

Identifying Irrigated Agriculture Land Using Remote Sensing and Machine Learning

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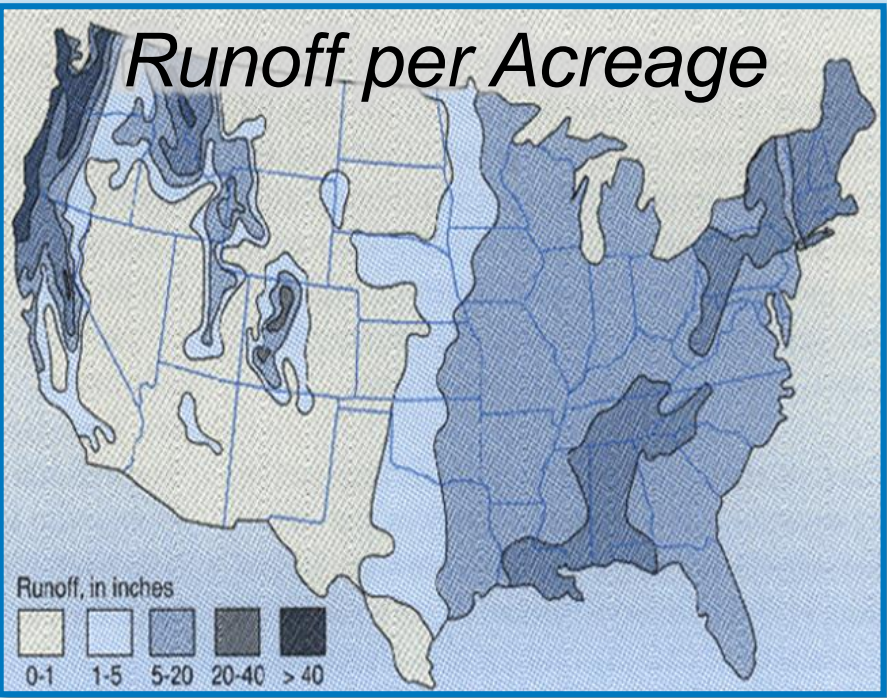
