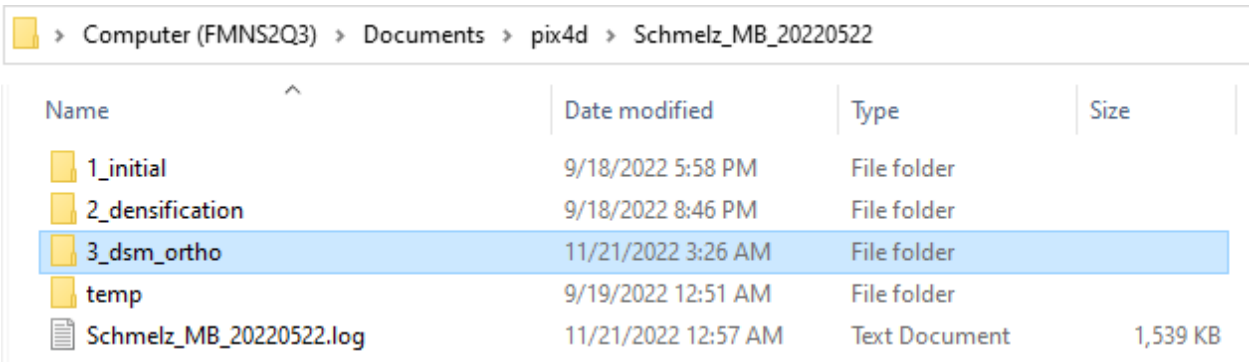
**Assignment 5 – to be completed in class on 11/21/2022 (due date of 12/12 if not completed)**

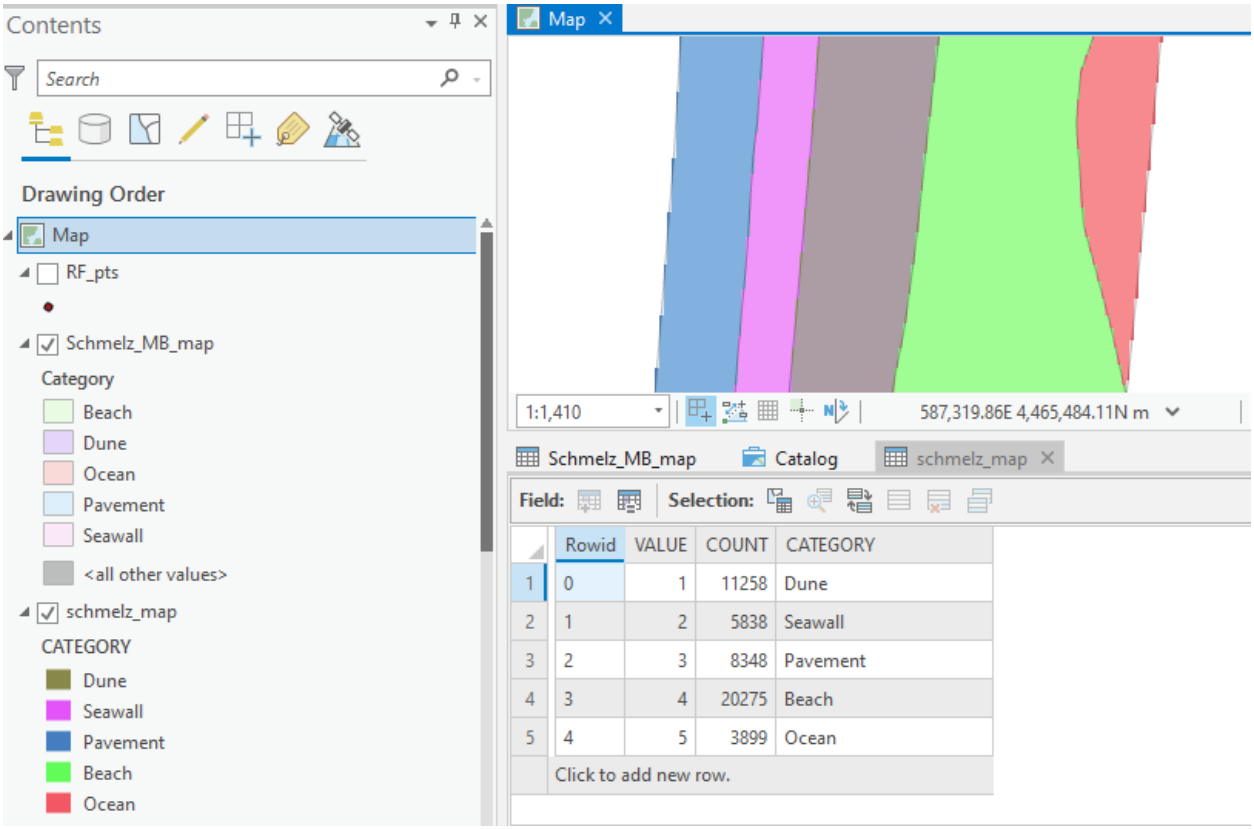
1. Open the Pix4D mapper project you established for assignment 2, within which you should have orthophotography and a DEM for the beach in Monmouth Beach, NJ collected on 05/22/2022.
2. If you have produced a DEM and an orthophoto from Pix4d as a part of Assignment 2, you will have a .tif file for each in "3_dsm_ortho" folder within your Pix4 project directory. Copy those files (including the .prj and .tfw files that correspond to the .tif image) into your week 11 project folder. (If you do not have these files stored, you can copy from my folder.)




