



National Aeronautics and  
Space Administration



# Southern Indiana Ecological Conservation II

Mapping Foliage Height Diversity and  
Canopy Closure Trends to Inform Oak and  
Hickory Restoration and Public Outreach

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Maryland – Goddard | Spring 2025



# Oak-Hickory Forests

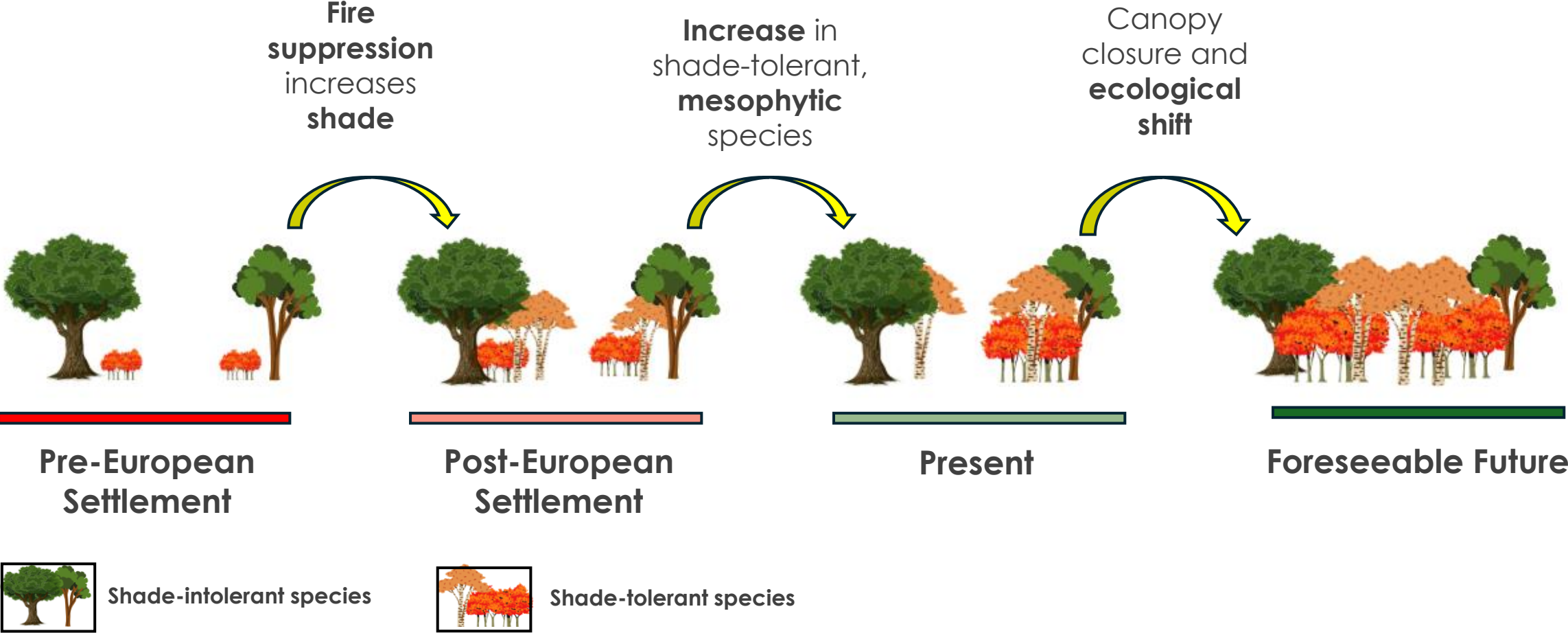
- Oaks are keystone species in the Central Hardwood Forest region
- Provide habitat and food to micro and macro life forms
- Requires open tree canopies to survive as a cover type