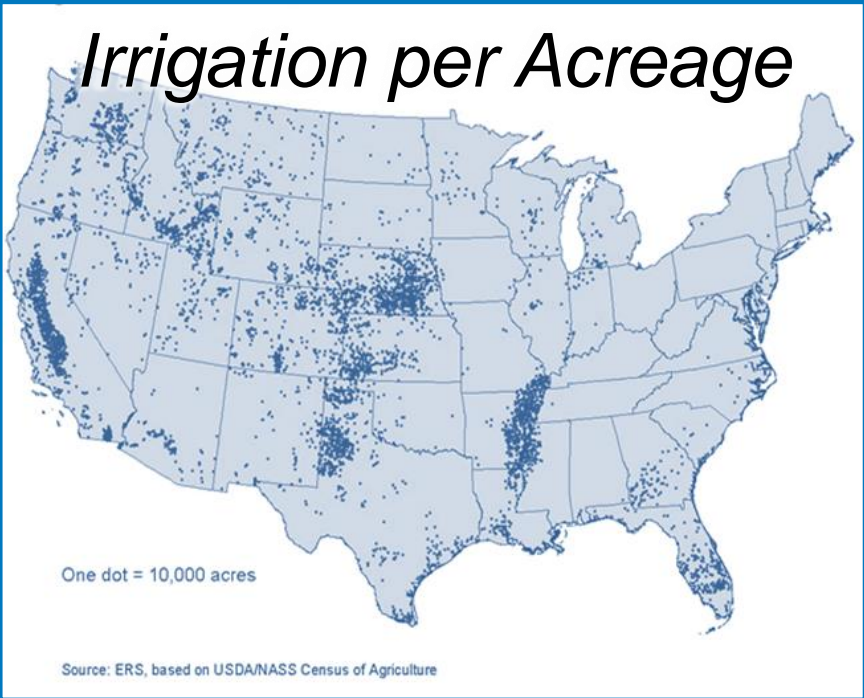
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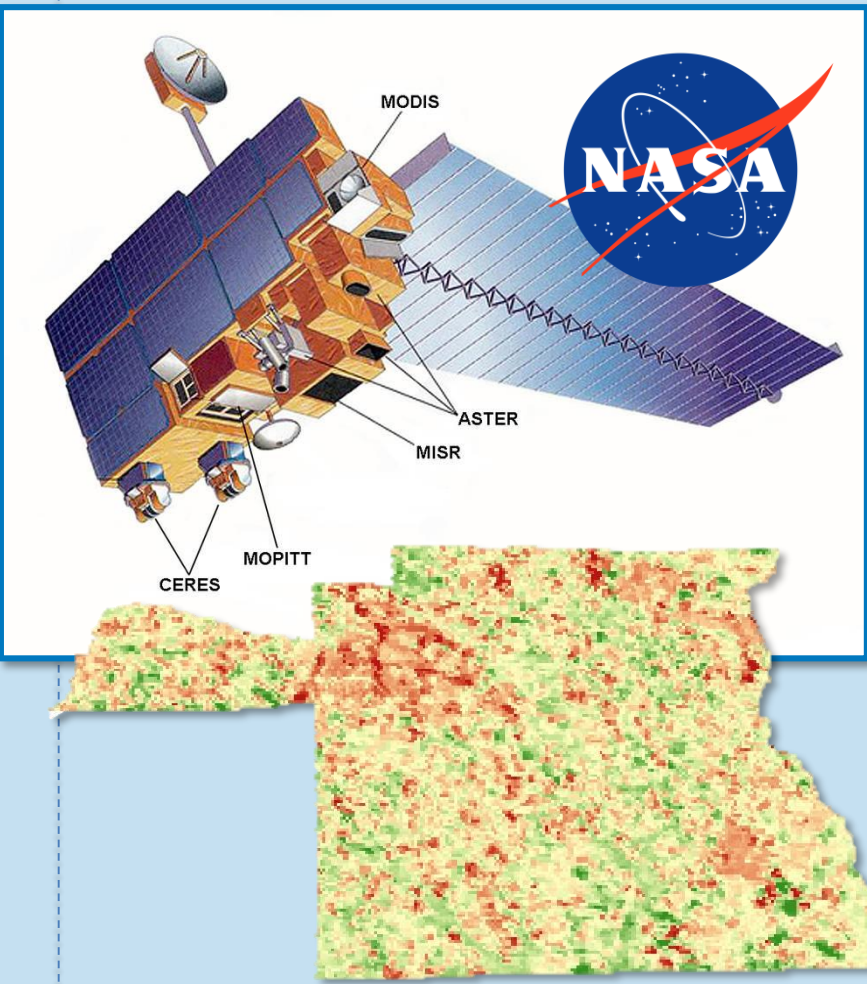
Introduction