3. After copying those files into your week 11 project folder, start running the creation of another dsm and orthophoto within pix4d. This time create the DSM and orthophoto with a 100 cm GSD, i.e., a 1m x 1m resolution DEM and orthophoto. To do this, go to the DSM and orthophoto processing options and change the GSD to "custom", specifying 100 cm. Rerun ***ONLY*** the creation of the DSM and mosaic orthophoto. This will likely only take a few minutes (<5). Let it run in the background.
4. Open an ArcGIS Pro project. Import the two original, 3 cm resolution tiff files (orthophoto and DEM) into the new ArcGIS project. "Calculate statistics" on the DEM file, and change the display scale of the DEM to range from -32.5 to -24.5.
5. Create a new polygon shapefile, call this file "[last name]_MB_map".
6. Add this polygon file to your map.
7. Open the attribute table for this polygon shapefile, and add a field to the shapefile. Call this field "Category", make its type "Text". Save to apply changes.
8. Within the attribute table, add 5 rows. The category names for these five rows should be "Ocean", "Beach", "Dune", "Seawall", and "Pavement".
9. Go to the symbology for the polygon that we created, change the symbology to unique values and change field 1 to category.
10. Take a maximum of 15 minutes to map these categories in the area shown. The polygons you make for different categories **cannot** overlap. Using the autocomplete polygon tool will prevent any overlap of categories, and will make adjacent polygons perfectly align. To use this tool, a mapped space needs to be completely enclosed by the boundaries you create and/or previously created polygons in the shapefile. Don't map more than 50% of the total area, we will be using the random forest algorithm to predict categories for that space. Save your edits periodically.
11. Go back into the Pix4D project, confirm that the 100 cm DSM and orthophoto have been created. If completed successfully, copy the new .tif files (and corresponding .prj and .tfw files)

into a subfolder in your week 11 project folder (because they will be named similarly to your original DEM/ortho).

