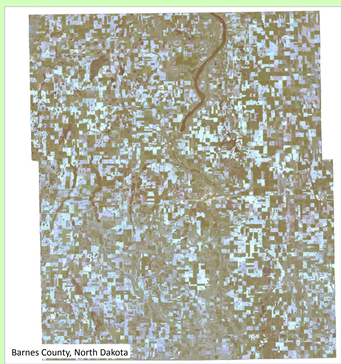
Identifying Wetlands in Barnes, North Dakota Using Satellite Imagery

The Problem - Identifying Wetlands within Easements

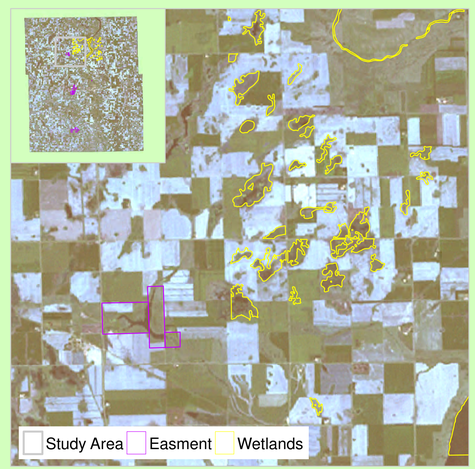


Barnes County, North Dakota

Wetlands in North Dakota. Photo by Emma York.

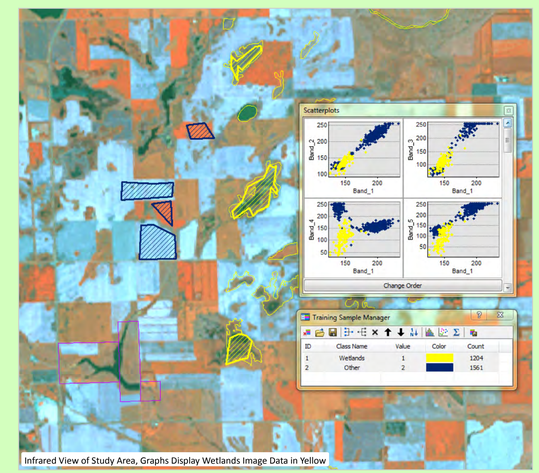
The Fish and Wildlife Service is in possession of Cadastral data that includes easements meant to protect wetlands. The problem is that the actual wetlands within the easements are not marked, therefore the actual wetland coverage is unknown. The solution proposed in this project is to identify the wetlands within easements using image processing tools found in ArcGIS as opposed to using heads-up-processing which can be inefficient and lengthy.

The Solution - Infrared Image Analysis



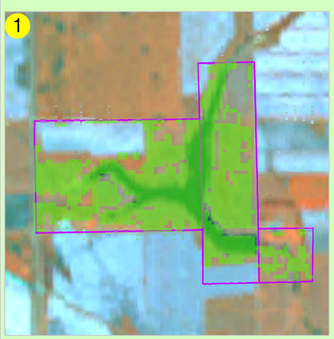
The frame to the left shows which area was mainly studied, the cluster of easements (purple) are near wetlands (yellow) and the differences and the results would be easily compared.

The method that was used in this project involved looking at the unique infrared signatures found within wetlands. The primary tool for this is the Image Classification tool, with it portions of infrared imagery can be selected and categorized into examples like wetlands or crop fields. The differences in the infrared signatures can be viewed in the image to the right, the graphs show the differences between the satellite imagery data of the wetlands (yellow) and the crops and bare dirt (blue). Once the wetlands were established, a Maximum Likelihood Classification tool was run on the easement imagery to identify the wetlands.

