Identifying Cover Crops Using ArcGIS's ModelBuilder

INTRODUCTION

- Every year in the Upper Mississippi Basin, we are losing nutrients in our soil, polluting our streams and rivers, sending our healthy soil down the Mississippi and into the Gulf of Mexico, and increasing flash flood risk. This is largely due to the bare farmland with no vegetation that we leave alone every winter. Whether it is rain or snowmelt, we lose vast amounts of healthy soil every year where there are no living roots holding the soil together. Fortunately, there are several conservation practices and solutions that can reduce soil discharge. One of the most effective of these practices is the use of cover crops. Cover crops are off-season plants like cereal rye, winter wheat, and oats. They are typically planted in the late summer or fall after the primary cash crop is harvested. These plants have long roots that grow deep into the earth, holding the soil and its nutrients together and greatly reducing runoff.

DATA AND OBJECTIVES

This data comes from Northeast Iowa Resource Conservation and Development, as well es the Iowa open source geodata library and USGS satellite images. It contains crop information like crop history to help with selecting cover crops.

Tracking cover crop usage is very important for watershed managers because we can find the areas that are not using cover crops and give them incentive to plant, but it is difficult to track because no dataset exists showing the spatial distribution of cover crop usage.

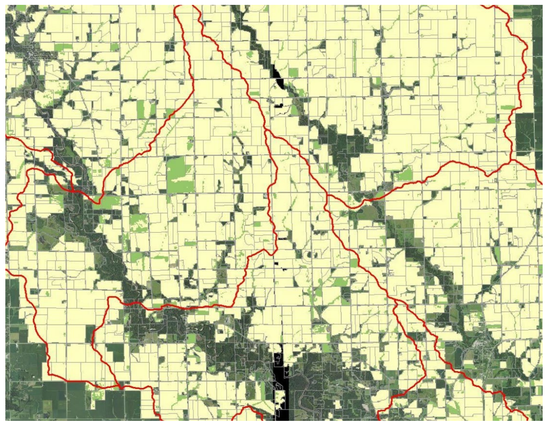
This project focuses on automating the process of selecting cover crop fields by using ModelBuilder in ArcGIS.

METHODS

To effectively and efficiently determine which areas may have had cover crops, I will implement a method used by the Environmental Working Group and the Practical Farmers of Iowa. Using ArcGIS software, and the Near Infrared (NIR) and Red bands from Landsat 8 satellite imagery in the spring months of 2017 before the planting of corn or soybeans, I could calculate the Normalized Difference Vegetation Index (NDVI) value of every pixel of a Landsat image over the Upper Wapsipinicon. This NDVI value is a number between -1 and 1 that can detect what kind of land cover exists at any given pixel of an image.

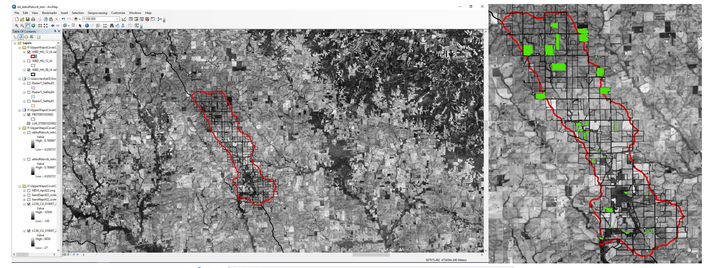
Looking only at agricultural land, I displayed every agricultural parcel in a new layer in ArcMap according to these NDVI value standards:

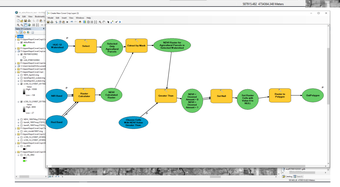
- -1 to 0: Water, Ice, Snow, etc.
- 0 to 0.1: Dirt
- 0.1 to 0.5: Dead vegetation
- 0.5 to 1: Dense vegetation- Cover Crop or Perennial



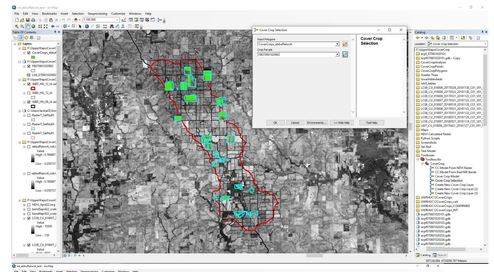
Using these standards, along with the crop rotation history of the parcel, I was able to determine that if a parcel of land showed green (NDVI value of above 0.5) for the spring months of 2017, the farmer may have used a cover crop in the offseason. Aerial Imagery by county and crop rotation history was used to confirm these assumptions. For example, if land that was detected as dense vegetation had forest, perennial crops, or anything other than corn or soybeans in the previous year's crop history, it was assumed that cover crops were not planted in the previous fall, and the land already had vegetation in the off-season. I then created a new polygon layer in ArcGIS for all areas that appeared to use cover crops for further analysis.

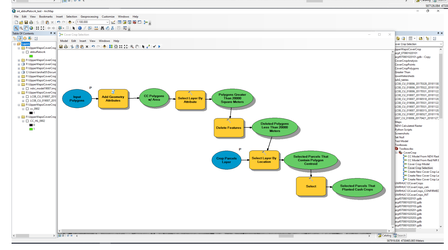
RESULTS





By using ModelBuilder, I was able to create cover crop polygons. From these polygons, I was able to select parcels that contained cover crop polygons, and select the parcels that had planted cash crops (corn or soybeans) in the past year.





CONCLUSIONS

- Things to improve
  - More user interactivity
  - Automate preprocessing steps
- Automation sped up process successfully. I was able to detect cover crops and create a new layer in a fraction of the time it took me to do the same process manually without ModelBuilder.