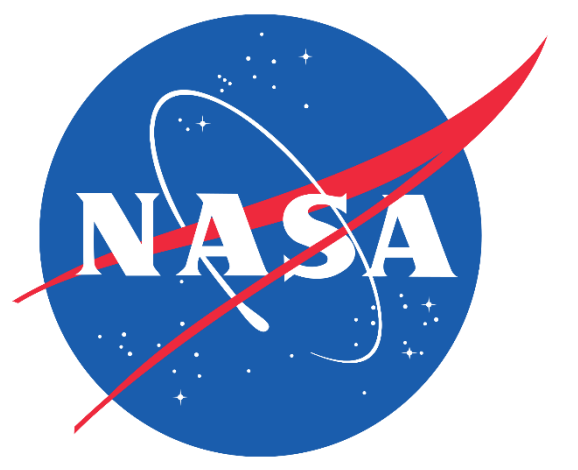




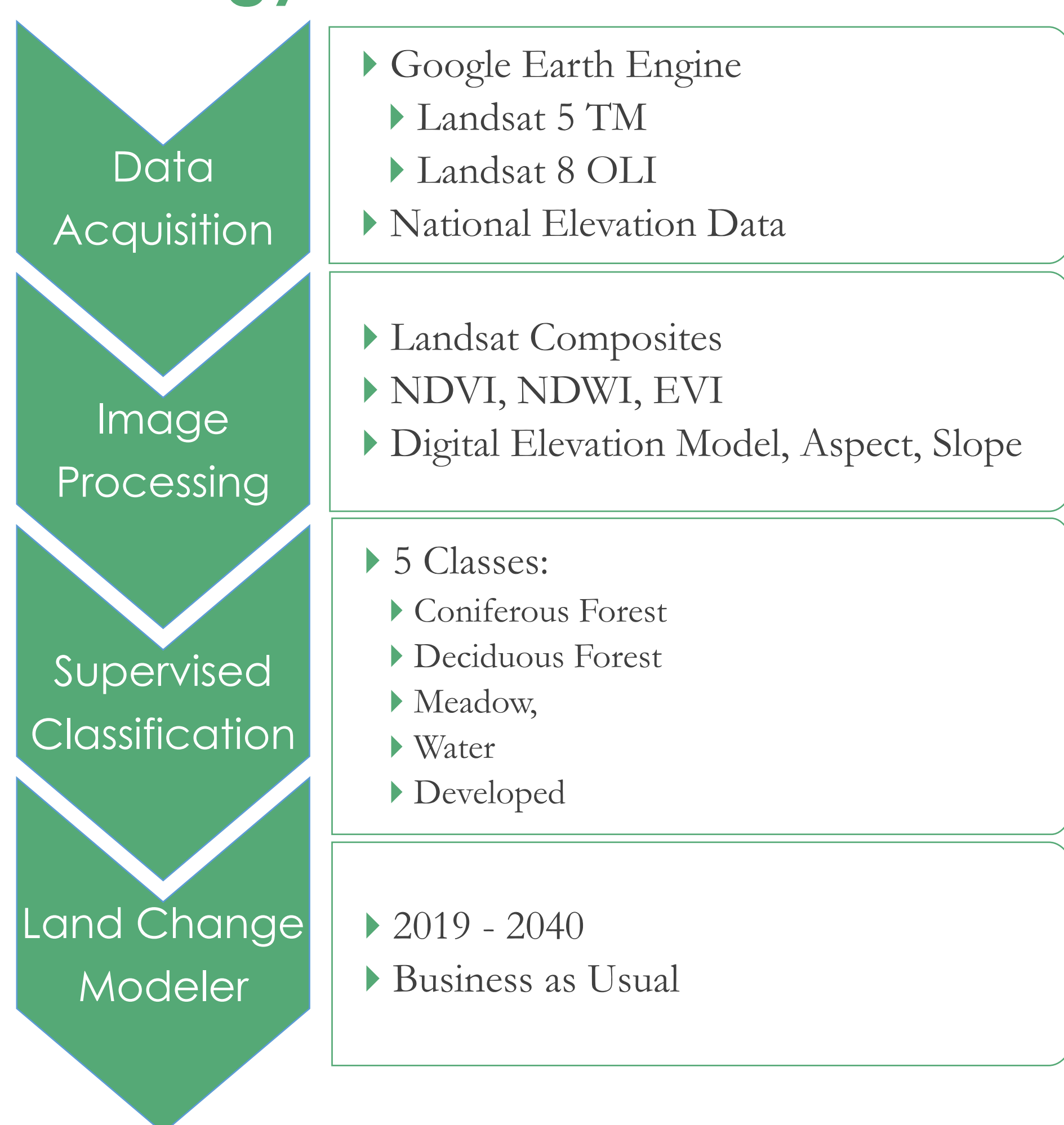
# Utilizing NASA Earth Observations to Classify Ground Cover Types in the Mark Twain National Forest



