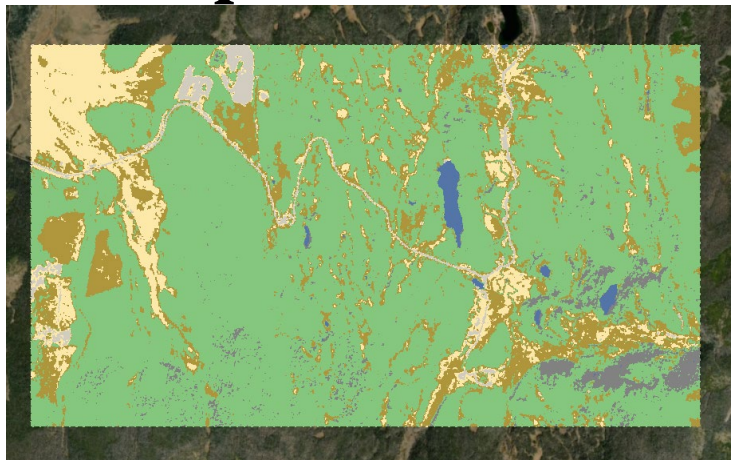


# EXERCISE 3

## Unsupervised Classification



### Introduction

In this exercise you will learn how to conduct an unsupervised pixel-based classification to create a thematic raster. Pixel-based classifications rely solely on spectral characteristics of the input image. Unsupervised classification does not require samples and is particularly useful when working with coarse resolution imagery where humans have a difficulty interpreting features. In this exercise we will use a Sentinel-2 image to create a land cover raster.

### Objectives

- Learn to conduct unsupervised classification in the Image Classification Wizard.
- Use tools to clean up classification results.

### Required Data

- **Sentinel2.tif**—Sentinel-2 composite in **CourseData**
- **NAIP.tif** – NAIP imagery for reference in **CourseData**
- **Uinta\_class.clr** – Colormap in **CourseData**
- **Exercise 3 Classification Schema.ecs** – Classification scheme in **CourseData**

### Prerequisites

- Install Esri ArcGIS Pro
- A basic understanding of ArcGIS software.



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## Part 1: Set up ArcGIS Pro and Evaluate the Area

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### A. Open ArcGIS Pro

1. Launch ArcGIS Pro from the start menu by clicking **Start, Programs, ArcGIS, ArcGIS Pro**.
2. Under **New, Blank Templates**, Click **Map**.
3. Name the project **Unsupervised\_Classification**. Save the project in your desired location.

### B. Add data

1. Click the **Add Data** button in the Map toolbar.
2. Navigate to the **CourseDownloads, CourseData** and **Exercsie3** folder.
3. Select **Sentinel2.tif** and **NAIP.tif**
4. Click **OK** to add the data to the map.

### C. View and evaluate the imagery

1. In order to familiarize yourself with the **Sentinel2.tif** imagery, pan and zoom around to determine what land cover classes are present. You can turn on and off **NAIP.tif** in the Table of Contents to help determine land cover classes. You may notice seasonal and land cover changes between the two images. In this exercise we will focus on water, barren, forest, and non-forest vegetation land cover classes.

## Part 2: Classify the Imagery

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In this part you will classify the Sentinel-2 data in the Image Classification Wizard. You can conduct classification using individual tools in ArcGIS Pro but the Image Classification Wizard offers a streamlined approach to classify imagery. It processes data on the fly so you do not have to save intermediate layers and can adjust parameters without rerunning the tools.

### A. Configure the Image Classification Wizard

1. With **Sentinel2.tif** selected in the Table of Contents, **Click** on the Imagery tab to open the toolbar.
2. **Click** the Classification Wizard tool. This will open the Classification Wizard window.
3. For **Classification Method** choose **Unsupervised** from the drop-down menu.
4. For **Classification Type** choose **Pixel based**.
5. For **Classification Schema** navigate to **Exercise 3 Classification Schema.ecs** in CourseData.
6. Choose your desired output location.

7. Click **Next** to move on to the Train page.

## B. Train and Classify

1. For **Classifier** leave the default, ISO Cluster. This is only unsupervised classifier in ArcGIS Pro.
2. Enter **40** for **Maximum Number of Classes**.