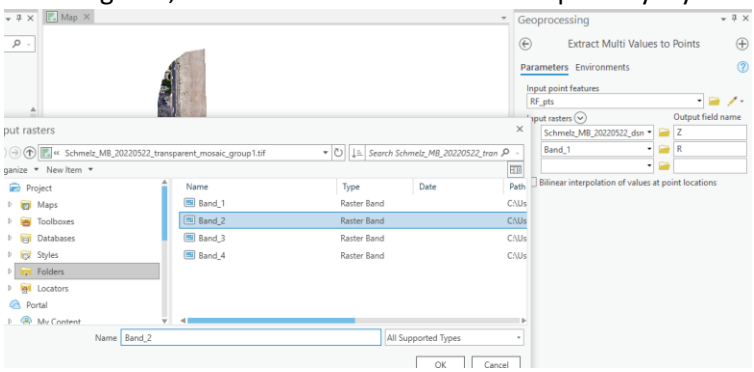
12. Import those new files into ArcGIS pro, and rename the new 1m res. DEM and ortho layers so those layers have names different than the original 3 cm DEM/ortho.
13. In ArcMap, apply the raster to point tool to the 1 m DEM. Save these points as "RF_pts_zRGB_m" in your project folder. This should create a shapefile with ~200,000 points.
14. Use the polygon to raster tool to transform the map polygon file to a raster dataset. Set the processing extent in environment variables to same as the 1m resolution DEM. Open the attribute table of the new file. Note that the categories are mapped to an integer value.



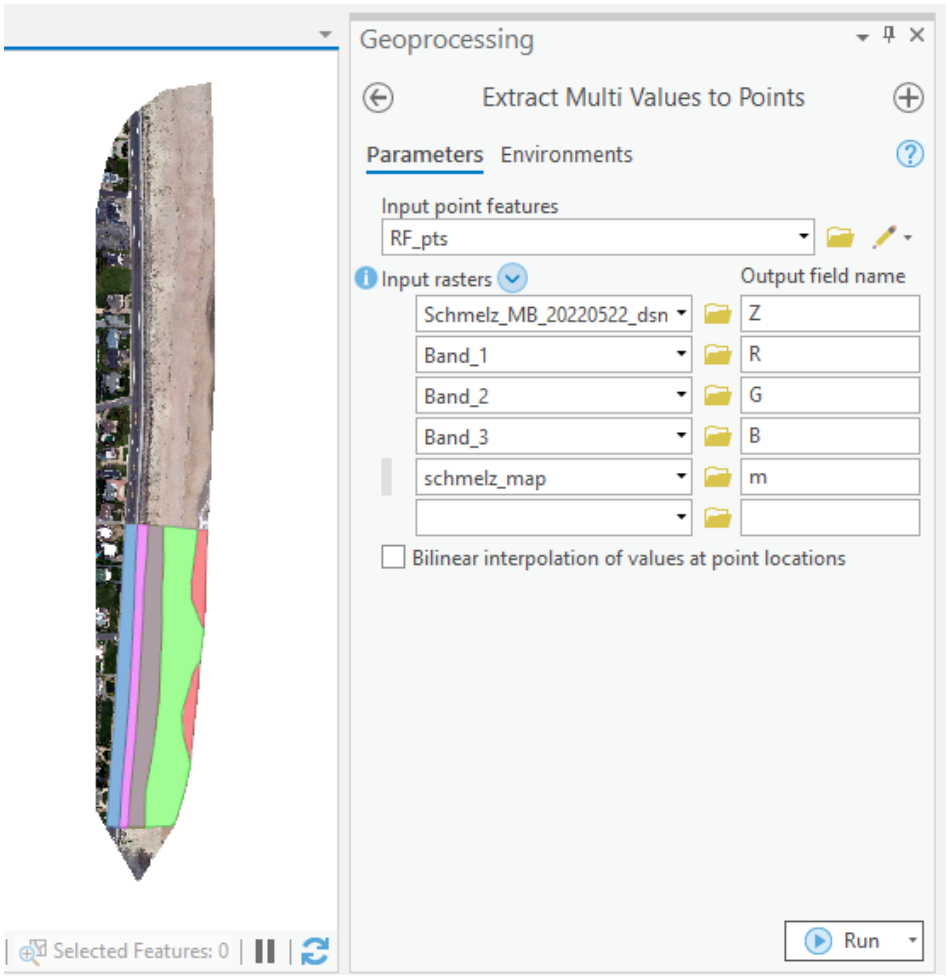

| | Rowid | VALUE | COUNT | CATEGORY |
|---|---|---|---|---|
| 1 | 0 | 1 | 11258 | Dune |
| 2 | 1 | 2 | 5838 | Seawall |
| 3 | 2 | 3 | 8348 | Pavement |
| 4 | 3 | 4 | 20275 | Beach |
| 5 | 4 | 5 | 3899 | Ocean |