Image Credit: Milo Pynes



# Mesophication: Ecological Shift



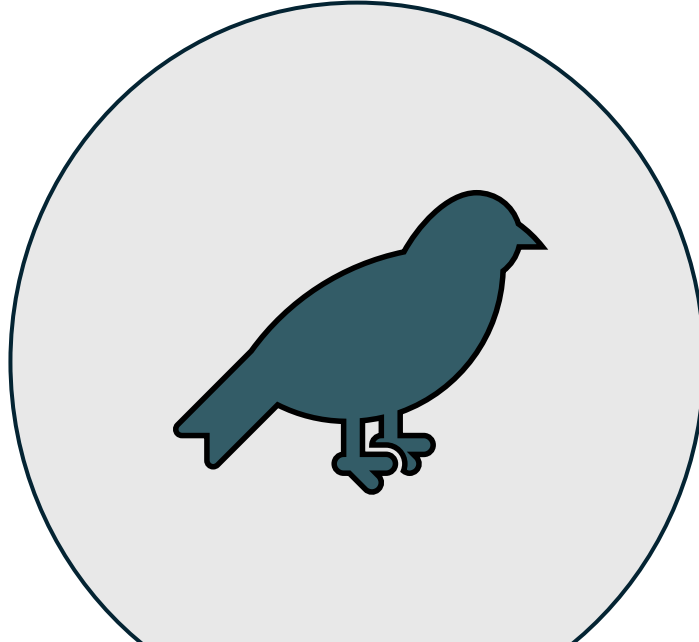
# Community Concerns



**Negative Perception of Fire**



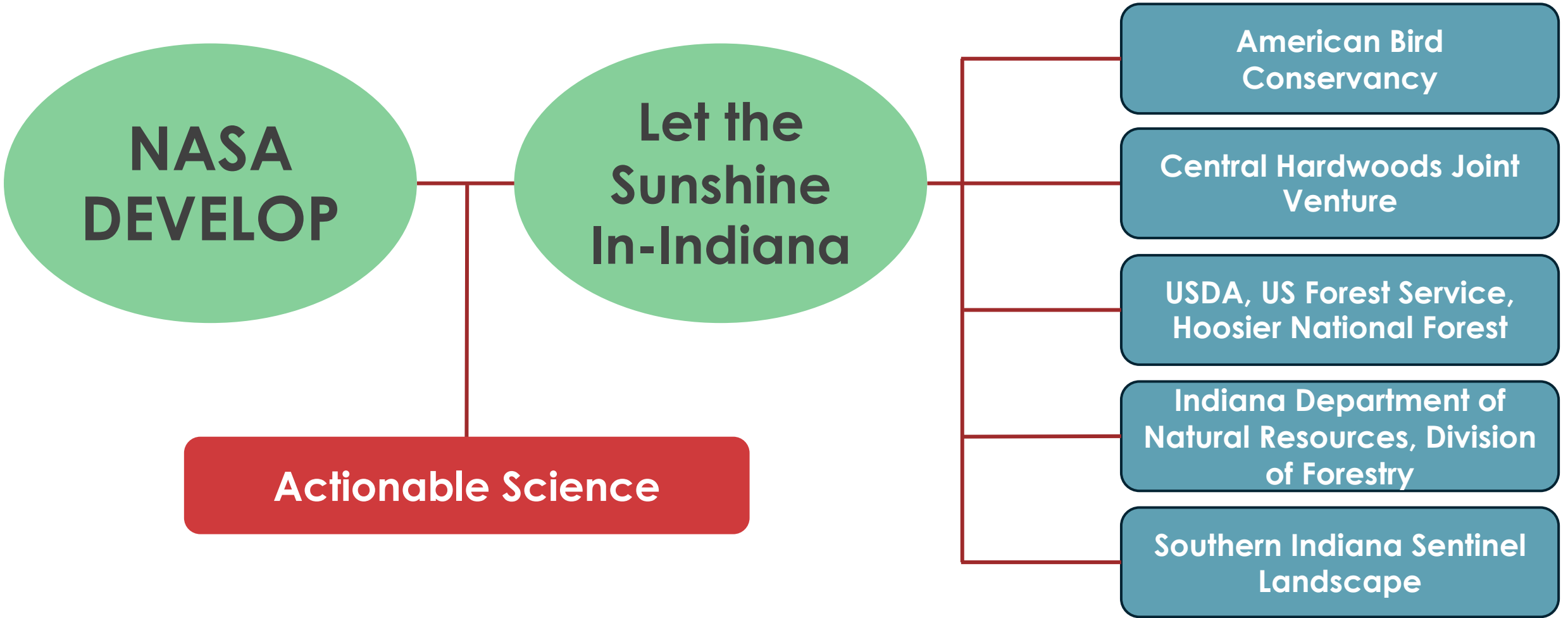
**Habitat Loss**



**Decline in