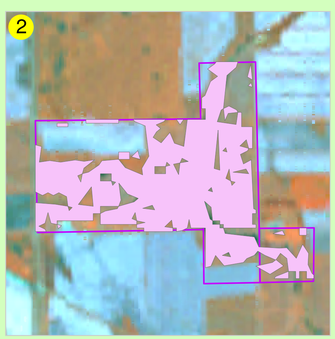


Infrared View of Study Area, Graphs Display Wetlands Image Data in Yellow

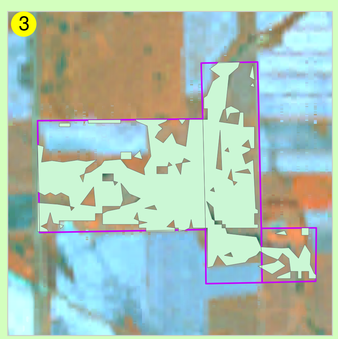
The Solution - Processing Resultant Polygons



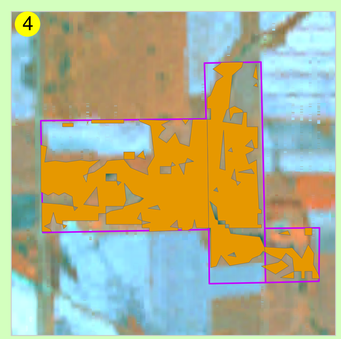
The above image is the result of running the Maximum Likelihood Classification tool on the easement satellite imagery after assigning the Wetlands and Other classes. The green denotes what areas of the easements are wetlands. This raster image is useful but impractical to work with until it is converted into a polygon.



The polygon above is the result of a Raster to Polygon conversion on the wetlands raster. The spatial data can now be worked with but it is still disorganized. The polygon has no useable values. In order to organize this polygon it was necessary to run the Identity tool with the easement shape files to assign a corresponding easement ID to each wetland polygon.



The next step in the process for the polygons has them Identified given the attributes of their corresponding easements. While these polygons now have attributes they are not practical because each shape has its own values. In order to fix this they need to be unified into one polygon for every easement.



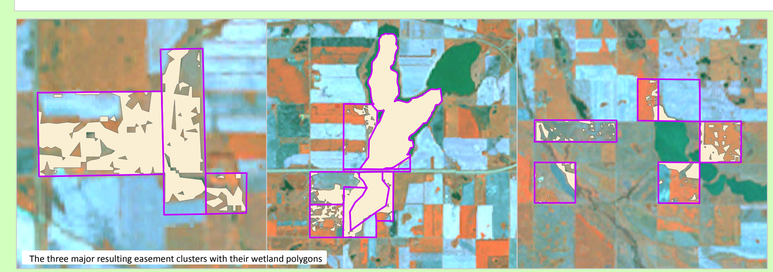
The fourth and final step in the process requires using the Dissolve tool in order to to join all the separate the polygons into one large polygon for each individual easement. This will make the wetland polygons much easier to work with and they can be joined and used with the existing cadastral data.

Conclusion

The project was an overall success, wetlands were successfully extracted using no manual digitizing. The method tested in this project is viable but does still have a few flaws.

Digitizing the wetlands using this method has two main disadvantages. Firstly, there may be small errors with the Image Classification such as a pool being identified as part of the wetlands. While this is unlikely to happen this scenario would indicate that the results of the process would require a simple quality check. This may be slightly inconvenient but is unavoidable when using any automated process as none of them are likely to be perfect. Another disadvantage is the complex polygon shapes that result.

This method's advantages greatly outweigh its disadvantages and should be seriously considered. One advantage is that almost the entire process can be automated using the ModelBuilder, this would allow for one model to be used every time a new set of easements had to be processed for wetlands. It would greatly cut down on time required and would prove to be very efficient. Using a pre-written model would also facilitate applying the method at a larger scale, such as identifying the wetlands inside all the easements of a state. Lastly, the wetland polygons created inherit all the attributes from their parent easement polygons.



The three major resulting easement clusters with their wetland polygons

Map Designer: Albert Marquez

Data Sources: USFWS National Wetlands Inventory Data, USFWS National Cadastral Data, Esri Landsat Imagery