## Abstract

The Mark Twain National Forest (MTNF) encompasses 1.5 million acres of public land in the Ozarks region of Southeastern Missouri. The industrial boom between the 1880s and 1920s had devastating effects on the shortleaf pine (*Pinus echinata*), Missouri's only native pine species. The combination of fire suppression on this fire-dependent species and timber harvest of mature pine stands inhibited the development of pine seedlings and promoted the establishment of hardwood stands. Partners at the US Forest Service (USFS) MTNF are currently involved in restoration efforts in two ranger districts, which includes removing invasive eastern red cedar (*Juniperus virginiana*) and prescribed burning. To expand spatial coverage for the MTNF beyond *in situ* observation sites, the NASA DEVELOP team analyzed land cover change from 1986 through 2019 and forecasted changes based on a 'business-as-usual' scenario out to 2040. The team incorporated remotely sensed data from Landsat 5 Thematic Mapper and Landsat 8 Operational Land Imager into the random trees supervised classification tool in ArcGIS Pro. This tool spectrally separated pixels into five distinct land cover classes and produced classifications for 1986 and 2019, with kappa statistics of 0.87 and 0.81, respectively. Overall, there was a net decrease in conifer and meadow land cover between 1986 and 2019 along with a net increase in water, developed, and deciduous land cover. The team used TerrSet's Land Change Modeler to forecast land cover through 2040. Results showed an increase in coniferous land cover and a decrease in deciduous cover, indicating a high probability that current restoration efforts will produce the intended effect.

## Methodology

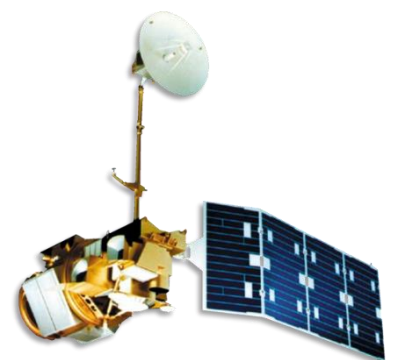


## Objectives

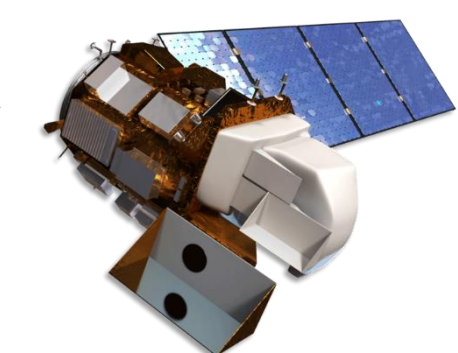
- **Create** a land cover type analysis of MTNF that can be used to assist with species-level classifications, allowing land managers to better determine areas in need of restoration
- **Forecast** various land cover distributions out to the year 2040 to determine changes in land cover type based on current US Forest Service land management practices