Songbird Populations**



# Partners



# Project Objectives



**Map** Foliage Height Diversity



**Show** canopy closure trends overtime across the study area

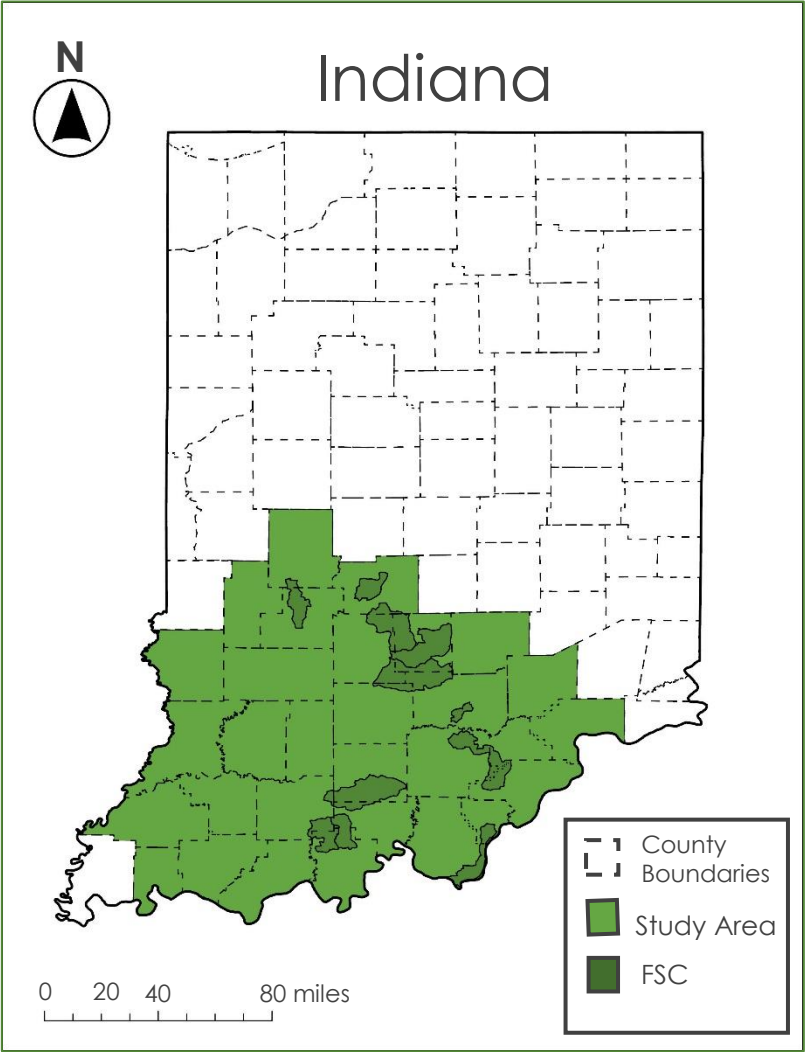


**Identify** areas undergoing mesophication