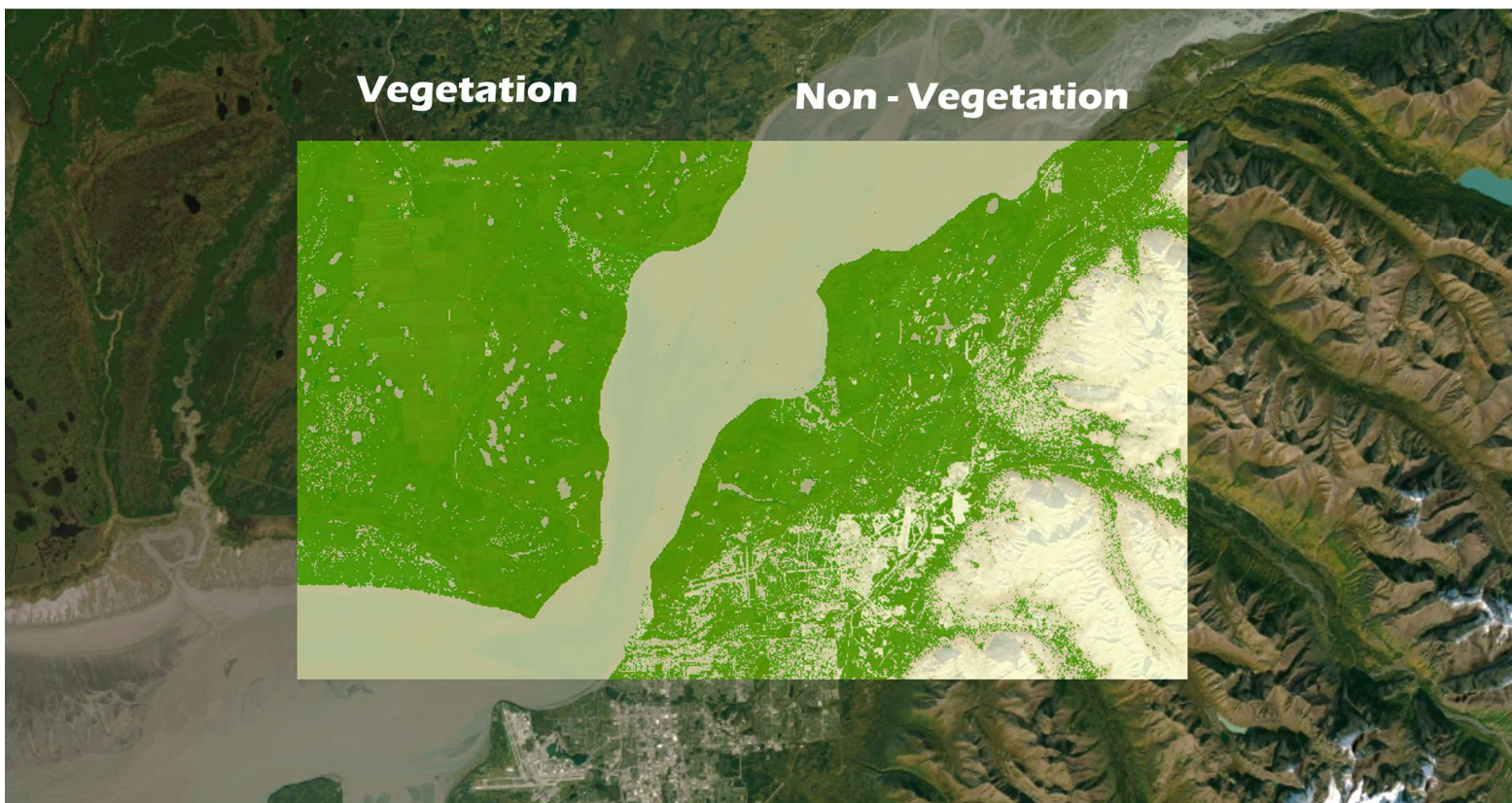




ArcGIS Pro

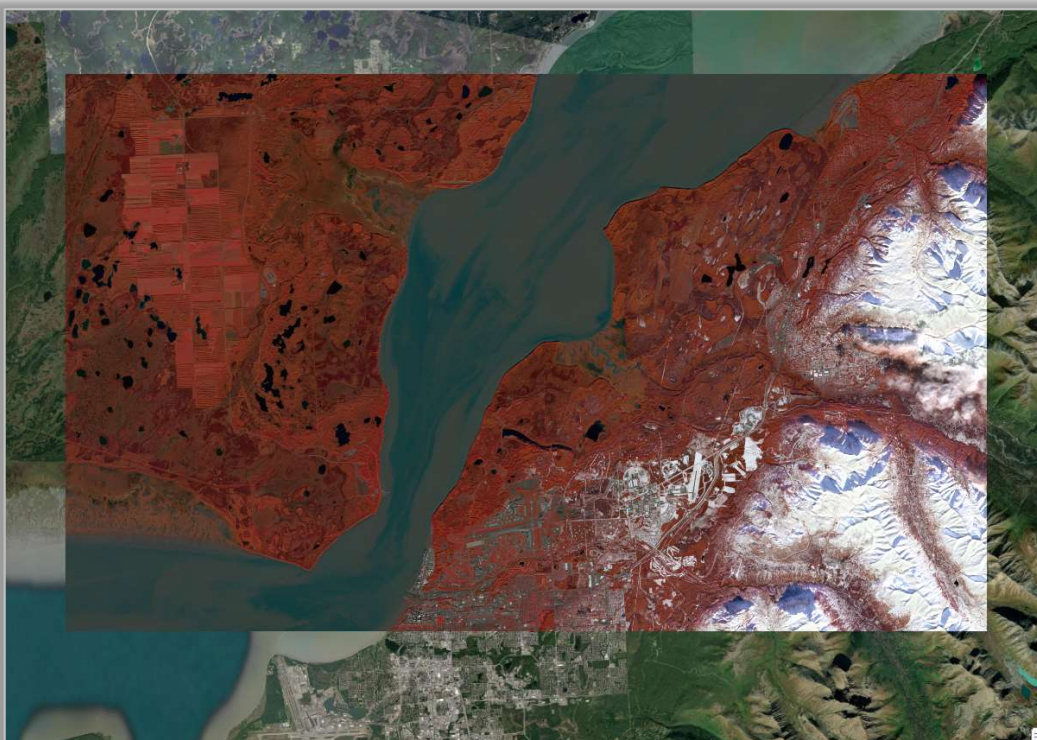
## In this Hands-On:

- We will get some practice of doing a pixel-based image classification and performing an accuracy assessment against an NDVI reference dataset.
- You will try to classify an image into vegetated and non-vegetated areas. Your result will then be compared with an NDVI image classification.



## Add Data to a new Project

- Add a new folder connection so that you can add in the NDVI shapefile and the Sentinel2 image.
  - Background information on the NDVI shapefile: The shapefile has been created by calculating the NDVI (band arithmetic) based on the Sentinel2 image that we are using. After calculating the NDVI, the raster was reclassified into two classes and then turned into a polygon based on those two class values.