## Earth Observations

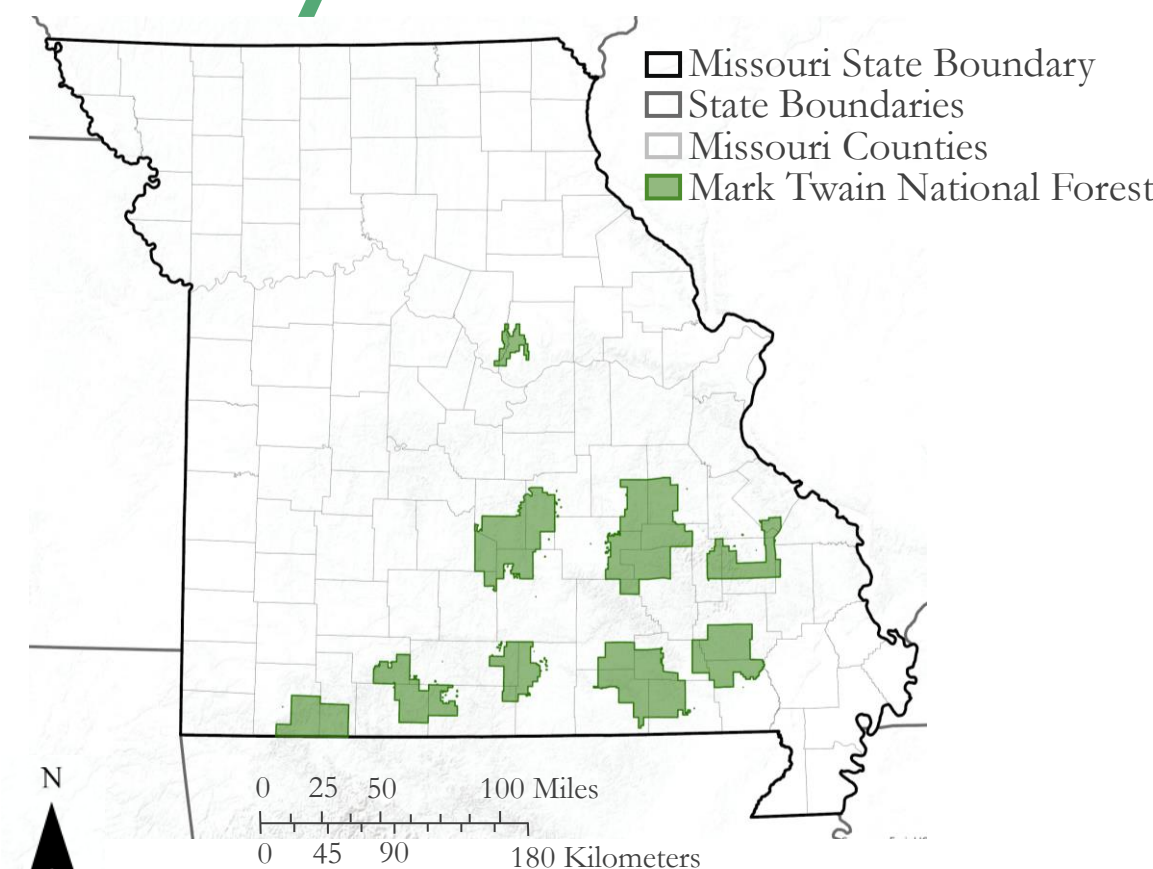
Landsat 5 Thematic Mapper (TM)



Landsat 8 Operational Land Imager (OLI)