to **inform** management efforts



# Study Area

- ~11,900 sq. miles
- 30 counties
- Forest Stewardship Clusters



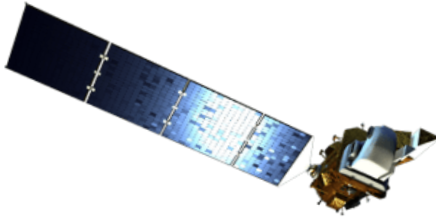
# Earth Observations & Study Period

Landsat 5 **TM**



1986, 1995,  
and 2005

Landsat 8 **OLI**

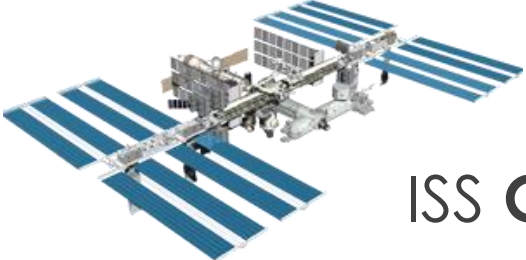


2015 and  
2024



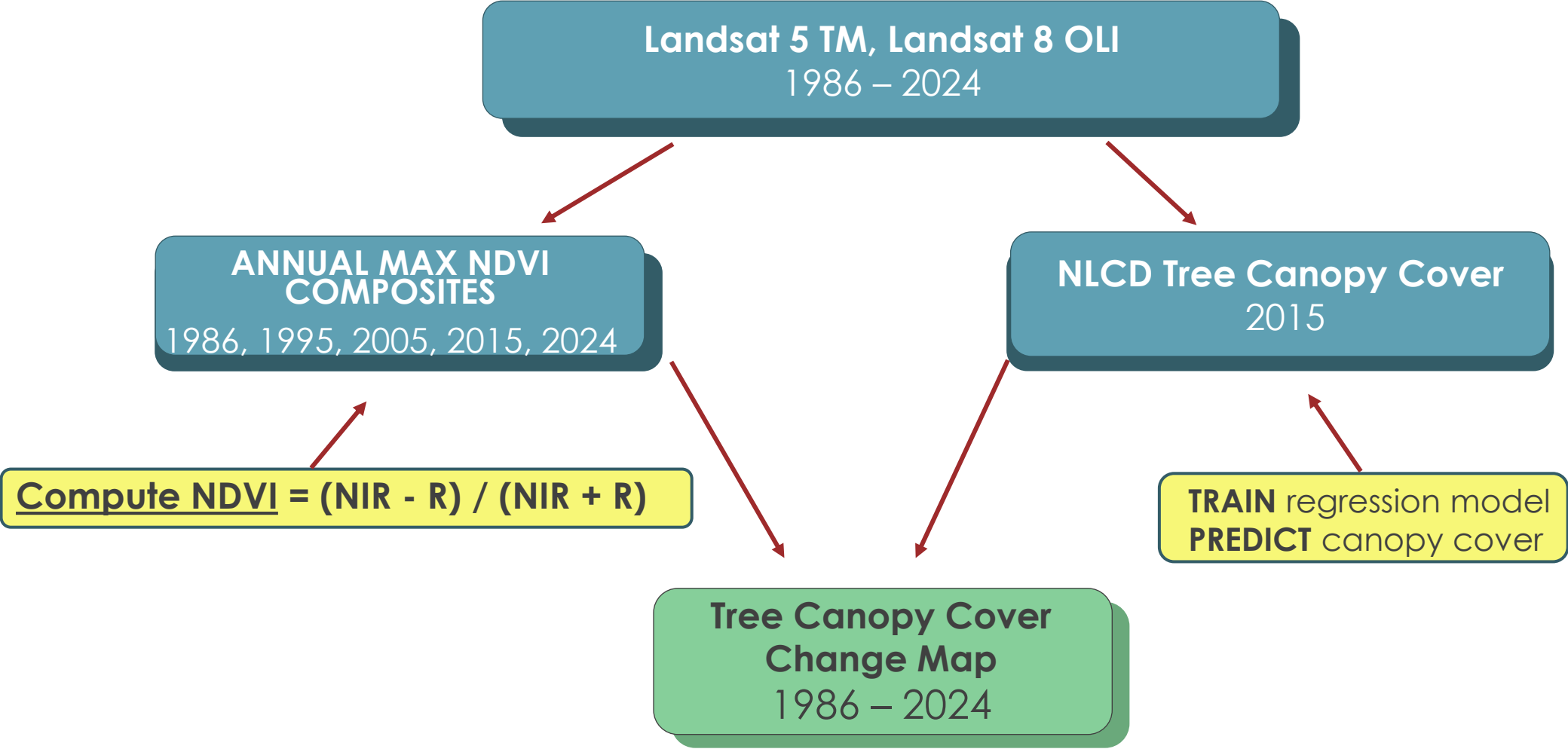
Image Credit: NASA

2019 through 2024

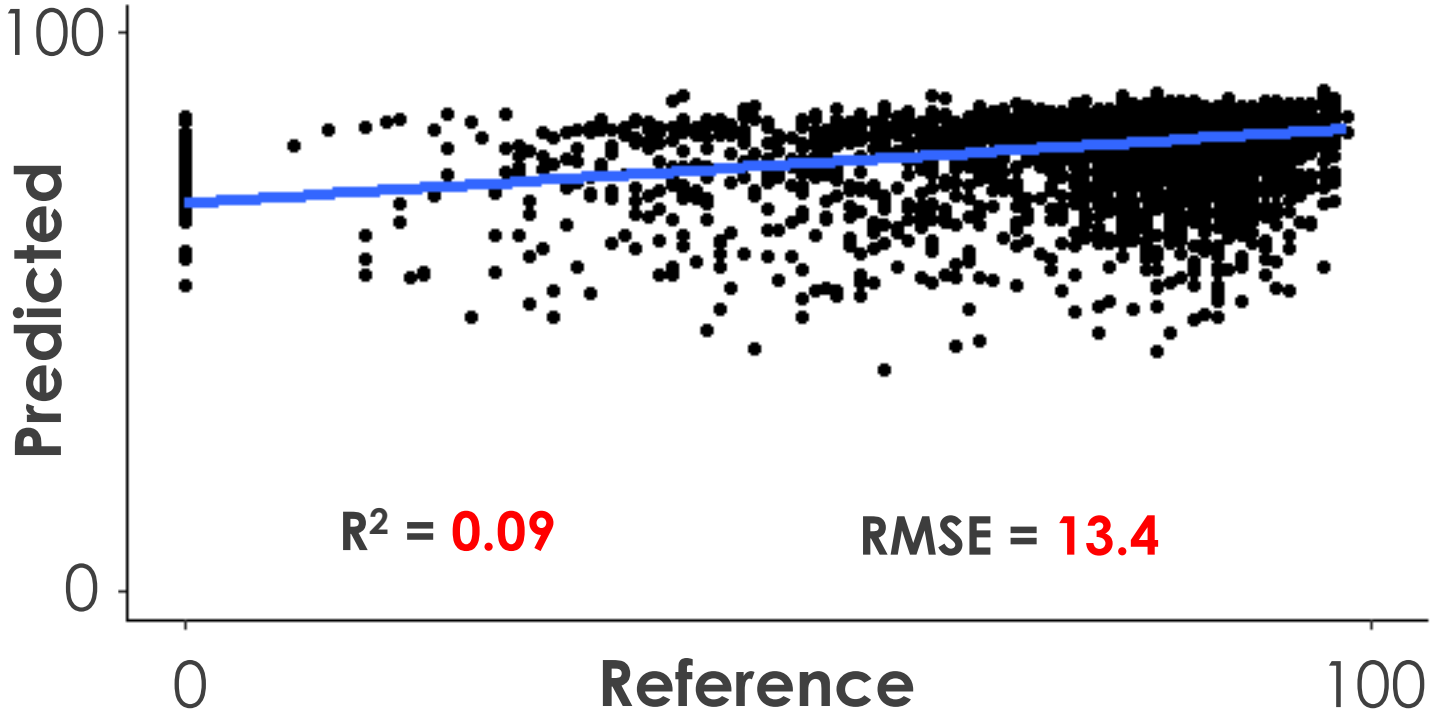


ISS **GEDI**

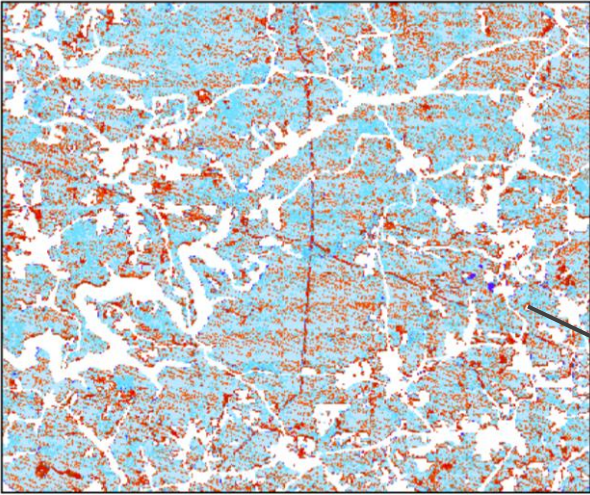