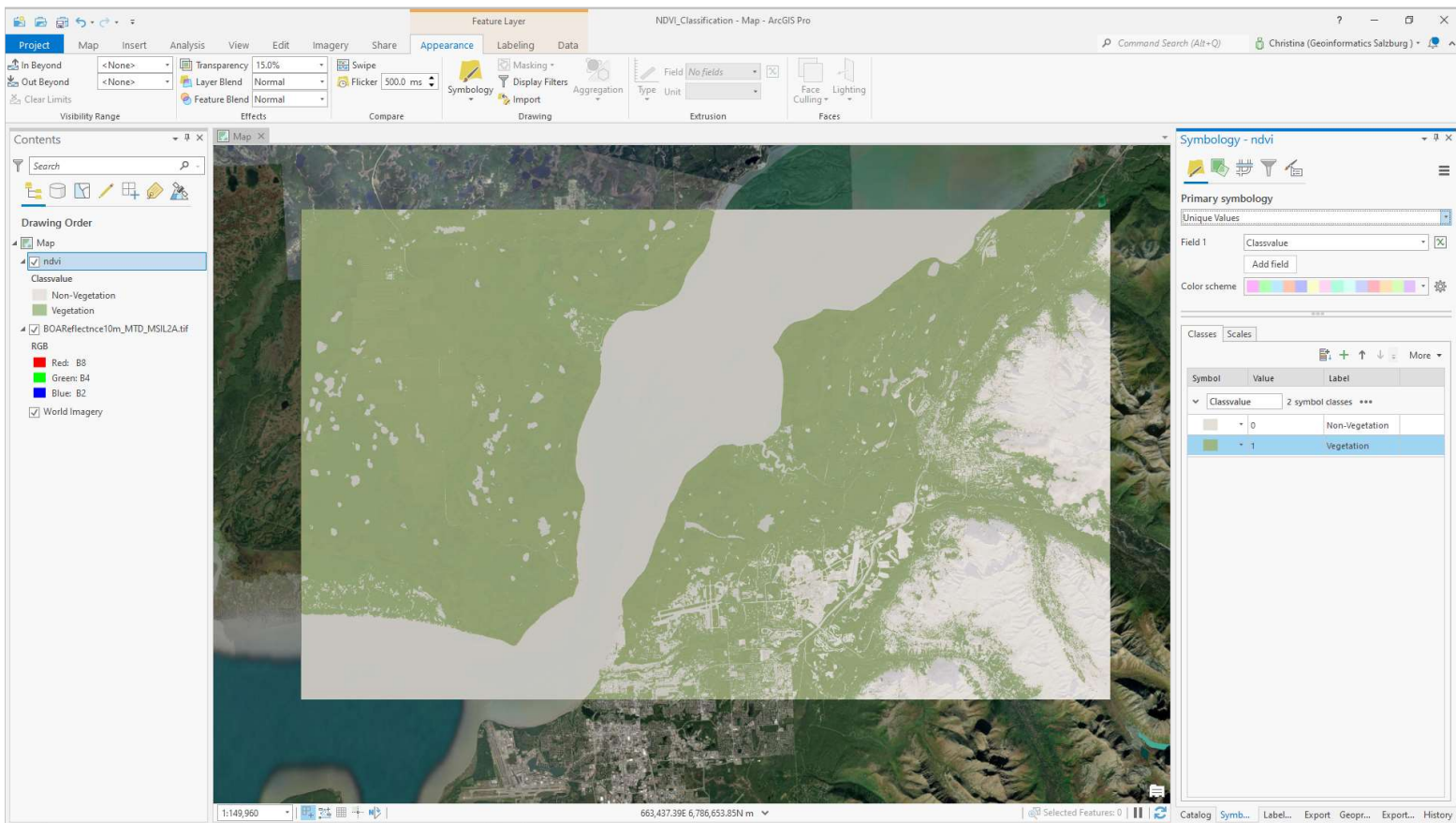




# Hands-On: Image Classification and Accuracy Assessment

## Give the NDVI shapefile appropriate Symbology

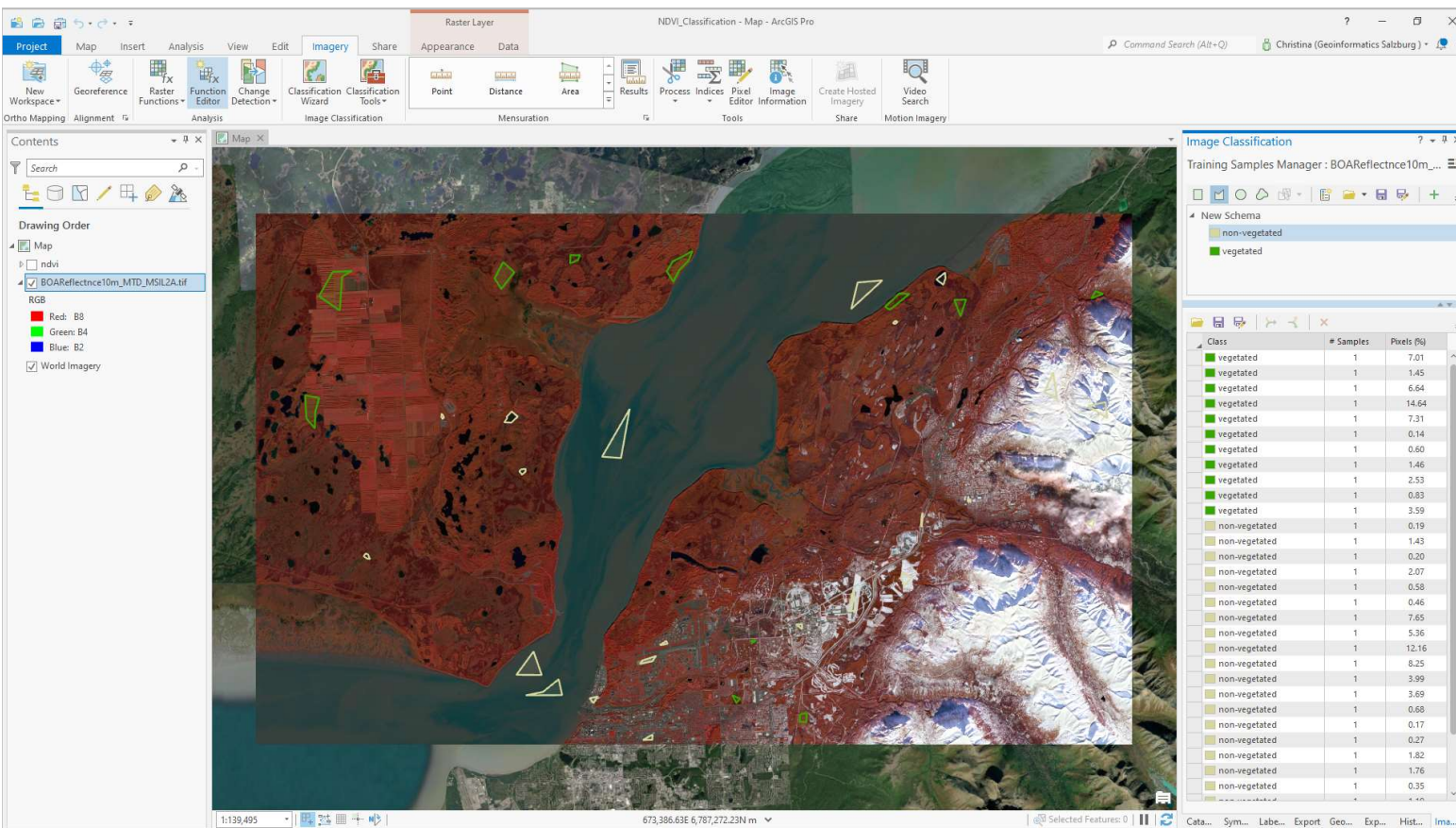
- We can visualise the two classes in a meaningful way to represent vegetation and non-vegetation
  - Set symbology to “Unique Values” as per “Classvalue”. Then change the colors.
  - This will be helpful when we later compare and make sense of the quality of our classification.



# Hands-On: Image Classification and Accuracy Assessment


## Start the Classification Process: Create a Schema and Samples

- To begin the classification process, we need to create a schema with training samples.
- Open the Training Samples Manager (Imagery > Classification Tools > Training Samples Manager)
- Add a new schema
  - Add two classes: one for non-vegetated (classvalue = 0) and one for vegetated areas (classvalue = 1)
- Create representative samples



The screenshot shows the ArcGIS Pro interface with the 'Image Classification' tool active. The 'Training Samples Manager' window is open, displaying a 'New Schema' with two classes: 'non-vegetated' (yellow) and 'vegetated' (green). The table below the schema shows the number of samples and pixels for each class.