Note: Even though you enter 40 as the maximum number of classes the algorithm will only identify the number of classes it is able to clearly differentiate given the characteristics of the input imagery. You want the classifier to identify many more classes than you ultimately desire. A good rule of thumb is 10 times the number of input bands. For the purpose of this exercise, we are only using four bands so we will use 40 as the maximum number of classes.

3. Set **Skip Factor** to **5**. A skip factor of 5 will use every 5<sup>th</sup> pixel to create the initial clusters. All pixels will be assigned to a cluster after these initial clusters are created. A higher value will process more quickly but produce less accurate results.
4. Leave all other parameters as the default.
5. Click **Run**. This will open a preview of the classified raster in the table of contents. From here you can inspect the output and compare parameters before running the classifier.
6. Click **Next**.
7. Name the Output Classified Dataset Uinta\_classified.
8. Click **Run**.
9. Click **Next**.

## C. Assign Class

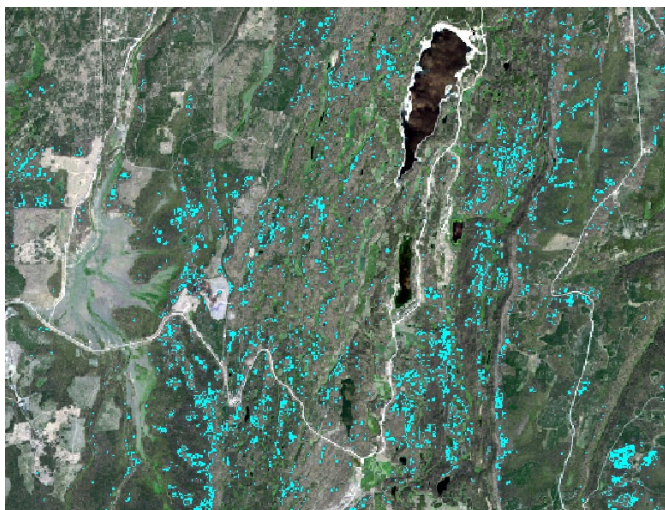
The unsupervised classification created many more classes than we ultimately desire. The assign classes window lets you easily assign a meaningful land cover class to the initial classes. We will

use an existing classification schema but if you are working with your own data you can add and remove classes based on your desired land cover classes.

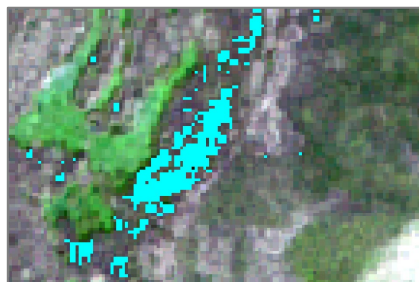
1. In the Table of Contents select **Preview\_UnsupervisedAssignClasses**
2. In the **Appearance** Tab set the Transparency to **100%**



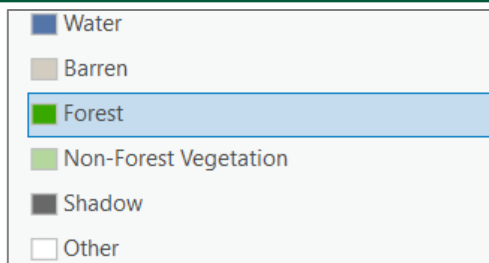
3. Turn off **Uinta\_classified** and **Preview\_Classified** layers so that **Preview\_UnsupervisedAssignClasses** is above **Sentinel2.tif**
4. In the Image Classification Wizard **Select** the first row, 0 under Old Class. This will highlight pixels classified as 0 in the Map pane. Your classes will be different but your map should look similar to the image below with highlighted pixels above imagery.



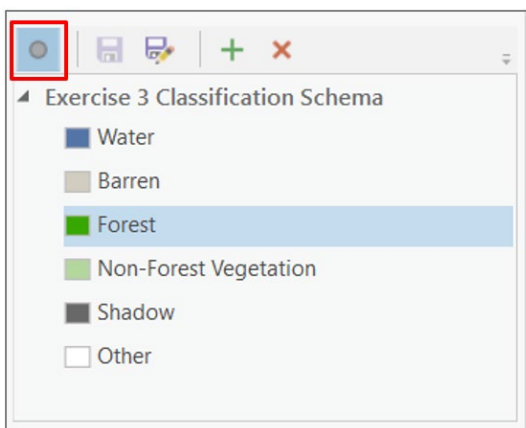
5. Zoom to a group of highlighted pixels in the Map.