# Tree Canopy Cover Change



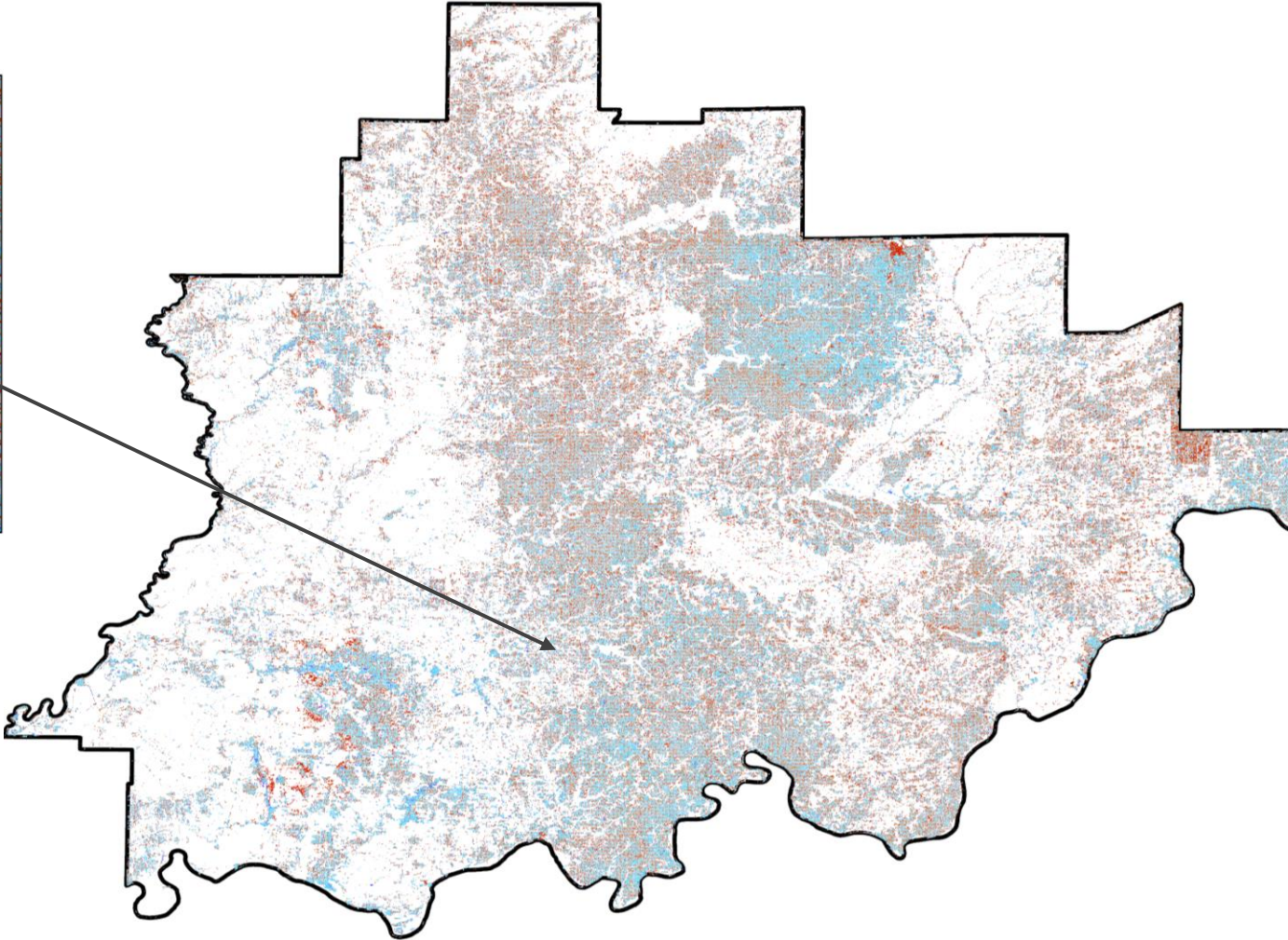
# Tree Canopy Cover Modeling



# Percent Tree Canopy Change (2011 to 2021)



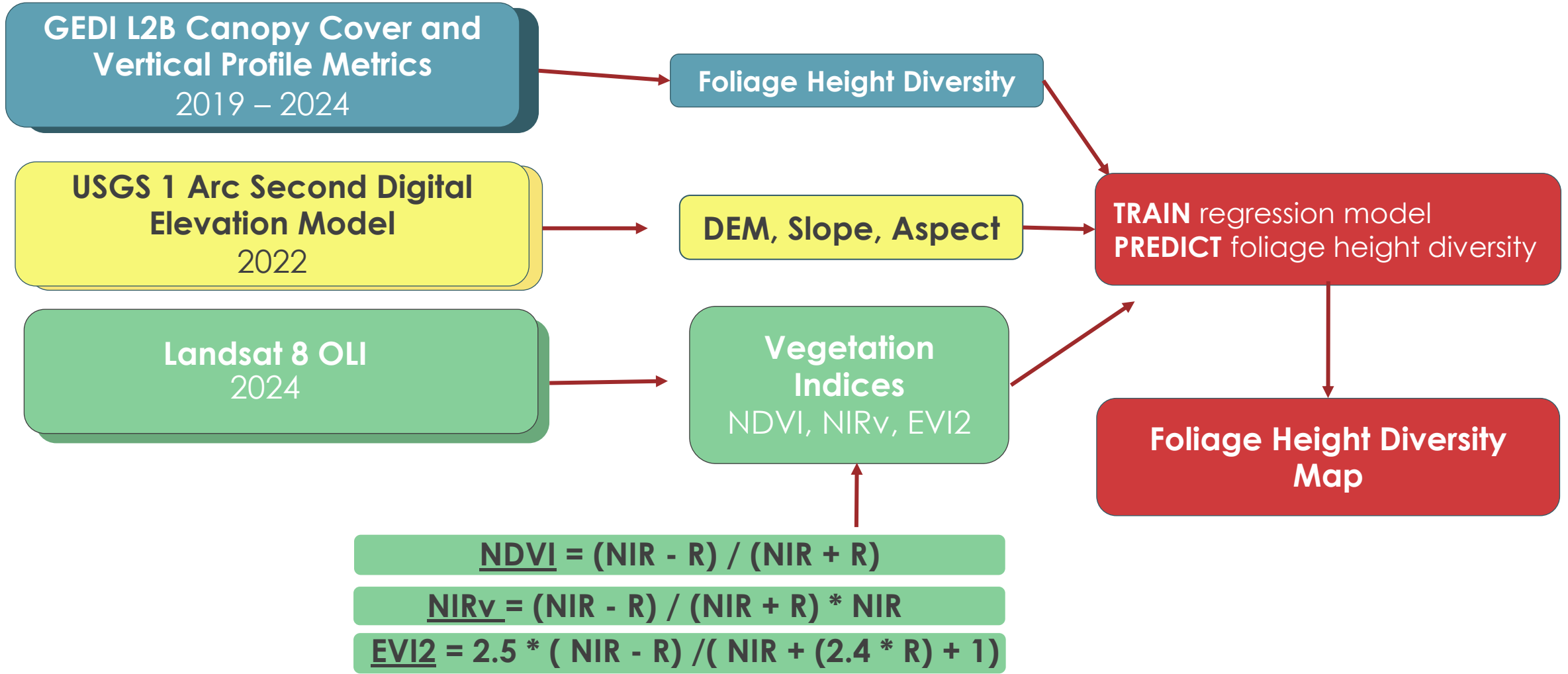
0 2 4 8 Miles



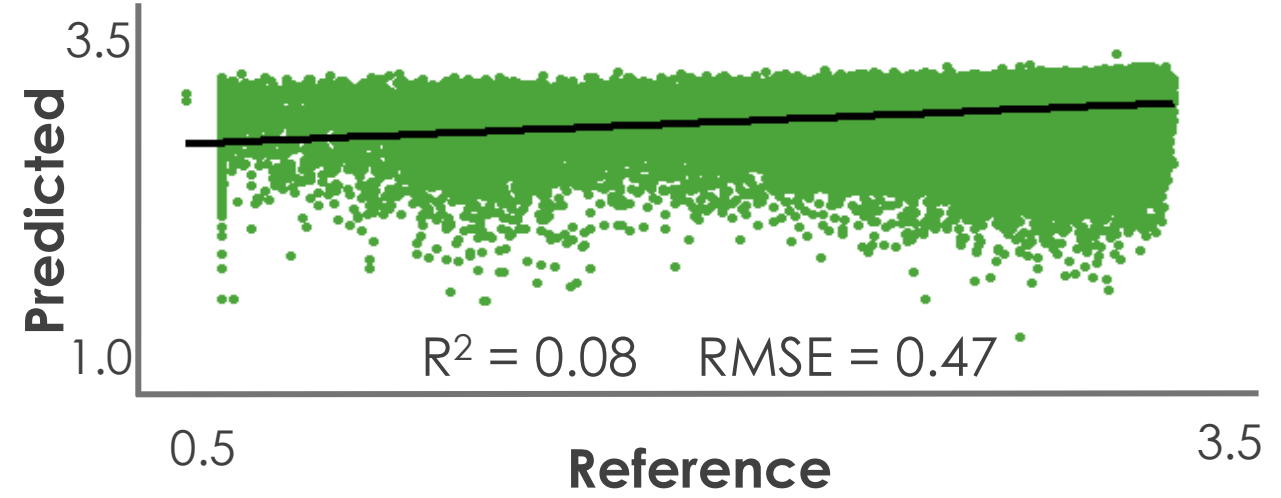