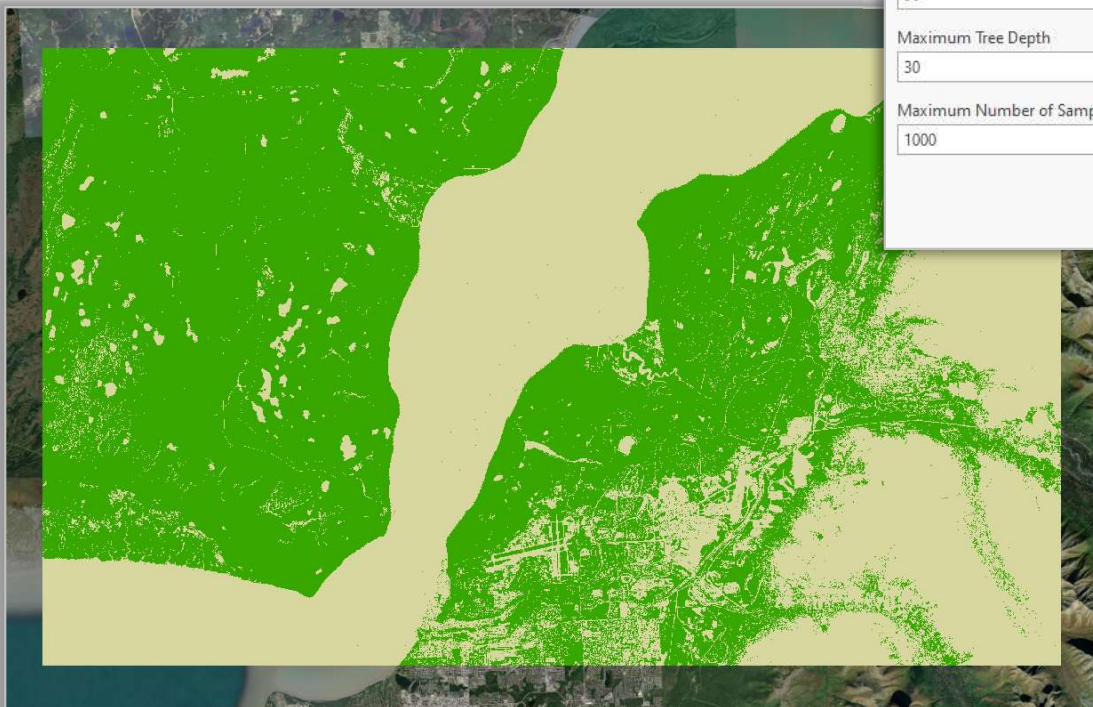
Class	# Samples	Pixels (%)
vegetated	1	7.01
vegetated	1	1.45
vegetated	1	6.64
vegetated	1	14.64
vegetated	1	7.31
vegetated	1	0.14
vegetated	1	0.60
vegetated	1	1.46
vegetated	1	2.53
vegetated	1	0.83
vegetated	1	3.59
non-vegetated	1	0.19
non-vegetated	1	1.43
non-vegetated	1	0.20
non-vegetated	1	2.07
non-vegetated	1	0.58
non-vegetated	1	0.46
non-vegetated	1	7.65
non-vegetated	1	5.36
non-vegetated	1	12.16
non-vegetated	1	8.25
non-vegetated	1	3.99
non-vegetated	1	3.69
non-vegetated	1	0.27
non-vegetated	1	0.17
non-vegetated	1	1.82
non-vegetated	1	1.76
non-vegetated	1	0.35

- Once you are satisfied, save your schema and your samples (  ) in a place where you will find them again.

# Hands-On: Image Classification and Accuracy Assessment

## Perform a Classification

- Open the Classification Wizard (Imagery > Classification Wizard)
  - The wizard will guide you through a number of steps to arrive at a final classification
- In the first step, specify how you would like to classify your image: Supervised and pixel-based
- Add your schema and training samples in the appropriate places
- “Next”
- Now you will see the schema and samples again, and have a chance to adjust them before the classification.
- If you are happy with the samples, simply click “Next”
- In the next step you must choose how to train your classifier. We will work with the “Random Trees” classifier.
- Once you have configured the “Train” step, click “Run”
- The classifier is now applied to the image according to your schema and training samples. It will give you a first output.