Though the state of AL receives more average rainfall than nearly anywhere else in the continental U.S., however agricultural yields have fallen below national average over the past century. As the state supports irrigation, it needs tools to understand the impact expanded water use would have on natural resources. Identifying existing irrigated land is one of those tools. Our project attempts to answer this need.



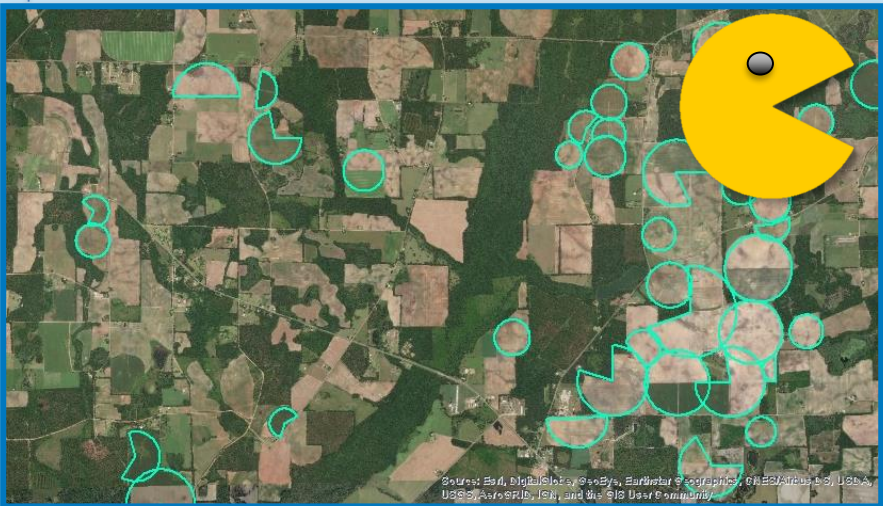
Data & Methods

Remote Sensing



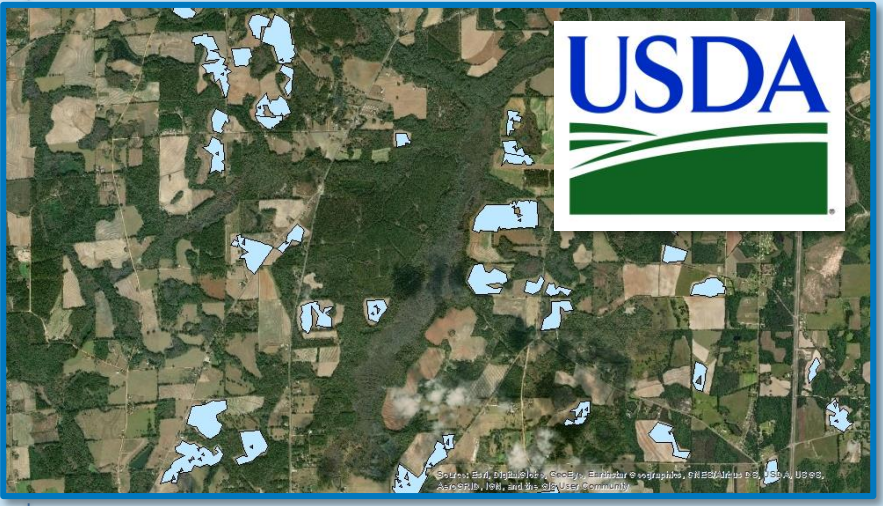
Terra (EOS AM-1)¹

We use the *Moderate Resolution Imaging Spectroradiometer* (MODIS.) Of MODIS's many products, the *Enhanced Vegetation Index* (EVI) is our prime interest. Healthy crops (presumably irrigated crops) will have a higher EVI. To the left, we have the EVI of Houston County. Green is high; red is low.



Center-pivots

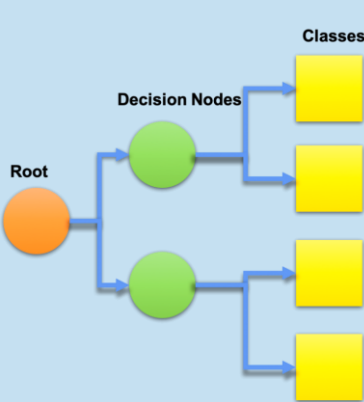
An in-house survey produced our ground truth (irrigated crops land) data. Center-pivot irrigation has a circle or pac-man shape.



