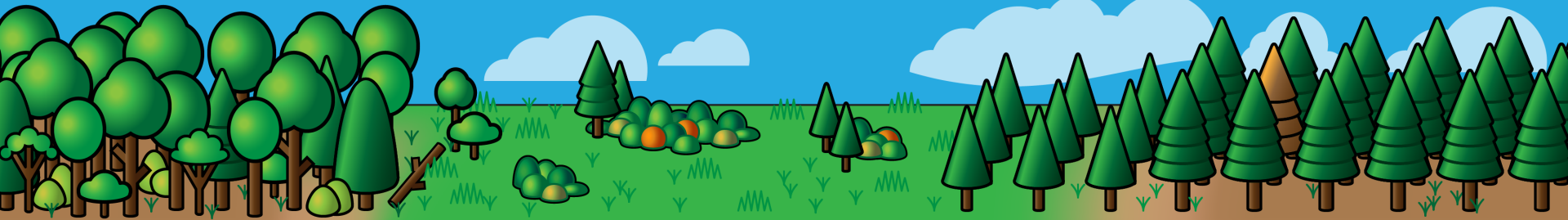


# Assessing Competition and Vegetation Management in FATES



Joshua Rady, R. Quinn Thomas

Department of Forest Resources and Environmental Conservation  
Virginia Tech



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United States Department of Agriculture  
National Institute of Food and Agriculture

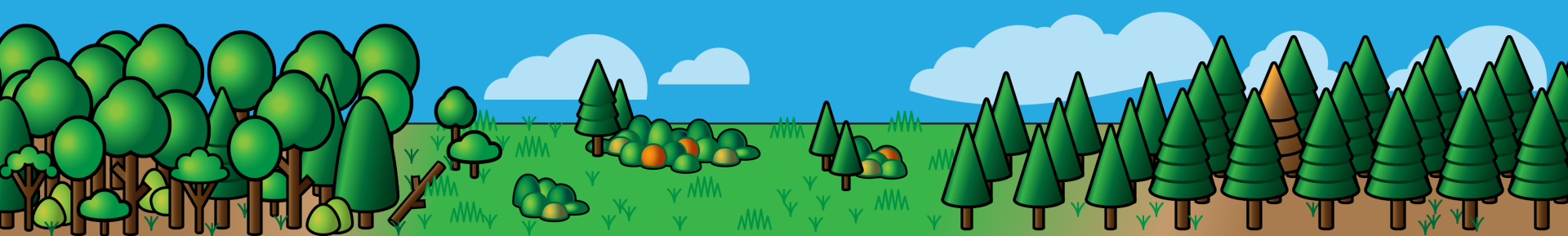
*CESM Land Model and Biogeochemistry Working Group Meeting 2021*

Forests account for 25% of the emissions reductions in the Paris Accord.

*Grassi et al. Nature Climate Change 7: 220-226, 2017.*

U.S Forests absorb 10% of U.S. carbon emissions.

*Ruddell et al. Journal of Forestry 2007.*



52.5% of forests globally have a management plan.

*Global Forest Resources Assessment 2015. FAO, 2016.*

9% of the Southeast U.S. land surface is managed pine.



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9% of the Southeast U.S. land surface is managed pine.

Fire in U.S. has increased in part because of forest management practices.

