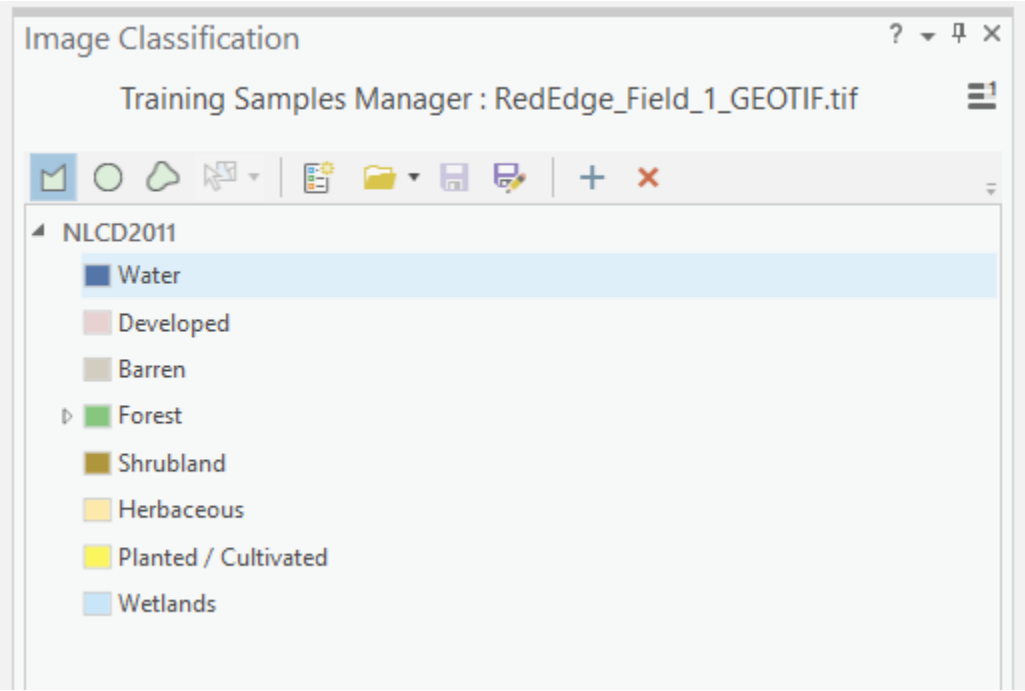
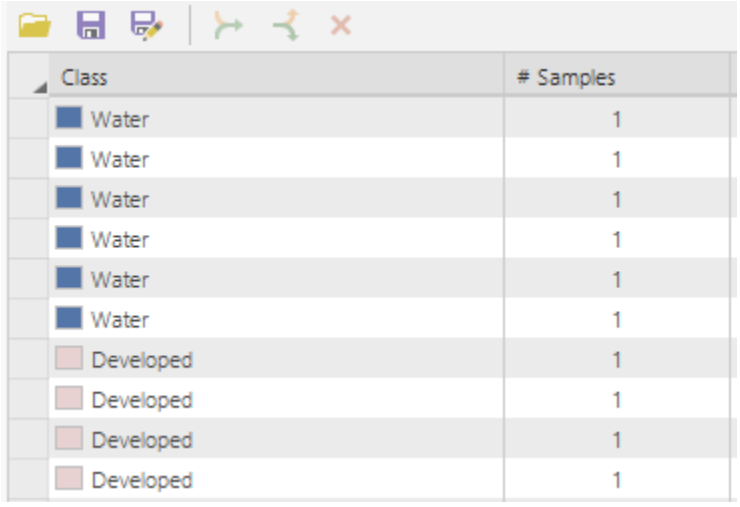
polygons around water features in different parts of the drone image, because we are trying to get a representative sample of water pixels to train the software to recognize other water pixels in the image.



12. Repeat step 11 to sketch 4 or 5 training sample polygons for the planted/cultivated class, developed class, and barren class respectively.
13. Once we have finished identifying training samples for each of the four classes (i.e. water, cultivated areas, developed/building, barren/dirt roads), the lower half of the Training Samples Manager should look like Figure XX with each sample listed in the table. Click on Save icon above the word Class to save your training samples, call the output TrainingSamples.



Class	# Samples
Water	1
Water	1
Water	1
Water	1
Water	1
Water	1
Developed	1
Developed	1
Developed	1
Developed	1

14. Once we have saved the training samples, it is a good practice to make sure that it has been saved successfully. Go to the View tab, click on Catalog Pane, navigate to the location where the TrainingSamples output was saved, and you should see that it has been saved either as a

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shapefile or feature class. Add the TrainingSamples output to your map. Right click on the folder and select Refresh if you don't see the new TrainingSamples file.