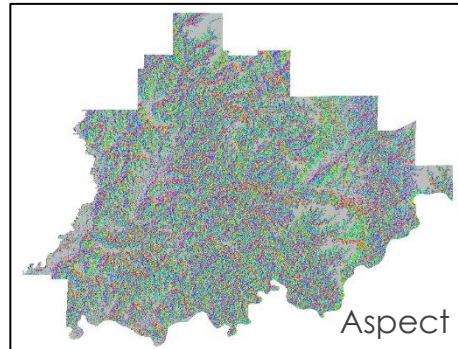
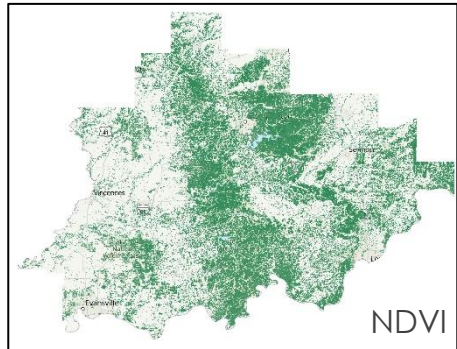
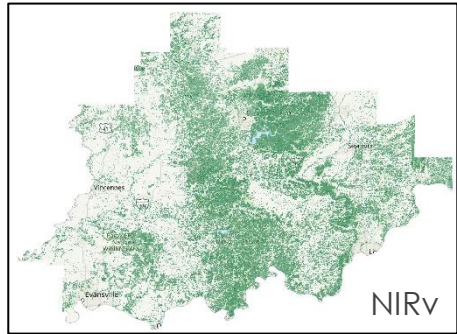
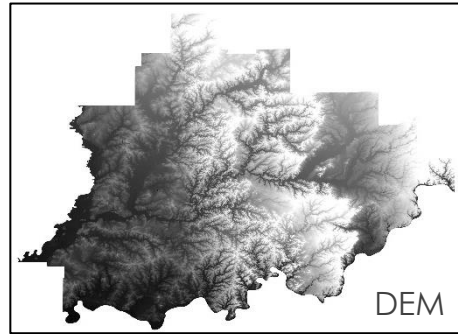
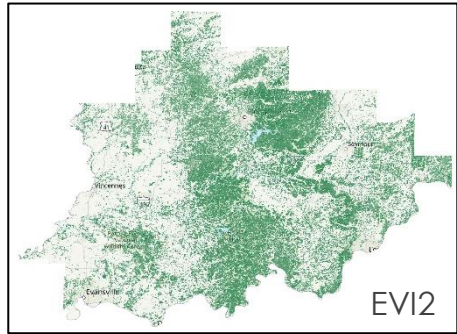
0 10 20 40 Miles