*Schoennagel et al. PNAS 2017.*

# What do we Need?

## Tools:

Need to be able to simulate management activities and regimes

FATES

Management

Competition

## Data:

Forestry Field  
Trial Data

Spacing experiment → Intraspecific competition

Thinning experiments → Recovery from disturbance



# Complementary Opportunities

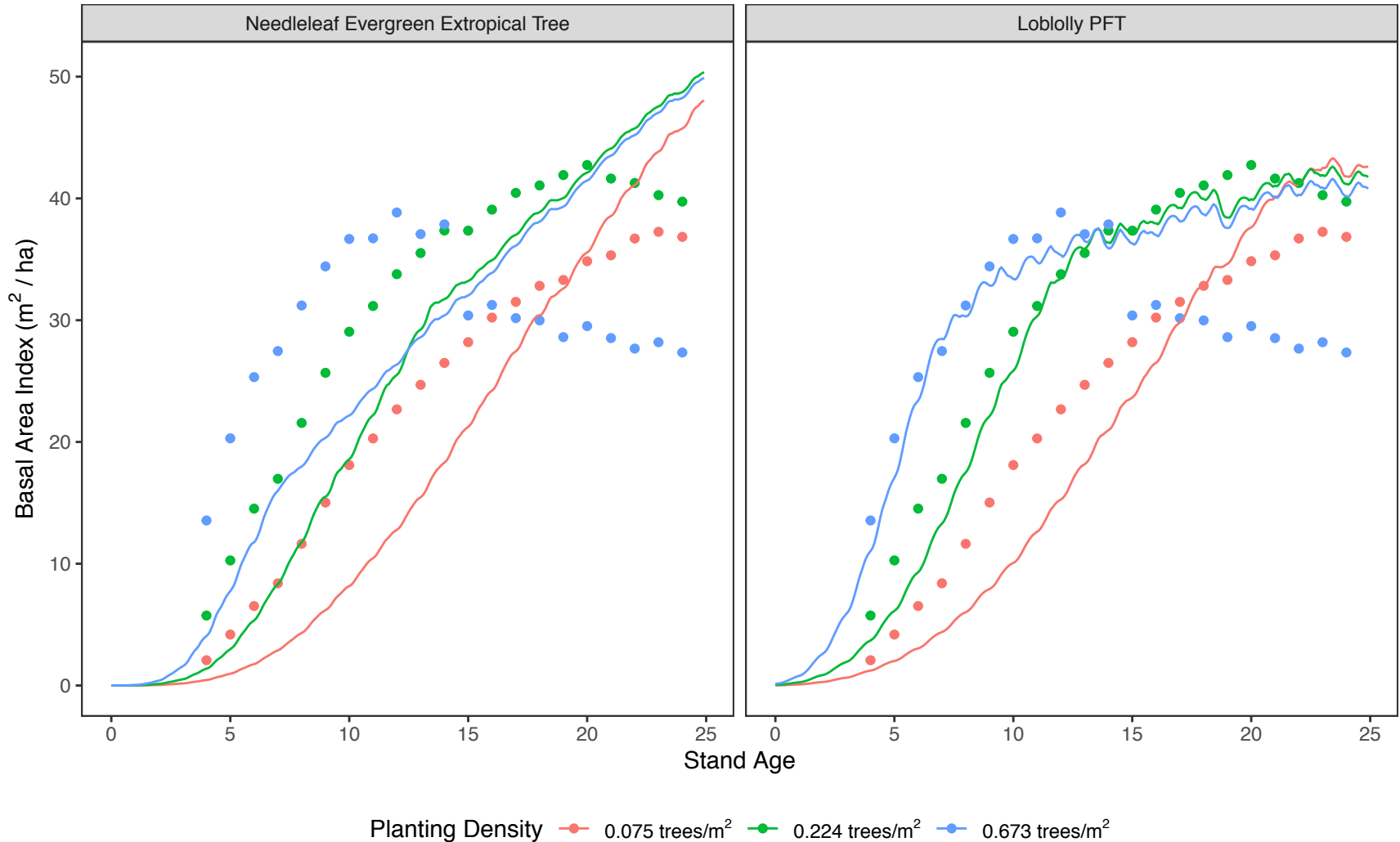
**Use forestry experiments to help understand competitive processes in FATES**