6. Using Sentinel2.tif and NAIP for reference, determine the dominant land cover for the highlighted pixels. Turn on and off the **PreviewUnsupervisedClassification** layer to help determine land cover.
7. Once you have determined the land cover, click on that class in the classification schema to select it.



8. Click the **Assign Class** tool in the upper left corner (see graphic below).



9. In the Map pane, click on highlighted cells with the cursor to assign these cells to the new class. The new classification will appear under the New Class column.

Old Class	New Class
0	Forest

10. Repeat steps 4-9 for the remaining classes until all old classes are classified. You may not need all classes provided.

11. In the Table of Contents select **Preview\_UnsupervisedAssignClasses**

12. To view the classified dataset click the **Appearance** Tab set the Transparency to **0%**

13. When you are satisfied with your results **Click Next**.

## D. Clean Results with Reclassifier

The reclassifier pane allows you to clean-up results by drawing polygons and reassigning pixels in those polygons to a new class. This should be the final step once you are confident that you have achieved optimal results with the initial classification.

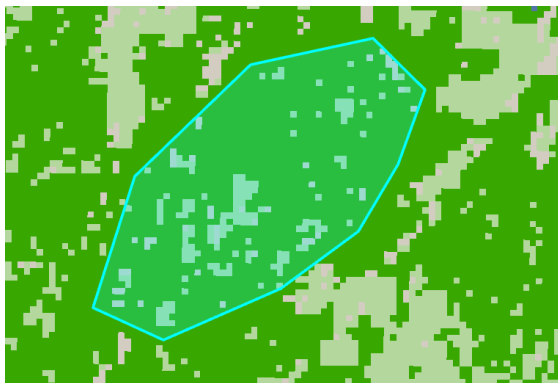
1. Pan and zoom around to find an area with misclassifications. Use the "L" key to turn on and off transparency.
2. For **Edit Type** choose Reclassify within a region.
3. For **Remap Classes** select the misclassified class for Current Class or use Any to reclassify all pixels in the region. Select the correct class under New Class.

- Remap Classes

Current Class

New Class

4. Draw a polygon around the misclassified region. Double-click to end the drawing. After a few seconds the reclassified pixels will change to the new class.



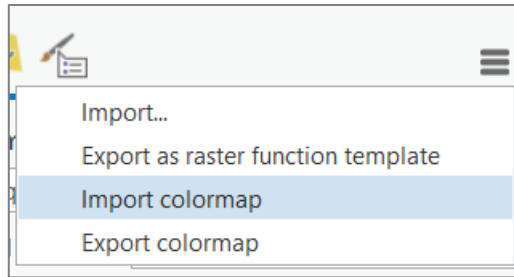
5. Continue to Pan and Zoom around the image to find misclassifications. Repeat steps 1-4 a few more times until you are comfortable with the tool and satisfied with your results.

## Part 3: Improve Classification with Generalization

### A. Majority Filter

1. In the **Analysis** Tab, Click **Tools** to open the Geoprocessing Search Window.
2. Search for **Majority Filter**.
3. For Input raster choose **Reclassified.tif**
4. Save the Output raster in your desired location. Name the file **MF\_reclassified.tif**
5. Set **Number of neighbors** to **Eight**.
6. Set **Replacement threshold** to **Majority**.
7. Click **Run**.
8. In the Table of Contents, right click on **MF\_reclassified.tif**, click **Symbology** to open the symbology pane.
9. In the upper right corner, click the three lines then **Import colormap**.





10. Navigate to **ExerciseData, Exercise3**, select **Uinta\_class.clr**
11. Click **Ok**.
12. View your outputs and compare the unfiltered output to the filtered results. Notice the results have been smoothed and isolated pixels have been absorbed into the surrounding class.

**Congratulations!** You have successfully completed this exercise! You now know how to run an unsupervised classification and clean up the results to create a land cover raster. Unsupervised classification is a straightforward technique for conducting classifications that is particularly useful when you do not have samples.