- 100 to -60 %
- 60 to -30 %
- 30 to -15 %
- 15 to -5 %
- 5 to 0 %
- 0 to 5 %
- 5 to 15 %
- 15 to 30 %
- 30 to 60 %

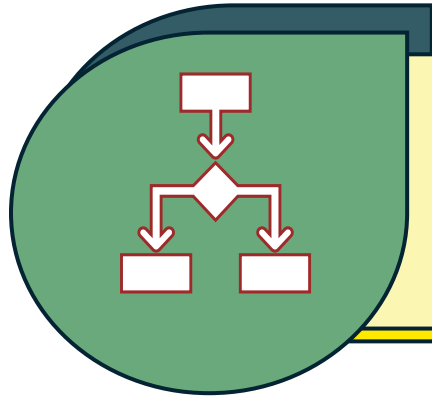
# Foliage Height Diversity



# Foliage Height Diversity

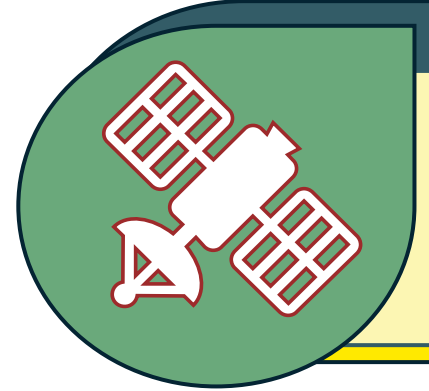


# Challenges & Limitations



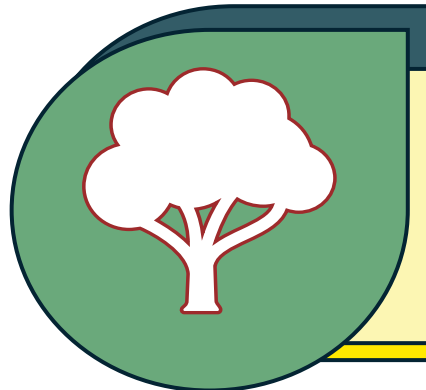
## Data Accessibility

- Extreme difficulty acquiring GEDI in a useable file format



## Data Processing

- Insufficient data storage and processing software



## Index Calculations

- Variable Landsat data quality and choice of indices were factors



# Conclusion and Feasibility Analysis



Indicators of mesophication could **not** be **reliably modeled** for partner use over the course of this term



To address community concerns of oak-hickory ecosystem loss, partners could **incorporate** datasets with a higher **spectral, spatial** and **temporal** resolution in analysis



# Acknowledgements

## Partners from the Let the Sunshine In Indiana

- Kyle Brazil, Central Hardwoods Joint Venture Coordinator
- Judith Brown, American Bird Conservancy and Let the Sunshine In-Indiana Coordinator
- RD Sample, USDA Forest Service, Hoosier National Forest
- Mike Spalding, Coordinator for the Southern Indiana Sentinel Landscape
- Kathryn O'Shay
- Joe Seifert
- Sheela Turbek, Central Hardwoods Joint Venture Science Coordinator

## NASA DEVELOP Personnel

- Spencer Harman, Node Lead (Maryland – Goddard)
- Sean McCartney, Science Advisor
- Joseph Spruce, Science Advisor
- Marisa Smedsrud, Geoinformatics & Project Coordination Fellow
- Dr. Kent Ross, DEVELOP Program Manager



*This material is based upon work supported by NASA through contract 80LARC23FA024. Any mention of a commercial product, service, or activity in this material does not constitute NASA endorsement. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration and partner organizations.*