National Agricultural Imaging Program

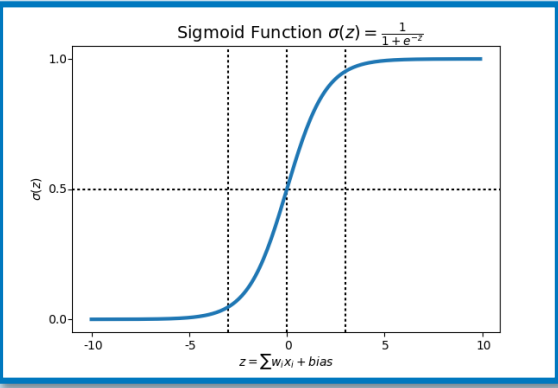
Our agriculture crop cover includes corn, cotton, soybeans, and wheat.

Machine Learning



Random Forest

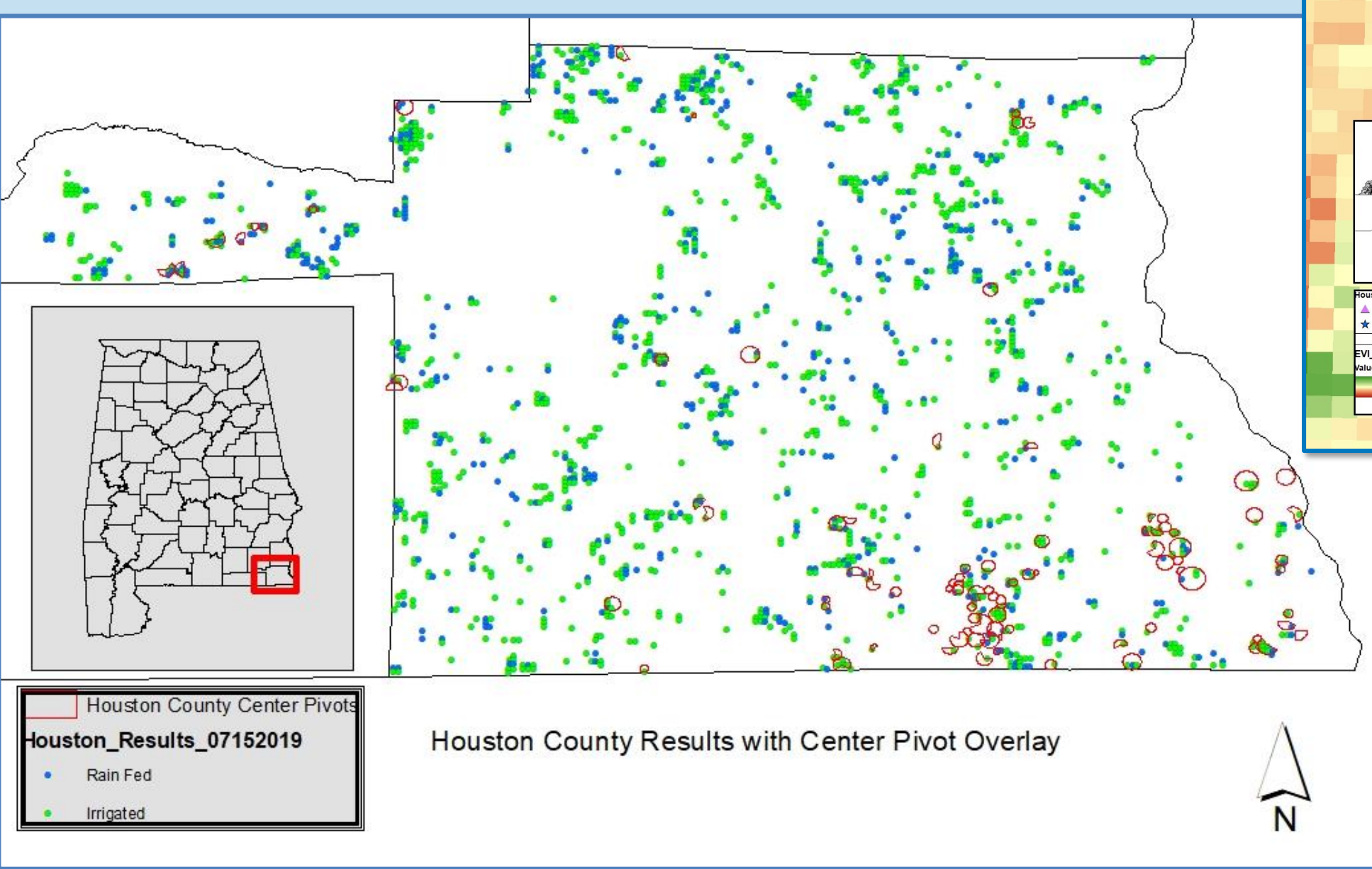
This model classifies data by organizing the data into several decision trees (left) with each node performing a data sort in Our model generates false positive rate (FPR) and true positive rate (TPR) values for 128 different thresholds.