15. Select the RedEdge_Field_1_GEOTIF.tif layer in the Contents. Return to the Imagery tab, click on Classification Tools, select Classify, and enter the following:
    -Classifier: Maximum Likelihood
    -Training Samples: (Use the dropdown to select) TrainingSamples

    -Output Classified Dataset: sup_class_output (be sure to save this output in a safe location)
    -Output Classified Definition File: sup_class_def.ecd (be sure to save this output in a safe location and include the .ecd extension)
    -Hit Run

To learn more about the different types of classifiers available, see https://pro.arcgis.com/en/pro-app/help/analysis/image-analyst/classify.htm

Q2. Attach an image/printout of your map created with the Maximum Likelihood classifier **(be sure to put the name of the classifier in the title of your printout)**

16. Convert the supervised classification output (which is a raster layer) into a vector layer by going to the Analysis tab, click on Tools, and search for Raster to Polygon. Enter the following:
    -Input raster: sup_class_output
    -Field: Class_name
    -Output polygon features: sup_poly (be sure to save this output in a safe location)
    -(Leave Simplify polygons checked)
    -Hit Run
17. Run the dissolve tool to group polygons from the same class into one record in the attribute table. Do this by going to the Analysis tab, click on Tools, and search for Dissolve, and enter the following:
    -Input Features: sup_poly
    -Output Feature Class: sup_poly_Dissolve
    -Dissolve_Field(s): Class_name
    -(make sure that Create multipart features is checked)
    -Hit Run
18. We will now calculate the area that belongs to each of the four classes (i.e. water, cultivated areas, developed/building, barren/dirt roads).

Open the attribute table of the sup_poly_Dissolve 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: sup_poly_Dissolve
    -Geometry Properties: Geodesic_area
    -Area Unit: Acres

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-Coordinate System: (select sup_poly_Dissolve, and WGS_1984_UTM_Zone_31N should be populated)
-Click Run

Q3. What is the area (in acres) for the barren class? (varies; ex: 2.36)
Q4. What is the area (in acres) for the developed class? (varies; ex: 1.09)
Q5. What is the area (in acres) for the planted/cultivated class? (varies; ex: 10.79)
Q6. What is the area (in acres) for the water class? (varies; ex: 0.99)

19. Repeat steps 15-18 using the same TrainingSamples file, except this time, carry out the supervised classification using a classifier other than Maximum Likelihood or ISO Cluster. (For Support Vector Machine, use Maximum Number of Samples per Class: 500.)

Q7. Which classifier did you use? (Random Trees or Support Vector Machine)
Q8. What is the area (in acres) for the barren class? (varies)
Q9. What is the area (in acres) for the developed class? (varies)
Q10. What is the area (in acres) for the planted/cultivated class? (varies)
Q11. What is the area (in acres) for the water class? (varies)

Attach an image/printout of your map created with the classifier of your choice **(be sure to put the name of the classifier in the title of your printout)**