## Study Area



## Team Members



Kaitlyn Bretz  
Project Lead



Madison Bradley

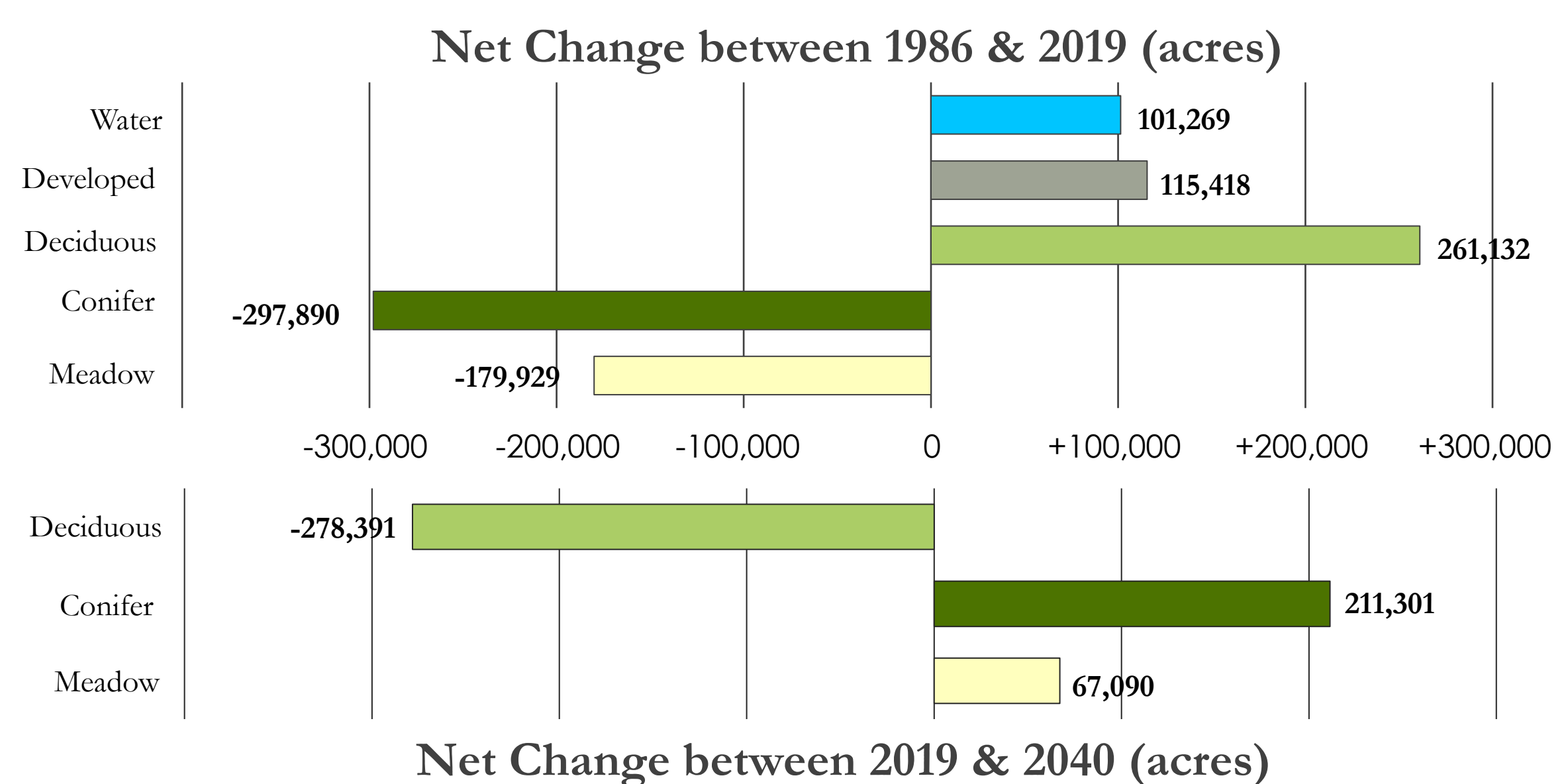
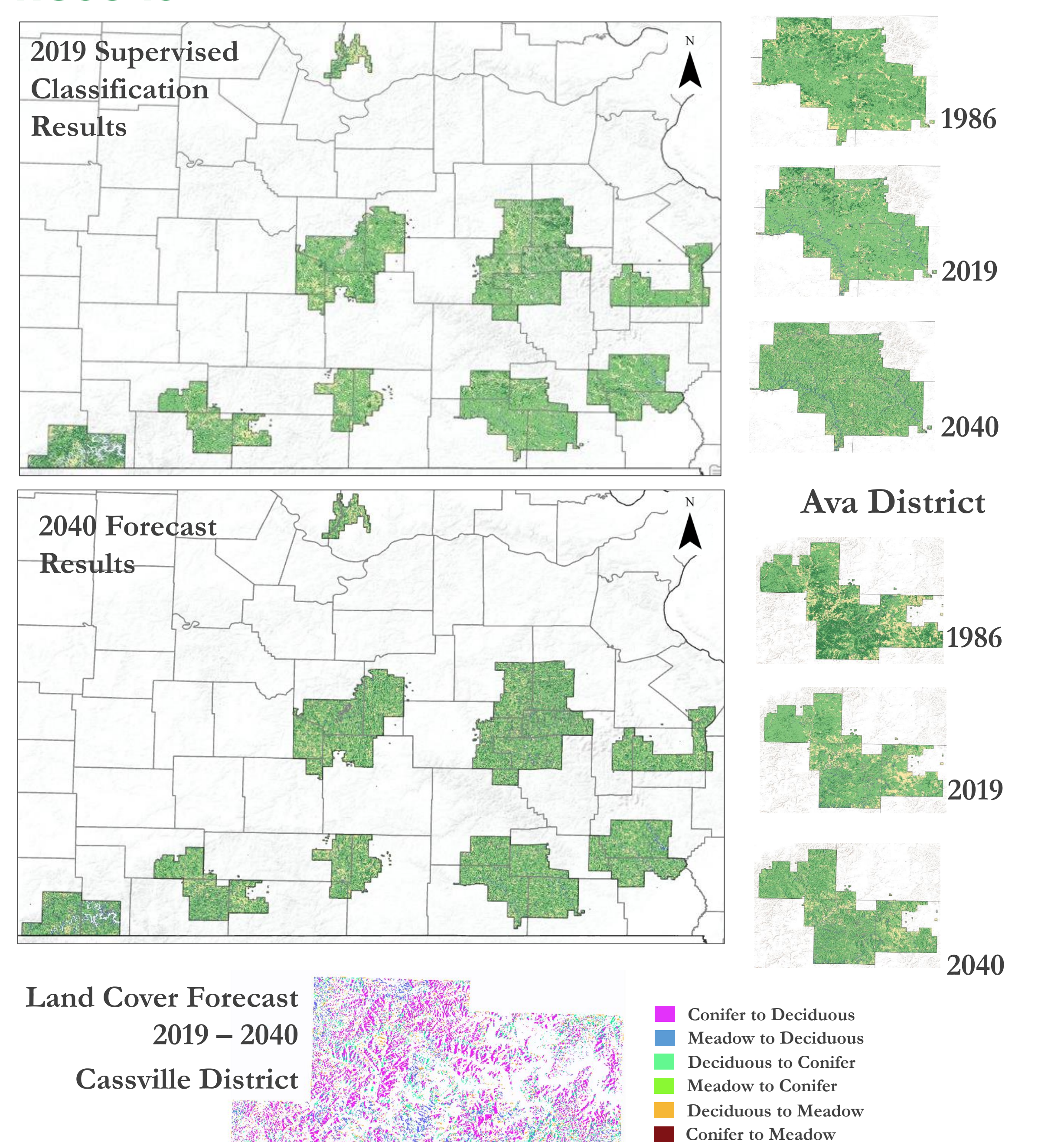


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## Results



## Conclusions

- There was an overall decrease in conifer forests and meadow land cover between 1986 and 2019, while water, developed areas, and deciduous forest land cover increased.
- Forecasted land coverage based on current land management practices predicts an increase in conifer forests and meadow land cover, indicating that current restoration efforts, if maintained, may reach their goals.
- *In situ* data needs to be distributed across ranger districts to accurately interpolate and predict species distributions.
- Remote sensing is useful for comprehensive land cover classifications when combined with high-resolution aerial imagery and elevation data.

## Project Partners

- USDA, US Forest Service Mark Twain National Forest
- USDA, US Forest Service Geospatial Technology and Applications Center

## Acknowledgements

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