Click to add new row.

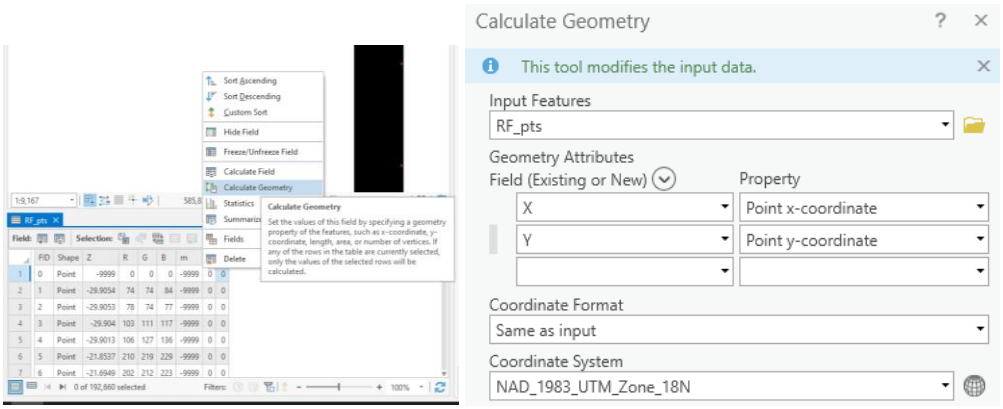
15. Apply the "extract multi values to points" tool to extract the elevation of:1) the 1m DEM; 2) the red band of the 1 m ortho;3) the green band of the 1 m ortho; 4) the blue band of the 1 m ortho; and 5) the map raster as values at the locations of the RF_pts_zRGB_m shapefile. NOTE: you will need to navigate to the orthophoto .tif file in your project folder to get individual bands. Band 1 is red, band 2 is green, band 3 is blue. Band 4 is a transparency layer that we can ignore.

a. 

b.




16. Open the attribute table for the RF_pts_zRGB_m shapefile, remove all fields except FID, Shape, Z, R, G, B, and m. Add two fields, name them X and Y. Make the type “double”. Save edits.
17. Use “calculate geometry” to calculate the X and Y positions of each point in the attribute table. Set the coordinate system to UTM 18N




18. Save your project and close ArcGIS.
19. Navigate to your project folder, open the .dbf file associated with the RF_pts_zRGB_m shapefile in Microsoft Excel. (Right click on file in windows explorer, choose “open with”, excel.exe is in this folder -> C:\Program Files\Microsoft Office\root\Office16).

20. Cut the last two columns and paste them as the first two column. **Important:** the columns in the file should be ordered X, Y, Z, R, G, B, m. After confirming the order of the columns, delete the first row of the .dbf file with the column names. Save the file as “RF_pts_zRGB_m.csv”, make sure to set the format as CSV (comma separated values).
21. Run the Jupyter Notebook that contains the script to apply the random forest algorithm.
    a. We will go over code in the last 15 minutes of class.
22. The first script will produce a .csv file with the predictions that come out of your mapping and application of a random forest algorithm.
23. Import that .csv file into ArcGIS and create a point dataset from it. Apply the point to raster tool to that point dataset to create a raster dataset that shows the map feature predictions, and make a professional map (north arrow, scale bar, sufficiently descriptive legend) of the training/test data and the model predictions.