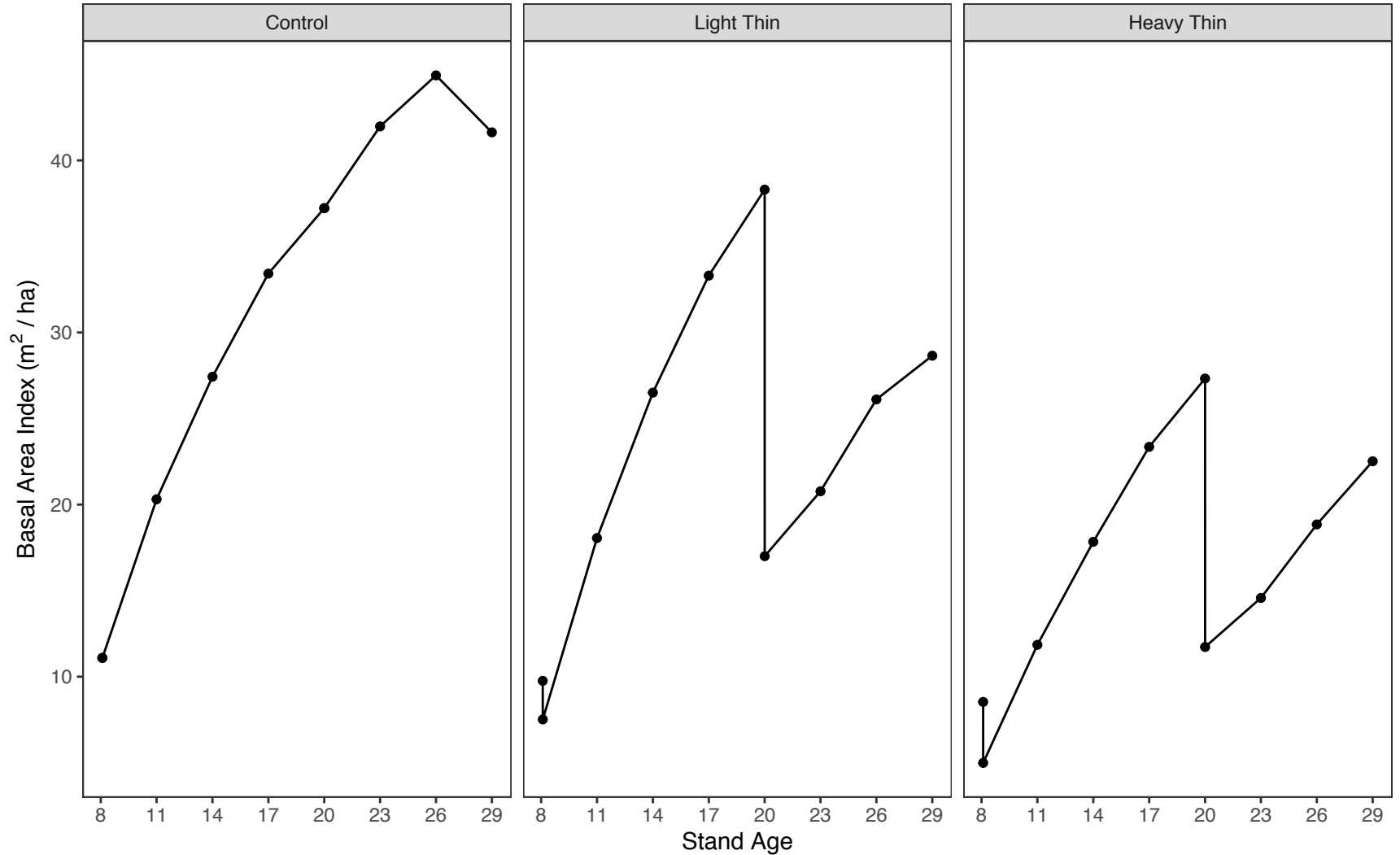
**Develop approaches to understand the role of forest management in the Climate System**