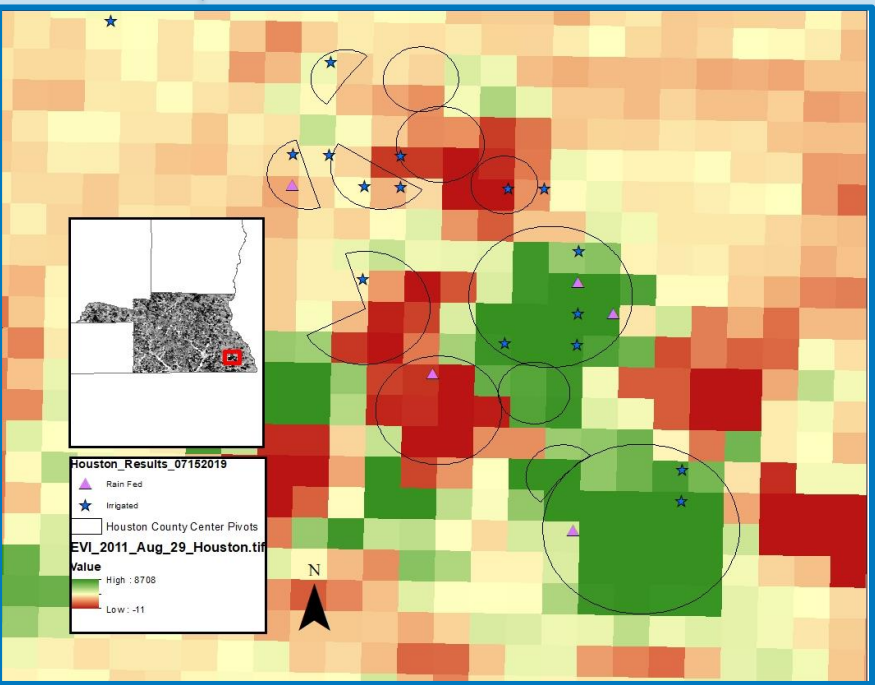
Logistic Regression

The binomial logistic regression model classifies data by computing the log-odds that can be later used by the Sigmoid Curve to convert to probabilities. The data on one side of the curve falls in one category and vice versa. The model identifies the input dependency of the odds of an output.

Key Findings & Future Work



The figures show some disagreement between the pixels the models have deemed as categorized versus our the ground truth (center-pivots).



Key Findings

The overall goal was to define a work flow and have preliminary results to define a viable methodology for finding irrigated land. We now have a process for determining the accuracy of the machine learning results.

Future Work

The remainder of this project will be fine-tuning the models to better interpret the variations across the state. The results from this summer were found by training the models on Limestone county, and then testing it on Houston county. We believed that we can improve the accuracy by accounting for other major crops neglected in the initial testing. Furthermore, we plan to experiment with other vegetation indexes and other satellite products.

Acknowledgements & References

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¹"Terra Instruments." *Terra: The EOS Flagship*. NASA, 28 July 2019. Web. 15 July 2019. <https://terra.nasa.gov/about/terra-instruments>

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