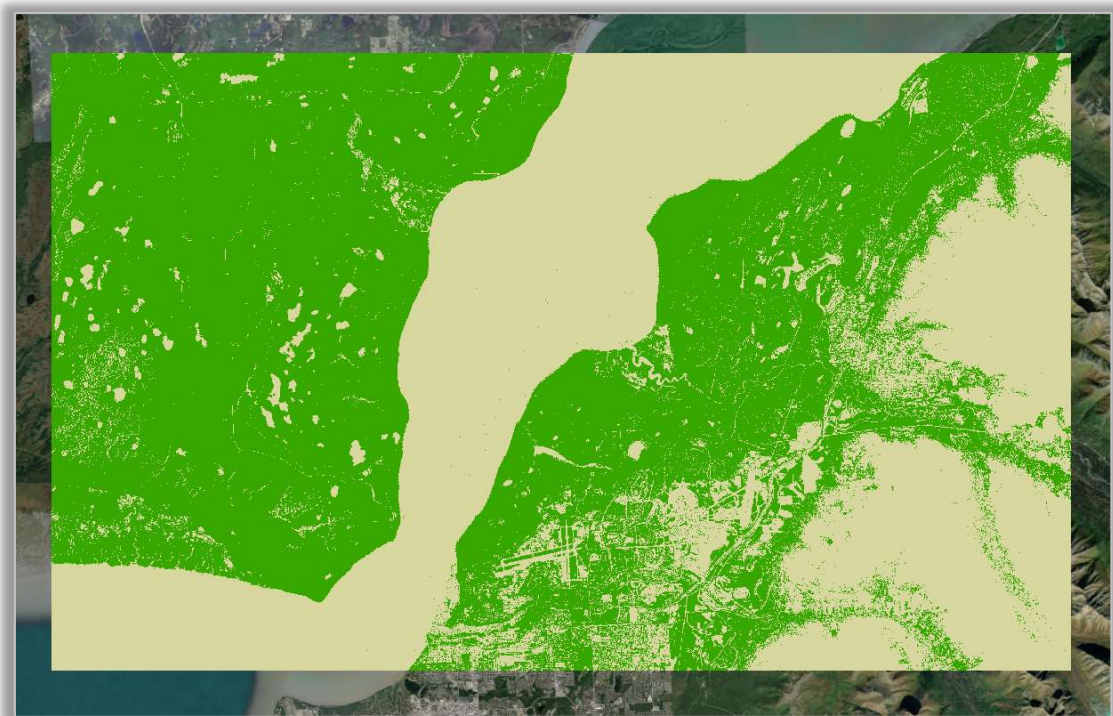


- Now you can visually inspect your first result, and make an assessment on whether or not you are already satisfied with this. If you would like to adjust your samples, click “Previous” to get back to the training samples and edit them. Then re-run your classifier. You can repeat these steps as often as you like.
- In the next step “Classify” you do not need to do anything (this step is useful if you want to save your result on your desktop). Click “Run” and then “Next”.