# Competition During Stand Development

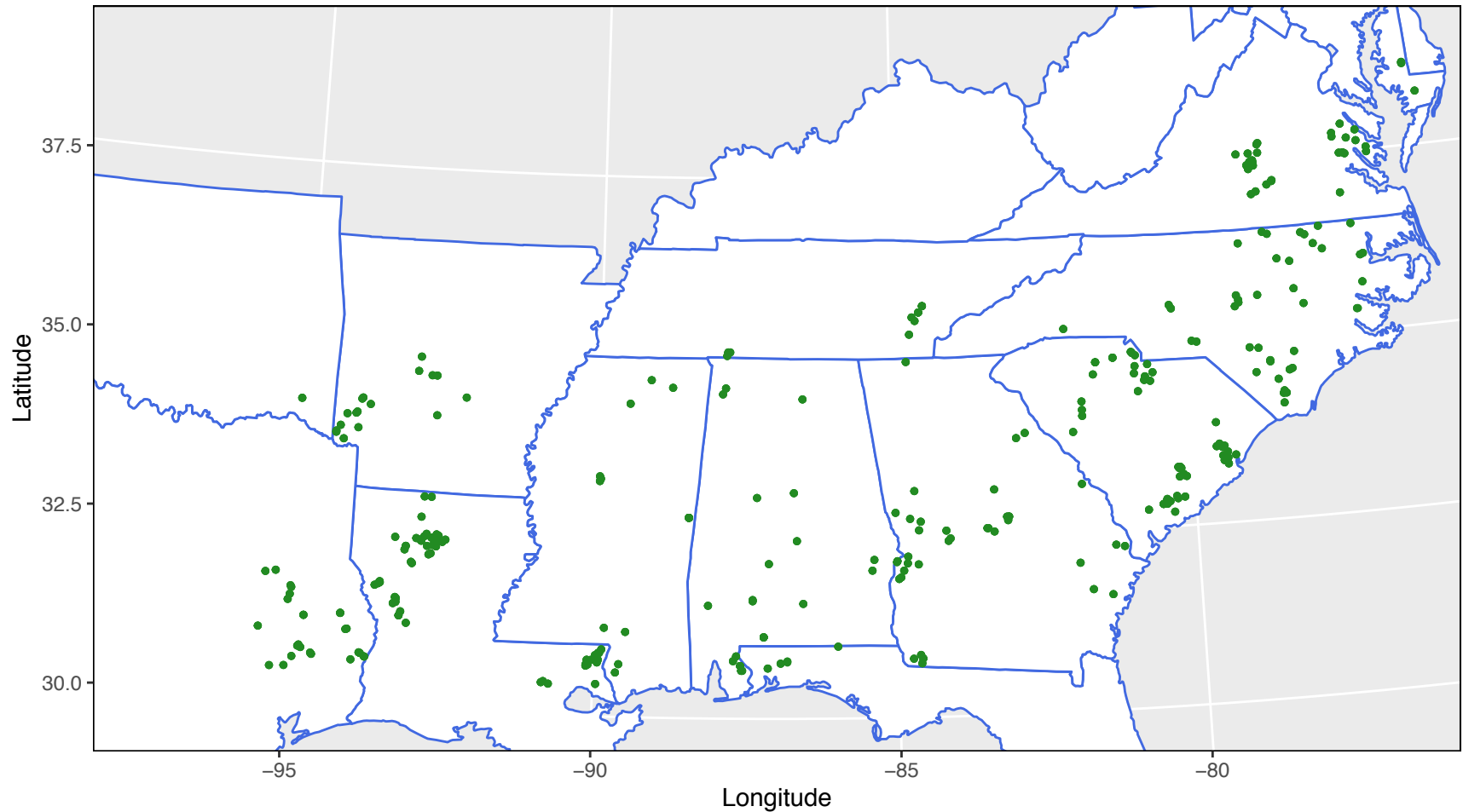
To capture this you need PFT and stand level changes