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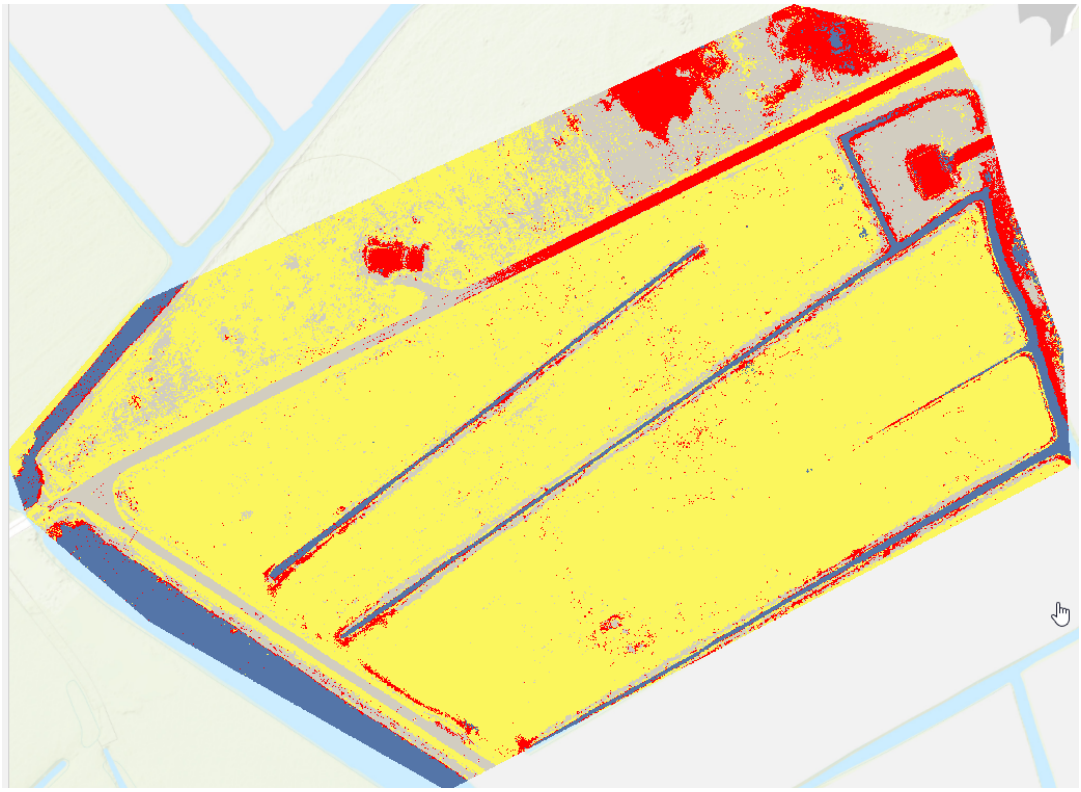
Example: Maximum Likelihood Classifier output



Example: Random Tree Classifier output

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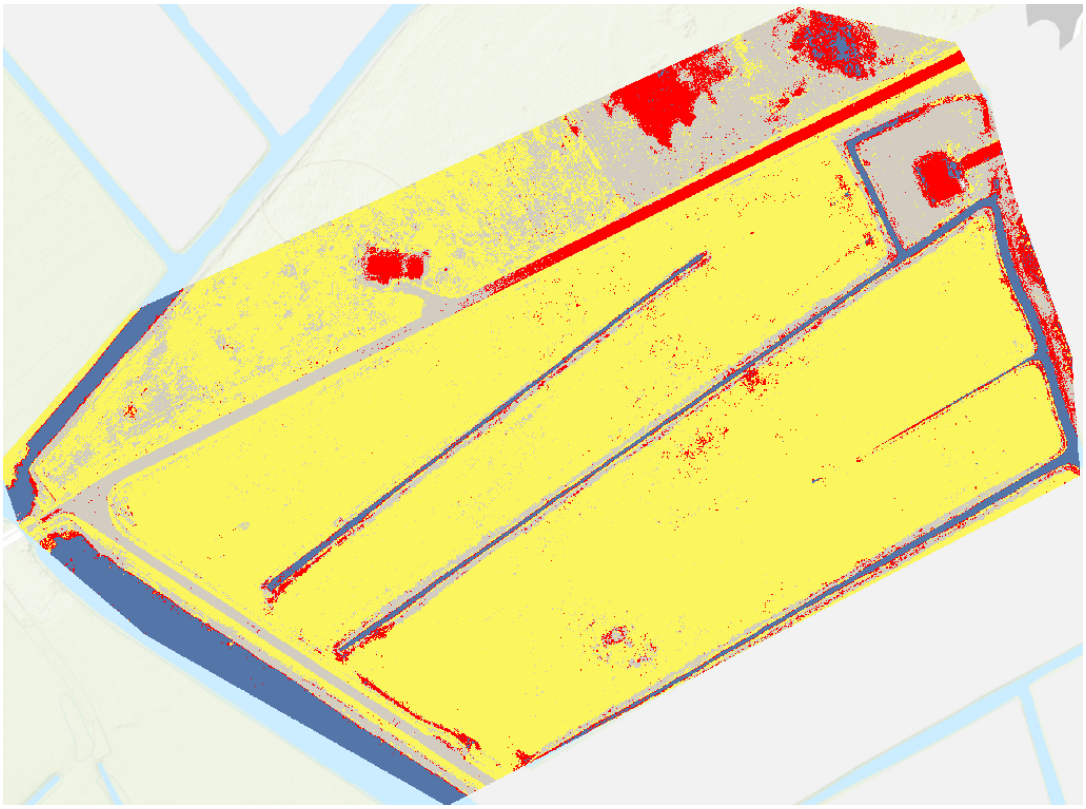

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