## Hands-On: Image Classification and Accuracy Assessment

- The next step will ask you if you wish to merge any classes. We do not need this for our classification, so you can simply click “next”.
- Finally, you have the option of reclassifying your results. This can be seen as a final, manual correction. You can specify any region of the classified image and change all pixels of one class to another.
- Once satisfied, click “Run” and “Finish”.
- Your final result will be called “Reclassified\_...”.



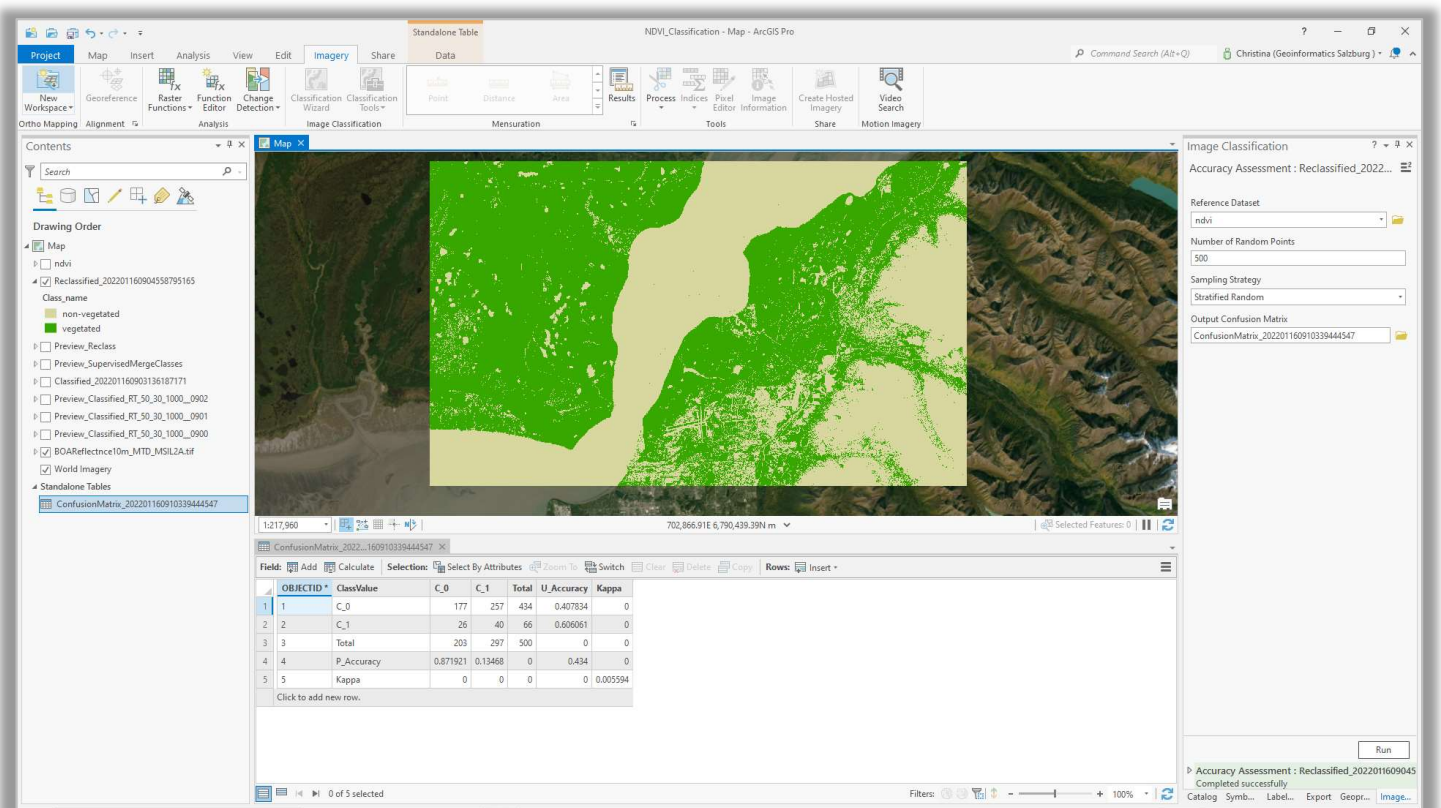
For more background information on the Classification Wizard visit:

<https://pro.arcgis.com/en/pro-app/latest/help/analysis/image-analyst/the-image-classification-wizard.htm>

# Hands-On: Image Classification and Accuracy Assessment

## Accuracy Assessment

- The next step is to compare if we were able to classify the image in a way that's similar to the NDVI classification.
- To check this, open the Accuracy Assessment tool (Imagery > Classification Tools > Accuracy Assessment)
- Select the “ndvi” shapefile as the reference dataset.
- Leave the Sampling Strategy at “stratified random” for now.
- Click “Run” and a table called “ConfusionMatrix” will appear in your content panel. Open it to see the results.



The screenshot shows the ArcGIS Pro interface with the Accuracy Assessment tool open. The tool's parameters are set as follows:

- Reference Dataset: ndvi
- Number of Random Points: 500
- Sampling Strategy: Stratified Random
- Output Confusion Matrix: ConfusionMatrix\_202201160910339444547

The Confusion Matrix table is displayed below the tool window:

OBJECTID	ClassValue	C_0	C_1	Total	U_Accuracy	Kappa
1	C_0	177	257	434	0.407834	0
2	C_1	26	40	66	0.606061	0
3	Total	203	297	500	0	0
4	P_Accuracy	0.871921	0.13468	0	0.434	0
5	Kappa	0	0	0	0	0.005594

- P\_Accuracy (producers accuracy) = false negatives, or errors of omission
  - In other words: how many of the points that should have been this class did you miss.
- U\_Accuracy (user's accuracy) = shows false positives, or errors of commission
  - In other words: How many points of this class are in wrongly in this class.
- Try to make sense of what this matrix is showing us (it can be tricky to wrap your mind around it in the beginning!)
- We can even take a look at the points that were used for this accuracy assessment
  - Catalog > Databases > “your\_project.gdb” > Add the point layer “AcrcyAssmntPnts”.

For more information on the accuracy assessment and confusion matrix visit:

<https://pro.arcgis.com/en/pro-app/latest/help/analysis/image-analyst/accuracy-assessment.htm>

## Understanding the Process and What's Important

### (1) Which class is easier to classify and why?

- One class is more heterogeneous (the samples consist of mixed spectral profiles) than the other
- The more mixed a class is, the more tricky it can be for the classifier to know exactly how to recognise that class. In the ideal case, all classes that you create are very homogeneous (their samples are all very alike).

### (2) How many training samples and how large should they be?

- Your samples should be representative of the actual proportions of each class in the image. If you have one tiny cloud in a large image, your cloud training sample should only make up a small percentage of all your training samples.
- You can use the percentage indicator in the Training Samples Manager to monitor this.

### (3) How to interpret the accuracy assessment?

- Keep in mind that the confusion matrix uses a given reference dataset to check how well your classification compares. So the accuracy assessment can only ever be as good as the reference dataset(!).
- Keep a critical stance when you interpret the accuracy assessment. Use it to help you draw conclusions, but do not use it as the de-facto truth about your assessment.