# Recovery Following Partial Disturbance

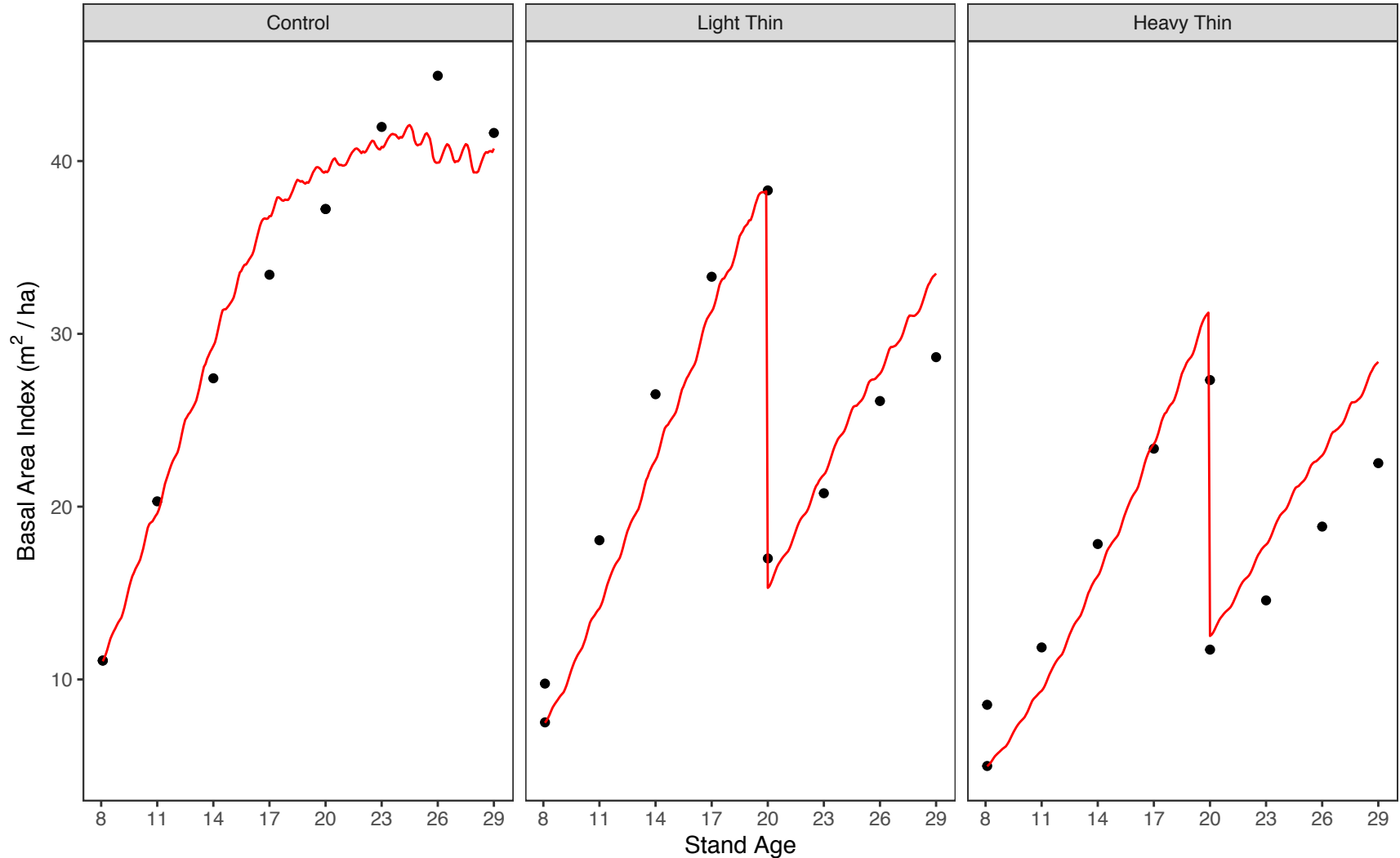


# Thinning Sites Span the Southeast



# We Can Simulate Thinning!

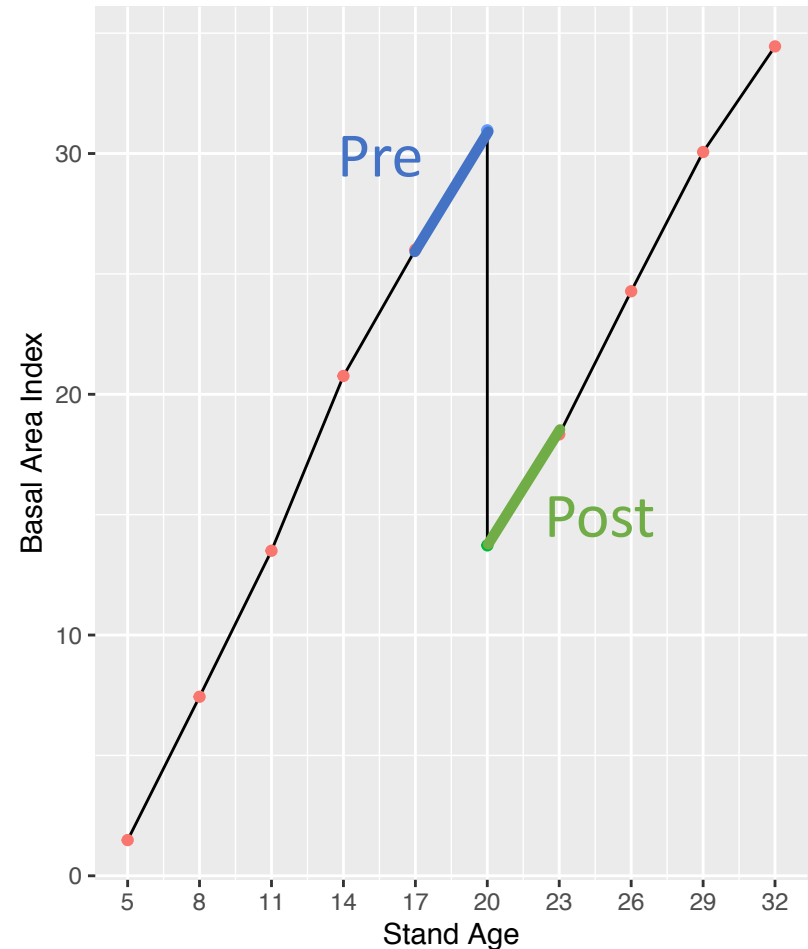
Initial results are within regional thinning response



# Quantifying Thinning “Release” Effect

- Stand Basal Area (BAI) is used as a directly observed proxy of biomass change
- Calculate BAI slope before & after thinning
- Thinning effect = adjusted second derivative of BAI

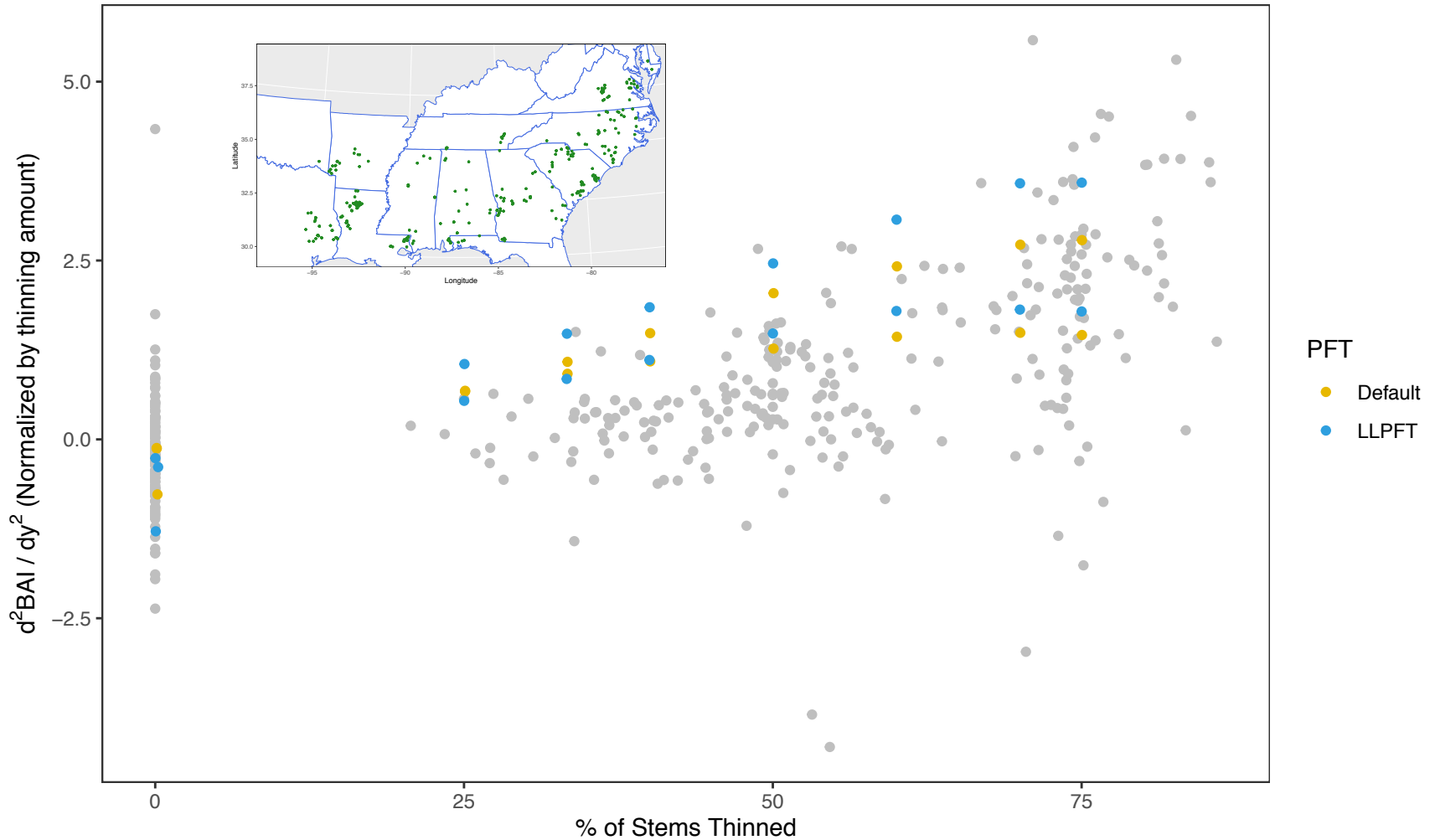
$$\bullet \frac{d^2 BAI_a}{dy^2} = \frac{m_{BAIpost}}{\text{Thin Fraction}} - m_{BAIpre}$$





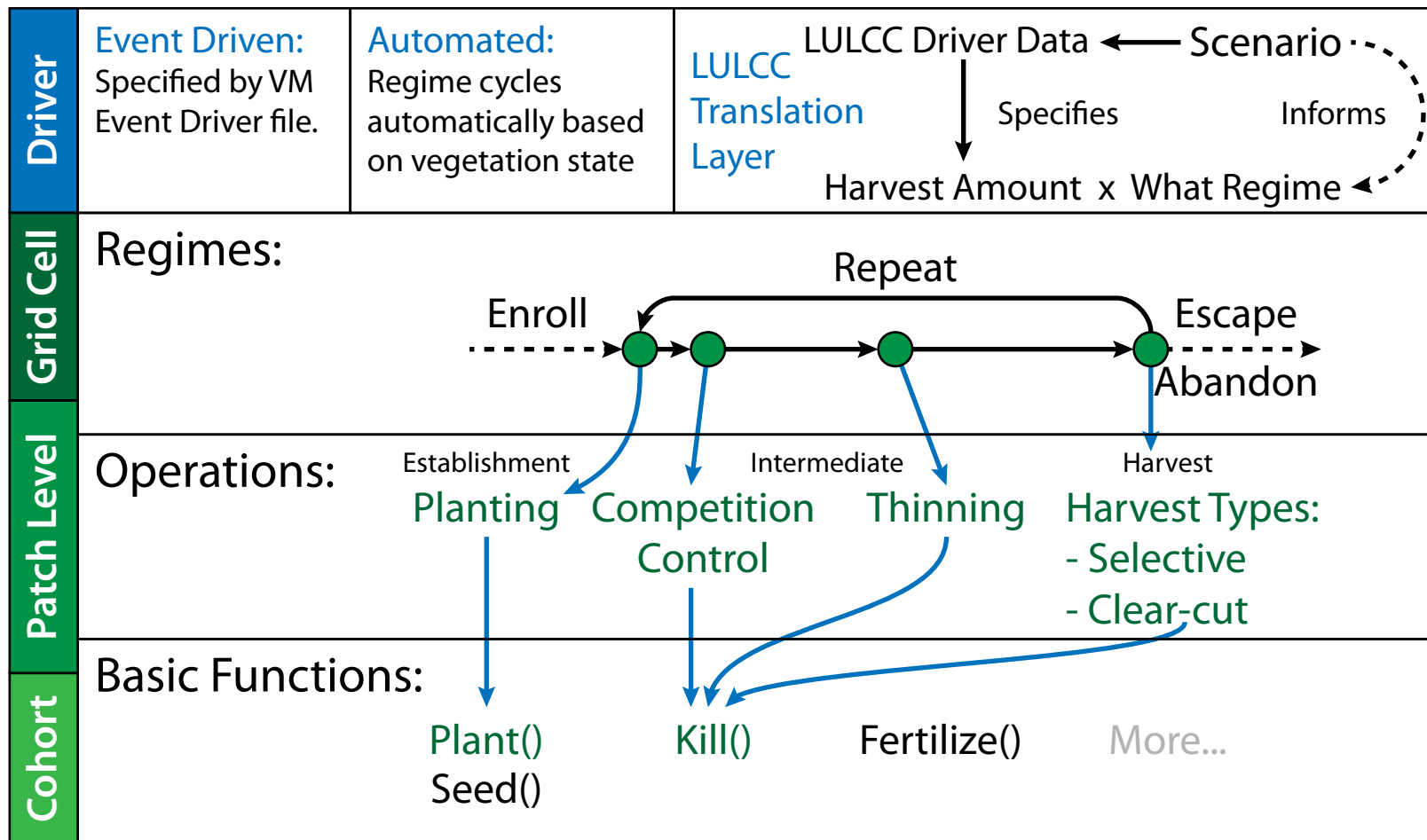
# Thinning Effect Sim vs. Observations

Effect of Thinning on Basal Area Change



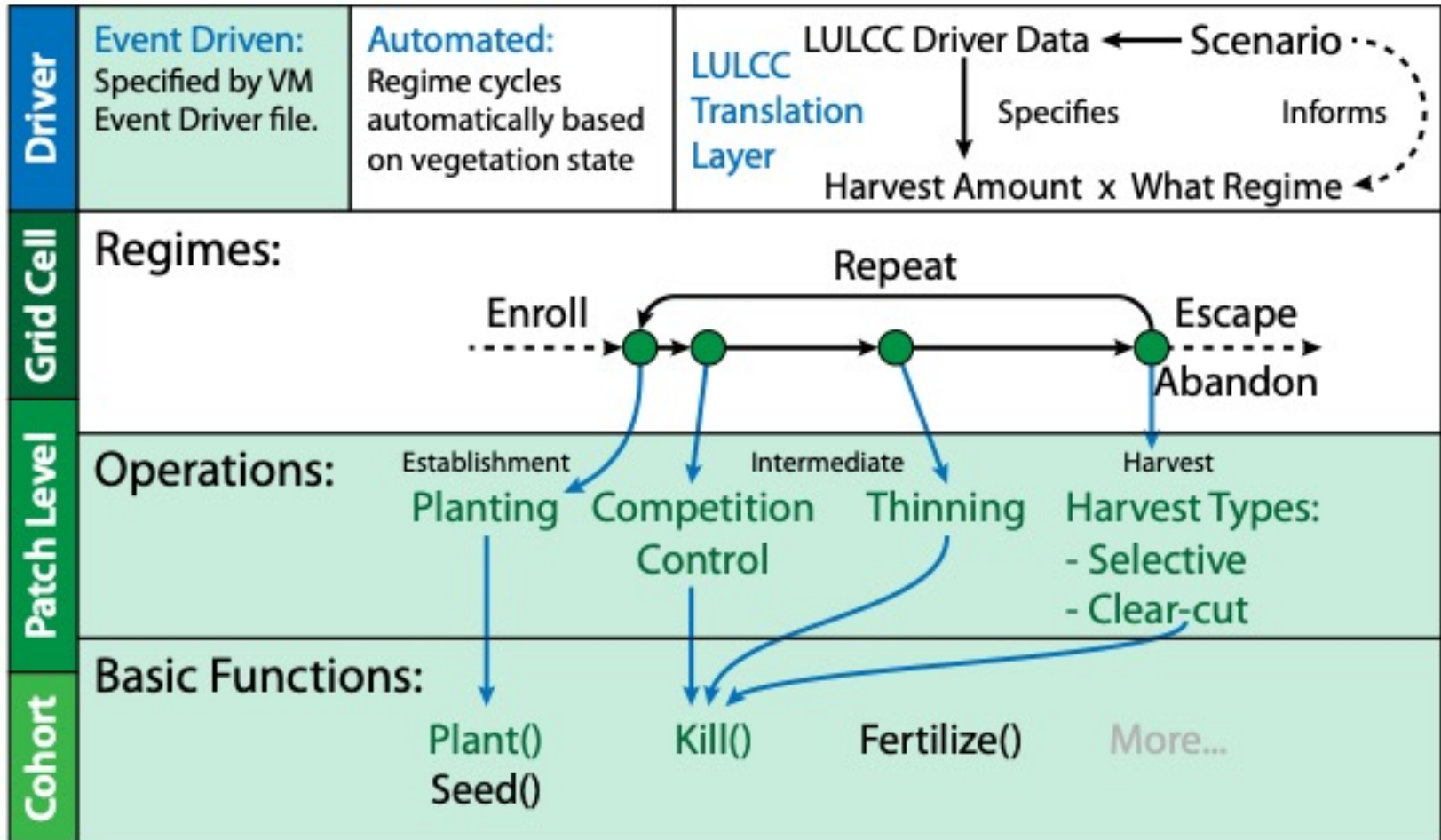
# Vegetation Management Module

New Module in Development



# Vegetation Management Module

New Module in Development



# Summary

- Forest manipulation studies from the forestry sector can help us learn to simulate management while assessing competition within the model.
- The simulated the response to crown thinning in FATES is within the range of observations, but so far shows a consistent high bias.
- The Vegetation Management module will allow us to conduct experiments that capture the full management cycle of forests.

# Acknowledgements

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Jackie Shuman

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FATES Community

NCAR Computational and Information Systems Lab

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A photograph of a pine forest with a path leading through the trees under a blue sky. The trees are tall and thin, and the ground is covered in green ferns. The word "Questions?" is written in a large, blue, italicized font across the center of the image.

# *Questions?*

Photo: Corey Green